

PIK-20 Service manual

Item	Part	Weight (lbs)	Arm (ins.)	Moment (lb.-ins./1000)
	Turn and bank indicator Model:			
	Artificial horizon Model:			
	Battery Model:			
	Accelerometer Model:			
	Clock Model:			
	Radio Model:			
	Oxygen Equipment Model:			
	Water Ballast tanks Model:			

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Kisällinkatu 8
SF-15170-Lahti 17

PIK-20 Repair manual

**PIK-20
REPAIR MANUAL**

Approved:

EIRIAVION OY

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FOREWORD

The intention of this repair manual is to give basic advice needed for repairing structural damage to the PIK-20 sailplane made of glass fiber reinforced plastic (GFRP). Basic information about GFRP is not treated in this manual because the repair worker is assumed to have professional knowledge of repairing items of GFRP. Repairing sailplanes is not a proper field for practising GFRP laminating.

Before starting the work, study carefully what kinds of material, supplies, tools and work methods are required. You will find the answers in this manual. To maintain the excellent performance figures of the sailplane the surface quality should be equal to the original one.

If there are doubts about repairing structural damage always contact the manufacturer to find out what can and what cannot be done.

The information given in this booklet applies to minor repairs, such as a hole in the bottom fuselage caused by a landing gear-up, a handling accident in hangar etc.

Major repairs must not be accomplished before contacting the manufacturer or their representative. Typical repairs that must be considered major are:

1. Damage to the wing spar
2. Damage to the wing root rib
3. Damage to the fuselage main bulkheads
4. A hole in the wing trailing edge that damages the rear spar of the wing
5. Damage to vertical stabilizer/fuselage fitting and bulkhead
6. Damage to horizontal stabilizer fitting
7. Damage to control surfaces that includes holes, cracks or other damage that reach 20 % of the chord into the structure
8. Holes, cracks or other damage in the wing that are larger than 15 cm (6 in) in diameter or 25 cm (10 in) in length

Additional information about repairing of laminates is given in FAA Advisory Circular AC 43.13 1A.

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1. REPAIRING IN GENERAL

During rough landings, ground loops or when exceeding permitted load factors during flight the largest calculated state of load might be exceeded. Damage arising in this way can be difficult to observe but it can cause the structure to become weaker so that the sailplane is durable in normal circumstances but not in situations with increased load. After these cases the sailplane must be properly examined because the lamination may be broken. In disintegration of GFRP laminates, part of the fibers break and one part becomes loose from the plastic bond. The lamination becomes partly or thoroughly white and opaque depending on how large the damage is. The structure must be repaired because of its incapacity for load in all situations. Repair the damaged place by laminating the necessary cloths on top of the structure or remove the damaged place and relaminate the whole area.

These kinds of breaks are also sensitive to humidity because water can permeate into the lamination along the fibers and the bond between plastic and fiber becomes weaker making the lamination less durable.

NOTE

After a rough landing or ground loop the area surrounding the main wing pin must be thoroughly examined for possible damage.

When starting the repair the quality of cloth used, the amount and the direction of fibers must all be known. To find this out sand the lamination with sandpaper or burn some plastic from a little piece which has been removed. In this way you can see the cloth directions clearly.

It is important to remember from which place and direction the piece of lamination has been removed. Paragraph 7 in this manual treats the structures used in most important surfaces and also the quality of cloth, amount and direction of laying.

TOOLS

- Accurate balance for preparing the right mixture of resin
- Jars and sticks for mixing
- Brushes for spreading of resin
- Mohair roller for spreading of resin on large area
- Iron roller for damping fibers and eliminating air bubbles
- Scissors for cutting glass fiber cloth
- Tape
- Plastic film for high temperature tent
- Hot air blower (hair drier)
- Sandpapers of different degree of fineness
- Knife
- Hack-saw blades for cutting of reinforced plastic

2. REPAIRING OF REINFORCED PLASTIC LAMINATES

Cases of damage that can be self-repaired are usually one of the following three:

- Broken monocoque structure
- Broken surface of sandwich plate
- Hole in sandwich plate

BROKEN MONOCOQUE STRUCTURE

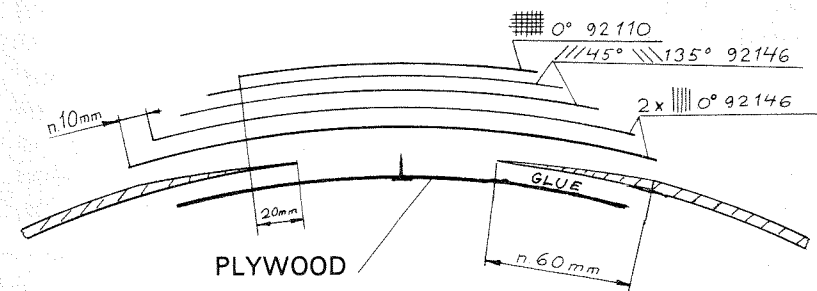


Figure 1

First determine how large the damage is by carefully sanding the surface paint up to where the lamination seems to be unbroken. Then remove the broken area and make a bevel approximately 60 mm at the edges of the opening. Avoid grease. Be sure to clean the area with pure acetone. Laminate each cloth with approximately 10 mm less overlap than the previous one. Laminating this way the last cloth should be 20 mm over the edges. The quality and direction of the cloths must always be the same as in the original lamination. Use an iron roller to eliminate air bubbles: in this way the cloths also become better wetted. During this period use some film (cellophane, or usual plastic film) to cover the area you are patching, and remove the air under the film using a trowel. This way you will get a smoother surface and there is less finishing to do. Remove the film when the resin has hardened. If the hole is big the area should be propped in some way in order to obtain good results when laminating. This can be done for instance by fastening a thin sheet of plywood with glue on the inner side. (See Figure 1). The sheet of plywood can be left there because being glued it will not get loose from the lamination.

If you cannot reach the hole from the inner side, make an oval hole and have a prop which can be layed on place through the oval hole. Before placing the prop set fastening pin or iron wire (See Figure 1). in the prop so that it can be fastened in place during lamination.

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OUTER SURFACE OF SANDWICH PLATE IS BROKEN (Wing, Vertical- and Horizontal control surfaces)

There are three cloths in the sandwich plate and for this purpose make a bevel approximately 40 mm. Remove broken PVC-foam and wash the area with pure acetone. Then fill the hole with mixture of microballoon resin. When the mixture has hardened, sand the area and remove dust and dirt (See Figure 2). Cut the pieces of cloth so that the first goes approximately 40 mm over the edge and the next one always 10 mm less than the previous one. You can now laminate the cloth in place. When the lamination has hardened the manner of proceeding is the same as in paragraph "Broken monocoque structure".

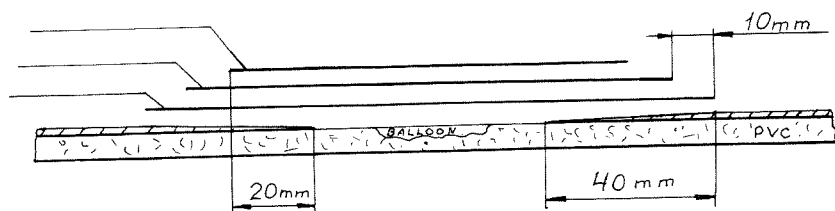


Figure 2

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HOLE IN SANDWICH PLATE (Wing, Vertical- and Horizontal control surfaces)

When there is a hole in the sandwich plate in such an area where laminating from the inner side is impossible, support the area in some way. First make the hole larger so that edges are solid. Remove enough PVC-foam so that a strip approximately 20 mm wide is left around the hole. (See Figure 3). Roughen the strip and make a bevel. After this the manner of proceeding is the same as in the paragraph "Broken monocoque structure". A thin sheet of plywood can be used for supporting. After this you can laminate (45° 92125) on the support and on the inner solid cloth. Let it harden. If the hole is small (100 mm) the manner of proceeding is the same as in the paragraph "Broken outer surface of sandwich plate". When the hole is larger make a PVC-plate to fit the curvature of the hole.

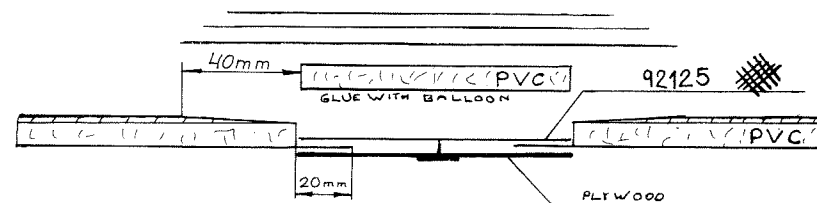


Figure 3

Fill the pores of PVC-foam with microballoon resin and glue it immediately on top of the inner cloth. Put a load on the piece to make it stick better in lamination.

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When the glue has hardened sand the area smooth and make a bevel the same way as in the paragraph "Broken outer surface of sandwich plate". Fill the pores of PVC-plate and laminate the cloths immediately.

When the hole is larger first glue the inner laminate to the PVC-plate. To begin, the manner of proceeding is the same as in the previous case. Fill the pores of the PVC-plate with microballoon resin and fit the plate to suit the hole, then laminate the cloth of inner surface (45° 92125) immediately to PVC-plate. When this has hardened glue a sheet of plywood as a prop and draw a nail or iron wire through the plate and plywood. Then glue the PVC-plate on the area with microballoon resin (see Figure 4). Remember to wash the area with acetone and to roughen it before gluing. Use a load or iron wire to accomplish pressing. Do not use too much load because then the inner laminate can get loose from PVC-plate.

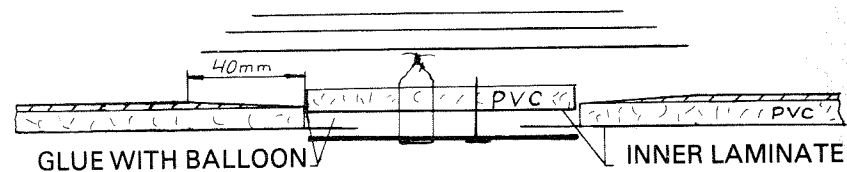


Figure 4

The third way to patch a hole in sandwich plate is to first prepare the patch and bond line together. Remove all broken parts of the hole and leave no inner laminate as edge. Shape the PVC-plate to the hole and glue the previously prepared piece of cloth laminate to the PVC-plate.

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The piece of laminate consists of two cloths (/// 45° 92146 + \\\ 135° 92145) which overlap the edge by approximately 40 mm (See Figure 5). Perform the lamination of the cloth on a table on top of plastic film or 2-3 layers of wax and one layer of PVA. After gluing, cut the pieces of laminate to a suitable size.

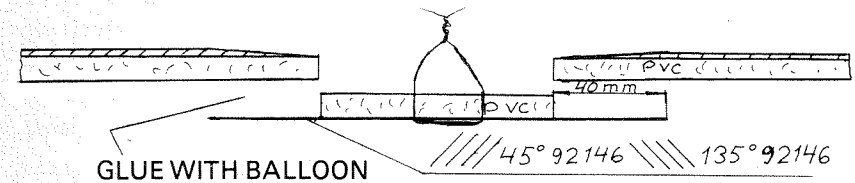


Figure 5

Roughen and wash the bond lines. Then glue the patch with microballoon resin. Make an oval for reaching the hole from the inner side. Use iron wire to accomplish pressing. When the resin has hardened continue the work as usual.

NOTE

Especially when you are gluing "blindly" use microballoon resin so that air is eliminated from the bond line. For this purpose make the bond line approximately 40 mm wide.

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AILERONS

For strenghtening the surfaces in flaps and ailerons the PVC-plate used is 5 mm. Outer surface is of the same kind as the wing but there is no lamination on the inner surface.

Repairs are similar to the repairs of sandwich plate except that the inner surface is not made. The PVC-plate is glued with microballoon resin only at the edge.

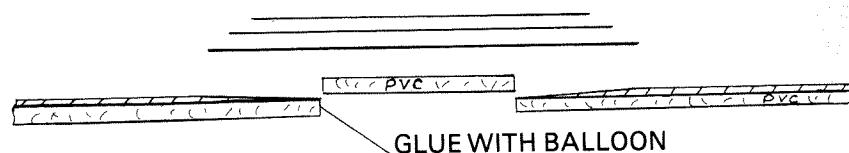


Figure 6

NOTE

When repairing the control surfaces it is important to prevent an increase in the weight. An increase in weight usually causes the center of gravity to shift. This means that the control surfaces should be massbalanced again.

FINISHING

Use sandpaper no. 100 to roughen and start finishing with sandpaper no. 300. Use microballoon resin as filler. It is easy to handle and grind. When repairing the wing use a metal plate to spread the microballoon. This way the solid area supports the work. Use water sandpaper (no. 400 — 600) to sand the filler. Use filler until the weave of the cloth cannot be seen after sanding. Then the surface of the cloth is ready for painting. When the paint has hardened start grinding with wet water sandpaper no. 600 and use grinding pastes afterwards. If you can still see the weave of the cloth another coat of paint is needed. For waxing the sailplane a normal car wax is good enough, not, however, one containing silicone.

NOTE

For painting the exterior surface use only INERTA 70 two-component paint. The hardener is an aliphatic isocyanate, thus the binder is fully resistant to ultra-violet light. Also the pigmentation is fully resistant to light. The following coloration standard measured with a Hunterlab D 25 D colordifference meter may be used:

Color	CIE chromaticity co-ordinates x and y, Luminance factor Y		
TM 101 white	x = 0.336	y = 0.366	Y = 90.8
TM yellow	x = 0.501	y = 0.485	Y = 65.9
TM 292 red	x = 0.627	y = 0.324	Y = 9.9
Green	x = 0.343	y = 0.461	Y = 28.75

3. REPAIRING OF CRACKS IN PLEXIGLASS

Before starting the work, prevent the progression of the crack by stop-drilling (2 mm hole) the ends of the crack. Then open the crack and fill it with acryl glue starting from the bottom of the V. (See Figure 9). Use Tensol no. 7 for gluing. Fill the crack layer by layer and let the layers harden in between to prevent air bubbles because the glue shrinks while hardening. When the crack has been filled and the glue is hard grind the

patch smooth first with fine water sandpaper and afterwards with grinding pastes and liquids so that the bond line becomes transparent. To begin use water sandpaper no. 600 for eliminating scratches and defects of the surface if they are deep. Fasten the paper on a soft grinding tool which has curved edges. Do the grinding by gently rotating with help of the weight of the fingers. After this use grinding paste ("Perspex" Polish no. 1) which is also good for starting to repair very small cracks. Spread the paste with a soft piece of cloth or grinding disc if a grinding

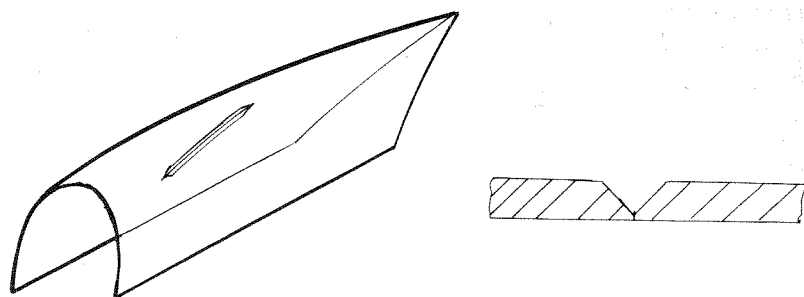


Figure 9

machine is available. Change the cloth every five minutes; the paste must not dry on the cloth. The grinding pressure must be very light. Remove the paste with a clean piece of cotton cloth, after this polish with polishing liquid ("Perspex" Polish no. 2A). Use the same piece of cloth both for spreading and polishing. Take care that the piece of cloth is clean from dust and dirt during the work. Use "Perspex" Polish no. 3 to remove possible static electricity due to grinding and polishing. If necessary use water to make the Polish thinner and spread the Polish on the canopy with a soft, humid cloth. Use a clean, soft and dry cloth for rubbing the canopy shiny. You can also wash the canopy with a solution consisting of 10 % "Perspex" Polish no. 3 and 90 % water. Afterwards dry the canopy with a soft cloth. After washing the static electricity must be removed to avoid dust. Use warm water and soap for washing. The use of organic solutions (as solvents of paint and turpentine) is forbidden.

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4. REPAIRING OF METAL PARTS

The steel parts of the sailplane are made of chrome molybdenum steel SAE 4130.

The steel plate has been in a soft condition and the tube normalized. If you use an inert gas welding system it is necessary to carry out annealing afterwards. This can be done, for instance, by warming the welding line and surrounding it with a gas flame. When you use a normal gas welding system annealing is not needed. The wing fitting parts, landing gear and flaps-airbrakes torque tube are normalized (100 kp/mm²). If these parts are welded they must be renormalized. Paint the repaired area with primer (for instance Herberts Standox Reaktionsgrund). The interior surface of the tubes are protected against rust (Dinitrol ML).

NOTE

Only a qualified welder may weld airplane parts.

The push rods are made of aluminum with rod ends. The rollers of the push rods leads are made of nylon. All the bolts are millimetric high strength bolts. The bolts used in control system are of close tolerance and these are sold by the manufacturer. The fastening bolts are coated with zinc (for instance Bright Zinc F ZB). The fuselage pins and bolts are made of chrome molybdenum steel. If a bushing made of bronze wears it can be changed to a close tolerance bushing (AP 110). The rudder control cables are totally enclosed in a nylon tube.

The cable is 7 x 7 Ø 3/32" MIL-1511 and it is approximately 6,40 m long.

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NOTE

It is necessary to have two fastening bushings (swages) at the cable wire ends and their distance from one another must be approximately 8 mm (1/3 in).

5. INSPECTION OF WATER TANKS

The water tanks of the sailplane are made of plastic strengthened with nylon so they are very strong. It is, however, good to inspect them every year at least. Loosen the tanks by sawing loose the fitting which comes out from main rib and take the tank out from the hole in the main rib. The easiest way of inspecting the tanks is to look for humid areas or chafed places when tanks are filled with water.

In case of leakages, patches for an air mattress or car wheel are suitable. Check durability of the patch before putting the tanks back.

Start installation by fastening a tube fitting (Ø 25 mm GF 21, 96, 04) with a tube tightener to the tank. Then push the tank into wing using a stick approximately 5 m long with a hook which fits the loop of the tank.

Notice during installation:

- no wrinkles allowed in the tank when it is on the bottom of the wing
- the seam towards trailing edge

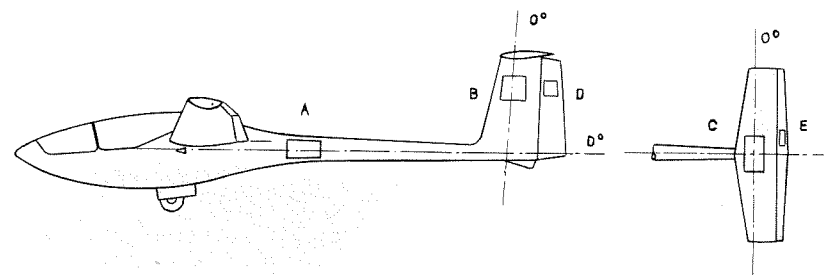
When the tank is inside push the tube fitting into the hole in the main rib and lock the tank by gluing the fitting (Ø 25 GF 21, 64, 01) to the tube fitting.

Parts for water tanks are sold by the manufacturer.

6. OTHER REPAIRS

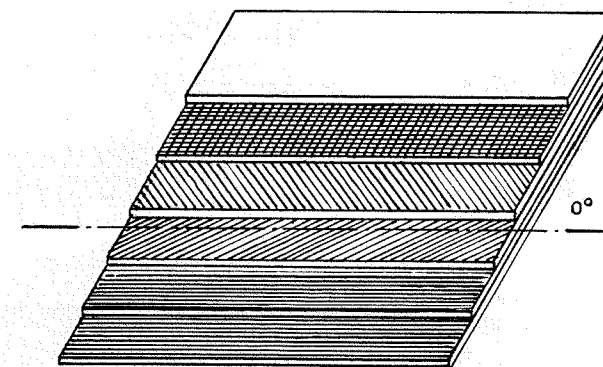
The repairs of instruments, radios and oxygen systems must be performed according to instructions of manufacturers or aviation authorities.

7. GLASS FIBER CLOTHS USED IN DIFFERENT PLACES



A FUSELAGE

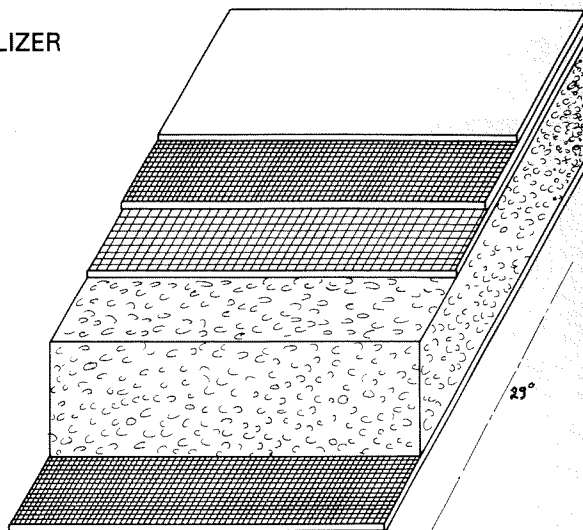
Surface paint	
0°	90070
45°	92146
135°	92146
0°	92146
0°	92146



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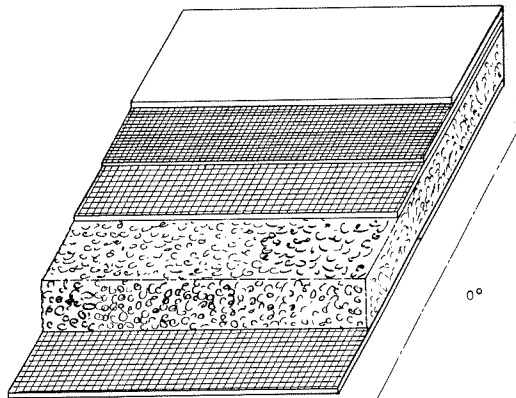
B VERTICAL STABILIZER

Surface paint
90° 92110
90° 92125
10 mm
Hard PVC-foam
Lynizel 4060
0° 92110



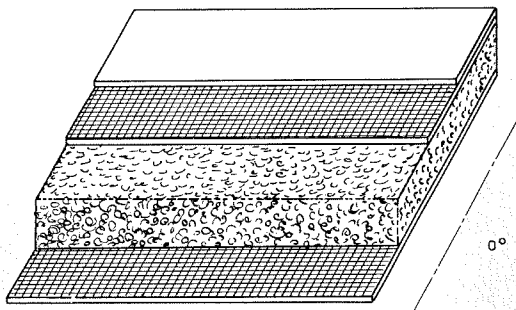
C STABILIZER

Surface paint
0° 90070
0° 92125
5 mm
Hard PVC-foam
Lynizel 4060
0° 92110



D RUDDER

Surface paint
0° 92110
5 mm
PVC-foam
Lynizel 4040
0° 92110



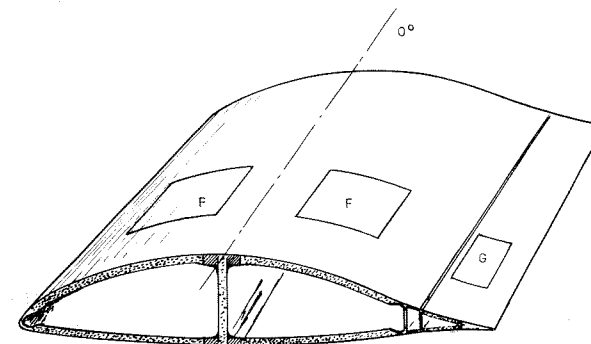
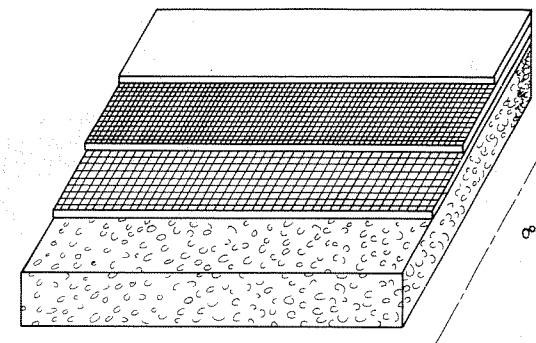
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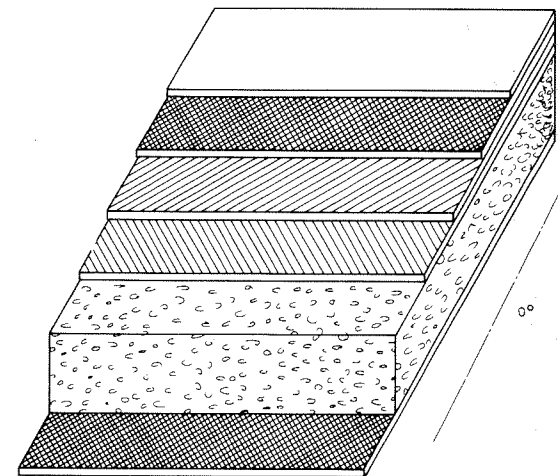
E ELEVATOR

Surface paint
0° 92110
0° 92125
5 mm
PVC-foam
Lynizel 4040



F WING

Surface paint
45° 90070
45° 92145
135° 92145
10 mm
PVC-foam
Lynizel 4060
45° 92110



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G FLAPS-AIRBRAKES AND AILERONS

Surface paint

0° 90070

45° 92145

135° 92145

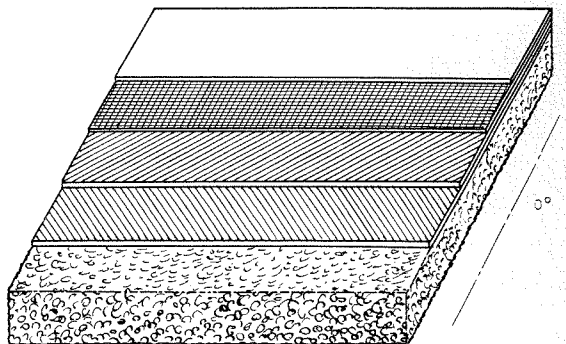
In addition to this
flaps-airbrakes have

0° 92125

5 mm

PVC-foam

Lynizel 4040



8. RAW MATERIAL LIST FOR PLASTIC STRUCTURES

Plastic

Resin

Rütapox L 02

Hardener

Rütapox H 91/SG (91, SG 50, SG)

Mixture

(mass parts):

34 H 91

100 L 02 + 33 SG 50

30 SG

Manufacturer:

Bakelite GmbH

5868 Letmathe

Gennaerstr. 2-4, Federal Republic of Germany

Glass fiber cloths

Manufacturer:

Interglas GmbH, Federal Republic of Germany

Interglas no.

weight g/m²±5%

90070

80

92110

116

92125

280

92140

395

92145

215

92146

440

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Finishing I 550

Rovings

RA 45T 448M 15

Manufacturer: Scandinavian Glasfiber, Sweden

Surface paint

Inerta 70

polyurethane surface paint

T-M shades:

101 white

291 yellow

292 red

Solvent:

9526

Mixture:

2 units by volume resin + 1 unit by volume hardener

Manufacturer:

Teknos Maalit Oy, Finland

Core material of sandwich plates

Hard PVC-foam

Conticell 60 (60 kg/m³)

Manufacturer: Continental Ag, Federal Republic of Germany

or

Lynizel 4060 (60 kg/m³) and 4040 (40 kg/m³)

Manufacturer: Indewek GmbH, Federal Republic of Germany

Fillers

Microballoon: Eccospheres

Manufacturer: Emerson & Cumings, Belgium

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Chopped fibers EC 10-S

Manufacturer: Gevetex Textilglas GmbH, Federal Republic of
Germany

Release agents

Wax QZ 11 3

Manufacturer: CIBA Ag, Switzerland

Polyvinylalcohol PVA Mould Release Agent No. 3

Manufacturer: Downland, England

Protecting ointments for hands

(Suitable for epoxy resins)

Arretil Q (before lamination)

Stokolan (after washing and lamination)

Manufacturer: Stockhausen Krefeld

Acryl plate

Finnacryl; 3 mm thick

Manufacturer: Lohjan Kalkkitechdas Oy, Finland

Repairing material for plexiglass

Acryl glue: "Tensol 7" and hardener

Manufacturer: ICI, England

Grinding and polishing material for acryl

"Perspex Polish No. 1"

" " No. 2A

" " No. 3

Manufacturer: ICI, England

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