

Figure 9

The leading edges of the wing, tail and control surfaces are the most common plywood bending exercise in the Falco. There are several methods that may be used. One of these is to pre-bend the plywood over a mandrel as shown in Figure 9. This is a method employed by a Falco builder to pre-bend his wing skins. A large broom stick was used as the mandrel, and it was clamped between two boards. One of the boards was cut to receive the broom stick. In most cases, the weight of the plywood is sufficient to bend the plywood, but weights may be added as well.

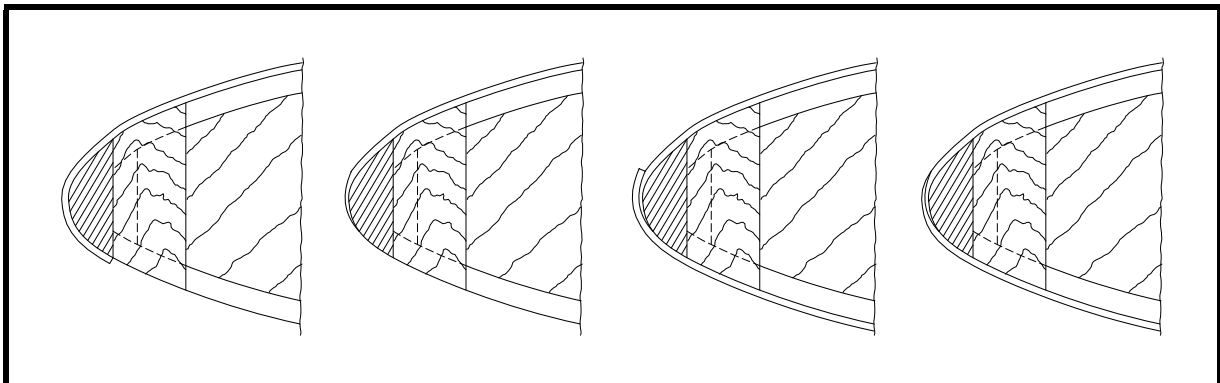


Figure 10

After the skin is bent for the leading edge radius, the skin is glued in place as shown in Figure 10. Next the skin is scarfed. Unlike most scarfs, this is not a straight cut. Instead, you must sand a smooth, radiused scarf on the plywood. This is not as difficult as it may seem, since the layers of wood and glue lines reveal any irregularities. Next the skin for the other side is glued in place. After the glue is dry, the plywood is feathered to a smooth radius.

Most Falco builders do not pre-bend their skins off the airplane. Instead, they prefer to bend the plywood over the leading edge strip using nails or clamps to hold the plywood in place. One method developed by a Falco builder is to use large rubber bands to bend the leading edge skin. This method is shown in Figure 11. The skin is cut so that it is a couple of inches longer than needed at the leading edge. To this extra plywood, you glue a scrap piece of wood, say 20x20 pine. Before gluing the pine in place, drive a nail into it every 4 inches or so. Another piece of 20x20 pine-with-nails is used as well, and it is clamped to the rib. Cut an automobile inner tube into long strips about 1" wide. If you cut the inner tube with a spiral cut, the rubber band will be

quite long, and this is desirable. To bend the plywood, lace the rubber bands back and forth over the nails of the two 20x20 pine pieces. The first couple of lacings will do little to bend the plywood, but as you work your way down the leading edge, the cumulative pressure of the bands will bring the plywood down into place. If a single pass is not enough, then lace back over the nails again and again until the plywood bends into place. Ordinarily, soaking the leading edge of the plywood in water is all that is required, but the use of a steam iron in this situation would greatly speed things up.

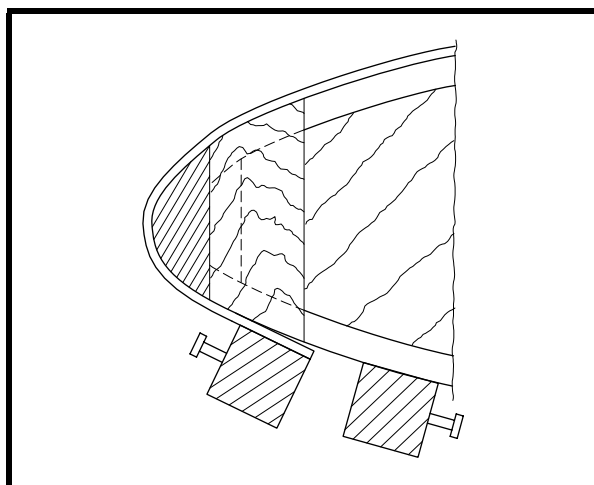


Figure 11

After the leading edge plywood is bent, it is kept clamped in place for a couple of days until dry. The plywood is then removed from the airplane and allowed to completely dry. When the skin is glued to the airplane, the same method with the rubber bands may be used to clamp the skin in place. After the glue is dry, the extra plywood and the 20x20 pine is cut away. The same method is used for the skin on the other side of the wing, or tail.

A few builders complain that these methods are not completely to their liking, since the plywood tends to lift from the rib while the leading edge radius is being bent. Another method—and the one used on the production Falcos—is to glue the first skin in place without bending the leading edge radius or getting any glue on the leading edge strip. After the glue is dry, the leading edge of the plywood is bent by wetting the wood with hot water and using a steam iron. Pull the plywood over and nail to the leading edge strip. After a couple of days, remove the nails and allow the entire assemblage to dry completely. Then, stuff glue under the leading edge of the plywood and nail down. Then proceed as shown in Figure 10.

The fuselage has slight compound bends on the side skins around the cockpit. In this case the plywood is clamped to the fuselage frames. As an alternative method, you may make a simple form to bend the skin over. Don't worry about this now, instructions for bending this plywood be covered in the appropriate chapter.

Clamping Methods

Figure 12 shows the most common method of clamping a rib to a spar. A block of wood is inserted into the gusset pocket of the rib, then two pieces of wood are screwed together as shown and a clamp is used to hold things in place.

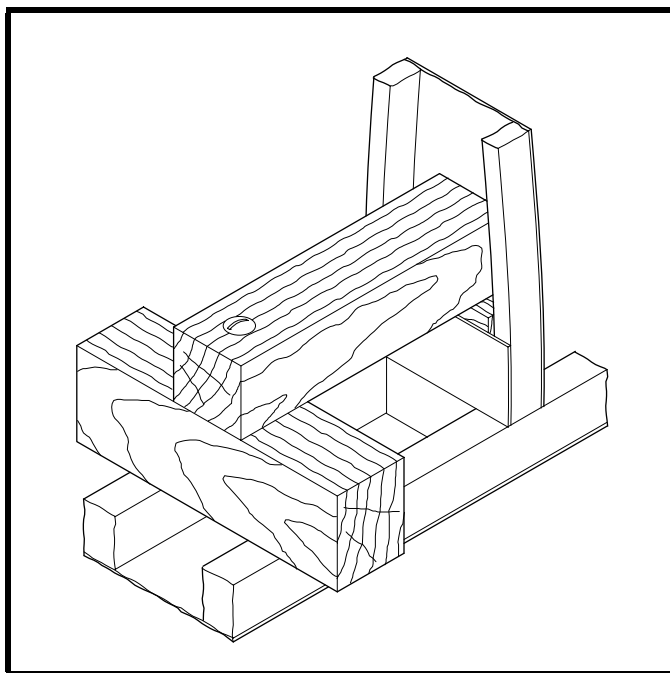


Figure 12

For many of the wing ribs you can use the rubber bands to clamp the ribs in place. These are the “open” ribs; that is, they do not have plywood glued to the face of the rib.

To clamp a corner block in place, the method shown in Figure 13 is most often used. The clamping blocks will try to slip, so you can clamp a couple of blocks in place to keep them from moving, or you can drive a couple of small nails through the clamping blocks so that the ends of the nails will stick out slightly and bite into the wood.

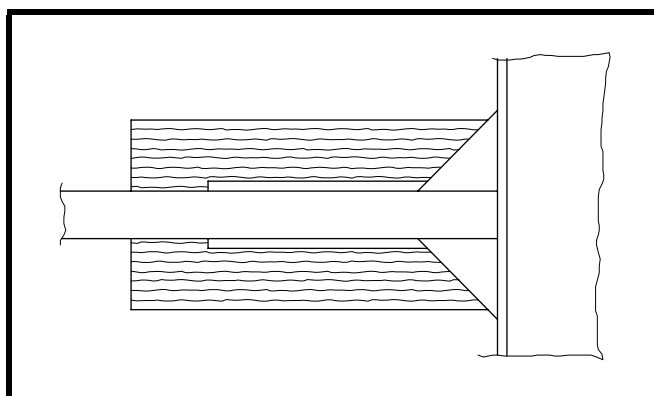


Figure 13

Figure 14 shows a method for clamping a trailing edge strip in place. The nails are for rubber bands. If this type of clamping block is positioned right over the rib, you will end up gluing it as well, so you can use some wax paper to keep this from happening.

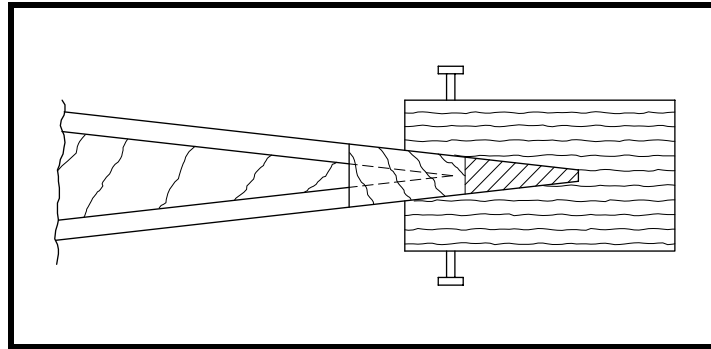


Figure 14

When you glue the leading edge skins on the elevator or rudder, you can use the method shown in Figure 15. These custom band clamps are made of aluminum and a bolt is used as a jack-screw to apply the pressure. The nut may be epoxied in place and you may tap the wood if you wish. These clamps work very well, but they have a couple of disadvantages. They will not work well with fast setting glues such as Aerolite unless you can devise some way of quickly putting the clamps in place. The clamps are also some trouble to make.

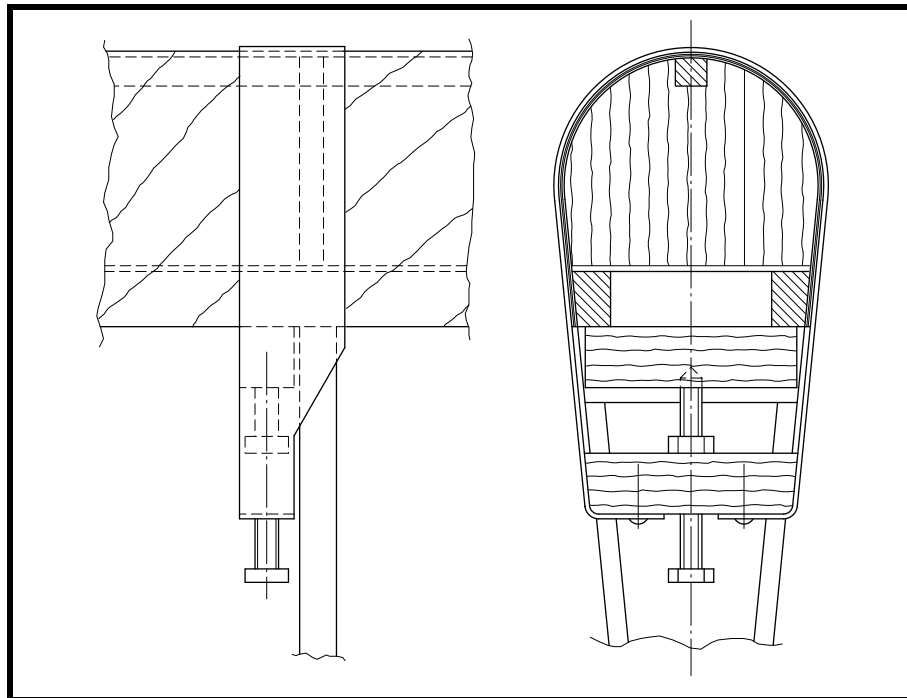


Figure 15

For the ailerons you can use a variation shown in Figure 16. In this case a $3/4"$ Ø dowel is used and a hole drilled in the assembly jig for the dowel.

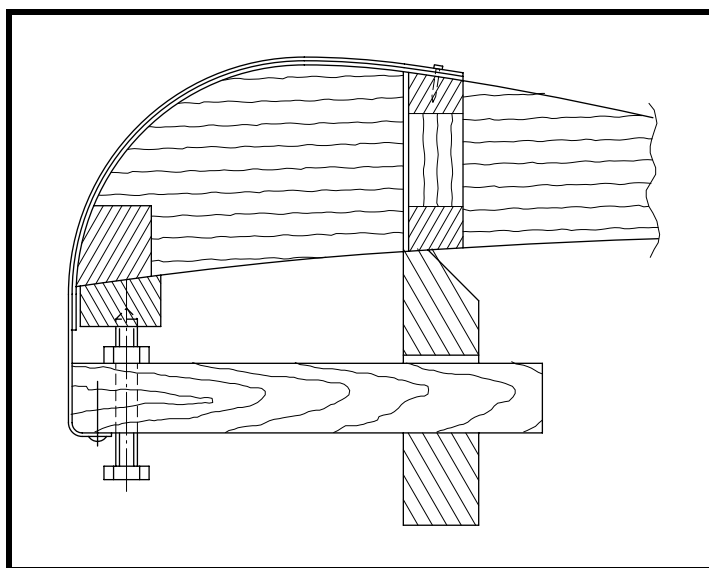


Figure 16

A simpler method is to use the large rubber bands to clamp the skins in place. For the upper leading edge skin of the aileron, you may use the same type of method shown in Figure 11.

Drilling Holes

Most of the fittings (supplied in our kits) already have the required mounting holes drilled in them. To install the fittings, clamp the fittings in place and drill through the wood. It is always best to drill the holes on a drill press. This way you can be assured that the holes are straight. You should also use brad point drills. These drills do a beautiful job of drilling holes in wood, unlike ordinary twist drills which tend to tear their way through the wood. Brad point drills leave an exceptionally clean hole—the inside of the hole is nearly a polished surface. You should always use a piece of scrap wood on the far side of the spruce to keep the drill from splintering the wood when it appears on the other side.

When you drill a hole in metal, you typically drill the hole undersized and then ream up with the final size drill. You do not do this with wood. With wood you use the proper size drill the first time.

There are a few places in the Falco where you will have to drill through wood and a steel plate. This requires a special procedure. If you attempt to drill the steel plate in the airplane, you are in for a very rude surprise! When the drill hits the steel, it will tend to wander. This will end up ruining the fitting and the steel plate, and the hole in the wood will be a genuine mess. The proper procedure is to drill the wood first, using only the normal backup block. After the holes are drilled in the wood, the steel plate is clamped in position. The steel part is then marked using a “transfer punch”. A transfer punch is just like a center punch except that the shaft of the punch is to a specific diameter to fit inside a drilled hole. Unlike a center punch, it is not free to move around in the hole. The transfer punch is hit with a hammer, which center-punches the steel plate dead on center. After all holes are marked like this, the steel plate is removed from the airplane and drilled on a drill press.

There will be a few instances when you will find that you have really botched a hole. In this case, you may use a wood dowel to plug the hole. Glue a short dowel in place, and after the glue is dry, drill the hole again.

Bolt Torques

With a metal airplane, all bolts are expected to be torqued to a specific value. This is not true of a wood airplane. The bolts are expected to be tight but not so tight that the wood is crushed. You will notice that the more important fittings have wide plates on the reverse side to distribute the load into the wood. The larger the backing plate, the more the bolts may be tightened without damaging the wood. Other fittings use channel-nuts or wide washers. If you overtighten the bolts, you will notice that the large washers will start to cone. If this happens, you have gone too far, and you are crushing the wood. By the same token, you do not want any of the bolts loose.

Drain and Vent Holes

When an airplane climbs to altitude, the air becomes thinner. Any air trapped within a closed compartment will try to force its way out due to the lower outside air pressure. For this reason, you should not build any such closed compartments in the airplane. Because of the nature of the Falco design, this will require that holes be drilled in the tail ribs and at other places to allow air to move about the airplane.

These holes should be positioned so that they will drain any water that may enter the airplane or condense within it. The bottom of the wing, tail and fuselage should have drain holes drilled in the lower skins to allow any water that may be in the airplane to escape.

The vent holes should be positioned so that it also makes it difficult for moisture to enter the airplane. For example, the leading edge of the rudder is a closed compartment without any vent holes drilled. At the upper leading edge, it is best to route any vent holes through the spar instead of “daylighting” out at the upper hinge opening. The escape path for the air should lead to the bottom of the rudder.

Drain holes are normally 1/4"Ø. For vent holes, all you need is a 1/8"Ø hole. With many of the drawings, we drew all of the vent and drain holes as 1/8"Ø. Many builders blanch at the thought of 1/4"Ø holes in the airplane, and you may use any size hole you like. The only important thing is that the holes be open so that water will drain out. This is a maintenance item, and the larger holes are less likely to become clogged with dirt.