

## Sheet Metal Worker *A Guide to Course Content*

*Sheet Metal Workers use metal of 10 gauge or lighter to make and repair products and buildings.*

**Training Requirements:** 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 7200 hours and at least 4 years in the trade.

There are four levels of technical training delivered by Saskatchewan Polytechnic in Saskatoon:

Level One: 8 weeks  
Level Two: 8 weeks  
Level Three: 8 weeks  
Level Four: 8 weeks

**\*Any person who is not a journeyperson Sheet Metal Worker must become registered as an apprentice to work in this trade.**

The information contained in this pamphlet serves as a guide for employers and apprentices. The pamphlet briefly summarizes the training delivered at each level of apprenticeship training. An apprentice spends approximately 15% of the apprenticeship term in a technical training institute learning the technical and theoretical aspects of the trade. The hours and percentages of technical and practical training may vary according to class needs and progress.

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

## **Level One - 8 weeks**

### **Trade Theory**

- safety equipment and safe work practices
- common sheet metal hand and shop tools and equipment
- types of sheet metal seams, locks and edges
- materials used in the sheet metal industry
- fasteners for sheet metal applications
- fabrication procedures used in shops
- techniques and materials used to solder metals
- factors affecting building ventilation
- architectural systems and accessories
- procedures to rig and hoist materials safely

### **Bench and Shop Work**

- selection of tools and machines appropriate to applications
- operation of powered metal forming equipment
- forming seams, locks and edges
- fabricating basic sheet metal items using simple layout procedures
- using a spot welder to join sheet metal components
- assembly of a section of duct complete with takeoffs
- lay out various degrees of rectangular elbows using basic layout methods
- fabricating regular and ogee offsets using basic layout methods

### **Pattern Drafting**

- drafting tools used to make drawings
- types of lines, angles and lettering used for drawings
- pictorial drawings and orthographic projections
- terminology associated with drafting
- views used in the sheet metal industry
- using geometric principles to construct lines, angles and common shapes used in layout work
- two methods of marking patterns in the shop
- making orthographic drawings from pictorial drawings
- the three main methods of pattern development
- lay out patterns for sheet metal fittings using basic layout
- lay out patterns for rectangular elbows
- develop patterns for regular and transitional cheek ogee offsets
- lay out patterns for rectangular to round fittings by triangulating from the plan view
- using the parallel line method of pattern development to lay out mitred fittings
- using the radial line method to develop patterns for round to round centered tapers

### **Math**

- using basic mathematics
- using basic algebra
- using metric units

## **Level Two - 8 weeks**

### **Residential Mechanical Ventilation**

- factors that influence indoor air quality (IAQ)
- interpretation of codes and standards related to residential mechanical ventilation
- sizing a ventilation system

### **Trade Theory**

- HVAC system categories and components including package units, built up systems and terminal units
- conditions that create airflow in ductwork
- interpretation of the air friction chart to establish cubic feet per minute (CFM), air velocity, friction loss and duct diameter
- purpose of performing testing, adjusting and balancing (TAB)
- components and subsystems within a material handling system
- how costs are calculated in bidding a job
- tools, equipment and manpower requirements to install HVAC and architectural systems and components
- preparation for ductwork installations
- characteristics of anchors and hangers used to install ductwork
- characteristics of fire and smoke dampers (use, operation, installation and classification)
- interpretation of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) duct fabrication standards
- interpretation of information related to chimneys and vents

### **Bench and Shop Work**

- safe operation of powered shop equipment
- setup of powered machinery to perform basic operations
- operation of a power press brake to form various types of metal to specific shapes
- operation of the notching and punching stations on an iron worker
- cutting structural steel shapes using an horizontal band saw
- tapping holes in metal components for specified machine screws
- rolling heavy gauge sheet metal to various diameters using power rolls
- fabricating components from pictorial drawings using the appropriate powered equipment
- fabricating a round tee using parallel line development
- lay out round elbows using the mitre rise method
- using the six point method of triangulation to fabricate a drop cheek elbow
- fabricating a change ogee offset using the combined methods of basic layout and triangulation
- lay out rectangular transitions using triangulation
- threading holes to accommodate various threaded fasteners

### **Pattern Drafting**

- identification of various round tees and their parts
- identification of various round elbows and their parts
- calculation of roof pitch and rise for various roof jacks
- determining true length triangles for various rectangular transitions
- identification of drop cheek characteristics from a single view shop ticket
- calculation of the swing points and the wrapper lengths of change ogee offsets
- lay out patterns for 90° and angled tees using parallel line development
- develop patterns for round elbows using the elevation and plan view
- using trigonometry and the mitre rise method to make stacked gore patterns for round elbows
- lay out patterns for a three piece round offset
- using the six point method to develop patterns for transitional drop cheek elbows
- lay out inside patterns for change ogee offsets
- develop patterns for rectangular transitions from a specified shop ticket

### **Print Reading**

- identification of isometric, oblique and perspective drawings
- how plans and specifications are used by the sheet metal worker
- preparing scaled and freehand isometric and oblique drawings
- interpreting plans and specifications

### **Welding**

- hazards related to cutting and welding processes
- selection of personal protective equipment
- operation of oxy-acetylene cutting equipment
- operation of shielded metal arc welding (SMAW) equipment

### **Electrical**

- electrical terminology: voltage, current, resistance and power
- the four components of an electrical circuit
- the operation of a standing pilot appliance
- performing electrical calculations using the Ohm's Law
- measure resistance, voltage and current
- calculation of voltage, current and resistance (given two values - determine the missing value)

### **Math**

- performing Imperial conversions between fraction and decimal length measurements
- using the Right Triangle Formula
- performing trade calculations
- application of basic trigonometry to solve right triangle problems

### **Trade Science**

- structure and properties of matter
- different forms of matter
- chemical reactions
- kinetic molecular theory
- heat energy and heat transfer
- problems involving simple machines

## **Level Three - 8 weeks**

### **Residential Heat Loss/Gain Calculations**

- comfort principles of heating and air conditioning
- calculation of the heat loss through residential structures
- calculation of the heat gains through residential structures
- calculation of outside air infiltration
- calculation of ventilation requirements

### **Trade Theory**

- comparison of HVAC systems and components
- properties of air
- ventilation
- analyzing air flow in ductwork
- categorizing fans used in HVAC systems
- analyzing HVAC duct systems
- characteristics of heat
- characteristics of cooling systems

- duct design characteristics
- comparing duct sizing methods
- field measuring principles
- analyzing hoisting and rigging operations
- HVAC equipment and installations
- automatic control systems
- sign work

### **Bench and Shop Work**

- hazards related to the use of powered fabrication equipment
- operational characteristics of powered fabrication equipment
- operational characteristics of a power press brake
- gas metal arc welding (GMAW) operations
- safe operation heavy gauge fabrication equipment including the press brake and the iron worker
- fabrication of metal parts using heavy gauge fabrication equipment
- fabrication of fittings using the radial line method of pattern development
- fabrication of fittings using the elevation view method of triangulation
- fabrication of mitred sheet metal components using the parallel line method
- field measurement of a given spouting system
- fabrication of a spouting system

### **Pattern Drafting**

- radial line development
- square to round layout using triangulation from an elevation view
- layout using a combination of drafting methods
- layout of Y branches using the elevation view method
- layout of mitres and rake mitres using the parallel line method
- lay out patterns for oblique round tapers using the radial line method
- lay out patterns for pitched tapers using the radial line method
- lay out patterns for pitched square to rounds using the elevations view method of triangulation
- lay out patterns for 3-piece square to round using parallel lines and the elevation view method of triangulation
- lay out patterns for 7-branch using the elevation view method of triangulation
- lay out patterns for mitred components using the parallel line method
- lay out patterns for rake mitres using the parallel line method

### **Print Reading**

- distinguishing between the different types of drawings found in a set of prints
- civil drawings and specialty areas
- differentiating between architectural, structural and electrical drawings
- mechanical drawings
- shop drawings
- interpretation of information from plans and specifications
- interpretation of information from mechanical prints
- performing a takeoff from a shop drawing

### **Welding**

- preparing for gas metal arc welding (GMAW) operations
- selection of protective equipment
- operating GMAW equipment for welding operations

### **Mathematics**

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

### **Trade Science**

- properties of various materials
- concepts of thermodynamics
- application of concepts of Psychrometry
- using qualitative and quantitative methodology pressure concepts in static and dynamic situations
- heat energy and heat transfer
- solving problems involving simple machines

## **Level Four - 8 weeks**

### **Residential Air System Design**

- sizing system components to meet the requirements of existing codes and standards
- determining air flow rates from equipment specification sheets
- calculation of mixed air temperatures
- calculation of external static pressure from equipment specifications sheets
- designing a residential air distribution system

### **Trade Theory**

- 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

### **Bench and Shop Work**

- shop safety
- the gas tungsten arc welding (GTAW) process
- calculation of a bend allowance using the empirical formula
- fabricating complex fittings using the triangulation method
- fabricating complex fittings using the parallel line method
- fabricating complex fittings using the radial line method
- using a combination of drafting methods to fabricate various fittings
- calculation of bend allowances using the empirical method and then form the part

**Pattern Drafting**

- 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

**Print Reading**

- the importance of prints and specifications in the construction industry
- interpreting information found in prints and specifications
- producing a shop print for a given blow pipe system
- performing a takeoff from a shop drawing

**Welding**

- preparing a work area for welding operations
- selection of personal protective equipment
- operate gas tungsten arc welding (GTAW) equipment

**Electrical**

- operation of a standing pilot appliance
- electrical components used in modern appliances
- sequence of operation for an intermittent pilot appliance
- sequence of operation for a direct spark ignition appliance
- sequence of operation for a hot surface ignition appliance
- measuring voltage, current and resistance in a standing pilot appliance
- measuring voltage, current and resistance to confirm the operation of electrical controls found in an appliance

**Trade Mathematics**

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

**Communications**

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