**Make a BBQ Flipper**

**Description**

The purpose of this activity is to introduce students to the metal shop through practical activity. This activity is an introduction to sheet metal fabrication and basic hand tools used in working with sheet metal. It also includes a design element that allows students to personalize their finished product while increasing their skill level.

### 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 finishing techniques



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### 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.

**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.

**Jewellers saw**: a hand saw with very fine teeth used to cut internal designs into metal.

**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.

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

### Estimated Time

2–3 hours

### Recommended Number of Students

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

**Facilities**

Metal shop facility with all necessary equipment

### Tools

* Aviation snips
* Bar folder
* Box and pan brake
* Centre punch
* Emery cloth
* Files – both coarse and smooth
* Hammer
* Jewellers saw
* Letter stamps
* Pop rivet gun
* Personal protection equipment
* Ruler
* Scribe
* Squaring foot shear
* Vise – with soft jaws/vise caps
* Whitney punch with a 3⁄16" die (other dies may be required on an individual basis depending on student design choices)

### Resources

###### “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.

**Videos**

**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=w8d3n\_kvlyMhttps://[www.youtube.com/](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)

### Materials (per student)

|  |  |
| --- | --- |
| **Number of pieces** | **Material and size specifications** |
| 1 Handle | 1" × 14" 14 gauge stainless steel |
| 1 Head | 4" × 6¾" 14 gauge stainless steel |
| 2 | 1" × 6" × 3⁄16" plywood (plus paint or stain) |
| 2 | 3⁄16" machine screws, countersunk heads |
| 2 | 3⁄16" nuts |
| 2 | 3⁄16" shank tinner’s rivets (or blind/pop rivets)  5⁄16" long – aluminum |

**Student Activity**

1. On a blank sheet of paper, sketch out 6 design ideas for the head of your flipper (e.g., flames, #1 griller, starburst). These designs should be in pencil, neat and detailed.
2. Choose one of your designs, and on a separate piece of paper draw out your BBQ flipper head to scale, including your chosen design. The head should measure 4" × 6¾", including the 1¾" fold line. (See Dimension diagram on page 7.)
3. Once your design and template are complete, show your teacher and gather your materials: 1 handle piece, 1 flipper head piece.

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

1. Using the dimensioned diagram attached, lay out all holes on both the handle and the flipper head using the scribe and ruler. There should be 6 holes in total.
2. Lay out the fold line on both the handle and flipper head. This should be a solid scribed line.

###### Show your teacher before proceeding.

1. Centre punch each hole location on both pieces of your flipper.
2. Punch both holes on the flipper head using the Roper Whitney punch and a 3⁄16" die.
3. Punch all 4 of the holes on your flipper handle using the 3⁄16" die on the Roper Whitney punch. Be sure to centre the Roper Whitney punch on the layout marks.
4. With a smooth cut file, make sure there are no burrs or sharp edges where your holes have been punched.
5. Test fit to ensure your handle holes line up with the flipper head.
6. Set your handle aside. Using a permanent marker and layout tools, trace out your chosen design onto the flipper head. Be careful to centre your design and leave space along the outside edges.
7. Show your teacher your layout and confirm you are ready to cut out the design.
8. Using the Roper Whitney punch and a jewellers saw, cut out your design carefully. This may take some time.
9. File any rough or sharp edges until smooth and free of burrs.
10. Sharpen the edge of your flipper head opposite your holes for the handle attachment. Use a file first, then emery cloth to smooth the edge.
11. Using the vise and soft jaws to secure your flipper head, slightly round the four corners to ensure there are no sharp edges. This could be done using a smooth cut file or emery cloth.
12. Now that all surfaces and edges are smooth, the handle and flipper head need to be bent to a 30° angle using either the box and pan brake or bar folder. Line up your fold line evenly to guarantee a good bend.
13. Finish off your handle piece and flipper head with 400 grit emery cloth. Make sure you sand in the same direction to ensure your flipper parts have a uniform finish.
14. Ask your teacher for 2 rivets and join the handle piece to the flipper head using the rivet gun. Make sure your pieces are lined up correctly before you complete the riveting process.
15. Gather 2 pieces of 1" × 6" × 3⁄16" wood from your teacher and the required hardware

(3⁄16" machine screws, countersunk heads and nuts) to attach the wood to your flipper handle.

1. Sand the wood pieces with 120 grit sandpaper and finish using a wood stain or oil. 22.Using the letter stamps and a hammer, stamp your initials or name into ONE of the two

wooden handle pieces.

1. Attach the wood pieces to your flipper handle, being sure to tighten the screws.
2. Hand in for marking along with your design drawings.

### Extension Activity

If AutoCAD or similar design software is available, use it to create the flipper head design, then either laser engrave or CNC machine your design, depending on the equipment available in the shop.

### 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
  + Design drawings are neat and organized and include details
  + Accurate measurements and layout
  + Appropriate use of tools
  + All burrs are removed and sharp edges are smooth
  + Project is assembled correctly and securely
  + Name stamp located on wooden handle is easy to read. Equally spaced and lined up horizontally
  + All folds are even and square

## BBQ Flipper Body

#### 4.0000

Slight radius created by filing edges

Student designed center

6.7500

Fold line for handle attachment

0.5000

1.7500

0.5000

3/16" hole

Note: All holes are 3/16" in diameter

BBQ Flipper Handle

#### 0.5000

0.5000

7.2500 4.0000

1.0000

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1.0000

#### Fold line for handle attachment

**Metal Work – Fabrication**

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