PRZEDSIEBIORSTWO DOSWIADCZALNO-PRODUKCYJNE SZYBOWNICTWA

"PZL BIELSKO"

BIELSKO - BIAŁA

SAILPLANE: SZD - 48 "JANTAR STANDARD 2"

TECHNICAL DESCRIPTION

TECHNICAL SERVICE MANUAL WITH THE SCHEDULE OF MAINTENANCE WORKS

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CONTENTS:

LIST OF INTRODUCED CHANGES

NOTE: The place where the text has been changed is marked with the vertical line on the left side of the text and with the number of the change

Item	Page	Change	Date	Signature
1	-	On the page of "Contents" the page No-1A- has been added — Acc. to Bulletin of Changes Nr. BK-01/78	29.09.78	/ - /
	-	The pages 1B and 1C have been added		
	Fig 1	Change of rudder deflection		
	Fig 5	Rudder deflection has been changed — SZD-48		

Item	Page	Change	Date	Signature

1. TECHNICAL DATA

WING

Span	15 m
Wing area	10,66 m^2
Aspect ratio	21,1
Dihedral	1,5°
Root chord	0,95 m/theoretical,
Tip chord	0,45 m
Mean standard chord	0,742 m
Aileron span	2,4 m
Aileron area	0,266 m^2
Area of the air brake plate /one plate/	0,11 m^2

HORIZONTAL TAILPLANE

Span	2,43 m
Area	1,26 m^2
Elevator area	0,38 m^2
Angle between the wing and tailplane chord	3,5°

VERTICAL TAILPLANE

Height	1,26 m
Area	1,03 m^2
Rudder area	0,47 m^2

FUSELAGE

Length	6,71
Width	0,6 m
Height	1,51 m

MASSES

Empty sailplane with the equipment necessary for the flight	261 ± 4 kg
Useful load	120 kg
Max. all-up mass without ballast	385 kg
Max. all-up mass with ballast	535 kg
Max. wing loading	50,2 kG/m^2
Min. wing loading	29,3 kG/m^2
Wing	140 ± 4 kg
Fuselage with tail-unit	121 ± 4,5 kg

Sailplane layout with the general dimensions and control deflections is shown on Fig. 1

2. DESCRIPTION OF SAILPLANE

SZD-48 "JANTAR STANDARD 2" is the high-performance competition one seater of the standard class. All the sets are of the glass-fibre reinforced epoxy resin. For the sandwich core it had been used the hard foam of PCV.

The two-part wing of the trapez outline uses the aerofoil NN-8 The box spar uses the glass roving. The sandwich covering of glass-fibre /foam/ glass-fibre has the thickness of 8 mm. The aileron on 20 per cent chord is suspended on 5 hinges and actuated in one point. The airbrake in the form of extended dural sheet has the cap moulding to the wing outline.

The fuselage and fin are of glass-fibre. In the tube part of the fuselage there are semiframes to support the shell. The fuselage central part comprises a steel framework to which there are fixed the wings and retracted undercarriage with the wheel of 350 mm diameter having the tyre and tube as the shock absorbing elements. The pilot's cockpit has the fixed windshield and removable canopy fixed with the two locks.

The "T"-tail unit is of the trapez outline, horizontal tailplane has the 30 per cent chord elevator suspended on 5 hinges .

The rudder is completely mass balanced. The tail structure is of sandwich form. The aerial of semiwave dipol type is fixed inside the fin with the cable end conducted to the instrument panel.

The second hook for winch launching provided on the special order.

TECHNICAL SERVICE MANUAL

1. ASSEMBLING AND DISASSEMBLING OF THE SETS

Assembling of the wing and tailplane can be performed by 4 persons. Providing that the suitable supports under wing tips and fuselage nose are in disposition 3 persons are sufficient.

Before the assembling of all the sets it is necessary to clean and grease all the working surfaces of the elements.

WING ASSEMBLING /Fig. 2/

- Put the airbrake hand grip in the cockpit into its front position
- Retract the air brake plates inside the wings.
- Insert the roots of the spars 1 into the fuselage. During the inserting the pins 2 protruding of the framework and the spar pins 3 should meet the proper ball nests 4 on the wing ribs.
- Using the assembling lever 5 hitch it into the feet 6 on the spars and fit in the wings to the fuselage.
- Join the wings with the bolt 7 and secure with the pin inserted to the hole 8 and lock the safety pin 9.
- Connect the aileron control circuit push-rods with the The control circuit connected automatically during the insertion of the wings.
- The water ballast installation is connected automatically when fitting the wing.
- Disassembling in the inverted sequence

HORIZONTAL TAILPLANE ASSEMBLING /Fig. 3/

The spring trimming lever in the cockpit shall be put into the"nose heavy" position.

- Put the tailplane 1 on the fin 2 joining in the same time the push-rod end 3 with the elevator lever 4. Join when the tailplane

is slightly elevated over the fin and with the elevator deflected up.

- Fix the fittings with the bolt 5 inserting it through the hole on the leading edge of the fin. The red lines on the bolt extending end and the stabilizer nose making one straight line ensure the correct securing of the bolt, as well as the characteristic hang of the spring sinking into the slot of the bolt.
- Disassembling requires the inverted sequence. Rotating the bolt on 90° / the red lines on the bolt and tailplane nose become perpendicular/ dissecures the bolt.

DISASSEMBLING AND ASSEMBLING OF RUDDER

- Disassemble the horizontal tailplane
- Pull both the pedals back and secure in this position
- Screw off the inspection hole located on the starboard lower part of the fin.
- Disconnect the ends of the rudder cables through this inspection hole / Secure against sinking in the fuselage/
- Disconnect the elevator push-rod out of the lever and take it out axially up.
- Remove the securing pin from the lower hinge of the rudder
- Take off the rudder from the hinges sliding it axially up.
- Assembling of the rudder requires the inverted sequence.

DISASSEMBLING AND ASSEMBLING OF ELEVATOR

- Disassemble the horizontal tailplane
- Disconnect both the elevator halfs removing both the screws on the elevator lever.

- Remove the elevator halfs off the hinges sliding them axially outwards
- Assemble in the inverted sequence

DISASSEMBLING AND ASSEMBLING OF AILERON /Fig. 4/

- Screw out the stopper on the lower wing surface near the outer end of the aileron.
- Remove the aileron /deflected down/ out of the hinges sliding it axially towards the wing tip.
- Remove the aileron out of the wing together with the lever 3 sliding it into direction shown with the hint.
- Remove the screw 5
- Remove the pin 4 out of the nest 2
- Remove the lever 3 out of the aileron
- Assemble the aileron in the inverted sequence

NOTE: Before fixing the aileron on the hinges the lever 3 shall be inserted into the sleeve 6.

2. CONTROL CIRCUITS OF THE CONTROLS AND DEVICES AND THEIR ADJUSTMENT /Fig. 5, 6, 7, 8/

The control circuits of: rudder, towing,hook, adjustment of pedals and wheel brake are of cable type. All the other control circuits are push-rod type.

The control circuits and devices can be accessed:

- after removing the instrument panel and its base,
- after removing the cockpit floor
- after removing the top fuselage inspection hole
- after opening the inspection hole in the fin.

The adjustment is to be performed in case of presence of the excessive deviations in the deflections or in the case of incorrect position of the devices. The control deflections are given on Fig. 1. On the figures 5, 6, 7, 8 the push-rod ends the barrels and screw intended for adjusting are marked with the hint and letter "R". There is also given the neutrum position of the levers. Adjusting the cable barrels take care to have the thread invisible outside of the barrels. Adjusting the ends of the push-rods check that the thread closes the inspection slots of the tube. The adjusted element shall be secured again.

- The rudder deflections are adjusted either by means of the screw stops on pedals or cable barrels. The clearance between the additional rudder deflection stop /to right or left/ and hinge is max. 1 mm - detail "A", Fig. 5.
- The elevator deflections are adjusted either by means of the screw stops on the control column or push-rod-ends
- The aileron deflections are adjusted by means of the variable washer amount under the head of the control column fitting screw /stick to right/ or replacement of the polyamid sleeves /stick to left/ or the push-rod ends
- The front hook control circuit needs no adjustment
  In case the front and bottom hook are installed, the adjustment is obtained by means of the threaded bowden's end /idling -Fig 5,6/
- The undercarriage control circuit is adjusted by means of the push-rod end.
- In the airbrake control circuit only the plate caps are adjusted By rotating of the nuts the tension of the spring pressing the caps into the plates is changed. For the airbrake extended the springs should have a tension /to provide the pressing force

of the cap in station of spring/ of value:

1,0 kG for the lower caps

1,5 kG for the upper caps

The wheel brake control circuit is adjusted by means of:

- threaded bowdens end

  NOTE: The adjusted cable shall not cause the initial deflection of the lever on wheel in respect to the basic position

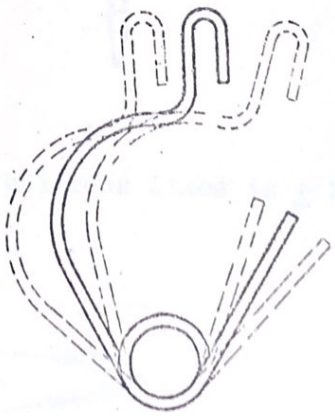
- adjusting screw 1 on the right side of the brake disc after releasing of the locking 2 - detail "A" of Fig. 8

  NOTE: The axial play causes the change of brake lever movement angle on the wheel

- The adjustment of the spring trimmer depends on:
  - bending off or on the trimming spring

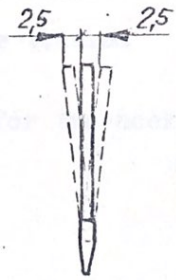
    The properly formed spring sinked in the 3rd slot /counted from front/ should maintain the elevator in neutral position.

    Check by intermediation of friction force, which should be of about 0,3 kG



Allowable stick play for elevator fixed is ± 3 mm measured acc. to the sketch

Allowable elevator play for stick fixed in neutrum is ± 2,5 mm measured on the trailing edge of elevator acc. to the sketch



Allowable stick play for ailerons fixed is ± 2,5 mm measured acc. to the sketch

Allowable aileron play for stick fixed in neutrum is ± 3 mm measured on the trailing edge of the aileron acc. to the sketch.

If on the cables it has been found the corrosion or break of one of the wire the cable shall be replaced by the new one. The way of the replacement is described in the Repair Manual.
Allowable friction forces in the control circuits /measured on the middle point of the hand grips in the neutral position /are:

1,0 kG	aileron control ciruit
0,25-0,35 kG	elevator control circuit/without action of the trimming spring/
2,5 kG	rudder control circuit /measured on the upper footplate /
8,0 kG	air brake control circuit

The allowable towing-hook control forces are:
- in case one towing hook is installed
  9 kG - without towing cable tension
  12 kG - with towing cable tension
- in case two hooks are installed
  6 kG - without towing cable tension
  9 kG - with towing cable tension

NOTE: The lower forces for two-hooks depends on the greater gearing

3. UNDERCARRIAGE /Fig. 7/

The main whell is suspended on the front /Fig. 6 for the version with towing hook and Fig. 8 for the version without towing hook/ and rear arm. For the retracting the rear arm is folded.
In the extended position the dead point on the rear arm is fixed by blocking of the cockpit push-rod. The undercarriage housing is closed with the covers loaded by means of the rubber cables or spring. The wheel tube pressure is of 2,0 at. what gives the

tyre deflection of 2 cm for the empty sailplane without the ballast. The wheel hub consisted of two parts is equipped with the disc brake. The tube valve is accesible through the plugged hole on the brake disc at the right side of the fuselage. The rear wheel pressure is of 1,5 at.

DISASEMBLING OF THE WHEEL TYRE AND TUBE /Fig. 8/

- Remove the nuts and take off 2 screws connecting the wheel axle with the undercarriage arm,
- Disconnect the brake control circuit, loose the spring loading the wheel brake lever
- Remove the axle and put off the nave from the arm.
- Take off the brake disc of the hub
- Take off the nuts and 3 screws joining the both halfs of the nave remove the tyre and tube.
- Assembling of the wheel requires the inverted sequence

NOTE: - Before assembling two hub parts with the tyre and tube, fill the tube slightly with the air
- the brake disc with the axial play adjusting screw, should be assembled into the hube this side, where the tube valve end is located
- item 3, Fig. 8 - tube valve cover.

4. INSTRUMENT PANEL /Fig. 8/

The sailplane, as a standard, is equipped with the instruments of PZL production:

1 - Airspeed indicator PR-250 s seria B or PR-400S
2 - Altimeter W-10S or W-12S
3 - Variometer WRs-5D with the compensator KWEC
4 - Variometer PR-03
5 - Compass BS-1 or KI-13
6 - Slip and turn indicator EZS-3

Moreover the sailplane is adopted for the incorporation of additional equipment:

- Electric variometer with the computing set,
- Artificial horizon,
- Glider transceiver
- Oxygen equipment
- Fitting for the photo-camera

The instrument panel is fixed to its base by means of the screw on the front wall in the axis of symmentry. Disassembling depends on the removing of the screw and pulling the panel "back". This enables the acces to all the instruments.

Location of the adopters:
- Two static pressure adopters 7 in the front fuselage part
- Total pressure adopter 8 in the upper part of the fin leading edge with the drainage unit 10 on bottom between the fin and rudder /accesible throug the inspection hole/.

- The nest 9 adopted for fixing the additional total pressure adopter of 6 - 7 mm diameter on the upper part of the fin leading edge under the total pressure adopter with the drainage unit near the one for total pressure adopter.

The ends of the ducts of the above adopters are conducted to the instrument panel and have the following colour designations:

- from static pressure adopter - red
- from total pressure adopter - green
- from additional pressure adopter - yellow

Before fixing the additional adopter on its position in the lower nest it should be slightly greased with the vaseline.
After the flight in clouds, rain, or when it is suspected that the ducts got water it is necessary to disconnect the ducts and remove the water by means of blowing air.

5. WATER BALLAST /Fig. 10/

The water ballast tanks are in the wings. The water jettisoning and ventilating ducts go from the tanks through the ribs. The water jettisoning ducts are connected with the valve behind the undercarriage housing. The ventilating ducts 8 are connected with the orifices in the lower covering near the wing root. The valve is operated by means of the tension member having the hand grip ball on the port board of the cockpit. The water is jettisoned behing the undercarriage housing.

FILLING OF THE TANKS

- Check the connection of the ducts 1 with the jettisoning ends 2
- Open the valve 4 /move the ball 5 "back"/
- Insert the elastic end of the duct 6 /through which the tanks will be filled/ into the jettisoning opening behind the under-

carriage housing

- Fill in the tanks with the clear water using the containers located higher then the wing or using the funnel 7. Do not fill connecting immediately the duct 6 with the water supply tap because the water pressure may tear the tanks.
- During filling put the wings level*. The steady water stream from the ventilating opening shows that the tanks are full. Then close up the valve and remove the duct from the jettisoning opening

Do not put the sailplane into the hangar with the full tanks.

CHECKING OF THE TANK TIGHTNESS

- Plug the ventilating opening
- Check the tank tightness through the jettisoning tube protruding out of the wing
- The checking depends on producing the vacuum or overpressure
- When checking by means of altimeter the required height should be of about 600 m.
- When checking the overpressure by means of water, the water height, measured from the upper wing covering should be of about 700 mm
- The tank is accepted as tight when within the 15 minuts time period no pressure decrement occurs.

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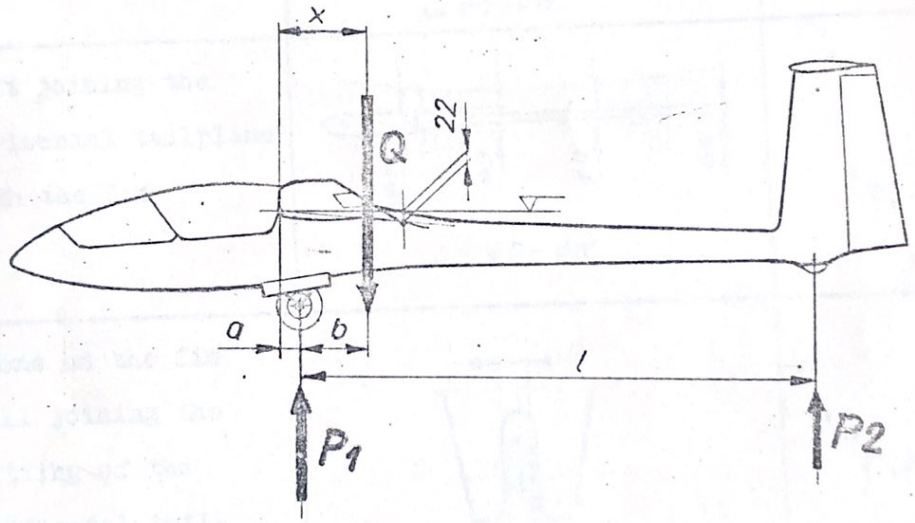
* On supports or slightly banded up

6. WEIGHING OF THE SAILPLANE

The sailplane should be weighted on two balances with the accuracy of ± 0,2 kG. The supports are to be located under the main and tail wheels. The height difference of the supports shall ensure such the root chord position that the trailing edge is 22 mm lower than the leading edge /Fig. 1/

The distance between the wing root chord leading edge and the c.g. location of empty sailplane with the equipment necessary for flight is:

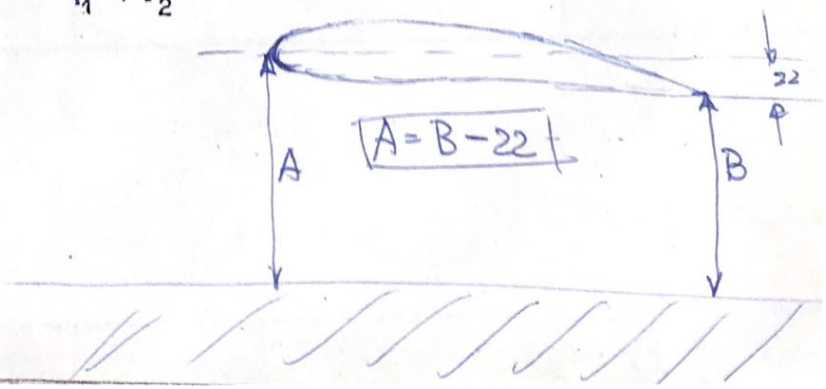
53 ± 2 cm



$$x = 53{,}0 \pm 2 \text{ cm}$$

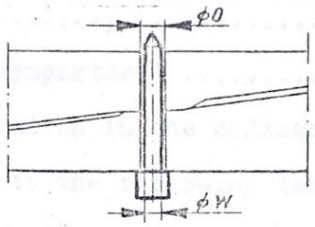
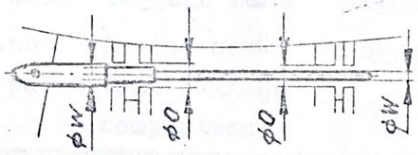
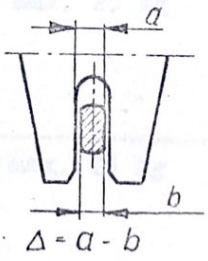
$$x = a + b$$

$$b = \frac{P_2 \; l}{P_1 + P_2}$$



7. ALLOWABLE PLAYS

During the service there can appear the excessive plays on the following joints: / if found greater than listed in the table it is necessary to follow the directions of "Repair Manual"/

JOINT	SKETCH	ALLOWABLE PLAY
Bolt joining both the spars		0,100 mm
Bolt joining the horizontal tailplane with the fin		0,100mm
Stone on the fin wall joining the fitting of the horizontal tail-plane		0,300 mm
Slide and ball bearing of the control column		0,100 mm

8. ADDITIONAL EQUIPMENT AND LUGGAGE /Fig. 11/

There can be installed on the sailplane the additional equipment /instruments, oxygen equipment, transceiver etc/ and the luggage of the total mass together with the pilot and the parachute no greater than 120 kg.

A. In the cockpit near pilot's c.g. ..... 55-110 kg

B. In the instrument panel .....max 4 kg

C. In the central luggage compartment near the spar ends ..... max. 25 kg

D. In the rear luggage compartment ..... max. 10 kg

To preserve the c.g. location in the defined limits these masses shall be displaced acc. to the following table:

Luggage mass in the pilot's cockpit	Luggage mass in the instrument panel	Luggage mass in the central luggage compartment	Luggage mass in the rear luggage compartment
55kg-70kg*	max. 4 kg	max. 25 kg	prohibited
*The cockpit load of 55-60 kg mass for the back-rest positions 1-3			
70kg-85kg	max. 4 kg	max. 25 kg	max. 4 kg For each 1 kg load in the rear luggage compartment put 1 kg load in the instrument panel
85kg-95 kg	max. 4 kg	max. 25 kg	max. 10 kg. For each 1 kg of load in the rear luggage compartment put 0,4 kg load in the instrument panel
95kg-110kg	max. 4 kg	max. 25 kg	max. 10 kg

In the case of sailplane loading in the manner various than this listed in the above plan/e.g. when the pilot's mass is different than the allowable cockpit loading/ it is necessary to check the mass and c.g. location of the sailplane in the flight by means of weighing the glider with the full loading.

Tke allowable c.g. limits and all-up masses of the sailplane are listed in the Flight Manual.

9. SERVICE AND SCHEDULE OF MAINTENANCE WORKS

BEFORE THE BEGINNING OF THE FLIGHTS IT IS NECESSARY TO CHECK:

1. The validity of the sailplane inspection certificate
2. The integrity of the structure and coverings.
3. The securing of the fitting elements and control circuits joints.
4. Operation of the control circuits and controls.
5. Operation of the towing hook.
6. Undercarriage condition, movement of the main and tail wheel, operation of the wheel brake, air pressure in the tyre /by eye/ cleanness of the undercarriage housing.
7. Pilot's safety belts.
8. Adopters for static and total pressure.
9. Operation of the board instruments.

AFTER THE FLIGHTS IT IS NECESSARY TO:

1. Make an inspection the same as before the flights.
2. Complete the adnotations in the sailplane Log-Book

THE FOLLOWING MAINTENANCE WORKS SHALL BE PERFORMED ACC. TO THE SCHEDULE LISTED ON THE END OF THIS PARAGRAPH:

Check:

1. the condition of the sailplane sets particulary the elements loaded during the flight and landing
2. the surface condition of main fittings and bolts as well as the assembling plays on the main sets
3. the security of the assembling elements of the sailplane and of the control circuits
4. the security of the canopy locking
5. the condition and operation of the towing hook
6. the condition and correct deflection of the control surfaces and air brake

7. the friction forces of the control circuits and the forces for actuating the devices
8. the condition of the undercarriage and tail wheel as well as the operation of the wheel brake
9. the condition and operation of the board instruments
10. the condition of the outer surfaces of the metal elements especially, of those being exposed for corrosion or faults in the protecting coats/cables, undercarriage etc/.
11. Clean and grease the bearings and fitting elements with the bearing grease
12. Check the tightness of the water ballast tanks/as described in para 5/
13. Check the deflection angles of the control surfaces.

Time of maintenance	Item of maintenance work
Beginning of the flying season	1 to 13
After 100 hours of flight	1 to 11
After landing with the damaged undercarriage	1 to 9
After heavy landing	1,2,7,8, and 9
End of the flying season /or before the long hangaring/	1,10,12, and 13

The first reapir is to be performed after 1000 flight hours. This time will be extended to the hours amount and under the conditions resulting from the exploitation tests.

NOTE: The small defects appearing during the use of the sailplane should be repaired acc. to "Repair Manual for glass-fibre sailplane SZD-48 "Jantar Standard 2" Issue I-1978

10. HANGARING AND TRANSPORT

During the dead winter season or during the longer interrupt of the use it is recommended to disassemble the sailplane and to grease the fittings and assembling elements.

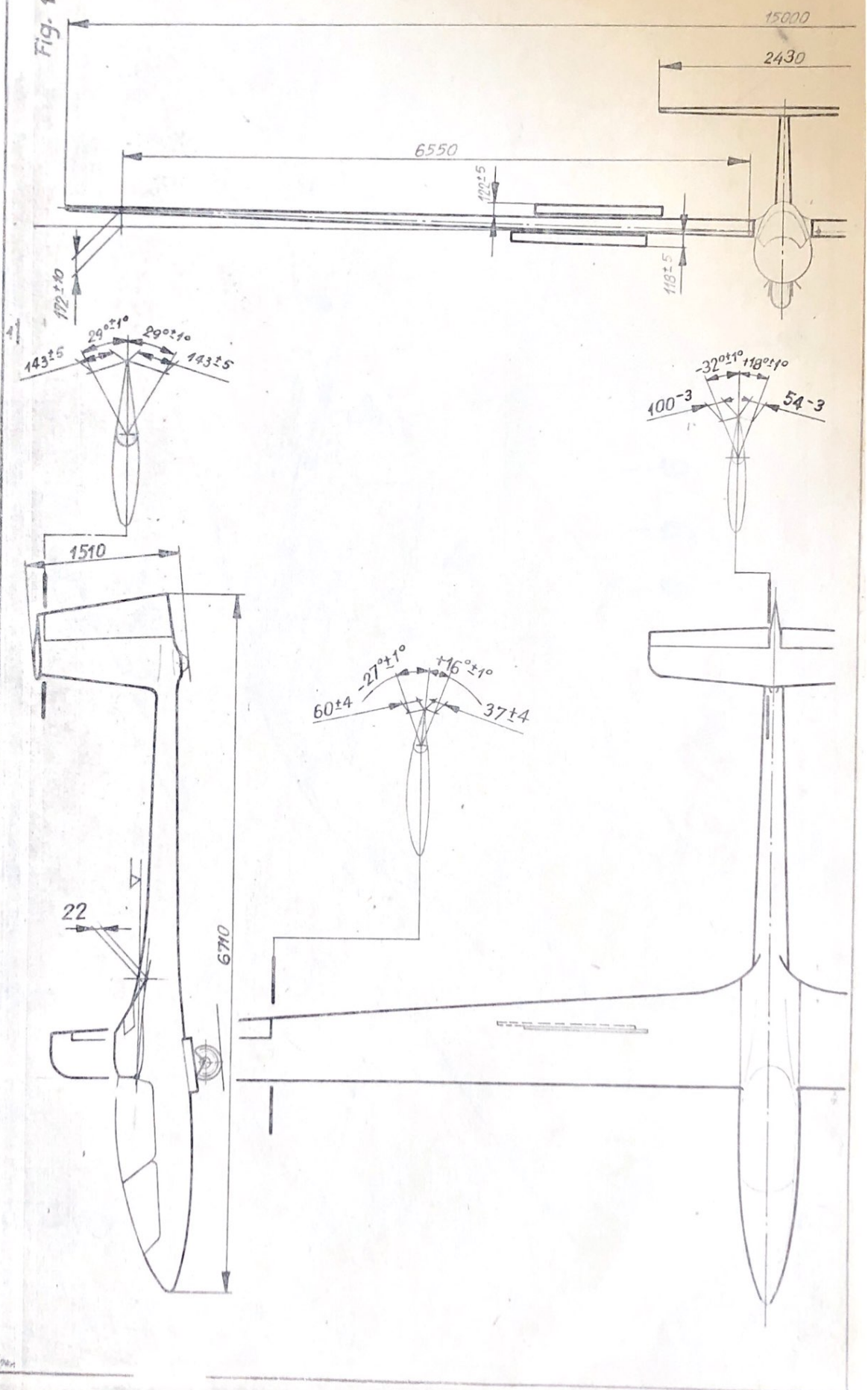
When hangaring in the assembled condition it is recommended to support the wing tips.

For the trailer transport the sets of the sailplane can be fixed as follows:

- on external surfaces by means of the wide support faced with the soft material, or by means of the strips,
- wings on the spar ends,
- fuselage on the wheels,

For the transport the fittings, inspection holes and bearings should be secured against the dust and dirt. The push-rod ends and control surfaces should be fixed.

Fig. 1


15000
2430
6550
120±5
118±5
112±10
29°±1°
29°±1°
143±5
143±5
-32°±1°
118°±1°
100⁻³
54⁻³
1510
60±4
-27°±1°
+16°±1°
37±4
22
6710

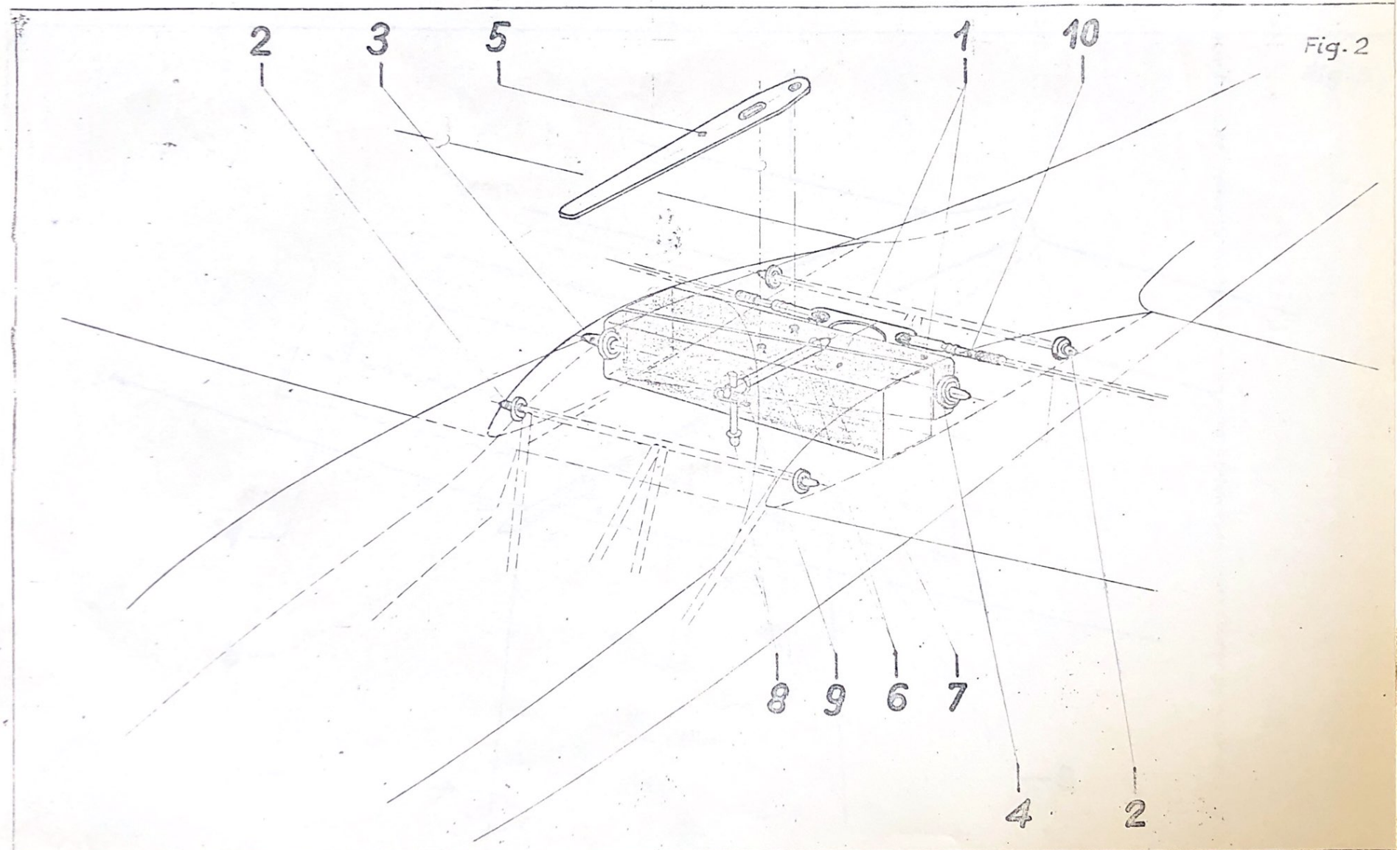
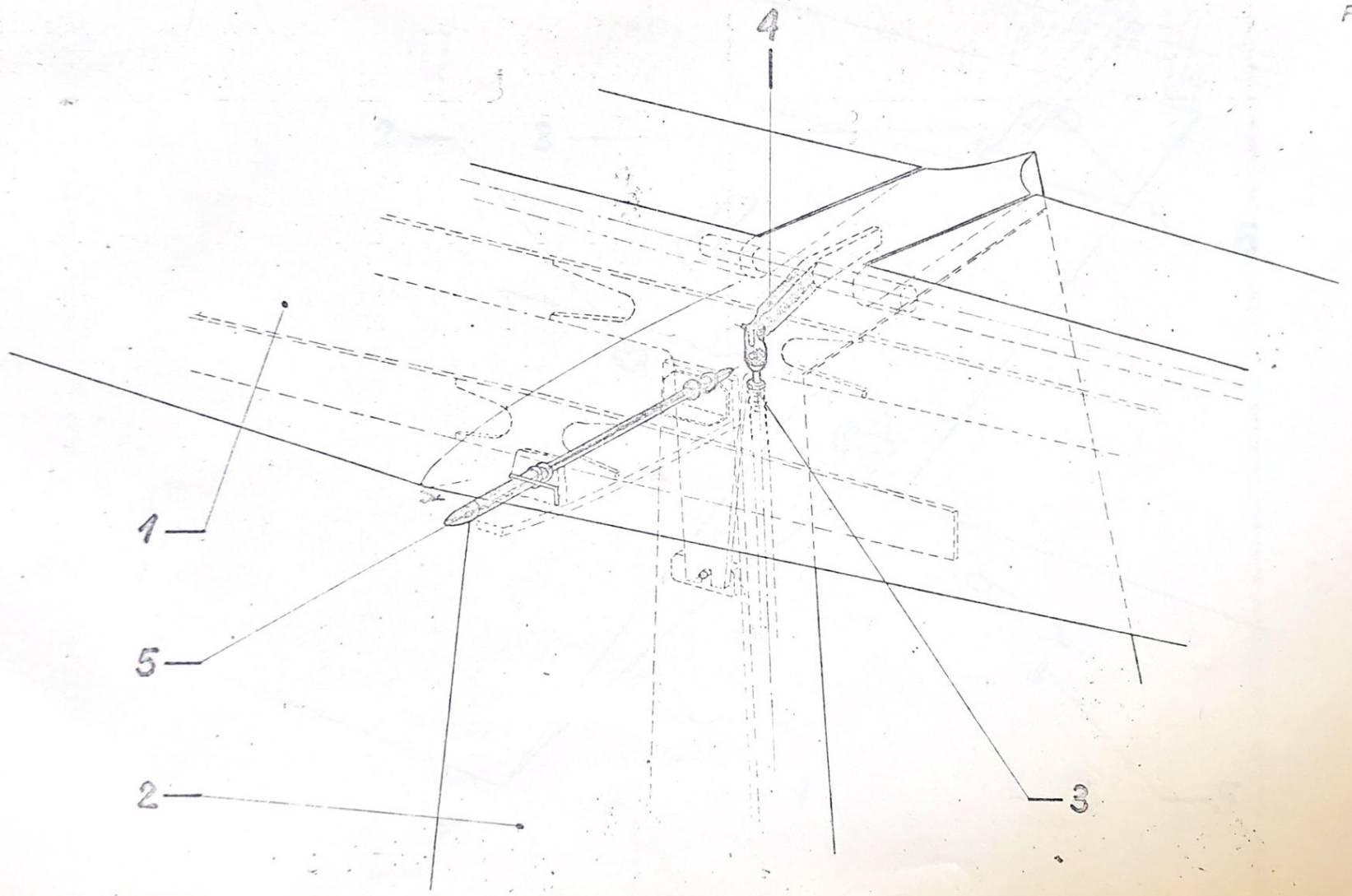


Fig. 2

Fig. 3



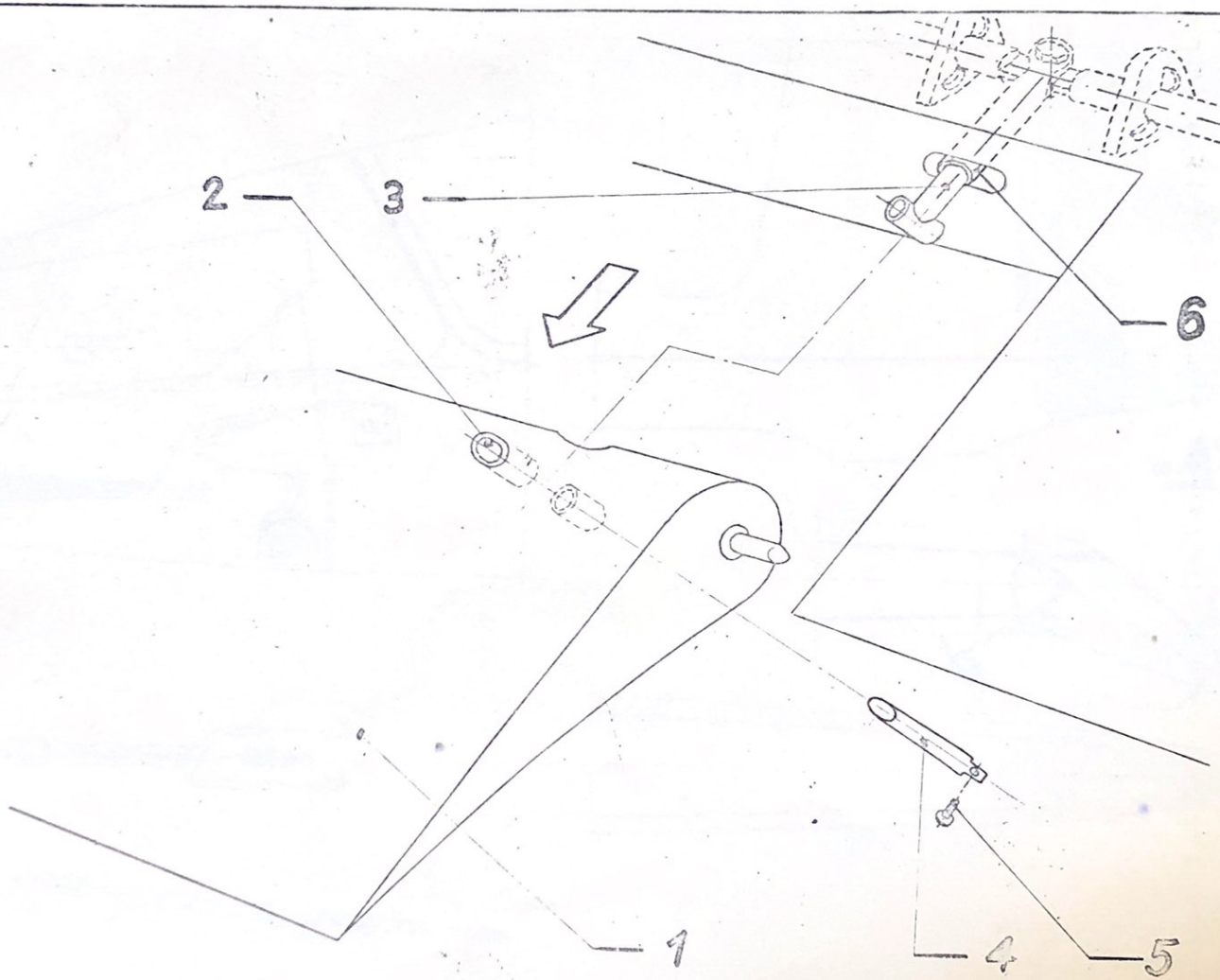


Fig. 4

Fig.5

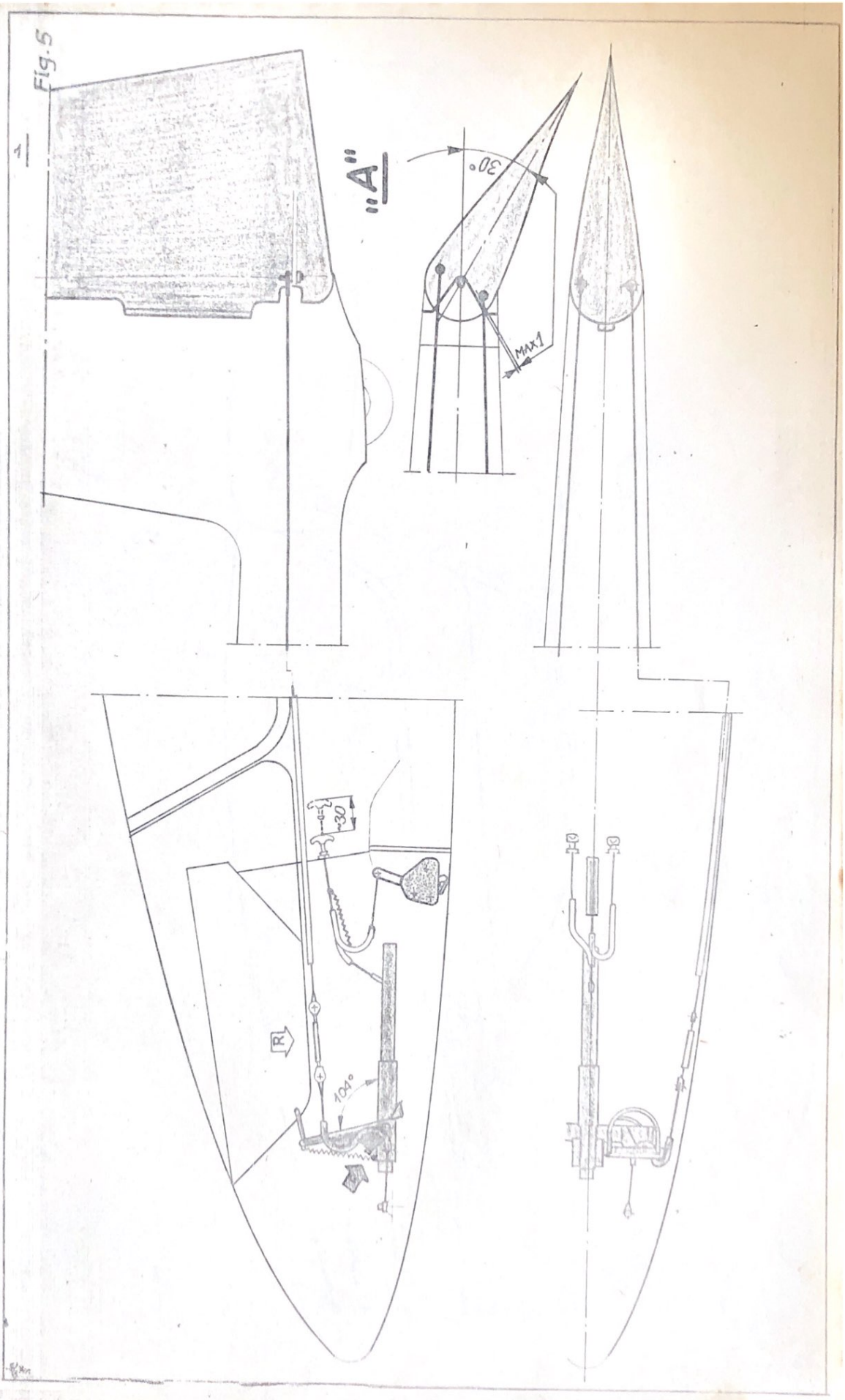
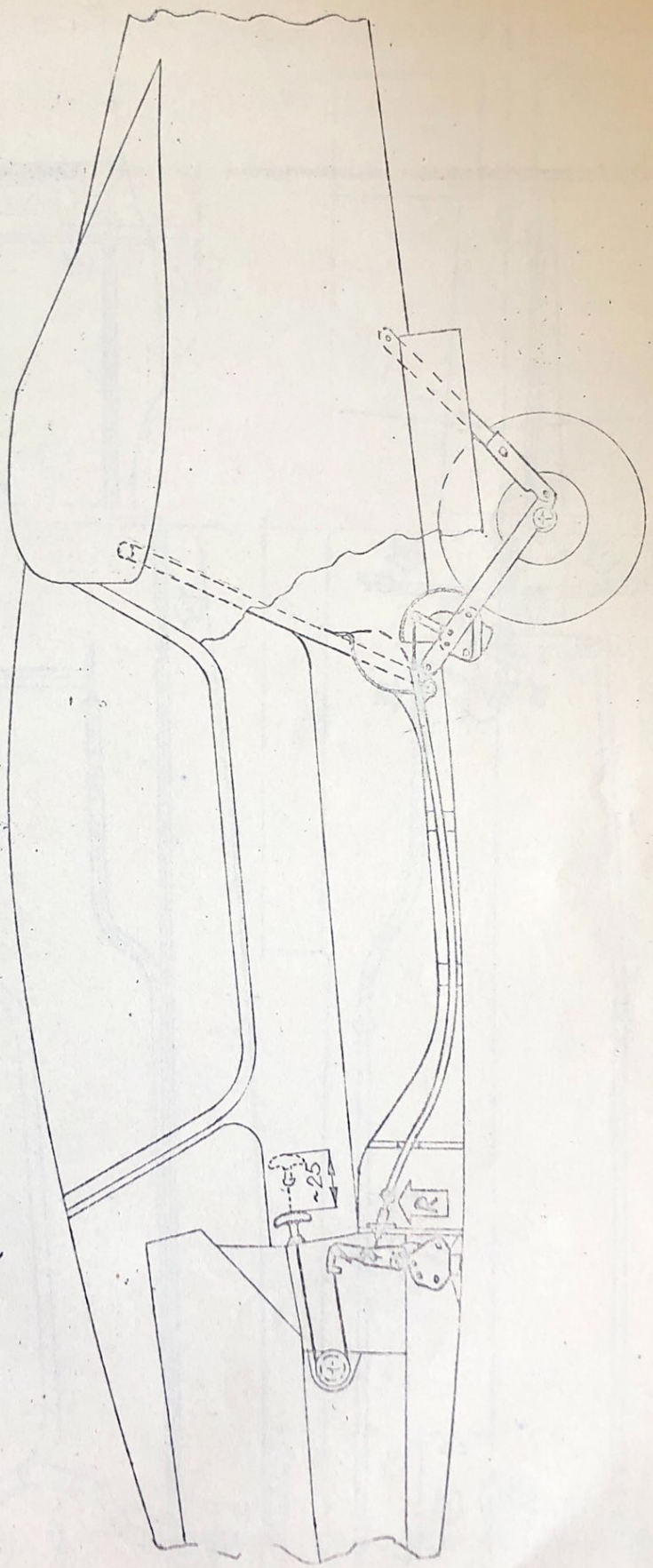


Fig. 6



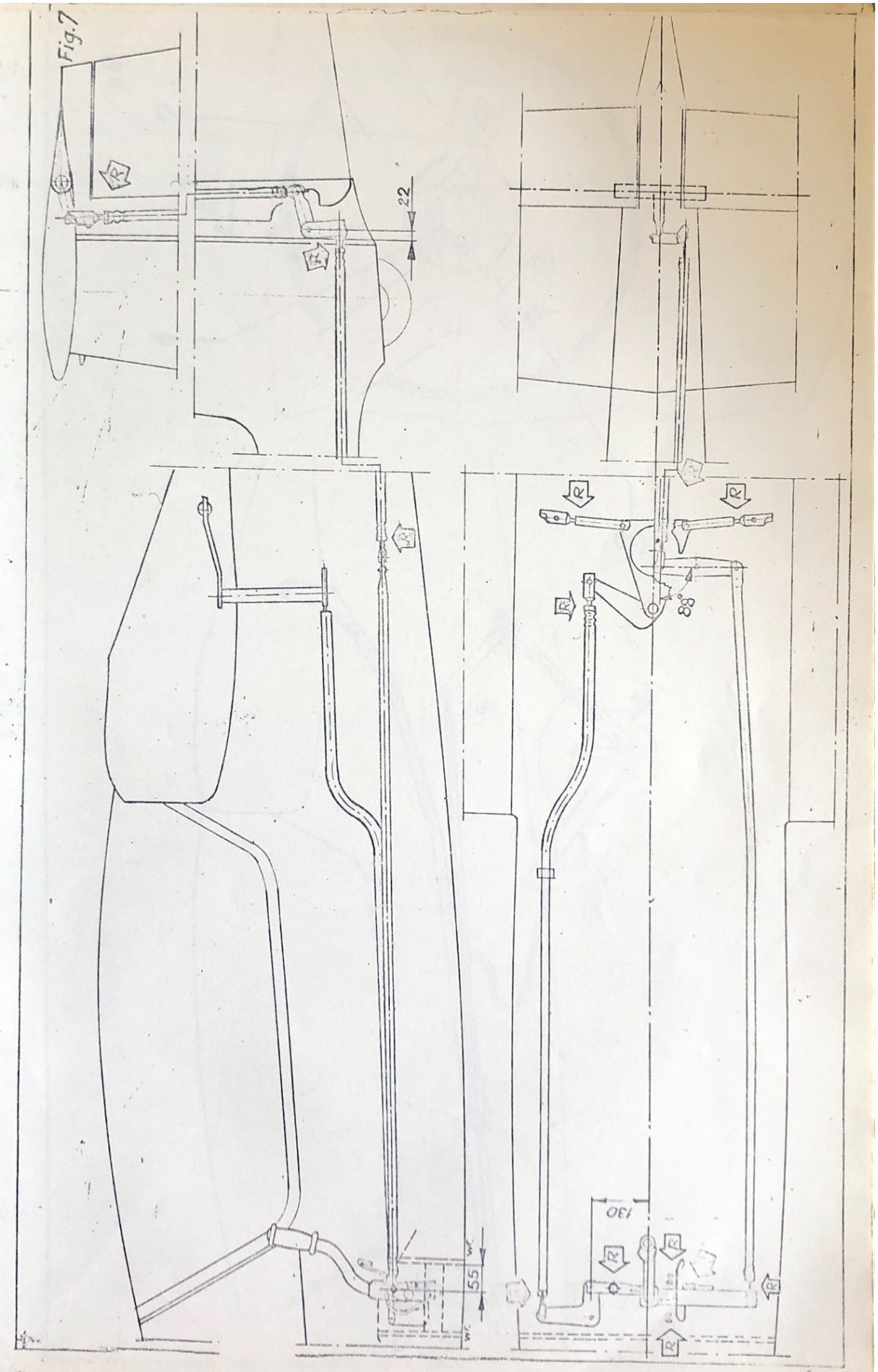
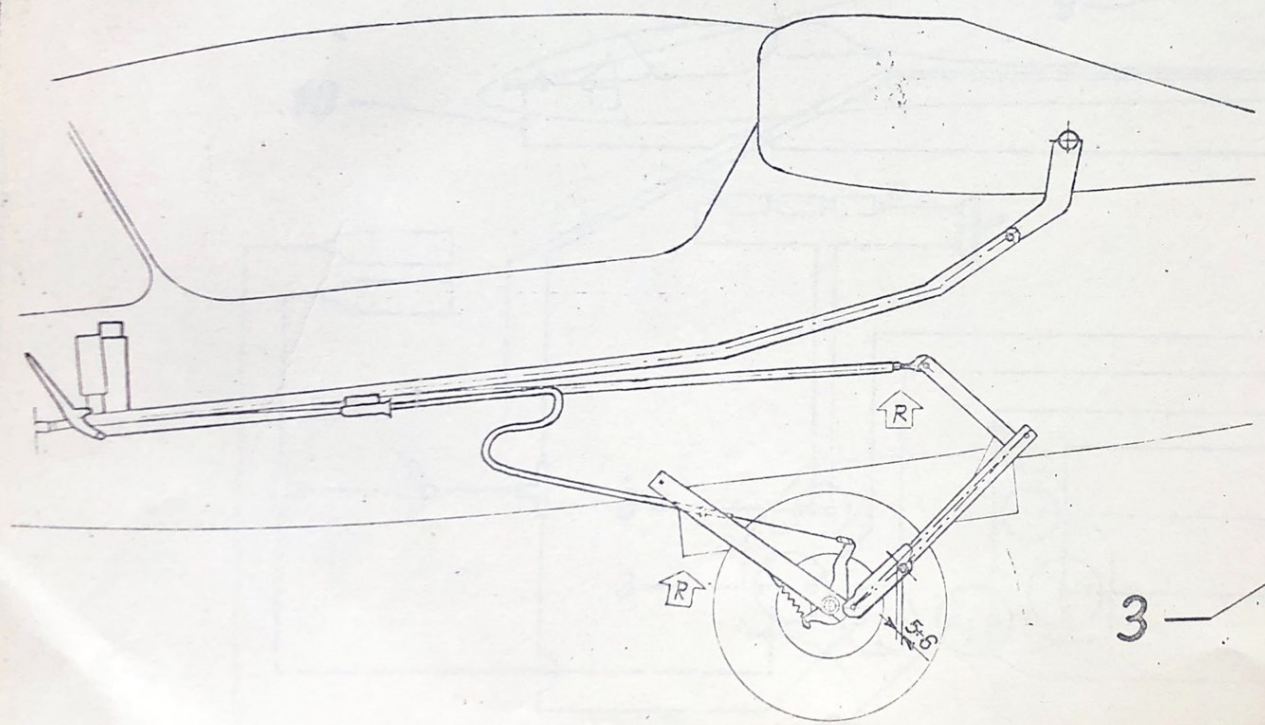


Fig.7
22
88
55
130

Fig.8



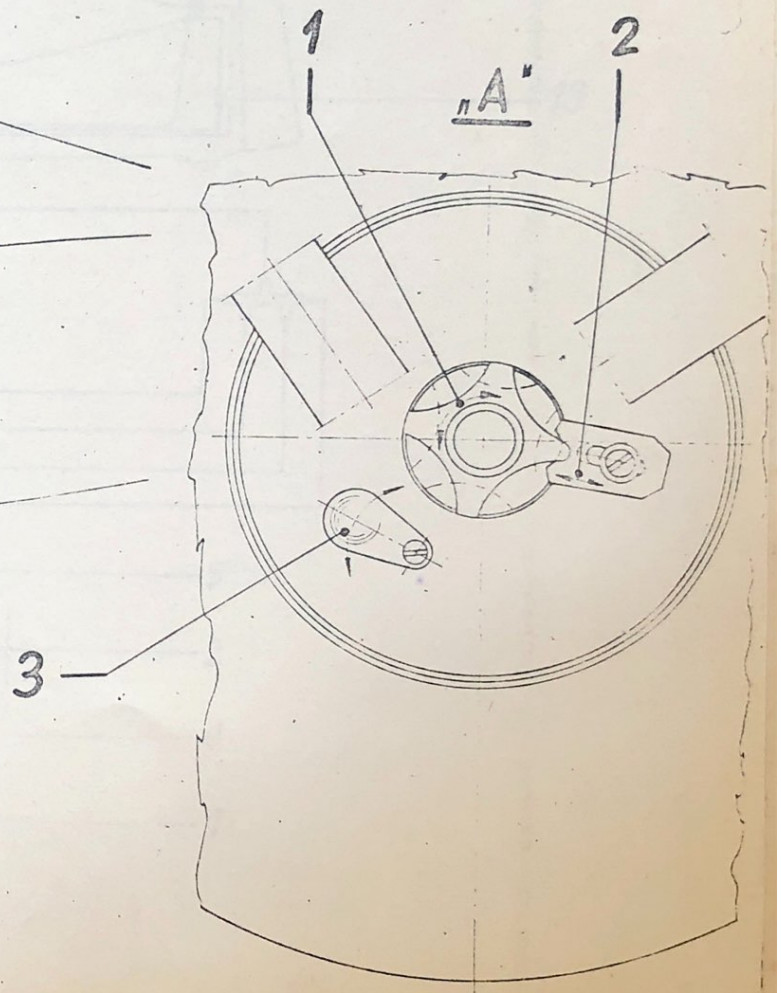


Fig. 9

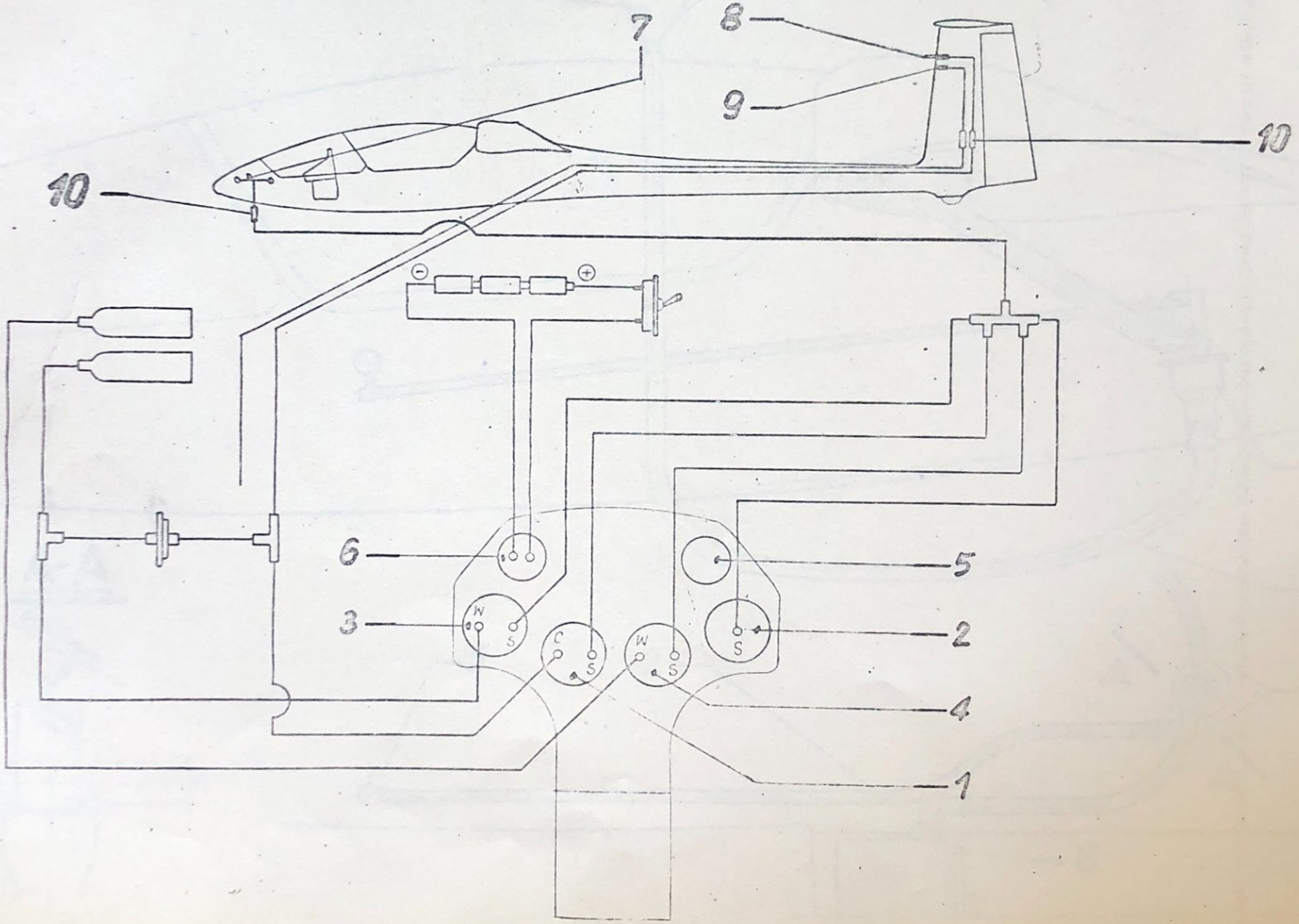


Fig.10

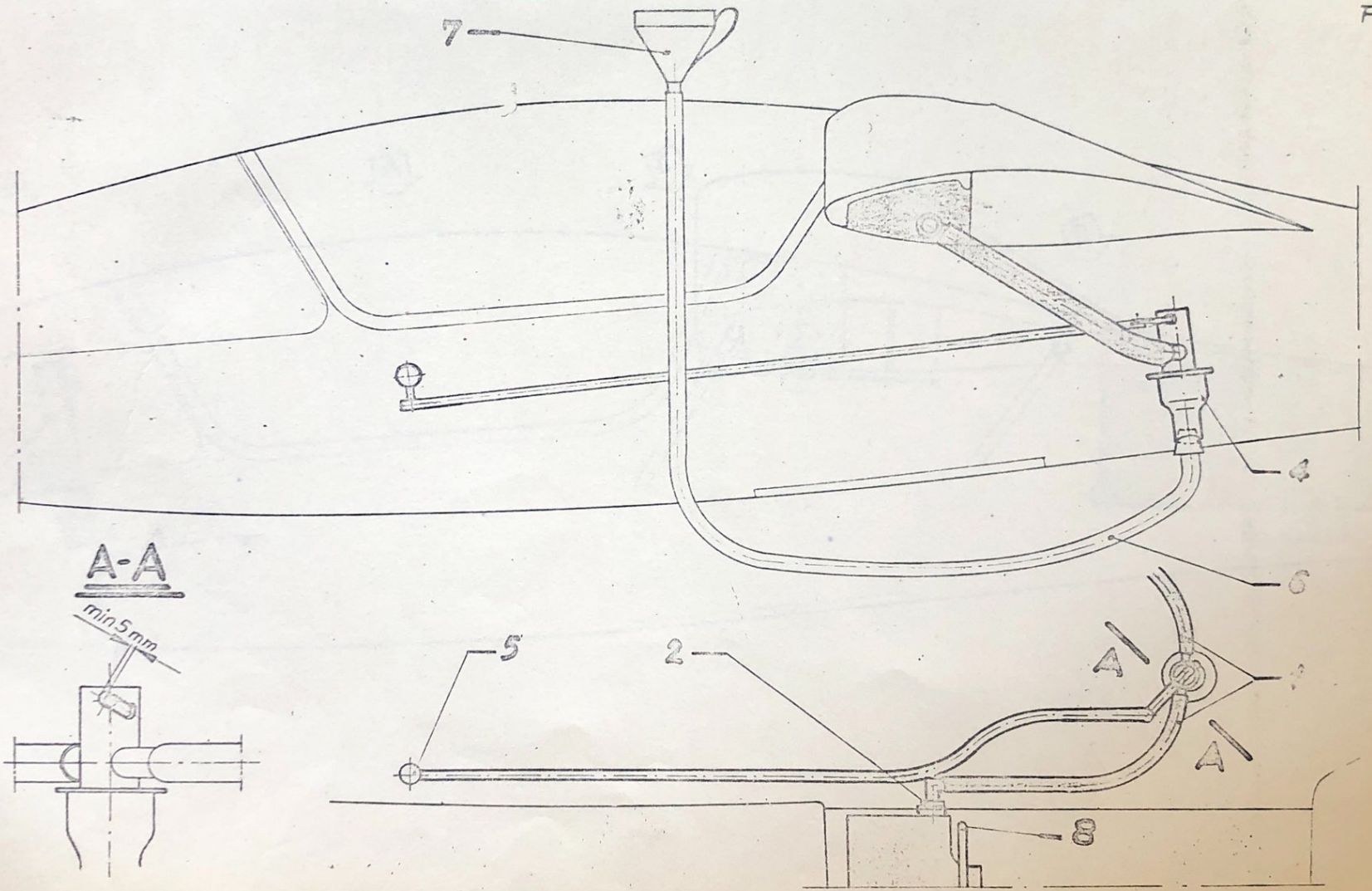
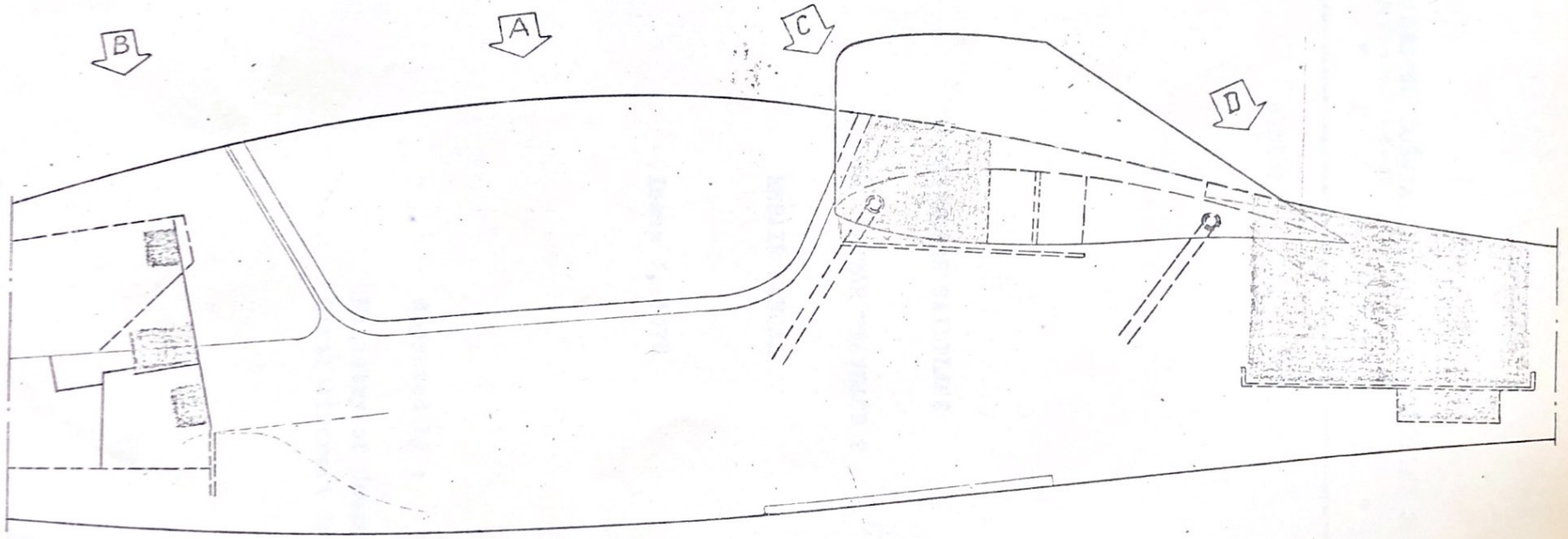


Fig. 11



PRZEDSIĘBIORSTWO DOŚWIADCZALNO - PRODUKCYJNE SZYBOWNICTWA

" P Z L - B I E L S K O "

BIELSKO - BIAŁA, POLAND

GLASS-FIBRE SAILPLANE

SZD-48 JANTAR STANDARD 2

REPAIR MANUEL

Issue I, 1978

Approved by :

Ministry of Communication
Civil Aircraft Inspection Board

LIST OF THE CHANGES INTRODUCED

Places on which the text has been changed are marked with the vertical line at the left of the text and with the number of the change.

Item	Page	Remarks	Signature and date

C O N T E N T S

1. INTRODUCTION

This manual contains direction for the user enabling him repairs of minor failures of the glass-fibre sailplane described in the clause 2.2.
The second group of failures - major ones - which do not require the factory repair however, will be investigated by the manufacteur individually after examination of the real condition. Depending on the complication of the problem the repair will be done either by the user or by the skilled worker on user's order. The failures assumed to be repaired by the manufacturer are listed at the end of clause 2.2.
Before starting the repair it is necessary to get acquainted with the following documents:

- Sailplane log-book
- Technical Service Manual
- Certificates of equipment
- Certificate of Manufacturer's Inspection
- Report on the sailplane tests.

The repair shall be notified to the State Authority having the supervision over the sailplane.
According to the principle that the sailplane after the repair shall have the full airworthiness it is necessary to check whether-as a consequence of the repair-there have been not exceeded the limits of weight and c.g. position of the sailplane. This instruction is associated with the ''Workshop Instruction for the Production of Stressed Glass-fibre Materials IW-76/412.4''.

2. REPAIR OF GLASS-FIBRE PARTS

2.1. Repair conditions

Except of the requirements listed in introduction it shall be observed that the rooms where the repairs of the glass-fibre parts are to be performed have the relative humidity of no more than 85 per cent and temperature of not less than +20 ^{o}C. When the repair procedure is finished it is necessary to maintain the temperature of +20 ^{o}C at least during minimum 10 hours i.e. the time necessary for the process of hardening of the resin composition. It is advised after the hardening time the repaired place to be additionaly heated during at least few (4 to 6) hours in the temperature of +40 to +60 ^{o}C (e.g.by means of infra-red lamps installed at the distance of about 0.6 m. from the repaired place, under the canvas tent, or other). The room for the repair shall be clean, free of dust and with good illumination. For the reasons of health the good ventilation is desired.
The workers performing repair shall be familiar with the appropriate repair method. The correct repair will be done if they have a training in the production or repair of the glass-fibre sailplanes.
When the performed repair is the first contact of the worker with the glass--fibre repair techniques it is necessary for him to getacquainted with the instruction elaborated by the manufacturer: ''Workshop Instruction for Production of the Stressed Glass-fibre Materials IW-76/412.4'' giving the detailed directions for the production.

Apart of above the worker performing the repair shall be approved by the person having the supervision on the repair.

2.2. Classification of failures

In respect to the various importance of the assemblies subjected to damage and the various methods of repair or particular faults the sailplane has been divided into 3 zones having the different dimensions of the faults allowed to be repaired by the user. This is illustrated in fig.1. The general types and sizes of the faults for the particular zones are listed in the table Zone III concerns the places not suitable for repair.

Item	Fault	Zone I normal (mm)	Zone II with limited size of fault (mm)
1	Holes, tears	Ø100	Ø40
2	Cracks	250 in arbitrary direction	100 only along the span of the set
3	Unglued nose	100 control surfaces	40 wings and stabilizer
4	Whiteing	as in item 1 or 2, but around the main fittings inadmissible	
5	Unglued trailing edges	250	
6	Unglued aprons of the root ribs	arbitrary, but on the wings inadmissible	
7	Damaged paintings	arbitrary	

In case of any doubts in the interpretation of the type or size of the fault it is necessary to contact the manufacturer who after examination of the description and pictures of the fault will give his advise.
The manufacturer excludes the possibility of repair by the user in following cases:

a) Unglued or damaged (whited) zone of the main fittings,
b) Spar flange broken,
c) Wing root rib, spar root the wing front torsion box in the zone of the water ballast tank damaged,
d) Fuselage, wing, stabilizer, aileron or control surfaces broken,
e) In all other cases if skilled repair cannot be ensured.

2.3. Typical repairs

All repairs of the glass-fibre elements shall be performed according to the schemes given below taking moreover into account:

- use of materials prescribed in fig.1 and in item 2.4,
- preparation of the surfaces for the glueing or resining by means of cleaning with the surfaces for the glueing or resining by means of cleaning with the acetone or trichloroethylene (for degreasing), grinding with the sand-paper and removing the consequent dust. (use the sand-paper of about ''180'' grade)
- protect materials against grease, moisture and dirt
- accurate doses of the hardener
- the pot time of resin/hardener composition being about 30 minutes in the room temperature
- the hardening time of composition being minimum 10 hours in the temperature of not less than +20 °C.

2.3.1. Sandwich shell glass-fibre/foam

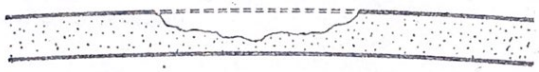


Fig. a. Damage

If the damage to the shell is not right troughout the repair sequence is following:

- round the edges of the hole
- remove the foam in the hole to be sure that the inner covering is undamaged
- cut the foam under the external covering acc. to the drawing b

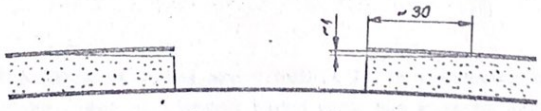


Fig. b. Preparation for repair

- glue in the foam acc. to fig.1 having the smaller thickness than previously by about 1 mm and glue in the external covering to the oblique edges of the foam round the hole
- after hardening of the glue clean the edge of the external covering round the hole and pad-in the foam
- complete the external covering using the glass-fabrics prescribed in fig. 1

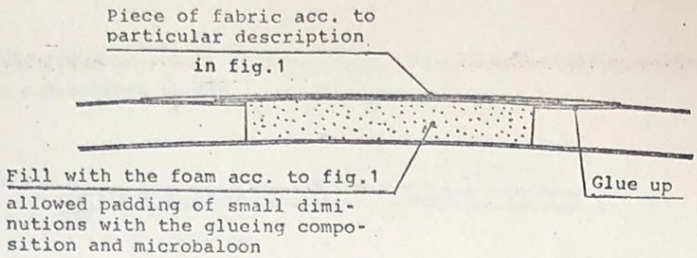


Fig.c. Repair of the covering

In case of damage to the sandwich throughout, the procedure first step is different:

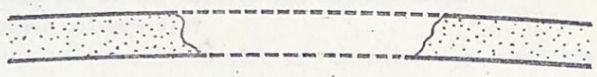


Fig.d. Damage

- prepare the edge of the hole
- cut out the foam around the hole as in fig.e and make a cut under the external covering as previously

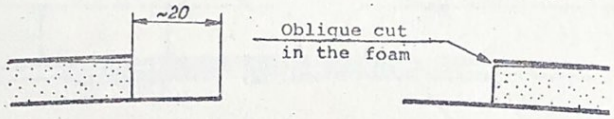


Fig.e. Preparation for repair

- glue up or complete with the glass fabric patch on the cleaned inner covering as shown in fig. f

Note:

If the edges of the inner covering are flexible it is necessary to glue up from inside the supporting piece of plywood fixed with the wire or like, till the glue becomes hard.

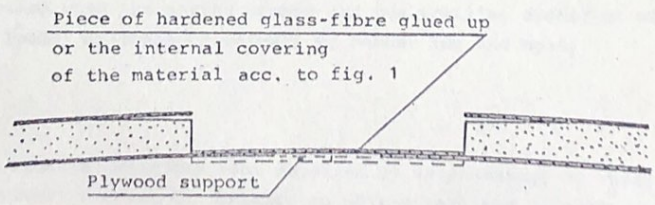


Fig.f. Repair of the internal covering

- further procedure is the same as before (see fig. c).

2.3.2. Sole glass-fibre shell

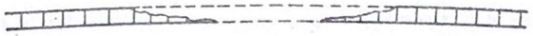


Fig.g. Damage

In case of damage of glass-fibre shell as shown in fig. g the procedure is following:

- smooth the edges of the hole to the regular shape
- cut the edges oblique 1:30
- if the hole is rather large glue up the support to avoid the flexibility during the completion of the glass fabric
- complete the glass fabrics as prescribed in fig.1 stepping the dimmensions of the sequent layers by the value: length of the oblique cut divided by the number of layers.

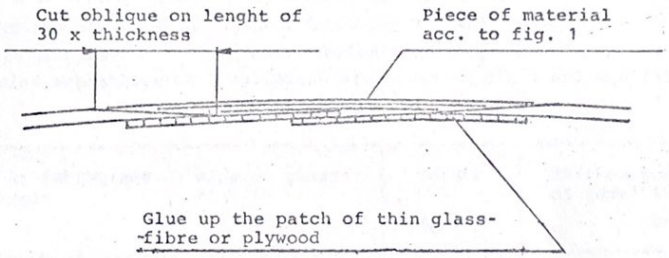


Fig.h. Preparation and repair

2.3.3. Unglueing of the aprons of the trailing edges

After removing and cleaning the oild joint glue up both surfaces with the resin composition condensed with the fillers prescribed in item 2.4. During the hardening, both the surfaces shall be fixed together using e.g. the wooden slats locked with the spring cramps (on the trailing edges) or with the ribbons loaded by means of weights or rubber (on the nose).

Note:

When the rudder trailing edge has been repaired it is necessary to check the mass balance and eventualy correct the balance to obtain required balancing of 100 per cent.

2.4. Materials for typical repairs of particular assemblies of the sailplane

For repairs, the materials listed below shall be used providing that the prescribed storage time limit for them has not been exceeded. For the composition there shall be used the epoxy resin Epidian 53 and the hardener Z-1 or Epidian 52 and the hardener Z-1 for the spar and root rib repairs both the resin types and hardener produced by Zakłady Chemiczne Sarzyna, Poland. The ratio of the hardener for 100 parts /by weight/ of the resin in

- for Epidian 52: $13 \pm 0{,}5$ g or $13 \pm 0{,}5$ cm^3
- for Epidian 53: $10{,}5 \pm 0{,}5$ g or $10{,}5 \pm 0{,}5$ cm^3

The hardener can also be dosed by volume as listed above.

Both the components shall be precisely mixed till to be homogenous. If the composition is to be used as g glue for the thickened joint it is necessary to add to the mixed composition one of the prescribed fillers. The pot life of both the compositions in the room temperature is of about 30 minutes.

In the one repair it is not allowed to use both the compositions. Apart of the mentioned compositions, the other ones can also be used for the repairs if they are approved by the Authorities.

As the rainforcing glass it is advised to use the glass-fabrics INTERGLASS with the preparation I 550 or Volan A (produced in West Germany).

The kind and amount of the glass-fabrics necessary for the repairs of the particular assemblies of a sailplane are shown in Fig.1 and the following table:

Item of INTERGLASS catalogue	Kind of glass-fabric	Weight (g/m^2)	Thickness of 1 layer of resulting material (mm)
92 110	crossed symmetrical	160	0.2
92 125	crossed symmetrical	280	0.35
92 145	canvas unsymmetrical, warp strengthned 8x	215	0.25
90 070	canvas	80	0.1

If other kinds of glass-fabrics are to be used with consent of the appropriate Authority (glass-fabrics) accepted for the aircraft production) the principle thet the amount of used fabrics is to be at least equal to the total amount (weight) of the fabrics prescribed in fig. 1, must be observed.

For elements produced of roving, the roving ES 10-40x60 K43 (produced by GEVETEX TEXTILGLASS, West Germany) shall be used or its equivalent or eventually the roving ER 2003 tex 2280 (produced by KROŚNIEŃSKIE HUTY SZKŁA, Poland).

In the repair of the sandwich shell the diminutions of the foam shall be completed with the foam CONTICELL CC 60 of specific weight of 0.06 g/cm^3 or CONTICELL

CC 41 of specific weight of 0.04 g/cm^3 according to the directions given in fig. 1. Instaed of the above foam there can be used other foams applicable in the glass-fibre gliders, especially if the damage is small.
If the composition for glueing or padding must be condensed it is necessary to use one of the following fillers:
- brown microbalon (produced by UNION CARBIDE, Brenntag GmbH)
- cotton flakes, SCHWARZWÄLDER TEXTIL-WERKE
- fibres cut for the length of 3 to 6 mm from the rovings listed above.

For the selection follow the principle:
- the foam and the trailing edges glue up with addition of the microbaloon
- the noses and aprons of the ribs with - addition of the cotton flakes
- bonds, fittings etc - the addition of cut fibres.

2.5. Painting

The repaired places shall be painted with white enamels (produced by LESONAL WERKE, West Germany). For padding of the greater waveness of the surface there are used PE-FÜLLER 02-69150 with the hardener PE-HÄRTER 07-20560 mixed by weight 100:3. As the external decorative layer use the PE-SCHWABBELLACK WEISS 03-69120 with the same hardener mixed by weight 100:10. The pot time of the composition is 20 minutes. Put on by means of a brush.
Wet-grind the consequent layers, firstly rough than fine with the sand-paper No 360 to 400.
The producer allows to use other painting materials of a good quality under the supervision of the Authority, providing that the lacquer will not get yellow during the sailplane utilization.

3. REPAIR OF OTHER PARTS

3.1. Repair of the metal parts

All the repairs of the metal parts are allowed only on the approval of the Authority or on the direction of the producer. The welding shall be performed only by skilled aircraft welde. The damage to the protective coverings of galvanic (anodizing or zinc plating) or lacquering nature, providing that as corrosion reducing strength of material appears, can be repaired by cleaning up to the pure metal, degreasing, putting the anticorrosive layer and lacquering with the enamel for external application. It is allowed to use enamels applicable in the aircraft industry, or in repairs of motor-car parts observing the directions given by the enamel producer.

3.2. Replacement of the rudder control circuit cables

If the rudder control circuit cables are qualified to be replaced it is necessary to:
1. Prepare 2 cables Ø3.2 7x7-Z/s-I-g-200 of 6700 mm length and 4 thimbles C 3.5.

X For decorative layer white polyurethane enamel 7669-461-010 with the hardener for this enamel /produced by Poland/ should be used. The ratio of hardener for 100 parts of an enamel is 35 parts. Pot-time of the composition is 6 ÷ 8 hours. Apply with brush.

2. Plait in the ends of the cables to the pedals (or press in if the pressing device is accepted by the Authority) and submit to the tension of 0.5 to 0.6 of the tensile ultimate force during a time period of minimum 3 minutes.
3. Perform the disassembling of the rudder and cable ends acc. to item 4 of ''Technical Service Manual''.
4. Cut off the cable ends close to the rudder and sold the tin wire on fix the strong string.
5. Remove the cables introducing the wire or string into the polyamid tubes.
6. Fix the new cable to the wire or string (from the cockpit side) and slide it through the polyamid tube.
7. Plait in the cables close to the rudder (or press in).
8. Re-assemble the rudder and the control circuit and perform adjustment acc. to ''Technical Service Manual''.

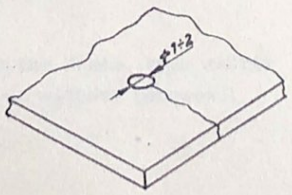
3.3. Reaming of the fittings

During the reaming of the fittings it is necessary to maintain unchanged kind of fit. The reaming steps with appropriate dimensions are given in fig. 2, 3 and 4. For each the reaming step the producer supplies the collaborating part of the oversized dimension (list or spare parts in clause 4, parts 1a,b and c) marked with the points made at the visible place (number of points corresponds to the step of reaming). In case of hand-reaming it is necessary to rotate the reamer in one direction only and to apply a slight pressing. Occasionally the reamer should be taken out in order to remove chips and to check the surface condition. During the reaming it is advised to use lubricants:

- for steel - machine oil
- for duraluminium - kerosene
- for bronzealuminium - machine oil.

3.4. Perspex

In case of appearance of small microcracks or internal perspex changes as a consequence of the sun operation the whole panel must be replaced. The same concerns the long linear cracks or impact holes.
The propagation of the cracks is to be avoided by means of drilling the small holes at the end of the crack, as shown in the sketch.



The cracks or the complementing pieces are to be glued with the glues for perspex observing directions of the glue producer.

4. EXCHANGE OF PARTS

The design and the production of the sailplane enable replacement (carried out by the user) of the following parts, shown in fig. 5, due to damage or wear:

1. The fitting elements with the dimensions enlarged to the repair reaming according to the following table:

Item	Part	Nominal dimension (mm)	I reaming (mm)	II reaming (mm)	III reaming (mm)
1a	Main bolt connecting both the spars	Ø14f7	Ø14.25f7	Ø14.5f7	Ø14.75f7
1b	Bolt connecting the tailplane with the fin	Ø12/Ø10h7 ϕ14/ϕ12h7 *	Ø12.2/Ø10.2h7 ϕ14.2/ϕ12.2 h7*	Ø12.4/Ø10.4h7 ϕ 14.4/ϕ 12.4 h7*	Ø12.6/Ø10.6h7 ϕ14.6/ϕ 12.6 h7*
1c	Block on the fin web, connecting the tailplane fitting	$^{8}_{-0.05}$	$^{8.3}_{-0.05}$	$^{8.6}_{-0.05}$	$^{8.9}_{-0.05}$

* Valid for the sailplanes of Fact.Nrs above W-857 incl.

2. Undercarriage parts:
   a. undercarriage door
   b. undercarriage legs
   c. main wheel
   d. tail wheel Continental 28RO/200-20N.

3a, b. Airbrake plates and fairings.

4. Total pressure adapter.

5. Towing hooks: SZD, TOST Combi, Europa.

6. Removable equipment in the cockpit:
   a. pilot's rest
   b. head rest pillow
   c. instrument panel
   d. support of the instrument panel
   e. floor
   f. pedals assembly.

7. Canopy:
   a. perspex without the frame, type JANTAR
   b. the frame with or without perspex.

8. Control surfaces:
   a. rudder
   b. elevator
   c. ailerons.

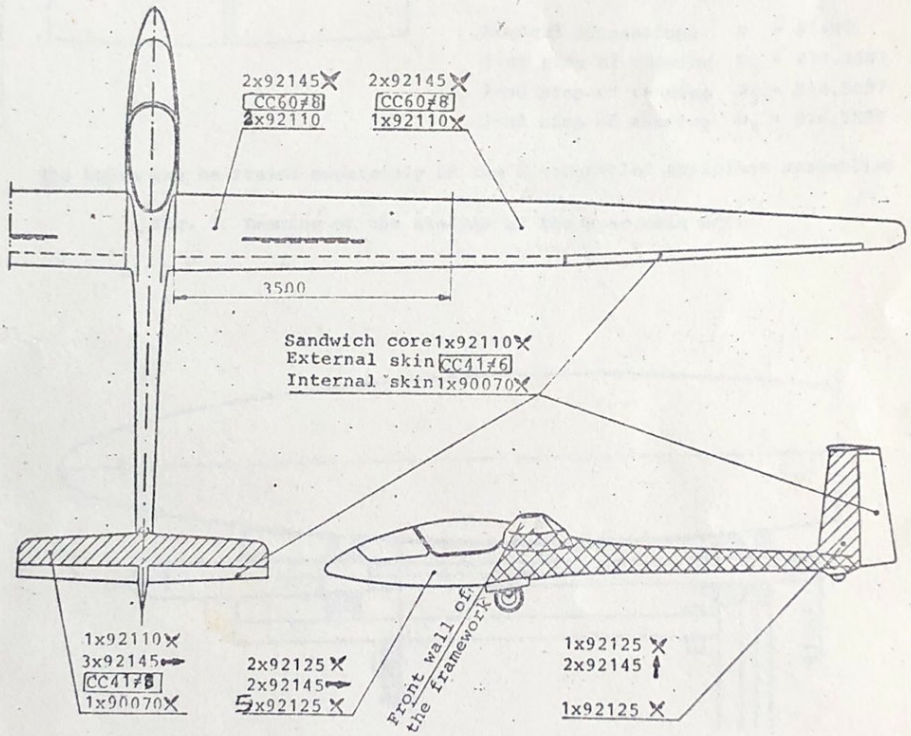
9. Stabilizer.

10. Wings.

- The tail wheel (item 2d) is to be ordered in OTTO ALLMENDINGER TECHNISCHE INDUSTRIEBEDARF, 7332 Eislingen/Fils, Postfach 1120, West Germany.
- The perspex without the frame (item 7a) in MECAPLEX AG, Solothurnstrasse 138 2340 Grenchen, Suisse.
- The towing hook TOST in RICHARD TOST, Flugzeuggerätebau, München.

All the other parts are to be orderd in the producer's factory. The producer reserves that the exchange of the wings can be made only according to the factory instruction. If the user has any doubts in respect of his own ability to carry out exchange of the wings, he should order all necessary parts No 149 together with replacement directions for them.

5. DRAWINGS

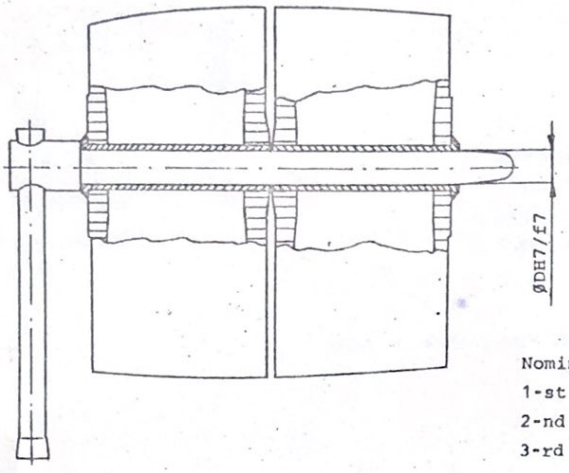


Zone I - areas of normal faults

Zone II - areas of reduced faults

Zone III - areas withaut repair possibilities

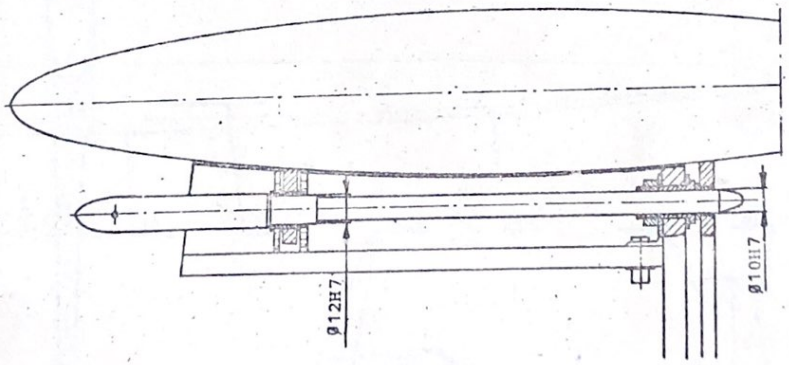
Fig. 1. Distribution of zones and repair material specifications



Nominal dimmensions	D	= Ø14H7
1-st step of reaming	D_1	= Ø14.25H7
2-nd step of reaming	D_2	= Ø14.50H7
3-rd step of reaming	D_3	= Ø14.75H7

The holes may be reamed seperately in the disassembled sailplane assemblies.

Fig. 2. Reaming of the sleeves of the spar main bolt

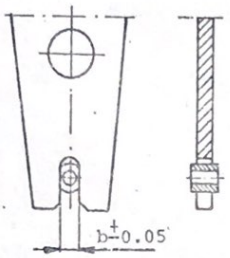


Nominal dimensions	D/d	= Ø12H7/Ø10H7	
1-st step of reaming	D_1/d_1	= Ø12.2H7/Ø10.2H7	ø14,2H7/ø12,2H7 ✱
2-nd step of reaming	D_2/d_2	= Ø12.4H7/Ø10.4H7	ø14,4H7/ø12,4H7 ✱
3-rd step of reaming	D_3/d_3	= Ø12.6H7/Ø10.6H7	ø14,6H7/ø12,6H7 ✱

✱ Valid for the sailplanes of Fact.Nr above W-857 incl.

The holes may be drilled seperately in the disassembled sailplane assemblies.

Fig. 3. Reaming of the sleeves for the stabilizer-to-fin bolt



Nominal dimensions	b	$= 8 \pm 0.05$
1-st. step of filing	b_1	$= 8.3 \pm 0.05$
2-nd. step of filing	b_2	$= 8.6 \pm 0.05$
3-rd. step of filing	b_3	$= 8.9 \pm 0.05$

Fig. 4. Filing the stabilizer rear fitting

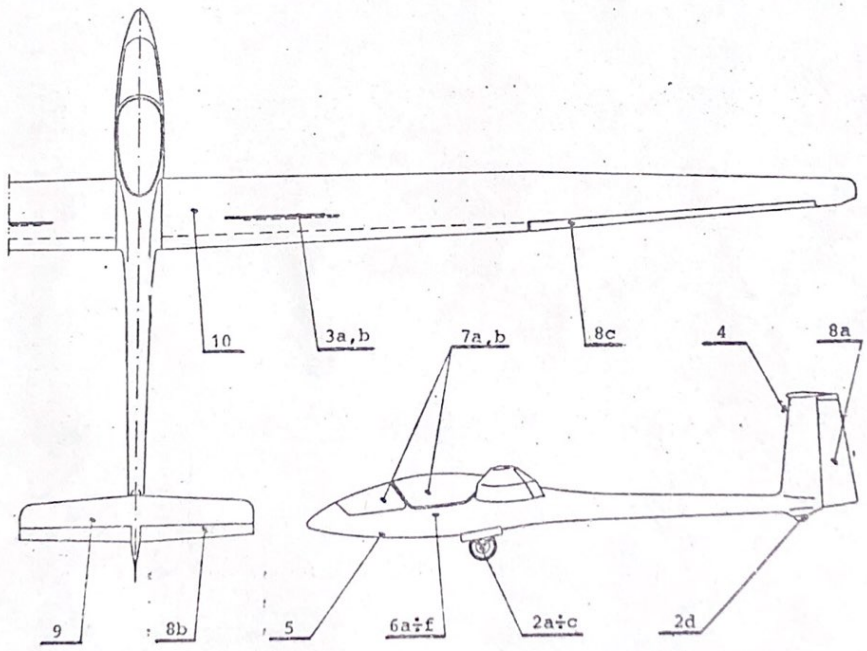


Fig. 5. Parts allowed to be replaced