**Fabricate a Tool Caddy**

**Description**

Fabrication is a basic set of skills that include cutting, bending and assembling processes. In this Activity Plan, students will be fabricating a tool caddy using a variety of sheet metal fabrication tools, equipment and fabrication processes.

### Lesson Objectives

The student will be able to:

* Break out and lay out stock
* Cut sheet metal
* Form sheet metal
* Assemble sheet metal
* Finish sheet metal

### Assumptions

The teacher will:

* Be a certified technology education/industrial education teacher
* Be familiar with the metal shop where this Activity Plan is being conducted
* Have experience with all aspects of the given metal shop, including machines, tools and processes

The student will:

* Be attentive and participatory
* Recognize that appropriate attitudes are the best insurance for safety
* Cut, form and join sheet metal material to create the desired project
* Safely work in the metal shop
* Demonstrate safe and appropriate use of hand tools and equipment
* Use appropriate layout tools
* Demonstrate appropriate finishes

### Terminology

**Aviation snips**: a hand tool designed to cut sheet metal into intricate designs. Can be used to cut compound curves. Red = left cutting; Green = right cutting; Yellow = universal, able to cut in any direction.



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**Bar folder**: a sheet metal machine that is used to create straight bends in sheet metal.

**Box and pan brake**: a sheet metal machine that is used to create bends, hems and boxes in sheet metal.

**Breaking**: bending the sheet metal along a line.

**Centre punching**: marking the centre of a hole.

**Combination square**: a ruled blade with both 45° and 90° heads. Used to lay out right angles and 45° angles.

**Emery cloth**: an abrasive cloth used to remove material and smooth surfaces.

**File**: a hand tool designed to shape and smooth metal. Available in a variety of shapes and sizes to fit different projects. Made of hardened steel with varying textures to remove large or very minimal amounts of material.

**Finishing**: the process of using sanding, polishing, sandblasting or painting to create a desirable end product appearance.

**Hem**: a border made by folding over the edge of a piece of sheet metal to increase strength and durability.

**Hemming**: the process in which the edge is rolled flush to itself.

**Layout**: the process of transferring a pattern from paper to the material using pens, scribes, centre punches, squares and scales.

**Letter and number stamps**: hardened steel bars with letters and numbers. Used to permanently label metal projects.

**Pattern**: a model or design used as a guide.

**Riveting**: a mechanical joining technique used to join two or more pieces of sheet metal together with a rivet.

**Roper Whitney punch**: a hand tool used to punch holes in sheet metal stock.

**Ruler**: a precision measurement tool that is a length of steel with marks at regular intervals.

**Scribe**: a long pointed piece of hardened steel that is used to mark layout lines on metal.

**Sheet metal**: a term used to describe a variety of thin rolled metal sheet stock.

**Spot welder**: a resistance welding technique.

**Squaring foot shear**: a foot-controlled machine used to cut sheet metal stock.

### Estimated Time

3–5 hours

**Recommended Number of Students**

20, based on the *BC Technology Education Association Best Practices Guide*

### Facilities

Metal shop with all necessary tools and equipment

### Tools

Personal protection equipment

###### Stationary Equipment/Machinery

* Beverly shear
* Bar folder
* Box and pan brake
* Squaring foot shear
* Spot welder

###### Hand Tools

* Aviation snips
* Centre-punch
* Combination square
* Coarse and smooth files
* Rivet gun
* Roper Whitney punch
* Ruler
* Square
* Scribe

### Materials (per student)

|  |  |
| --- | --- |
| 1 – Body | 15" × 14½" 18 ga. sheet metal |
| 1 – Handle | 14½" × 3" 18 ga. sheet metal |
| 2 – Ends | 8" × 8" 18 ga. sheet metal |

**Resources**

**Box and pan brake**  [http://www.bing.com/videos/search?q=how+to+use+a+box+and+pan+brake&view=detail&mid=0](http://www.bing.com/videos/search?q=how%2Bto%2Buse%2Ba%2Bbox%2Band%2Bpan%2Bbrake&amp;view=detail&amp;mid=0) B5F895025F7C74515AE0B5F895025F7C74515AE&FORM=VIRE

**Roper Whitney punch**  [http://www.bing.com/videos/search?q=how+to+use+a+whiney+punch&&view=detail&mid=94426](http://www.bing.com/videos/search?q=how%2Bto%2Buse%2Ba%2Bwhiney%2Bpunch&amp;&amp;view=detail&amp;mid=94426) 538A09825CF06DD94426538A09825CF06DD&FORM=VRDGAR

**Bar folder**  [http://www.bing.com/videos/search?q=how+to+use+a+bar+folder&&view=detail&mid=300C3F9](http://www.bing.com/videos/search?q=how%2Bto%2Buse%2Ba%2Bbar%2Bfolder&amp;&amp;view=detail&amp;mid=300C3F9) B87B7F4360FE7300C3F9B87B7F4360FE7&FORM=VRDGAR

###### Foot shear

https://[www.youtube.com/watch?v=S0Vl77nS\_5U](http://www.youtube.com/watch?v=S0Vl77nS_5U)

###### Pop rivet gun

https://[www.youtube.com/watch?v=WPwNsQMnx88](http://www.youtube.com/watch?v=WPwNsQMnx88)

###### Aviation snips

https://[www.youtube.com/watch?v=5Nrc2xvLmC0](http://www.youtube.com/watch?v=5Nrc2xvLmC0)

###### “HEADS UP! for Safety” handbook

https://[www.bced.gov.bc.ca/irp/resdocs/headsup.pdf](http://www.bced.gov.bc.ca/irp/resdocs/headsup.pdf)

###### BC Technology Education Association Best Practices Guide

<http://www.bctea.org/best-practice-guide/>

*Modern Metalworking*, textbook by John R. Walker, copyright 2004, Goodheart-Wilcox Company Inc.

# Student Activity

##### Body and Ends

1. Gather all materials from your teacher.

###### Note: Sheet metal is very sharp and can cut skin easily.

1. Lay out the body and both ends. Using a ruler and scribe, measure out all dimensions (see dimensions on diagram page 8), making sure that all cut and fold lines are easily visible.

###### Have your teacher check the layout of each piece before proceeding to the cutting step.

1. Using the shear, cut out the body. Be careful to line up each edge precisely with the cutting surface of the shear.

###### New material will not be handed out. If you are unsure of the process, consult your teacher.

1. File away any burrs or sharp edges on all exposed edges.
2. Cut angles on both end pieces using the squaring foot shear.
3. File away any burrs or sharp edges on all exposed edges.

###### Have your teacher check your edges before proceeding with folding your hems.

1. Hemming machine: Set to the correct depth before folding (if available). If using the box and pan brake, fold each long edge on the body. It should be a ½" hem. Fold the material completely over and make sure the hem is smooth and flat.
2. Aviation shears/tin snips: Cut tabs on your base. Keep your lines straight and accurate.

###### Have your teacher check your tabs and hems before proceeding to the next step.

1. Using the letter stamps and a hammer, stamp your name into the base of your caddy.
2. Box and pan brake: You may have to adjust the keys/fingers to make room for the various folds that need to take place. Folded edges should be square and crisp.
3. End pieces: Use the box and pan brake fold the angled edges on your end piece into a hem. The hem should be ½". Make sure each hem is flat and smooth. You will repeat this step until all four hems are complete: two on each end piece.
4. Set your folded body and both end pieces off to the side.

##### Base

* 1. Fold tabs 90° in relation to the sides.
  2. Fold both sides up 90° in relation to the bottom. You should end up with a U-shaped body piece.

###### Have your teacher check your folds.

**Handle**

1. Using your ruler and scribe, lay out the handle pattern on your pre-cut piece of sheet stock (see dimensions on the diagram on page 8).

###### Have your teacher check your layout before you begin cutting.

1. Aviation snips: Cut out corners according to the pattern. File all edges to make sure they are smooth and free of burrs and sharp edges.
2. Hemming machine: Set to the correct depth before folding (if available). If using box and pan brake, make sure work is square to the finger. Fold all ½" hems completely over. Make sure all hems are smooth and as flat as possible.

###### Have your teacher check your tabs and hems before proceeding to the next step.

1. Box and pan brake: Adjust fingers as needed.
   * Fold long length on both sides 90°.
   * Fold end tabs to 90°.

**Assembly and Finishing**

1. Place the end pieces inside the body and spot weld evenly along both edges and the bottom.
2. Repeat step 1 for the other end.
3. Add handle and spot weld the tab at the top of each end piece. Ensure your welds have good contact points and are secure.
4. Once all of your spot welds have been completed, use the files to remove any rough edges.
5. Use emery cloth to sand all surfaces and make sure they are smooth and clean.
6. Paint or decorate as you see fit.
7. Hand in for marking.

### Assessment

Consider co-creating the evaluation criteria with your students at the beginning of the activity/ project. You may want to include the following:

* Safe working procedures at all times
* Personal and project management: good use of time, attitude, effort
* Accurate measurements and layout
* Appropriate tools use
* All hems and folds are clean, straight and uniform
* All burrs and sharp edges are smooth
* Instructions were followed throughout the activity
* Product is painted/finished neatly
* Name stamp located on body base is easy to read. Letters are uniformly spaced and lined up horizontally

Tool Caddy Dimensions

#### 13.0000

0.7500

0.5000

#### Fold line

3.0000

#### Fold line

Tool caddy dimension DI

8.0000

#### Fold line

3.0000

0.5000

#### Fold line

Fold line

Fold line

Tool Caddy Ends

1.0000

0.5000

Fold line

for 1/2" hems on both edges

8.0000

0.3000

8.0000

**10**

Using aviation snips remove all 4 corners marked with the X

1/2" fold line

1/2" fold line

0.7500

0.7500

13.0000

0.5000

1.0000

3.0000

1.0000 0.5000

1/2" fold line

1/2" fold line

**Fabricate a Tool Caddy**

Tool Caddy Handle

Fold line to create end tabs, same line O opposite end

**Metal Work – Fabrication**

Youth Explore Trades Skills