



Metal Fabricator (Fitter)

On-the-Job Training Guide

2024

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Recognition:

To promote transparency and consistency, portions of this document has been adapted from the 2021 Metal Fabricator (Fitter) Red Seal Occupational Standard (Employment and Social Development Canada).

A complete version of the Occupational Analysis can be found at www.red-seal.ca



STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

Major Work Activity (MWA): the largest division within the standard that is comprised of a distinct set of trade activities.

Task: distinct actions that describe the activities within a major work activity.

Sub-task: distinct actions that describe the activities within a task.

On-the-Job and In-school Training Content for the Metal Fabricator (Fitter) Trade: a chart which outlines on-the-job examples for apprentices to achieve relevant work experience at work.

TRAINING REQUIREMENTS FOR THE METAL FABRICATOR (FITTER) TRADE

To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1800 hours each year. Total trade time required is 5400 hours and at least 3 years in the trade.

There are three levels of technical training delivered by Saskatchewan Polytechnic in Saskatoon.

Journeyman to apprentice ratio for this trade is: 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentices results in skilled and certified workers. These pages summarize the tasks that should be covered by the apprentice during the on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of the apprenticeship term training on-the-job.

It is the employer's or journeyman's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious and learning-friendly work environment
- provide mentored, hands-on practice in the use of tools and equipment
- further the apprentice's ability to interpret technical drawings and perform trade math
- demonstrate the procedures relevant to the layout, forming, fitting and fabrication of metal components
- ensure that the apprentice can estimate production costs and understand quality assurance procedures
- use guided instruction to develop skill for tacking in all positions and running straight beads using both GMAW and SMAW methods using 7018 electrodes

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first followed by suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

METAL FABRICATOR (FITTER) TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2016 Metal Fabricator (Fitter) National Occupational Analysis. Each sub-task details the corresponding essential skill and level of training where the content is covered.

* Sub-tasks with numbers in the boxes is where the content will be delivered in training.

A - Performs Common Occupational Skills

26%

A-1 Performs safety-related functions	1.01 Maintains safe work environment 1	1.02 Uses personal protective equipment (PPE) and safety equipment 1		
A-2 Uses and maintains tools and equipment	2.01 Uses hand, power, layout and measuring tools and equipment 1	2.02 Uses stationary machinery 1	2.03 Maintains cutting and welding equipment 1, 2	2.04 Uses access equipment 1
A-3 Organizes work	3.01 Interprets plans, drawings and specifications 1, 2, 3	3.02 Organizes project tasks 3		
A-4 Performs quality assurance throughout fabrication and assembly process	4.01 Performs visual inspections 3, In Context in 1	4.02 Verifies measurements, welds and layout 3, In Context in 2, 3	4.03 Tracks material and parts for traceability 3, In Context in 2, 3	
A-5 Handles materials	5.01 Organizes material 3	5.02 Determines weights 1, In Context in 2	5.03 Applies rigging practices 1. In Context in 2	5.04 Operates material handling equipment 1. In Context in 2

A-6 Uses communication and mentoring techniques	A-6.01 Uses communication techniques 1	A-6.02 Uses mentoring techniques 3		
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B – Fabricates Components

43%

B-7 Performs layout	7.01 Performs pattern development 1, 2, 3	7.02 Calculates material allowances for various processes 1, 2, 3	7.03 Determines dimensions 1, 2, 3	7.04 Transfers dimensions 2, 3	7.05 Makes templates 2, 3
B-8 Cuts materials	8.01 Cuts material using plasma cutting equipment 1, 2, 3	8.02 Cuts material using manual oxy-fuel cutting equipment 1, 2, 3	8.03 Cuts material using shears 1, 2, 3	8.04 Cuts material using saws 1, 2, 3	8.05 Cuts material using ironworkers 1, 2, 3
	8.06 Cuts material using computer numerical controlled (CNC) equipment 1, 3	8.07 Drills holes 1, 2, 3	8.08 Cuts threads 1, 2, 3	8.09 Prepares joints 1, 2, 3	
	B-9 Forms materials	9.01 Forms materials using plate rollers 2, 3	9.02 Forms materials using shape rollers 2, 3	9.03 Forms materials using conventional and computer numerical controlled (CNC) press brakes 2, 3	9.04 Forms materials using benders 2, 3

C – Assembles Components

31%

<p>C-10 Fits and fastens sub-components and components</p>	<p>10.01 Assembles jigs</p> <p>1</p>	<p>10.02 Determines proper sequence for assembly</p> <p>1, 2, 3</p>	<p>10.03 Assembles sub-components and components</p> <p>1, 2, 3</p>	<p>10.04 Sets fabricated component in place</p> <p>1, 2, 3</p>	<p>10.05 Joins components on-site</p> <p>1, 2, 3</p>
<p>C-11 Performs welding activities</p>	<p>11.01 Applies heat prior to tack welding</p> <p>1, 2. In Context in 3</p>	<p>11.02 Performs tack welding</p> <p>1</p>	<p>11.03 Minimizes welding distortions</p> <p>1, 2. In Context in 3</p>	<p>11.04 Applies welding processes</p> <p>2</p>	<p>11.05 Corrects welding distortions</p> <p>2. In Context in 3</p>
<p>C-12 Completes project</p>	<p>12.01 Identifies type of finish</p> <p>3</p>	<p>12.02 Prepares material for finishing</p> <p>3</p>			

TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Level One	Transcript Code	Hours
Layout, fit and Fabrication	EQPT 170 – Theory	25
	EQPT 171 – Shop	45
Mathematics	MATH 190	24
Print Reading and Drafting	PRNT 182	24
Rigging and Overhead Crane	RIGG 188	42
Safety and Access Structures	SFTY 190	15
Tools and Equipment	TOOL 186	20
SMAW/FCAW/MCAW/GMAW Welding and Tacking	WLDR 180	30
Oxy-Fuel and Plasma Arc Cutting	WLDR 180	15
		240

Level Two	Transcript Code	Hours
Metallurgy and Material Designation	METL 280	30
Fabrication Safety	SFTY 281	9
Drawing Interpretation	DRAW 280	24
Forming Fitting and Fabrication	METL 281 – Theory	26
	METL 282 – Shop	54
Machine Operations	EQPT 282	26
Mathematics	MATH 279	24
Layout	EQPT 283	35
Welding and Cutting Processes	WLDR 279	20
		240

Level Three	Transcript Code	Hours
Quality Control	QC 380	28
Drawing Interpretation	DRAW 380	28
Layout	EQPT 380	16
Project Planning and Estimating	ESTM 385	18
Engineered Design	DSGN 380	12
Shop Organization	SHOP 381	12
Fitting and Fabrication	METL 300 – Theory	26
	METL 381 – Shop	88
Mathematics	MATH 392	12
		240

ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE METAL FABRICATOR (FITTER) TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	8 weeks	240 hours
Layout, Fit, and Fabrication – Theory <ul style="list-style-type: none"> perform geometric constructions develop two dimensional templates describe use and advantages of jigs 		25 hours
Layout, Fit, and Fabrication – Shop <ul style="list-style-type: none"> make a bend set template make sweep templates layout flanges layout square grid on floor determine plum and level fabricate small projects 		45 hours
Mentors can assist the apprentice to prepare for this section of technical training by: <ul style="list-style-type: none"> demonstrating and assisting the apprentice to perform geometric constructions, mark up, template development and plate layout describing the advantages of using jigs assisting the apprentice to perform a bend set and flange layout showing examples of and describing grid and flange layouts ensuring the apprentice can use the tools required to determine plumb and level 		
Mathematics for Fabricator 1 <ul style="list-style-type: none"> use arithmetic use equation fundamentals use metric units 		24 hours
Mentors can assist the apprentice to prepare for this section of technical training by: <ul style="list-style-type: none"> ensuring the apprentice can read a tape measure in both metric and imperial having the apprentice convert from imperial dimensions to metric dimensions, and back having the apprentice repetitively add imperial measurements, particularly fractions teaching the apprentice to convert decimal measurements to fractions, and back 		
Print Reading and Drafting <ul style="list-style-type: none"> develop shop drawings interpret drawings calculate materials interpret welding symbols describe joint preparation 		24 hours

Mentors can assist the apprentice to prepare for this section of technical training by:

- *assisting to interpret print document lines, symbols and abbreviations*
- *providing instruction regarding projections, views and dimensioning*
- *providing instruction and opportunity for the sketching of miscellaneous simple components*
- *discussing a bill of material and demonstrating material calculations*
- *showing examples of and ensuring the apprentice understands weld symbols*
- *showing examples of and ensuring the apprentice understands joint preparations*

Rigging and Overhead Crane

42 hours

- discuss occupational health and safety regulations
- discuss types of cranes
- apply rigging
- demonstrate signaling
- calculate load estimate
- establish capability of crane
- demonstrate effective site evaluation
- use crane controls
- operate crane
- discuss crane maintenance
- fill out a log book
- describe use of jacks
- describe the use of equipment aids
- identify strengths of ropes and knots

Mentors can assist the apprentice to prepare for this section of technical training by:

- *reviewing the rigging, hoisting and turning of loads, and describing the OH&S Table 16 requirements for overhead crane operation*
- *describing the meaning of Working Load Limit (WLL) and showing how various rigging components are marked to provide this information*
- *demonstrating the procedures to estimate the weight of loads*
- *demonstrating the safe use of wire rope, chains, attachments and lifting and jacking devices*
- *identifying and demonstrating the use of different ropes and knots*

Safety and Access Structures

15 hours

- practice safety in the workplace
- interpret safety legislation
- describe the safe use of scaffolds, walkways, and ladders
- promote safety in the workplace
- describe confined space entry procedures

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring familiarization with the scope and content of the OH&S Regulations*
- *practicing and promoting safety in the workplace and requiring the use of PPE*
- *reviewing the OH&S Table 14.1 requirements for training on power mobile equipment*
- *demonstrating the safe use of scaffolds, walkways and ladders*
- *discussing confined space entry and the associated safety rules*

Tools and Equipment

20 hours

- use measuring tools
- use layout tools
- use benchwork tools
- describe assembly tools

- use metal working equipment such as band saw, iron worker, press brake
- use stationary and portable grinders and sanders
- demonstrate drill, tap and thread procedures
- demonstrate deburring methods
- describe the operation of Computer Numerical Control (CNC) equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying and demonstrating the correct use of layout and measuring tools*
- *explaining the use of metal working hand tools*
- *providing training and supervision in the use of hand tools and pneumatic tools*
- *demonstrating the safe use of stationary and portable grinders*
- *demonstrating and providing hands-on opportunities to drill, tap and thread*
- *demonstrating the safe use of and providing hands-on opportunities to operate band saws*
- *providing instruction and allowing supervised operation of ironworkers and press brakes*

SMAW/FCAW/GMAW/ Welding and Tacking

30 hours

- describe the fundamentals of electrical theory
- describe the design and operation of a SMAW power source
- tack weld specified joints using SMAW
- describe the design and operation of a GMAW power source
- describe the design and operation of a FCAW power source
- describe the design and operation of a MCAW power source
- tack weld specific joint using GMAW
- weld in flat and horizontal positions using GMAW

Mentors can assist the apprentice to prepare for this section of technical training by:

- *describing the equipment and consumables (electrodes, gases, etc.); and the process to change out replaceable components and consumables*
- *having the mentoring journey person demonstrate technique, then monitor progress of the apprentice*
- *allowing opportunities for the apprentice to train on the different machines that are available*
- *letting the apprentice perform welds on practice materials prior to the actual work required*
- *allowing the apprentice to perform hands-on welding in various situations and positions*

Oxy-Fuel and Plasma Arc Cutting

15 hours

- oxy-fuel and plasma arc safety, equipment and consumables
- complete 90 degree and bevel cuts using manual oxy-fuel equipment
- cut structural shapes using oxy-fuel process
- use motorized cutting carriage
- cut plate using plasma arc cutting
- cut plate using CNC plasma arc cutting

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating and allowing the apprentice to perform 90 degree and bevel cuts using manual oxy-fuel equipment*
- *explaining how to cut structural shapes and allowing opportunities to perform these cuts*
- *providing instruction and opportunities to use plasma arc cutting equipment*

Level Two

8 weeks

240 hours

Metallurgy and Material Designation

30 hours

- describe the steel making process
- discuss the properties of metals
- evaluate weldability
- apply heat treatment
- apply heat forming
- identify industrial, structural and vessel fasteners
- identify structural shapes and hollow structural sections
- identify plate, sheet, grating and mesh
- interpret CSA Code G40.21M
- identify pipe fittings
- discuss proper storage and handling procedures

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating the procedures used to identify different types of metals*
 - *developing their knowledge of the physical properties of metals*
 - *demonstrating and explaining the application of heat treatment*
 - *explaining weldability and hot and cold working of metals*
 - *describing the differences between ASTM and CSA plate designations*
 - *explaining the selection of expanded mesh, perforated sheets, grating, hollow structural shapes and specialty tubes*
 - *identifying the applications and installation procedures for structural and vessel fasteners*
-

Fabrication Safety

9 hours

- select personal protection equipment
- describe fall protection procedures
- develop accident prevention awareness
- interpret applicable sections of the Occupational Health and Safety Act and Regulations
- complete reporting forms
- identify additional Health and Safety organizations and their function

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing and describing personal protective equipment*
 - *providing training for the procedures and use of fall protection equipment*
 - *describing unsafe working conditions and industrial health hazards and monitoring for future action appropriate to situations*
 - *ensuring familiarization with the scope and content of the OH&S Regulations regarding the reporting of accidents and occurrences*
-

Drawing Interpretation

24 hours

- interpret drawings for miscellaneous fabrication, frames, structural members and tanks
- interpret tank drawings
- interpret structural drawings

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and allowing opportunities to interpret intermediate fabrication and structural drawings*
- *describing and providing example drawings of pressure vessels and their components*
- *continuing to expand the apprentice's knowledge of joint and weld types, welding symbols and technical abbreviations*

- *having the apprentice assist in the start-up of domestic appliances*
-

Forming Fitting and Fabrication – Theory

26 hours

- describe structural connections
- describe pressure vessels
- describe types of power saws and their operation
- describe types of shears and their operation
- describe plate rolls and their operation
- describe types of ironworkers and their operation
- describe types of press brakes and their operation
- describe fixed ladder fabrication

Forming Fitting and Fabrication – Shop

54 hours

- operate power saws
- operate shears
- operate iron worker
- operate plate rolls
- bend structural shapes, pipe and hollow structural shapes
- operate press brake
- perform stair layout
- fabricate guard rails and hand rails

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing examples of welded and bolted structural connections such as column bases, column splices; and seated, end plate, double angle beam, bracing, skewed and knee brace connections*
 - *describing the practices particular to pressure vessel fitting such as Hi-Low, maximum out-of-roundness nozzles onto cylinders, large diameter holes and hydrostatic testing*
 - *having the apprentice participate in the fitting and fabrication of a pressure vessel*
 - *explaining shear, plate roller and press brake operation and requirements*
 - *providing information regarding the bending of structural shapes such as radius of bend, springback and plate grain*
 - *describing the terminologies associated with stair construction such as rise, run and stringer*
 - *demonstrating the fabrication of stair stringers, ladders, guard and hand rail fabrication*
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Machine Operations

26 hours

- use drill press to drill, ream and tap
- perform power threading and tapping
- practice tool sharpening and metal finishing
- describe basic turning and milling operations

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating the correct procedures and allow the apprentice to use a drill press to drill, ream and tap*
- *explaining and demonstrating power threading and tapping equipment*
- *demonstrating the proper techniques to sharpen tools*
- *offering hands-on opportunities to perform basic lathe and milling machine operations*

Mathematics**24 hours**

- use basic mathematics skills
- apply perimeter, area, and volume fundamentals
- use percentages

Mentors can assist the apprentice to prepare for this section of technical training by:

- *continuing to have the apprentice perform all types of math calculations in both systems of measurement*
- *having the apprentice calculate perimeters, areas and volumes; and monitoring for faults*
- *having the apprentice complete actual work-related problems and perform material quantity estimating using percent*

Layout**35 Hours**

- use parallel line development to develop templates
- use radial line development to develop templates
- use triangulation to develop templates
- develop stretch-out templates
- layout vessel components

Mentors can assist the apprentice to prepare for this section of technical training by:

- *describing and demonstrating layout procedures for parallel lines, triangulation and radial lines and stretch-out templates*
- *having the apprentice assist with the layout of vessel components*

Welding and Cutting Processes**20 hours**

- operate GMAW and SMAW equipment
- perform the FCAW and MCAW process
- evaluate SAW and its applications
- evaluate stud welding and its applications
- operate air carbon arc cutting equipment
- operate oxy-fuel cutting equipment to prepare components

Mentors can assist the apprentice to prepare for this section of technical training by:

- *continuing to provide opportunities to the apprentice to perform various welding processes such as SMAW, GMAW, FCAW and MCAW*
- *where possible, exposing the apprentice to the equipment and techniques for stud welding, Air Carbon Arc Cutting and submerged arc welding*
- *continuing to provide opportunities for the apprentice to perform oxy-fuel and plasma arc cutting to prepare components*

Level Three

8 weeks

240 hours

Quality Control

28 hours

- discuss the benefits of quality assurance
- identify documents typical to quality assurance
- discuss codes and standards
- discuss inspection methods and stages of inspection

Mentors can assist the apprentice to prepare for this section of technical training by:

- *discussing the benefits of a good quality assurance program, and discussing the pitfalls of a poor quality assurance program*
 - *ensuring the apprentice can complete quality assurance documentation; can identify quality control systems, standards and codes; and has the ability to perform various inspection methods*
 - *describing and providing examples for various standards of finishing*
-

Drawing Interpretation

28 hours

- interpret complex welding symbols
- interpret structural drawings
- interpret tank drawings
- interpret vessel drawings
- interpret heat exchanger drawings
- interpret piping drawings

Mentors can assist the apprentice to prepare for this section of technical training by:

- *working with and monitoring the apprentice to ensure understanding of advanced drawings including those for structural steel, tanks and pressure vessels*
 - *demonstrating the development of miscellaneous fabrication drawings*
 - *ensuring the apprentice can interpret complex welding symbols*
-

Layout

16 hours

- perform parallel line development for fabrication
- perform radial line development for fabrication
- perform triangulation for fabrication
- perform layout for vessels including: shells, nozzles, fittings, heads, flanges, saddles, skirts, re-pads
- perform layout for structural connections

Mentors can assist the apprentice to prepare for this section of technical training by:

- *offering hands-on opportunities to develop full scale template development including segmented elbows, lateral connections, cones and transitions*
-

Project Planning and Estimating

18 hours

- determine project plan and sequence of operations
- describe methods and processes of fabrication estimating
- select estimating method
- estimate material costs
- estimate labour time and costs

Mentors can assist the apprentice to prepare for this section of technical training by:

- *discussing the importance of determining an appropriate sequence of operations*
 - *describing the various estimating methods*
 - *identifying costs of production for estimating purposes*
 - *demonstrating the estimating of time, material and overhead costs*
-

Engineered Design

12 hours

- describe general considerations of design engineering
- describe the forces acting on buildings, bridges, and other load bearing structures
- describe engineering solutions to design considerations and forces

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining common types of stresses such as shear and tension*
 - *identifying critical areas of stress on fabricated components such as trusses and beams*
 - *identifying and explaining the stress flow patterns on beams, columns, stiffeners and reinforcing pads*
-

Shop Organization

12 hours

- describe the elements of good shop organization as defined by considerations for safety, productivity and efficiency
- evaluate shop organization
- organize shop to suit project requirements

Mentors can assist the apprentice to prepare for this section of technical training by:

- *allowing the apprentice to plan equipment layout while explaining how it can affect productivity and efficiency*
 - *working with the apprentice to organize the shop for a particular project*
-

Fitting and Fabrication – Theory

26 hours

- describe tank fabrication procedures and codes

Fitting and Fabrication – Shop

88 hours

- fabricate cones and transitions
- fabricate structural steel assemblies
- fabricate pressure vessel
- complete short run manufacturing project

Mentors can assist the apprentice to prepare for this section of technical training by:

- *offering opportunities for the apprentice to develop and demonstrate the application of fabrication procedures for cones and transitions; structural steel assemblies*
 - *continuing to expose the apprentice to tank and pressure vessel fabrication, further explaining procedures and codes*
-

Mathematics

12 hours

- use arithmetic
- use equation fundamentals
- use basic trigonometry

Mentors can assist the apprentice to prepare for this section of technical training by:

- *constantly allowing the apprentice to increase their math skills with regards to the calculation of areas, volumes, capacities, mass and linear measurements*
- *allowing the apprentice to calculate practical problems by performing estimating and other trade specific calculations*
- *demonstrating the various trigonometry functions used by fabricators such as determining an angle when two sides of a right angle triangle are known; or determining a side when an acute angle and one side of a right angle triangle are known*

Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

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