Technical Tips

Working With Sheet Metal, Part II

One of the skills you must learn if you have one of our metal kitplanes is counter sinking and dimpling.

If you are a lawyer, accountant or sheep farmer, for example, you have probably counter sunk a few bits of wood for the chicken coup or whatever. But doing so in a very expensive, pre-punched wing skin, I doubt. And why should you have; ever asked an aircraft technician if he has dipped a sheep?

Counter sinking involves removing aluminum from the sides of a hole in a conical shape so a flush rivet can be installed.

Dimpling is used on skins too thin for counter sinking, and involves using two shaped disks, one convex, one concave, that come together to produce a concave dimple into which the rivet head sits.

Lets start with counter sinking. You will need a micro stop. Few people who live normal lives know what these are, so lets look at one. A micro stop is a special receptacle into which you screw the countersinking bit, having basically two rotating barrels, interlocking with fine teeth. You pull the two barrels apart under spring tension, and rotate them. This alters the depth of the counter sink. The teeth re-engage, locking the position, and jolly accurate it is too. So "micro" adjustable that you will be driven crazy trying to remember which way to turn it, as its almost impossible to detect with the human eye.

Counter sinking bits come in a variety of angles, so use the correct one. Avex have 120 degree heads, solid rivets usually 100 degrees.

The nipple to guide the bit into the hole comes in the various hole sizes, so you need a selection of bits corresponding with the hole diameters you intend to counter sink. Try to avoid the type that have the cutting edge running partially into this nipple…they can enlarge the hole.

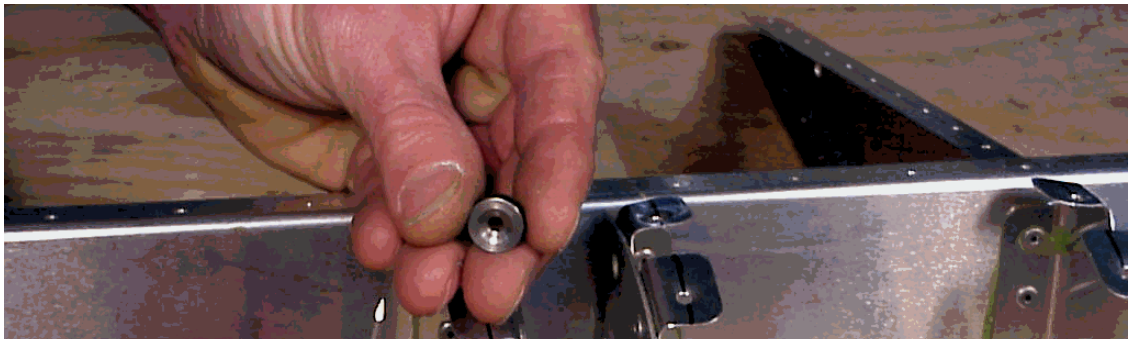
I like the sets (usually 3 bits and the microstop) available from various tool suppliers as the micro stop usually has a nylon edge that butts up to the work, preventing scratches.

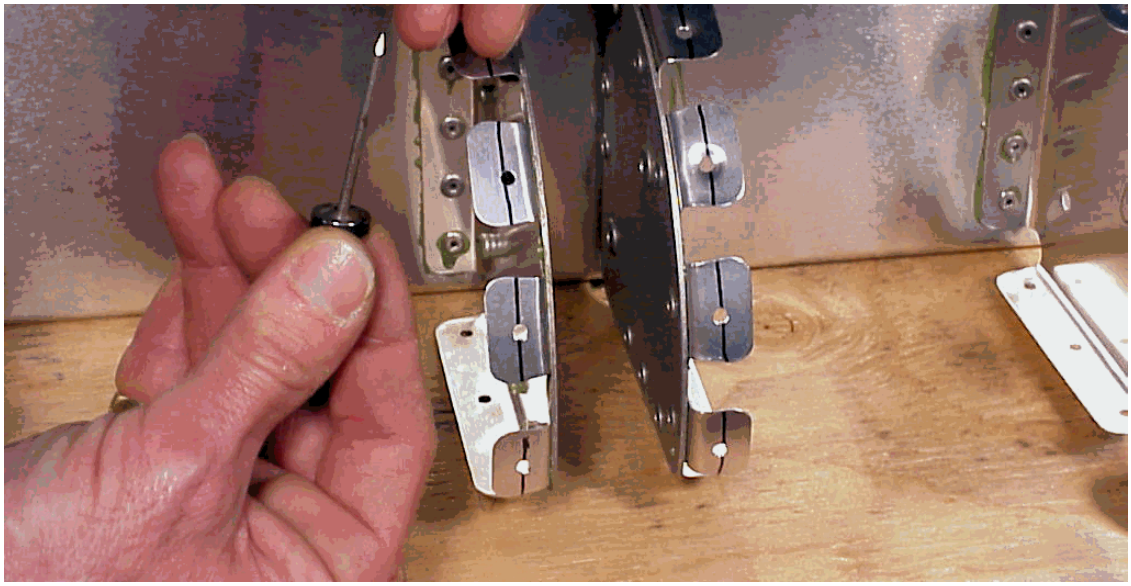
Chuck the assembly into your drill, get a piece of scrap, with lots of holes drilled in it, and practice. Once you have the correct depth (check it with the same rivet you will use), you are holding the drill perpendicular and no chattering is taking place, you can attack your kit.

Dimpling is usually performed on homebuilts with the two disks mentioned earlier fitted into a hand pop rivet gun. The nail that runs through the disks is inserted into the gun like a rivet mandrel.

Dimpling squeezers are available for extensive dimpling, with various types of bits available, but usually have limited use on large sheets due to their throat size.

Dimpling does deform the hole, slightly enlarging it. For this reason some people drill to final size after dimpling.





Cutting sheet metal is another area where a few explanations can go a long way. As with everything else, your tools are the most important element.

Tin snips: forget about buying cheap tin snips. Invest in a good set from a reputable tool company, preferably the offset type. This gives you more leverage and keeps your hand clear of the work. Good quality snips have sharp, smooth jaws that don't deform the aluminum. Cheap ones have nasty serrations, and are sold mostly for butchering steel, such as heating ducts etc. Never use your snips for cutting anything but sheet metal, and respect the maximum thickness, so you don't damage them.

I remember with fond memories the first time I started to trim a 0.016 skin (from a Renegade, I think), and wondering why my hands looked like I'd been blackberry picking blind folded. Wear gloves, if you can!

Some simple rules.

1. Lay out what you want to cut out, and with the felt tip scribble over the waste, so that the material you want to keep is clearly marked.
2. Cut to the WASTE side of the line, so you can file smooth up to the line.
3. Never close the jaws of the snips fully. Doing that deforms the work and will cause a crack.
4. Always drill correct size radius holes at the intended corners, and cut to them.
5. Don't try to snip round a large radius corner to the line. Cut well clear and file to the line.

Chain drilling: if you have to cut a slot in a sheet of aluminum, say 3/8" wide, use a drill bit to drill a series of holes. Then take a small file and file through the holes to remove the waste, and file smooth.

Hacksaws. I have never understood why people treat their hacksaws with such cruelty. If you ask a guy for a hack saw, he rummages about in the depths of his shop, and emerges with a rusty offering, with a broken blunt blade. The hacksaw is one of your most important tools. The handle should balance well and have a mechanism for changing the blade easily.

Never buy cheap blades. Buy the best, and I have the following in my box: several 24's and 28's (the number of teeth per inch), a couple of 32's for fine work, and a couple of 14's, 24's and 28's

in cobalt. Change the blade frequently. If you want to cut thick stuff as straight as possible, fit two blades into the saw to stiffen it. Remember to put the blades in the correct way. You cut on the down stroke, and the teeth point forwards. Good blades have an arrow indicating the tooth orientation.

Files. You simply cannot build a sheet metal aircraft with an old bastard, (file that is). You need a selection of fine, medium and coarse flat, half round and round metal files. Believe it or not, the ones you get to sharpen chain saws I find superb.

You may have in your shop various power tools, and a band saw and belt sander I feel are essential. A small brake (for bending), and a shear are also very useful, but not essential.

So, after all these words of wisdom, you should be able to drill holes, cut metal and make nice pretty bits for your flying machine. Perhaps here it would be appropriate to mention corrosion proofing, wet assembly and jointing compounds. I get asked more questions on this subject than anything else, and surprisingly, it’s a very simple part of the construction.

The aluminum used in our kits is mostly 6061-T6. This alloy is very corrosive resistant, as it forms an oxide coating on its surface, protecting itself against the elements. The problem is if this coating cannot form or is fretted away, allowing standing moisture to start attacking it. Areas where this can occur are between riveted sheets, high vibration areas, and especially where dissimilar metals are in contact.

Most fittings are 2024-T3. This is a stronger alloy, but corrodes badly. With sheets of this aluminum, the surface is skinned in a thin layer of pure aluminum ("Alclad") to protect it. This is easily scratched away, so care is needed when handling it. The thicker plates or machined fittings in our kits, made from 2024-T3 are not clad, so usually these are painted.

With the sheet metal parts made from 6061-T6, we recommend you paint between the mating surfaces, and rivet the assembly up "wet". For float operations or where extra protection is needed, you can paint all the internal structure.

There are a lot of different surface treatments available, but we tend to use Polyfibre’s epoxy chromate. This is a two part, catalytic primer supplied with the chromate primer, catalyst and reducer. It can be brushed on neat, or thinned for spraying.

Mix up a small quantity, and keep it in the freezer. It should last a week. For painting between surfaces, you need a nice thick consistency. This you will get if you leave it overnight in the freezer…fresh chromate is very runny.

Paint the chromate over the two mating surfaces, cleco and rivet up while wet.

To spray the surface of a sheet of aluminum, this is how I do it, and it works for me. If the aluminum is new, and you have just removed the plastic, all I do is Scotch Bright the surface

with acetone, and wipe it clean with fresh, clean shop wipes. Take the part straight into the bay; apply a dust coat and 20 minutes later a light full coat. For heavy usage areas, apply a second full coat. You won't believe how it sticks!

For weathered, old aluminum, use an acid etch wash, and proceed as above.

I don't want to make you loose sleep, but badly applied primer is actually worse than no primer at all. If the chromate is applied incorrectly, to an unkeyed surface, not properly degreased, and the chromate too thick, it will not stick, preventing the oxide coating from forming, but allowing moisture in.

A lot of people do not realize that the best substance to use between mating surfaces is the fuel tank sealant, Proseal.

I use it all over the fuselage, in high vibration or stressed areas such as the main gear and tail cone areas. It seals the panels so the fuselage does not leak, and provides an increase in sheer strength. Thin it with MEK to a brushable consistency, and paint it on.

Lastly, bolts that are subject to high corrosion environments, such as in the wheels, brakes or float operations, can be installed with non-setting zinc chromate. This is a yellow paste, and when spread over the shank of the bolt, wont let anything past it!