



Task prepared for the project “Using Technology to Facilitate Connections between Literacy and the Broader Community” (2014)

This task set was vetted by this project and was not reviewed by the QUILL team.

OALCF Task Cover Sheet

Task Title: Explore the Sheet Metal Worker Trade

Learner Name:	
Date Started:	Date Completed:
Successful Completion: Yes ___ No ___	
Goal Path: Employment ___ Apprenticeship <input checked="" type="checkbox"/> Secondary School ___ Post Secondary ___ Independence ___	
Task Description: Learners will read about the trade and then try out some Sheet Metal Worker skills.	
Competency: A: Find and Use Information C: Understand and Use Numbers	Task Group(s): A1: Read continuous text A2: Interpret documents C2: Manage time C3: Use measures
Level Indicators: A1.3: Read longer texts to connect, evaluate, and integrate ideas and information A2.3: Interpret somewhat complex documents to connect, evaluate, and integrate information C2.1 Make low-level inferences to calculate using time C3.3 Use measures to make multi-step calculations; use specialized measuring tools	
Performance Descriptors: see chart on last page	
Materials Required: <ul style="list-style-type: none">• Instruction sheet• Handout “On the Job with a Sheet Metal Worker”• Handout “Do you have the essential skills to be a sheet metal worker?”• Pen or pencil• Scientific calculator	



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The Canadian government provides information for persons interested in entering the skilled trades. Here is an opportunity to learn about being a sheet metal worker.

Learner Information and Tasks:

Task 1: Look at the entire handout “On the Job with a Sheet Metal Worker”. List the essential skills used by a sheet metal worker.

Tasks 2-5: Look at the handout “Do you have the essential skills to be a Sheet Metal Worker?” Try the questions. Keep in mind that these are questions that a **journeyperson** (who has had about 4 to 5 years of training on the job and in a classroom) should be able to answer.

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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 continuous text, interpreting documents, using measures 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 journey person 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:

- **interpret documents** to create and read drawings and to locate information in tables;
- **use measures** 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 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.

A day in the life of a sheet metal worker: Rachel’s story

Getting information about duct specifications

Rachel 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. Rachel’s task is to connect these two ducts to each other. To do this, she 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, Rachel talks to the client to get more information (**interact with others**). She asks whether the duct will be moving air or product and whether it needs to have any particular specifications. Rachel learns that the duct will be moving hot air (over 200°C) at high pressure.

Measuring the pipes

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

Rachel’s work requires precise measuring—jobs like this one only allow a $\frac{1}{16}$ -inch difference between specifications and actual measurements—but also some estimation, or “eyeballing.” For example, she uses her estimation skills to find the centre point of the duct rather than measuring to determine its exact location (**use measures**).

Making calculations

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

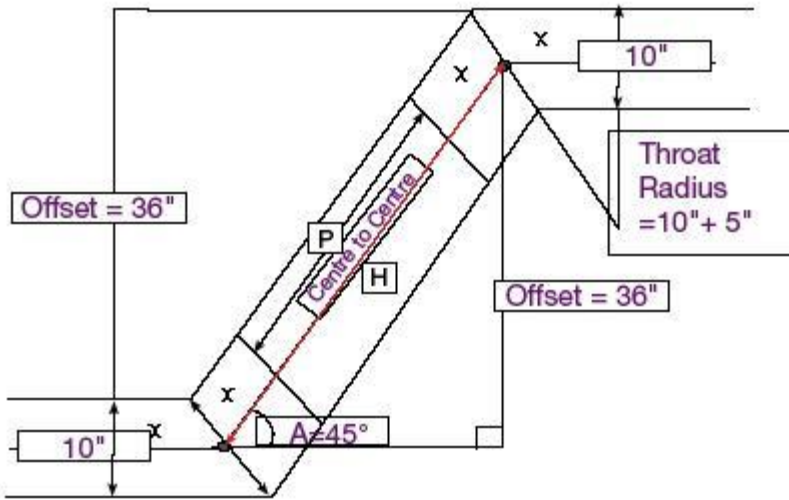
Rachel writes all of these measurements on a field drawing that she will give to the shop where everything will be custom-made for this job. The field drawing will also include all the final design and product specifications (**interpret documents**).

Choosing materials

Before giving her field drawing to the shop, Rachel 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. Rachel consults the heating, ventilation and air conditioning codes to find out exactly how thick the steel needs to be (**interpret documents**). All apprentices are taught how to read and use these codes during their training.

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

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Choosing products

To meet the particular specifications of this job, Rachel uses high-temperature silicone to install the parts. Before she gets started, he reads the Material Safety Data Sheet (MSDS) for this product to check for any safety information she should know about it (***interpret documents***). She also reads the directions on the package to find out how long it takes to dry (***read continuous text, use measures***). Timing is important because the plant is being shut down while Rachel 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.

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

http://www.edsc.gc.ca/eng/jobs/les/tools/awareness/smw_story.shtml



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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 journey person sheet metal worker.

2. 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. \times 24 in. duct.

$$1 \text{ ft.}^2 = 144 \text{ in.}^2$$

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



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3. 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?

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 OSHA permissible limit for formaldehyde.

4. 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

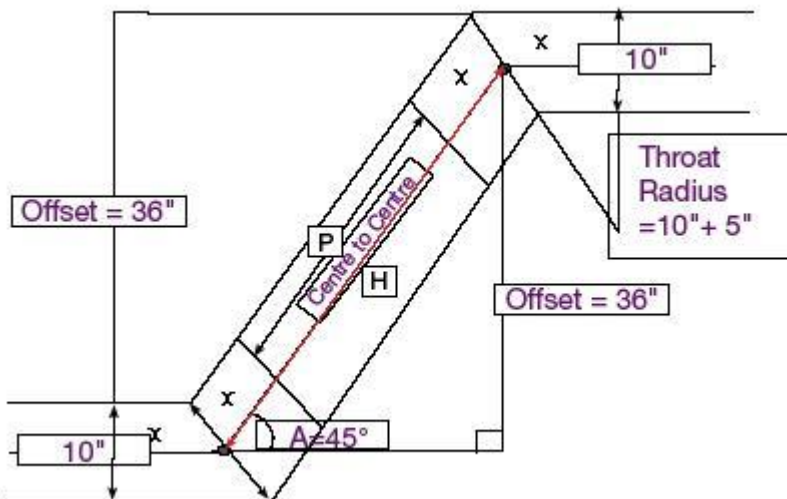
1. Remove all previous material from mating surfaces.
2. For best results, clean and dry all surfaces with a residue-free solvent.
3. Cut nozzle to desired bead size, $\frac{1}{16}$ " to $\frac{1}{4}$ " in diameter. An $\frac{1}{8}$ " bead is usually sufficient for most applications.

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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.

5. 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:

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

Step 2:



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Calculate the length of x . Use this formula:

$$x = \text{Throat Radius} \times \tan (A/2)$$



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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.

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

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Answer Key

Task 1: interpret documents
use measures
problem solving
interact with others
use of memory (thinking skills)
decision making (thinking skills)
read continuous text

Task 2: a. $8 \text{ in.} \times 24 \text{ in.} = 192 \text{ in.}^2$
 $192 \text{ in.}^2 \div 144 \text{ in.}^2/\text{ft.}^2 = \mathbf{1.33 \text{ ft.}^2}$
b. $1.33 \text{ ft.}^2 \times 1200 \text{ ft./min} = \mathbf{1\ 596 \text{ ft.}^3/\text{min}}$

Task 3: The sheet metal worker will need to wear safety glasses and neoprene, rubber or butyl rubber gloves.

Task 4: The earliest the silicone will be set is 3 p.m.

Task 5: Step 1: 50.91 inches
Step 2: 6.21 inches
Step 3: 38.49 inches
Step 4: $38\frac{1}{2}$ inches
The length of straight duct needed is **$38\frac{1}{2}$ inches.**

Notes for practitioner: Task 1 measures “reading continuous text”
Task 2 measures “use measures”
Task 3 measures “interpret documents”
Task 4 measures “interpret documents” and “manage time”



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Task 5 measures “interpret documents” and “use measures”

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Performance Descriptors		Needs Work	Completes task with support from practitioner	Completes task independently
A1.3	<ul style="list-style-type: none"> manages unfamiliar elements (e.g. vocabulary, context, topic) to complete tasks 			
	<ul style="list-style-type: none"> uses organizational features, such as headings, to locate information 			
	<ul style="list-style-type: none"> follows the main events of descriptive, narrative, informational and persuasive texts 			
	<ul style="list-style-type: none"> obtains information from detailed reading 			
A2.3	<ul style="list-style-type: none"> performs complex searches using multiple search criteria 			
	<ul style="list-style-type: none"> manages unfamiliar elements (e.g. vocabulary, context, topic) to complete tasks 			
	<ul style="list-style-type: none"> integrates several pieces of information from documents 			
	<ul style="list-style-type: none"> uses layout to locate information 			
	<ul style="list-style-type: none"> identifies the purpose and relevance of documents 			
	<ul style="list-style-type: none"> makes inferences and draws conclusions from information displays 			



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C2.1	<ul style="list-style-type: none">• adds, subtracts, multiplies and divides whole numbers and decimals			
	<ul style="list-style-type: none">• identifies and performs required operation			
	<ul style="list-style-type: none">• represents dates and times using standard conventions			



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C3.3	<ul style="list-style-type: none"> calculates using numbers expressed as whole numbers, fractions, decimals, percentages and integers 			
	<ul style="list-style-type: none"> understands and uses properties of angles and triangles to solve problems 			
	<ul style="list-style-type: none"> manages unfamiliar elements (e.g. context, content) to complete tasks 			
	<ul style="list-style-type: none"> chooses and performs required operations; makes inferences to identify required operations 			
	<ul style="list-style-type: none"> interprets, represents and converts measures using whole numbers, decimals, percentages, ratios and fractions 			

This task: was successfully completed____ needs to be tried again____

Learner Comments

Instructor (print)

Learner Signature