

Chapter 51

Standard Practices and Structures - General

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51-00-00

GENERAL

51-00-01

Access Panel Identification

For the Extra 200 all removable covers and fairings are defined as access panels (refer to Figure 1 and the adjacent chart). If maintenance or repair is not restricted to a small area it is advisable to remove all access panels before beginning work or checks.

NOTE

Access panels partly overlap. Remove the front panels first.

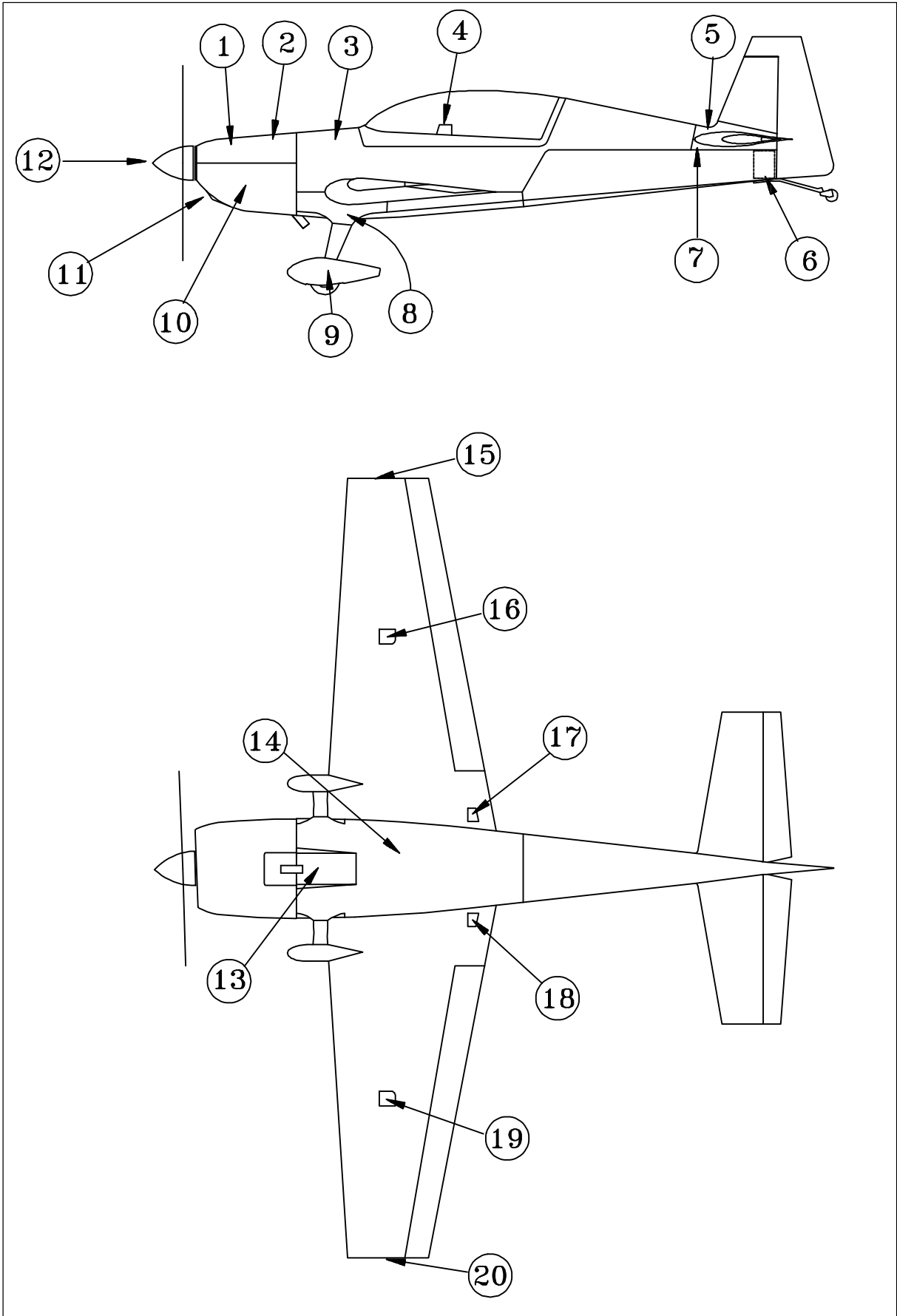
All panels are screwed.

For the removal/installation of the wing tip panels refer to Chapter 57.

Prior to unscrewing of the air inlet screen remove bottom half of the engine cowling not to lose the attachment stopnuts and washers.

Main Fuselage Cover Removal/Installation

- 1 Remove the canopy per Chapter 53.
- 2 Remove the front instrument panel per Chapter 31 (if installed).
- 3 Remove the rear instrument cover per Chapter 31.
- 4 Disconnect the electrical wiring from the single strobe light.
- 5 Remove the rear canopy hinge.
- 6 Remove the center tank filler neck attachment screws.
- 7 Remove engine cowling attachment screws and remove engine cowlings.
- 8 Remove the main fuselage cover attachment screws and remove the main fuselage cover.
- 9 Install in reverse sequence of removal.



Access Panel Identification
Figure 1

Position	Item
1	Top half of the engine cowling
2	Oil filler access door (non-removable)
3	Main fuselage cover
4	Instrument cover
5	Tail fairing
6	Tail cone access panel (RH)
7	Tail side skin (LH/RH)
8	Cuff (LH/RH)
9	Wheel speed fairing (LH/RH)
10	Bottom half of the engine cowling
11	Air inlet screen
12	Spinner
13	Exhaust area covering sheet
14	Bottom fuselage cover
15	LH wing tip panel
16	LH outboard access panel
17	LH inboard access panel
18	RH inboard access panel
19	RH outboard access panel
20	RH wing tip panel

From Ser. No 27 item 13 is attached to item 14 by rivets

51-10-00

INVESTIGATION

51-10-01

Damage Classification

WARNING

All damage of composite parts must first be classified by qualified personnel. In case of doubt with regard to the classification of damage, if a clear definition of the extent of damage is not possible, or if a repair of damage in spite of the valid manufacturer documentation is doubtful, contact EXTRA-FLUGZEUGBAU GmbH.

WARNING

Only the Damages Classes 2, 3 and 4 may be repaired by qualified personnel. In case of Damage Class 1 it has to be contacted EXTRA-FLUGZEUGBAU GmbH.

According to the Luftfahrt-Bundesamt (Federal German Aviation Authority) four damage classes are defined:

Damage Class 1:

Large scale destruction requiring a partial reconstruction of the component or large scale repair. Each destruction over 300 mm diameter and each damage of a spar is a large scale destruction. EXTRA-FLUGZEUGBAU GmbH has to be contacted prior to repair.

Damage Class 2:

Damage to primary structures and to secondary structures to the following extent: Holes and fractures extending through a sandwich component and a scale under 300 mm diameter.

Damage Class 3:

Damage to primary structures and to secondary structures to the following extent: Small holes or fractures in the external covering layers, if not accompanied by damage to supporting layers or internal covering layers.

Damage Class 4:

Erosion, scratches or nicks not accompanied by fractures or breakages. Damage to fairings belong to this class.

51-10-02

Repair Criteria and Limits

IMPORTANT

All damage of composite parts must first be classified prior to repair. Refer to Chapter "51-10-01 Damage Classification".

IMPORTANT

Only the Damages Classes 2, 3 and 4 may be repaired by qualified personnel. In case of Damage Class 1 it has to be contacted EXTRA-FLUGZEUGBAU GmbH.

The decision whether to repair or replace a major unit of structure will be influenced by factors such as time and labor available, and by comparison of labor costs with the price of replacement assemblies. Past experience indicates that replacement, in many cases, is less costly than major repair. Certainly, when the aircraft must be restored to its airworthy condition within limited time, replacement is preferable.

51-30-00

MATERIALS

This Section describes metallic and non-metallic materials used in the repair of the Extra 200 and gives the sources of supply (manufacturers and supplier).

51-30-01

Composite Parts

IMPORTANT

Only approved materials have to be used for the repair of composite parts.

Epoxy-system

Manufacturer: RÜTGERS,BAKELITE
Aktiengesellschaft,Varzinerstr. 49,
D-47138 Duisburg 12, Germany

Resin: Rütapox L20

Hardener: Rütapox SL

Ratio of comp.: 100 parts *L20* / 34 parts *SL* (weight ratio)

Glass fibre fabrics

Manufacturer: INTERGLAS, Interglas AG
Söflinger Straße 246, Postfach 3820,
D-89077 Ulm, Germany

Style	WLB-No.* LN 9169	US-style	weave patterns	weigh g/m ²
90070	8.4505.60	1610	plain	80
92110	8454860	none	twill 2/2	163
92125	8455160	none	twill 2/2	280
92140	8455160	none	twill 2/2	390

*All glass fabric is made of alkali-free E glass with Volan-A finish or with finish I 550.

Carbon fibre fabrics

Manufacturer: CCC, C. Cramer GmbH & Co. KG
 Postfach 209,
 D-48619 Heek-Nienborg, Germany

Style	CCC	WLB-No.* DIN 65147	US-style	weave patterns	weight g/m ²
447		8,3507;80	none	plain	160
452		8,3520;80	none	twill 2/2	204
459		-	none	cross-twil	220

*WLB: Werkstoff Leistungsblatt, according to German standard DIN-WL

Glass rovings:

Manufacturer: GEVETEX Textilglas-GmbH
 Postfach 426,
 D-5100 Aachen, Germany

Supplier: Lange & Ritter GmbH
 Postfach 100321,
 D-7016 Gerlingen, Germany

Type: Vetrotex EC14 - 2400-P185

Carbon rovings:

Manufacturer: Tenax Fibers GmbH & Co. KG
 Kasinostr. 19-21
 D-42103 Wuppertal

Supplier: Tenax Fibers GmbH & Co. KG
 Kasinostr. 19-21
 D-42103 Wuppertal

Type: TENAX JHTA 5131 1600tex f24000 t 0
 (WLB: 8.3614.85)

Core material

a) PVC Foam:

Manufacturer: DIAB
Divincell International GmbH
Max-von-Laue-Straße 7
D-30966 Hemmingen, Germany

Supplier: see above

Type: Divinycell HT 50

b) Honeycomb:

Manufacturer: EUROCOMPOSITES S.A:
B.P.95, Zone Industrielle,
L-6401 Echternach / Luxembourg

Type: ECA-I-R 4.8-29-R

Filler material for resin:

Manufacturer: EBERHARD Chemie GmbH
Olpener Straße 405,
D-51109 Köln 91 (Merheim), Germany

Type: - Cotton flakes
- Microballoons BJO - 0930

Paint:

Manufacturer: GLASURIT GmbH
Max-Winkelmannstr. 80,
D-48165 Münster/Hiltrup, Germany

Supplier: WESSELSAG
Pagenstecherstraße 121,
D-49090 Osnabrück, Germany

Type:

285-100	Glassodur-Rapidfüller AC 85-0100
929-73	Glassodur-MS-Härter SC 29-0173
352-91	Glassodur-Einstellzusatz SV 41-0391

1006-202/3	Glassit Spritzfüller SP 60-7023
948-36	Glassit Härterpaste, rot SB 48-3360
21-	Glassodur-PUR-Acryl-Lack AD/AE 2
929-73	Glassodur-MS-Härter SC 29-0173
352-91	Glassodur-Einstellzusatz SV 41-0391

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Metal Components

IMPORTANT

Only approved materials have to be used for the repair of metal components.

Steel tubing:

Manufacturer: Pacific Tube Company
5710 Smithway Street
Los Angeles, California 90040, USA

Supplier: Wicks Aircraft Supply, Co.
410 Pine Street
Highland, Illinois 62249, USA

Type: AISI 4130 N (MIL-T-6736 Normalized)
2" x 0.049", 1 1/8" x 0.058", 1" x 0.058"
7/8" x 0.058", 7/8" x 0.035",
3/4" x 0.035", 5/8" x 0.035"

Steel sheet metal :

Manufacturer: Cold Metal Products, Inc.
2301 So. Holt Road
Indianapolis, In. 46241, USA

Supplier: Wicks Aircraft Supply, Co.
410 Pine Street
Highland, Illinois 62249, USA

Type: AISI 4130 N (MIL-S-18729 G Normalized)
0.04", 0.063", 0.08", 0.1", 0.125"

Paint:

Manufacturer: GLASURIT GmbH
Max-Winkelmannstr. 80,
D-48165 Münster / Hilstrup, Germany

Supplier: WESSELSAG
Pagenstecherstraße 121,
D-49090 Osnabrück, Germany

Type:

801-1552 Glassofix Grundfüller-EP AC 01-1492

965-32/2 Glassofix Härter-EP SC 65-0322

21- Glassodur-PUR-Acryl-Lack AD/AE 2

1929-73 Glassodur-MS-Härter SC 29-0173

352-91 Glassodur-Einstellzusatz SV 41-0391

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Aluminium Components

Aluminium sheet metal:

Manufacturer: Kaiser Aluminium & Chem. Corp.
Spokane, Washington

Supplier: Westdeutscher Metallhandel
Postfach 104245
45141 Essen

Type: WLB 3.1364. T3511 or 2024 T3
0.6mm; 0.8mm; 1.2mm

Control rod tubings:

Manufacturer: Aluminium AG
CH-5737 Menziken

Supplier: Karstens & Knauer GmbH & Co
D-28865 Lilienthal

Type: WLB 3.1354. T3
ø 25x1mm

Paint:

Manufacturer: GLASURIT GmbH
Max-Winkelmannstr. 80,
D-48165 Münster / Hilstrup, Germany

Supplier: WESSELSAG
Pagenstecherstraße 121,
D-49090 Osnabrück, Germany

Type:

Primer:

283-150 Glassofix-Grundfüller AB83-1150

352-228 Glassofix-Zusatzlösung SC12-0228

Lacquer:

21- Glassodur-PUR-Acryl-Lack AD/AE 2

1929-73 Glassodur-MS-Härter SC 29-0173

352-91 Glassodur-Einstellzusatz SV 41-0391

**Aluminium hardware metal (brackets, pedestals,
castings, etc.):**

Paint:

Manufacturer: Parker & Anchem, Ambler, PA 19002

Supplier: Aircraft Spruce

Chem. coating: Alodine No. 1201 (MIL-C-5541)

Lacquer: see above

51-60-00

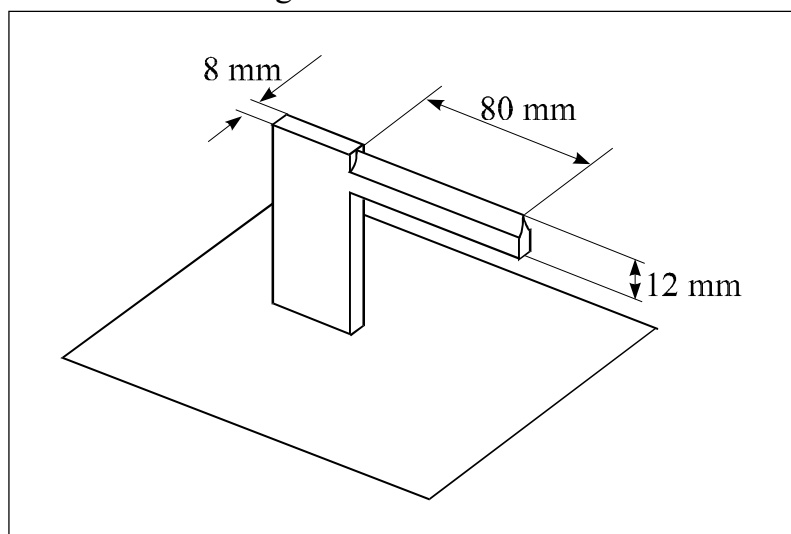
CONTROL SURFACE BALANCING

51-60-01

Weighing and Determination of Control Surface Moments

All weighing of control surfaces is performed with surface removed from aircraft. Weighing and determination of control surfaces moments is necessary after repairs or painting. Weigh the control surfaces including the mass balances in disassembled condition. The aileron weight includes the spade. Copy page 31, enter the values (W, m, r) there and check whether the surface weights or moments are within the given tolerances. If they are not, contact the manufacturer for advice.

For the determination of control surface moments follow the steps as described below and use two balancing mandrels like shown in the Figure 2:



*Balancing Mandrels
Figure 2*

Procedure

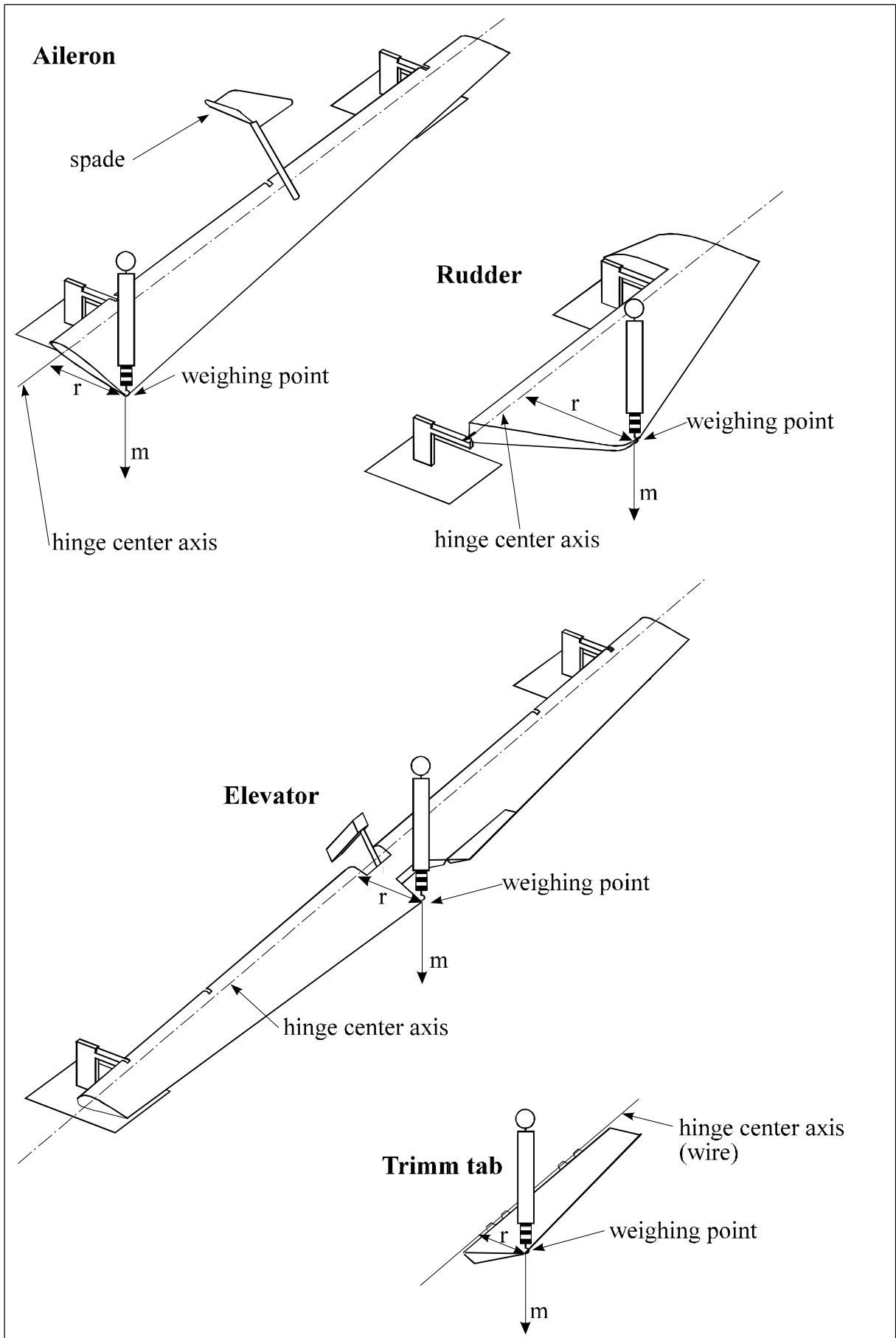
- 1 Remove the control surface (refer to chapter 27).
- 2 Reinstall the bolts in two brackets.

- 3 Put the control surfaces on the balancing mandrels (use a wire for the trim tab).
- 4 Weigh by means of a conventional spring balance (kg/g-indication) at the given weighing points (Figure 3) and enter the weight (m) in Figure 4.
- 5 Measure distance of hinge center line to weighing point (r) and enter the value in Figure 4.
- 6 Calculate the control surface moment (M) in Figure 4.

IMPORTANT

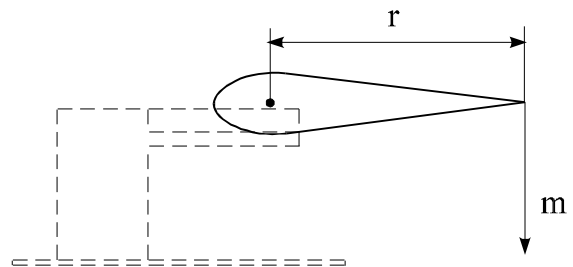
If values exceed the given tolerances in Figure 4 contact the manufacturer before beginning any changes of control surfaces.

- 7 Reinstall the control surfaces.



Determination of Control Surface Moments
Figure 3

EA 200		
Item	Permissible Weight (W) kg from / to	Permissible Moment (M) Ncm from / to
Aileron (incl. mass balance and spade)	5.4 / 6.55	0 / 68
Rudder (incl. mass balance)	4.5 / 6.55	45 / 135
Elevator (incl. mass balance and trim tab)	6.2 / 7.2	140 / 225
Trim tab	0.16 / 0.21	5.0 / 5.6



Weights

- Aileron LH: (W) kg
- Aileron RH: (W) kg
- Rudder: (W) kg
- Elevator: (W) kg
- Trim Tab: (W) kg

$$M \text{ (Ncm)} = m \text{ (kg)} \cdot g \text{ (m/s}^2\text{)} \cdot r \text{ (cm)}$$

Moments

- Aileron LH: (m) kg · 9.81^{m/s²} · (r:) cm = (M:) Ncm
- Aileron RH: (m) kg · 9.81^{m/s²} · (r:) cm = (M:) Ncm
- Rudder: (m) kg · 9.81^{m/s²} · (r:) cm = (M:) Ncm
- Elevator: (m) kg · 9.81^{m/s²} · (r:) cm = (M:) Ncm
- Trim Tab: (m) kg · 9.81^{m/s²} · (r:) cm = (M:) Ncm

*Control Surface Weights and Moments
 Figure 4*

51-70-00

REPAIRS

51-70-01

Repair of Reinforced Glass and Carbon Fibre Components

IMPORTANT

Repair of composite parts has to be carried out only by qualified and authorized personnel.

If the aircraft is damaged, proceed as follows. First conduct a careful visual inspection of the surface and the damaged area. Frequently, the damage extends to further components, sometimes a fracture will continue invisible beneath the surface.

Perform the repair work with utmost care. The external shell of the wing and empennage is stressed; a failure of this bonded structure can lead to an aircraft crash. In order to eliminate dangerous stress concentrations, avoid changes in cross-sectional areas.

IMPORTANT

The resin-hardener mixture ratio must be precisely maintained (+0.5%). Clean cups and tools must be used. The weight ratio of glass fabric to resin mixture should be approximately 50:50.

Immediately prior to applying the wet laminate, sand and vacuum clean the repair area, so that no dirt and dust is involved which could prevent a secure adhesion.

WARNING

Sanding carbon and glass fibre laminates gives off a fine dust that may cause skin and/or respiratory irritation unless suitable skin and respiration protection is used.

WARNING

Carbon-tetracloride or Acetone used for cleaning repair areas are flammable liquids and should be used with proper ventilation and safety equipment.

IMPORTANT

As with plywood grain, the direction of the various fibres (longitudinal or diagonal) is of great importance for the stability.

The number of layers required to restore the stability in the damaged area can be taken from the layer sequence/place-ment plan. (Refer to the respective Chapters)

It is necessary to know the number and direction of layers in the damaged area, in order to be able to replace them with the original number. In all cases, the thickness of the laminate has to be measured with a vernier calliper for the exact determination of the laminate thickness.

One technique to learn about the number of layers is to burn a small piece taken from the damaged area. The resin will burn off, leaving the glass and/or carbon fabric to be in-spected for the number of layers and the type of fabric.

Creating a scarfed overlap takes time. Sand away as much of the old material, that the new fabric patches do not project beyond the contour.

In order to shorten the curing time, a heater can be used to increase the ambient temperature.

CAUTION

Too high temperature will cause large air bubbles in the laminate. Local overtemperature can be prevented by using a foil tent which leads the hot air stream.

The curing cycle must be maintained as stated. Use a thermometer to monitor the temperature.

IMPORTANT

After repair of control surfaces, check for proper bal-ance (refer to chapter 27, Flight Controls).

It is recommended to prepare test specimens at the same time as the actual repair is accomplished. These can then be subject to a material test to establish the quality of the laminate in the repaired part. To make this determination valid, the specimens must be assembled with the same style of fabric and resin mixture. Subsequently the specimens must be subject to the curing pressure, temperature and time identical with those in the actual repair.

51-70-02**Repair of Sandwich Material**

Two types of core materials are used for sandwich on the EXTRA 200:

- PVC hard foam
- Honeycomb

both with glass or carbon fibre shells

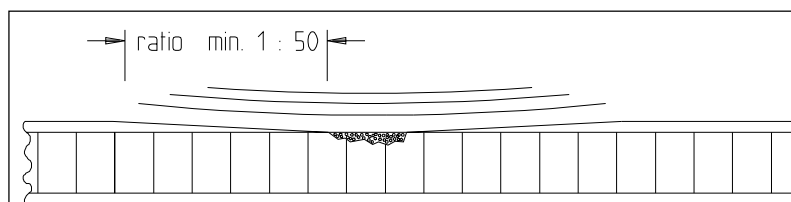
The following section describes the repair of both types of sandwich. Different processing techniques for these materials, if necessary, are also described.

a) Minor surface damage

Around a visible crack, the laminate may be separated from the core material. Determine the extent of this area by coin tapping. Remove the separated laminate carefully using a sanding disk, sanding block or a sharp knife. Prepare a scarfed overlap of the laminate around the damaged area. Overlap length per fabric layer min. 20 mm;

IMPORTANT

Ratio (laminate thickness : overlay length) min. 1: 50 (refer to Figure 5).



*Minor surface damage
Figure 5*

After preparing the scarfed overlap, clean the repair area thoroughly as follows:

- Remove the sanding dust with a pneumatic vacuum cleaner
- Clean the scarfed overlaps with carbon-tetrachloride or acetone in case of dirt or grease was introduced during the preparation.

Damaged core material has to be refilled with a mixture of resin and microballoons (weight ratio 100:15). Apply resin mixture

to the repair area and lay on fabric in accordance to the layer sequence plans. Ensure to use correct style and direction of fabric.

IMPORTANT

Repair area must be clean of dirt, dust and grease!

Lay out the required number and size of fabric pieces on a piece of colored plastic foil and soak (wet) them with resin mixture, subsequently position them on the repair area.

IMPORTANT

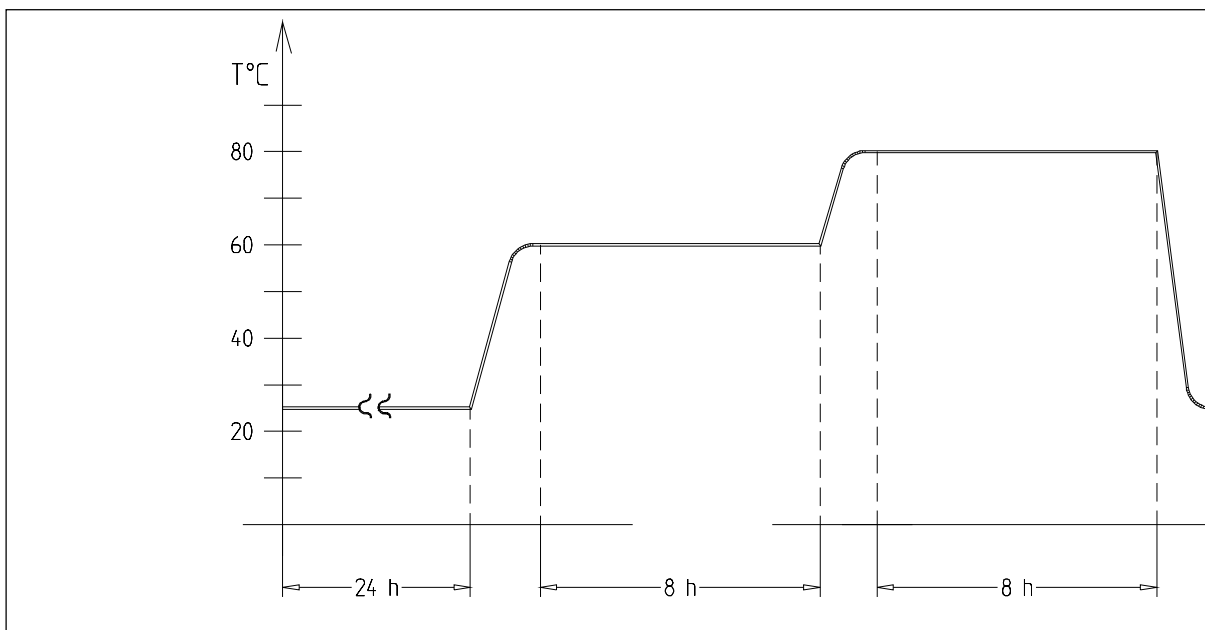
Remove the plastic foil after each positioning process.

For a repair of honeycomb sandwich parts you have to observe the following: The repair area has to be cured under condition of vacuum bagging.

For vacuum bagging, proceed as follows:

- Apply peel nylon fabric on the last repair fabric layer
- Perforate a clean, thin plastic foil with a thick needle (max. spacing of holes: 20mm x 20mm) - mainly in the area of the honeycomb - and lay it on the repair area.
- Lay a jute cloth (weave) or equivalent bleeder cloth on this perforated plastic foil.
- Lay an air tight plastic foil upon the jute weave and seal their edges to the surrounding surface using an adhesive tape.
- Apply suction with a vacuum pump (pressure approx. 0.7 bar/ 10 psi)
- Apply the thermal curing cycle. (Refer to Figure 3)
- Following the curing cycle remove vacuum bagging material and peel nylon fabric.

After the pre-curing period at room temperature, the repaired area has to be cured according the temperature cycle as shown on Figure 6.

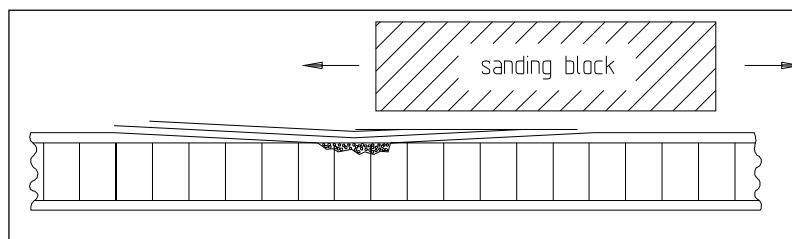


Curing cycle resin L20/SL
Figure 6

After the curing process is completed, the repair area can be sand level to the surrounding area.

CAUTION

Sand only the edge thickness of repair laminate (refer to Figure 7)!



Level Sanding of Surrounding Area
Figure 7

NOTE

For painting of the repair area refer to Chapter 51-70-06.

b) Damage of complete sandwich

If the inner laminate is also damaged, first remove the upper laminate within the area, where no secure bond connection to the core material is suspected. Trim out the complete damaged portion of core material to a circular or elliptical shape.

The damaged area of the inner laminate has to be taken out as well. Make sure not to increase the disbond area by preparing the hole. Preferably use a hand held milling machine. In case of cutting with a saw, the pulsation stress may peel of the inner laminate (secondary damage). If the extent of the disbonded area on the inner laminate exceeds the prepared cut out, increase the cut out of material and upper laminate.

Prepare a scarfed overlap of laminate around the circular cut out. Overlap length of inner laminate should not be less than 20 mm.

IMPORTANT

Overlap length of the upper laminate should not be less than 1/50; (ratio: laminate thickness / overlap length).

Prepare a replacement block of core material (foam or honeycomb) with equivalent diameter and thickness. Cut it to fit snugly in the trimmed hole. In case of foam core, coat one side with a mixture of resin and microballoons (ratio 100:15). Apply pre-laminated fabric layers required for the inner laminate on this side of the core filler block. Ensure correct style and direction of fabric. After precuring the laminate at elevated room temperature (30°C), scarf the overlap and sand the upper overlapping core material down, up to the surrounding core material.

Subsequently clean the repair area thoroughly as follows:

- Remove the sanding dust with a pneumatic vacuum cleaner
- Clean the scarfed overlaps with carbon-tetrachloride or acetone in case of dirt or grease was introduced during the preparation.

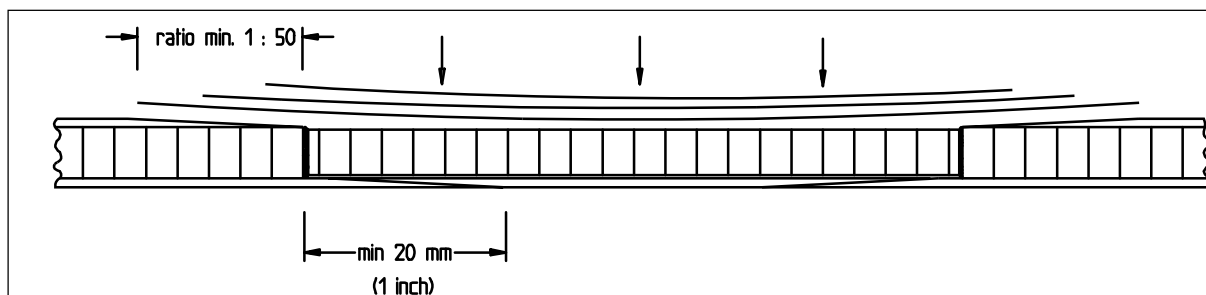
WARNING

Carbon-tetrachloride or Acetone used for cleaning repair areas are flammable liquids and should be used with proper ventilation and safety equipment.

IMPORTANT

Repair area must be free of dirt and grease.

Wet all surfaces of the backing plate and the scarfed area with resin mixture. Lay on pre-laminated fabric layer in accordance to the layer sequence plan. Ensure correct style and direction of fabric.



*Damage of Complete Sandwich
 Figure 8*

Lay out the required number and size of fabric pieces on a piece of plastic foil and wet them with resin mixture. Subsequently position them on the repair area.

IMPORTANT

Remove the plastic foil after each positioning process.

The repair area has to be cured under condition of vacuum bagging. Proceed as follows:

- Apply peel nylon fabric on the last repair fabric layer
- Perforate a clean, thin plastic foil with a thick needle (max. spacing of holes: 20mm x 20mm) - mainly in the area of the honeycomb - and lay it on the repair area.
- Lay a jute cloth or equivalent bleeder cloth on this perforated plastic foil
- Lay a second plastic foil upon the jute weave and seal their edges to the surrounding surface using an adhesive tape.
- Apply suction with a vacuum pump (pressure approx. 0.7bar / 10psi)
- Apply the thermal curing cycle
- Following the curing cycle carefully remove vacuum bagging material and peel nylon fabric.

NOTE

After the pre-curing period at room temperature, the repaired area has to be cured according the temperature cycle as shown on Figure 6.

After the curing process is completed, the repair area can be sand level to the surrounding area.

IMPORTANT

Sand only the edge thickness of repair laminate!

For painting of the repair area proceed like mentioned in Chapter 51-70-06.

51-70-03

Repair of Laminates

a) Minor damage

Scarf the edges of the minor damage area with sandpaper. Minimum length of scarf per fabric layer approx. 20 mm; ratio (**laminat thickness : scarf length**) approx. **1: 50**.

Following the scarf procedure, clean the repair area thoroughly:

- Remove the sanding dust with a pneumatic vacuum cleaner
- Clean the scarfed overlaps with carbon-tetrachloride or acetone in case of dirt or grease was introduced during the preparation.

CAUTION

Repair area must be free of dirt, dust and grease.

Wet the prepared scarfed areas with resin mixture. Lay on pre-laminated fabric layer in accordance to the layer sequence plan. Ensure correct style and direction of fabric. Apply peel nylon fabric on the last repair fabric layer.

NOTE

Lay out the required number and size of fabric pieces on a piece of colored plastic foil and wet them with resin mixture. Subsequently position them on the repair area.

IMPORTANT

Remove the plastic foil after each positioning process.

After the curing process is completed, remove the peel nylon fabric. The repair area can be sand level with the surrounding area.

CAUTION

Sand only the edge thickness of repair laminate!

Refinish the surface according chapter 51-70-05 Painting.

If the extent of the damaged area exceed 10 cm (4 inches) a large damage repair is required.

Carefully trim out the damaged portion to a circular or oval shape.

Pre-laminate a backing plate from two layers of glass fibre fabric and resin mixture, which must be approx. 20 mm larger than the damaged area. Apply peel nylon fabric as external layer. Sandwich the resin wetted layers between two sheets of plastic foil.

Work the excess resin out and allow the plate to cure at elevated room temperature for 8 hours on a flat surface or a plasticfoil-covered surface of the proper curvature near the damaged area, or the same location on a comparable undamaged part.

Following the curing cycle remove plastic foil and peel nylon fabric. Bond the backing plate to the inside using a mixture of resin and cotton flocks, and adapt to the contour. Cure the bonding at elevated room temperature for 8 hours.

Subsequently scarf the edges of the damaged portion with sandpaper. Minimum length of scarf per fabric layer approx. 20 mm;

IMPORTANT

Ratio (laminat thickness : scarf length) approx. 1: 50.

Following the scarf procedure, clean the repair area thoroughly:

- Remove the sanding dust with a pneumatic vacuum cleaner
- Clean the scarfed overlaps with carbon-tetrachloride or acetone in case of dirt or grease was introduced during the preparation of the overlap.

IMPORTANT

Repair area must be free of dirt, dust and grease.

Wet all surfaces of the backing plate and the scarfed area with resin mixture. Lay on pre-laminated fabric layer in accordance to the layer sequence plan. Ensure correct style and direction of fabric.

NOTE

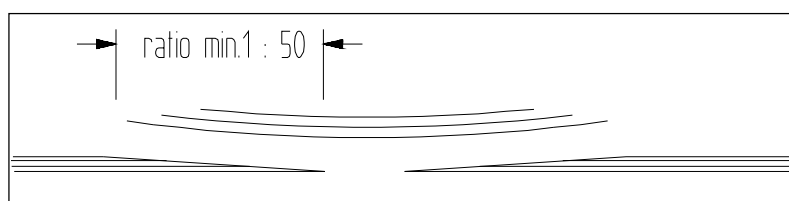
Lay out the required number and size of fabric pieces on a piece of colored plastic foil and wet them with resin mixture. Subsequently position them on the repair area.

IMPORTANT

Remove the plastic foil after each positioning process.

The repair area has to be cured under condition of vacuum bagging. Proceed as follows:

- Apply peel nylon fabric on the last repair fabric layer
- Perforate a clean, thin plastic foil with a thick needle (max. spacing of holes: 20mm x 20mm) - mainly in the area of the honeycomb - and lay it on the repair area.



*Repair of minor damage
Figure 9*

b) Large damage

If the extent of the damaged area exceed 10 cm (4 inches) a large damage repair is required.

Carefully trim out the damaged portion to a circular or oval shape.

Pre-laminate a backing plate from two layers of glass fibre fabric and resin mixture, which must be approx. 20 mm larger than the damaged area. Apply peel nylon fabric as external layer. Sandwich the resin wetted layers between two sheets of plastic foil. Work the excess resin out and allow the plate to cure at elevated room temperature for 8 hours on a flat surface or a plasticfoil-covered surface of the proper curvature near the damaged area, or the same location on a comparable undamaged part.

Following the curing cycle remove plastic foil and peel nylon fabric. Bond the backing plate to the inside using a mixture of resin and cotton flocks, and adapt to the contour. Cure the bonding at elevated room temperature for 8 hours.

Subsequently scarf the edges of the damaged portion with sandpaper. Minimum length of scarf per fabric layer approx. 20 mm;

IMPORTANT

ratio (laminate thickness : scarf length) approx. 1: 50.

Following the scarf procedure, clean the repair area thoroughly:

- Remove the sanding dust with a pneumatic vacuum cleaner
- Clean the scarfed overlaps with carbon-tetrachloride or acetone in case of dirt or grease was introduced during the preparation of the overlap.

IMPORTANT

Repair area must be free of dirt, dust and grease.

Wet all surfaces of the backing plate and the scarfed area with resin mixture. Lay on pre-laminated fabric layer in accordance to the layer sequence plan. Ensure correct style and direction of fabric.

NOTE

Lay out the required number and size of fabric pieces on a piece of colored plastic foil and wet them with resin mixture. Subsequently position them on the repair area.

IMPORTANT

Remove the plastic foil after each positioning process.

The repair area has to be cured under condition of vacuum bagging. Proceed as follows:

- Apply peel nylon fabric on the last repair fabric layer.

- Perforate a clean, thin plastic foil with a coarse needle (max. spacing of holes: 20mm x 20mm) - mainly in the area of the honeycomb - and lay it on to the repair area.
- Lay a jute cloth or equivalent bleeder cloth on this perforated plastic foil.
- Lay an air tight plastic foil upon the jute weave and seal their edges to the surrounding surface using an adhesive tape.
- Apply suction with a vacuum pump (pressure difference approx. 0.7bar / 10psi)
- Curing cycle
- Following the curing cycle carefully remove vacuum bagging material and peel nylon fabric.

After the pre-curing period at room temperature, the repaired area has to be cured according the temperature cycle as shown on *Figure 3*.

After the curing process is completed, the repair area can be sand level to the surrounding area.

CAUTION

Sand only the edge thickness of repair laminate!

Refinish the surface according chapter: 51-10-09 Painting.

51-70-04

Repair of Spars

The spars consists of carbon roving caps, glass or carbon fibre webs and PVC foam cores.

IMPORTANT

The spars are highly stressed; a failure of this bonded structure can result in loss of the aircraft! In all cases, the repair of a spar must be considered as a large-scale repair with a Damage Class 1 (Refer to Chapter 51-10-01 Damage Classification"). EXTRA-FLUGZEUGBAU GmbH has to be contacted prior to repair!

51-70-05

Structural Repair of Steel Components

Restoration of a damaged fuselage to its original design strength, shape and alignment involves careful evaluation of the damage, followed by exacting workmanship in performing the repairs.

IMPORTANT

Should structural repairs practicable on the aircraft be necessary, refer to "Aircraft Inspection and Repair FAA AC 43.13-1A" and "Aircraft Alterations Acceptable Methods, Techniques and Practices FAA AC 43.13-2A".

IMPORTANT

Alterations or repair of the airplane must be accomplished by *licensed* personnel. Consult EXTRA-FLUGZEUGBAU GmbH in case of doubt about a repair not specifically mentioned there.

NOTE

If welding work must be performed, use only the TIG procedure (Tungsten Inert Gas). Use steel welding wire 1.7324, 1.7734.2, or equivalent for welding additive.

51-70-06

Painting of Composite Parts

WARNING

Coating materials may cause sensitization by inhalation and skin contact. Hardeners and coating materials ready for use can have an irritant and sensitizing effect upon the skin and respiratory tracts and cause allergic reactions.

WARNING

Provide for a continuous supply of fresh air during and also after the application, do not inhale the vapours and wear a breathing mask during the spray application of these materials. Persons suffering from an allergy or being prone to diseases of the respiratory tracts must not get in contact with coating materials.

Refer to the manufacturer technical information sheet!!

After curing cycle the surface of repaired area can be sanded with sandpaper (80 grade). Indentations are filled with white polyester filler. Subsequently achieve a surface as uniformly rough as possible using a finer dry sandpaper (150 or 320 grade). Prior to paint application, the surface of the repair area must be cleaned thoroughly of all sanding dust, separation compounds and other foreign materials. Subsequently apply Glassodur Rapid Filler with a spray gun.

NOTE

The Rapid Filler must be completely dry before the covering paint can be applied.

For the final sanding, use 400 grade wet sandpaper to achieve a smooth clean surface. Allow surface to dry. Paint application of Glassodur-Pur-Acryl-Lack AD/AE 21 two component acryl paint is performed with a spray gun.

Paint can be mixed with small quantities of reducer. After completion of the painting, polish the repair area.

51-70-07

Aluminium and Steel Components Refinishing

Complete procedure necessary to remove existing paint from aluminium and steel components and then to repaint them as described in the following paragraphs.

Degreasing

WARNING

Cleaning solvents can be toxic and volatile. Use only in well ventilated areas. Avoid physical contact with solvent and do not inhale vapors. Keep solvent containers covered when not in use.

CAUTION

Before stripping parts, remove all fittings, O-rings, nuts, bolts, washers, pistons, bearing cups, etc.

- 1 Clean all metal parts by immersing in a clean degreasing solution. An alkaline based solution is recommended for aluminium and magnesium parts.
- 2 Hardened dirt or grease may be removed with soft bristle brush, or by soaking in cleaning solution.
- 3 Where necessary clean bearing cones carefully in a separate container of clean solvent.

CAUTION

Do not spin bearing cones with compressed air.

- 4 After cleaning, thoroughly dry all metal parts with filtered, dry compressed air.
- 5 It is recommended that all O-rings, backup rings, and wipers be replaced at each overhaul. However, if necessary, O-rings may be reused, but should be put back into position from which removed.
- 6 Wipe down O-rings, backup rings, wipers, or other rubber parts with a clean dry cloth. Lubricate with a suitable O-ring lubricant prior to installation.

Paint Removal

Disassemble components to the level required for repainting, then proceed as follows.

WARNING

Stripping solvents can be toxic and volatile. Use only in well ventilated areas. Avoid physical contact with solvent and do not inhale vapors. Keep solvent containers covered when not in use.

CAUTION

Before stripping parts, remove all fittings, O-rings, nuts, bolts, washers, pistons, bearing cups, etc. Parts must be totally immersed in solvent, to maximize cleaning.

- 1 Degrease part per degreasing paragraph.
- 2 Totally immerse part in paint removing solvent. Portions not totally covered by solvent will begin to corrode.

NOTE

Stripping agents are commercially available for removing topcoat and primer. Follow manufacturer's recommendations for use and disposal of stripping solutions.

- 3 Remove part from solvent and rinse thoroughly with water heated to 160° to 180°F (71° to 82° C). Flush solvent from all cavities and threaded holes where entrapment might occur
- 4 Thoroughly dry part with filtered, dry compressed air.
- 5 Where applicable refer to inspections procedures given in the respective chapters for specific parts to locate possible defects.

NOTE

Refinishing should be completed as soon as possible; unprotected parts will begin to corrode.

Repainting

Paint all surfaces except those which are subjected to friction (bearing surfaces, anchor bolt bores, etc.). Proceed as follows:

- 1 Parts to be repainted should be cleaned and stripped per instruction in degreasing and paint removal paragraphs.
- 2 Aluminium parts should have a protective barrier between the topcoat and base metal. It is recommended they be treated with solutions listed in Chapter 51-30.
- 3 Apply solution liberally and evenly. Allow it to set from 1 to 5 minutes. The solution must completely wet the surface and overlap onto the adjoining anodize.
- 4 Remove excess coating by flushing with clean water.
- 5 Paint parts with one coat of wash primer. Allow to dry thoroughly.
- 6 Paint parts with one coat of lacquer listed in Chapter 51-30. Allow to dry thoroughly before reassembly.