



# Sheet Metal Worker Course Outline

**2022**

# 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
Trade Theory	SHME 100	59
Pattern Drafting	DRFT 100 - Theory	10
	DRFT 101 - Practical	47
Welding and Cutting	WELD 139	12
Bench and Shop Work	BESK 102 - Theory	14
	BESK 103 - Practical	80
Trade Mathematics (Exceeds)	MATH 198	18
		240

Level Two	Transcript Code	Hours
Print Reading	PRNT 204	14
Trade Theory	SHME 200	40
Pattern Drafting	DRFT 203 - Theory	8
	DRFT 204 - Practical	44
Welding	WELD 208	8
Bench and Shop Work	BESK 200 - Theory	8
	BESK 201 – Practical	80
Scheduled Maintenance & Repair	MAIN 204	24
Trade Mathematics (Exceeds)	MATH 293	14
		240

Level Three	Transcript Code	Hours
Welding	WELD 303	12
Pattern Drafting Theory	DRFT 300 - Theory	8
	DRFT 301 – Practical	40
Print Reading	PRNT 303	18
Trade Theory	SHME 381	56
Bench and Shop Work Theory	BESK 300 - Theory	10
	BESK 301 – Practical	68
Scheduled Maintenance & Repair	MAIN 300	14
Trade Mathematics	MATH 381	14
		240

Level Four	Transcript Code	Hours
Scheduled Maintenance & Repair	MAIN 400	18
Communication	COMM 480	8
Pattern Drafting Theory	DRFT 400 – Theory	8
Pattern Drafting Practical	DRFT 401 – Practical	30
Print Reading	PRNT 401	18
Trade Theory	SMHE 481	56
Bench and Shop Work Theory	BESK 400 – Theory	8
Bench and Shop Work Practical	BESK 401 – Practical	80
Trade Mathematics	MATH 481	14
		240

# TECHNICAL TRAINING COURSE OUTLINE

This chart outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training sequencing. For the harmonized level of training, a cross reference to the Red Seal Occupational Standard (RSOS) apprenticeship technical training sequencing, at the learning outcome level, is provided.

Sub-tasks listed are the minimum to be covered in a topic. Related sub-tasks not listed may be used as a reference and taught “in context” in other topics.

Implementation for harmonization took place progressively. Level one was implemented in 2018/2019, level two in 2019/2020, level three in 2020/2021, and level four in 2021/2022.

The Red Seal Sheet Metal Worker Curriculum Outline, which provides additional detail of the Harmonized technical training, can be found at [www.red-seal.ca](http://www.red-seal.ca)

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<b>Level One</b>	<b>8 weeks</b>	<b>240 hours</b>
<b>Trade Theory</b>		<b>59 hours</b>
<ul style="list-style-type: none"><li>• demonstrate proper use of safety equipment and safe work practices</li><li>• identify common sheet metal hand tools and equipment</li><li>• describe the characteristics of shop tools and equipment</li><li>• recognize sheet metal seams, locks, and edges</li><li>• recognize appropriate fasteners for various sheet metal applications</li><li>• describe fabrication procedures used in typical sheet metal shops</li><li>• discuss the techniques and materials used to solder various metals</li><li>• describe factors affecting building ventilation</li><li>• demonstrate the knowledge and procedures required to rig and hoist materials safely</li><li>• discuss techniques and equipment for brazing</li><li>• discuss measurement and layout of equipment</li><li>• discuss organizing materials and equipment</li><li>• use effective communication techniques</li><li>• discuss installation of air handling equipment</li><li>• discuss installation of duct and duct accessories</li><li>• discuss installation of plenums</li></ul>		
<b>Bench and Shop Work Theory</b>		<b>14 hours</b>
<ul style="list-style-type: none"><li>• discuss the appropriate sheet metal hand tools and machines for specific shop applications.</li><li>• identify powered metal forming equipment for a specific metal forming function.</li><li>• discuss Gas Metal Arc Welding GMAW operations.</li><li>• discuss hot process metal cutting using plasma and oxy-fuel equipment</li></ul>		
<b>Bench and Shop Work Practical</b>		<b>80 hours</b>
<ul style="list-style-type: none"><li>• explain fabrication procedures for various sheet metal seams, locks, and edges</li><li>• fabricate basic sheet metal items using simple layout procedures</li><li>• use a spot welder to seam sheet metal objects</li><li>• assemble a simple duct complete with takeoffs using standard sheet metal tools and equipment</li><li>• layout degree and ninety degree rectangular elbows using basic layout methods</li><li>• fabricate regular and “ogee” offsets using basic layout methods</li></ul>		

- explain safety related functions within a work environment
- fabricate sheet metal products using soldering and brazing
- use hoisting, rigging and positioning equipment
- fabricate insulated ducts and fittings
- fabricate hangers, supports, and bases
- install air handling equipment
- install dampers
- install outlets and louvers
- install plenums

### **Pattern Drafting Theory**

**10 hours**

- discuss the various drafting tools used to make drawings for the sheet metal industry
- recognize the types of lines, angles, and lettering used for drawings in the sheet metal industry
- recognize pictorial drawings and orthographic projections
- define terminology associated with drafting
- explain characteristics and measurements of various transverse connections
- identify complex layout methods

### **Pattern Drafting Practical**

**47 hours**

- discuss geometric principles to construct lines, angles, and common shapes used in layout work
- illustrate orthographic drawings from pictorial drawings
- lay out patterns for sheet metal fittings using basic layout
- lay out patterns for rectangular elbows
- lay out patterns for regular and transitional cheek ogee offsets
- describe three main methods of pattern development.

### **Welding and Cutting**

**12 hours**

- use Gas Metal Arc Welding (GMAW) equipment
- use welding and cutting protective equipment
- operate oxy- acetylene cutting equipment
- operate plasma arc cutting equipment
- safe work practices and procedures pertaining to the use of soldering and brazing equipment

### **Math**

**18 hours**

- uses basic mathematics
- uses basic algebra
- uses metric units

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## Level Two

8 weeks

240 hours

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### Print Reading

14 hours

- use trade-related documentation
  - interpret drawings
  - perform basic design and field modifications
  - develop patterns using radial line layout methods.
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### Trade Theory

40 hours

- describe HVAC system categories and components including package units, built-up systems and terminal units
  - describe the components and subsystems within a material handling systems
  - identify the tools, equipment, and manpower to install HVAC and architectural systems and components
  - explain how to prepare for ductwork installations
  - describe the characteristics of anchors and hangers used to install ductwork
  - discuss the characteristics of fire and smoke dampers
  - interpret the SMACNA duct fabrication standards to determine gauge, transverse joint spacing and reinforcement for a given section of ductwork
  - interpret information related to chimneys and vents
  - discuss appliance venting theories for various types of HVAC appliances
  - discuss types of chimneys and related applications
  - discuss certifications, licenses, and bonding related to appliance installations
  - interpret National Building Codes related to chimneys and venting of appliances
  - interpret Saskatchewan Codes of Practice related to chimneys and venting appliances
  - interpret manufacturer installation methods for a given appliance
  - design a new and retro-fitted chimney installation to meet applicable codes and standards
  - explain the process of demolition for renovations
  - explain field measuring fundamentals
  - discuss installation of insulation and cladding
  - discuss different forms of matter
  - describe heat energy and heat transfer Solve problems involving simple machines
  - interprets plans and specifications
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### Pattern Drafting Theory

8 hours

- identify characteristics of basic layout of sheet metal fittings
  - identify characteristics of parallel line layout of sheet metal fittings
  - identify characteristics of radial line layout of sheet metal fittings
  - identify characteristics of triangulation layout of sheet metal fittings
  - identify isometric, oblique, and perspective drawings
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### Pattern Drafting Practical

44 hours

- develop patterns using basic layout methods
  - develop patterns using parallel line layout methods
  - develop patterns using radial line layout methods
  - identify characteristics of triangulation layout methods
  - prepare scaled and freehand isometric and oblique drawings
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**Welding** **8 hours**

- recognize hazards related to welding and cutting processes
- select personal protective equipment
- use gas tungsten arc welding (GTAW) equipment

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**Bench and Shop Work Theory** **8 hours**

- demonstrate safe operation of powered shop equipment
- set up powered machinery to perform basic operations
- examine gas tungsten arc welding (GTAW) operations

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**Bench and Shop Work Practical** **80 hours**

- operate a power press brake to form various types of metal to specific shapes
- operate the notching and punching stations on an iron worker
- tap holes in metal components for the specified machine screw
- use a power rolls machine to roll heavy gage sheet metal to various diameters
- fabricate components from pictorial drawing using the appropriate powered equipment
- assembles ductwork fittings and flexible connectors
- fabricate ducts, duct accessories, and fittings using basic layout
- fabricate fittings using parallel line layout
- fabricate fittings using radial line layout
- Fabricate fittings using triangulation layout
- use soldering and brazing equipment
- assembles ductwork, fittings, and flexible connectors
- fabricate exterior architectural sheet metal components
- demonstrate on-site measuring
- install appliances and venting
- install decking, hangers, and supporting components
- install air handling equipment
- install duct accessories
- demonstrate the process for sealing exposed joints and seams on ductwork

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**Scheduled Maintenance & Repair** **24 hours**

- define terminology associated with the servicing of system components
- use tools and equipment associated with the servicing of system components
- identify hazards and safe work practices pertaining to service work
- preform calculations of system performances
- use tools and equipment associated with airflow in ductwork
- describe the conditions that create airflow in ductwork

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**Trade Mathematics** **14 hours**

- use basic algebra to solve problems
- solve Complex problems
- apply the basic trigonometric functions to solve problems

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## Level Three

7 weeks

240 hours

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### Trade Theory

56 hours

- compare HVAC systems and components
- examine the properties of air
- examine ventilation
- analyze air flow in ductwork
- categorize fans used in HVAC systems
- analyze HVAC duct systems
- examine the characteristics of heat
- examine the characteristics of cooling systems
- examine duct design characteristics
- compare duct sizing methods
- describe field measuring principles
- analyze hoisting and rigging operations
- examine HVAC equipment and installations
- discuss automatic control systems
- discuss sign work
- discuss properties of various materials
- solve problems involving simple machines
- examine specialty sheet metal products

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### Welding

12 hours

- select protective equipment
- recognize hazards related to welding and cutting processes
- use gas tungsten arc welding (GTAW) operations
- use Shielded Metal Arc Welding (SMAW) procedures

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### Pattern Drafting Theory

8 hours

- identify Characteristics of basic layout of sheet metal fittings
- identify characteristics of parallel line layout of sheet metal fittings
- identify characteristics of radial line layout of sheet metal fittings
- identify characteristics of triangulation layout of sheet metal fittings
- identify characteristics of a combined layout method for sheet

### Pattern Drafting Practical

40 hours

- develop patterns using basic layout methods
- develop patterns using parallel line layout method
- develop patterns using radial line layout method
- develop patterns using triangulation layout method
- develop patterns using combined layout methods

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### Print Reading

18 hours

- interpret information from plans and specifications
- interpret information from shop drawings
- examine plans and specifications
- develop shop drawings for given specifications
- perform a take-off from a shop drawing



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**Bench and Shop Work Theory****10 hours**

- recognize hazards related to the use of powered fabrication equipment
- discuss the operational characteristics of powered fabrication equipment
- examine the operational characteristics of a power press brake
- examine Gas Tungsten Arc Welding (GTAW) operation
- examine Shielded Metal Arc Welding (SMAW) operation

**Bench and Shop Work Practical****68 hours**

- demonstrate safe operation of powered shop equipment
- fabricate metal parts using heavy gage fabrication equipment
- fabricate ducts, duct accessories, and fittings using basic layout
- fabricate fittings using parallel line layout
- fabricate fittings using radial line layout
- fabricate fittings using triangulation line layout
- fabricate fittings using combined layout methods
- fabricate specialty sheet metal products
- fabricate specialty sheet metal products using stainless steel
- install air handling system equipment and accessories
- install air handling plenums
- install coils and terminal boxes

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**Scheduled Maintenance & Repair****14 hours**

- performs maintenance inspections
- service components service
- diagnoses system faults
- repairs worn or faulty system components
- use testing and inspection tools and equipment

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**Trade Mathematics (exceeds)****14 hours**

- basic mathematics and algebra
- performing calculations involving trade applications
- application of basic trigonometry to solve trade problems

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## Level Four

8 weeks

240 hours

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### Bench and Shop Work Theory

8 hours

- discuss shop safety
- calculate bend allowance using empirical formula
- discuss the operational characteristics of powered fabrication equipment

### Bench and Shop Work Practical

80 hours

- fabricate complex fittings using the triangulation method
- fabricate complex fittings using the parallel line method
- fabricate complex fittings using the radial line method
- use a combination of drafting methods to fabricate various fittings
- calculate bend allowance using the empirical method and form the part
- fabricate dampers and louvers
- install insulation, lagging, cladding, and flashing
- install material handling components and equipment
- install air handling components and equipment

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### Communication

8 hours

- application of job-related interpersonal and oral communications
- principles of customer service
- preparation of workplace documents

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### Pattern Drafting Theory

8 hours

- performing calculations related to change ogee offsets
- performing calculations related to drop cheek elbows
- calculation of the cut size of round elbows
- calculation of panel lengths for a rectangular transition from a single view
- draft complex fittings using the triangulation method
- draft complex fittings using the parallel line method
- draft complex fittings using the radial line method
- use a combination of drafting methods to draw various fittings

### Pattern Drafting Practical

30 hours

- draft complex fittings using the triangulation method
- draft complex fittings using the parallel line method
- draft complex fittings using the radial line method
- use a combination of layout methods to fabricate various fittings
- uses computer technology for pattern development

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### Print Reading

18 hours

- describe the importance of prints and specifications in the construction industry
- interpret information found in prints and specifications
- produce a shop print for a given blow pipe system
- perform a take-off from a shop print

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### Trade Theory

56 hours

- analyzing industrial sheet metal
- comparison of industrial material handling systems
- blowpipe systems

- industrial specialties related to sheet metal work
- duct leakage testing
- testing, adjusting and balancing work
- commissioning a building
- examination of indoor air quality
- comparison of filtration and air cleaning equipment
- special ventilation needs
- commercial refrigeration systems
- how automatic controls function in HVAC systems
- fabrication and installation procedures related to boiler breeching
- planning and running jobs
- application of job-related interpersonal and oral communications
- principles of customer service
- preparation of workplace documents
- basic mathematics and algebra
- performing calculations involving trade applications
- application of basic trigonometry to solve trade problems

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### **Scheduled Maintenance & Repair**

**18 hours**

- review the operation of a standing pilot appliance
- identify electrical components used in modern appliances
- describe the sequence of operation for various appliances
- perform leak tests of a duct system
- perform testing adjusting and balancing of a duct system
- perform commissioning of air and material handling systems
- measure voltage, current, and resistance to confirm the operation of electrical controls found in an appliance

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### **Mathematics**

**14 hours**

- basic mathematics and algebra
  - performing calculations involving trade applications
  - application of basic trigonometry to solve trade problems
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# SHEET METAL WORKER TASK MATRIX

This chart outlines the major work activities, tasks and sub-tasks from the 2016 Sheet Metal Worker Red Seal Occupational Standard. 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. Implementation for harmonization will take place progressively. Level one was implemented in 2018/2019, level two in 2019/2020, level three in 2020/2021, and level four in 2021/2022.

## A – Performs common occupational skills

20%

<b>Task A-1 Performs safety-related functions</b>	<b>A-1.01 Uses personal protective equipment (PPE) and safety equipment</b>  <b>1</b> (In Context 2, 3, 4)	<b>1.02 Uses personal protective equipment (PPE) and safety equipment</b>  <b>1</b> (In Context 2, 3, 4)	<b>A-1.03 Performs lock-out and tag-out procedures</b>  <b>1</b> (In Context 2, 3, 4)		
<b>Task A-2 Uses and maintains tools and equipment</b>	<b>A-2.01 Uses hand and portable power tools</b>  <b>1</b>	<b>A-2.02 Uses shop tools and equipment</b>  <b>1, 2, 3</b>	<b>A-2.03 Uses gas metal arc welding (GMAW) equipment</b>  <b>1, 2, 3, 4</b>	<b>A-2.04 Uses resistance spot welding equipment</b>  <b>1</b>	<b>A-2.05 Uses gas tungsten arc welding (GTAW) equipment</b>  <b>3</b>
	<b>A-2.06 Uses shielded metal arc welding (SMAW) equipment</b>  <b>2</b>	<b>A-2.07 Uses oxy-fuel and plasma arc cutting equipment</b>  <b>1</b>	<b>A-2.08 Uses soldering and brazing equipment</b>  <b>1, 2</b>	<b>A-2.09 Uses measuring and layout equipment</b>  <b>1</b>	<b>A-2.10 Uses testing and inspection devices</b>  <b>2, 3, 4</b>
	<b>A-2.11 Uses stationary and mobile work platforms</b>  <b>1</b>	<b>A-2.12 Uses hoisting, rigging and positioning equipment</b>  <b>1</b>			
<b>A-3 Organizes work</b>	<b>A-3.01 Uses trade-related documentation</b>  <b>1, 2</b> (In Context 3, 4)	<b>A-3.02 Interprets drawings</b>  <b>1, 2</b> (In Context 3, 4)	<b>A-3.03 Organizes materials and equipment for project</b>  <b>1</b>	<b>A-3.04 Performs basic design and field modifications</b>  <b>1, 2</b> (In Context 3, 4)	
<b>Task A-4 Uses communication and mentoring techniques</b>	<b>A-4.01 Uses communication techniques</b>  <b>1</b> (In Context 2, 3)	<b>A-4.02 Uses mentoring techniques</b>  <b>4</b> (In Context 2, 3)			

## B – Performs fabrication

31%

Task B-5 Performs pattern development	B-5.01 Develops patterns using simple and straight line layout 1	B-5.02 Develops patterns using parallel line method 2	B-5.03 Develops patterns using radial line method 2	B-5.04 Develops patterns using triangulation method 2	B-5.05 Uses computer technology for pattern development 4
Task B-6 Fabricates sheet metal components for air and material handling systems	B-6.01 Cuts ductwork, fittings and components 1	B-6.02 Forms ductwork, fittings and components 1, 2, 3, 4	B-6.03 Insulates ductwork, fittings and components 1	B-6.04 Assembles ductwork, fittings and components 1, 2, 3, 4	B-6.05 Fabricates dampers 4
	B-6.06 Fabricates hanger systems, supports and bases 1				
Task B-7 Fabricates flashing, roofing, sheeting and cladding	B-7.01 Cuts metal for flashing, roofing, sheeting and cladding 2	B-7.02 Forms flashing, roofing, sheeting and cladding 2			
Task B-8 Fabricates specialty products	B-8.01 Cuts material for specialty products 3	B-8.02 Forms specialty products 3	B-8.03 Assembles specialty products 3	B-8.04 Finishes specialty products 3	

## C – Installs air and material handling systems

35%

Task C-9 Prepares installation site	C-9.01 Performs on-site measurements 2 (In Context 3, 4)	C-9.02 Performs demolitions for renovations 2 (In Context 3, 4)	C-9.03 Installs penetrations and sleeves 2 (In Context 3, 4)	C-9.04 Installs supports and bases 2 (In Context 3, 4)	C-9.05 Installs hangers, cables, braces and brackets 2 (In Context 3, 4)
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<b>Task C-10 Installs and connects chimneys, breeching and venting to exhaust appliances and mechanical equipment</b>	<b>C-10.01 Installs chimney</b>  2 (In Context 3, 4)	<b>C-10.02 Connects appliances or mechanical equipment to chimney and breeching</b>  2 (In Context 3, 4)	<b>C-10.03 Installs high efficiency appliances and mechanical equipment</b>  2 (In Context 3, 4)		
<b>Task C-11 Installs air handling system components</b>	<b>C-11.01 Installs air handling equipment</b>  1, 2, 3, 4	<b>C-11.02 Installs sheet metal ducts and fittings</b>  1	<b>C-11.03 Installs dampers</b>  1	<b>C-11.04 Installs fire and fire/smoke dampers</b>  2	<b>C-11.05 Installs registers, grilles, diffusers and louvers</b>  1
	<b>C-11.06 Installs terminal boxes</b>  3	<b>C-11.07 Installs coils</b>  3	<b>C-11.08 Installs system component accessories</b>  2, 3, 4	<b>C-11.09 Installs plenums</b>  1, 3	
<b>Task C-12 Installs material handling system components</b>	<b>C-12.01 Installs pneumatic and gravity material handling system components</b>  4	<b>C-12.02 Installs mechanized material handling system components</b>  4			
<b>Task C-13 Applies thermal insulation, lagging, cladding and flashing</b>	<b>C-13.01 Applies thermal insulation to components</b>  4	<b>C-13.02 Applies lagging and cladding to components</b>  4	<b>C-13.03 Applies flashing to components</b>  4		
<b>Task C-14 Performs leak testing, air balancing and commissioning</b>	<b>C-14.01 Performs leak tests</b>  3, 4	<b>C-14.02 Performs testing, adjusting and balancing (TAB)</b>  3, 4	<b>C-14.03 Participates in the commissioning of air and material handling systems</b>  3, 4		

## D – Installs roofing and specialty products

8%

<b>Task D-15 Installs metal roofing and cladding/siding systems</b>	<b>D-15.01 Lays out roof and walls</b>  2	<b>D-15.02 Installs insulation, isolation material and building envelope components</b>  2	<b>D-15.03 Installs roofing and cladding/siding system components</b>  2	<b>D-15.04 Seals exposed joints</b>  2	<b>D-15.05 Installs decking</b>  2
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**Task D-16 Installs exterior components**

**D-16.01 Prepares surface**  
**2**

**D-16.02 Fastens exterior components**  
**2**

**Task D-17 Installs specialty products**

**D-17.01 Installs stainless steel specialty products**  
**3**

**D-17.02 Installs non-stainless steel specialty products**  
**3**

**D-17.03 Installs marine products**  
**3**

## E – Performs maintenance and repair

**6%**

**Task E-18 Performs scheduled maintenance**

**E-18.01 Performs maintenance inspections**  
**3**  
**(In Context 4)**

**E-18.02 Services components**  
**3**  
**(In Context 4)**

**Task E-19 Repairs faulty systems and components**

**E-19.01 Diagnoses system faults**  
**3**

**E-19.02 Repairs worn or faulty components**  
**3**

*\*The Sheet Metal Worker Red Seal Occupational Standard (RSOS), describing the “full scope” of the trade, can be found at [www.red-seal.ca](http://www.red-seal.ca).*

*For more detailed information on course content, please refer to the Sheet Metal Worker Guide to Course Content at [www.saskapprenticeship.ca](http://www.saskapprenticeship.ca).*