Bending Flat Parts

Some airframe parts require bending, whether bending a flat part to a given angle, or reforming an existing angle (rib flange, channel flange, etc.) to a proper fit.

Accuracy

Angles are often noted very precisely on the plans (e.g. 93.7 degrees). However, there is NO NEED for an individual builder to be nearly that precise. Often being within a degree or two is more than enough.

Measuring Angles

Angles can be measured a number of ways - an adjustable protractor, an angle finder, lines drawn on your workbench, a piece of cardboard cut to the proper angle, etc.. There is no need for expensive or "machinist" grade tools.

Bend Radius

The plans identify the minimum bend radius for each bend. For material .032 and less this is often a .0625" radius. This radius occurs naturally when using a form block or most other tools, however, if you are using a bending brake or hand seamer with a particularly "sharp" edge you will need to be careful not to form a sharp bend, which, in time, can crack.

Thicker parts require a larger bend radius. As with bend accuracy, there is no need to be precise on the bend radius, just close. If you use the V-block method described here for bending your thick parts the proper radius will be achieved by using the proper diameter rod.

Bend Tangency Lines

The plans identify "Bend Tangency Lines". These lines indicate the beginning and the end of a bend radius. When forming parts in a vise or bending brake, one of these lines will typically be at the edge of the vise jaw or bending brake. When forming parts using a V-block, the steel rod is centered between the bend tangency lines.

Part Preparation

It is good practice to debur the edges of a part before it is bent. Removing the scratches near the bend will prevent the part from cracking at the edge while it is being formed.

Finishing Up

Inspect the bend area for signs of cracking - both the surfce and the edge. Seldom will cracks form using these methods. If cracks do form the part must be discarded.

Orange peel is common. Orange peel, as its name implies, is an uneven texture at the bend which is restricted to the surface. Orange peel should be polished off to make sure it is not hiding an underlying crack.

Tools and Techniques

The tools and techniques mentioned here are only suggestions. Every builder has different skills and different tools. The goal is to achieve proper results and usable parts no matter what tools and techniques you use. Take pride in your work.

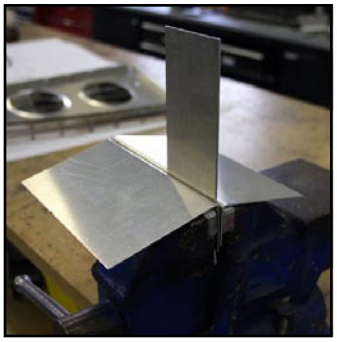
When trying a tool or technique for the first time it is best to practice on scrap before bending the part.

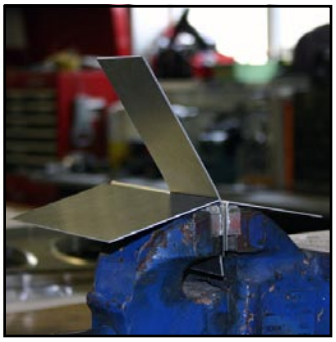
Parts Up to .032" Thick

Aluminum up to .032" thick can be easily bent with a hand seamer or small bending brake. Irregular shaped objects, such as ribs being built from scratch, are best shaped on form blocks. Long bends, such as the bends in the seat pan, need to be done on a bending brake. If you don't have access to a bending brake your local heating and cooling shop may make these simple bends for you for a nominal cost.

Parts .063" to .090" Thick

Aluminum from .063 to .090" thick is best bent on a small brake. Narrow parts can also be clamped in a vise and bent with the palm of your hand or rubber mallet. Be sure to pad the vise jaws so you do not mar the surface of the part. Keep in mind the bend will occur just above the jaws. If using a vise it is best to practice on a piece of scrap before committing to the actual part.





These photos show how a piece of .062" or .090" can be bent in a vise. Scraps of aluminum protect the part from the jaws of the vise and the part was easily formed with the palm of a hand. When using this method, one bend tangency line is even with the top of the vise jaws, and the other is above that. An acceptable bend radius usually occurs automatically.

Parts .125" Thick

Aluminum .125" thick should be bent on a brake, or with the V-block method.

Parts .1875" and Thicker

Material over .125" thick can be easily and accurately formed by the average builder with some simple, homemade "V" blocks, rods, dowels or pipes of the proper diameters, and a small arbor press, large vise, or car jack. This method is described in detail on the following page.

Forming Parts with a V-Block

V-blocks can be made from scrap wood (2 x 4s work well) and the forming tool can be a scrap piece of steel rod, pipe, or wood dowel of the correct diameter. A bench-top arbor press is all that is needed to press the aluminum part into the V-block. Creative builders have also used a car jack as a press.

Homemade wood V-blocks and rods of various diameters. While solid steel rods are shown here, wood dowels and steel pipe would also work.

V-Block Dimensions

The V-block in these photos was used to form all the 3/16" thick parts for a Sonex airframe. The top of the "V" is 3-1/4" wide, and it is 5/8" deep. The block was made from a piece of 2x4 lumber.

Forming Parts

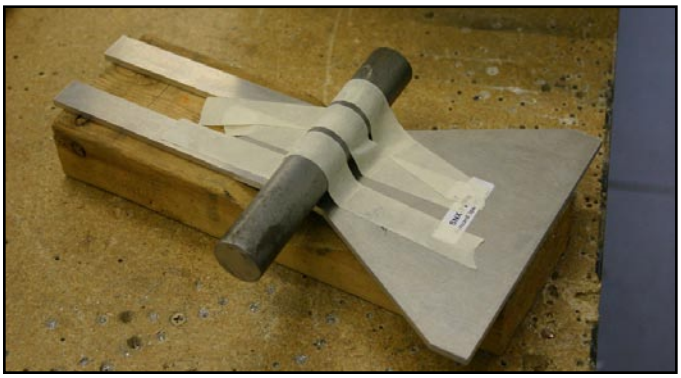
1. Mark the centerline of the bend on the part. Be sure to mark the edge of the part as well, as this is all that will be visible as the radius rod is taped in place.

Note: When forming a part with a V-block, the bend's centerline *must be marked. That line is centered between the "bend tangency lines" shown on the plans.*

The bend centerline is marked on this Sonex spar fitting.

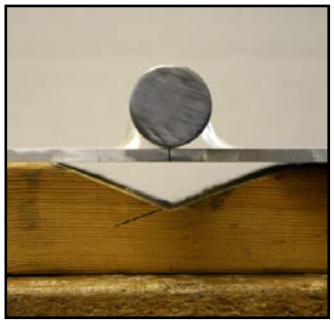
2. Tape a steel rod, pipe, or wood dowel of the correct diameter on the part, centered over the bend centerline.

Note: The proper diameter for the forming rod will be twice the bend radius identified on the plans (e.g. a bend radius of 1/2" requires a 1" diameter rod).



The rod taped to the centerline of the part.

3. Center the bend centerline of the part over the center of the "V" in the V-block.



The rod taped to the centerline of the part and centered over the "V" in the V-block.

4. Apply pressure to the rod until the part has been formed to the proper angle.