PRZEDSIĘBIORSTWO DOŚWIADCZALNO-PRODUKCYJNE SZYBOWNICTWA

„PZL-BIELSKO"

BIELSKO-BIAŁA UL. CIESZYŃSKA 325

TECHNICAL SERVICE MANUAL

OF

GLIDER

SZD-51-1 "JUNIOR"

Factory No	

Translated by Polish Authority approved interpreter :

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Issue I / JAR-22, April 1995

SECTION 0

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0. ISSUANCES

0.1. Record of revisions

Any revision of the present manual must be recorded in the following table.

The new or amended text will be indicated by a black vertical line and Revision No in the left hand margin, and the date will be shown on the bottom left hand of the page.

Rev. No.	Affected Section	Affected Pages	Date of Insertion	Signature

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0.3. Contents

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SECTION 1

1. DESCRIPTION AND TECHNICAL DATA OF GLIDER

1.1. Description of glider

1.2. Technical data of glider

I. DESCRIPTION AND TECHNICAL DATA OF GLIDER

1.1. Description of glider

SZD-51-1 "JUNIOR" is the school and training one-seater designed on the base of JAR-22 Airworthiness Requirements in "Utility " category. The structure components are of glass-epoxy composite.

WING - in two panels, of bi-tapered planform, with FX S02-196 profile on in-board portion, passing into FX S02/1-158 profile on the wing tip. Double-T spar with roving caps. Sandwich type wing skin with core of hard PVC foam, of 6.5 mm (0.256 [in]) thickness.

AILERON - 20 per cent of chord, of composite structure, suspended on 5 and actuated at one point.

AIR BRAKE in a form of duralumin sheet plate, with caps fitted to the wing contour, extended on the upper wing surface only.

FUSELAGE - of composite structure, integral with fin. The tube portion of fuselage stiffened with composite semi-frames. The fin stiffened with ribs of hard PCV foam, of 14 mm (0.55 [in]) thickness and with composite spar. The fuselage central part contains the steel framework, to which the wings and fixed undercarriage are fastened, the latter comprising the Ø400x140 (15.8 x 5.5 [in]) non-sprung wheel. The cockpit is covered with a one-piece, side opening canopy.

TAIL UNIT of composite structure, rudder covered with fabric. Horizontal, tapered tailplane, of "T" arrangement. Two panel elevator, ranging 30 per cent of chord, actuated at one point. Each half suspended on three points.
The rudder ranging 40 per cent of chord, suspended on two points, is mass balaneed. On both elevator halves the two symmetrically arranged fixed loading-tabs are provided.

CONTROL SYSTEMS of rudder, hooks and wheel brake - cable type, while d controls of aileron, air brake, elevator, eanopy emergency jettisoning and air-conditioning are of push-rod type.

Note: THE CONTROL STICK IS ELECTRICALLY BONDED BY MEANS OF A WIRE CONNECTING IT WITH THE C.G. HOOK FIXING SCREW.

INSTRUMENT PANEL - is adopted for accommodation of:

- 5 instruments Ø80 [mm] (3.15 [in]) {or 4 instruments Ø80 [mm] (3.15 [in]) plus transceiver}, and 2 instruments Ø60 [mm] (2.364 [in])
- 2 variometer compensating bottles and variometer compensator

Immediately on the instrument panel and in the upper portion of its cover, there are two separate air outlets for cockpit air-conditioning, individually in-flight controlled by the pilot.

The glider is factory equipped with set of PZL instruments (see Fig. 2/6, page 2.11) necessary for flights in the full range of operation limitations specified in Flight Manual. Mass of this instruments set, ranging 2.5 kg (5.51 lb), is contained in the mass of empty glider:

- airspeed indicator PR-250S seria B(I) with colour marking as given in Flight Manual,
- altimeter W-10S or W-12S (2),
- variometer WRS-5D (3) with KWEC-2 compensator (11), bottle W 450 (10) and Mc Cready ring,
- compass BS-1 (4),
- turn indicator EZS-4

Note: AS THE ADDITIONAL EQUIPMENT OF INSTRUMENT PANEL THE ADDITIONAL VARIOMETER (13) CAN BE INSTALLED, E.G. ELECTRO-VARIOMETER CONNECTED TO THE PRESSURE HEAD K = -1, AND SUPPLIED FROM TRANSCEIVER BATTERY.

SYSTEMS AND EQUIPMENT

Pressure systems (see Fig. 2/6).

The glider is factory equipped with three pressure systems:

- static pressure system with two heads (6) in front fuselage part and with drainage unit (8) in the instrument panel,
- total pressure system with head (7) located in the air in-take for cockpit air conditioning, in the nose of fuselage, and with drainage unit (8) in the instrument panel,
- system for K = -1 head (15) consisting of nest (14) in the fin, and duct leading to the ducts connector (9).

Ducts connector (9), enabling the full disassembly of instrument panel out of the glider, has the ends marked with colour dots to connect the ducts as follows:

- red - static pressure
- black - total pressure
- white - pressure from K = -1 head
- yellow - additional, e.g. for bottle of additional variometer

Note: AFTER CLOUD OR RAIN FLYING, OR IF WATER IS SUSPECTED TO HAVE ENTERED THE PRESSURE DUCTS, THEY SHALL BE DISASSEMBLED OUT OF THE INSTRUMENTS AND BLOWN WITH THE AIR, AND THE DRAINAGE UNITS SHALL BE DRIED.

Transceiver installation

The glider is factory equipped with system allowing for the installation of glider transceiver (and additional electro-variometer), consisting of:

- dipole half-wave aerial of CT.J8.01.00 type, installed in the fin, and concentric eable led to the instrument panel,

Note: THE CABLE LENGTH IS TUNED WITH AERIAL AND THUS CANNOT BE SHORTENED.

- switch "transmission-receiving" fitted to the stick, with the electrical cable led to branch-joint block located under the eontrol column,
- electrical cable from upper luggage compartment to branch-joint, and further two cables to instrument panel (for transceiver and electro-variometer).

The installation of transceiver block is provided in the instrument panel (see page 1.3), or in the column of instrument panel.

The microphone and loudspeaker should be located acc. to the type of transceiver applied.

The transceiver installation, provided within the allowed loading instructions - see Section 7.

Oxygen equipment

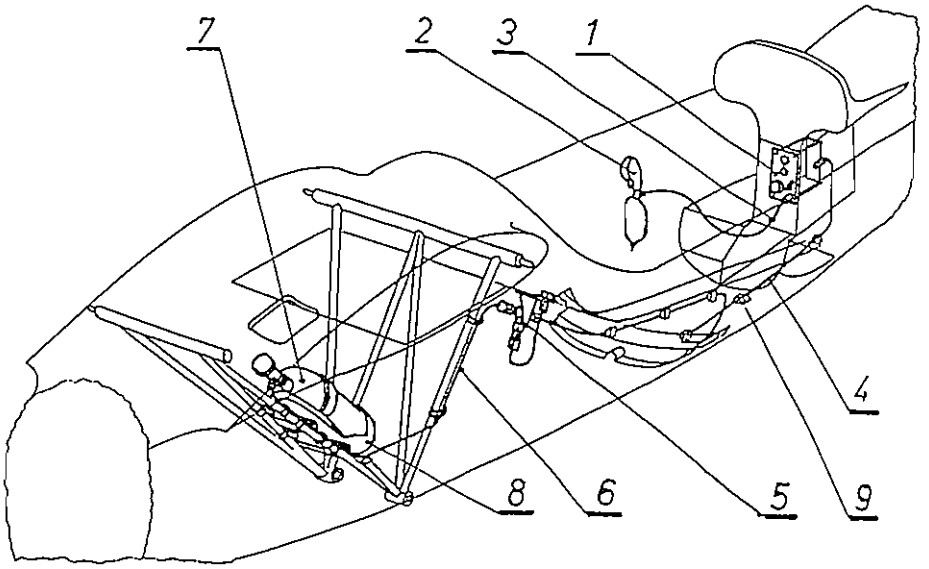
The possibility of installing the oxygen equipment on the glider is provided.

It is recommended to install the oxygen bottle on the fuselage framework, and its control unit on the instrument panel column.

Installation of oxygen equipment, within the allowed loading conditions - see Section 7.

As an example, installation of TA-03A type oxygen equipment, produced at "PZL-WSK WARSZAWA", Poland, is shown on Fig. 1/1.

Fig. 1/I. Installation of TA-03A oxygen equipment



1. TA-03A oxygen control unit in instrument panel base - mass of 1.4 kg (2.9 lb)
2. TM-01A oxygen mask
3. Rubber hose
4. Oxygen duct
5. Three-way connector with supply end
6. Oxygen duct
7. Oxygen bottle of 4 l capacity with valve - mass of 6.5 kg (14.33 lb)
8. Bottle nest fixed to the framework
9. Rubber element positioning the oxygen ducts.

Air-conditioning of cockpit

- air intake in fuselage nose,
- duct of inner diameter of Ø36 mm (1.42 in), led to the tight chamber in instrument panel cover,
- two air outlets : one on instrument panel cover controlled with push-rod, second one on instrument panel adjusted manually. Each one controlled indcpendently.
- side window in canopy, with venting tab

Cockpit equipment

- seat pillow fastened to the seat pan by means of adhesive tape,
- pocket for hand luggage, screwed to the cockpit right board,
- pocket for glider log-book, fixed in the lower luggage compartment,
- gaiter covering the stick.
- rubber bulb with duct drained out of the fuselage, housed under the seat pan,
- first aid kit container, screwed to the fuselage shell on the right side of upper luggage compartment.

Load fastening facilities

- the barograph holder on right side of upper floor consists of two rubber cord clamps,
- the base for fastening the photo-camera holder is provided on the right side of the canopy frame by its rectangular extension. The holder, depending on camera type, can be screwed to the base by means of screws or self-tapping screws,
- holder for hanging the assembling wrench is provided in a form of pivot glued up into the fuselage shell, above the upper luggage compartment. The assembling wrench hole should be placed on pivot, elastically pressed, and secured with safety pin.

1.2. *Technical data of glider*

WING					
Span		15	[m]	49.2	[ft]
Area		12.51	[m^2]	134.7	[sqft]
Aspect ratio		18		18	
Root chord		1.115	[m]	3.658	[ft]
Tip chord		0.440	[m]	1.444	[ft]
Mean Standard Chord		0.880	[m]	2.887	[ft]
Aileron span		2.5	[m]	8.2	[ft]
Aileron area		0.315	[m^2]	3.39	[sqft]
Area of airbrake single plate		0.2	[m^2]	2.15	[sqft]
HORIZONTAL TAILPLANE					
Span		2.75	[m]	9.02	[ft]
Area		1.55	[m^2]	16.68	[sqft]
Area of both elevator halves		0.465	[m^2]	5.005	[sqft]
VERTICAL TAILPLANE					
Height		1.3	[m]	4.265	[ft]
Area		1.14	[m^2]	12.27	[sqft]
Rudder area		0.46	[m^2]	4.95	[sqft]
FUSELAGE					
Length		6.69	[m]	21.95	[ft]
Height		1.57	[m]	5.15	[ft]
Cockpit width		0.62	[m]	2.03	ft]
Cockpit height		0.87	[m]	2.85	[ft]
MASSES					
Empty glider mass with equipment	min.	200	[kg]	441	[lb]
	max.	240	[kg]	529.2	[lb]
Payload mass	max.	140	[kg]	308.7	[lb]
Max. all-up mass		380	[kg]	838	[lb]
Wing loading	from	20.4	[kg/m^2]	4.18	[lb/sqft]
	to	30.4	[kg/m^2]	6.23	[lb/sqft]
Wing mass	min.	105	[kg]	231.5	[lb]

*) EMPTY GLIDER WITH THE EQUIPMENT NECESSARY FOR FLIGHT CONTAINS :

- set of instruments acc. to item 1.1. page 1.3.
- seat pillow,
- pilot's belts,
- two towing hooks of SZD or TOST type.

Note: THE "FACTORY EQUIPMENT NECESSARY FOR FLIGHT" IS THE EQUIPMENT, THE GLIDER IS OFFERED THE CUSTOMER WITH.

SECTION 2

2. ASSEMBLING AND DISASSEMBLING OF GLIDER AND ITS COMPONENTS

2. ASSEMBLING AND DISASSEMBLING OF GLIDER AND ITS COMPONENTS

2.1. General

Before assembling of all components, the mating surfaces of connections should be cleaned and lubricated.

2.2. Wing / fuselage rigging and de-rigging

Rigging and de-rigging of the wing can be performed by 3 persons. Sequence of operation :

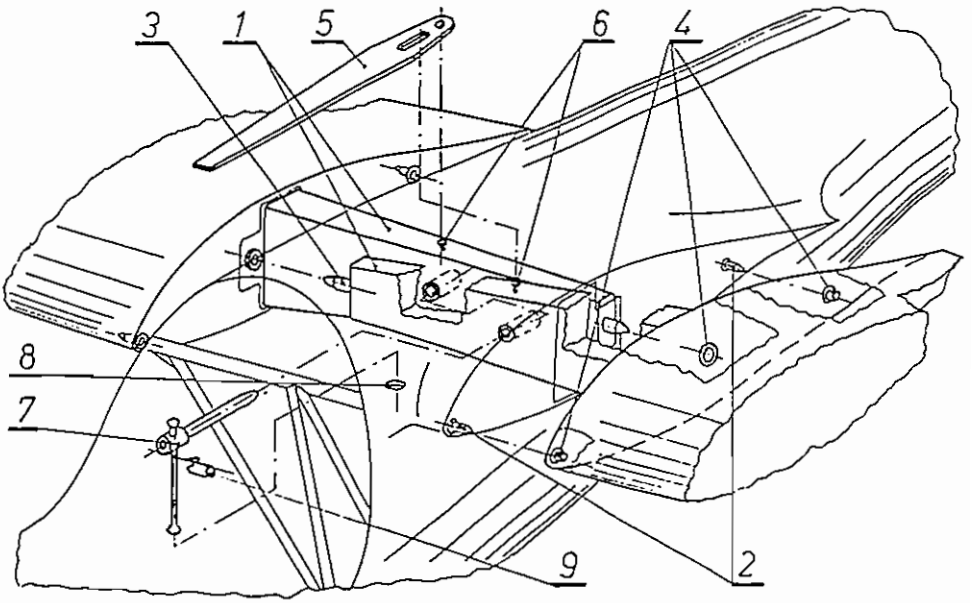
- put the airbrake control grip into its front position, set the stick neutral,
- retract the airbrake plates, set the ailerons neutral,
- shove the ends (1) of wing spars into the fuselage.

  In continued wing motion, the pivots (2) protruding out of the framework and the pivots (3) of spars should enter proper nests (4) on wing ribs.
- hitch the assembling lever (5) on the feets (6) of spars, and pull the wings onto the fuselage,
- connect the wigs by means of bolt (7), and secure it with pin inserted into hole (8) and lock with safety pin (9),
- the control systems of airbrake and aileron connect automatically when inserting the wings.

Note: AFTER RIGGING, CHECK THROUGH THE INSPECTION HOLE IN FUSELAGE THE CORRECT COUPLING OF AIR BRAKE AND AILERON CONTROL SYSTEMS.

- wing de-rigging requires the reverse sequence.

Fig. 2/1 Wing / fuselage rigging



1 - Spar ends
2 - Framework pivots
3 - Spar pivots
4 - Nests
5 - Assembling lever
6 - Feet
7 - Bolt
8 - Opening in the floor
9 - Safety pin

2.3. Disassembling and assembling of aileron (see Fig. 2/2)

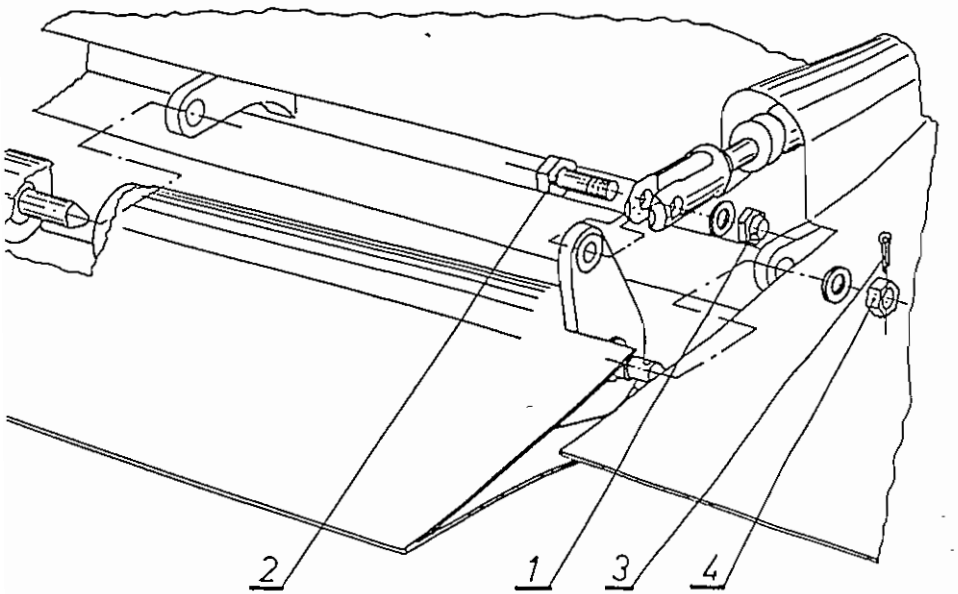
Disassembling of aileron shall be performed as follows :

- disconnect the aileron control system removing the nut (1) and screw (2), one connecting the push-rod end with aileron lever,
- take off the split pin (3) and remove the nut (4),

Note: IN EACH ASSEMBLY PROCEDURE A NEW SPLIT PIN (3) SHALL BE USED(EXPENDABLE DETAIL).

- deflect the aileron down completely, and axially shift it outside,
- aileron assembling requires the reverse sequence.

Fig. 2/2 Aileron assembling



1. Nut
2. Screw
3. Safety pin
4. Nut

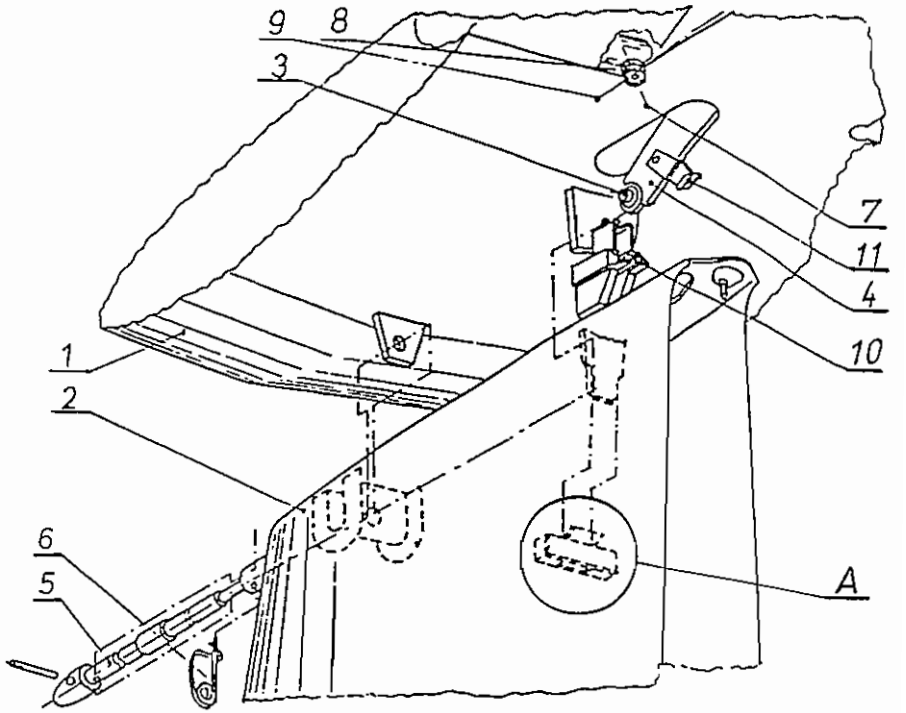
2.4. Tailplane rigging and de-rigging (see Fig. 2/3)

Rigging of horizontal tailplane shall be performed as follows :

- put the handle of spring trimming in cockpit into its front position,
- put the tailplane (1) on the fin (2), with elevator deflected upwards. Pay attention that the rollers (3) of elevator lever slide into the guides (10) of the push-rod end,
- connect the fittings inserting the bolt (5) into the hole in fin leading edge, and secure it with safety pin (6).

Tailplane de-rigging requires the reverse sequence.

Fig. 2/3 Tailplane rigging



1. Horizontal tailplane
2. Fin
3. Roller of elevator lever
4. Elevator lever
5. Bolt
6. Safety pin
7. Screw
8. Nut
9. Split pin (expendable)
10. Roller guide
11. Stop

2.5. Disassembling and assembling of elevator (see Fig. 2/3)

Disassembling of elevator shall be performed as follows :

- remove the split pin (9), undo the nut (8) and take out the screw (7), one fixing the elevator to the elevator control lever suspended in the fin,

Note: IN EACH ASSEMBLY PROCEDURE A NEW SPLIT PIN (3) SHALL BE USED (EXPENDABLE DETAIL).

- take the elevator off the hinges, sliding it axially outwards,

- elevator assembling requires the reverse sequence.

2.6. Disassembling and assembling of rudder (see Fig. 2/4)

Disassembling of rudder shall be performed as follows :

- disconnect the rudder control cables (1) removing the split pin (2), undoing nut (3) and removing screw (4), one fixing the cable end to the rudder lever,

Note: TO SECURE THE CABLES AGAINST PULLING THEM INTO THE FUSELAGE IT IS RECOMMENDED, BEFORE DISCONNECTION OF CABLES, TO FASTEN THE PEDAL BY STIRRUPS TO E.G. INSTRUMENT PANEL COLUMN.

- remove the split pin (5) and undo the screw (6) of lower hinge,

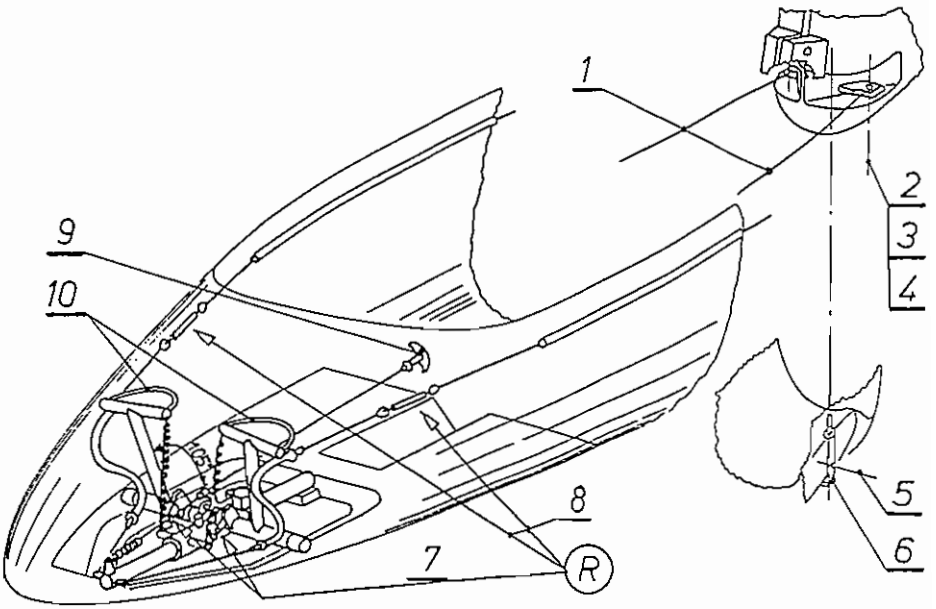
Note: THE SCREW (6) IS UNREMOVABLE AND, WHEN LEAVING THE SLEEVE THREAD, IT HANGS ON THE INNER STOP.

Note: IN EACH ASSEMBLY PROCEDURE A NEW SPLIT PINS SHALL BE USED (EXPENDABLE DETAIL).

- deflect the rudder backwards on upper articulated hinge and take off the rudder axially downwards,

- rudder assembling requires the reverse procedure

Fig. 2/4 Rudder assembling



1. Cables of rudder control system
2. Split pin
3. Nut
4. Screw
5. Split-pin
6. Screw
7. Screw stops of pedals
8. Turnbuckles
9. Hand-grip
10. Pedal stirrups

2.7. Disassembling and assembling of main wheel (see Fig. 2/5)

The main wheel ∅400x140 mm (15.8x5.5 [in]) is suspended by means of the axle and two distance sleeves on two fuselage framework joints, protruding out of the fuselage contour.

The wheel hub is of two parts with the disc brake.

The access to the inflate valve is by the hole in the brake disc on the right side of fuselage. For inflating the tube the special end is supplied together with the glider.

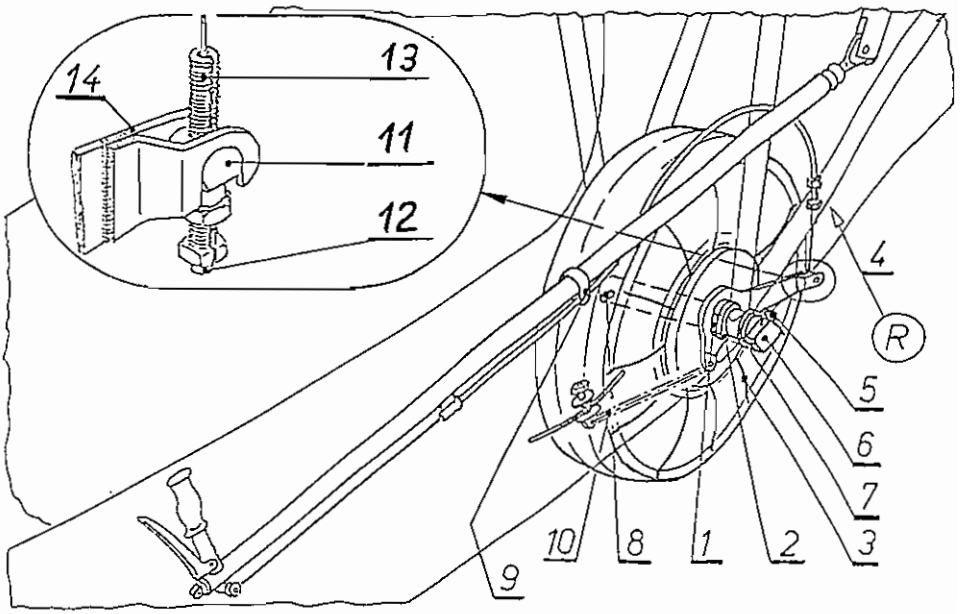
The pressure measurement is possible e.g. by means of motor-car pressure gauge.

Disassembling of wheel, tyre and tube :

- Remove the securing brass wire (5), undo and remove the screw (6) with washer (7) connecting the wheel axle with framework,
- Disconnect the wheel brake control system. Sequence of operation :
  - disconnect spring (10) from brake lever (14),
  - in a cockpit, dismount the end of tension member from the lever pin,
  - screw out the adjusting screw (13) of the pin (11),
  - dismount the adjusting screw (13) from cable,
  - remove the cable end from pin (11),
  - slip-off the pin (11) from brake lever (14),
- Take-off the axle and remove the hub,
- Remove the brake disc out of the hub,
- Screw-off the brake disc from the hub
- Remove the nuts and take-off the 3 screws connecting both hub halves - remove the tyre and tube.
- Wheel assembling requires the reverse sequence.

Note: BEFORE ASSEMBLING BOTH HALVES OF HUB WITH TYRE AND TUBE, THE TUBE SHOULD BE SLIGHTLY INFLATED. THE BRAKE DISC WITH NUT FOR AXIAL PLAY ADJUSTMENT SHOULD BE POSITIONED ON THE TUBE VALVE OUTLET SIDE OF THE HUB.

Fig. 2/5 Main wheel assembling



1. Adjusting nut
2. Counter-nut
3. Radial splines
4. Bowden's end
5. Securing wire
6. Special screw
7. Washer
8. Axle
9. Clamp
10. Spring
11. Pin
12. Cable end
13. Adjusting screw
14. Brake lever

2.8. Disassembling and assembling of tail wheel

The tail wheel axle is in the form of special screw. To disassemble, deflect the securing washer and undo the nut, and next remove the screw-axle.

Assembling requires the reverse sequence.

2.9. Disassembling and assembling of front skid

To protect the structure of fuselage front lower part against an abrasion the small steel skid with rubber shock absorbing block is installed.

The disassembling of the front skid and rubber block is possible when two nuts, visible on the bottom of front floor well, are removed.

The access to the nuts is enabled by disassembling the instrument panel base.

Assembling requires the reverse sequence.

2.10. Disassembling and assembling of instrument panel (see Fig. 2/6)

- Remove the screws fastening the cover of instrument panel to the fuselage boards and lift the cover.

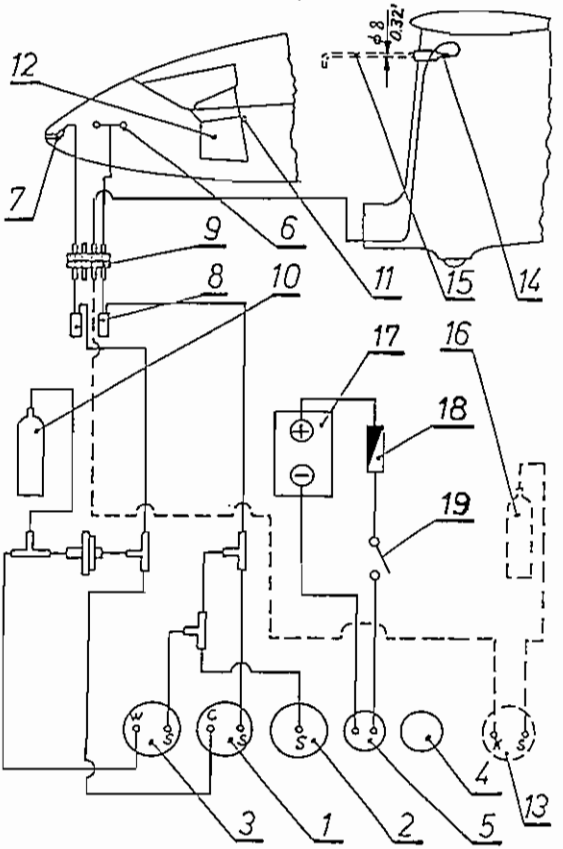
Note: IT IS NOT NECESSARY TO DISASSEMBLE THE TOWING CABLE RELEASE HANDLE SUSPENDED ON THE COVER OF INSTRUMENT PANEL

- Shift-off the cockpit air conditioning duct from the outlet nest in the instrument panel.
- Put the canopy outside till it hangs on the towing release cable.
- Disassemble the duct connector (9)

Note: BE SURE THAT THE O-RING SEALS DID NOT FALL OUT OF THE BODY OPENINGS.

- Remove the screw (11) fixing the instrument panel to its base (12) and "pull-back" the panel.
- Assembling requires the reverse sequence.

Fig. 2/6 Instrument panel installation



1. Airspeed indicator PR-250S Seria B*
2. Altimeter W10s or W12s
3. Variometer WRS-5D
4. Compass BS-1
5. Turn and slip indicator EZS-4
6. Static pressure heads
7. Total pressure head
8. Drainage unit
9. Connector of ducts
10. Bottle W450
11. Screw
12. Instrument panel column
13. Electro-variometer **
14. K= -1 head nest**
15. K= -1 head**
16. Bottle**
17. Battery 12 V
18. Fuse element 0.5÷0.7 A
19. Switch

*) Or alternatively PR-400S-A

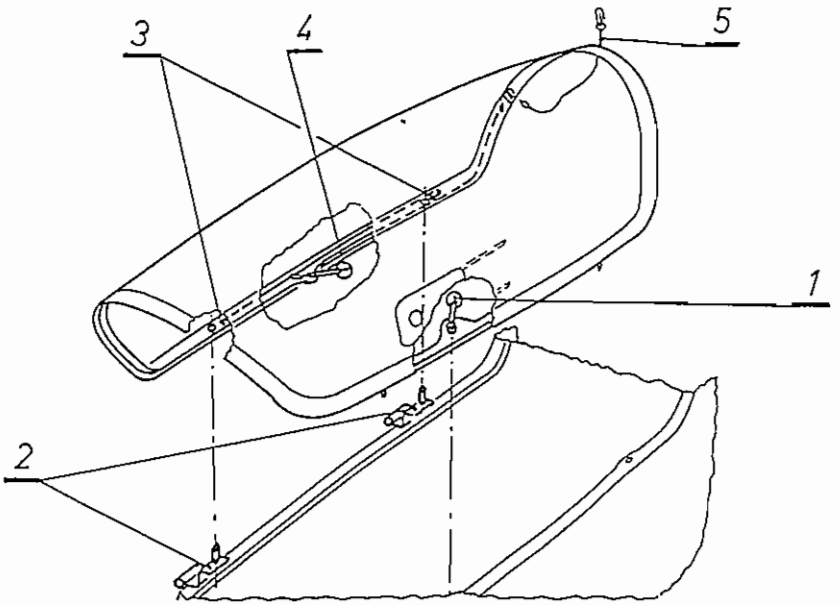
**) Optional equipment

2.11. Opening and emergency jettison of canopy (see Fig. 2/7)

The mechanism of opening and emergency jettison of the canopy consists of :

- canopy lock (1) equipped with ball click, securing the locked position,
- two hinges on the right side (2), to which the canopy frame is fastened by means of two pins (3), in emergency shoved out by the emergency jettison lever (4),
- cable (5) limiting the open position of canopy, coupled with emergency jettison control system.

Fig. 2/7 Canopy assembling



1. Canopy lock
2. Hinges
3. Pins
4. Emergency jettison lever
5. Limiting cable

2.12. Access for disassembling and assembling of control systems elements

All control system elements can be disassembled without disintegration of the structure, except of:

- elevator control lever,
- air brake arms,
- short cable in pedals.

SECTION 3

3. TECHNICAL PARAMETERS, TOLERANCES AND ADJUSTMENT

3.1. Technical parameters

3.2. Allowed plays and tolerances in control systems of glider, and in assembling connections of its components

3.3. Adjustment of control systems and glider components

3.4. Painting of external surfaces

3. TECHNICAL PARAMETERS, TOLERANCES AND ADJUSTMENT

3.1. Technical parameters

3.1.1. Undercarriage wheels pressure

Main wheel: 0.15 [MPa] which, for the empty glider, corresponds to the tyre to hard ground contaet length (wings level) equal to the distanee between the two adjacent radial splines (see item 3 in Fig. 2/5, page 2.9).

Tail wheel: 0.15 [MPa].

3.1.2. Rudder cable tension

(see Fig. 2/4, item 1, page 2.7).

For pedals neutral and $293^{\pm 5}$ K ($20^{\pm 5}$ °C) temperature the rudder cable tension should be 10 daN (22 [lb]).

3.1.3. Allowed forces for controls operation

Control system	Force measurement	Allowable force
Aileron	on stick tip to left and to right between stops	0.8÷2.0 [daN] (1.8÷4.4[lb])
Elevator	on stick tip forwards and backwards between stops, without action of trimming spring	0.5÷1.5 [daN] (1.1÷3.3[lb])
	as above, and with disconnected both elevator and push-rod in the fin	0.3 [daN] (0.66 [lb])
Rudder	on the upper pedal foot	10 [daN] (22 [lb])
Air brake	on the center of handgrip	2.0÷20 [daN] (4.4÷44.1[lb])
Hooks	release handgrip	min. 2.0 [daN] (4.41 [lb]) max. 20 [daN] (44.1 [lb])
Emergency canopy jettison	left and right handgrip of emergency canopy jettison	max. 20 [daN] (44.1 [lb])

3.2. Allowed plays and tolerances in control systems of glider, and in assembling connections of its components

3.2.1. Allowed plays in control systems

Note: AT THE FOLLOWING POINTS, DURING THE OPERATION, THE EXCESSIVE PLAYS CAN APPEAR. IN CASE THE PLAYS EXCEED THE GIVEN BELOW VALUES, THE INSTRUCTIONS CONTAINED IN REPAIR MANUAL SHOULD BE FOLLOWED.

Element of control system free	Element of control system locked in neutral position	Play to be measured at	Allowed play	
			Direction from neutral position	value
control stick	elevator	stick tip	forwards / rearwards	3 [mm]
	aileron		to left / to right	2.5 [mm]
elevator	control stick	elevator trailing edge, aceord. to B-B on Fig. 6/2	upwards / downwards	2.5 [mm]
aileron		aileron trailing edge at inboard end	upwards / downwards	3 [mm]

3.2.2. *Allowed plays in assembling connections of the glider*
(see also NOTE item 3.2.1.)

Connection	Mating elements	Allowed play (radial)
1	2	3
spar-spar	bolt and sleeve	0.1 [mm] (0.039 [in])
stabilizer-fin	bolt and sleeve of front nest	0.1 [mm] (0.039 [in])
	bolt and sleeve of rear nest	0.1 [mm] (0.039 [in])
	bolt and sleeve of stabilizer rear fitting	0.1 [mm] (0.039 [in])
	mating surfaces of stabilizer rear fitting in fin spar, and these of positioning fitting in fin spar	0.2 [mm] (0.078 [in])
wing-fuselage (wing with articulated joint nest)	framework pivots and wing articulated joint nest	0.12 [mm] (0.047[in])
	spar pin and wing articulated joint nest	0.15 [mm] (0.059[in])
wing-fuselage (wing with fixed sleeves)	framework pivots and sleeves in wings	0.10 [mm] (0.039[in])
	spar pins and wing sleeves	0.10 [mm] (0.039[in])

3.2.3. Allowed values of wing/fuselage gap measured under load

Variations in this gap measured on nose and trailing edge of the wing should not exceed 0.5 [mm] (0.197 [in]) and 1.5 [mm] (0.591 [in]), respectively - for alternate wing tip loading in wing chord plane with 10 [daN] (22 [lb]) force.

3.2.4. Allowed axial play (along the bolt - item 5, Fig. 2/3, page 2.5.) of the tailplane assembled on the fin

It shall not exceed 0.5 [mm] (0.2 [in]). When moving the tailplane tip up and down, no knocking can appear as a result of play between the "T" fitting end and its fixture (see detail "A" in Fig. 2/3, page 2.5).

3.2.5. Allowed periphery play in aileron and airbrake control system clutches at wing/fuselage connection

It shall not exceed 0.1 [mm] (0.039 [in]).

3.2.6. Allowed slot between the aileron and wing apron

It shall be max. 0.5 [mm] (0.02 [in]).

3.2.7. Allowed axial play in aileron hinges

It shall be max. 0.2 [mm] (0.008 [in]).

3.2.8. Slot between the aileron and wing trailing part

It shall be 1 [mm] (0.039 [in]), on each side.

3.2.9. Allowed radial play in elevator hinges

It shall be max. 0.1 [mm] (0.004 [in]).

3.2.10. Allowed radial play in the joint of elevator ends with torsion tube

Shall be max. 0.05 [mm] (0.002 [in]).

3.2.11. Allowed radial play in rudder hinges

It shall be max. 0.1 [mm] (0.004 [in]).

3.3. Adjustment of control systems and glider components

3.3.1. Adjustment instruction

The main eontrol systems are shown on Fig. 2/4, 2/5, 3/1, 3/2, 3/3, and 3/4, where the push-rod ends, turnbuckles and serews used for adjustment of control systems are marked with sign "R", as well as the neutral lever locations are given.

When adjusting the turnbuckles, the thread of ends may not remain visible.

When adjusting the push-rod ends, care should be taken that the eheek-holes in tubes are closed with the thread of end.

The adjustment is to be done in case of exeessive deviation in deflections, or incorrect positions of devices. Control surfaees defleetion are given on Fig. 6/2.

Having completed the adjustment, the concerned element shall be loeked again.

3.3.2. Adjustment of elevator control system (Fig. 3/1, page 3.7).

The push-rod system consists of stick (4) mounted in control column, three duralumin push-rods, and of two intermediate levers suspended on fuselage framework and on fin spar, as well as of elevator actuating lever suspended in stabilizer. The long push-rod in fuselage tube is guided by three roll-eyes.

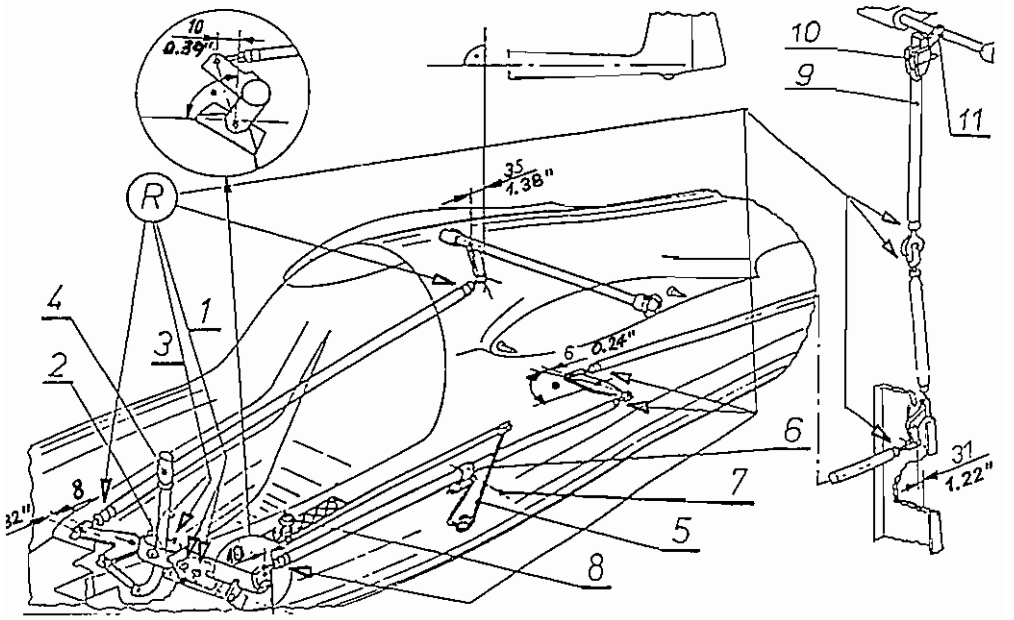
The last, third push-rod of a system located in the fin consists of two sections:

a) upper (9) - guided in two roll-eyes, and secured against rotation with the shape guide. This is equipped at the top end with guide (10) of lever rolls (11) used in automatic coupling of elevator control.

b) lower - connecting the upper section with intermediate lever

The elevator defleetions are adjusted by means of screw stops (1) on control column bracket (2), or with push-rod end.

Fig. 3/1 Control systems for rudder, aileron and trimming device



1. Screw stops of control column
2. Control column bracket
3. Screw stops of stick
4. Control stick
5. Trimming spring
6. Clamp
7. Split pin
8. Hand-grip
9. Push-rod upper section
10. Guide
11. Lever with rolls

3.3.3. Adjustment of trimming device - (Fig. 3/1, page 3.7).

Spring trimming device is used. The trimming spring (5) suspended on tarnamide sleeve is fastened to e.g. hook housing. The shorter spring end is rotary supported in clamp (6), fastened to elevator control push-rod and factory-secured against shifting by means of splint-pin (7). The longer spring end, actuated by duralumin push-rod, fitted with the spring-grip (8), to be set by a pilot in one of 11 adjustable locations in trimming retainer.

The adjustment of spring trimming consists in modification of spring ends (5) camber. The characteristics of properly shaped spring is such that, when trimmed:

- "tail-heavy" - elevator is maintained neutral,
- "nose-heavy" - a force required to pull the stick "back", resulting of initial spring tension, is 1.7 ±0.1 [daN] (3.75±0.22 [lb]) (measured on stick end).

The characteristics of spring trimming is to be verified, having previously measured the friction forces in elevator control system acc. to item 3.1.3.

Operation sequence for adjustment of spring-grip (8) location in trimming retainer:

- press on the grip ball, to unlock the control system,
- slide the grip forth or back,
- release the grip ball, to lock the control system.

Note: THE SYSTEM LOCKS AUTOMATICALLY AS A RESULT OF SPRING ACTION INSIDE THE GRIP. TO CHECK THE RELIABILITY OF LOCKING, IT IS RECOMMENDED TO PULL THE GRIP BALL UP.

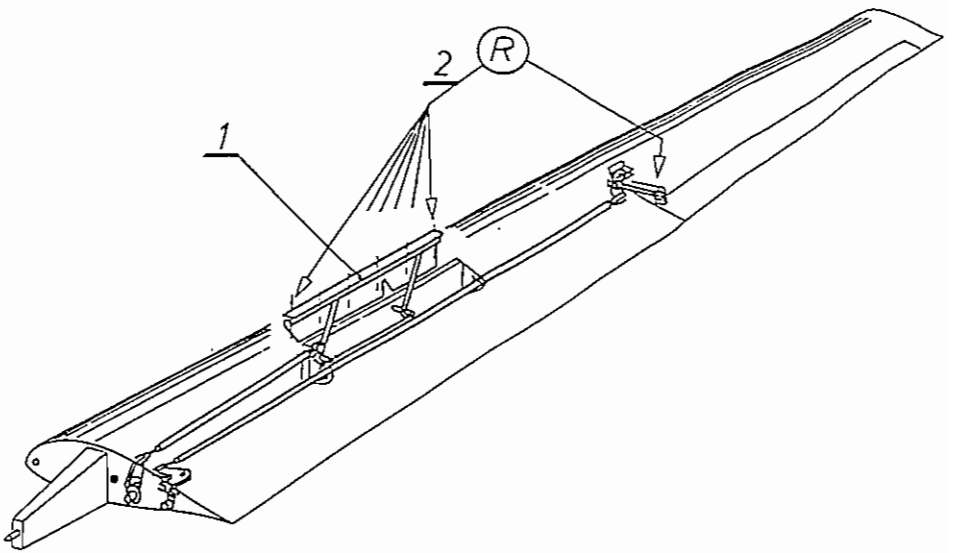
3.3.4. Adjustment of aileron control (Fig. 3/1, page 3.7, Fig. 3/2, page 3.9).

In fuselage portion, a push-rod type control system consists of stick (Fig. 3/1 item 4) rotary suspended in the control column, short connector, intermediate lever suspended in the front floor, and of duralumin push-rod actuating the torque tube, connected with the wing system by means of dog clutch.

The control system in wing consists of connector, intermediate lever suspended on root rib, long duralumin push-rod guided in two roll pass-by, intermediate lever suspended on the spar web and of short push-rod actuating the aileron. Differential aileron deflection is obtained in the wing portion of control system.

The aileron deflections are adjusted by means of screw stops (3) on the stick or by means of adjustable push-rod ends.

Fig. 3/2 Control system for aileron and air brake in wings



1. Cap of air brake plate
2. Springs of cap

3.3.5. Air brake control adjustment (Fig. 2/5 page 2.9, Fig. 3/2 page 3.9).

System of push-rod type. In fuselage (Fig. 2/5, page 2.9) it consists of duralumin push-rod with hand-grip, actuating the torque tube connected with the wing system by means of dog clutch.

In wing (Fig. 3/2, page 3.9) the control system consists of conical gear, duralumin push-rod actuating the inboard airbrake arm, coupled with the outboard one by means of connector. The airbrake plate with cap (1) pressed to the plate by means of springs (2) is fitted to the arms.

The tension of springs (2), pressing the caps (1) to the plates, is adjustable by means of nuts tighten-up. With airbrake retracted, the springs should be tensioned so to obtain the initial cap tension of approx. 2 [daN] (4.41 [lb]) (measurement of the force applied to the eap at spring location).

3.3.6. Rudder control adjustment (Fig. 2/4, page 2.7).

Cable control system consists of pedals and long cables actuating the rudder. Cables are of Bowden type Ø3.1 [mm] (0.122 [in]) W1x19-160 or 180, acc. to standard : PN-73/M-80239, with tightened ends. The end to eable joints are marked with red paint.

The cable is guided in polyamide tube Ø10x1 [mm] (0.394 x 0.039 [in]), resined to the fuselage shell.

In pedals there are the short sections of aircraft cables Ø3 mm (0.118 [in]) guided in polyamide tube Ø8x1 [mm] (0.315x0.039 [in]) of "S" shape.

The cable circuit is opened one and the cables are tensioned by two springs on pedals. In pedals neutral position the tension of 10 [daN] (22.1 [lb]), at temperature of 293±5 K (20±5 °C) (68±9 °F) is ensured.

The rudder deflection and the angle of pedals neutral position are adjusted by means of screw stops (7) on pedals.

The rudder neutral position is adjusted by means of turnbuckles (8).

Note: WITH PEDAL FULLY DEFLECTED, THE PLAY BETWEEN THE DEFLECTED RUDDER AND THE STOP ON THE FIN SPAR SHOULD BE SENSIBLE. (This corresponds to the extra rudder deflection of about 5 [mm] (0.2[in]) measured at the bottom of rudder trailing edge).

Note: AFTER DEFLECTION ADJUSTMENT CHECK THE PLAY BETWEEN THE FULLY DEFLECTED RUDDER AND ELEVATOR - MINIMUM 2 mm (0.079 [in]).

Note: ON FINDINIG THE CABLE CORROSION, BREAK OF EVEN ONE WIRE, OR THE CABLE SLACKED OUT OF THE END, THE CABLE SHALL BE REPLACED.

The longitudinal pedals position is to be adjusted as follows :

- unlock by pulling the hand-grip (9) - (the first phase of grip movement),

- pulling the grip further results in the backward movement of pedals

IT IS RECOMMENDED TO HELP WITH LEGS - PULL WITH THE FOOT FINGERS ON THE PEDAL STIRRUP (10)

- to shift forwards, push the unlocked with hand-grip pedals by legs,
- releasing hand-grip (9) results in pedals locking. The excess of tension-member length is reduced by the spring.

3.3.7. Main wheel brake adjustment (Fig. 2/5, page 2.9)

The disc brake is controlled by means of Bowden cable, suspended on the airbrake push-rod by means of clamp (9).

The cable is connected with the brake lever(14) on the wheel by means of the special pin (11).

The lever is retained in initial position with spring (10).

The brake control system is adjusted by means of:

- adjusting screw (13), accessible on the end of air brake lever(14),
- adjusting nut (1) and counter-nut (2) on the left side of hub axle, provided for correction of brake disc axial play, appearing as a consequence of disc-lining wear.

Note: THE AXIAL PLAY HAS AN EFFECT ON ANGLE OF BRAKE LEVER MOVEMENT (ON THE WHEEL). THE ADJUSTED LENGTH OF CABLE SHOULD NOT RESULT IN CHANGE TO WHEEL LEVER POSITION, IN RESPECT TO INITIAL ONE.

3.3.8. Hook control system adjustment (Fig. 3/3, page 3.12; Fig.3/4, page 3.13)

The hooks are controlled by aircraft cables ∅2 [mm] (0.079 [in]). In the system the pulley gear (Fig. 3/3) is employed to decrease the release force.
The spring loaded release hand-grip (Fig.3/3) touches the elastic end resined to the instrument panel cover. From the housing of pulley gear (5) the cables (1) extend to the front and bottom hooks (through the pass-by tubes).

Connection of cable ends with hooks is shown on Fig. 3/4.

The control system of front hook needs no adjusting. The bottom hook control system is to be adjusted by means of adjustable Bowden cable end (4) (the lost movement of hand grip - Fig. 3/3).

Possible installation

The installation of the front (2) and c.g. (3) hooks on the glider is allowed (Fig. 3/3) in one of the three combinations:

- SZD-III A 56P front hook and SZD-III A 56P bottom hook without self-releasing device,
- TOST EUROPA E 85 front hook and TOST EUROPA G 88 bottom hook with self- releasing device.
- SZD-III A 56P front hook and self-releasing TOST EUROPA G 88 bottom hook.

The glass-fibre hook housings are factory adapted for installation of both hook types, i.e. of SZD-III and TOST (Fig. 3/4 "A", "B").

The type of installed bottom hook is marked with the placard in cockpit, (Fig. 14/2 items 18 or 19). When the hook is replaced, the placard should be changed for actual one.

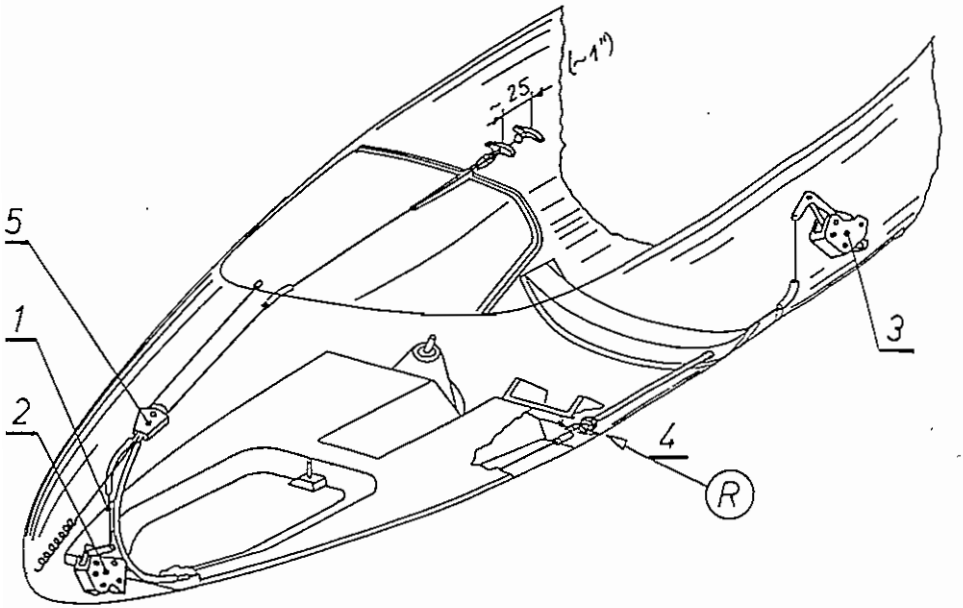
3.3.9. Fitting for bungee take-off

On each glider the tail fitting is installed, which can be used for anchoring as well.

The place for installation of bungee take-off hook (supplied to the customer order) is provided in the bottom of fuselage, behind the rubber cover of front-hook under the rectangular offset of front floor. The installation is shown on Fig. 3/4 "A". The hook is installed by means of four M5 screws (2) of "45" steel.

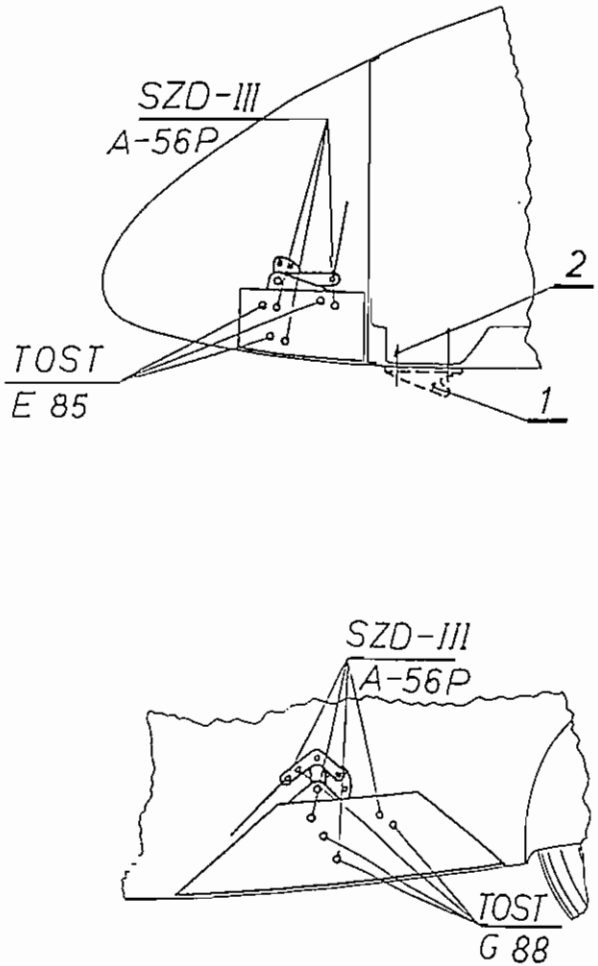
The hook installation can be made by the user himself. In this case the hook with screw set is delivered by the producer. The installation of the hook made by the user himself shall be recorded in the glider Log Book and approved by the local Airworthiness Authority.

Fig. 3/3 Control system of hooks



1. Cables of towing hook control system
2. Front hook
3. Bottom hook
4. Bowden adjusting end
5. Housing of pulley gear

Fig. 3/4 Possible installation of SZD-III and TOST hooks



1. Bungee take-off hook
2. Screws M5

3.3.10. Pilot's belts and their adjustment

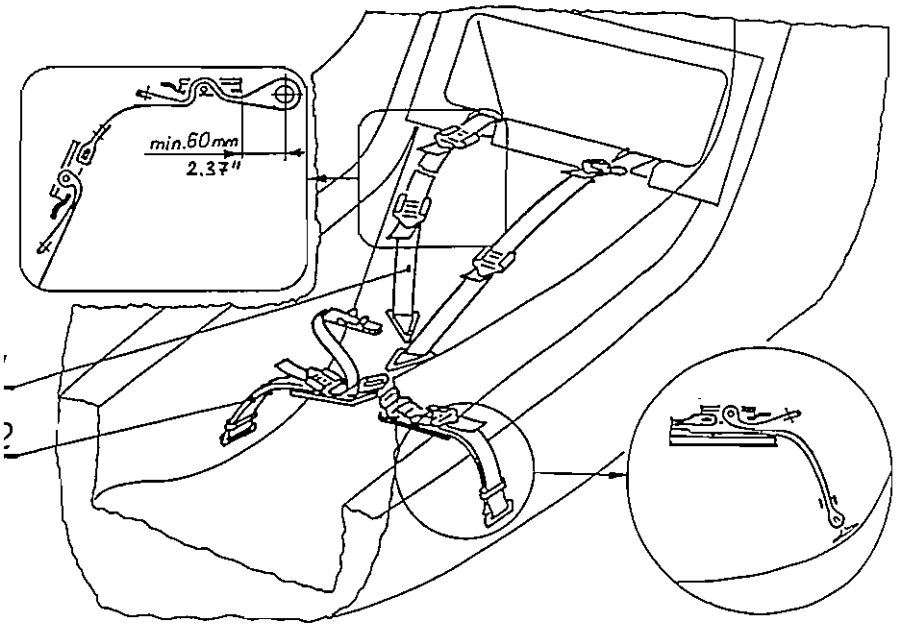
Four piece belts (of PZL-Bielsko production) :

- shoulder belts (1) of CT.J5:70.00 L 700 type
- abdomen belts (2) of CT.J5.10.00 L 450 type.

The belt length is adjustable.

Note: WHEN ADJUSTING THE SHOULDER BELTS THE MINIMUM FATTENING LENGTH OF 60 [mm] (2.36 [in]) SHALL BE ENSURED acc. to Fig. 3/5.

Fig. 3/5 Pilot's belts



1. Shoulder belt
2. Abdomen belt

3.4. Painting of external surfaces

The external surfaces of glider should have the white, not getting yellow, painting coats.

On upper surfaces of wings and tailplane no colour markings are allowed.

SECTION 4

4. LIST OF TOOLS

4.1. Special tools

4. LIST OF TOOLS

4.1. Special tools

For ground servicing each glider is equipped with the set of special tools :

- assembling lever for rigging the wings,
- two special wrenches for adjusting the wheel brake,
- special end for inflating the main wheel.

SECTION 5

5. LUBRICATION INSTRUCTION

5.1. General

5.2. Elements to be lubricated

5.3. Elements to be not lubricated

5. LUBRICATION INSTRUCTION

5.1. General

All rolling and sliding bearings and assembling elements, as well as cables in Bowden's housing, are subject to lubrication.

The lubrication scheme is shown on Fig 5/1, page 5.3.

5.2. Elements to be lubricated

5.2.1. Lubrication of rolling and sliding bearings, and of elevator control coupling

The rolling and sliding bearings and coupling of elevator control should be lubricated with a general application grease for rolling bearings : ŁT 43 PN-72/C-96-134.

The substitutes are the US greases, namely :

- SHELL - Alvania G2, Alvania R2
- MOBIL - Mobi Lux 2
- ESSO - Beacon 2,

Note: ALL THE ABOVE GREASES CAN BE MIXED WITH ŁT-43.

IT IS NOT NECESSARY TO REMOVE THE OLD ŁT-43 GREASE.

5.2.2. Assembling elements lubrication

The assembling elements should be greased with the high melting technical vaseline TW PN-69/C-96120.

This vaseline is of oil origin. Its kinematic viscosity at 100 °C (212 [°F]) temperature should be no less than 5 [mm^2/s] (0.197 [sqin/s]), and the chemical reaction should be neutral.

5.2.3. Lubrication of cables in Bowden's housing

The cables guided in the Bowden's housing should be lubricated with a low melting compounded oil 40Z /PN-88/C-96071.

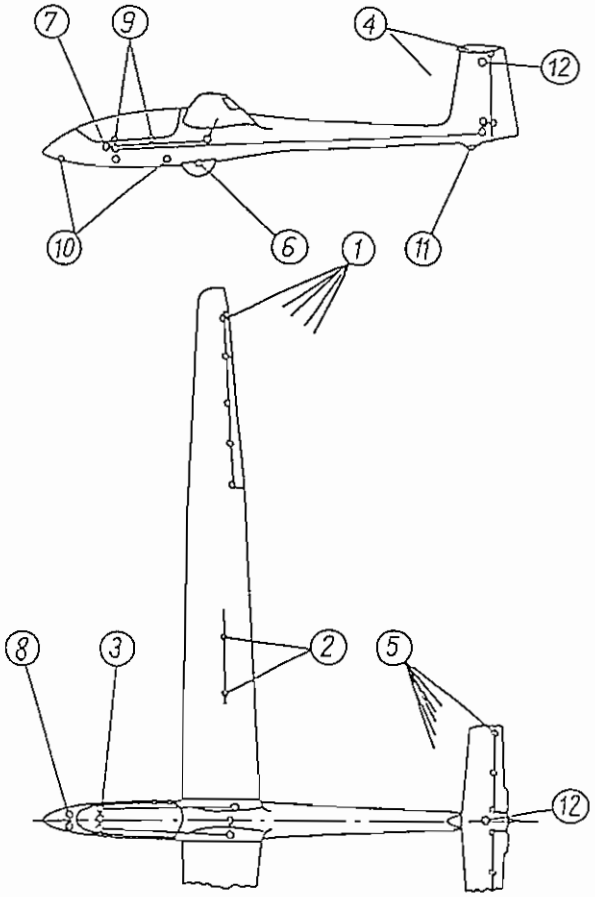
The kinematic viscosity of this oil should range 52.8 to 63.5 [mm^2/s] (8.2 to 9.86 [sqin/s]) and acid number should not exceed 0.20 [mgKOH/g].

5.3. Elements to be not lubricated

Tarnamide bearings and control cables in polyamide pipes do not require a lubrication.

Note: THE FREQUENCY OF LUBRICATION FOR PARTICULAR SETS AND DETAILS IS LISTED IN PARAGRAPHS OF SECTION 15 (PERIODIC WORKS).

Fig. 5/1 Lubrication plan



1 - Hinges (bearings) and actuating levers of aileron.

2 - Hinges of air brake plates.

3 - Bearings of control columns and these of aileron and elevator control system.

4 - Rudder hinges.

5 - Elevator hinges.

6 - Main wheel bearings.

7 - Guide and bearings of air brake control system.

8 - Bearings and guides of pedals.

9 - Locks and hinges of canopy.

10 - Towing hooks.

11 - Tail wheel bearings.

12 - Coupling of elevator control.

SECTION 6

6. GLIDER LEVELLING AND CHECKING OF CONTROL SURFACE DEFLECTIONS

6.1. Glider levelling

6.2. Checking of control surface deflections

6.3. Geometry of elevator loading-tab

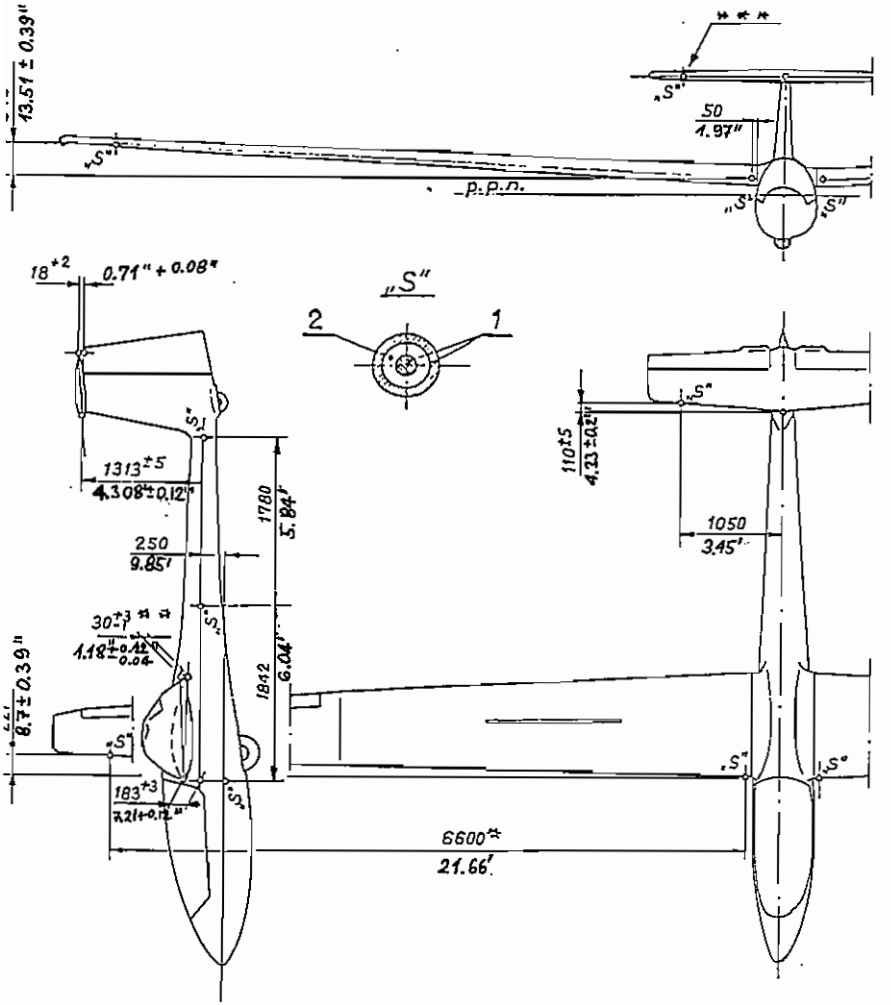
6. GLIDER LEVELLING AND CHECKING OF CONTROL SURFACE DEFLECTIONS

6.1. Glider levelling

The levelling should be carried out acc. to Fig. 6/1.

The levelling points are marked there with letter "S".

Fig. 6/1 Glider levelling



Legend :

"S" - levelling point

1. - red colour

2. - white colour

The levelling point centre is permanently marked by means of gluing up into the covering the copper wire which does not protrude out of the shell surface.

p.p.n. - levelling points plane

* - dimension in projected position

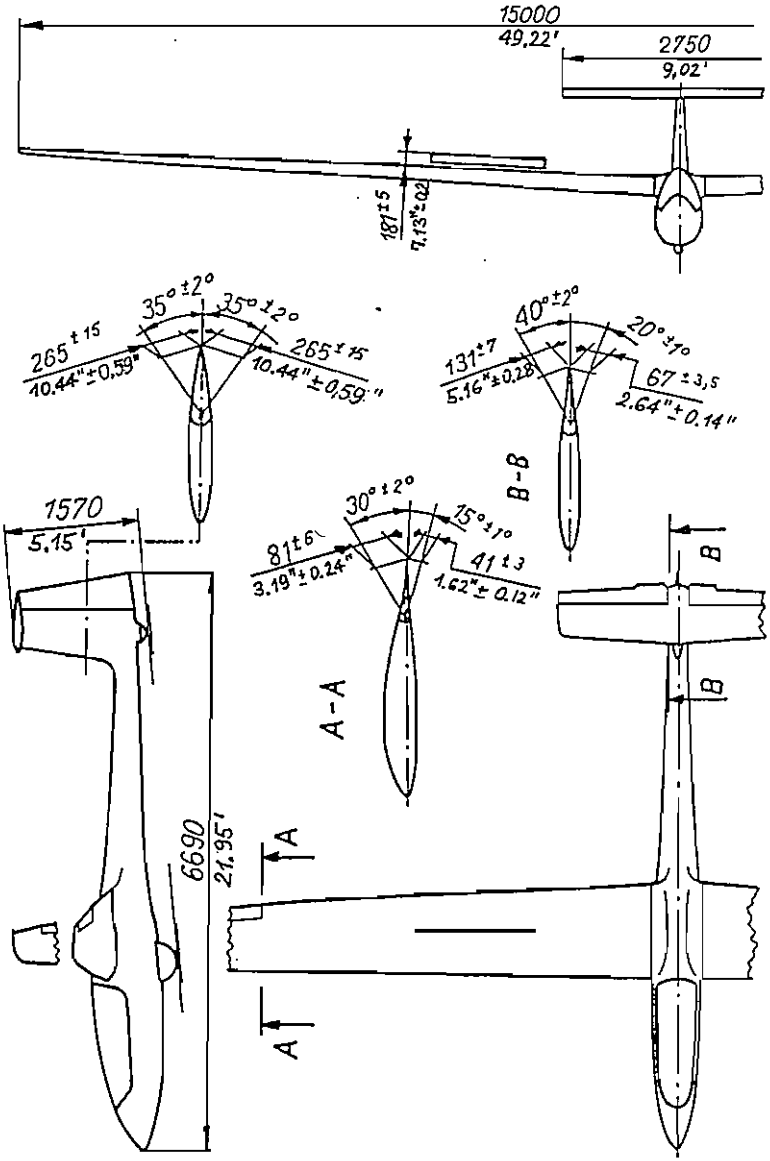
** - allowed dimension difference between the lefthand and righthand wings is max. 2 [mm] (0.079 [in])

*** - allowed difference in respect to p.p.n. is max. 10 [mm] (0.39 [in])

6.2. *Checking of control surfaces deflection*

The checking should be carried on acc.to Fig. 6/2.

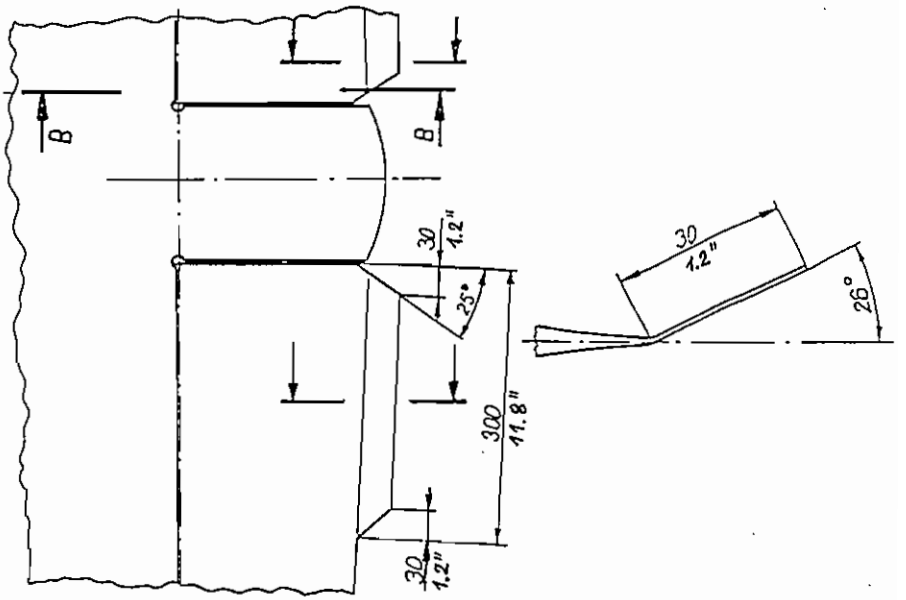
Fig. 6/2 Control surfaces deflection



6.3. *Geometry of elevator loading-tab*

The geometry should be checked acc to Fig. 6/3

Fig. 6/3 Geometry of elevator loading-tab



Note: CROSS-SECTION "B-B" - SEE Fig. 6/2

SECTION 7

7. WEIGHING THE GLIDER

7.1. Weighing procedure

7.2. Allowable range of empty glider C.G. location

7.3. Location of additional fixed equipment installation

7. WEIGHING THE GLIDER

7.1. Weighing procedure

Weighing procedure is shown on Fig. 7/1, page 7.3.

Weigh the glider using two decimal balances of ±2 [N] (±0.44 [lb]) accuracy.

The supports should be located under the main and tail wheels. The difference of height should be adjusted so that the trailing edge of wing root rib and the wing leading edge (levelling mark) are on the same level.

The C.G. position of empty glider with equipment necessary for flight, measured aft of leading edge at root rib, is :

$$X = a + b;$$

where:

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

P_1, P_2 - to be weighed

a, l - to be measured

The range of permissible C.G. locations of empty glider is shown on Fig. 7/2, page 7.4. In case the not permissible C.G. location is found, the glider shall be balanced by installing in safe manner the fixed balancing mass (1) at location shown on Fig. 7/1, page 7.3.

- In front, the lead balancing weight is screwed in, to the resined at this place screw.

- In the tail, the lead shot is resined with the composition.

The weight and location of installed ballast should be recorded in the GLIDER WEIGHING TABLE, in Flight Manual, Section 6, item 6.2.6.

The additional equipment, e.g. additional instruments to "Factory instruments set necessary for flight" - see Sec. 1, page 1.3, and glider transceiver, oxygen equipment etc., can be installed on the glider at the following locations, shown on Fig. 7/3 page 7.5. :

A. In the cockpit, near the pilot's C.G.

B. In the instrument panel

C. In the lower luggage compartment

D. In the upper luggage compartment (battery, transceiver and barograph)

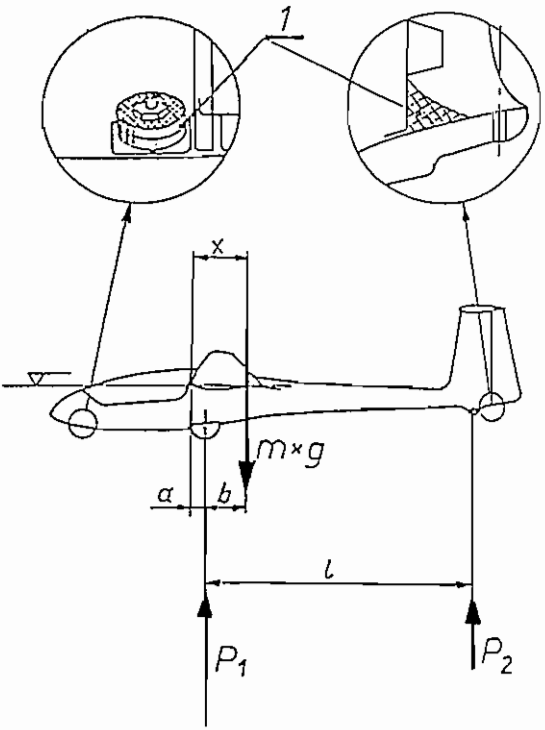
E. In central part, near the empty glider C.G. (e.g. oxygen bottle - see Fig 1/1, pg 1.5)

Notes: 1. THE LIMITATIONS FOR LOAD IN INSTRUMENT PANEL "B" AND IN CONTROL PART "E" ARE CONTAINED IN Flight Manual item 6.2.5.

2. IN BOTTOM LUGGAGE COMPARTMENT "C", THE SOFT LUGGAGE CAN BE STORED ONLY.

3. IF THE ADDITIONAL EQUIPMENT HAS BEEN INSTALLED IN THE COCKPIT, NEAR PILOT'S C.G, THE ALLOWABLE PILOT'S WITH PARACHUTE MASS IS TO BE REDUCED ACCORDINGLY.

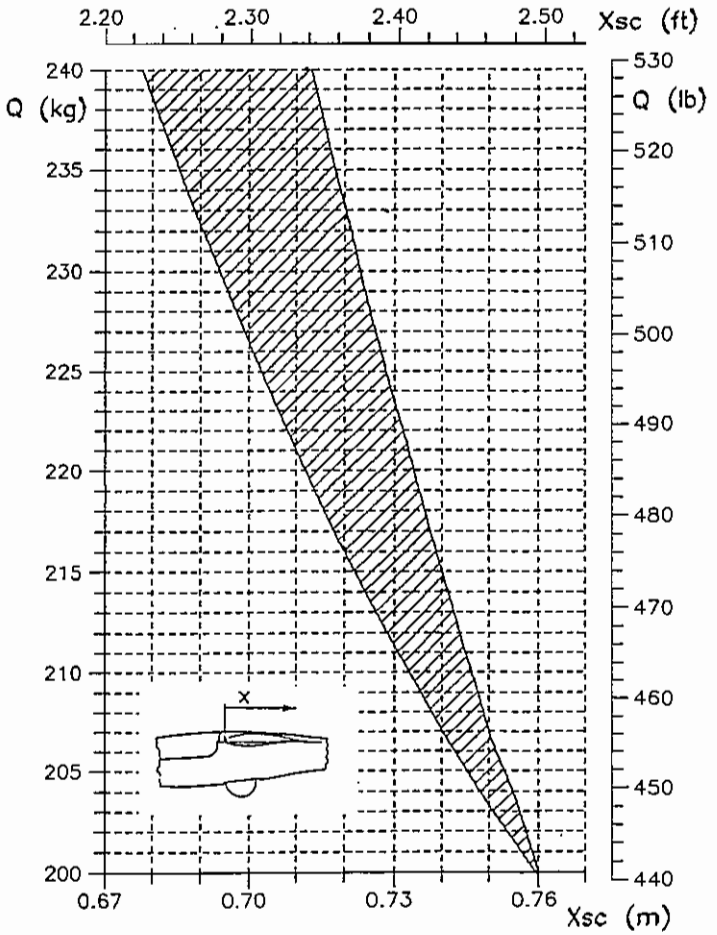
Fig. 7/1 Weighing the glider



1. fixed balancing mass

7.2. Allowable range of empty glider C.G. location

Fig. 7/2 Allowable range of empty glider C.G. location
in respect to leading edge at wing root; x_{CG}
(to be measured with the root chord level)



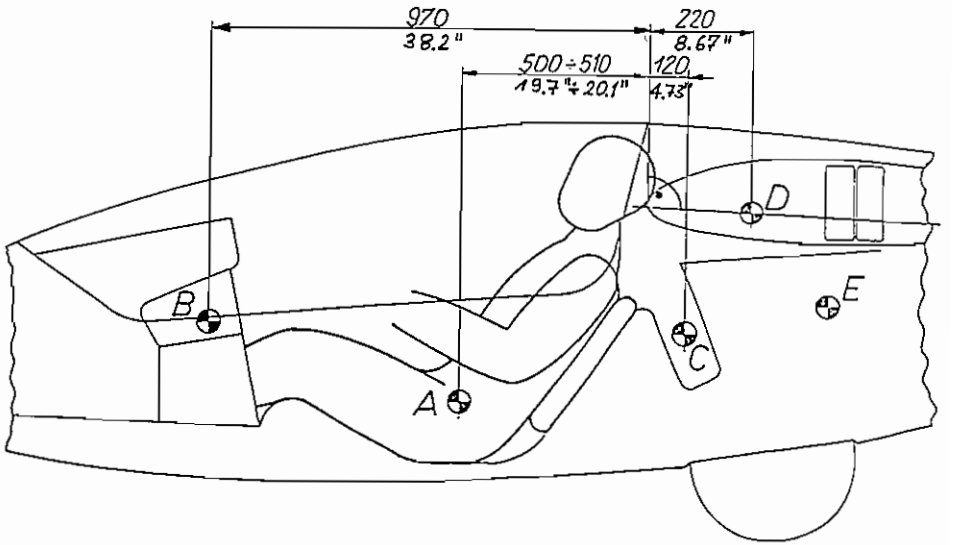
In this diagram the weight of so called "Factory Equipment Necessary for Flight", i.e. the equipment offered to the customer, and this of an additional equipment, has been included into the glider empty mass.

The list of "Factory Equipment Necessary for Flight" is contained in item 1.2 on page 1.8.

To customer's order, the installation of instruments other than these provided in "Factory Equipment .." is possible.

7.3. Location of additional fixed equipment installation

Fig. 7/3 Location of additional fixed equipment installation



Legend for letter marking :

"A", "B", "C", "D" and "E" - see page 7.2.

SECTION 8

8. CHECKING OF MASS-BALANCE OF CONTROL SURFACES

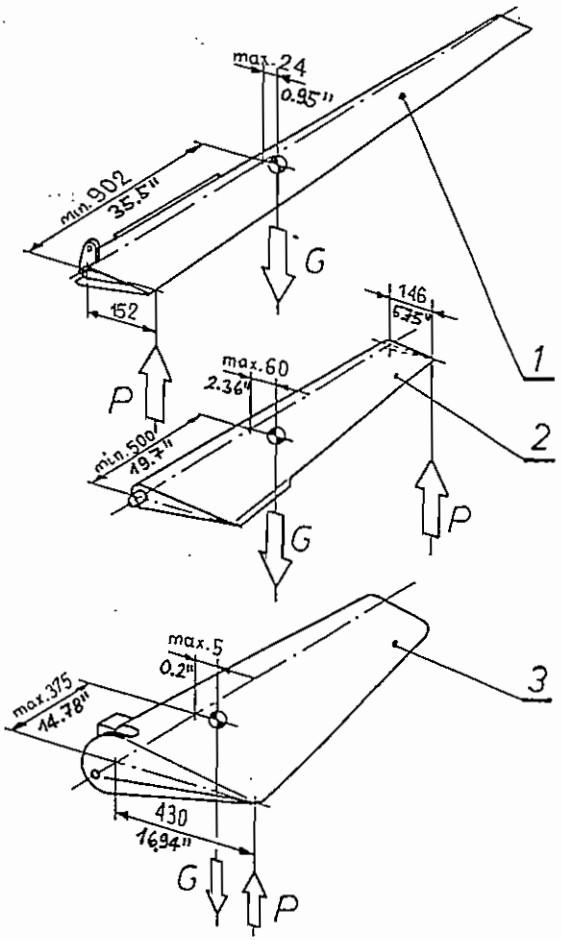
8.1. Data for checking

8.2. Procedure of checking

8. CHECKING OF MASS-BALANCE OF CONTROL SURFACES

8.1. Data for checking

Fig. 8/1 Check of control surfaces mass-balance



A - Scheme of aileron balance checking

B - Scheme of elevator balance checking

C - Scheme of rudder balance checking

8.2. Procedure of checking

The procedure of control surface balance checking is as follows (for each control surface individually)

1. Weigh the control surface to find the weight "G " [daN] ([lb]).
2. The disassembled control surface is to be suspended on two hinges in such a way that the rotation drag is minimized.

Note: SUSPEND THE AILERON ON 2 HINGES IN SUCH A WAY THAT ITS DEFLECTION IS NOT EXCESSIVE ONE.

3. Calculate the "P" force acc. to the following formulas :
   - aileron (see Fig. 8/1, detail A) $P = 0.158*G$ [daN] ([lb]),
   - rudder (see Fig. 8/1, detail B) $P = 0.411*G$ [daN] ([lb]).
   - elevator (see Fig. 8/1, detail C) $P = 0.116*G$ [daN] ([lb]),
4. Apply the force "P" by means of dynamometer as shown on Fig. 8/1, detail "A", "B", "C" and read the force value. The chord must be level.
5. Compare the measured "P" force value with the value calculated acc. to the formulas in item 3.

The balance is correct when the measured force value is :

- for aileron $P_{measured} \leq 0.158*G$ [daN] ([lb]),
- for rudder $P_{measured} \leq 0.411*G$ [daN] ([lb]),
- for elevator $P_{measured} \leq 0.116*G$ [daN] ([lb]).

SECTION 9

9. GLIDER LIFE-TIME

9.1. Allowed glider service life

9. GLIDER LIFE-TIME

9.1. Allowed glider service life

Allowed glider service life is 6000 flying hours.

SECTION 10

10. LIST OF SERVICE DOCUMENTS FOR PARTS AND SETS APPROVED INDEPENDENT OF THE GLIDER

10.1. Instrument certificates

10.2. Hook certificates

10. LIST OF SERVICE DOCUMENTS FOR PARTS AND SETS APPROVED INDEPENDENT OF THE GLIDER

10.1. Instrument certificates

The instrument certificates are the part of glider individual documents.

10.2. Hook certificates

The hook certificates are the part of glider individual documents.

Note: THE ABOVE LIST CONCERNS THE GLIDER WITH "FACTORY EQUIPMENT NECESSARY FOR FLIGHT".

THE LIST AND DEFINITION OF "FACTORY EQUIPMENT NECESSARY FOR FLIGHT" - SEE ITEM 1.2, PAGE 1.8.

SECTION 11

11. CLEANING AND MAINTENANCE

11.1. Canopy perspex

11.2. Painted external surfaces

11.3. Glider hangaring on winter season, or prolonged break in operation

11. CLEANING AND MAINTENANCE

11.1. Canopy perspex

Wash the canopy with clear water with addition of the washing detergent, suitable for perspex, if necessary.

On ground the canopy should be protected against dust and sand by means of canvas cover.

Note: DO NOT WASH THE CANOPY WITH SOLVENTS OR GASOLINE AS THIS MAY PERMANENTLY DEGRADE THE TRANSPARENCY.

11.2. Painted external surfaces

The painted external surfaces should be washed with clear water and, if necessary, an addition of gentle non-abrasive detergent.

Rinse with clear water and dry with flannel or chamois leather.

After washing, dry the wetted glider inside, as necessary, ensure drainage holes are clear. This concerns particularly the air brake box.

The dry, clean outer surfaces should be covered with protecting agent e.g. for furniture.

11.3. Glider hangoring on winter season, or prolonged break in operation

During the winter season, or in prolonged break in operation, disassembly of glider is recommended.

The de-rigged wings should be shored with supports or motor-car tyres in vicinity of root rib and at wing-tip. For prolonged storage, the wing should be placed chord-vertically, and shored under spar root and under leading edge at aileron semispan.

SUPPORTS FOR WING SHELLS SHALL BE UPHOLSTERED WITH SOFT PADS, TO AVOID INDENTATIONS.

The de-rigged fuselage should be shored under front part with the soft upholstered support, fitted to the fuselage cross-section.

When in prolonged storage, the main and tail wheels should be lightened, and the fuselage supported under the framework front pivots and fuselage rear portion (tube) near the fuselage-to-fin transition.

PROLONGED FUSELAGE SUPPORTING ON THE COCKPIT REGION NOT RECOMMENDED, DUE TO THE POSSIBLE PROBLEMS WITH THE CANOPY TO COCKPIT BOARDS MATCHING.

Note: TO AVOID THE LACQUER DAMAGES OR CORROSION, THE GLIDER IS TO BE STORED ONLY IN DRY CONDITION. THIS CONCERNS BOTH OUTER AS WELL AS INNER SURFACES, E.G. AIR BRAKE BOX, COCKPIT INTERIOR ETC.

IN PARTICULAR STORING WETTED GLIDER IN CLOSED TRAILER, OR GLIDER DRESSED IN WET CANVAS COVERS, PROHIBITED.

SECTION 12

12. AIRFIELD TRANSPORTATION

12.1. Ground rolling

12.2. Motor-car towing

12. AIRFIELD TRANSPORTATION

12.1. Ground rolling

In rolling the glider on ground, the direction "tail ahead" is recommended - by pushing on the leading edges of wings. When turning, the tail is to be lifted using the handle sinked in the fin. Pulling or pushing on the glider wingtips not recommended, since this introduces the considerable loadings on the wing root.

Note: PUSHING, OR LIFTING THE TAIL BY TAILPLANE OR BY RUDDER - PROHIBITED.

12.2. Motor-car towing

When motor-car towing the glider, with no transportation tail wheel attached, avoid the turns of small radius due to possible tail-wheel wearing.

The control stick should be immobilized by means of pilot's shoulder belt.

Note: WHEN MANOEUVRING ON THE MUDDY SURFACE, ESPECIALLY "TAIL AHEAD," THE ROLLABILITY OF WHEEL CAN BE RESTRICTED BY LOCKING THE UNDERCARRIAGE WELL WITH A MUD.
CLEAN BEFORE TAKE-OFF !

SECTION 13

13. TRAILER, RAILWAY OR TRUCK TRANSPORTATION

13.1. Trailer transportation

13.2. Railway or truck transportation

13. TRAILER, RAILWAY OR TRUCK TRANSPORTATION

13.1. Trailer transportation

For transportation of the de-rigged glider it is recommended to :

- fix the wings on spar root and on leading edge, in vicinity of aileron semispan,
- fix the fuselage on the shaped support in the vicinity of central part and on tail wheel, or on main and tail wheels,
- immobilize the control surfaces, stick and short push-rod in fin.

13.2. Railway or truck transportation

For transportation secure the fittings, inspection holes, bearings, guides and elevator control joints against a dust or dirt.

When the glider is railway- or truck-transported, its loading and fixing in a container should be performed acc. to the special documentation.

SECTION 14

14. INFORMATION PLACARDS AND THEIR LOCATION

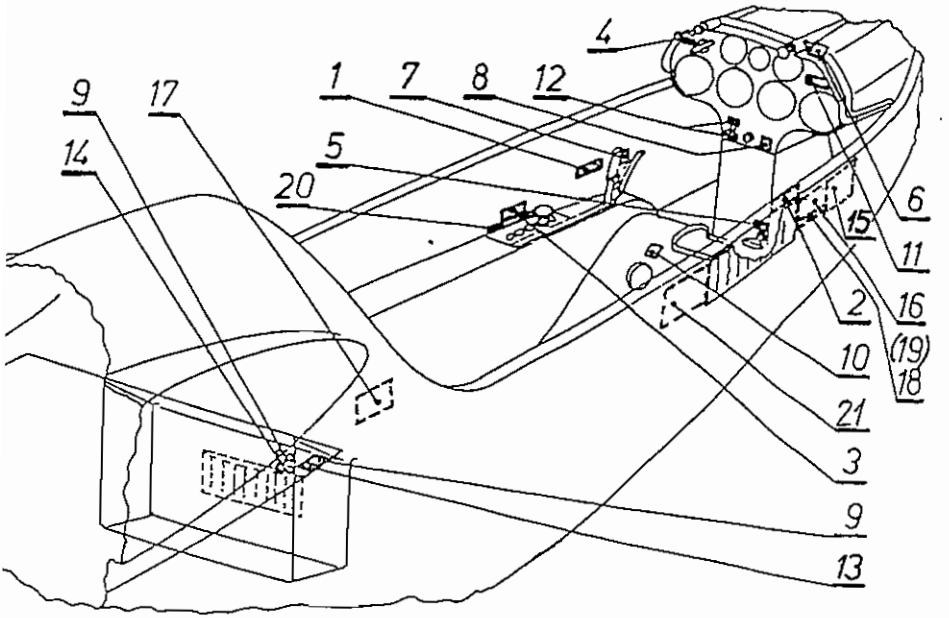
14.1. Meaning and location of information placards

14.2. Patterns of placards

14. INFORMATION PLACARDS AND THEIR LOCATION

14.1. Meaning and location of information placards

Fig. 14/1 Meaning and location of information placards

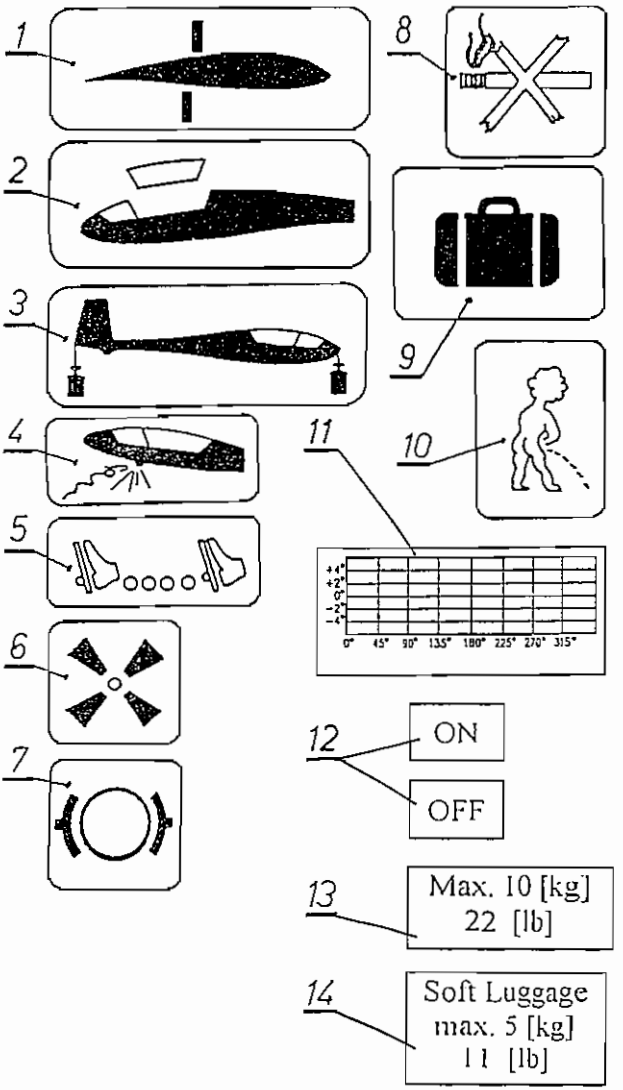


1. Air brake extended
2. Canopy emergency jettison
3. Trimming device
4. Towing cable release
5. Adjusting of pedals
6. Cockpit air conditioning
7. Wheel brake
8. Don't smoke
9. Luggage compartment
10. Sanitary device
11. Compass reading correction
12. Turn indicator (ON/OFF)
13. Max. 10 [kg] (22 [lb])
14. Soft luggage max. 5 [kg] (11 [lb])
15. Operation limitations
16. Loading plan
17. Factory identification placard
18. C.G. hook without self-release
19. C.G. hook with self-release
20. Glider trimming (location of trimming device)
21. Pre-flight checklist

14.2. Patterns of placards

Fig. 14/2 Patterns of placard (location on Fig. 14/1)

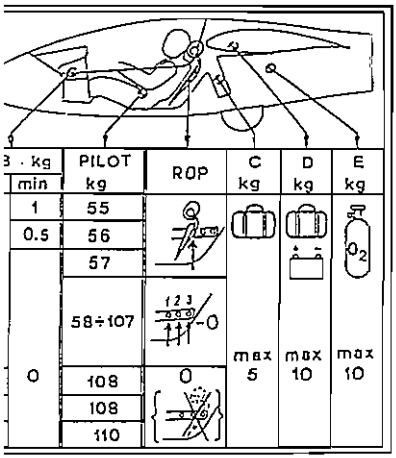
(Placard numbers are related to Fig. 14/1)

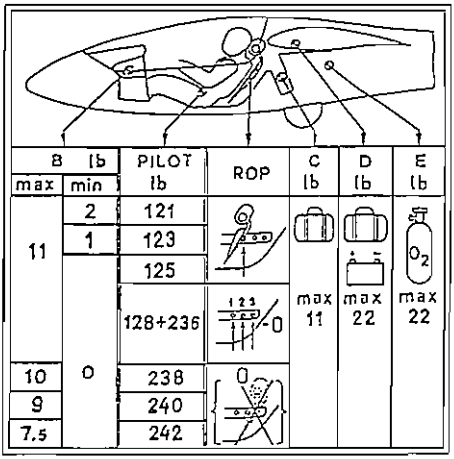


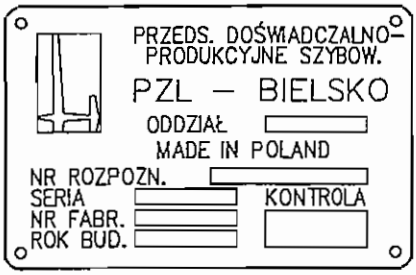
15

OPERATION LIMITATIONS			
AIRSPEED (IAS)	[kts]	[mph]	[km/h]
V_{NE} - never exceed	119	136	220
V_A - manoeuvring	84	96	155
V_T - aerotowing	81	93	150
V_W - winch-launching	70	81	130
MASSES		[lb]	[kg]
MAX. OF EMPTY GLIDER		529	240
MAX. IN-FLIGHT		838	380
MAX. COCKPIT LOAD		309	140
MIN. COCKPIT LOAD		123	56
OTHER LIMITATIONS :			
AEROBATIC MANOEUVRES : loop, stall turn, spin, climbing turn, lazy eight, steep turn.			
SAFETY LINK IN TOWING CABLE: 690 ± 69 [daN]			
PRESSURE IN MAIN WHEEL TUBE: 1.5 [at]			

16







17

BOTTOM HOOK WITHOUT SELF-RELEASE
SZD-III A-56-P

18

BOTTOM HOOK WITH SELF-RELEASE
TOST G 88

19

11 o 9 o 7 o 5 o 3 o 1

20

PRE-FLIGHT CHECKLIST		
1	Loose items in cockpit	- CHECK
2	Back rest, pedals	- ADJUST
3	Parachute	- PUT ON
4	Safety belts	- FASTEN
5	Controls deflection	- CHECK
6	Air brakes	- RETRACT
7	Trim device	- SET
8	Altimeter	- SET
9	Canopy	- CLOSE
10	Radio	- CHECK
11	Tow cable attachment	- CHECK

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SECTION 15

15. PERIODIC WORKS

15. PERIODIC WORKS

15.1. General rules of periodic works

When performing periodic works, the information and directions included in Sections: 2, 3, 5, 6, 7, 8, 9, 10, 11 and 14 should be followed.

15.2. Periodic works on equipment

Instruments servicing is to be performed in accordance with individual instrument manuals.

15.3. Periodic works on hooks

Periodie works concerning the towing hooks are specified in hooks producer's maintenance manuals.

15.4. Periodic works on glider

The following is a list of periodic works and maintenance, which shall be performed acc. to the Schedule on page 15.11 :

15.4.1. Check the integrity of the whole structure in rigged condition,

with a special attention paid to the severely loaded sets, including :

1. Inspection of glider external covering and fabric skin on rudder.
2. Inspection of glider cockpit for possible presence of loose objects, which could lock the control systems.
3. Inspection of seat pan and its fastening condition.
4. Inspection of pilot's belts condition.
5. Inspection of canopy perspex condition for transparency, scratches or cracks.
6. Checking the reliability of canopy locking.
7. Operation test of canopy emergency jettison.
8. Checking of correct assembling and securing of glider components.
9. Checking of assembly clearance in wing/fuselage connection.

   Checking of assembly clearance and elasticity of wing/fuselage connection, as well as opening of the gaps between the wings and fuselage. The allowed value of gap variation - see item 3.2.3, page 3.5.

   The estimation of assembly clearance on fittings is accomplished by quick movement of wing tip with small force.

   If an excessive play appears, it is sensible in the form of insignificant mutual displacements of connected sets and eventual knocking.

10. Checking the assembly clearance in fuselage/tailplane connection - as for wing/fuselage connection. Allowed plays : see item 3.2.2. page 3.4.

11. Cheeking the plays in elevator and rudder hinges. The eventual plays are perceptible when pulling on the control surface trailing edge with varying force. Allowed plays : see item 3.2.9. and 3.2.11., page 3.5.

12. Checking the correct operation and resistance to motion of control devices in the cockpit : see item 3.1.3. page 3.2.

13. Checking plays in aileron and elevator control systems. Measure the play on the tip of control stick grip.

    The allowed plays of the control stick given in item 3.2.1. page 3.3.

14. Check the cable tension in rudder control system : see detail 1 on Fig. 2/4, page 2.7.

    The cable tension value : see item 3.1.2. page 3.2.

15. Check the eondition and correct operation of hooks and their control system : see Fig. 3/3, page 3.12.

16. Check the eondition of main undercarriage and tail wheel, as well as operation and efficiency of main wheel brake.

    Check the condition and wear of tires.

17. Disasscmble the wheel and lubricate the hub bearings.

18. Check the glider levelling : see Section 6, page 6.2.

19. Check the deflections of glider control surfaces: see Section 6, page 6.4.

20. Check the contour and bent down of the elevator loading-tab : ace. to Fig. 6/3, page 6.5.

21. Check the condition of external surfaces of metal parts, especially those exposed to protection coat failures and corrosion (cables, undercarriage etc.).

15.4.2. Check the tightness of instruments pneumatic system in the cockpit, and instruments operation

The scheme of instrument system : see Fig. 2/6, page 2.11.

15.4.3. Check the operation of turn-indicator and battery fixing

The electro turn-indicator system : see Fig. 2/6, page 2.11.

Note: THE TYPE AND INSTALLATION OF 12 V BATTERY ARE AGREED INDIVIDUALLY WITH A CUSTOMER.

15.4.4. Check the electro-bonding between the c.g. hook and control stick

Connect the non-insulated stick part and hook by means of electro-circuit with pocket battery and 4.5 V bulb. The bulb should glow.

15.4.5. Check the operation and correct installation of additional systems

The additional systems, installed to user's order, comprise e.g. transceiver, oxygen equipment or eventually other systems incorporated.

15.4.6. Check the correct rigging and de-rigging

Rigging and de-rigging of the main glider components contains the wing/fuselage and tailplane/fuselage connections.

Note: IN EACH RIGGING ALL THE CONNECTED PARTS SHOULD BE LUBRICATED (see Section 5).

15.4.7. Check the integrity of the structure in the disassembled condition

1. Check the condition of wing spar roots and of fittings glued-in, as well as the connection between spar and root rib (Rib No 1).
2. Check the condition of Rib No 1, with special attention paid to the articulated joints and their nesting.
3. Inspect the main bolt surface condition (only scarce small scratches and local seizings are allowed).
4. Check the condition of internal structure at wing root - by eye, through the openings for aileron control levers in root ribs and through the lightening holes in ribs.
5. Disassemble the ailerons, check the condition of hinges and their installation in ailerons and attachment on wing.

   Check the connection between the auxiliary spar for aileron hinges and wing covering. Check the condition of the aileron structure.

Note: PRIOR TO THE REPEATED AILERONS ASSEMBLY THE HINGES AND PUSH-ROD TO LEVER CONNECTION SHOULD BE LUBRICATED (see Section 5).

6. Check the condition of air brake fittings and its control system. Check the air brake arms, plates and caps. In the gliders of Fact. Nos. W-927 to W-964 and up to B-1801 inclusive, check the condition of fastening the screws in air brake caps, make sure the drainage holes in air brake boxes are clear.

7. Check the condition of: connections in fuselage central part, coverings, framework and its installation in the fuselage, upper floor and wing connection fittings.

8. Check the rest of fuselage internal structure, especially the condition of spar, webs and ribs of the fin, the condition of upper and lower rudder hinges, condition of connections and structure of the fuselage front part, the front frame and front floor ineluded, the installation of hook housings and frames under the seat.

   For this inspection the seat pan shall be disassembled.

9. Disassemble the stabilizer and elevators. Inspect the structure of these, as well as fuselage-tailplane connection and elevator hinges condition. Pay special attention to the condition of welded connection and eventual lacquer cracks - in partieular of these close to the fittings, which may indicate the structure defects.

   Check the locking of torque tube nests in lefthand and righthand elevators. Check that in the assembled condition no friction of control surface against apron exists. The elevator should fall down under its gravity.

   Before tailplane assembly all movable and fixed connections should be greased (see Section 5).

10. Disassemble the rudder. Check the canvas covering, external surface and condition of control surface hinges. Check the correct installation of balancing weight.

    Before assembling the rudder, lubricate all movable conneetions (see Section 5).

11. Inspect the control system elements, sets and their fixing to the glider structure, namely : control columns, push-rods, levers, pedals and cables. If necessary lubricate the movable connections (see Section 5).

15.5. Rules of cable servicing

15.5.1. The recommended service life of control cables
of rudder control is 1500 flying hours or 12 years, while this of cables in "S"-shape pedals towing member is 500 flying hours or 6 years (Fig. 2/4, page 2.7).

15.5.2. The recommended service life of all other control cables
(hooks and wheel brake systems) is 1500 flying hours or 12 years.

15.5.3. On exceeding the recommended service life
the cables accessible for disassembling should be taken out of the glider and carefully inspected. In case of correct technical condition the cable is valid for further operation.

15.5.4. The cables which cannot be disassembled
without damage should be replaced with new ones.

15.5.5. All cable tension members with the allowed service life expired
should be replaced (in accordance with Bulletin No BE-007/94 "Cable tension members".

15.5.6. The cables having corrosion, broken single wires, wires worn
to about a half of their diameter, with worn tarnamide guides or with jammed, not rotating pulleys, are not allowed for further operation.

15.5.7. The replacement of cables and the repair of pulley guides
should be recorded in the glider log-book.

Note: LUBRICATION OF CABLES - see item 5.2.3, page 5.2.

15.6. Main inspection

15.6.1. General
The main inspection of gliders having the Polish registration and operated in Poland is carried out by Przedsiębiorstwo Doświadczalno-Produkcyjne Szybownictwa or other aeronautical plant or workshop, which has been authorized for this purpose.

Abroad of Poland the main inspection can be performed only by a firm or plant which has the authorization of Przedsiębiorstwo Doświadczalno-Produkcyjne Szybownictwa for repair works.

Specification of the inspection range should have a form of glider verification protocol, based on the works performed acc. to Section 15 of this Manual.

15.6.2. Find the flying hours.

completed on this glider (on the base of its documents), number of landings, glider repairs, check if the mandatory Bulletins have been introduced.

15.6.3. Check the glider and its equipment to be complete.

15.6.4. De-rig the glider, wash and clean

its components. If necessary, lubricate the accessible movable joints.

Lubricate the details of main fittings (see lubrication Instruetion, Section 5, page 5.3).

15.6.5. Rig the glider

Check on the rigged glider :

1. Integrity of the structure : item 15.4.1, page 15.2
2. Plays in wing/fuselage connection by means of measurements of wing - fuselage gap variation: see item 3.2.3, page 3.5 and item 15.4.1/9, page 15.2
3. Deflections of glider control surfaees : see Seetion 6, page 6.4
4. Plays in control systems of elevator and ailerons : see item 3.2.1, page 3.3
5. Plays in fittings of tailplane/fuselage connection : see item 15.4.1/10, page 15.3 (allowed plays : see item 3.2.4, page 3.5)
6. Correct operation and resistance to motion of controls in cockpit : see item 3.1.3, page 3.2

15.6.6. De-rig the glider once more

and inspect in detail its components, according to the following specification :

15.6.6.1. Wing with aileron :

1. Perform the operations acc. to item 15.4.7, page 15.4.
2. Check the remaining wing structure, especially the condition of glue joints of leading and trailing edges, and this of air brake box.

   Check the external surfaces for indentations and lacquer cracks, which can indicate the structure damages.
3. Check the condition of bolt eonnecting the spars. Measure the plays between the bolt and spar sleeves. The allowed play : see item 3.2.2, page 3.4.

4. Measure the plays between the pivots of spar and of framework, and their nests in wings. Allowed play : see item 3.2.2, page 3.4.
5. Measure the periphery plays in clutches joining the aileron and air brake control systems in wing/fuselage connection. Allowed plays : see item 3.2.5, page 3.5.
6. Check the components of air brake system in wing : see item 15.4.7/6, page 15.5.
7. Check the condition and operation of aileron control system in wing.
8. Check the gap width between the aileron and wing apron. The allowed play : see item 3.2.6, page 3.5.
9. Check the axial play on aileron hinges. The allowed play : see item 3.2.7, page 3.5.
10. Check the gap width between the aileron and wing trailing part. Allowed gap size : see item 3.2.8, page 3.5.
11. Disassemble the ailerons and check them according to item 15.4.7/5, page 15.4.
12. Check the aileron mass-balance according to Section 8, page 8.2 and 8.3.

15.6.6.2. Fuselage :

1. Check the mating of following sets in assembled condition, and then disassemble :
   - canopy (emergency jettison)
   - instrument panel
   - pilot's belts
   - seat pan
   - luggage compartment
   - rudder.

Having completed the above, check :

2. Condition of fuselage structure acc. to item 15.4.7/7, page 15.5.
3. Condition of the pilot's belts fittings, and its installation in the fuselage.
4. Condition of the canopy, condition and installation of its fittings, perspex glue joint, sealing of side window and locks.
5. Condition of control systems of : rudder, ailerons, longitudinal trimming, air brake, wheel brake, both hooks. Check the correct securing.
6. Turn the fuselage upside-down :
   - Dismount, and disassemble the main wheel, clean its elements if necessary. Check and eventually replace the friction pad of disc brake, as well as the tyre. Assemble and install the wheel and preliminary adjust the wheel brake.

     Check the condition of wheel cover.
   - Check the condition of tail wheel bearings and tyre.

     Pay attention to the condition of mud-guard and axle nests installation.

7. Check the instrument certificates and perform the instrument maintenance, if necessary.
   Cheek the condition of pneumatic ducts and system tightness ace. to item 15.4.2, page 15.3.
   Check the condition of electro turn-indieator system and installation of battery acc. to item 15.4.2 and 15.4.3, page 15.3.
8. Check the electrical bonding between the c.g. hook and control stick : see item 15.4.4, page 15.4.
9. Check the operation, and correct installation of additional systems acc. to item 15.4.5, page 15.4.
10. Check the hooks acc. to item 15.4.1/15, page 15.3.
11. Assemble the fuselage, check correct assembling and securing, as well as operation of all devices.

15.6.6.3. Tailplane

Perform the operations acc. to item 15.4.7/9, page 15.5 and, in addition :

- measure the radial plays in aileron hinges. Allowed play : see item 3.2.9, page 3.5
- measure the radial plays in conneetion of elevator halves control lever with torque tube. Allowed play : see item 3.2.10, page 3.5

-cheek the elevator mass-balance acc. to Section 8, pages 8.2 and 8.3.

15.6.6.4. Rudder

Perform the operations acc. to 15.4.7/10 page 15.5 and, additionally :

- check the rudder mass-balance acc. to Section 8, pages 8.2. and 8.3.
- check the radial plays value in the rudder hinges. Allowed play see: item 3.2.11. page 3.5.

15.6.7. Final inspection

1. Rig the glider and connect all controls.

   Check the operation and deflection of control surfaces, and of air brake. Adjust, if necessary, following the directions of Technical Service Manual.
2. Weigh the glider and find the c.g. position, following the directions of Technical Service Manual.
3. Check the correct operation of instruments
4. Perform thc test flight.

15.7. General remarks on special procedures in periodic works and in main inspection.

15.7.1. In case a damage of glider structure

at an invisible location is suspected, it is necessary to remove the lacquer coat or open the structure by means of a hole cut in the shell, or by cutting-out a covering fragment, for inspection.

15.7.2. In case the permanent deformation of metal elements is suspected,

contact producer of glider.

15.7.3. If the resistance to motion of control systems is excessive, or the stiffness loss is encountered,

the system should be carefully inspected, disassemby of parts or inspection openings in the covering included.

15.8. Schedule of periodic works and maintenance

Time of work	Kind of work acc. to Section 15, pages: 15.2 to 15.9 incl.	Remarks
On the begin of flying season	15.4.1 and particularly items 1 thru 17 incl. 15.4.1 items 19 thru 21 incl. 15.4.2 thru 15.4.6 incl. 15.4.7 items 1 thru 11 incl. Check the cable tension members in regard to their service-life according to items 15.5.1 thru 15.5.7. incl.	
After every 50 flying hours	15.4.1. and particularly items 1 thru 16 incl. 15.4.2 thru 15.4.5 incl..	-Check of gap opening not required -The measurements of controls operation forces perform only when excessive, or too low, resistance to control motion is found
After every 100 flying hours	15.4.1 items 1 thru 17 incl. 15.4.1 items 19 thru 21 incl. 15.4.2 thru 15.4.6 incl. Check the cable tension members in regard to their service-life acc. to items 15.5.1 thru 15.5.7. incl.	For 100 flying hours or annual inspection the glider shall be washed and clean.
Annual inspection **shall be performed after every 12 months of calendar**	Procedures similar as those after every 100 flying hours	All aceess/inspection holes shall be opened.
After heavy landing	15.4.1 items 1, 3, 4, 5, 6, 8, 9, 10, 11,12,13,14,15,16,17,19 15.4.2 15.4.3 15.4.5 15.4.6 15.4.7 items 1 thru 4 incl. 15.4.7 items 7 thru 11 incl.	
Main inspection of glider after every 1000 flying hours	All operations contained in item 15.6 "Main Inspection"	

SECTION 16

16. REPAIRS OF THE GLIDER

16. REPAIRS OF THE GLIDER

16.1. Introduction

This Manual contains directions enabling the repairs of minor damages to composite structure sailplane by the user himself. These damages have been described and classified in item 16.2.3.

Repair method of the damage greater than described above is to be agreed with the producer, individually for each actual case.

The sets which, as a rule, will be repaired by the producer or by authorized workshop only, are listed in item 16.2.3.

Prior to starting the repair it is necessary to complete, and become acquainted with the following documents :

- Glider Log-Book,
- Technical Service Manual,
- Built Inspeetion Certificate,
- Protocol of the Glider Tests,

as well as to notify the responsible Authority on the planned repair.

Having completed the repair, it is to check that the glider mass has been not exceeded, and the correct c.g. location obtained. In case the sailplane empty mass or the range of c.g. locations is exceeded, the data concerning the load and loading conditions should be corrected.

16.2. Repair of composites

16.2.1. Conditions of the repair

Apart from the introduetory remarks, when performing the repairs of composite structure, it should be observed that a relative humidity in repair room during laminating operations does not exceed 85% and the temperature is above +19 °C (+66 [F]). After completing the laminating or gluing the temperaturc above +19 °C (+66 [F]) should be maintained for minimum 16 hours, i.e. the period of resin complete hardening.

After hardening, it is recommended to heat the repaired areas for 4 hours minimum at the temperature of +40 °C through +60 °C (+104 [F] through +140 [F]).

When heating with the infrared radiator, the check thermometer should be shielded against the direct radiation of the heat source.

The room intended for the repair should be clean, free of dust and good illuminated. It is recommended to use the air-conditioned rooms.

The persons involved in the repair should be familiarized with thc composite structure technology (the licenses are required). If the repair is a first contact of worker with the composite technique it is recommended to make as initial one the test composite work and gluing, following exactly item 16.2.2 of this Manual, or "Workshop instruction on construction of the stressed composites" No IW-76/412.4 - associated with this Manual

The qualifications are to be stated satisfactory by the Authority responsible for the airworthiness of thc ship.

16.2.2. Basic rules of composite technique

In the rooms for work in composites the conditions described in item 16.2.1. shall be ensured. It's necessary to work in the cotton or rubber clean gloves to protect the hands as well as the composite surfaces against the dirt.

Specially danger, in respect to the quality of works in composites, is the contamination with greases, so they should be unconditionally removed from the sites of works with composites.

Prior to any gluing or laminating, it is necessary to even up the composite surfaces, make the proper chamfering, and to clean it thoroughly by grinding with sandpaper of "120" ÷ "180" grade and removing the dust.

Before the glue is applied, in each ease a " fit dry" is recommended. The epoxy composition with the colloidal silica (e.g. Aerosil) should be used for gluing.

The silica should be added to the ready made composition, in amount to obtain the "cream consistence" (it cannot flow down from the spatula), approx. 6 through 8 % by weight.

Prior to the application of basic glue layer, the glued surfaces should be wetted with the liquid composition without the filler. When the basic glue is applied, the glued parts should be joined together and immobilized for the prescribed time period (the complete hardening occurs after 16 hours approx.). The gluing with the epoxy composition basically does not require the pressure.

The composite structures and foams are to be treated with the typical tools for metal and wood (saws for metals, rasps for wood, files, chisels etc.).

The sharp tailor's scissors should be used for cutting the unsaturated glass fabrics. The cutting procedure requires the dry clean table. The straight line of fibers and perpendicularity of the warp and weft should be maintained.

To prepare the laminating composition, the carefully weighed portions of resin and hardener should be put into the clean and dry pot (e.g. paper or polyurethane cup) and mixed thoroughly within 1 minute with the dry wooden spatula. When weighing, the proportions prescribed in item 16.4. should be maintained.

The single portion should be not lower than 50 g (0.11 [lb]). When mixed, the portion should be used within time period not longer than so called "pot life" acc. to item 16.4.

The fabrics should be saturated with the clean, dry brush or spatula.

When saturating, pay attention to :

a) perpendicularity of warp and weft,

b) direction of warp and weft acc. to the drawing 16/1 and 16/2 where the sign X concerns the warp and weft inclination of 45° to the axis of the set, while sign ⇒ concerns the warp (strengthened) arranged along the axis of the produced set.

c) before applying the new fabric layer, the composite is to be wetted with the composition so that the saturation is obtained by the resin pressed up from below the fabric.

All the pads or gluing compositions should be prepared so, that the filler is added to the resin mixed with the hardener in the proper amount to obtain the required consistence.

The hardening process takes the time period of 16 hours in which the repaired set should be not moved, and the air conditions described in item 16.2 maintained.

The rest of the resin in the cup should be stored together with the repaired set, since the correct set-up of the resin certifies the correct set-up of the repaired detail.

The materials used for the repair should be stored in the dry, clean place proteeted against the contamination. The resin and hardener should be stored in the tight containers.

16.2.3. Classification of the damages.

In respect to the various importance of the sets which can be damaged, as well as to the different methods of the damage repair, the structure has been divided into three zones.

The location of zones I and II on the glider is shown on drawings 16/1 and 16/2, pages 16.5 and 16.6. The zone III concerns the skeléton elements of fuselage and tailplanes.

The following table describes kind and size of defects in the particular zones allowed for repair. In case of doubts in interpretation as to the kind or size of the damage, the assistance of producer is recommended. The precise description and photo documentation of the damage should be presented to the producer.

Item	DAMAGE TYPE	MAX. DAMAGE SIZE		
		zone I	zone II	zone III
1.	Holes or deficiencies	∅150 [mm] (5.9 [in])	∅100 [mm] (3.9 [in])	∅40 [mm] (1.6 [in])
2.	Cracks	200 [mm] (7.9 [in])	100 [mm] (3.9 [in])	40 [mm] (1.6 [in]
3.	Disgluing of the trailing edge	without limits	without limits	———
4.	Other disgluings	250 [mm] (9.8 [in])	250 [mm] (9.8 [in])	———
5.	Disgluing of the skeleton	———	———	max. half of the required glue joint length
6.	Damages to lacquer	without limits (if the structure has not been affected)		———

The possibility of the repairs performed by the user himself is excluded by the producer in the following cases:

a) the user is unable to fulfil the conditions of items 16.2.1. and 16.2.2.

b) the damage concerns the main fittings or their vicinity,

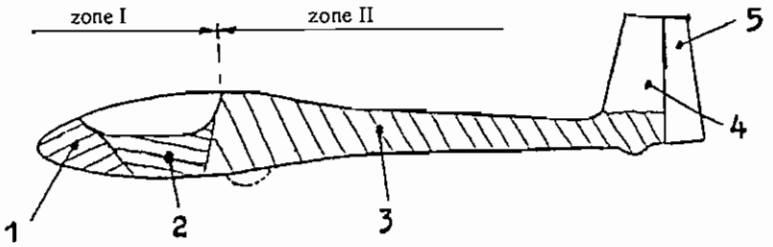
c) the fuselage tube, wing, tailplane or fin are broken,

d) the spar or root rib is damaged,

e) the skeleton element is damaged over its whole height (ribs, webs, stiffeners), or diameter (frames).

Note: THE WHITENING OF THE COMPOSITE STRUCTURE IS EQUIVALENT TO THE DAMAGE OF THE ELEMENT.

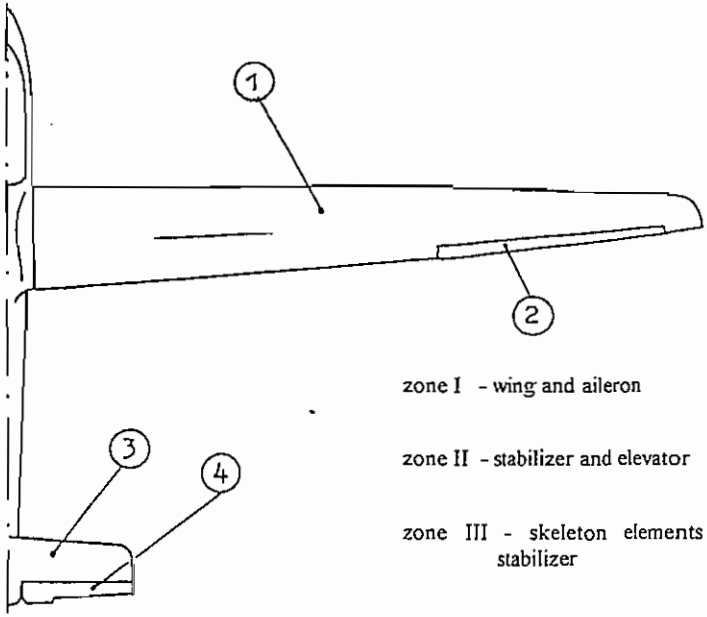
Fig. 16/1 Repair zones and specification of materials for fuselage repairs



Material specification

1.	1 x 92140	or	1 x STR-47 (STR-58) X
	1 x 92125	or	1 x STR-5 X
	1 x 92145	⇒	
	1 x 92125	or	1 x STR-5 X
2.	1 x 92140	or	1 x STR-47 (STR-58) X
	3 x 92145	⇒	
	1 x 92125	or	1 x STR-5 X
3.	1 x 92140	or	1 x STR-47 (STR-58) X
	4 x 92145	⇒	
	1 x 92125	or	1 x STR-5 X
4.	1 x 92140	or	1 x STR-47 (STR-58) X
	2 x 92145	⇒	
	1 x 92125	or	1 x STR-47 (STR-58) X
5.	2 x 90070	X	
	1 x 92125	or	1 x STR-5 X
6.	Skeleton elements of fuselage and fin		(all in zone III)
	3 x 92125	or	3 x STR-5 X

Fig. 16/2 Repair zones and specification of materials for wing repairs



zone I - wing and aileron

zone II - stabilizer and elevator

zone III - skeleton elements of stabilizer

Material specification

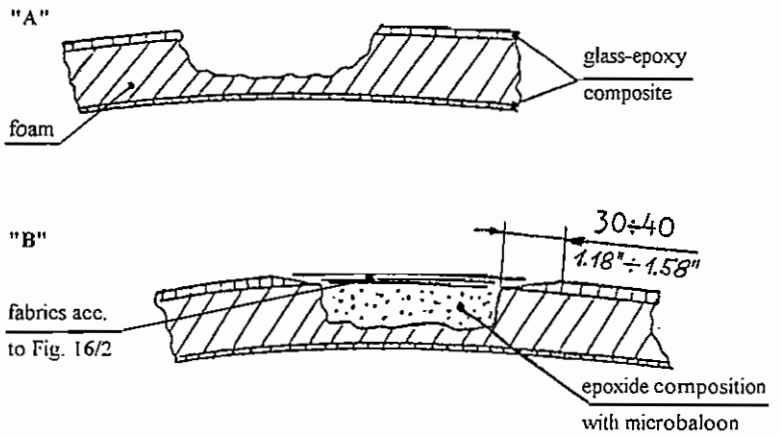
1.	1 x 90070	X	
	H-60 = 6.5 mm (CC-60)		
	1 x 92140	or	1 x STR-47 (STR-58) X
2.	1 x 92140	or	1 x STR-47 (STR-58) X
	2 x 90070	X	
3.	1 x 92125	or	1 x STR-5 X
	1 x 92145	⇒	
	2 x 90070	X	
4.	1 x 92140	or	1 x STR-47 (STR-58) X
	2 x 90070	X	
5.	Skeleton of fin (zone III)		
	3 x 92125	or	3 x STR-5 X

16.3. Typical repairs

For the repairs, the materials listed in item 16.4. should be used, following the drawings contained in this item, and Figs : 16/1 and 16/2.

16.3.1. Sandwich shell, small damage not throughout

Fig. 16/3 Small damage not throughout "A" - its repair "B"

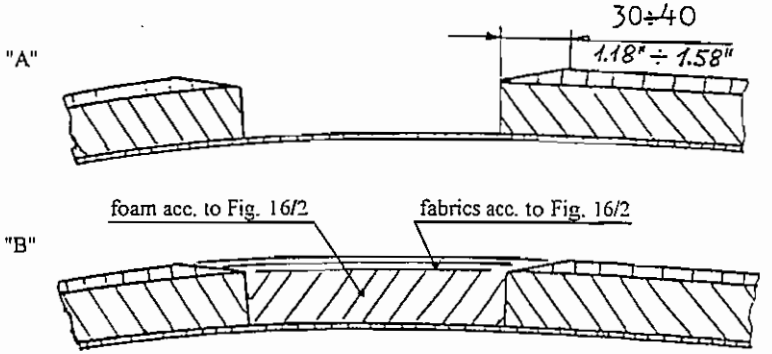


Repair procedure :

- chamfer the outer skin acc. to Fig. 16/3 "B"
- complement the foam deficiency with the composition thickened with microbaloon
- wet laminate the outer skin aec. to the fabric specification on Fig. 16/2
- repair the lacquer coat acc. to item 16.3.7.

16.3.2. Sandwich shell, large damage not throughout

Fig. 16/4 Sandwich shell, large damage not throughout "A", and its repair "B"

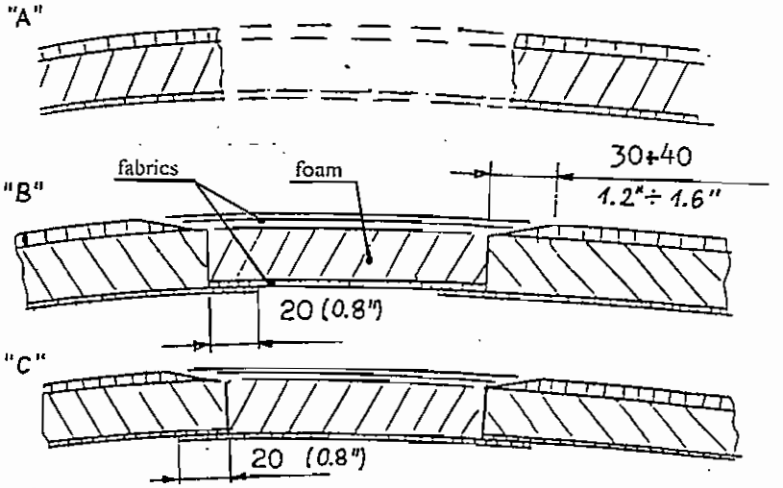


Repair procedure :

- remove the damaged foam in the opening, check if the inner skin is not damaged,
- chamfer the outer skin acc. to 16/4 "B"
- fit the foam to the hole, and glue up with the composition thickened with microbaloon,
- pad the foam with the composition, thickened with colloidal silica, clean the chamfered surface,
- glue up the outer skin acc. to the fabric specification on 16/2,
- make the further operations acc. to item 16.3.1.

16.3.3. Shell damaged throughout

Fig. 16/5 Shell damaged throughout



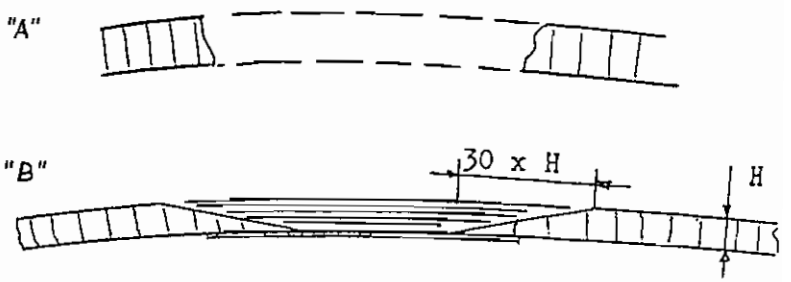
Repair procedure :

- work out the hole edges, remove the foam and chamfer edges acc. to Fig. 16/5 "B"
- form the inner skin on a piece of PET or PE foil, harden in shell, fit this to the hole shape
- grind the skin and glue up the foam core acc. to Fig. 16/5 "B",
- make the further operations as in procedure 16.3.1.

Note: THE INNER SKIN IS OF VERY THIN FABRIC. WHEN DURING THE PROCESSING OF HOLE ACC. TO Fig. 16/5 "B" THE EDGE APRON OF INNER SKIN IS DAMAGED, THE REPAIR SHALL BE PERFORMED ACC. TO Fig. 16/5 "C". IN THIS CASE THE INNER SKIN SHOULD BE CAREFULLY GRINDED THROUGH THE HOLE, THE CONDITION OF GRINDED SURFACE CHECKED WITH A MIRROR, THE REPAIRED PORTION OF INNER SKIN PUT ON THROUGH THE HOLE AND GLUED UP.

16.3.4. Solid composite detail

Fig. 16/6 Solid composite detail



In case of damage as on Fig. 16/6 the repair procedure is as follows :

- trim the edges to regular shape
- measure the shell thickness and chamfer it on the distance of 30 x thickness
- protect the hole by means of gluing the supporting plate of thin glass-fibre layer or plywood underneath Fig. 16/6 "B",
- form the shell acc. to Fig. 16/6 "B", observing the fabrics layout given in Fig. 16/1,
- harden the shell and perform further operations acc. to item 16.3.1

16.3.5. Splitting

Fig. 16/7 Splitting of glue joint at trailing edge

Repair of splitting :

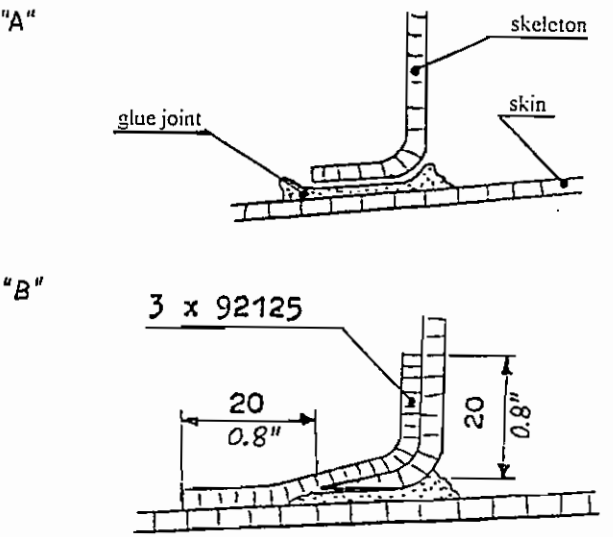
- remove the old glue from the splitted region,
- clean the composite surface in the splitted region,
- glue up the structure elements with epoxy composition, using one of the fillers listed in item 16.4.4.

Note: WHEN HARDENING, THE ELEMENTS SHOULD BE PRESSED TOGETHER BY MEANS OF STRAIGHT SLATS TO RETAIN THE STRAIGHT LINE. PAY ATTENTION TO AVOID THE TWIST OF GLUED SET.

IN CASE OF REPAIR TO TRAILING EDGE OF CONTROL SURFACE, ITS MASS-BALANCE SHOULD BE CHECKED AND CORRECTED, IF NECESSARY.

16.3.6. Ungluing of skeleton elements

Fig. 16/8 Example of skeleton joint ungluing



In case the skeleton element is unglued the repair depends in :

- careful cleaning of glue joint region, removing the glue excesses and careful grinding the unglued element and shell
- chamfering ace. to Fig. 16/8 "B"
- covering the repair region with composition with silica,
- forming the angle bar acc. to Fig. 16/8 "B".

16.3.7. Repair of lacquer coats

When the shell repairs are completed, the repaired region should be grinded with sand paper of "120", and then of"220" grade.

The repaired surfaces should be free of cavities or buckles. On wings the control with aid of a straight-edge is recommended.

After grinding, spray on the white enamel (e.g. polyurethane, acrylic or similar enamel) 2 times in crossed directions. When the enamel gets hard the repaired place should be uniformed with the whole set by means of polishing it with a paste and, in case of grinded surface, by means of grinding with sand papers of "220", "320", "400", "600", "800" grade.

Note: WHEN GRINDING, THE COMPOSITE STRUCTURE MAY NOT BE AFFECTED.

16.4. Materials for repair of composite structure

For the repair of composite structure the described below materials shall be used. These materials shall be attested, with actual date of validity and stored in conditions required by item 16.2.2.

The application of other materials must be agreed with producer.

16.4.1. Epoxy composition

a) Epidian 53 resin with Z-1 hardener, dosage :

100 parts by weight of resin + 10.5 ±0.5 parts by weight of hardener

pot life : 60 minutes

producer : Zakłady Chemiczne "Organika-Sarzyna", Nowa Sarzyna

b) Glycidylether 162 resin with Laromin C 260 hardener, dosage :

100 parts by weight of resin + 38 ±1 parts by weight of hardener

pot life : 30 minutes

producer : Glicydylether 162 - Shell

Laromin - BASF

Way of preparing acc. to item 16.2.2.

Note: APPLYING VARIOUS COMPOSITIONS IN ONE REPAIR IS NOT ALLOWED.

Note: GLYCIDYLETHER 162 / LAROMIN C 260 COMPOSITION IS NOT ALLOWED FOR REPAIRS OF SKELETON ELEMENTS.

16.4.2. Glass-fabrics

As the composite reinforcement the glass fabrics with I 550 or Volan A preparation,. listed in the following table should be used :

Catalogue No	Kind of weave	Mass		Thickness of 1 layer (hand laminating)		Producer
		[g/m^2]	[lb/sqft]	[mm]	[in]	
90070	plain	80	0.0164	0.10	0.00394	INTERGLASS
92125	double crossed	280	0.0574	0.35	0.01380	TEXTIL,
92140	double crossed	395	0.0809	0.50	0.01970	Germany
92145	plain (unsymmetrical 6x7)	215	0.0440	0.28	0.01100	
STR 5	double crossed	315	0.0646	0.40	0.01576	PZTT
STR 47	satin	445	0.0912	0.60	0.02364	Pabianice,
STR 58	satin	445	0.0912	0.60	0.02364	Poland

The fabrics, listed in the table, can be replaced with other glass-fibre fabrics, providing that :

1. The fabrics have the preparation I 550 or Volan A.
2. The fabrics are allowed for aircraft production by the Authority.
3. The total surface mass of fabrics used is equal to, or higher than originally used in this area, resulting of fabric layout acc. to Fig. 16/1 and 16.2.

16.4.3. Foams

For repairs of sandwich shells the Divinycell H-60 or Conticell CC-60 foam, of mass density of 0.06 g/cm^3 (0.00216 [lb/c in]) and thickness of 6.5 mm (0.256 [in]), is used.

Instead of the listed in Manual foams the different type of eore material applied in composite gliders can be used, especially if the damage is not a large one.

Producer of foam : Diab Barracuda GmbH, Hannover, Germany.

16.4.4. Fillers

To thicken the epoxy composition (for gluing, padding, filling the small cavities) the materials listed in the following table can be used :

Kind of material	Amount of addition (per weight)	Producer
Microbaloon (brown)	20 per cent	Union Carbide, USA
Microspheres	30 per cent	PZOEl Katowiee
Chopped glass-fibre	15 per cent	KHS Krosno
Colloidal silica (e.g. aerosil)	6 per cent	DEGUSSA, Germany
Titanic white	4 per cent	
Talc	acc. to need	

Note: 1. TALC AND TITANIC WHITE ARE USED FOR PADS ONLY.

2. MICROBALOON AND MIKROSPHERES ARE USED FOR GLUING THE TRAILING EDGES OR PADDING THE FOAM.

16.5. Repair of non-composite parts

16.5.1. Repair of metal elements

All repairs of the damaged metal parts are allowed only on base of agrement with the responsible Authority, or when the opinion of the producer is obtained.

Welding can be performed by the licenced aircraft welder only.

The damages to lacquer or galvanic coverings can be repaired, providing that no corrosive degradation of structure strength occurred. The repair depends in cleaning the metal surface, degreasing it, applying the layer of anticorrosive primer and external enamel coat. The aircraft painting materials or motor-car renovation lacquers can be used.

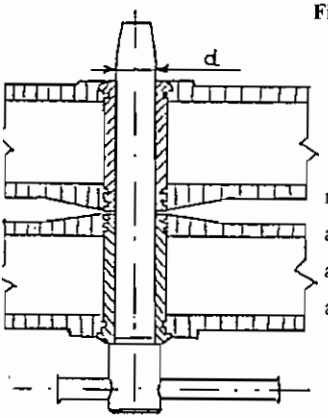
Reaming of fittings.

At the overhaul reaming of fittings the general rule is to preserve the applied fit tolerance. The particular reaming steps and associated dimensions are given on Fig. 16/9, respectively.

For cach reaming step the elements of overhaul dimensions, marked by means of indented points on a visible place, are supplied by the producer.

The amount of points eorresponds to stage of repair.

Fig. 16/9 Reaming of main bolt sleeves



nominal	d = 19 [mm] H7	(0.7486 [in]H7)
after first reaming	I d = 19.25[mm] H7	(0.7585 [in]H7)
after second reaming	II d = 19.5 [mm] H7	(0.7683 [in]H7)
after third reaming	III d = 19.75[mm] H7	(0.7782 [in]H7)

In hand reaming one scnse of reamer rotation should be used, with axial pressure. Time to time the reamer should be taken out of the hole and chips removed. When reaming the steel and bronze elcments, the machine oil - and for duralumin element lubrication with kerosene, should be applied.

The bolt joining the spars has the following dimensions :

nominal	d = 19 [mm] f7	(0.7486 [in] f7)
after first reaming	I d = 19.25 [mm] f7	(0.7585 [in] f7)
after second reaming	II d = 19.5 [mm] f7	(0.7683 [in] f7)
after third reaming	III d = 19.75 [mm] f7	(0.7782 [in] f7)

16.5.2. Canopy perspex

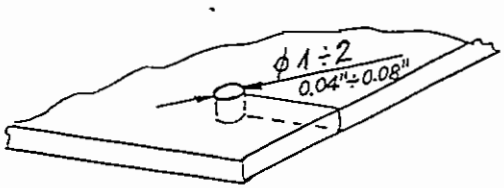
The canopy is made of perspex (polymethacrylate of methyl). NITRO solvent is not allowed for eleaning.

In ease the perspex gets "silver" (appearance of the small internal microcracks as a consequence of ageing under the influence of light), the perspex shall be replaced.

The propagation of perspex small cracks can be stopped by drilling the hole at the end of crack, acc. to Fig. 16/10.

For gluing or refilling of the perspex small deficiencies the glue for perspex can be used.

Fig. 16/10 Repair of the perspex small cracks



16.5.3. Repair of fabric covering of rudder

In case of large tears, holes or loss of tension the fabric should be replaced in specialized workshop.

The tension should be checked with static pressure with force of about 5 [daN] (11 [lb]) by means of ball of 40 [mm] (1.58 [in]) diameter. The pressure is to be retained for approx. 3 seconds. The pressure should not result in the permanent (non disappearing) deformation.

For covering, the arbitrary aircraft cotton fabric of mass density of 60 to 120 [g/m^2] (0.0123 to 0.0246 [lb/sqft]) should be used.

Repair of small failures :

- remove the lacquer on the damaged region (in case of problems with the lacquer removal , the lacquer carefully grinded is acceptable),
- stitch the edges of damaged fabric with cotton thread,
- prepare the patch by means of tightening the aircraft cotton fabric with cellon (minimum overlap for gluing is 30 [mm] (1.18 [in]),
- glue up the pateh with nitro-cellulose glue.

Note: AFTER REPAIR OF FABRIC, THE RUDDER MASS BALANCE SHOULD BE CHECKED AND CORRECTED.

16.6. Replacement of parts

Design and eonstruction of glider allow for replacement by user himself of the following torn-off, or damaged parts :

1. Bolt conneeting the spars.
2. Underearriage :
   a) main wheel,
   b) tail wheel,
   e) wheel axles.
3. Caps and plates of airbrake.
4. Pilot's cockpit equipment :
   a) instrument panel,
   b) cover of instrument panel,
   c) pedals for rudder control,
   d) seat pan,
   e) luggage eompartment,
   f) control column, stick,
   g) instrument panel base.
5. Rudder with control cables.
6. Canopy :
   a) perspex,
   b) canopy frame,
   c) canopy complete.
7. Elevator.
8. Stabilizer.
9. Ailerons.
10. SZD III or TOST G88, E85 towing hook.
11. Push-rods and levers of control systems.

When the user is unable to perform the correct replacement of parts he should order the parts acc. to Spare Parts Catalogue together with replacement instructions.

TOST hooks and tail wheel are to be ordered at:

Richard Tost, Flugzeuggerätebau,

München.