PROGRAM OUTLINE

Metal Fabricator (Fitter)
METAL FABRICATOR (FITTER)
HARMONIZED PROGRAM OUTLINE

APPROVED BY INDUSTRY
OCTOBER 2016

BASED ON
NOA 2012
AND
CCDA HARMONIZATION
RECOMMENDATIONS 2015

Developed by
Industry Training Authority
Province of British Columbia
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Section 1

INTRODUCTION

Metal Fabricator (Fitter)
Foreword

This Program Outline is for use in Metal Fabricating industry apprenticeship training classes sponsored by the Industry Training Authority and will be used as a curriculum planning guide for instructors in the formal classroom portions of apprenticeship training.

Practical demonstration and student participation should always be integrated with classroom sessions.

Safe working practices, though not always specified in each of the competencies and learning tasks, are an implied part of the program and should be stressed throughout the apprenticeship.

Achievement Criteria set a common minimum standard for training providers to measure achievement of practical competencies. Where Achievement Criteria are specified, the apprentice must achieve the specifications, safety standards and timeframes described.

Competencies that are solely theory-based will be assessed through a multiple choice test(s) for which the apprentice must achieve a minimum score of 70%.

This 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.

SAFETY ADVISORY

Be advised that references to the WorkSafeBC 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 him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.
Acknowledgements

Subject Matter Experts retained in 2013 to assist in reviewing the Program Outline to address the 2012 NOA updates:

- Robert Finlayson  Kwantlen Polytechnic University
- John Folkers  Weldco Beales
- Nathan Van Seters  Intercontinental Truck Body
- Henry Ostermann  British Columbia Institute of Technology (BCIT)
- John Sutton  Thompson Rivers University (TRU)
- Dave Marcinew  Canron Western Constructors
- Al White  Teck Resources Ltd. (accompanied by Sean Horton)

In 2015, Subject Matter Experts were convened to review and re-sequence the Metal Fabricator trade as part of the Pan-Canadian Harmonization Initiative. The following are the Subject Matter Experts who participated in this review:

- Larry Meier  British Columbia Institute of Technology (BCIT)
- Kevin Neustaedter  Coquitlam Steel Products Ltd.
- Nick Williams  Marcon Metal Fab
- Steve Binning  Eagle Iron Ltd.
- Matt Horst  Coastal Pacific Crane & Hoist Engineering Ltd.
- James Cai  British Columbia Institute of Technology (BCIT)

In 2016, Subject Matter Experts were convened to review the BC Occupational Analysis Chart (OAC) and Program Outline with respect to the Pan-Canadian Harmonization Initiative changes. The following are the Subject Matter Experts who participated in this review:

- Mike MacIntosh  Int. Assn. of Bridge, Structural, Ornamental & Reinforcing Iron Workers
- Peter Thomas  British Columbia Institute of Technology (BCIT)
- Stephen Plain  College of New Caledonia (CNC)
- Brad Harder  Penticton Fabricating
- Dave Marcinew  Canron Western Constructors
- Eric Bohne  Int. Assn. of Bridge, Structural, Ornamental & Reinforcing Iron Workers
- Gord Lane  Teck Resources Ltd.
- Kevin Neustaedter  Coquitlam Steel Products Ltd.
- Rick Fenwick  Solid Rock Steel
- Rodney Morris  George Third & Son
- Don Smith  British Columbia Institute of Technology (BCIT)

The Industry Training Authority would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Metal Fabrication occupation.

Committee members and consultation groups involved with prior editions of the BC Program Outline can be found in the Previous Contributors section in the appendices at the end of this document.
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.

<table>
<thead>
<tr>
<th>Section</th>
<th>Training Providers</th>
<th>Employers/ Sponsors</th>
<th>Apprentices</th>
<th>Challengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Credentialing Model</td>
<td>Communicate</td>
<td>Understand the</td>
<td>Understand</td>
<td>Understand challenger pathway to</td>
</tr>
<tr>
<td></td>
<td>program length and</td>
<td>length and structure</td>
<td>the length</td>
<td>Certificate of Qualification</td>
</tr>
<tr>
<td></td>
<td>structure, and all</td>
<td>of the program</td>
<td>and pathway</td>
<td></td>
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<td></td>
<td>pathways to</td>
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<td>to completion</td>
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<td></td>
<td>completion</td>
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</tr>
<tr>
<td>OAC</td>
<td>Communicate the</td>
<td>Understand the</td>
<td>View the</td>
<td>Understand the competencies they must</td>
</tr>
<tr>
<td></td>
<td>competencies that</td>
<td>competencies that an</td>
<td>competencies</td>
<td>demonstrate in order to achieve</td>
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<td></td>
<td>industry has</td>
<td>apprentice is</td>
<td>they will</td>
<td>they must demonstrate in order to</td>
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<td></td>
<td>defined as</td>
<td>expected to</td>
<td>achieve</td>
<td>achieve as a result of program completion</td>
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<td></td>
<td>representing the</td>
<td>demonstrate in</td>
<td>as a result</td>
<td></td>
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<td></td>
<td>scope of the</td>
<td>order to achieve</td>
<td>of program</td>
<td></td>
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<td></td>
<td>occupation</td>
<td>certification</td>
<td>completion</td>
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</tr>
<tr>
<td>Training Topics and Suggested</td>
<td>Shows proportionate</td>
<td>Understand the</td>
<td>Understand</td>
<td>Understand the relative weightings of</td>
</tr>
<tr>
<td>Time Allocation</td>
<td>representation of</td>
<td>scope of competencies</td>
<td>the scope</td>
<td>various competencies of the occupation</td>
</tr>
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<td></td>
<td>general areas of</td>
<td>covered in the</td>
<td>of competencies</td>
<td>on which assessment is based</td>
</tr>
<tr>
<td></td>
<td>competency (GACs)</td>
<td>technical training,</td>
<td>covered in</td>
<td></td>
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<td></td>
<td>at each program</td>
<td>the suggested</td>
<td>the technical</td>
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<td>level, the</td>
<td>proportion of time</td>
<td>training,</td>
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<td>suggested</td>
<td>spent on each GAC,</td>
<td>the suggested</td>
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<td>time spent on</td>
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<td>each GAC, and</td>
<td>time spent on</td>
<td>theory versus</td>
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<td>practical</td>
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<td>time spent on</td>
<td>application</td>
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<td>theory versus</td>
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</tr>
<tr>
<td>Program Content</td>
<td>Defines the</td>
<td>Identifies detailed</td>
<td>Provides detailed</td>
<td>Allows individual to check program</td>
</tr>
<tr>
<td></td>
<td>objectives, learning</td>
<td>program content and</td>
<td>information on</td>
<td>content areas against their own</td>
</tr>
<tr>
<td></td>
<td>tasks, high level</td>
<td>performance</td>
<td>program content and</td>
<td>knowledge and performance</td>
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<tr>
<td></td>
<td>content that must</td>
<td>expectations for</td>
<td>performance</td>
<td>expectations against their own skill</td>
</tr>
<tr>
<td></td>
<td>be covered for</td>
<td>competencies with a</td>
<td>expectations</td>
<td>levels</td>
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<td></td>
<td>each competency,</td>
<td>practical component;</td>
<td>for demonstrating competency</td>
<td></td>
</tr>
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<td></td>
<td>as well as defining</td>
<td>may be used as a</td>
<td></td>
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<td></td>
<td>observable,</td>
<td>checklist prior to</td>
<td></td>
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<td></td>
<td>measureable</td>
<td>signing a</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>achievement criteria</td>
<td>recommendation for</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>for objectives with</td>
<td>certification (RFC)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a practical</td>
<td>for an apprentice</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>component</td>
<td></td>
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</tr>
</tbody>
</table>
## HARMONIZED PROGRAM OUTLINE

### Introduction

<table>
<thead>
<tr>
<th>Section</th>
<th>Training Providers</th>
<th>Employers/ Sponsors</th>
<th>Apprentices</th>
<th>Challengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Provider Standards</td>
<td>Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program</td>
<td>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</td>
<td>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</td>
<td>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</td>
</tr>
<tr>
<td>Appendix – Glossary of Acronyms</td>
<td></td>
<td></td>
<td>Defines program specific acronyms</td>
<td></td>
</tr>
</tbody>
</table>
Section 2
PROGRAM OVERVIEW

Metal Fabricator (Fitter)
Program Credentialing Model

Apprenticeship Pathway with Optional Endorsement
This graphic provides an overview of the Metal Fabricator (Fitter) apprenticeship pathway.

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

Metal Fabricator (Fitter) Level 3
Technical Training: 180 hours
Work-Based Training: 4,800 hours total
Interprovincial Red Seal Exam

Metal Fabricator (Fitter) Level 2
Technical Training: 210 hours
Work-Based Training: Accumulate hours
ITA Standardized Written Exam
(when implemented in June 2018)

Metal Fabricator (Fitter) Level 1
Technical Training: 210 hours
Work-Based Training: Accumulate hours
ITA Standardized Written Exam

Metal Fabricator (Fitter) Foundation
Technical Training: 690 hours

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

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

RED SEAL

Optional Post-CofQ Endorsement

Marine Fitter Endorsement
Technical Training: 240 hours
Work-Based Training: 2,460 hours total
ITA Standardized Written Exam

Marine Fitter
Technical Training: 240 hours
Work-Based Training: 2,460 hours total
ITA Standardized Written Exam

APPRENTICESHIP - DIRECT ENTRY

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

Metal Fabricator (Fitter) (Generalist)
Technical Training: Level 1
Work-Based Training: None

Boilermaker
Technical Training: Level 1
Work-Based Training: None

Welder
Technical Training: Level 1
Work-Based Training: None

Marine Fitter
Technical Training: 240 hours
Work-Based Training: 2,460 hours total
ITA Standardized Written Exam

Marine Fitter
Technical Training: 240 hours
Work-Based Training: 2,460 hours total
ITA Standardized Written Exam

Marine Fitter
Technical Training: 240 hours
Work-Based Training: 2,460 hours total
ITA Standardized Written Exam
# Occupational Analysis Chart

## METAL FABRICATOR (FITTER)

### Occupation Description:
“Metal Fabricator” means a person who interprets drawings and is involved in the development, layout, marking, cutting (e.g., burning, sawing, shearing), hole punching, rolling, bending, drilling, shaping, forming, straightening, fitting and assembling, reaming, bolting, welding, testing, inspecting, painting, rigging, and handling of structural and mechanical fabrications constructed from plates and structural shapes of ferrous and non-ferrous metals in the Metal Fabrication Trade.

Metal Fabricators typically work in the following industries: shipbuilding, aerospace, oil and gas, commercial and residential buildings, mechanical, mining, architectural structural steel, transportation, infrastructure, bridges, and forestry.

<table>
<thead>
<tr>
<th>PERFORM SAFETY-RELATED FUNCTIONS</th>
<th>Maintain safe work environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A1</td>
</tr>
<tr>
<td>1 2 3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USE TOOLS AND EQUIPMENT</th>
<th>Use hand, power, layout and measuring tools and equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Use stationary machinery</td>
</tr>
<tr>
<td>1</td>
<td>B1</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORM QUALITY CONTROL</th>
<th>Perform inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Verify structural measurements, welds and layout</td>
</tr>
<tr>
<td></td>
<td>D2</td>
</tr>
<tr>
<td>1 2 3</td>
<td>2 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS</th>
<th>Interpret blueprints</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Interpret structural steel drawings</td>
</tr>
<tr>
<td>1 2 3</td>
<td>C2</td>
</tr>
<tr>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORM QUALITY CONTROL</th>
<th>Track structural materials, consumables and parts for traceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Apply principles of metallurgy</td>
</tr>
<tr>
<td>1 2 3</td>
<td>D3</td>
</tr>
<tr>
<td>1 2 3</td>
<td>D4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERFORM QUALITY CONTROL</th>
<th>Control distortion</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>D6</td>
</tr>
<tr>
<td>1 2 3</td>
<td>1 2 3</td>
</tr>
<tr>
<td>HANDLE MATERIALS</td>
<td>Organize specialty materials and products</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>E</td>
<td>E1</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>PERFORM TRADE</td>
<td>Perform line development</td>
</tr>
<tr>
<td>MATH AND LAYOUT</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>1 2 3</td>
</tr>
<tr>
<td>FORM MATERIALS</td>
<td>Form material using plate rolls</td>
</tr>
<tr>
<td></td>
<td>G</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>FABRICATE</td>
<td>Construct templates and jigs</td>
</tr>
<tr>
<td>COMPONENTS</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>1 2 3</td>
</tr>
<tr>
<td>PERFORM WELDING</td>
<td>Apply weld symbols</td>
</tr>
<tr>
<td>ACTIVITIES</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>1 2 3</td>
</tr>
<tr>
<td>COMPLETE PROJECT</td>
<td>Determine finishing process</td>
</tr>
<tr>
<td></td>
<td>J</td>
</tr>
<tr>
<td></td>
<td>3</td>
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# Training Topics and Suggested Time Allocation: Level 1

## Metal Fabricator (Fitter) – Level 1

<table>
<thead>
<tr>
<th>Line</th>
<th>Training Topic</th>
<th>% of Time</th>
<th>Theory</th>
<th>Practical</th>
<th>Total</th>
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<tr>
<td><strong>Line A</strong></td>
<td>PERFORM SAFETY-RELATED FUNCTIONS</td>
<td>3%</td>
<td>85%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>A1</td>
<td>Maintain safe work environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line B</strong></td>
<td>USE TOOLS AND EQUIPMENT</td>
<td>14%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>B1</td>
<td>Use hand, power, layout and measuring tools and equipment</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>Use stationary machinery</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>Use thermal cutting and welding equipment</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>Use access equipment</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line C</strong></td>
<td>INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS</td>
<td>24%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>C1</td>
<td>Interpret blueprints</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Interpret structural steel drawings</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td><strong>Line D</strong></td>
<td>PERFORM QUALITY CONTROL</td>
<td>6%</td>
<td>75%</td>
<td>25%</td>
<td>100%</td>
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<tr>
<td>D1</td>
<td>Perform inspection</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D4</td>
<td>Apply principles of metallurgy</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D5</td>
<td>Control distortion</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td><strong>Line E</strong></td>
<td>HANDLE MATERIALS</td>
<td>6%</td>
<td>85%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>E2</td>
<td>Calculate mass for structural steel</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>Apply rigging practices</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>E4</td>
<td>Operate material handling equipment</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td><strong>Line F</strong></td>
<td>PERFORM TRADE MATH AND LAYOUT</td>
<td>24%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
</tr>
<tr>
<td>F1</td>
<td>Perform line development</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>Calculate bending allowances and stretch outs</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>Calculate diagonals, volume, mass and capacity</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Line G</strong></td>
<td>FORM MATERIALS</td>
<td>8.5%</td>
<td>50%</td>
<td>50%</td>
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</tr>
<tr>
<td>G5</td>
<td>Fabricate plate</td>
<td>✓</td>
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<td><strong>Line H</strong></td>
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<td>H1</td>
<td>Construct templates and jigs</td>
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<td>H6</td>
<td>Fabricate structural components</td>
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## Harmonized Program Outline

### Program Overview

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<td>I2 Use welding processes</td>
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**Total Percentage for Metal Fabricator (Fitter) Level 1**

100%
# Training Topics and Suggested Time Allocation: Level 2

## Metal Fabricator (Fitter) – Level 2

### % of Time Allocated to:

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<td>Line B</td>
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<td>70%</td>
<td>30%</td>
<td>100%</td>
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<tr>
<td>B3</td>
<td>Use thermal cutting and welding equipment</td>
<td>✓</td>
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<tr>
<td>B5</td>
<td>Use computer numerical controlled (CNC) equipment</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Line C</td>
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<tr>
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<td>Interpret structural steel drawings</td>
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<td>✓</td>
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<tr>
<td>Line D</td>
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<td>40%</td>
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<td>Verify structural measurements, welds and layout</td>
<td>✓</td>
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<td>Track structural materials, consumables and parts for traceability</td>
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<td>Apply principles of metallurgy</td>
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<td>Control distortion</td>
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<td>Calculate bending allowances and stretch outs</td>
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<td>Calculate diagonals, volume, mass and capacity</td>
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<td>✓</td>
<td>✓</td>
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<td>G2</td>
<td>Form material using shape rolls</td>
<td>✓</td>
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<td>Form material using a brake press</td>
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<td>H2</td>
<td>Construct sub-components</td>
<td>✓</td>
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<tr>
<td>H3</td>
<td>Determine proper sequence for assembly and welding</td>
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<td>H4</td>
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<td>✓</td>
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<td>Set fabricated component in place</td>
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<td>Fabricate structural components</td>
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### Program Overview

#### PERFORM WELDING ACTIVITIES

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| Total Percentage for Metal Fabricator (Fitter) Level 2 | 100% |

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## Harmonized Program Outline

### Program Overview

**Metal Fabricator (Fitter) – Harmonized Industry Training Authority**

### Training Topics and Suggested Time Allocation: Level 3

**Metal Fabricator (Fitter) – Level 3**

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<td>Maintain safe work environment</td>
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<tr>
<td><strong>Line B</strong></td>
<td><strong>USE TOOLS AND EQUIPMENT</strong></td>
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<tr>
<td>B5</td>
<td>Use computer numerical controlled (CNC) equipment</td>
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<td>C2</td>
<td>Interpret structural steel drawings</td>
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<td><strong>Line D</strong></td>
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<td>Track structural materials, consumables and parts for traceability</td>
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<td>Perform line development</td>
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<td>Calculate bending allowances and stretch outs</td>
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<td>Calculate diagonals, volume, mass and capacity</td>
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<tr>
<td>G2</td>
<td>Form material using shape rolls</td>
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<td>G3</td>
<td>Form material using a brake press</td>
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<td>Form material using computer numerical controlled (CNC) brake press</td>
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<td>H1</td>
<td>Construct templates and jigs</td>
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<td>Construct sub-components</td>
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<td>Assemble sub-components and components</td>
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<td>Set fabricated component in place</td>
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<td>H6</td>
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### HARMONIZED PROGRAM OUTLINE

#### Program Overview

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**Total Percentage for Metal Fabricator (Fitter) Level 3** 100%
Section 3

PROGRAM CONTENT

Metal Fabricator (Fitter)
Level 1

Metal Fabricator (Fitter)
HARMONIZED PROGRAM OUTLINE
Program Content
Level 1

Line (GAC): A PERFORM SAFETY-RELATED FUNCTIONS
Competency: A1 Maintain safe work environment

Objectives
To be competent in this area, the individual must be able to:
• Describe safe work rules and procedures.
• Describe fire prevention methods and precautions.
• Describe requirements for working in confined spaces.

LEARNING TASKS
1. Describe first aid and emergency procedures

   CONTENT
   • Site orientation
   • Safety bulletins
   • Initial first aid procedures
   o First aid stations
   o Muster stations
   o Eye wash stations
   o Fire extinguisher
   • Limits of untrained persons
   • Location of first aid attendant and their responsibilities
   • Recognition of emergency circumstances
   o Unconsciousness
   o Cardio pulmonary emergency
   o Severe bleeding
   o Burns
   • Report hazards
   o Company policy
   o OH&S requirements
   • Communications
   • Accident reporting procedures
   • Field level risk assessment (FLRA)
   • Job hazard assessment (JHA)

2. Describe communication equipment

   CONTENT
   • Applications
   • Operational procedures
   • Types
   o Radios
   o Cell phones
   o Computers
   • Care
   o Maintenance
   o Storage
<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
</table>
| 3. Describe chain of command | • Professionalism  
| | • Respectful communication |
| 4. Describe safe practices, equipment and processes | • Personal Protective Equipment (PPE)  
| | • Eye protection  
| | • Body mechanics  
| | • Lifting and carrying loads  
| | • Housekeeping  
| | • Confined space  
| | • Access and egress  
| | • Flash screens  
| | • Barriers  
| | • Air quality  
| | • Respiratory equipment  
| | • Tools and equipment  
| | • Mobile equipment  
| | • Lock out and isolation  
| | • Electrical and mechanical hazards  
| | • Pinch points  
| 5. Describe safety precautions | • Power operated machinery  
| | • Safe operating capacity  
| | • Starting and stopping  
| | • Emergency shut off  
| | • Calibration  
| | • Securing material  
| | • General maintenance  
| | • Hand and power operated tools  
| | • Fire hazards  
| | • Flammable liquids, gases and metals  
| | • Oily rags  
| | • Paper or wood products  
| | • Electrical apparatus  
| 6. Describe the standard classifications of fires and fire extinguishers | • Classes of fires  
| | • Types of extinguishers  
| | • Prevention methods  
| 7. Describe handling and storage of hazardous and toxic materials | • Workplace Hazardous Materials Identification System (WHMIS)  
| | • Waste disposal  
| | • Material Safety Data Sheets (MSDS) |
LEARNING TASKS

8. Define key terms used in the Workers Compensation Act

9. Describe applications of the Occupational Health and Safety Regulations of WorkSafeBC

10. Describe applications of the federal Occupational Safety and Health Regulations

CONTENT

- Applicable terms

- Applicable regulation (WorkSafe parts 1-19)

- Applicable regulation (Bill C-45)
Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B1 Use hand, power, layout and measuring tools and equipment

Objectives
To be competent in this area, the individual must be able to:
• Describe and maintain measuring, layout and hand tools.
• Describe the procedures for using various specialized measuring tools.
• Describe and maintain bench and hand grinders.
• Describe and maintain handheld power tools.
• Describe the use of nibblers.

LEARNING TASKS

1. Describe and maintain hand tools
   • Hammers
   • Wrenches
   • Clamps
   • Drill bits
   • Files
   • Drift pins
   • Chisels
   • Care
     o Maintenance
     o Storage

2. Describe and maintain layout tools
   • Layout tools
   • Specialty tools
   • Care
     o Maintenance
     o Storage
     o Calibration
     o Specialized measuring tools

3. Describe and maintain grinders
   • Types
   • Applications
   • Safety considerations
   • Care
     o Maintenance
     o Storage
LEARNING TASKS

4. Use grinders

5. Describe and maintain power and pneumatic tools

6. Use magnetic drill

7. Describe and maintain nibbler

CONTENT

- Procedures
- Manufacturer's specifications
- Deburr edges
- Bevel plate edge
- Remove plate corner radius square corners

- Applications
- Safety considerations
- Operational procedures
- Types and features
- Care
  - Maintenance
  - Storage

- Marking
- Centering
- Reaming

- Safety considerations
- Applications
- Types
- Capacity
  - Type and thickness
  - Material characteristics
- Cut considerations
Line (GAC): B USE TOOLS AND EQUIPMENT  
Competency: B2 Use stationary machinery

Objectives
To be competent in this area, the individual must be able to:
• Explain safety considerations for stationary machinery.
• Use and maintain stationary machinery.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
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</thead>
</table>
| 1. Describe stationary machinery | • Applications  
  • Safety considerations  
  • Components  
  • Machine operation  
  • Operational procedures  
  • Inspection  
  • Types  
  • Care and maintenance  
  • Documentation/administration |

| 2. Describe brake press | • Safety  
  o Lockout/isolation  
  • Capacity plate  
  • Types of forming operations  
  • Electric controls and settings  
  • Machine actuation  
    o Hydraulic  
    o Mechanical  
    o Manual  
  • Maintenance  
  • Components |

| 3. Use brake press | • Inspection  
  • Start up  
  • Shut down  
  • Settings  
  • Programming |

| 4. Describe plate rolls | • Applications  
  • Components  
  • Machine capacity  
  • Maintenance |
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<td>• Process</td>
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<td>• Inspection</td>
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<td>• Set up</td>
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<td>• Rolling</td>
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<td>• Reverse</td>
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<td>• Commercial</td>
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<td>6. Describe pedestal grinders</td>
<td>• Capacity/RPM</td>
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<td>• Maintenance</td>
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<tr>
<td></td>
<td>• Mounting wheel</td>
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<td>• Addressing and truing wheel</td>
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<td>• Proper washers and tightening</td>
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<td>7. Use pedestal grinders</td>
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<td>• Process</td>
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<td>• Inspection</td>
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<td>• Set up</td>
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<td></td>
<td>• Sharpen</td>
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<td>• Cold chisel</td>
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<td></td>
<td>• Centre punch</td>
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<td>• Twist drill</td>
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<tr>
<td>8. Describe the components and procedures of the plate shear</td>
<td>• Applications</td>
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<td>• Safety considerations</td>
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<td></td>
<td>• Components</td>
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<td></td>
<td>• Machine operation</td>
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<td></td>
<td>• Procedure</td>
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<td></td>
<td>• Automated and manual controls</td>
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<td>• Foot control</td>
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<td>• Rake angle</td>
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<td>• Blade clearance</td>
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<td>• Back gauge</td>
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<td></td>
<td>• Capacity</td>
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<tr>
<td>9. Use the plate shear</td>
<td>• Shear</td>
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<td></td>
<td>• Backstop</td>
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<td></td>
<td>• Shadow line</td>
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</tbody>
</table>
LEARNING TASKS

10. Describe band saws

CONTENT
- Applications
- Advantages and disadvantages
- Safety considerations
- Components
- Types
- Automatic feed
- Machine operation
- Procedure
- Blades
  - Types
  - Styles
  - Tooth pitch
  - Rake
- Capacity

11. Use band saws

CONTENT
- Structural shapes
  - Seam
  - Part orientation
  - Stack cutting/nested cuts
- Shop tolerances
- Cuts
  - Mitre
  - Square
  - Compound

12. Describe ironworker

CONTENT
- Applications
- Safety considerations
- Types
  - Mechanical
  - Hydraulic
- Components
- Automatic feed
- Machine operation
- Procedure
  - Back stops
  - Gauges
  - Jigs
- Capacity
LEARNING TASKS

13. Use ironworker

14. Describe drill presses

CONTENT

- Structural shapes
- Shop tolerances
- Cuts
  - Mitre
  - Square
  - Compound
- Applications
- Safety considerations
- Types
  - Bench top
  - Floor
  - Radial arm
  - Sensitive
  - Magnetic base
- Components and tools
- Capacity
  - Type and thickness
  - Material characteristics
  - Drill considerations
- Procedure
  - Set up
  - Speed/feed rate
  - Material
  - Hole dimensions
  - Cutter/drill bit
  - Sharpening
LEARNING TASKS
15. Describe the thread cutting machine

CONTENT
- Applications
- Safety considerations
- Types
  - Manual
  - Electric
  - Hydraulic
- Components
  - Carriage
  - Chucks
- Procedure
  - Speed/feed rates
  - Die installation
  - Mounting material in chuck
  - Ream/cut pipe
    - Round stock
    - Pipe
- Capacity
  - Type and thickness
  - Material characteristics
  - Thread considerations
- Maintenance
Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B3 Use thermal cutting and welding equipment

Objectives
To be competent in this area, the individual must be able to:
• Describe various thermal cutting methods.
• Describe welding equipment.
• Use oxy-fuel cutting equipment.

LEARNING TASKS
1. Describe various thermal cutting processes
   • Oxy-fuel
   • Air arc
   • Plasma
   • Manual and Semi-automatic
   • Maintenance
   • Advantages and disadvantages

2. Identify oxy-fuel cutting and welding equipment
   • Safety considerations
   • Operational considerations
   • Components
     o Consummables
     o Maintenance

3. Use oxy-fuel cutting equipment
   • Set up and shutdown
   • Operation
   • Maintenance
   • Storage

4. Identify plasma arc cutting equipment
   • Advantages and disadvantages
   • Safety considerations
   • Capacity/material
   • Components
   • Types of gases
LEARNING TASKS
5. Describe air-arc cutting (AAC)

CONTENT
- Applications
- Advantages and disadvantages
- Capacity
- Components
- Safety considerations
- Procedures
- Trouble shooting
  - Slag
  - Carbon deposit
  - Control

Achievement Criteria
Performance
The learner will be able to correctly set up and operate oxy-fuel cutting equipment to produce a profile burned coupon.

Conditions
Shop projects will be completed in a training provider facility, given:
- 1/2" plate material
- Tools and equipment
- A prescribed time limit

Criteria
The learner will be evaluated on:
- Project completion within 4 hours
- Accuracy and tolerances (+/- 1/16")
  - Circles
  - Squares
  - Triangles
  - Bevels
  - Slots
  - Guided cuts
- Cut edge quality
- Manual cleaning processes (only)
HARMONIZED PROGRAM OUTLINE
Program Content
Level 1

Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B4 Use access equipment

Objectives
To be competent in this area, the individual must be able to:
• Select and identify ladders, scaffolds and platforms.
• Identify motorized access platforms.

LEARNING TASKS

1. Select and identify ladders

2. Select and identify scaffolds and platforms

CONTENT

1. Select and identify ladders

   • Applications
   • Operational procedures
   • Regulations
   • Types of ladders
     - Step
     - Extension
     - Single straight
   • Care
     - Maintenance
     - Storage

2. Select and identify scaffolds and platforms

   • Regulations
   • Scaffold types
     - Fixed frame system
     - Tube and clamp
     - System
   • Platform types
     - Scissor lift
     - Aerial boom lift
     - Zoom boom
     - Fixed platform
   • Care
     - Maintenance
     - Storage
Line (GAC): C INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS

Competency: C1 Interpret blueprints

Objectives
To be competent in this area, the individual must be able to:
- Describe an orthographic drawing.
- Sketch multi-view drawings of objects using isometric and orthographic projection.
- Identify standard symbols and abbreviations on drawings.
- Sketch detail, auxiliary and section views.
- Interpret specifications.
- Interpret welding symbols.
- Describe advantages and disadvantages of CAD drawings.

LEARNING TASKS
1. Identify the alphabet of lines
   - Types
     - Object
     - Hidden
     - Centre
     - Extension
     - Dimension
     - Cutting plane
     - Break
     - Section

2. Describe the principles of orthographic and isometric projection
   - Views
   - Projection method
   - Auxiliary
   - Section

3. Draw and dimension orthographic sketches of simple objects
   - Rules and principles for dimensioning
   - Drawing units

4. Make an isometric drawing of a given object
   - Orientation
   - Development of construction lines
   - Drawing to scale
   - Non-isometric features

5. Draw auxiliary views of features on simple objects
   - Proportion
   - Orientation
   - Dimensioning
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<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
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<tbody>
<tr>
<td>6. Draw section views of simple objects</td>
<td>• Cutting plane axis and orientation</td>
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<td>• Scale</td>
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<td>• Types of lines</td>
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<td>• Dimensioning</td>
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<td>7. Interpret standard symbols and abbreviations</td>
<td>• Symbols</td>
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<td></td>
<td>• Abbreviations</td>
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<td>• Notes</td>
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<td>• Marks</td>
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<td>8. Interpret welding symbols</td>
<td>• Reference line</td>
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<td>• Arrow side/other side</td>
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<td>• Reading sequence</td>
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<td>• Weld symbols</td>
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<td>• Joint profile</td>
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<td>9. Describe CAD drawings</td>
<td>• Advantages and disadvantages</td>
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<td>• Uniformity</td>
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<td>• Scale</td>
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<td>• Object presentation</td>
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INTERPRET PLANS, DRAWING AND SPECIFICATIONS

Competency: C2 Interpret structural steel drawings

Objectives
To be competent in this area, the individual must be able to:
- Interpret structural steel drawing.
- Draw views.
- Construct a bill of material.
- Develop a simple estimate.

LEARNING TASKS

1. Interpret a structural drawing
   - Title block
   - Revisions
   - General layout
     - Orientation of beam or column on given drawing paper
   - Material list
     - Identification of main structural member(s)
   - Specifications

2. Draw section views
   - Cutting plane axis and orientation
   - Scale
   - Types of lines
   - Dimensioning

3. Interpret standard symbols and abbreviations
   - Centre line
   - Base line
   - Workpoint
   - Structural shapes

4. Describe a bill of material
   - Location
   - Purpose
   - Format
     - Item number
     - Piece mark
     - Quantity
     - Description
     - Length
     - Weight
     - Remarks
5. Develop a material list

6. Label and detail drawings

CONTENT
- Simple structural drawing
- Content
- Structural shapes
- Special instructions
- Hole location
- Cut details
- Plate edge preparation
- Dimensions
Line (GAC): D  PERFORM QUALITY CONTROL
Competency: D1  Perform inspection

Objectives
To be competent in this area, the individual must be able to:
• Describe types and applications of fabrication codes.
• Describe inspection and non-destructive inspection techniques.

LEARNING TASKS
1. Identify codes used in metal fabrication

2. Describe critical inspections for fabrication

CONTENT
- CSA S16
- CSA W59
- CSA G40.20 M
- AWS 3.1
- AWS D1.1
- CSA G40.21
- CSA G40.12
- CSA W47.1 (steel)
- CSA W47.2 (aluminum)
- BC Building Code
- Lloyds
- API 650
- CISC
- ASME
- AISC
- CWB W59
- ANSI

- Welding code tolerances
- Material characteristics
- Piece count
- Minimum quality requirements
- Mill materials
  - Deformities
  - Dimensional inaccuracy
- Obvious omissions
  - Welds
  - Parts
- Surface imperfections
  - Spatter
  - Gouges
LEARNING TASKS

CONTENT

- Sharp edges
- Weld defects
  - Location
  - Weld size
  - Porosity
  - Undercut
  - Crater cracks
- Fabrication defects
  - Distortion
  - Improper fit up
  - Piece alignment

3. Describe various non-destructive testing techniques

- Radiography - gamma and X-ray
- Dye and fluorescent penetrants
- Ultrasonic
- Magnetic particle
- Hydrostatic - air and water

4. Describe visual inspection techniques

- Material
- Welds
- Completed unit
**Objectives**

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

- Describe the characteristics of various types of steels.
- Describe effects of heat on metals.
- Describe methods of relieving stress on metals.
- Describe standard types and methods of testing common metals.

**LEARNING TASKS**

1. Describe the basic ways of manufacturing steel
   - Bessemer converter
   - Open hearth furnace
   - Crucible furnace
   - Electrical furnace

2. Describe the general characteristics of structural metals
   - Elements
   - Grades
   - Regulatory organizations
   - CSA standard types
   - ASTM standard types

3. Describe important properties of types of metals
   - Body centre cubic (BCC)
   - Face centre cubic (FCC)
   - Density
   - Tensile strength
   - Hardness
   - Ductility
   - Weldability
   - Chemical resistance
   - Atmospheric resistance
   - Heat resistance

4. Describe the effects of heat on metals
   - Hardening
   - Tempering
   - Annealing
   - Normalizing
   - Distortion control
<table>
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<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
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<tbody>
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<td>5. Identify standards processes for testing metals</td>
<td>• Charpy V notch</td>
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<td>• Rockwell</td>
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<td>• Brinnel</td>
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<td>• Tensile</td>
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</table>
Line (GAC): D  PERFORM QUALITY CONTROL
Competency: D5  Control distortion

Objectives
To be competent in this area, the individual must be able to:
- Describe the elements that contribute to distortion in fabrication.
- Describe how distortion can be observed and measured.

LEARNING TASKS

1. Identify fabricated assemblies where distortion must be considered
   - Engine and mechanical bases
   - Pipe/flange connections
   - Drive units
   - Bolted connections
   - Spliced connections
   - Trial assemblies
   - Drilling operations
   - Heat straightening
   - Dowel connections during trial assembly

2. Describe stress that may develop in fabricated metal structures
   - Types
     - Longitudinal
     - Transverse
     - Angular
     - Residual

3. Identify measures and controls to minimize distortion
   - Sub-assemblies
   - Jigs and fixtures
     - Strong back
     - Clamps
     - Braces
   - Welding sequences
   - Proper fit-up
   - Counter bending
Line (GAC):   E   HANDLE MATERIALS
Competency:  E2  Calculate mass for structural steel

Objectives
To be competent in this area, the individual must be able to:
• Convert metric and imperial units.
• Calculate area and weights/mass of various plate shapes.

LEARNING TASKS

1. Select and use tools and equipment
   • Load indicators
   • Calipers
   • Measuring tapes
   • Gauges
     o Sheet
     o Plate

2. Describe key terms and concepts necessary for correct calculation of plate weight
   • Drawings
   • Manuals
   • Suppliers’ catalogues
   • Plate shape
     o Square
     o Rectangular
     o Triangular
     o Circular
   • Plate weight constants
   • Dimensions required for calculation
   • Required formulas

3. Convert imperial dimensions to decimal values and vice versa
   • Decimal expression in feet or inches
   • Inch and fraction to decimal of a foot
   • Convert between Imperial and Metric
   • Convert feet and inches to decimals
   • Rounding numbers

4. Calculate imperial weights and areas of plate shapes
   • Plate shape
   • Appropriate formula
   • Required variables

5. Calculate metric weights and areas of plate shapes
   • Plate shape
   • Appropriate formula
   • Required variables
6. Use a steel handbook to determine mass of structural shapes
   - Beams
   - Channels
   - Angles
**Line (GAC):** E  **HANDLE MATERIALS**

**Competency:** E3 Apply rigging practices

### Objectives
To be competent in this area, the individual must be able to:
- Apply WorkSafeBC regulations.
- Describe safe rigging procedures.
- Apply rigging methods to lift loads.
- Develop a lift plan.

### LEARNING TASKS

| 1. Apply WorkSafeBC regulations | • Responsibilities  
                                 | • Inspection requirements |
|---------------------------------|-------------------------|
| 2. Calculate the weight of loads | • Type of material  
                               | • Weight/mass  
                               | • Centre of balance |
| 3. Identify rigging components  | • Wire rope  
                                | • Chain  
                                | • Plate clamps  
                                | • Tirfor jacks  
                                | • Turn buckles  
                                | • Hydraulic and screw jacks  
                                | • Hooks  
                                | • Shackles  
                                | • Spreader bars  
                                | • Cables  
                                | • Chains  
                                | • Come-a-longs  
                                | • Magnets  
                                | • Vacuum lifts |
| 4. Calculate working load limits for rigging | • Breaking strength  
                                             | • Safety factor  
                                             | • Rigger's rule of thumb |
LEARNING TASKS

5. Use cranes and hoists

6. Describe communications

7. Describe safe procedures for disconnecting and removing rigging

8. Describe and demonstrate rigging methods when moving loads

9. Identify and use knots, bends and hitches

CONTENT

- Types of cranes
  - Overhead
  - Gantry
  - Hoist
  - Jib
- Centre of gravity
- Lift points
- Potential damage to object being lifted
- Capacity of cranes

- Hand signals
  - Boom signals
  - Line signals
- Radio communications

- Dangers of load collapse or rollover
- Tensioned chokers or Tirfors
- Tag line
- Balance

- Hoisting
- Rotating (turning)
- Rolling
- Guiding
- Aligning
- Safety Considerations

- Parts of a rope
- Attaching to a fixed object
- Tying down a load
- Joining ropes together

Achievement Criteria

Performance The learner will perform an inspection on a hoist and single sling configuration.

Conditions The learner will be given:
  - Jib crane complete with hoist
  - Single sling configuration
  - Access to codes and standards
  - A prescribed time limit

Criteria The learner will be evaluated on:
  - Project completion within 1 hour
  - In accordance with WorkSafe BC regulations
Line (GAC): E HANDLE MATERIALS
Competency: E4 Operate material handling equipment

Objectives
To be competent in this area, the individual must be able to:
• Select appropriate lifting aids and equipment for lifting jobs.
• Identify the laydown area requirements.

LEARNING TASKS
1. Describe material handling equipment
   • Fork lift
   • Telehandler
   • Pallet jack
   • Carts
   • Conveyor
   • Dollies
   • Shop crane
   • Jib crane

2. Select appropriate lifting equipment
   • Slings
   • Shackles
   • Spreader beams
   • Lugs
   • Lifting points and attachments
   • Turn buckles

3. Describe laydown area requirements for receiving materials
   • Space availability
   • Level
   • Dry
   • Dunnage
   • Workflow coordination
   • Equipment lanes
Line (GAC):   F PERFORM TRADE MATH AND LAYOUT
Competency:  F1 Perform line development

Objectives
To be competent in this area, the individual must be able to:
• Define basic layout terms and sequences.
• Create patterns using parallel line development.

LEARNING TASKS

1. Define basic layout terms
   • Seam
   • Mitre
   • Base line
   • Tangent
   • Stretch out
   • Battle line
   • Ordinate
   • Centre line

2. Develop geometric line construction
   • Perpendicular
   • Bisect
     o Line segment
     o Arc
   • External radius
   • Segment
     o Circle
     o Line

3. Describe essential views for developing patterns
   • Elevation
   • Plan

4. Define basic layout sequences
   • Truncated rectangular pipe
   • Truncated round pipe
   • Pipe tee-joint
   • Offset-pipe tee-joint
   • Inclined (lateral) pipe joint
   • Multi-piece pipe elbow complete with branch
LEARNING TASKS

5. Layout various developed plate shapes
   • Stretch out
     o Half pattern
     o Full pattern
     o Hole pattern
   • Orientation
   • Ordinate sequencing
   • Angular and clock ray reference
   • Process mark plates
   • Bend sets and sweeps

6. Develop required patterns for various pipe connections
   • Wrap around
     o Internal
     o External
   • Inside dimension (ID) vs. outside dimension (OD) or mean dimension (MD)
   • Layout of saddle, sweep or hole
Line (GAC): F PERFORM TRADE MATH AND LAYOUT
Competency: F2 Calculate bending allowances and stretch outs

Objectives
To be competent in this area, the individual must be able to:
• Determine stretch out lengths.
• Develop sketches of flat plate layout.

LEARNING TASKS
1. Use a scientific calculator
   • Functions
     o Add, subtract, multiply, divide
     o Squares and square root
     o Convert dimensions

2. Describe process terminology
   • Inside dimensions
   • Mean dimensions
   • Bend allowance
   • Mean arc length
   • Material thickness

3. Determine the stretch out dimensions using flange calculations
   • Flanged shape

4. Determine the stretch out dimensions using mean calculations
   • Cylinder
   • Rolled segments
   • Rolled shape
   • Flanged shape
   • Dimensions
   • Labelling
   • Plate gauge

5. Develop sketches of flat plate layouts.
**Line (GAC):** F  **PERFORM TRADE MATH AND LAYOUT**

**Competency:** F3  Calculate diagonals, volume, mass and capacity

**Objectives**
To be competent in this area, the individual must be able to:
- Solve simple problems using ratio and proportion.
- Solve a variety of problem types involving weight, mass and the capacity of vessels.

**LEARNING TASKS**

<table>
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<tr>
<th>1. Describe Pythagoras’ Theorem</th>
<th><strong>CONTENT</strong></th>
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<tbody>
<tr>
<td></td>
<td>• Right angle triangles</td>
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<td>• Hypotenuse</td>
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<td>• Adjacent sides</td>
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<td>• Opposite sides</td>
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<td>• Fundamental formula</td>
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<td>• Desired derivative</td>
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<td>• Key terms and concepts</td>
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<td>• Fundamental formula</td>
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<td>• Transposing</td>
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<thead>
<tr>
<th>2. Apply Pythagoras’ Theorem</th>
<th><strong>CONTENT</strong></th>
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<tr>
<td></td>
<td>• Simple problems</td>
</tr>
<tr>
<td></td>
<td>o Calculate slope</td>
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<td>o Calculate rise</td>
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<td>o Calculate base</td>
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<td>• Identify right angle triangles within a given shape</td>
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<td>• Third angle projection</td>
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<td>• True lengths of sides</td>
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<td>• Rolling offset applied to pipe or round</td>
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<td>• Pythagoras’ Theorem</td>
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<td>o Truss</td>
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<td>o Hopper</td>
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<td>o Conical shape</td>
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<th>3. Describe key terms and concepts required for problem solution</th>
<th><strong>CONTENT</strong></th>
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<tbody>
<tr>
<td></td>
<td>• Working bevel (WB)</td>
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<tr>
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<td>• Ratio</td>
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<td>• Proportion</td>
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<td>• Word problems</td>
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<tr>
<th>4. Calculate unknown dimensions on shapes using ratio and proportion</th>
<th><strong>CONTENT</strong></th>
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<tr>
<td></td>
<td>• Similar triangles</td>
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<th>5. Apply ratio and proportion to trusses</th>
<th><strong>CONTENT</strong></th>
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<tr>
<td></td>
<td>• Working bevels</td>
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<td>• Similar triangles</td>
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<td>LEARNING TASKS</td>
<td>CONTENT</td>
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<tr>
<td>6. Identify types of plate fit up used on vessels</td>
<td>• Cylindrical</td>
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<tr>
<td></td>
<td>• Box-shaped</td>
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<tr>
<td></td>
<td>• End plate/corner to corner</td>
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<td>o Open</td>
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<td>o Closed</td>
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<td>7. Solve for cylindrical vessel weight/mass</td>
<td>• Selection of correct formula</td>
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<td>• Determine required dimensions</td>
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<td>8. Solve for cylindrical vessel capacity</td>
<td>• Selection of correct formula</td>
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<td>• Determine required dimensions</td>
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<tr>
<td>9. Identify information required to detail box-</td>
<td>• Dimensions of individual sides</td>
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<td>shaped vessels</td>
<td>• Thickness of material</td>
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<td>• Type of plate fit</td>
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<tr>
<td>10. Solve for box-shaped vessel weight/mass</td>
<td>• Individual plate dimensions</td>
</tr>
<tr>
<td></td>
<td>• Correct formulas</td>
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<tr>
<td>11. Solve for box-shaped vessel capacity</td>
<td>• Required dimensions for formula used</td>
</tr>
</tbody>
</table>
Line (GAC): G FORM MATERIALS
 Competency: G5 Fabricate plate

Objectives
To be competent in this area, the individual must be able to:
- Fabricate a J-hook.
- Fabricate a ring to ring.
- Fabricate a 3-piece, 90º elbow complete with branch.

LEARNING TASKS

1. Fabricate a J-hook

2. Fabricate a ring to ring

3. Fabricate a 3-piece, 90º elbow complete with branch

Achievement Criteria

Performance The learner will be able to fabricate the following:
- J-hook
HARMONIZED PROGRAM OUTLINE
Program Content
Level 1

- Ring to ring
- A 3-piece, 90° elbow complete with branch

Conditions
Shop projects will be completed in a training provider facility, given:
- Drawings
- 1/8" mild steel/low carbon material
- A prescribed time limit

Criteria
The learner will be evaluated on:
- Completion of all three projects within 18 hours in a shop environment
- Dimension and tolerance
- Alignment
- Form and fit
- Appearance
  - Neat and feathered tack welds
  - Tack spacing
  - Tack location
  - Edge finish
Line (GAC): H | FABRICATE COMPONENTS
Competency: H1 | Construct templates and jigs

Objectives
To be competent in this area, the individual must be able to:
- Assemble and use jigs.
- Layout and design templates.

**LEARNING TASKS**

1. Describe basic planning considerations for jigs
   - Advantages and disadvantages
   - Required materials
   - Tooling
   - Materials
   - Reference points
   - Tolerances
   - Allowances

2. Describe the different types of jigs used in fabrication
   - Advantages and disadvantages
   - Internal
   - External
   - Incremental
   - Alignment
   - Bolted
   - Welded

3. Define standard edge distances
   - Sheared or thermal
   - Connecting bolt
   - Anchor bolt
   - CISC/AISC

4. Describe templates
   - Advantages and disadvantages
   - Purpose and types
     - Templates
   - Materials
     - Cardboard
     - Sheet metal
     - Wood
     - Steel

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<td>5. Lay out template</td>
<td>• Workpoint</td>
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<td>• Sequence</td>
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<td>• Quality Control</td>
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<td>• Labelling and marking</td>
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<td></td>
<td>• Edge distance</td>
</tr>
</tbody>
</table>
Line (GAC): H  FABRICATE COMPONENTS
Competency: H6  Fabricate structural components

Objectives
To be competent in this area, the individual must be able to:
•  Describe fabricated components.
•  Fabricate a structural beam assembly.

LEARNING TASKS
1. Identify component classification of fabricated items
   •  Buildings
     o  Embedded iron
     o  Structural steel
     o  Sub-assembly
     o  Miscellaneous
     o  Architectural
   •  Machine fabrication
   •  Conveyors
   •  Bridges
   •  Heavy equipment

2. Determine timeline/estimate
   •  Drawing
   •  Bill of material
   •  Fabrication sequence
   •  Welding
   •  Finishing
     o  Painting
     o  Sandblasting
     o  Galvanizing
   •  Inspection and codes
   •  Shipping and site coordination
   •  Taxes
LEARNING TASKS
3. Fabricate a structural beam assembly

CONTENT
- Structural drawings
- Canadian Institute of Steel Construction (CISC) material classification
- Templates
- Working bevels
- Edge distance
- Fasteners
- Running dimensions
- Gauge and pitch
- Structural terminology

Achievement Criteria

Performance
The learner will be able to fabricate the following:
- Structural beam assembly

Conditions
Shop project will be completed in a training provider facility, given:
- Drawings
- Suitable CISC references
- Structural steel components
- Shop tools and equipment
- A prescribed time limit

Criteria
The learner will be evaluated on:
- Project completion within 12 hours
- Dimension
- Alignment
- Tolerance and fit up
- Edge preparation
- Hole locations
- Edge distance
- Appearance
  - Orientation
  - Mark up
  - Edge finish
PERFORM WELDING ACTIVITIES

Competency: I1 Apply weld symbols

Objectives
To be competent in this area, the individual must be able to:
- Apply standard symbols.
- Identify welding codes and standards.

LEARNING TASKS

1. Describe standard weld symbols
   - Terminology
   - Types
   - Design
   - Dimensions
   - Five basic joints
   - Edge preparation

2. Draw weld symbols
   - Fillets
   - Grooves
   - Profiles

3. Identify welding codes and standards
   - CWB W59, 47.1
   - AWS 3.1
   - Inspection
PERFORM WELDING ACTIVITIES

Competency: I2 Use welding processes

Objectives

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

- Use SMAW and GMAW welding processes.
- Perform tack welds.

Learning Tasks

1. Describe SMAW and GMAW
   - Safety
   - Applications
   - Power sources
   - Components
   - Current design
   - Set up
   - Operation
   - Maintenance
   - Consummables
   - Gases and electrodes

2. Describe acceptable weld preparation and profile
   - Groove
   - Edge fit up
   - Convex
   - Concave
   - Flush

3. Describe considerations for tack welding
   - Alignment
   - Offsetting
   - Gap allowance
   - Surface appearance
   - Material
     - Preparation and cleaning
     - Grade
     - Electrode
     - Preheat
   - Position and size of component
   - Tack size

4. Perform tack welding
   - SMAW
   - GMAW
Level 2

Metal Fabricator (Fitter)
**HARMONIZED PROGRAM OUTLINE**
**Program Content**
**Level 2**

**Line (GAC):** A

**PERFORM SAFETY-RELATED FUNCTIONS**

**Competency:** A1  Maintain safe work environment

**Objectives**

To be competent in this area, the individual must be able to:
- Use fall arrest/prevention equipment.
- Design a confined space entry plan.

**LEARNING TASKS**

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<tr>
<td>1. Select appropriate fall arrest/prevention equipment</td>
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<td>• Heights</td>
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<td>• Obstacles</td>
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<td>• Access and egress</td>
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<tr>
<td>• Mobility</td>
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<td>• Work activity</td>
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<tr>
<td>2. Use fall arrest/prevention equipment</td>
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<tr>
<td>• Equipment</td>
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<tr>
<td>o Lanyards</td>
</tr>
<tr>
<td>o Harness</td>
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<tr>
<td>• Anchors</td>
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<tr>
<td>• Fit and serviceability</td>
</tr>
<tr>
<td>3. Design a confined space entry plan</td>
</tr>
<tr>
<td>• Work activity assessment</td>
</tr>
<tr>
<td>• Air quality</td>
</tr>
<tr>
<td>• Access and egress</td>
</tr>
<tr>
<td>• Equipment</td>
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<tr>
<td>• Documentation/administration</td>
</tr>
<tr>
<td>• Personnel</td>
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<tr>
<td>• Rescue</td>
</tr>
</tbody>
</table>
Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B3 Use thermal cutting and welding equipment

Objectives
To be competent in this area, the individual must be able to:
- Use plasma-arc cutting process

LEARNING TASKS
1. Use plasma-arc cutting equipment

CONTENT
- Set up
- Operator position
- Cutting procedure
- Maintenance
  - Consummables
- Trouble-shooting
HARMONIZED PROGRAM OUTLINE
Program Content
Level 2

Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B5 Use computer numerical controlled (CNC) equipment

Objectives
To be competent in this area, the individual must be able to:
• Identify the CNC shape cutting machine.
• Use CNC shape cutting menus.

LEARNING TASKS
1. Identify computer numerical controlled (CNC) cutting equipment
   • Applications
   • Advantages and disadvantages
   • Safety considerations
   • Components
   • Software
   • Terminology
     o XY axis
     o Absolute
   • Set up and operation
     o Configuration
     o Plate orientation and origin
   • Cutting
     o Nesting
     o Strip
     o Profile
   • Gas types

2. Use menus to profile cut parts
   • Pipe flanges
   • Project plates
OBJECTIVES
To be competent in this area, the individual must be able to:
• Sketch views of complex objects.
• Apply standard symbols, abbreviations and specifications.
• Interpret complex drawings and specifications.
• Draw complex welding symbols.
• Describe CAD generated drawings.

LEARNING TASKS

1. Develop and detail orthographic drawings
   • Various views
     o Detail
     o Section
     o Auxiliary
     • Isometric

2. Apply standard symbols, abbreviations and specifications
   • Centre line
   • Base line
   • Elevation
   • Work point
   • Extension and dimension lines
   • Welding procedure data sheet (WPDS)

3. Draw complex welding symbols
   • Multiple reference lines

4. Describe CAD detailing to generate layout
   • Plate
   • Component
HARMONIZED PROGRAM OUTLINE
Program Content
Level 2

Line (GAC): C

INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS

Competency: C2 Interpret structural steel drawings

Objectives
To be competent in this area, the individual must be able to:
- Interpret complex structural steel drawing.
- Draw views of complex objects.
- Construct a bill of material.
- Develop a complex estimate.
- Describe electronic detailing.

LEARNING TASKS

1. Interpret a complex structural drawing
   - Title block
   - Revisions
   - General layout
     - Orientation of beam or column on given drawing paper
   - Material list
     - Identification of main structural member(s)
   - Specifications

2. Draw section views
   - Complex objects

3. Apply welding symbols and abbreviations
   - Detail drawings
   - Shop projects
   - Templates
   - Overlays

4. Develop a bill of material
   - Structural drawing
   - Components
   - Structural shapes
   - Special instructions

5. Develop a complex estimate
   - Structural drawings and details
   - Table of specifications
   - Codes and standards

6. Label and detail drawings
   - Hole location
   - Configuration
   - Profile shape
   - Cut details
   - Plate edge preparation
   - Dimensions
<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
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<tr>
<td>7. Describe electronic detailing</td>
<td>- AutoCAD Inventor</td>
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<td></td>
<td>- SigmaNEST</td>
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<td></td>
<td>- Solidworks</td>
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<td></td>
<td>- SDS</td>
</tr>
</tbody>
</table>
**Line (GAC):** D  **PERFORM QUALITY CONTROL**  
**Competency:** D2  Verify structural measurements, welds and layout

**Objectives**
To be competent in this area, the individual must be able to:
- Describe structural layout systems.
- Identify structural shapes and nomenclature.
- Apply quality control.

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>CONTENT</th>
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</thead>
<tbody>
<tr>
<td><strong>1.</strong> Identify structural shapes and their symbols and abbreviations&lt;br&gt;• Shape characteristics&lt;br&gt;• Component parts&lt;br&gt;• Dimensioning&lt;br&gt;• Symbol or abbreviation</td>
<td><strong>2.</strong> Use a CISC manual to determine mass of structural shapes&lt;br&gt;• Beams&lt;br&gt;• Channels&lt;br&gt;• Angles&lt;br&gt;• Allowances&lt;br&gt;  o Leg size&lt;br&gt;  o Angular offset&lt;br&gt;  o Depth&lt;br&gt;  o Flange size&lt;br&gt;  o Web thickness&lt;br&gt;• Milling of columns&lt;br&gt;• Machining of plates&lt;br&gt;• Rolling of shapes&lt;br&gt;• Hubs to shafts&lt;br&gt;• Bearing to machine surfaces&lt;br&gt;• Heat shrink fitting&lt;br&gt;• Keyways&lt;br&gt;• Trial assembly using dowels</td>
</tr>
</tbody>
</table>
| **3.** Interpret and describe manufacturing variances | **4.** Identify structural terms<br>• Orientation<br>  o Camber<br>  o Sweep<br>  o Twist<br>• Layout tolerances<br>• Cutting to length<br>• Finishing<br>• Thermal cutting

**5.** Identify workmanship tolerances
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<td>6. Confirm markings</td>
<td>• Pieces</td>
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<td></td>
<td>o Detail</td>
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<td></td>
<td>o Main</td>
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<td>7. Confirm torque and dimensions</td>
<td>• Fasteners</td>
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<td>8. Inspect weldments</td>
<td>• Components</td>
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<td>9. Confirm diagonals</td>
<td>• Size and location</td>
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<td>• Layout</td>
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<td>• Components</td>
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<td>• Assemblies</td>
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<td>• Marquee</td>
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</tbody>
</table>
Line (GAC): D PERFORM QUALITY CONTROL
Competency: D3 Track structural materials, consumables and parts for traceability

Objectives
To be competent in this area, the individual must be able to:
• Describe the purpose and method of labelling structural components.
• Describe methods and equipment used in metal identification.
• Develop a bill of material.

LEARNING TASKS
1. Describe the purpose of identifying parts required on a shop or field blueprint
   • Detail pieces
   • Completed units

2. Describe the importance of applying field identification marks in their proper location and specification
   • Piece mark
   • Direction mark
   • Field assembly marks
   • Match marks after trial assembly
   • Marking devices
   • Manual tracking systems
     o Tagging
     o Number stamping
     o Engraving

3. Describe record keeping and other requirements in the process operation
   • Identify sources and availability of materials
   • Quality control information
     o Mill certification
     o Heat number
       - Information transfer to crop material
     o Weld maps
     o Welder’s identification
     o Welder qualification
     o Company policy quality assurance (QA)
   • Document MTR and HIN for project
     o Material test report (MTR)
     o Heat identification number (HIN)
   • Coordinate receipt of materials
   • Document a bill of lading
   • Coordinate receipt of fabricated components
   • Inspect components for defects
<table>
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<td>4. Develop a bill of material</td>
<td>• Parts</td>
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<td>• Material</td>
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<td>• Weights</td>
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</tbody>
</table>
**Line (GAC):** D  **PERFORM QUALITY CONTROL**  
**Competency:** D4  Apply principles of metallurgy

**Objectives**  
To be competent in this area, the individual must be able to:
- Identify methods of relieving stress on metals.
- Describe standard types and methods of testing common metals.
- Describe the tools and equipment used to measure preheat temperatures.

**LEARNING TASKS**

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<th>CONTENT</th>
<th>LEARNING TASKS</th>
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<tr>
<td>• Peening</td>
<td>1. Identify methods of stress relieving on metals</td>
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<td>• Vibration</td>
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<td>• Heat treating</td>
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<td>• Flame straightening</td>
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<td>• Ultrasonic stress relieving</td>
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<td>• Heat pads</td>
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<td>• Spark spray pattern</td>
<td>2. Describe standard material tests</td>
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<td>• Tensile strength</td>
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<td>• Surface indentation</td>
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<td>• Notch toughness</td>
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<td>• Preheat/interpass/post</td>
<td>3. Determine heat temperatures and tools required</td>
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<td>• Worksite welding procedures</td>
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<td>• Blueprint</td>
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<td>• Crack prevention</td>
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<td>• Temperature measuring tools</td>
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<td>o Temperature stick</td>
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<td>o Digital heat sensor</td>
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<td></td>
<td>o Rosebud</td>
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<td>o Tiger torch</td>
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<td>• Induction heater</td>
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<td>• Physical characteristics</td>
<td>4. Interpret technical specifications</td>
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<td>• Spark spray pattern</td>
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<td>• Tensile testing and graph interpretation</td>
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<td>• Surface hardness</td>
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<td>• Britteness/toughness</td>
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</table>
Line (GAC): D PERFORM QUALITY CONTROL
Competency: D5 Control distortion

Objectives
To be competent in this area, the individual must be able to:
• Describe distortion allowances.
• Describe processes to control distortion.
• Describe procedures to minimize distortion.

LEARNING TASKS

1. Estimate possible distortion allowances
   • CISC allowance tables
   • Customer specifications

2. Describe how to help control and minimize the effects of heat distortion
   • Sub-assemblies
   • Jigs and fixtures
     - Strong back
     - Clamps
     - Braces
   • Welding sequences
   • Proper fit-up
   • Counterbalance/shrinkage forces

3. Identify methods of distortion control
   • Mechanical
   • Induction
   • Flame

4. Select and use tools and equipment
   • Come-alongs
   • Hydraulic rams
   • Peening
   • Torches
   • Temperature control devices
   • Induction heaters and ovens
     - Stress relief

5. Define the steps to correct distortion
   - Evaluate
   - Correct
   - Measure
Line (GAC): F PERFORM TRADE MATH AND LAYOUT
Competency: F1 Perform line development

Objectives
To be competent in this area, the individual must be able to:
• Develop various patterns using radial line development.

LEARNING TASKS

1. Develop a true length diagram (TLD)
   • Elevation
   • Offset
   • Mean dimension

2. Develop patterns and scaled models involving radial line methods
   • Concentric cone
   • Frustum of a concentric cone
   • Truncated cone
   • 90° cone to T
   • Cone transition to a cylinder
   • Round or square branch intersecting a cone
   • Inclined cone intersecting a cylinder

3. Calculate and layout complex formed pattern
   • Plate gauge and size
   • Nesting
   • Quality control
   • Labelling
   • Required patterns
Line (GAC):   F  PERFORM TRADE MATH AND LAYOUT
Competency:  F2  Calculate bending allowances and stretch outs

Objectives
To be competent in this area, the individual must be able to:
• Determine stretch out lengths.
• Interpret complex sketches to develop flat plate layout.
• Calculate mass and diagonals.

LEARNING TASKS
1. Interpret complex sketches to develop flat plate layout.
   • Cylinder
   • Rolled segments
   • Flanged shape

2. Determine mass of flat plate stretch outs
   • Cylinder
   • Rolled segments
   • Flanged shape
   • Plate gauge

3. Calculate stretch out diagonal
   • Pythagoras’ theorem
LINE (GAC): F PERFORM TRADE MATH AND LAYOUT

COMPETENCY: F3 Calculate diagonals, volume, mass and capacity

OBJECTIVES
To be competent in this area, the individual must be able to:
• Perform arc length calculations.
• Develop cone patterns.
• Develop hopper layouts.

LEARNING TASKS

1. Develop pattern for cone shape
   - Bend line spacing
   - True length diagram
   - Offset
   - Dimensions
     - Apex to base
     - Cone slope
     - Top to apex
     - Base arc
     - Top arc
   - Pattern checks and adjustments
     - Pattern angle calculation

2. Determine true length of hopper
   - Calculate
     - Slope
     - Rise
     - Base
     - Offset
   - Labelling
     - Bend directions
     - Plate gauge
     - True length
     - Orientation
     - Inside dimension (ID)

3. Determine arc lengths for nozzle placement on cylindrical planes
   - Inside dimension (ID), outside dimension (OD), mean dimension (MD)
   - Quarter marks
   - Ordinates
Line (GAC): G FORM MATERIALS
Competency: G1 Form material using plate rolls

Objectives
To be competent in this area, the individual must be able to:
• Describe power plate rolls.

LEARNING TASKS
1. Review elements of plate roll operation

CONTENT
• Applications
• Safety considerations
• Components
• Machine operation
• Procedure
  o Control console
  o Drive mechanisms
  o Roll adjustment mechanism
  o Pre-form material/pinching
  o Brake press, if required
  o Adjust plate roller
  o Sweep/template
  o Monitor material
• Measurement verification
• Removal of completed material
• Capacity
  o Formability of material
  o Grade
  o Quality
  o Thickness
  o Cut considerations
• Commercial and single pass rolling
Line (GAC): G FORM MATERIALS
Competency: G2 Form material using shape rolls

Objectives
To be competent in this area, the individual must be able to:
- Form material using shape rolls.

LEARNING TASKS

1. Describe the components and procedures of the shape rolls
   - Applications
   - Safety considerations
   - Components
   - Machine operation
   - Capacity
     - Formability of material
     - Grade
     - Quality
   - Operation procedure
     - Control console
     - Drive mechanism
     - Roll adjustment mechanism
     - Roll spacer
     - Structure shape and associated dies
     - Sweep/template
     - Monitor material
   - Measurement verification
   - Removal of completed material

2. Use shape rolls to form structural sections
   - Hard way/easy way
   - Machine adjustment
   - Sweeps
   - Removal of completed material
HARMONIZED PROGRAM OUTLINE
Program Content
Level 2

Line (GAC): G FORM MATERIALS
Competency: G3 Form material using a brake press

Objectives
To be competent in this area, the individual must be able to:
• Use the hydraulic brake press.
• Perform complex forming operations.

LEARNING TASKS
1. Describe hydraulic brake press operation and capabilities
   • Operational theory
   • Types of forming operations
   • Component parts
   • Calibration

2. Use the hydraulic brake press to form metal
   • Set up
   • Complex forming operations involving radial line development
   • Soft radius bending

3. Apply quality control and assurance
   • Sweeps and patterns
   • Check dimensions
   • True length dimensions
Line (GAC):  G  FORM MATERIALS

Competency:  G4  Form material using computer numerical controlled (CNC) brake press

Objectives
To be competent in this area, the individual must be able to:
• Describe the various software program functions.
• Form materials using computer numerical controlled (CNC) brake press

LEARNING TASKS
1. Describe forming material using the CNC brake press
   • Applications
   • Terminology
   • Advantages and disadvantages
   • Safety considerations
   • Software
   • Set up and operation
     o Back gauging
   • Maintenance
   • Troubleshooting

2. Form material using CNC brake press
   • Back gauge
   • Programming
     o Flanged shapes
     o Cylinders
     o Conical sections
     o Transitions
   • Troubleshooting
   • Project plates
   • Radial line development
     o Cone
   • Hopper plates
HARMONIZED PROGRAM OUTLINE
Program Content
Level 2

Line (GAC): G FORM MATERIALS
Competency: G5 Fabricate plate

Objectives
To be competent in this area, the individual must be able to:
• Fabricate a hopper.
• Fabricate a cone.
• Use a thread cutting machine.
• Fabricate a four-nozzle tank assembly.

LEARNING TASKS

1. Fabricate a hopper
   • Offsets
   • Calculations
   • Working bevel
   • True length diagram
   • Nesting
   • Machine selection, setup and sequencing
   • Forming
   • Fitting considerations
   • Labelling
   • Cardboard mock-up

2. Fabricate a cone
   • Stretch out
   • Radial line development
   • Calculations
   • Dimensions
   • Layout and tools
   • Symbols and marking
   • Machine selection and setup
   • Patterns and sweeps
   • Cardboard mock-up

3. Use a thread cutting machine
   • Set up
   • Internal/external
   • Pipe nipple

4. Fabricate a four-nozzle tank assembly
   • As built dimensions
   • Nozzle placement calculations
   • Layout and tools
   • Patterns and wrap arounds
   • Machine selection and setup
Achievement Criteria

Performance  The learner will be able to fabricate the following:
- Hopper
- Cone
- Four-nozzle tank assembly

Conditions  Shop projects will be completed in a training provider facility, given:
- Drawings
- Tools and equipment
- Manual plasma cutting equipment
- 1/8" mild steel/low carbon material
- A prescribed time limit

Criteria  The learner will be evaluated on:
- Completion of three projects within 24 hours
- Dimension and tolerance
- Alignment
- Form and fit
- Appearance
  - Neat and feathered tack welds
  - Tack spacing
  - Tack location
  - Edge finish
Line (GAC): H          FABRICATE COMPONENTS
Competency: H1 Construct templates and jigs

Objectives
To be competent in this area, the individual must be able to:
• Construct a jig.
• Construct a template.

LEARNING TASKS
1. Describe considerations for jig construction
   • Distortion
   • Interference
   • Clearance
   • Wear
   • Welding sequence and distortion

2. Construct a simple jig
   • Design
   • Cost
   • Computer-based design
   • Tolerances
     o Axis
     o Plane
     o Work point
   • Internal and external constraints
   • Hold downs
     o Dogging
     o Clamping
     o Manipulation

3. Construct a template
   • Interpret drawing
   • Reference datum
   • Hole set
   • Edge distance
   • Plate size
   • Codes and standards
   • Marking and identification
Objectives
To be competent in this area, the individual must be able to:
- Interpret structural drawings.
- Apply codes and specifications.
- Apply quality control.
- Transfer dimensions to material.

LEARNING TASKS

1. Describe structural layout
   - Work points
   - Centre lines
   - Slope
   - Run and rise
   - Working bevel
   - Datum
   - Running dimensions
   - Layout tools and equipment
     - Centre punch
     - Scribe
     - Templates

2. Orient components according to drawings
   - Near side/far side
   - Mirror faces
   - Left/right
   - Alignment
   - Fit up
   - Dimensional accuracy
   - Appearance

3. Apply codes and standards
   - CISC
   - Building code
     - Stairs and handrail
   - Architectural
   - Quality control
Line (GAC): H FABRICATE COMPONENTS
Competency: H3 Determine proper sequence for assembly and welding

Objectives
To be competent in this area, the individual must be able to:
• Plan for the installation and assembly of all components on site.

LEARNING TASKS
1. Describe the operation process for planning the installation and assembly of all components on-site
   • Codes and standards
   • Contractual requirements
   • Site dimensions
   • Elevations
   • Revisions
   • Staffing

2. Apply quality control
   • Dimensions
   • Alignment
   • Holes
   • Fit up
   • Marking
   • Geometry

3. Describe welding sequences
   • Distortion control
   • Weld
     o Spacing
     o Distribution
     o Sequence
HARMONIZED PROGRAM OUTLINE
Program Content
Level 2

Line (GAC): H  FABRICATE COMPONENTS
Competency: H4  Assemble sub-components and components

Objectives
To be competent in this area, the individual must be able to:
• Describe fasteners used in fabrication.
• Describe fitting considerations.

LEARNING TASKS

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<td><strong>3. Describe methods for fitting machine components</strong></td>
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<td>• Locating centerlines/reference lines</td>
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<td>• Maintaining position of sub-components</td>
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<tr>
<td>• Alignment methods</td>
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</tbody>
</table>
Line (GAC): H FABRICATE COMPONENTS
Competency: H5 Set fabricated component in place

Objectives
To be competent in this area, the individual must be able to:
• Describe levelling fabricated components using the builder’s level.

LEARNING TASKS
CONTENT
1. Read drawings
   • Location
   • Access
   • Grade
   • Timing

2. Describe installation considerations
   • Shimming
   • Shot elevations
   • Sight reduction
   • Sight maps
   • Alignment
   • Securing component

3. Describe the builder’s level
   • Purpose
   • Types
   • Characteristics
   • Components
   • Set up
   • Use
   • Correction
   • Maintenance
   • Calculations
   • Terminology
Line (GAC): H FABRICATE COMPONENTS
Competency: H6 Fabricate structural components

Objectives
To be competent in this area, the individual must be able to:
• Fabricate a stair assembly complete with handrail.

LEARNING TASKS
1. Fabricate a stair assembly complete with handrail

CONTENT
• Codes and standards
• Layout
• Run and rise
• Structural stair terminology

Achievement Criteria

Performance
The learner will be able to fabricate the following:
• Stair with handrail assembly

Conditions
Shop project will be completed in a training provider facility, given:
• Drawings
• Structural steel components
• Shop tools and equipment
• Manual plasma cutting equipment
• A prescribed time limit

Criteria
The learner will be evaluated on:
• Project completion within 12 hours
• Dimension
• Alignment
• Fit up
• Hole locations
• Appearance
  o Mark up
  o Edge finish
Line (GAC): I PERFORM WELDING ACTIVITIES
Competency: I1 Apply weld symbols

Objectives
To be competent in this area, the individual must be able to:
• Apply complex weld symbols.
• Interpret welding codes and standards.
• Interpret welding procedure data sheet (WPDS)
• Describe standard weld inspection symbols.

LEARNING TASKS (CONTENT)
1. Apply complex weld symbols
   • Multiple reference line
   • Terminology
   • Types
   • Design
   • Dimensions
   • Five basic joints
   • Edge preparation

2. Interpret welding codes and standards
   • CWB W59, 47.1

3. Interpret welding procedure data sheet (WPDS)
   • Design
   • Interpret
   • Apply

4. Describe standard weld inspection symbols
   • Radiography
   • Dye penetrant
   • Magnetic particle
   • Acoustic
   • Ultrasonic
   • Visual
Line (GAC): I PERFORM WELDING ACTIVITIES
Competency: I2 Use welding processes

Objectives
To be competent in this area, the individual must be able to:
• Describe FCAW and GTAW welding processes.

LEARNING TASKS
1. Describe FCAW and GTAW

CONTENT
• Safety
• Applications
• Power sources
• Components
• Current design
• Set up
• Operation
• Maintenance
• Consummables
• Gases and electrodes
Level 3

Metal Fabricator (Fitter)
Line (GAC): A PERFORM SAFETY-RELATED FUNCTIONS
Competency: A1 Maintain safe work environment

Objectives
To be competent in this area, the individual must be able to:
• Apply the Field Level Risk Assessment (FLRA)
• Apply the Job Hazard Assessment (JHA)
• Conduct an eccentric lift.

LEARNING TASKS
1. Apply the Field Level Risk Assessment (FLRA)
   • Plans
   • Equipment
   • Safety parameters
   • PPE
   • Actions on

2. Apply the Job Hazard Assessment (JHA)
   • Task
   • Equipment
   • Duration
   • PPE

3. Conduct an eccentric lift
   • Rigging components
   • Sling configurations
   • Centre of balance
   • Working load limits

Achievement Criteria
Performance
The learner will work in pairs to rotate an eccentric load in a controlled fashion.

Conditions
The learner will be given:
• Rigging components
• Hoist
• Eccentric structural shape
• Saw horses
• Dunnage
• A prescribed time limit

Criteria
The learner will be evaluated on:
• Project completion within 1 hour
• Safety
• Control
• Sling configuration
Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B5 Use computer numerical controlled (CNC) equipment

Objectives
To be competent in this area, the individual must be able to:
- Describe the CNC shape cutting machine.
- Use the CNC shape cutting features.

LEARNING TASKS
1. Describe computer numerical controlled (CNC) cutting equipment
   - Applications
   - Advantages and disadvantages
   - Safety considerations
   - Components
   - Software
   - Terminology
     - XY axis
     - Absolute
   - Set up and operation
     - Configuration
     - Plate orientation and origin
   - Cutting
     - Nesting
     - Strip
     - Profile
   - Gas types

2. Use CNC to generate shape cut parts
   - Pipe flanges
   - Project plates
   - Nests
   - Detail plates
Line (GAC): C  INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS
Competency: C1  Interpret blueprints

Objectives
To be competent in this area, the individual must be able to:
• Interpret advanced multi-drawing sets.
• Apply specifications.
• Apply welding symbols.
• Develop simple CAD details.
• Develop a detailed estimate.

LEARNING TASKS
1. Interpret multi-drawing sets
   • Drawing sets
     o Equipment
     o Machinery
     o Mechanical
     o Tanks
     o Vessels
     o Conveyance
     o Transportation

2. Apply specifications
   • Codes and standards
     o BC Building Code
     o S16
     o CSA

3. Apply welding symbols

4. Use weld procedure data sheet (WPDS)
   • Inspection
   • Design
   • Layout
   • Content
   • Application

5. Use CAD software to produce details
   • Plate
   • Component
   • Part configuration
   • Identification
   • Nests
LEARNING TASKS
6. Create a detailed estimate

CONTENT
• Material list
• Quantity
• Mass
• Description
• Time
• Process requirements
• Shipping
• Cost
Line (GAC): C  INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS
Competency: C2  Interpret structural steel drawings

Objectives
To be competent in this area, the individual must be able to:
- Interpret an advanced structural steel drawing.
- Use computer software to conduct a simple take-off.
- Develop an advanced estimate.

LEARNING TASKS
1. Interpret an advanced structural drawing
   - Title block
   - Material list
   - Specifications

2. Apply welding symbols and abbreviations
   - Detail drawings
   - Shop projects
   - Templates
   - Overlays

3. Develop an advanced estimate
   - Computer software
   - Bill of material
   - Structural drawings and details
   - Table of specifications
   - Codes and standards
   - Cranes
   - Shipping
   - Special considerations
     - Traffic control
     - Pilot car
     - Overtime

CONTENT
Line (GAC): D PERFORM QUALITY CONTROL
Competency: D2 Verify structural measurements, welds and layout

Objectives
To be competent in this area, the individual must be able to:
• Apply quality control to structural components.

LEARNING TASKS
1. Identify processes which contribute to measureable change of components
   • Machining
   • Rolling
   • Shaft clearances
   • Faying surface alignment
   • Thermal fitting (shrink fitting)
   • Interference fit
   • Alignment fit

2. Apply structural allowances
   • Deflection
   • Twist
   • Alignment
   • Distortion

3. Apply appropriate codes to determine permitted tolerances
   • CSA, CISC, ASME, AISC, API, CWB, ANSI
   • Camber tolerances
   • Sweep tolerances
   • Mill tolerances
   • Layout tolerances
   • Cutting to length
   • Finishing of ends
   • Cutting of bevel ends

4. Verify measurements
   • Work points (WP)
   • Datum
   • Elevations
   • Offsets
Line (GAC): D PERFORM QUALITY CONTROL
Competency: D3 Track structural materials, consumables and parts for traceability

Objectives
To be competent in this area, the individual must be able to:
• Develop a complex bill of material.
• Create an estimate.

LEARNING TASKS
1. Develop a complex bill of material based on a sub-assembly
   • Beam
   • Column
   • Structural shape

2. Develop a complex bill of material based on a structural detail
   • Plasma
   • Burned components
   • Machined items
   • Fasteners

3. Develop a complex bill of material based on a handrail
   • Cost per lineal foot
   • Jigs

4. Create an estimate
   • Bill of material
HARMONIZED PROGRAM OUTLINE
Program Content
Level 3

Line (GAC): D PERFORM QUALITY CONTROL
Competency: D5 Control distortion

Objectives
To be competent in this area, the individual must be able to:
• Apply control methods to prevent distortion.

LEARNING TASKS
1. Identify material classifications
   • Compatibility
   • Pre-heatability

2. Apply welding sequences
   • Offset
   • Balance
   • Deposition

3. Apply pre-forming considerations
   • Angular
   • Offset
   • Linear

4. Apply pre and post heat
   • Material grade
   • Plate gauge
Line (GAC): E HANDLE MATERIALS
Competency: E1 Organize specialty materials and products.

Objectives
To be competent in this area, the individual must be able to:
- Identify specific handling and storage requirements for specialty materials and products.

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<th>LEARNING TASKS</th>
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<td>o Stainless</td>
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<td>2. Locate and verify components</td>
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<td>3. Determine suitable storage for dissimilar products</td>
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<td>• Temperature</td>
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<td>• Softeners</td>
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<td>• Plate grabs</td>
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<td>• Rigging</td>
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</table>
HARMONIZED PROGRAM OUTLINE
Program Content
Level 3

Line (GAC):   F   PERFORM TRADE MATH AND LAYOUT
Competency:   F1   Perform line development

Objectives
To be competent in this area, the individual must be able to:
- Develop patterns using the triangulation method.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
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<tbody>
<tr>
<td>1. Describe the procedure for developing patterns</td>
<td>Views</td>
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<td>using triangulation</td>
<td>Dimensions</td>
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<td></td>
<td>Ordinates</td>
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<td>True lengths</td>
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<td>2. Develop patterns and scaled models using the</td>
<td>Chutes</td>
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<tr>
<td>triangulation method</td>
<td>Square to round transitions</td>
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<td>Round to round transitions</td>
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<td>3. Calculate and layout intersecting branches</td>
<td>Round to square</td>
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<td>Ordinate plane</td>
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<td>Cardboard mock-up (metering valve)</td>
</tr>
</tbody>
</table>
Line (GAC): F 
PERFORM TRADE MATH AND LAYOUT

Competency: F2 Calculate bending allowances and stretch outs

Objectives
To be competent in this area, the individual must be able to:
• Determine stretch out lengths.
• Interpret advanced sketches to develop flat plate layout.
• Calculate mass and diagonals.

Learning Tasks
1. Interpret advanced sketches to develop flat plate layout
   • Cylinder
   • Rolled segments
   • Flanged shape

2. Determine mass of flat plate stretch outs
   • Cylinder
   • Rolled segments
   • Flanged shape
   • Plate gauge

3. Calculate stretch out diagonal
   • Pythagoras’ theorem
HARMONIZED PROGRAM OUTLINE
Program Content
Level 3

Line (GAC): F PERFORM TRADE MATH AND LAYOUT
Competency: F3 Calculate diagonals, volume, mass and capacity

Objectives
To be competent in this area, the individual must be able to:
• Solve problems using trigonometric functions.
• Use triangulation to develop patterns.
• Solve advanced problems involving mass and the capacity of vessels.

LEARNING TASKS
1. Describe terms and names used in geometric construction
   • Tangent
   • Arc
   • Chord

2. Solve problems using trigonometry
   • Tangent
   • Sine
   • Cosine
   • Trusses
   • Cones
   • Hoppers
     o Bend sets
   • Arc lengths

3. Develop flat patterns for transition shapes
   • Square to round
   • Offset

4. Calculate dimensions using trigonometry and triangulation
   • Advanced problems
     o Slope
     o Rise
     o Base
   • Pattern angle
   • Identify right angle triangles within given shapes
   • True lengths of sides
   • Trigonometry
     o Trusses
     o Hoppers
     o Conical shapes
Line (GAC): G  FORM MATERIALS  
Competency: G2  Form material using shape rolls

Objectives
To be competent in this area, the individual must be able to:
• Form material using shape rolls.

LEARNING TASKS
1. Review the components and procedures for the use of shape rolls
   • Capacity
   • Direction
   • Set up and maintenance

2. Use shape rolls to form structural sections
   • Hard way/easy way
   • Machine adjustment
   • Sweeps
   • Removal of completed material
Line (GAC): G  FORM MATERIALS

Competency: G3  Form material using a brake press

Objectives
To be competent in this area, the individual must be able to:
• Perform complex forming operations.

LEARNING TASKS
1. Use the hydraulic brake press to form metal
   • Radial line development
   • Triangulation
   • Programming

2. Apply quality control and assurance
   • Sweeps and patterns
   • Check dimensions
   • True length dimensions
Line (GAC): G FORM MATERIALS
Competency: G4 Form material using computer numerical controlled (CNC) brake press

Objectives
To be competent in this area, the individual must be able to:
- Use machine operations software.
- Form materials using computer numerical controlled (CNC) brake press.

LEARNING TASKS
<table>
<thead>
<tr>
<th>Learning Task</th>
<th>Content</th>
</tr>
</thead>
</table>
| 1. Describe forming material using the CNC brake press | • Applications  
• Terminology  
• Advantages and disadvantages  
• Safety considerations  
• Software  
• Set up and operation  
  - Back gauging  
• Maintenance  
• Troubleshooting |
| 2. Form material using CNC brake press | • Back gauge  
• Programming  
  - Flanged shapes  
  - Cylinders  
  - Conic sections  
  - Transitions  
• Troubleshooting  
• Project plates  
• Triangulation  
  - Square to round transition  
  - Structural frame |
| 3. Use machine operations software to generate formed shapes | • Flanged shapes  
• Cylindrical  
• Conic sections  
• Transition |
Line (GAC): G FORM MATERIALS
Competency: G5 Fabricate plate

Objectives
To be competent in this area, the individual must be able to:
• Fabricate a square to round transition.

LEARNING TASKS

1. Fabricate a square to round transition

CONTENT
• Offsets
• Calculations
• Triangulated layout
• CNC machine operation
• CAD drawing
• Nesting software
• Forming
• Fitting considerations
  o Seam orientation
• Cardboard mock-up

Achievement Criteria

Performance
The learner will be able to fabricate the following:
• Square to round transition
• OPTIONAL – spiral staircase complete with handrail (CNC) – technical training time permitting

Conditions
Shop projects will be completed in a training provider facility, given:
• Drawings
• Tools and equipment
• 1/8” mild steel/low carbon material
• A prescribed time limit

Criteria
The learner will be evaluated on:
• Completion of the square to round transition project within 12 hours
• OPTIONAL – spiral staircase project complete with handrail completed within 18 hours
• Fitting accuracy
• Alignment
  o Appearance
  o Tack spacing
  o Tack location
  o Edge finish
HARMONIZED PROGRAM OUTLINE
Program Content
Level 3

Line (GAC): H  FABRICATE COMPONENTS
Competency: H1 Construct templates and jigs

Objectives
To be competent in this area, the individual must be able to:
• Construct a complex jig.
• Layout a complex template.

LEARNING TASKS
1. Construct a complex jig
   • Efficiencies
   • Construction materials
   • Time

2. Layout a complex template
   • Interpret complex drawing
   • Material list
   • Orientation
   • Marks and labelling
Line (GAC): H FABRICATE COMPONENTS
Competency: H2 Construct sub-components

Objectives
To be competent in this area, the individual must be able to:
• Interpret complex structural drawings.
• Apply codes and specifications.
• Apply quality control.
• Construct a material list.

LEARNING TASKS
1. Construct a material list
   • Structural drawings
   • Templates
   • Patterns
   • Material thickness
   • Part quantity
   • Marks and numbers
   • Codes and standards

2. Apply quality control
   • Tolerance
   • Dimensions
   • Angular offset
Line (GAC): H

Objective:
To be competent in this area, the individual must be able to:
• Plan for fabrication.

LEARNING TASKS

1. Coordinate fabrication
   • Site
   • Shop
   • Delivery
   • Sequencing
   • Space
   • Staging
   • Identification
   • Orientation

2. Apply quality control
   • Codes and standards
   • Inspection
   • Calibration of equipment
   • Staffing
   • Special needs
   • Cranes and rigging
   • Shipping
Line (GAC): H  FABRICATE COMPONENTS
Competency: H4  Assemble sub-components and components

Objectives
To be competent in this area, the individual must be able to:
• Plan for the installation and assembly of all components.

LEARNING TASKS
1. Verify component is correctly placed.
   • Manufacturers’ specifications
   • Blueprints
   • Tolerances
   • Inspections
   • Codes

2. Describe fabrication marks and shipping considerations.
   • Orientation
   • Cardinal
   • Item marks
   • Location reference
   • Coordination
   • Size and complexity
   • Handling
HARMONIZED PROGRAM OUTLINE
Program Content
Level 3

Line (GAC): H FABRICATE COMPONENTS
Competency: H5 Set fabricated component in place

Objectives
To be competent in this area, the individual must be able to:
• Use builder’s level to establish elevations.

LEARNING TASKS

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<td>• Sight plan</td>
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<td>• Record of sights</td>
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<td>• Corrected elevations</td>
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<td>- Shim requirement</td>
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<td>• Maintenance and storage</td>
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<td>• Components</td>
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<td>2. Demonstrate effective communication for recording sights</td>
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<td>• Environmental considerations</td>
</tr>
<tr>
<td>• Obstacles</td>
</tr>
<tr>
<td>• Spatial considerations</td>
</tr>
<tr>
<td>• Hand signals</td>
</tr>
<tr>
<td>• Verbal</td>
</tr>
<tr>
<td>• Radios</td>
</tr>
</tbody>
</table>

Achievement Criteria

<table>
<thead>
<tr>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will work in pairs to level two 20’ beams 8’ apart from each other to within 1/16”.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>As part of a practical shop project completed in a training provider facility, given:</td>
</tr>
<tr>
<td>• Sketch</td>
</tr>
<tr>
<td>• Shops tools and equipment</td>
</tr>
<tr>
<td>• Suitable foundation to measure (sight, grade and condition)</td>
</tr>
<tr>
<td>• Suitable assembly to level/evaluate</td>
</tr>
<tr>
<td>• Selection of shims</td>
</tr>
<tr>
<td>• Within prescribed time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learner will be evaluated on:</td>
</tr>
<tr>
<td>• Project completion within 4 hours</td>
</tr>
<tr>
<td>• Accuracy</td>
</tr>
<tr>
<td>- +/- 1/16”</td>
</tr>
</tbody>
</table>
Line (GAC): H FABRICATE COMPONENTS
Competency: H6 Fabricate structural components

Objectives
To be competent in this area, the individual must be able to:
• Fabricate a structural frame assembly.

LEARNING TASKS
1. Fabricate a structural frame assembly
   • Electronic nesting software
   • Layout
   • Machine operation

2. Manage project requirements
   • Coordinate
   • Conflict resolution
   • Roles and responsibilities
   • Troubleshooting
   • Quality control
   • Time management

Achievement Criteria
Performance The learner will work in pairs and will be able to fabricate the following:
• Structural frame assembly

Conditions As part of a practical shop project completed in a training provider facility, given:
• Structural detail drawing
• Computer lab
  o Electronic drawing and detailing software
  o Nesting software
• Structural steel components
• Shop tools and equipment
• Code and standards
• A prescribed time limit

Criteria The learner will be evaluated on:
• Project completion within 12 hours
• CNC/machinery selection and operation
• Quality control
  o Conforms to specifications
• Accuracy
  o Time
  o Estimate
• Troubleshooting
Line (GAC): I PERFORM WELDING ACTIVITIES
Competency: I1 Apply weld symbols

Objectives
To be competent in this area, the individual must be able to:
• Apply advanced weld symbols.
• Interpret welding codes and standards.

LEARNING TASKS
1. Apply advanced weld symbols
2. Interpret welding codes and standards
3. Apply weld inspection symbols

CONTENT
- Component to drawing (and vice versa)
- Field marking
- CWB W59, 47.1
- Radiography
- Dye penetrant
- Magnetic particle
- Acoustic
- Ultrasonic
- Visual
Line (GAC): J COMPLETE PROJECT
Competency: J1 Determine finishing process

Objectives
To be competent in this area, the individual must be able to:
• Describe finishing processes.
• Describe safety and environmental considerations
• Describe methods and equipment used.

LEARNING TASKS
1. Describe finishing processes
   • Advantages and disadvantages
     o Cost benefit
   • Process lifecycle
   • Tools, equipment and identification
     o Galvanizing
       - Air bleeds
       - Drain holes
     o Metalizing
     o Painting
       - Zinc
       - Epoxy
       - Latex
       - Enamel
     o Plating
     o Powder coat
     o Electro-plating
   • Cleaning and maintenance

2. Describe safety and environmental considerations
   • WorkSafe
   • Workplace Hazardous Materials Identification System (WHMIS)
   • Environmental
   • Local regulations

3. Identify special considerations
   • Inspection
   • No paint areas
   • Marking and tagging
Line (GAC): J COMPLETE PROJECT  
Competency: J2 Prepare material for finishing

Objectives
To be competent in this area, the individual must be able to:
• Describe methods used to prepare material for finishing.

LEARNING TASKS
1. Describe the different grades of finish required on metal
   • Society for Protective Coatings (SSPC)

2. Describe tools used for surface preparation
   • Brushes
   • Chipper
   • Scraper
   • Grinder
   • Sander
   • Rotary wire wheel

3. Describe equipment used for surface preparation
   • Wheelabrator
   • Sandblaster
   • Portable vacuum blaster
   • Abrasives

4. Describe chemical agents used for surface preparation
   • Petroleum
   • Chlorinated solvents
   • Acid

5. Inspect material edge and surface preparation
   • Burrs
   • Sharp edges
   • Cross-contamination
   • Surface blemishes
     o Plate clamp gouges
     o Arc strikes
     o Welding defects
     o Profile weld
     o Spatter
     o Slag
Section 4
ASSESSMENT GUIDELINES

Metal Fabricator (Fitter)
### Assessment Guidelines – Level 1

#### Level 1 Grading Sheet: Subject Competency and Weightings

<table>
<thead>
<tr>
<th>LINE</th>
<th>SUBJECT COMPETENCIES</th>
<th>THEORY WEIGHTING</th>
<th>PRACTICAL WEIGHTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PERFORM SAFETY RELATED FUNCTIONS</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>USE TOOLS AND EQUIPMENT</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>C</td>
<td>INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>PERFORM QUALITY CONTROL</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>HANDLE MATERIALS</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>F</td>
<td>PERFORM TRADE MATH AND LAYOUT</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>G</td>
<td>FORM MATERIALS</td>
<td>7</td>
<td>40</td>
</tr>
<tr>
<td>H</td>
<td>FABRICATE COMPONENTS</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>I</td>
<td>PERFORM WELDING ACTIVITIES</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total** 100% 100%

**In-school theory / practical subject competency weighting**

| In-school Percentage Score | 60 | 40 |

**Final in-school percentage score**

| IN-SCHOOL % |

**In-school Percentage Score**

Combined theory and practical subject competency multiplied by 80%

**Standard Level Exam Percentage Score**

The exam score is multiplied by 20%

**Final Percentage Score**

FINAL%
### Assessment Guidelines – Level 2

#### Level 2 Grading Sheet: Subject Competency and Weightings

<table>
<thead>
<tr>
<th>LINE</th>
<th>SUBJECT COMPETENCIES</th>
<th>THEORY WEIGHTING</th>
<th>PRACTICAL WEIGHTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PERFORM SAFETY-RELATED FUNCTIONS</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>USE TOOLS AND EQUIPMENT</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>PERFORM QUALITY CONTROL</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>PERFORM TRADE MATH AND LAYOUT</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>G</td>
<td>FORM MATERIALS</td>
<td>10</td>
<td>55</td>
</tr>
<tr>
<td>H</td>
<td>FABRICATE COMPONENTS</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>I</td>
<td>PERFORM WELDING ACTIVITIES</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**In-school theory / practical subject competency weighting**

<table>
<thead>
<tr>
<th>PROGRAM: IN-SCHOOL TRAINING: Metal Fabricator LEVEL 2</th>
</tr>
</thead>
</table>

**Final in-school percentage score**

**In-school Percentage Score**
Combined theory and practical subject competency multiplied by 80%

**Standard Level Exam Percentage Score**
The exam score is multiplied by 20%

**Final Percentage Score**

<table>
<thead>
<tr>
<th>In-school Percentage Score</th>
<th>Final Percentage Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined theory and practical subject competency multiplied by 80%</td>
<td>FINAL%</td>
</tr>
</tbody>
</table>
### Assessment Guidelines – Level 3

#### Level 3 Grading Sheet: Subject Competency and Weightings

<table>
<thead>
<tr>
<th>PROGRAM: IN-SCHOOL TRAINING:</th>
<th>Metal Fabricator LEVEL 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINE</td>
<td>SUBJECT COMPETENCIES</td>
</tr>
<tr>
<td>A</td>
<td>PERFORM SAFETY-RELATED FUNCTIONS</td>
</tr>
<tr>
<td>B</td>
<td>USE TOOLS AND EQUIPMENT</td>
</tr>
<tr>
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<td>INTERPRET PLANS, DRAWINGS AND SPECIFICATIONS</td>
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<td>D</td>
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<td>F</td>
<td>PERFORM TRADE MATH AND LAYOUT</td>
</tr>
<tr>
<td>G</td>
<td>FORM MATERIALS</td>
</tr>
<tr>
<td>H</td>
<td>FABRICATE COMPONENTS</td>
</tr>
<tr>
<td>I</td>
<td>PERFORM WELDING ACTIVITIES</td>
</tr>
<tr>
<td>J</td>
<td>COMPLETE PROJECT</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

| In-school theory / practical subject competency weighting | 60 | 40 |

#### 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 or ITA CoQ exam.

<table>
<thead>
<tr>
<th>IN-SCHOOL %</th>
</tr>
</thead>
</table>

All apprentices who complete Level 3 of the Metal Fabricator program with a FINAL level percentage score of 70% or greater will write the Interprovincial Red Seal examination as their final assessment.

ITA will enter the apprentices’ Metal Fabricator Interprovincial Red Seal examination percentage score in ITA Direct Access.

A minimum percentage score of 70% on the examination is required for a pass.
Section 5

TRAINING PROVIDER STANDARDS

Metal Fabricator (Fitter)
Facility Requirements

Classroom Area
- 900 sq. ft. for a class size of 12 - 16 students, with moveable tables and chairs
- Instructional media to include multimedia projector, projection screen, DVD player, and whiteboard

Shop Area
- 175 sq. ft. per student
- Well heated and ventilated
- 22 ft. high ceilings
- Lighting appropriate for detailed work
- Student locker and changeroom facilities
- 200 sq. ft. clean-up/waste area

Storage
- 200 sq. ft. raw materials storage (may be outdoors)
- 20 sq. ft. per student for tools storage (indoors)

Instructor’s Office Space
- 150 sq. ft. per instructor, with a desk, chairs and materials storage/filing system
Tools and Equipment

CUTTING EQUIPMENT

- Angle shear
- Nibblers
- Band saw
- Oxy-fuel torches
- Bevellers
- Pipe cutters
- Dry cutter saw
- Power hack saw
- Friction saw
- Vertical saw
- Hand shear
- Mechanical, electric and hydraulic shears
- Hand-help plasma cutter
- CNC cutting centre

DRILLING EQUIPMENT

- Blocks
- Micrometers
- Calipers
- Pedestal drill
- Core drills (cutters)
- Portable hand drill
- Drill bits
- Punches and dies
- Drill gauges
- Radial arm drill
- Drill press
- Reamers
- Drill press vise
- Standard upright drill
- Hold down clamps
- Tap and dies
- Magnetic drill

BENDING AND SHAPING EQUIPMENT

- Porta power
- CNC process equipment
- Brake press
- Punches
- Fixed and portable mechanical and hydraulic
- Punch presses
- Ironworker
- Various dies
- Manual shape bender
- Plate rolls

FINISHING TOOLS AND EQUIPMENT

- Angle grinder
- Pencil grinder (die)
- Assorted finishing discs
- Sand blaster
- Belt sander
- Sander
- Buffers
- Wheelabrator
- Chippers
- Wire brush
- Hand brush
- Wire wheels
HAND TOOLS

- Assorted wrenches
- Ballpeen hammer
- Bar clamps
- C-clamps
- Dogs and wedges
- Drift pins
- File
- Hand magnets
- Hi/low gauge
- Locking grips
- Measuring tools
- Plumb bob
- Punches
- Sledge hammer
- Squares
- Steel thickness gauge
- Tape measure
- Toggle clamps
- Torque wrench
- Transits
- Various levels
- Vernier calipers

SAFETY EQUIPMENT

- Dust mask
- Face shields
- Fire resistant clothing
- Gloves
- Hard hats
- Hearing protectors
- Reflective gauntlet
- Reflective vest and coveralls
- Respirator
- Safety glasses
- Safety harness
- Self-contained breathing apparatus (SCBA)
- Welding helmets

POWER TOOLS

- Angle grinder
- Air tools
- Bench grinder
- Concrete drills
- Core drill
- Explosive activated tools
- Hammer drill
- Hydraulic power tools
- Magnetic drill
- Pneumatic tools
- Power actuated tools (wrenches, riveters)
- Punches/rams
- Reamer drill

WELDING EQUIPMENT

- Anti spatter paste/gel/spray
- Carbon air arc gouging
- Chipping hammer
- Electrical resistance welding (ERW)
- Equipment for shielded metal arc
- Flux core welding (FCAW)
- Gas metal arc welding (MIG)
- Gas tungsten arc welding (TIG)
- Ground clamps
- Mig pliers
- Oxy-fuel welding
- Thermal electrode device (TED)
- Welding (SMAW)
- Welding cables
- Welding gauge
- Wire brush
HARMONIZED PROGRAM OUTLINE
Training Provider Standards

RIGGING EQUIPMENT

- Blocks
- Chain cinch
- Chain falls
- Chain slings
- Come-along
- Endless sling assemblies
- Hydraulic and manual jacks
- Manila rope
- Mesh slings
- Personnel basket
- Plate clamps
- Rope and tackle
- Shackles
- Spreader bars
- Synthetic ropes
- Synthetic slings
- Tirfor®
- Tuggers
- Turnbuckles
- Wire rope slings

ELEVATED WORK PLATFORMS

- Ladders
- Personnel basket
- Powered personnel lifts
- Scaffolds

MATERIAL HANDLING EQUIPMENT

- Bridge crane
- Fork lift
- Hydraulic cranes
- Magnetic lifting devices
- Overhead crane
- Mobile cranes and lifts

LAYOUT TOOLS

- Ballpeen hammer
- Beam board
- Beam gauge
- Bevel square
- Centre finder
- Centre punch
- Chalk line
- Combination square
- Divider
- Hand magnet
- Measuring tape
- Paint marker
- Piano wire
- Protractor
- Scribe
- Small clamps
- Soap stone
- Straight edge
- Templates
- Transfer punches
- Transits
- Trammel points
- Various squares
- Laser level
Reference Materials

Required Reference Materials
- WorkSafeBC Regulations Online
- Student Materials Package

Recommended
- AccurPress Accell User Manuals, No. 1 - 3
- American Institute of Steel Construction (AISC) website - Bolting & Welding, ppt.
- Koike Aronson Instruction Manual M10549A, 2006 (Kwantlen Polytechnic University)
- EHRT Punching Machine Holecut 40-9 Professional Operation Modules (CNC) - (Kwantlen Polytechnic University)
- Tool Change – Metal Forming Magazine, March 2007
- Canadian Welding Bureau (CWB) Learning Centre Modules, No. 1, 2, 3, 4, 6, 7 and 10 – CWB Group Industry Services, 2006
- Metal Fabrication Apprentice Modules, Level 1, 2 and 3 (Kwantlen Polytechnic University, 2008, 2009)
- Welder Training Program Modules, Level A & B (ITAC 2001)
- Welder Fitting Skills Modules (ITAC 1999)
- Alberta Learning ILM Welder Modules 204a-e, 204h, 2007

NOTE:
This list of Reference Materials is for training providers. Apprentices should contact their preferred training provider for a list of recommended or required texts for this program.
Instructor Requirements

Qualifications and Work Experience

A Metal Fabricator Instructor must have a combination of the following occupational qualifications and work experience:

- Metal Fabricator Interprovincial Red Seal certification
- A minimum of 5 years’ experience working in the industry as a journeyperson after earning Red Seal certification
- Demonstrated effectiveness of communication skills, instructional and interpersonal
- Experienced user of relevant software for:
  - Word processing
  - Spreadsheets
  - Presentations

Instructional Experience and Education

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

- Provincial (BC) Instructor Diploma or completion of a similar Trainer Training/Instructional Methods program, plus
- 1 year of supervisory or administrative experience
- Welding certification level “C” or equivalent
- Experienced user of relevant software for CAD
Appendices
Appendix A: Previous Contributors

The Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the Resource Training Organization of British Columbia. Members include:

Industry Subject Matter Experts retained in 2008-2009 to assist in the development of Program Outline content:

- Eric Bohne, Int Assn of Bridge, Ornamental & Reinforcing Iron Workers, Local 712
- Alex Bunt, DC Welding
- Garry Callander, Canadian Forces
- Derek Critchley, Canron
- Lorne Cook, Elk Valley Coal Corp.
- Robert Finlayson, Kwantlen Polytechnic University
- Gary George, Nahanni Manufacturing Ltd
- John Mortimer, Vancouver Shipyards Co. Ltd.
- Mike Pellett, Nahanni Manufacturing Ltd
- Terry Subtelny, BCIT
- Peter Thomas, BCIT
- Allen White, Teck
- Les Wiebe, Thompson Rivers University

Key stakeholders from industry sectors, including employers, associations, training providers, and trades workers, were integral to the guidance of this program development project. Members of the Project Steering Committee who contributed their valuable time and insights to the project were:

- Steve Anderson, Department of National Defence
- Danny Bradford, BC Federation of Labour
- Larry Doskoch, Teck
- Dana Goedbloed, Kwantlen Polytechnic University
- Wayne Muzylowski, West Fraser (Eurocan Pulp and Paper)
- James Piwek, Teck
- Brad Smith, Catalyst Paper
- Cindy Soderstrom, CAODC (Rig Tech Trade)
- Gene Von Matt, Elk Valley Coal
- Wayne Wetmore, Enform Training
- Trevor Williams, BCIT

Industry Subject Matter Experts retained in 2013 to assist in reviewing the Program Outline to address the 2012 NOA updates:

- Robert Finlayson, Kwantlen Polytechnic University
- John Folkers, Weldco Beales
- Nathan Van Seters, Intercontinental Truck Body
- Henry Ostermann, BCIT
- John Sutton, Thompson Rivers University
- Dave Marcinew, Canron
- Al White, Teck (accompanied by Sean Horton)

The Industry Training Authority would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Metal Fabrication occupation.