

37. Finishing

Beauty is skin deep according to the saying, and this in many ways is very true with a composite aircraft. No one will see all the excellent work that you have done on the internal structure of your Europa, but they definitely will see the surface finish and paint job quality, and your entire aircraft is likely to be judged on this one aspect alone. Many really well constructed composite aircraft that have been let down by a rushed filling and paint job. When you are standing next to your finished aircraft you want to feel really proud of your work; also a well finished example will always sell for more than a poorly finished one.

So...take your time, the finishing process can be just as satisfying as any other part of your Europa construction: remember at this stage the light is at the end of the tunnel!!!

The modern filling materials which you are using are much improved from the old micro balloons. They are formulated so that they are easy to apply and take about one tenth of the effort to sand smooth. The finishing process provides the final aerodynamic shape and protects the structure from ultra violet damage and weathering.

Sanding is a large part of the finishing process and extreme care must be exercised to avoid damaging the structure. A poorly executed finishing job can destroy the structural integrity of the airframe.

Colour

The finished colour of the composite aircraft can affect its structural strength and longevity.

Epoxy resins and foam are all sensitive to high temperatures. Room temperature curing epoxies soften and lose their strength and rigidity at only moderate temperatures -70°C (160°F). The sun is a source of heat, in still air on a hot sunny day it is possible to obtain surface temperatures that approach 105°C (220°F) on a black aircraft. The colour of the surface determines how much solar heat it will absorb. White surfaces absorb very little (10%) of the sun's heat whilst a black surface absorbing much more (95%) will heat up greatly. The accompanying graph shows the relationship between colour and surface temperatures.

White has been chosen as the only colour for fibreglass sailplanes to preclude any possibility of excess temperature due to solar heating. The same criterion applies to the Europa: white is the only

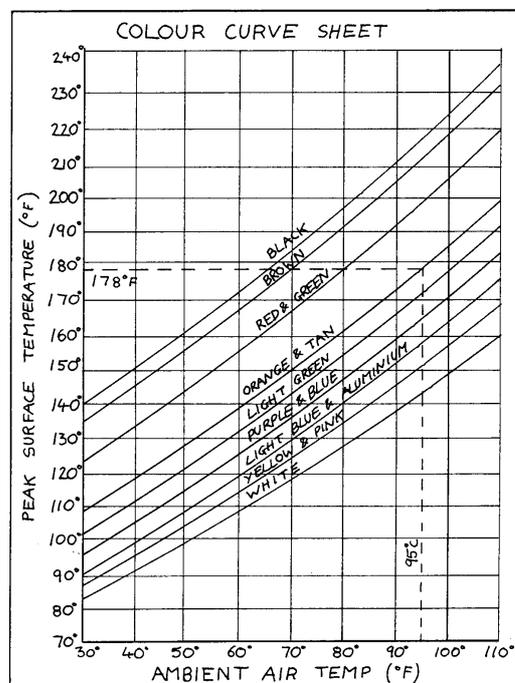


Fig 1. Colour - Temperature relationship.



recommended colour. Trim colours on the undersides, vertical surfaces and non critical areas (wing and fin tips) are permitted. Avoid span-wise stripes on the wings as these may trip the boundary layer destroying the laminar flow and create unwanted drag.

The finishing process can be broken down into three stages:-

1. Contouring
2. Smoothing
3. Painting.

The moulded parts supplied with your Europa kit -fuselage, wings, cowls, spinner etc. are ready to paint, apart from requiring a light sanding to key it with. The fuselage joints will require some local filling and sanding, as will the joints on the wings, but other than that there is very little work required.

The foam filled flying surfaces will obviously require filling before painting. Because we cut the foam cores accurately and you have done a super job of all the layups there will be very little actual contouring to be done. What you are aiming to do is simply fill the weave of the cloth.

Once this has been done, a 2 pack epoxy or polyester primer/surfacer is sprayed on to:-

1. give a uniform finish and
2. protect the lightweight filler material with a hard crust.

Once this has been sanded with a 360 grit production paper then you are ready for paint.

The paint systems we recommend are the two pack acrylic or polyurethane. These systems use an isocyanate to cross link the paint molecules to give a very tough finish and ultra violet protection. Ultra violet protection is required for all composite aircraft.

We strongly recommend, because of the harmful nature of these paints, that you use a proper spray bake paint shop and employ the services of a really good painter.

By doing all the preparation work yourself this should not be an expensive exercise but it will guarantee you a really first class professional paint job.

Over the years people have had several problems with the finish on composite aircraft. This usually manifests itself as poor paint adhesion or blistering. The problem can be traced to painting or filling epoxy systems that have not fully cured or the entrapment of moisture within the system.

The first thing that you need to do with your flying surfaces is post cure them at a temperature between 40-50°C . This will improve their strength and cook off any remaining volatiles and moisture within the epoxy system.

Make a simple oven with foam blocks, timber or sheets and an electric fan heater and cure your flying surfaces for 8-10 hours.

Do take care not to get them too hot and make sure that they are fully supported.

A few years ago a Quickie builder was post curing his canard and misread the temperature instructions, taking the oven to 150°C instead of 150°F. When he opened the oven doors his wing was draped over the saw horses he had used as supports.

Whilst your flaps, ailerons, rudder and tailplanes are curing, make yourself a couple of sanding splines as per figure 2.

Cover one with 80 grit paper and the other with 180 grit paper. The sanding spline is always held parallel to the leading edge of the airfoil and moved diagonally.

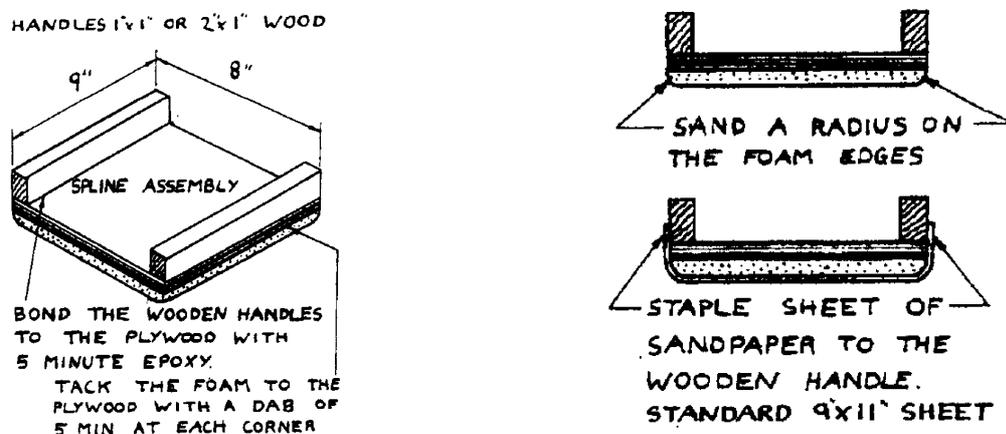


Fig 2. Spline for standard size sandpaper.

Make sure that the surface you are working on is properly supported. Wedges of blue foam are handy for this purpose.

Lightly abrade the surface using 80 grit paper - **DO NOT** use your spline for this but simply fold a sheet of paper into a quarter size. Clean the surface with a cloth moistened (not wet) with M.E.K., acetone or thinners making sure that any oil, grease or silicone based products are kept well out of the way.

The next step is to mix up some dry micro to contour and fill up the weave of the cloth. For this work you will use the final filling micro, which is made from thermoplastic polymer microspheres, not the glass microspheres you have been using in the aircraft construction.

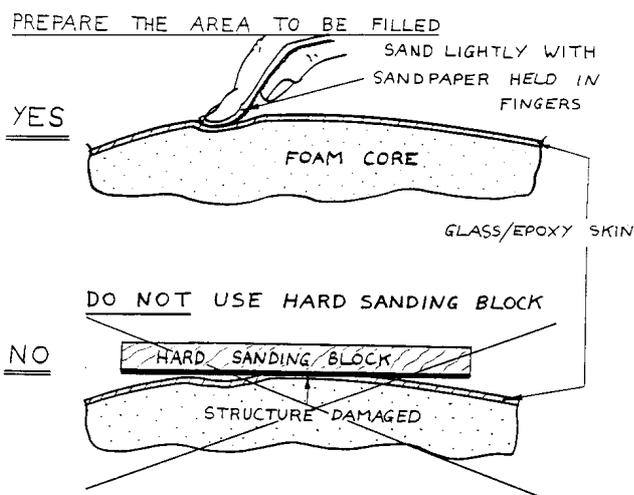


Fig 3. Abrading local low spots before filling.

You will need to experiment with the exact consistency, too dry and it will not adhere to the surface and roll up behind your squeegee, too wet and it will be heavy. The best guide we can give you is to mix in enough micro until it stops running off your mixing stick, with a consistency similar to whipped cream, but experiment for yourself.

You can apply the filler with your squeegee or over the larger surfaces a plastic ruler or something similar. By holding the ruler with both hands you can bend it to the aerodynamic contour. With a little practice you will be able to simply dump a pile of filler onto the surface to be filled and quickly and easily spread it to give an even cover.

Apply it just thick enough so that you cannot see the weave through it. Allow the filler enough time to fully cure before sanding.

Sanding

Extreme care needs to be taken. Remember that the skin is your actual structure, if you sand it away you will not fly too far on a foam aeroplane.

Starting with your 80 grit spline sand the tops off any undulations, once this has been done use your 180 grit spline to sand smooth. Always remember to move your spline with the contours; the last thing you want is a threepenny bit surface - for the youngsters amongst you, that is one with many flat areas instead of the aerofoil shape.

As you sand away the filler you will eventually (or quite quickly if you did not lump it on thickly to start with) see the weave of the cloth appear.

The rule is quite simple -

WHEN YOU HIT THE GLASS SURFACEQUIT SANDING.

Hopefully at this stage 99% of the surface will be nice and smooth and all that will be required is to add a little more filler to the lower unsanded areas.

If you find that you have sanded a panel nice and smooth but cannot see the glass through the filler then keep on sanding because you may have a further inch or two to sand away!!?

Obviously, filler = weight, and the aim is to use as little filler as possible to achieve a smooth surface and contour.

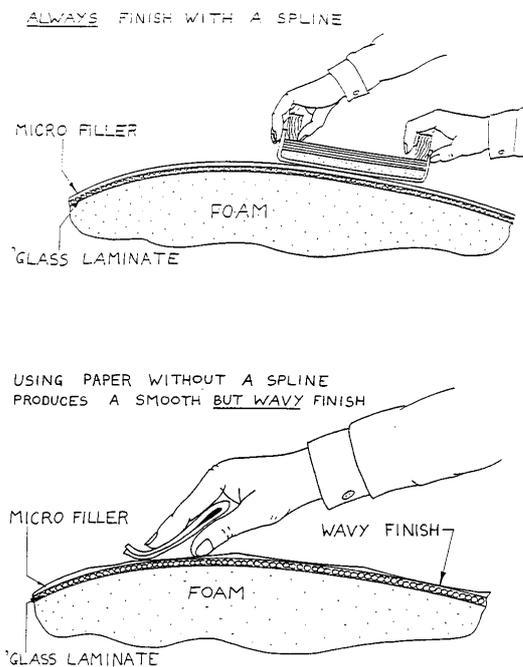


Fig 4. Use a spline, not unsupported sandpaper

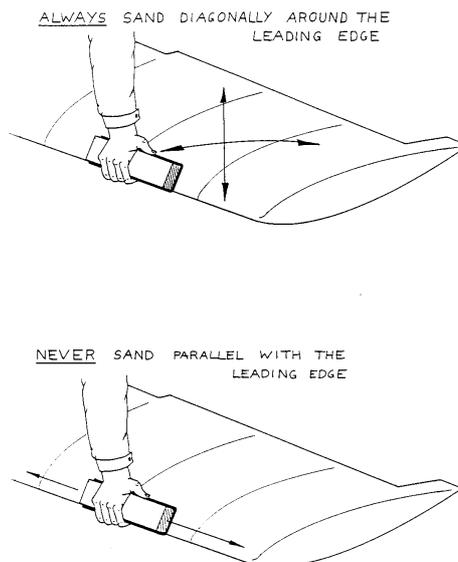


Fig 5. Take special care when sanding leading edges.

Two points are worth mentioning here:-

1. Use your large spline as much as possible because this will level out any undulations in the contouring, whereas using sandpaper free-hand can give you a very smooth, wavy finish.
2. Professional body workers etc. will often spray onto the filler, before sanding, a very thin mist coat of black paint. Once sanded the low areas will remain black, indicating where further filling is necessary.

Take care with the leading edges of your tailplanes to ensure that you do not have any flat areas on them. Always sand around the leading edges, never span wise.

Inspect and fill any pin prick size holes with filler. Always inspect for these holes in the morning, as you will very quickly come to believe, as we do, that they breed overnight!!

Once you are totally happy with your filling from a contouring and smoothness point of view you are ready to take your flying surfaces to the spray bake shop.

Once again, before spraying with a two pack polyester or epoxy based primer/filler, bake everything as before at 40-50°C.

You could, if required, brush on the primer filler but this would then require a bigger sanding job than if it was sprayed.

If you have done a good job of filling then a thin coat is all that is required to bring everything to a uniform colour and give a hard finish or crust to the filling process.

The primer filler will require sanding with a standard small block and 360 grit paper prior to painting.



All your moulded parts, cowls, spinner etc., simply require a very light sanding with 360 grit paper before painting.

Weight build up

The worst thing that you can do to any aircraft is to add unnecessary weight. Flying is fighting gravity, more weight more fight.

The finishing process can make the difference between a super lightweight flying aircraft and a lead sledge.

Use the minimum amount of filler and the minimum amount of paint required to get a first class finish.

There is a lot of area to be filled and painted in an aircraft (unlike a car) and just a few extra grams per square metre will make all the difference to the finished weight.

Painters just love to spray paint and they will quite happily spray on 50 litres if you let them. Most modern paints will give you a really good finish with the application of just one mist or tack coat followed by one full coat.

Finally take your time, be careful, have patience and you will be rewarded with a super finish and a Europa that you can be really proud of.