Human Resources and Skills Development Canada
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Essential Skills and Apprenticeship

Using Essential Skills: On the Job with a Sheet Metal Worker

Are you starting an apprenticeship as a sheet metal worker or are you thinking about a career in this trade? Pursuing a career as a sheet metal worker requires strong essential skills such as reading, document use, numeracy and critical thinking.

Use this booklet to:

- learn how sheet metal workers use essential skills;
- follow the daily routine of a sheet metal worker; and
- find out how your essential skills compare to those of a journeyperson sheet metal worker.

How sheet metal workers use essential skills

Sheet metal workers use essential skills to perform a variety of job-related tasks, for example:

- **document use** to create and read drawings and to locate information in tables;
- **numeracy** to calculate dimensions and angles or to measure and lay out work pieces; and
- **problem solving** to adjust specifications to produce a quality product.

Sheet Metal Worker

Essential Skills

Reading
Document Use
Numeracy
Writing
Oral Communication
Working with Others
Thinking
Computer Use
Continuous Learning

Sheet metal workers fabricate, assemble, install and repair sheet metal products. They work for sheet metal fabrication shops, sheet metal manufacturing companies and sheet metal work contractors, and they are employed in a variety of industrial sectors.

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Canada

A day in the life of a sheet metal worker: Richard's story

Getting information about duct specifications

Richard is a sheet metal worker who has been assigned to a job at a plant where cotton fibre is dried. A drying machine has recently been removed from the plant, leaving an open space between two round, heavy-gauge metal ducts. Richard's task is to connect these two ducts to each other. To do this, he will have to take measurements and perform calculations to design an offset, which is a duct structure used to connect two ducts at an angle. Offsets are made with two elbows and a length of straight duct.

Before starting the job, Richard talks to the client to get more information *(oral communication)*. He asks whether the duct will be moving air or product and whether it needs to have any particular specifications. Richard learns that the duct will be moving hot air (over 200°C) at high pressure.

Measuring the pipes

First, Richard measures the diameter of the two ducts; both have a diameter of 10 inches *(numeracy)*. Next, he uses a laser tool and a measuring tape to find the distance between the floor and the centre point of each duct.

Richard's work requires precise measuring—jobs like this one only allow a $^{1}/_{16}$ -inch difference between specifications and actual measurements—but also some estimation, or "eyeballing." For example, he uses his estimation skills to find the centre point of the duct rather than measuring to determine its exact location *(numeracy).*

Making calculations

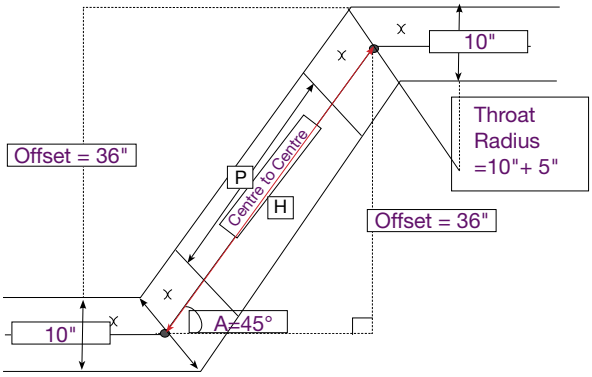
Now that he knows how far from the floor each duct is, Richard can calculate the centre-to-centre distance between the two ducts. He works it out to be 36 inches. Knowing he will attach a 45° elbow fitting (a piece of duct bent to a 45° angle) to the end of each duct, Richard uses trigonometry to calculate the length of the duct needed to join the two elbows *(numeracy)*. When Richard attended technical training during his apprenticeship, he had to memorize all the equations and formulas needed for his work. Now that he has used them so many times, he has no trouble remembering the common ones *(thinking skills – use of memory)*.

Richard writes all of these measurements on a field drawing that he will give to the shop where everything will be custom-made for this job. The field drawing will also include all the final design and product specifications *(document use)*.

Choosing materials

Before giving his field drawing to the shop, Richard needs to choose appropriate materials for the duct pieces. Since the air in the duct will be moving at high pressure, the duct will have to be made of a certain gauge (thickness) of galvanized steel in order to be safe. Richard consults the heating, ventilation and air conditioning codes to find out exactly how thick the steel needs to be *(document use)*. All apprentices are taught how to read and use these codes during their training.

The final field drawing that Richard gives to the shop contains the sketch, layout and calculations for all the components Richard needs, as well as a list of the materials that must be used to comply with code *(thinking skills – decision making)*.



Choosing products

To meet the particular specifications of this job, Richard uses high-temperature silicone to install the parts. Before he gets started, he reads the Material Safety Data Sheet (MSDS) for this product to check for any safety information he should know about it *(document use)*. He also reads the directions on the package to find out how long it takes to dry *(reading, numeracy)*. Timing is important because the plant is being shut down while Richard works. The client needs to know when the silicone will be dry so that he can start the plant back up as soon as possible.

Do you have the essential skills to be a sheet metal worker?

Complete the following questions to see how your skills compare to those of a journeyperson sheet metal worker. (Answers on page 6.)

1. Installing ducts

Sheet metal workers install ducts in buildings.

The equation below shows the relationship between:

- airflow volume in cubic feet per minute (V);
- air velocity in feet per minute (v); and
- area of a cross-section of duct in square feet (A).

$V = A \times v$

a. Calculate the area in square feet of a cross-section of an 8 in. × 24 in. duct.

1 ft.^{2} = 144 in.^{2}

b. Calculate the airflow volume if the air velocity in the same duct is 1200 feet per minute.

2. Material Safety Data Sheets

Sheet metal workers read MSDS for the hazardous materials they use in their work. Look at the excerpt below from the MSDS for a silicone product. What personal protection does the sheet metal worker need to wear when working with this material under normal conditions?

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eyes:	Safety glasses.
Skin:	Neoprene, rubber or butyl rubber gloves.
Ventilation:	General ventilation is usually adequate.
Respiratory Protection:	Not required under normal use. An approved respirator (i.e. NIOSH, etc.) should be worn when exposures are expected to exceed the applicable limits.
Comments:	When heated to temperatures above 300 degrees F, in the presence of air, this product can form formaldehyde vapors. Formaldehyde is a potential cancer hazard and a known skin and respiratory sensitizer. Safe handling conditions may be maintained by keeping vapour concentrations below the OHSA permissible limit for formaldehyde.

3. Technical data sheets

Sheet metal workers read instructions for using different types of products and materials. Look at the directions below outlining how to apply silicone gaskets. If the sheet metal worker applies the silicone at 1:00 p.m., when is the earliest that the silicone will be set?

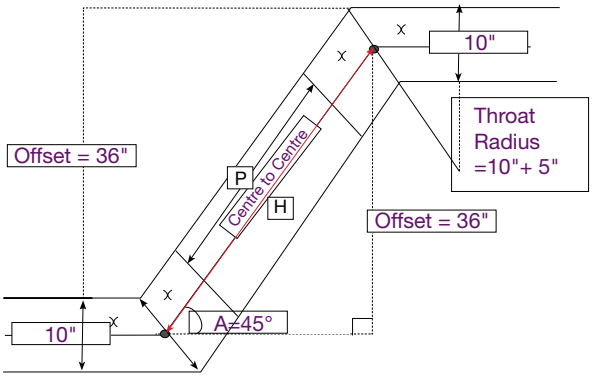
DIRECTIONS FOR USE

For assembly as a form-in-place gasket

1. Remove all previous material from mating surfaces.
2. For best results, clean and dry all surfaces with a residue-free solvent.
3. Cut nozzle to desired bead size, 1/16" to 1/4" in diameter. An 1/8" bead is usually sufficient for most applications.
4. Remove cap, puncture tube or cartridge seal and attach extension nozzle.
5. Apply a continuous and even bead of silicone to one surface, first tracing the internal areas of the gasket configuration, then all surrounding bolt holes.
6. Assemble parts immediately while silicone is still wet.
7. Finger tighten flange only until material begins to seep out the sides of the flange.
8. Allow to set for at least two hours and re-torque at least one quarter to one half turn.
9. For best results, allow to cure overnight.

4. Field drawing

Look at the field drawing below. Calculate the length of straight duct (P) needed for this offset. Give your answer as a mixed number (a whole number and a fraction) rounded to the nearest sixteenth of an inch.



Step 1:
Calculate the length of H, which is the centre-to-centre distance between the two ducts. Use this formula:

$$H = \frac{\text{offset}}{\sin A}$$

Step 2:
Calculate the length of x . Use this formula:

$$x = \text{Throat Radius} \times \tan\left(\frac{A}{2}\right)$$

Step 3:
The length of P is two lengths of x shorter than the centre-to-centre distance (H) calculated in Step 1. Calculate the length of P using this formula:

$$P = H - 2(x)$$

Step 4:
Convert your answer from Step 3 to a mixed number rounded to the nearest sixteenth of an inch.

Answers

1. **Installing ducts** *(numeracy)*

   a. 8 in. × 24 in. = 192 $in.^2$

   192 $in.^2$ ÷ 144 $in.^2/ft.^2$= 1.33 $ft.^2$

   b. 1.33 $ft.^2$ ×1200 ft./min = 1 596 $ft.^3$/min

2. **Material Safety Data Sheets** *(document use)*

   The sheet metal worker will need to wear safety glasses and neoprene, rubber or butyl rubber gloves.

3. **Technical data sheets** *(reading, numeracy)*

   The earliest the silicone will be set is 3 p.m.

4. **Field drawing** *(numeracy)*

   Step 1: 50.91 inches
   Step 2: 6.21 inches
   Step 3: 38.49 inches
   Step 4: 38½ inches
   The length of straight duct needed is 38½ inches.

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