**Sheet Metal Notes**

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**I. The Sheet Metal Industry**

**\*Sheet Metal is all metal in sheet form that is less than ¼"**

**\*Metal Plate is all sheet metal over ¼"**

**\*Sheet metal workers build ducts for heating and cooling, exhaust hoods, metal roofs, ceilings, skins for boats, trailers, and aircraft and space vehicles.**

**\*Other common sheet metal objects include: road signs, toys, appliance covers, file cabinets, desks, lockers, and etc.**

**\*Commonly used sheet metals are: Steel, Galvanized Steel, Tinplated Steel, Stainless Steel, Aluminum, Copper, and Brass.**

**II. Patterns and Pattern Making**

**A. Stretchout -pattern that shows the true size and shape of the flat sheet**

 **needed to make the object**

 **1. Full Size Patterns-used two ways**

 **a. attaching paper to metal and tracing around it**

**b. attaching paper to metal and punching holes through the paper as a guide**

 **2. Templates-multiple objects are made from the same original paper**

 **pattern**

**B. Pattern Development**

 **1. Parallel Line Development-used for objects that have parallel sides**

 **such as squares, rectangle and cylinders.**

 **2. Radial Line Development-used for objects such as cones, pyramids,**

 **and funnels 3. Triangulation-irregular sheet metal objects such as car doors.**

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**C. Hems and Seams**

 **1. Hems are folds along an edge used for strength and to**

 **protect the sharp edge.**

 **2. Seams are joints made by fastening two edges or pieces of sheet**

 **metal.**

 **3. Allowance is the amount of metal needed to make a hem or seam.**

 **4. Spot welded seams always need to be wider.**

**D. Bending sequence**

 **1. First bend all hems**

 **2. Second bend side containing seams**

 **3. Third bend remaining two sides**

 **4. Bending Sequence is done to ensure that the object can be**

 **bent and with the fewest number of steps**

**E. Bend Allowance**

 **1. Length of the bend**

 **2. Type of metal**

 **3. Grain of metal**

 **4. Number of bends**

 **5. Thickness of the metal**

**III. Sheet Metal Sizes**

 **A. Gage**

 **1. Thicker sheet metal the gage number is lower**

 **2. Thinner sheet metal the gage number is higher**

 **a. pop cans are 48 gage and cars are 26 gage (approximately)**

 **3. Sheet metal gage and wire gage is the same thing**

 **4. Manufacturers Standard Gage is the standard for all sheet steel**

 **5. American Standard Gage or Brown & Sharp is the standard for**

 **all nonferrous sheets such as aluminum, copper, and alloys**

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**IV. Hand Tools and Cutting Tools**

 **A. Hand Tools-Layout**

 **1. Scratch Awls-Sharp pointed tools for scribing layout lines**

**2. Wing Dividers-Used to scribe arcs and circles**

**B. Hand Tools-Hammers**

**1. Riveting Hammer-Used for setting solid rivets**

**2. Setting Hammer-Used for tucking or bending edges**

**3. Raising Hammer-Used for producing raised or curved surfaces**

**4. Mallet-Made of rawhide, wood, and rubber-used to shape sheet**

 **metal without marring the surface.**

**C. Hand Tools-Hole Making**

**1. Hand Punch-like a paper punch to put holes into sheet metal**

**2. Turret Punch-similar to a hand punch, but can punch many**

 **holes quickly,**

**D. Hand Tools-Benders**

**1. Flat-Nose Pliers-used to bend small corners**

**2. Hand Seamers-used to bend small hems and seams less than 6"**

**3. Hand Groover-used for finishing a standing grooved seam**

**E. Hand Tools-Cutting**

 **1. Aviation Snips**

 **a. straight cuts-yellow (also blue)**

 **b. right cuts-green**

 **c. left cuts-red**

 **d. all have serrated teeth which helps them cut easier**

 **e. compound levered which allows them to cut with less force**

**2. Tin Snips-similar to scissors but stronger for metal**

**3. Utility Shears-general purpose cutting but not good for metal**

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**V. Large Sheet Metal Tools**

 **A. Squaring Shears**

 **1. Cuts multiple pieces rapidly**

**2. 24" to 52" common sizes**

**3. Can be foot or pneumatically operated**

 **B. Notcher**

 **1. Cuts 45º and 90º relief's for hems and seams**

 **C. Ring and Circles Shears**

 **1. Similar to a band saw in appearance**

 **2. Cuts irregular shapes like car doors, lids, circles**

 **D. Portable Power Shears**

 **1. Also called nibblers**

 **2. Used for cutting large sheet metal and irregular curves**

 **E. Spot Welder**

 **1. Uses electricity to fuse/weld sheet metal together**

 **2. May reach temperatures over 3000º**

 **3. Hand operated and also robotic**

 **F. Brakes**

 **1. Box and Pan Brakes- interchangeable blocks for bending small**

 **sheet metal objects--nail trays and dust pans**

 **2. Cornice Brakes-large tools for bending long straight lines**

 **(lockers and file cabinets)**

 **G. Form Roller**

 **1. Used for curving sheet metal (vent pipe, car bodies)**

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