



**Allstar PZL Glider
Sp. z o.o.**

TECHNICAL SERVICE MANUAL

for a sailplane

Model: SZD-54-2 „Perkoz”

Serial No.:

Registration:

**TRANSLATION OF THIS DOCUMENT AND CONVERSION OF TECHNICAL DATA HAVE BEEN
DONE BY BEST KNOWLEDGE AND JUDGMENT**

IN ANY CASE OF DISCREPANCIES IN TRANSLATION THE POLISH VERSION SHOULD BE USED

**THIS MANUAL IS TO BE ALWAYS AVAILABLE DURING ROUTINE MAINTENANCE OPERATION,
INSPECTION AND PERIODIC WORKS.**

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Issue II – April 2014

corrected

Note to English version, Issue II – April 2014, corrected:

By the way of the Revision No. 2 implementation, the whole Technical Service Manual in English was checked and corrected in order to eliminate mistakes found and to be in line with Polish version. The corrections are not indicated to achieve compatibility with Polish version, however all pages are marked with “corrected” in the footer to distinguish them from previous not corrected editions. Therefore this edition of the Technical Service Manual replaces the previous one as a whole.

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SECTION 0. ISSUANCES

0.1. Record of revisions

Any revision of the present Manual must be recorded in the following table and - in case of Sections 10. and 16. - endorsed by the Agency (EASA).

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The new or amended text in the revised page will be indicated by a black vertical line in the outer margin and the Revision No. The number and date of the last revision will be shown in the footer of the page.

With every revision implementation, the pages affected with this revision and listed in the following table must be replaced.

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SECTION 1.

DESCRIPTION AND TECHNICAL DATA

1.1. Sailplane description

SZD-54-2 „Perkoz” is a two-seat sailplane made of composite: primary structure in glass-epoxy, with some components (exchangeable wingtips, canopy frame, rudder) in carbon-epoxy, designed according to certification specifications CS-22.

Two-panel wings of tapered outline with exchangeable wingtips: plane type (Category U and A), winglets (Category U only) or long with winglets (increasing wing span to 65,62 ft, Category U only). NN-8 laminar aerofoil. Sandwich skin composite-foam-composite. Wing spar flanges of glass roving reinforced composite. Spar roots joined together with horizontal main bolt.

Wing ailerons of 20% chord ratio, sandwich structure, mounted on five hinges, driven by single input. Long wingtip ailerons with constant chord, sandwich structure, mounted on two hinges and additionally supported on aileron clutch.

Two-plate airbrakes protruding from wing top surface only. Panels equipped with adjustable laminate cover straps, tightened with springs.

Connection of aileron and airbrake control systems is done automatically when wings are mounted to the fuselage.

Monocoque structure fuselage, integral with fin. Central part comprises a frame with formers (main front former, rear upper and lower former), upper ceiling and luggage boot floor.

Tail unit in conventional arrangement, with horizontal tailplane shifted slightly to the rear. Stabilizer and fin of sandwich structure. Elevator of sandwich structure, mounted on six hinges, driven by single input, mass balanced. Composite carbon-epoxy rudder with horn type balance – aerodynamic and mass.

Connection of elevator control system is done automatically by sliding elevator lever slit over a roller on a lever mounted in the fuselage. System is equipped with spring type longitudinal trim control (trimmer).

Monorail, fixed landing gear. Shock-absorbed main wheel (Ø350×135 mm) equipped with hydraulic brake. Nose (Ø255×110 mm) and tail (Ø200×50 mm) wheels non-cushioned, without brakes.

The cockpit with tandem seats arrangement equipped with one-piece canopy, side-opening to the right. Rotary hinges situated on RH cockpit board. Mounted to fittings laminated to fuselage shell. Emergency jettison mechanism located on canopy frame, on the right hand side. The canopy equipped with “Röger hook”.

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Seated pilot attitude in a cockpit. Fixed back rest at front seat with no regulation. Seat pan of rear seat adjustable on ground (vertical position and distance from pedals). Pedals at front seat adjustable in-flight, pedals at rear seat – fixed. At both seats additional back cushions are provided, not fastened to back rest, to enhance comfort for short pilots.

Instrument panels located at front and rear seats, the latter – optional. Sailplane minimum equipment is mounted in the front instrument panel and includes:

- airspeed indicator with range of indications 0 ÷ 160 or 200 kn
- altimeter with range of indications 0 ÷ 30 000 ft
- accelerometer with range of indications from -5 to +7 g
- *(item removed)*.

2 |

Additionally front instrument panel can be equipped with:

- compass
- electrical turn indicator with bank indicator
- bank indicator for inverted flight
- total energy compensated variometer with range ±10 kn (recommended)
- variometer's compensating vessel (recommended)
- variometer ±60 kn
- transceiver
- transponder
- stall warning unit SP3.

2 |

and other equipment listed in Section 8. of this Manual.

According to specification CS-22 equipment in rear instrument panel isn't necessary (for second pilot). However, the Type Certificate Holder suggest to install:

- airspeed indicator with range of indications 0 ÷ 160 or 200 kn
- altimeter with range of indications 0 ÷ 30 000 ft
- accelerometer with range of indications from -5 to +7 g
- total energy compensated variometer with range ±10 kn
- variometer's compensating vessel

Additionally rear instrument panel can be equipped with:

- compass
- electrical turn indicator with bank indicator
- bank indicator for inverted flight
- variometer ±60 kn

and other equipment listed in Section 8. of this Manual.

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1.2. Sailplane technical data

Span	57,42	65,62	[ft]
Length	27,69		[ft]
Height (fin with tail wheel)	6,73		[ft]
Root chord	4,27		[ft]
Outboard chord	1,77	0,98	[ft]
Mean standard chord (MSC)	3,25	3,15	[ft]
Wing area	176,10	186,22	[ft ²]
Aspect ratio	18,70	23,135	
Tailplane span	11,15		[ft]
Empty sailplane mass (brand new sailplane)	827 + 22	838 + 22	[lb]

An empty sailplane is defined as a sailplane with minimum equipment specified in the item 8.1. of this Manual, without balance weights and any load (crew, parachutes, baggage).

Maximum in-flight mass

In Category „U” **1356** [lb]

In Category „A” **1301** [lb]

2

1.3. Sailplane three view drawing

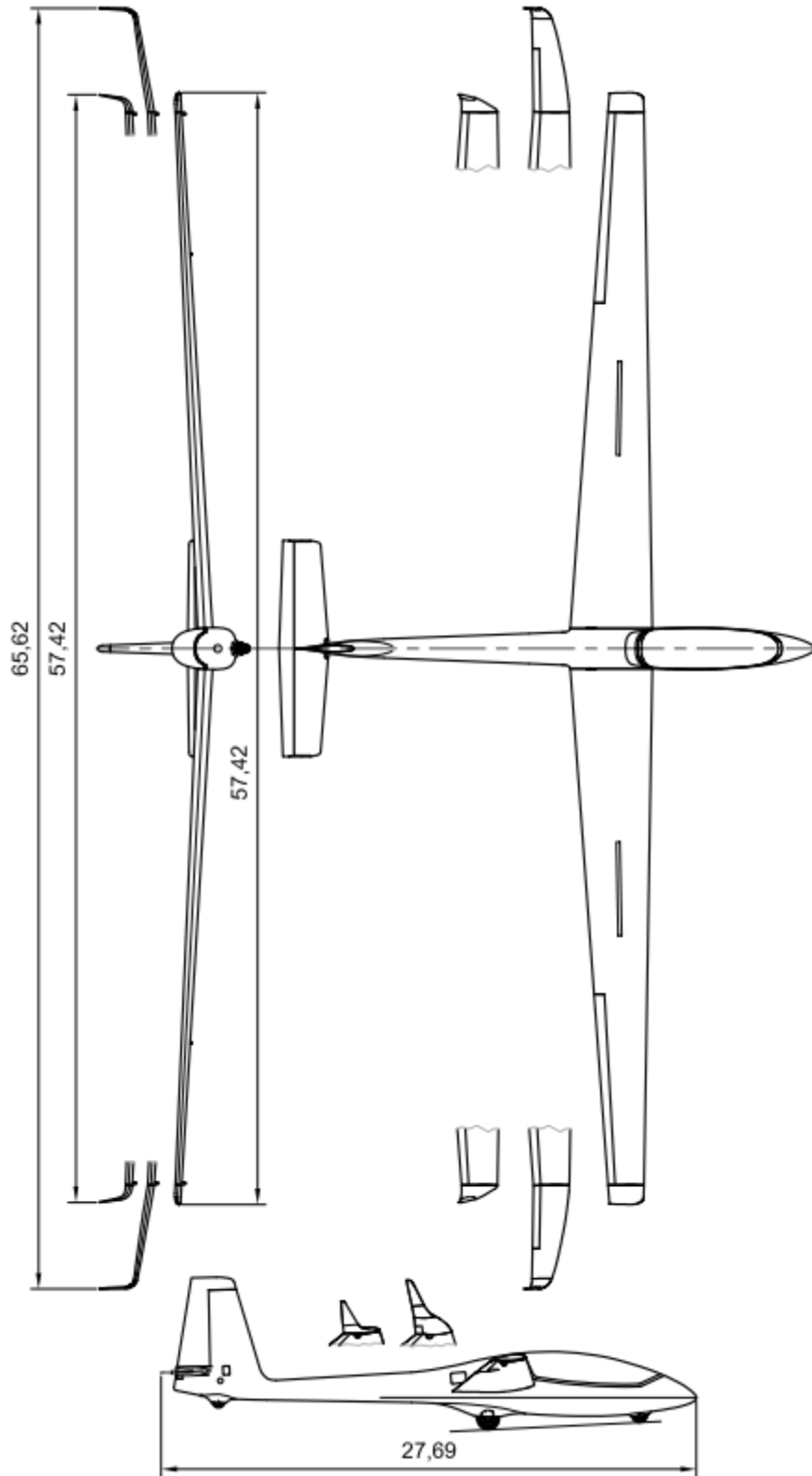


Fig. 1-1. Sailplane 3-view drawing

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1.4. Crew mass balancing

Two removable weights, 13,2 lb each, are provided for crew mass balancing according to sailplane loading plan. Weights are screwed down to plugs situated in the floor in front of front seat.

Mounting the weight consists in attachment with an appropriate screw, screwed in the plug in the cockpit floor. Dismounting the weight consists in screwing out the screw and removing the weight from a sailplane.

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SECTION 2.

ASSEMBLING AND DISASSEMBLING, SYSTEMS DESCRIPTION

2.1. Wings assembling and disassembling

2.1.1. Description of the wing-fuselage connection

Wing-fuselage connection is presented in Fig. 2–1.

NOTE:

Section A-A shows the situation after tightening the spar roots, connected with main pin and secured with safety pin.

Wings are joined together by spar roots, overlapping each other, wherein each of spar root through the pin (1) is embedded in the sleeve (2) which is mounted in the root rib (24) of the opposite wing. The fuselage is connected with wings with four pins (3) and (16) and the main bolt (10), wherein:

- two front pins (3) mounted in the root rib (24) are embedded in sleeves (4) mounted in the fuselage shell,
- two rear pins (16) being the ending of the fuselage frame (15) are embedded in rear fittings (14) and blocked by locking pins (18), which are secured by locking claws (17) blocking the pin guide (19),
- the main bolt (10) connects spar roots with the ball socket (9) mounted in the frame,
- the safety pin (13) protects the main bolt.

1

Legend to Fig. 2-1.:

1. Spar root pin
2. Sleeve
3. Wing front pin
4. Front sleeve
5. Terminal of torque tube in aileron control
6. Terminal of torque tube in airbrake control
7. Aileron driving latch pin
8. Airbrake driving latch pin
9. Ball socket in the fuselage frame (for the main bolt)
10. Main bolt
11. Handle of main bolt
12. Mounting wrench
13. Safety pin
14. Rear fitting
15. Frame tube
16. Fuselage rear pin
- 1 | 17. Elastic locking claws
18. Locking pin
- 1 | 19. Guide of the locking pin
20. Cotter pin
- 1 | 21. Rear fitting assembly key (Fig. 4-3. in TSM)
22. Spar fitting
23. Socket nut
24. Root rib
25. Wing upper and lower skin shell
26. Fuselage shell
27. Wing spars

1 |

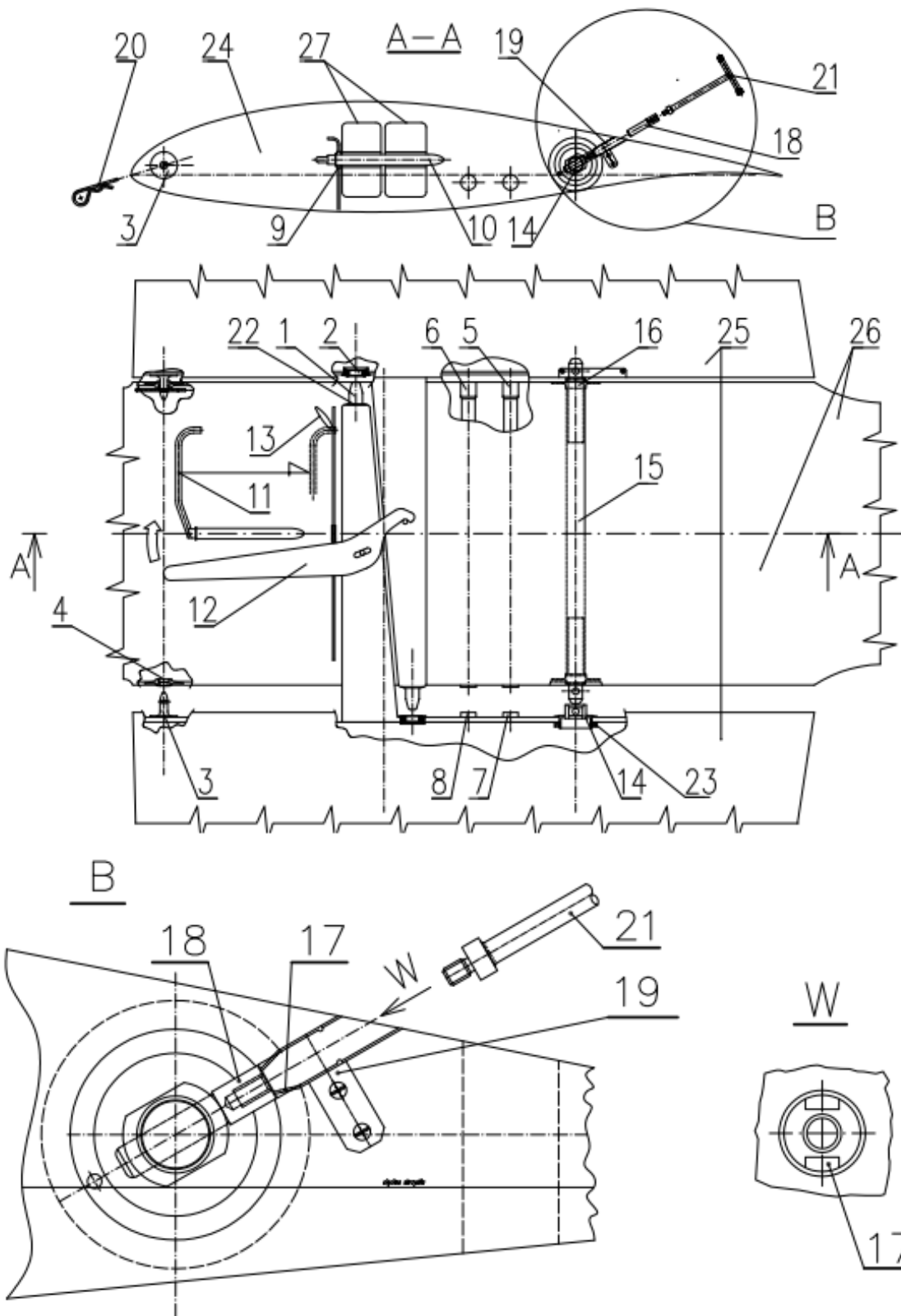


Fig. 2-1. Wings rigging

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2.1.2. Wings rigging

Rigging of the wings to the fuselage is to be done with disassembled wingtips.

Sequence of operations in rigging:

1

1. Put the assembly key (21) through the guide (19) and screw it into locking pin (18), causing falling outward of locking claws (17), and then with the same assembly key remove locking pins from wing rear fittings.
2. Insert the root of RH spar into fuselage, aligning pins (3) and (16) with fitting sleeves (4) and (14). In parallel, bring the terminals on torque tubes of aileron control (5) and airbrake control (6) to enter latch pins (7) and (8) in root rib of RH wing panel.
3. Insert the root of LH wing into fuselage. Manoeuvre with wing tips so to align the pins (3) and (16) and corresponding sleeves (4) and (14), and insert the conical portion of pins (1) in the sleeves (2).
4. Pull the spar roots to each other by means of special mounting wrench (12). In case of jamming over the final phase of movement, align the torque tubes terminals (5) and (6) with latch pins (7) and (8) by movements of the control stick and airbrake control pushrod.
5. Connect the spar roots with the main bolt (10), inserting simultaneously the bolt in the ball socket (9) fastened in the frame.
6. Lock the fuselage rear pins (16) by means of locking pins (18) with the assembly key (21) screwed in, inserting them through guides (19). Screw out the assembly key – in the final stage of screwing out (2 coils) check the efficiency of pin protection against protruding. In addition, visually check through the guide hole if locking claws (17) are blocking the locking pin – view “W”.
7. Secure the main bolt (10), connecting the handle of main bolt (11) with fuselage frame by means of safety pin (13).
8. Secure the wing front pins (3) by means of cotter pins (20).

1

Connection of control systems at the wing/fuselage junction is accomplished automatically. During operation of wing/fuselage rigging process the terminals of torque tubes in aileron (5) and airbrake (6) control systems are aligned with corresponding rotary latch pins (7) and (8) of controls mounted in wing root ribs. Connecting the spar roots with main bolt (10) ensures adequate protection of control systems against disconnection.

2.1.3. Wings de-rigging

Disassemble wingtips before de-rigging wings from fuselage.

De-rigging is to be made in reverse sequence.

To remove the main bolt (10), move the wing tips up and down. Disconnection of controls at wing/fuselage junction occurs automatically.

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2.2. Assembling and disassembling wingtips

2.2.1. Assembling wingtips: plane or winglet

Assembling wingtips - plane or winglet - is presented in Fig. 2–2.

In wingtips locking bolts (3) there are axial threaded M4 holes for screwing wingtip mounting key (6).

Operation sequence in assembling wingtips - plane or winglet:

1. Insert spar root of wingtip in a spar socket on wing side.
2. Pull down the bolt (3) onto stop by means of screwed-in key (6), hold in the „unlocked” position and shove the wingtip, mounting the spar pin (1) in the nest socket (2), as well front and rear pins (4) in sleeves (5).
3. Release bolt (3) up – onto stop, locking in this way the spar pin (1).
4. The bolt should hide completely in the wing. Unscrew the key (6).

2.2.2. Disassembling wingtips: plane or winglet

Pull down the bolt (3) onto stop, by means of screwed-in key (6), hold in the „unlocked” position and shove-out the wingtip from wing socket.

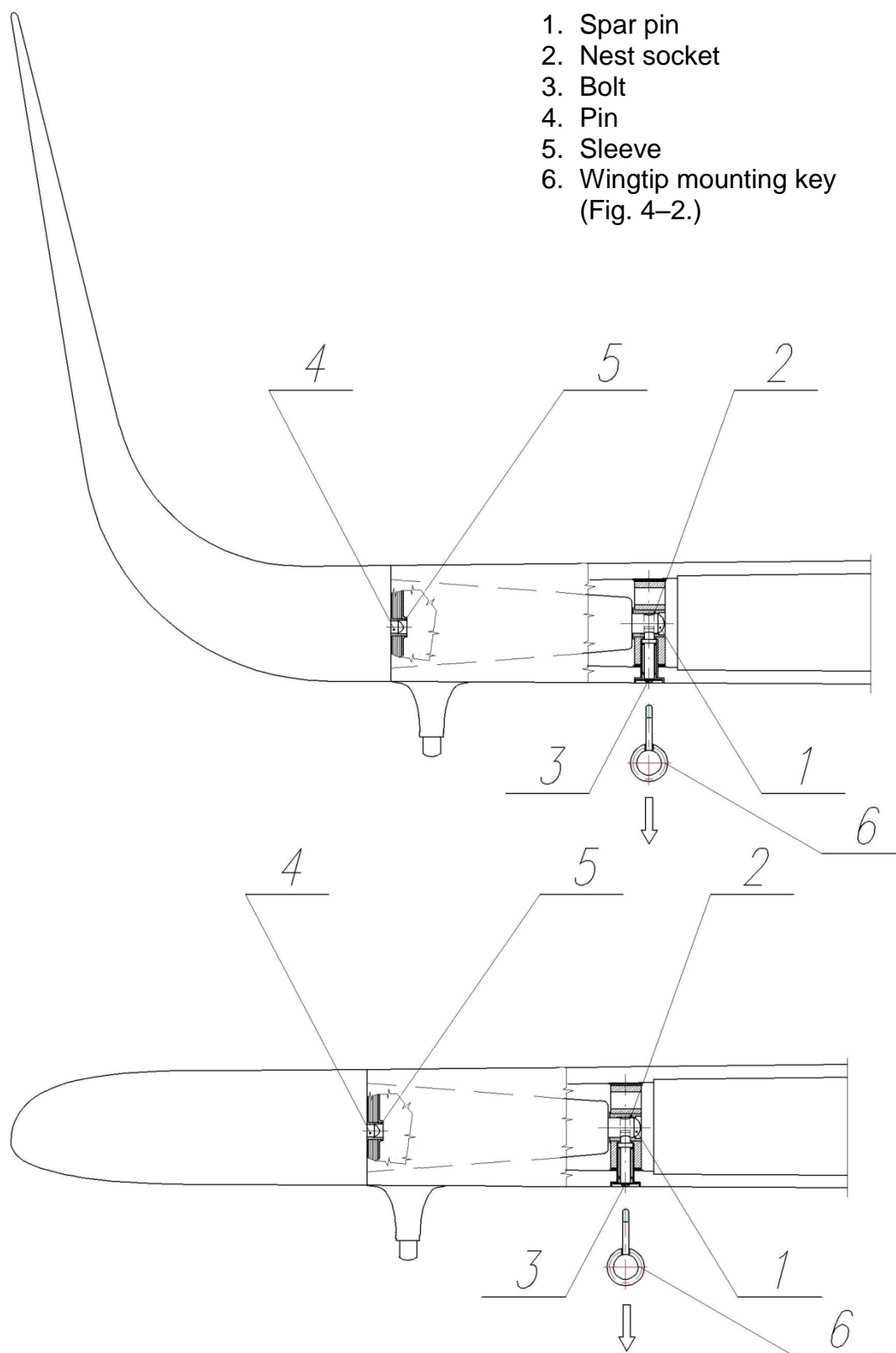


Fig. 2-2. Assembling wingtip: plane or winglet

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2.2.3. Assembling and disassembling long wingtips

Assembling long wingtips, extending wingspan to 65,62 ft, is shown on Fig. 2–3., Fig. 2–4. and Fig. 2–5. In wingtips locking bolts (3) there are axial threaded M4 holes for screwing wingtip mounting key (10).

Long wingtip aileron drive is connected automatically via coupling joint mounted in wingtip aileron axis with socket mounted in wing aileron axis.

Operation sequence in assembling long wingtips:

1. Insert spar root of wingtip in a spar socket on wing side.
2. Set the same deflection for wing and wingtip ailerons.
3. Pull down the bolt (3) onto stop by means of screwed-in key (10), hold in the „unlocked” position.
4. Push wingtip, mounting the spar pin (1) in the socket (2), front and rear pins (4) in sleeves (5), as well as spherical ending of the outer part of aileron clutch (6) together with pin (8) into socket of the inner part of aileron clutch (7).
5. Release bolt (3) up – onto stop, locking in this way the spar pin (1).
6. The bolt should hide completely in the wing. Unscrew the key (10).

Operation sequence in disassembling long wingtips:

1. Pull down the bolt (3) onto stop, by means of screwed-in key (10), hold in the „unlocked” position.
2. Shove-out the wingtip from wing socket.

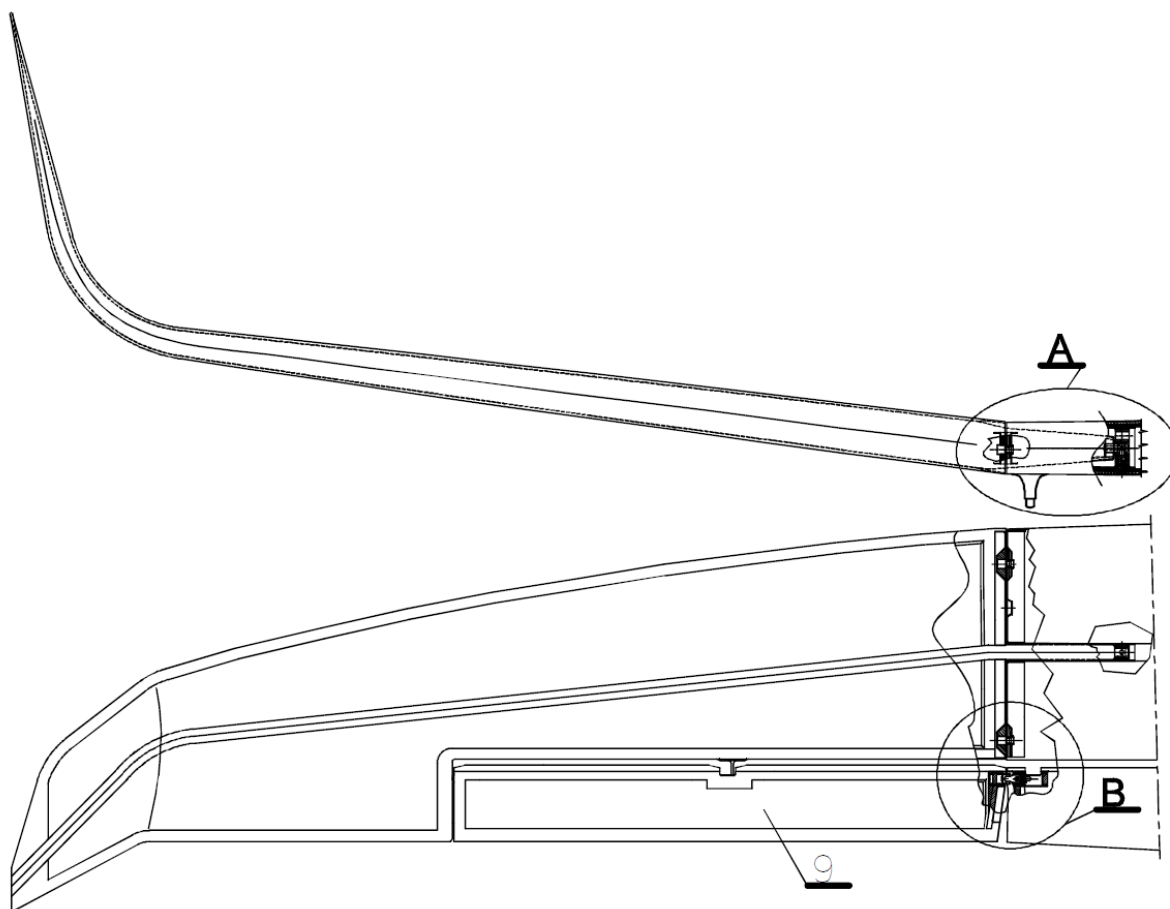


Fig. 2-3. Long wingtips assembling

Legend to Fig. 2-3., 2-4., 2-5.:

1. Spar pin
2. Nest socket
3. Bolt
4. Pin
5. Sleeve
6. Outer part of aileron clutch
7. Inner part of aileron clutch
8. Latch pin
9. Long wingtip aileron (outer)
10. Wingtip mounting key (Fig. 4-2.)

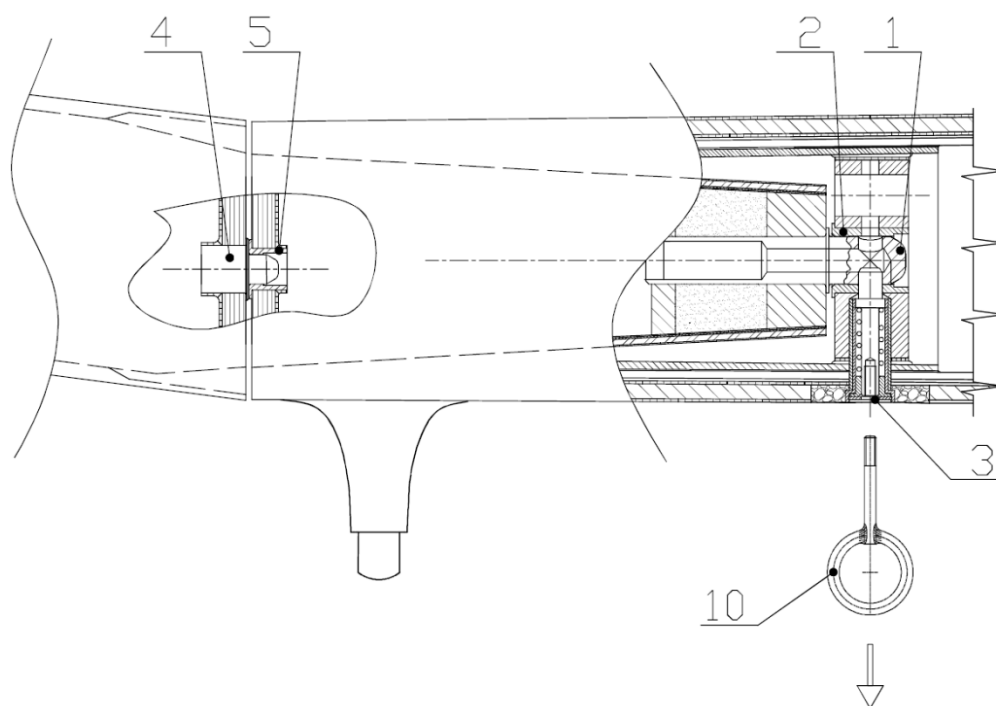


Fig. 2-4. Detail A of wing - long wingtip connection

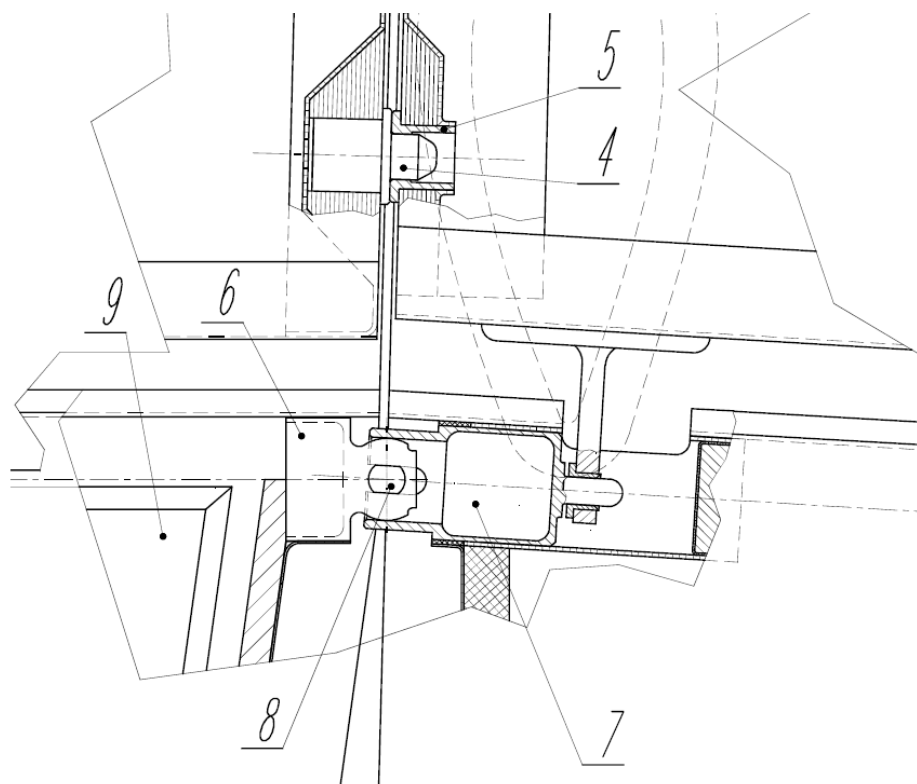


Fig. 2-5. Detail B of wing - long wingtip connection

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2.3. Horizontal tailplane assembling and disassembling

Horizontal tailplane and its connection to fuselage is presented in Fig. 2–6. Horizontal stabilizer is connected to the fuselage by two stabilizer pins (4) inserted into sleeves (5) and stabilizer fastening vertical bolt (1) screwed into fuselage fitting (3) mounted in rear web (13). Vertical bolt (1) is secured from screwing out by special safety pin (2).

Connection of elevator control system during mounting process occurs automatically by end lever (8) slid in elevator lever (9) cut-out.

Operation sequence in the tailplane assembling:

1. Set trimming device to NH (nose heavy) position, deflect rudder fully to right or left side.
2. Shove in the horizontal tailplane, inserting pins (4) in sleeves (5) (to be done by two persons), **with elevator deflected fully down**. Maintaining the lever (8) in upper and the elevator in lower position facilitates automatic connection of elevator control by aligning cut-out in the lever (9) with lever roll (8). Correct connection between levers (8) and (9) must be verified through transparent glass-sight (10).

WARNING:

Other than NH position of trimming device and elevator not complete deflection down results in lack of connection in elevator control.

3. Insert the vertical bolt (1) in the fitting (3) and tighten with $M = 7,38 \div 8,85$ lbf·ft torque, by means of torque wrench. The bolt head is to be positioned so to enable mounting of the special safety pin (2).
4. Check correct connection of elevator controls by gentle deflections of control stick fore and aft onto stop. Elevator deflections should follow these of control stick.
5. Secure bolt (1) with special safety pin (2) against loosening. The safety pin is to be inserted in level position, as per Fig. 2–6., to avoid collision with the rudder.

NOTE:

If the safety pin will be set to vertical position, this might be disconnected by the rudder.

Disassembling is to be accomplished in reverse sequence. Before pulling out stabilizer pins (4) from sleeves (5) slightly lift the tailplane to disconnect cone stabilizer fitting from fuselage fitting (3).

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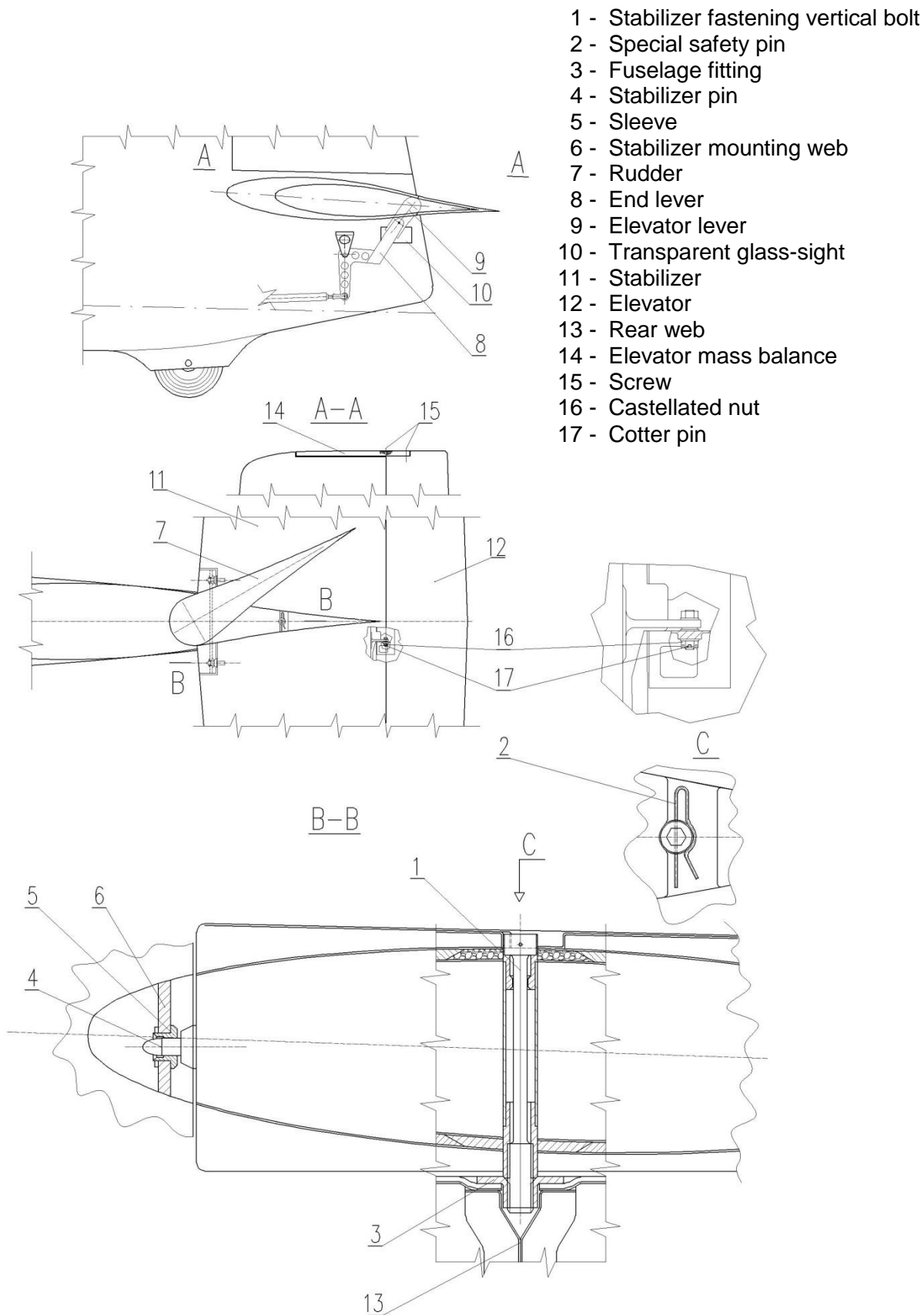


Fig. 2-6. Horizontal tailplane assembling

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2.4. Elevator mounting and dismounting.

The elevator is hung on six hinges. Method of its mounting on horizontal stabilizer is presented in Fig. 2–6.

Operation sequence in elevator dismounting:

1. Disassemble horizontal tailplane from the sailplane.
2. Unscrew two fixing screws (15) of right elevator mass balance (14).
3. Remove safety pin (17) and unscrew castellated nut (16) from hanging axle.
4. Slide out the elevator to the left.

Mounting to be accomplished in reverse sequence.

2.5. Rudder mounting and dismounting

Method of rudder mounting is presented in Fig. 2–11.

Rudder (13) **dismounting** is possible after uncovering the inspection hole (22) on the LH side of rudder. Dismounting follows by unscrewing the castellated nut (10) (after removing safety pin) out of axle (6) and pulling the rudder „upwards”.

Rudder **mounting** in reverse sequence. It is crucial that lever (5) and the rudder itself are in such position, that driving bolts (7) mounted in lever (5) goes into openings in the rudder lower fitting (9) mounted in the rudder lower rib.

2.6. Ailerons mounting and dismounting

2.6.1. Wing aileron dismounting

Method of ailerons mounting on wings is presented in Fig. 2–13.

Operation sequence in aileron dismounting:

1. Disconnect push-rod (3) ending from aileron driving lever (5).
2. Remove safety pin and unscrew castellated nut (7) out of hanging axle.
3. Deflect the aileron downwards and sidle out of hinges by moving it towards wing tip.

Mounting to be accomplished in reverse sequence.

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2.6.2. Long wingtip aileron dismounting

1. Remove spring washer (15) and washer (16) (Fig. 2–13.)
2. Remove aileron axially towards wingtip root.

Mounting to be accomplished in reverse sequence.

2.7. Nose wheel mounting and dismounting

Method of nose wheel mounting is presented in Fig. 2–7.

Dismounting:

To dismount the nose wheel, remove the cotter pin (5), unscrew the nut (6), remove the washer (4), the axle (2) and distance sleeves (3).

Mounting to be accomplished in reverse sequence.

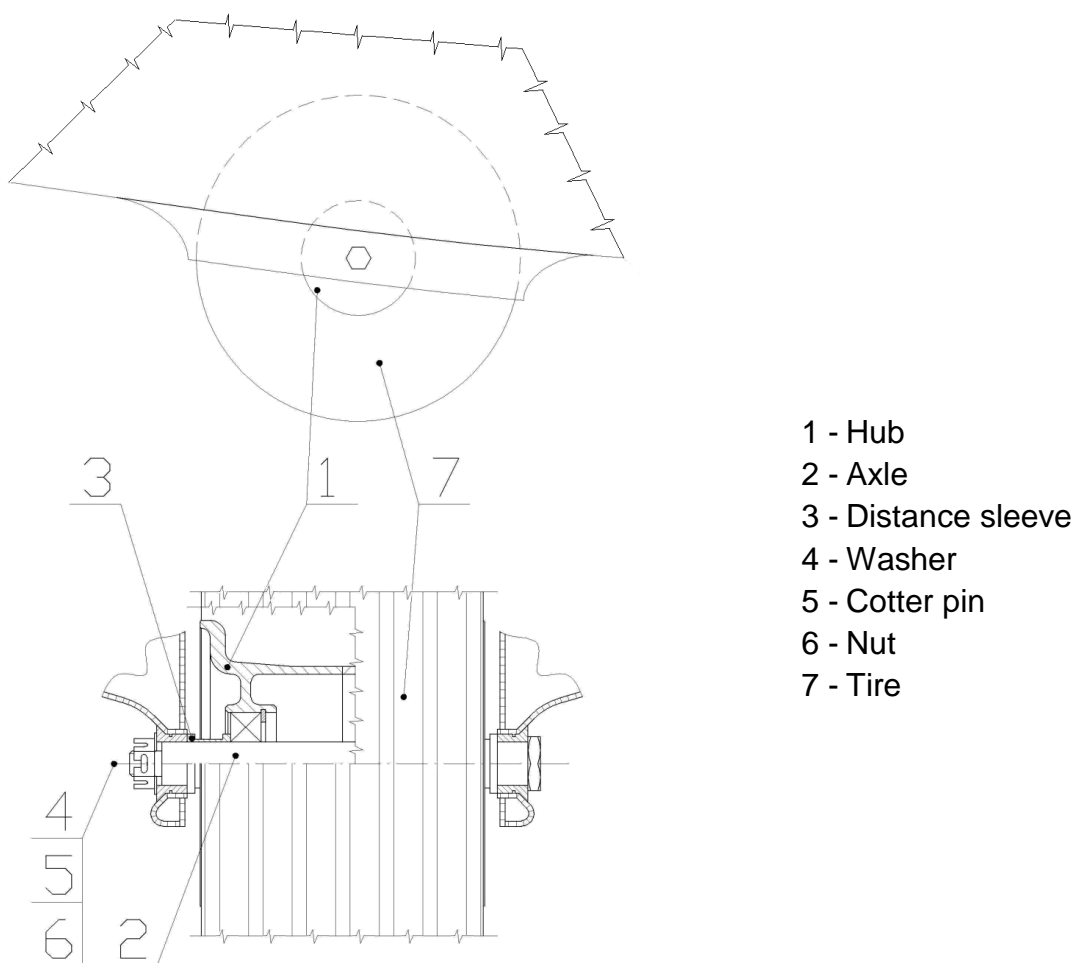


Fig. 2-7. Nose wheel mounting

2.8. Main wheel mounting and dismounting

Method of main wheel mounting is presented in Fig. 2–8.

Operation sequence in main wheel dismounting:

1. Remove bolts (20) connecting swingarm (2) with undercarriage shins (21).
2. Dismount brake shoes (3) without disconnecting the hose (7).
3. Unscrew axle screw (26).
4. Remove wheel axle (5).

Mounting to be accomplished in reverse sequence.

NOTE:

Axle screw (26) should be located on the side of the wheel brake.

Legend to Fig. 2–8.

1 - Wheel hub	15 - Fuselage frame
2 - Swingarm	16 - Screw
3 - Brake shoes	17 - Screw with nut
4 - Brake disk	18 - Bolt
5 - Wheel axle	19 - Pin
6 - Brake master cylinder	20 - Bolt
7 - Hydraulic hose 1	21 - Lower shin
8 - Hydraulic hose 2	22 - Upper shin
9 - Brake fluid reservoir	23 - Shock absorber
10 - Lever	24 - Bolt
11 - Brake Bowden	25 - Bolt
12 - Console	26 - Axle screw
13 - Brake lever on control stick	27 - Front main former
14 - Mudguard	28 - Rear lower former

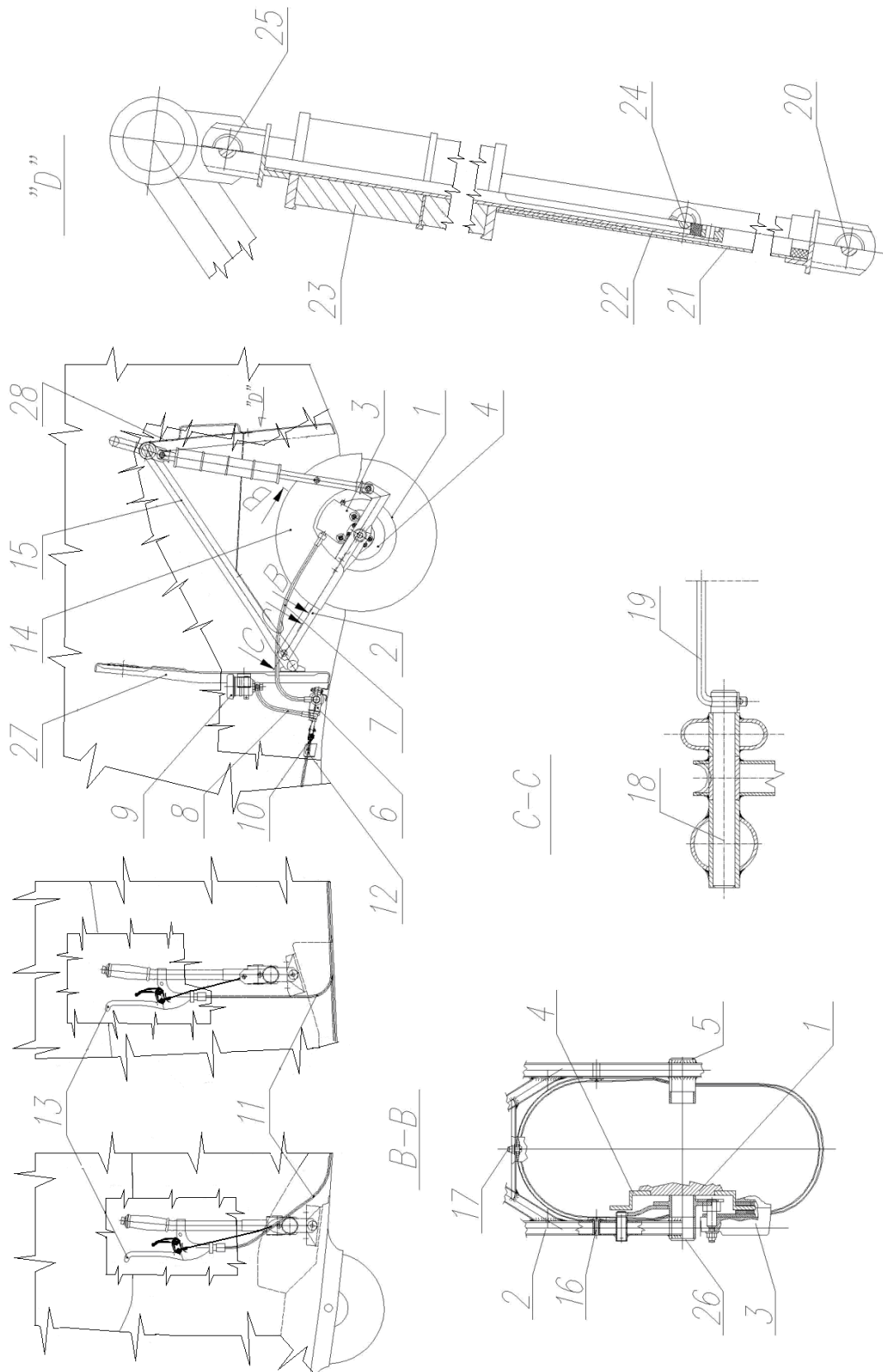


Fig. 2-8. Main landing gear

For dismounting of tire and inner tube (Fig. 2–9.) unscrew screws (4).

NOTE:

Before assembling both halves of hub and tire, inner tube is to be slightly pumped. Operation pressure in wheel is 58 psi.

- 1 - Left half of the hub
- 2 - Right half of the hub
- 3 - Brake disk
- 4 - Connecting screw

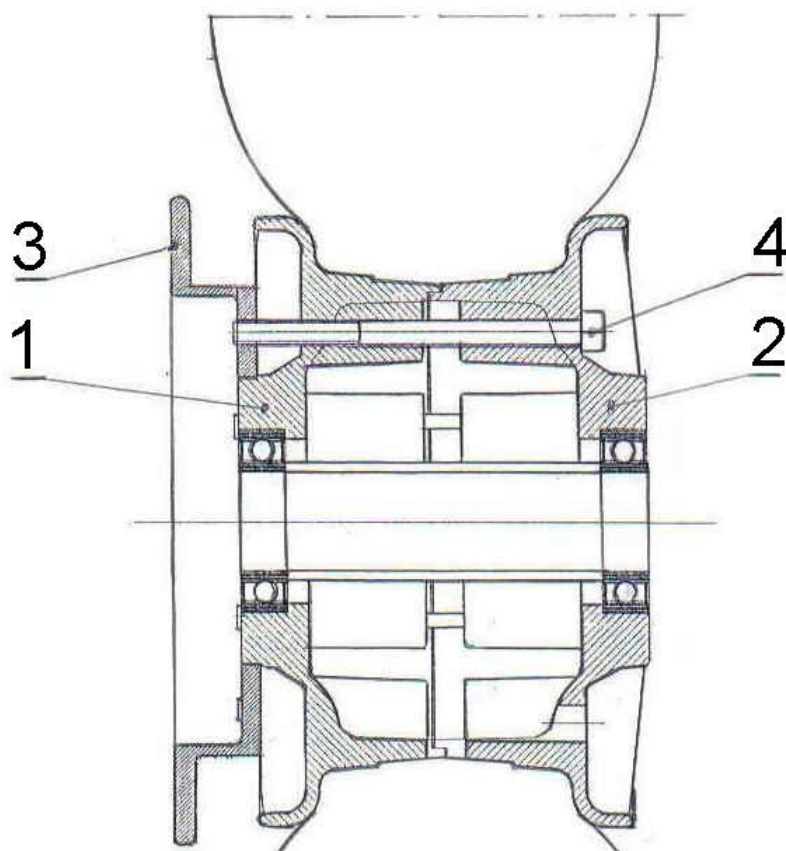


Fig. 2-9. Main landing wheel hub

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2.9. Main landing gear mounting and dismounting

Main landing gear system design is presented in Fig. 2–8.

Dismounting of main landing gear is done after dismounting main wheel according to description in item 2.8.

Operation sequence in main landing gear dismounting:

1. Unscrew screws (16) and (17) and remove the mudguard (14).
2. Remove cotter pins and pins (19) securing bolts (18).
3. Remove bolts (18).
4. Remove cotter pins securing bolts (20) and the bolts themselves.
5. Dismounting of shock absorbers (23) is done after removal of cotter pins from bolts (25) and the bolts themselves.

Disassembling of shock absorbers can be done after dismounting them from sailplane. To do this, remove cotter pin from bolt (24), exert a compressive force large enough to deflect shock absorber 3÷5 mm, and remove bolt (24). Then slowly decrease the compressive force to zero.

Mounting to be accomplished in reverse sequence.

2.10. Tail wheel mounting and dismounting

Dismounting:

A dedicated screw forms tail wheel axle. To dismount the tail wheel it is enough to bend off the safety washer and unscrew the nut, then remove the axle-screw.

Mounting to be accomplished in reverse sequence.

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2.11. Canopy

Method of canopy mounting is presented in Fig. 2–10.

Hinges (7) are placed on RH cockpit board. They are attached rotationally to fittings (10) laminated to fuselage shell.

Canopy jettison device is situated on the RH side of the canopy frame. It consists of levers (1) (situated by front and rear seat) connected by pushrod (3), which enables both pilots to use this device independently. Pushrod (3) is connected to pull rod (5) terminated by pin (11) connecting bracket (6) and lever (12) with telescopic slide (13), holding canopy in open position. Described canopy jettison connections provides simultaneous canopy disconnection from hinges (7) (by unlocking hooks (9) joined with levers (1)) and pull rod (5) when lever (1) is pushed forward by pilot from either front or rear seat.

In order to prevent inadvertent, too easy canopy jettison device actuation, the lever (1) is connected to canopy frame by brass lock wire, diameter 0,5 mm.

Canopy closing mechanism is mounted on LH side of canopy frame. It consists of two levers (2) connected with pushrod (4) and sockets (8) mounted to fuselage frame. Lever (2) forward movement results opening of the canopy. Closing in opposite direction.

Canopy dismounting:

Canopy dismounting from fuselage is to be done by moving forward canopy jettison lever (1) which cause unlock the hook (9) and disconnect canopy from canopy hinges (7), as well as pin (11) from bracket (6) and consequently from lever (12) with slide (13) set.

Mounting to be accomplished in reverse sequence.

Legend to Fig. 2–10.

- | | |
|-------------------------------|---------------------------|
| 1 - Canopy jettison lever | 7 - Canopy hinge |
| 2 - Canopy open/close lever | 8 - Sockets |
| 3 - Canopy jettison pushrod | 9 - Lock hook |
| 4 - Canopy open/close pushrod | 10 - Canopy hinge fitting |
| 5 - Canopy jettison pull rod | 11 - Pin |
| 6 - Lever bracket | 12 - Lever |
| | 13 - Telescopic slide |

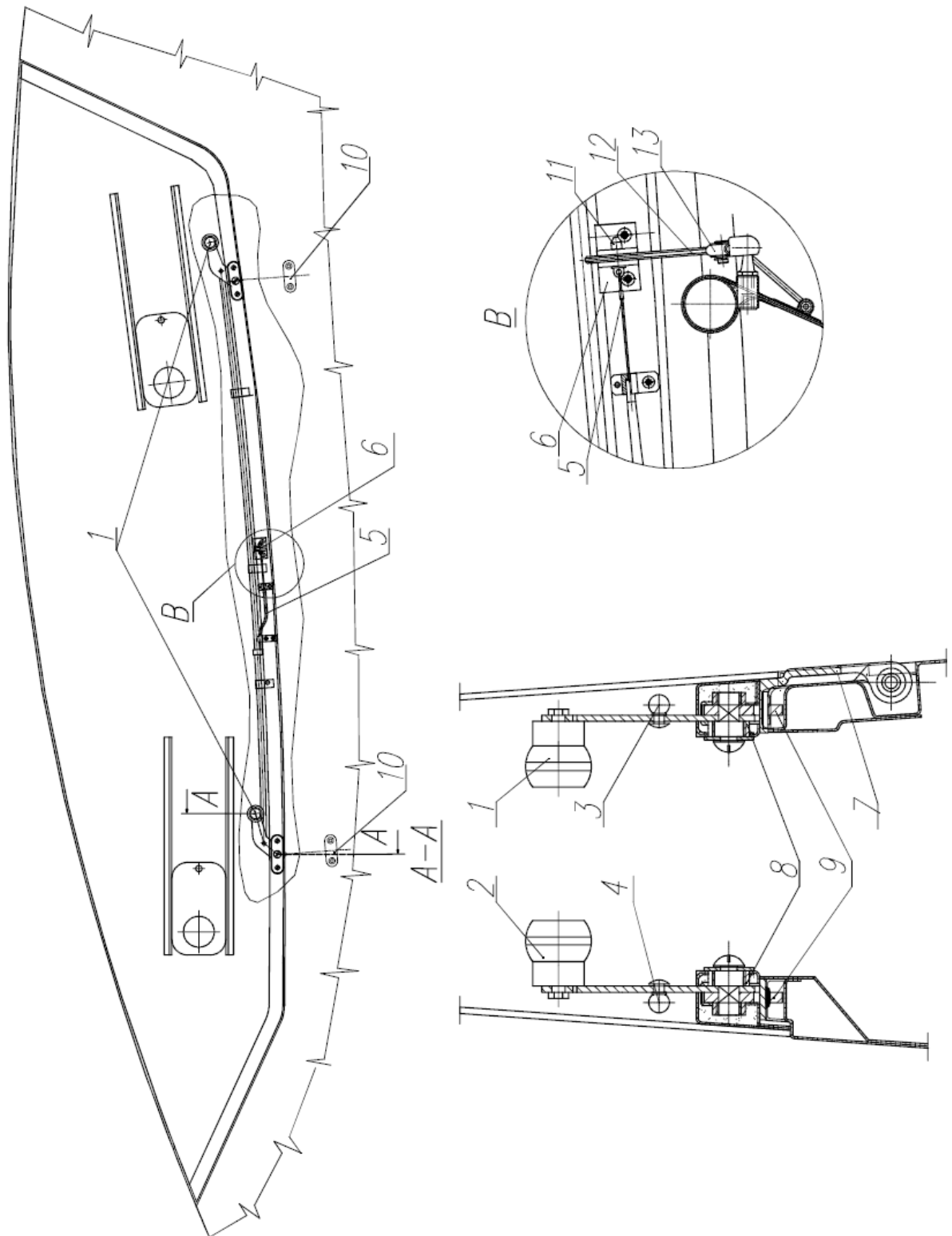


Fig. 2-10. Canopy

2.12. Rudder control system

Legend to Fig. 2–11.

- 1 - Rudder driving segment
- 2 - Long pushrod
- 3 - Torsional tube
- 4 - Short pushrod
- 5 - Lever
- 6 - Axle
- 7 - Driving bolt
- 8 - Rear foot pedals
- 9 - Rudder lower fitting
- 10 - Castellated nut
- 11 - Front foot pedals assembling
- 12 - Rudder upper hanging bolt
- 13 - Rudder
- 14 - Rudder driving cable pulleys
- 15 - Rear rudder pedals driving cable pulleys
- 16 - Rudder circuit cable
- 17 - Front rudder pedals driving cable
- 18 - Inter rudder pedals driving cable
- 19 - Rear rudder pedals driving cable
- 20 - Turnbuckle
- 21 - Inspection opening
- 22 - Inspection opening
- 23 - Bolt
- 24 - Safety pin
- 25 - Connector

CAUTION

Bolts (23) must be inserted from the centre of cockpit towards fuselage shell.

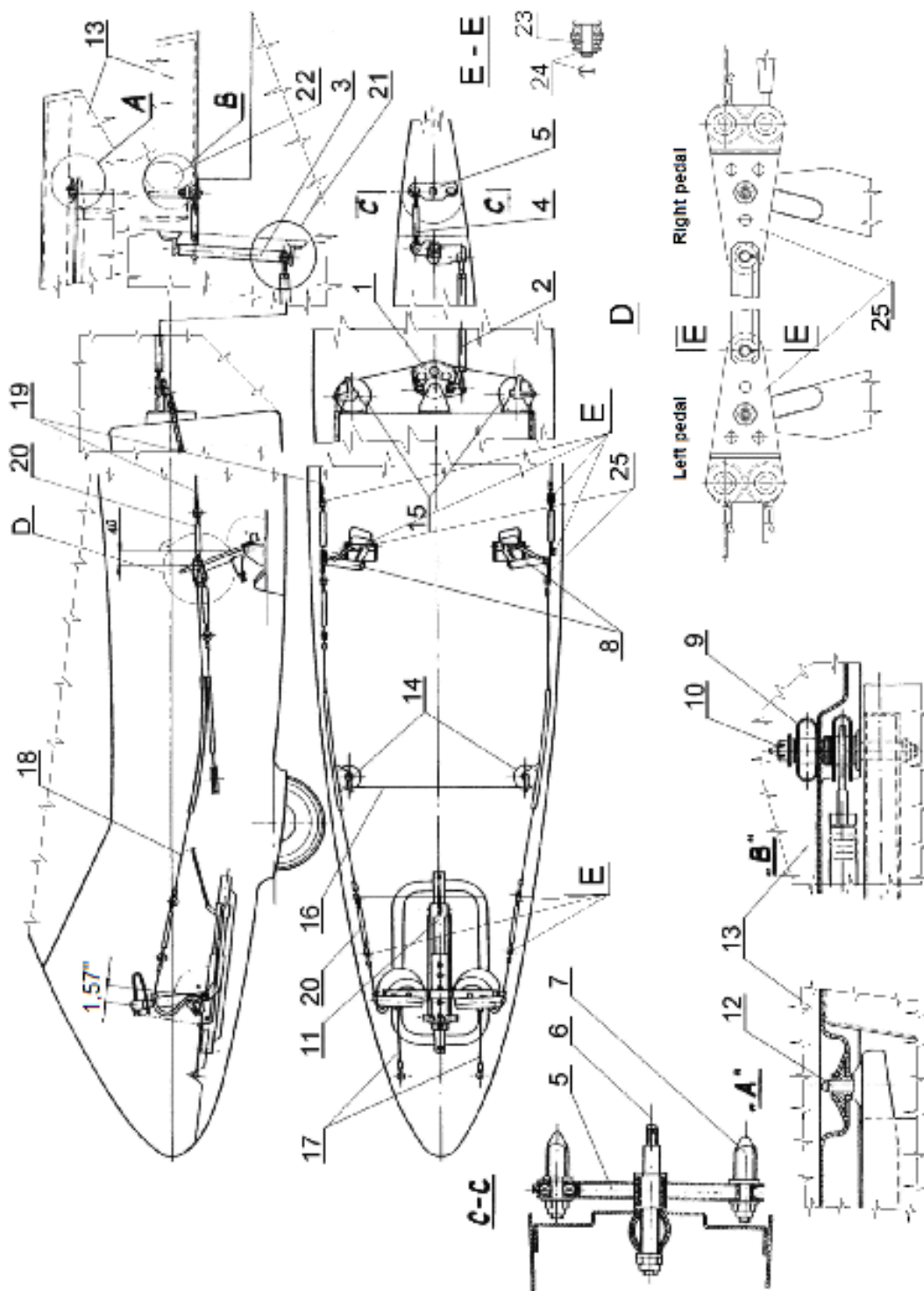


Fig. 2-11. Rudder control system

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2.13. Elevator, aileron and longitudinal trimming control system

Legend to Fig. 2–12.

- 1 - Front flying control
- 2 - Rear flying control
- 3 - Control stick
- 4 - Aileron deflection adjustment tap bolts
- 5 - Elevator deflection adjustment tap bolts
- 6 - Aileron control system pushrod between front and rear flying controls
- 7 - Aileron driving pushrod in fuselage
- 8 - Aileron driving torsional tube
- 9 - Elevator control system pushrod between front and rear flying controls
- 10 - Elevator driving pushrod in fuselage
- 11 - Elevator driving lever
- 12 - Elevator driving pushrod in tail
- 13 - Rear lever
- 14 - Elevator lever
- 15 - Trimmer control lever / ball handle (2nd version)
- 16 - Trimmer locking cable
- 17 - Trimmer pushrod
- 18 - Trimmer locking lever
- 19 - Trimmer locking device
- 20 - Trimmer spring tightener
- 21 - Trimmer spring
- 22 - Trimmer locking trigger (only 2nd version)

Sailplane does not have classic trimmer, i.e. adjustable flap at the elevator. It has spring-balancing device, which for simplicity of records in this Manual is referred to as “trimmer”.

Sailplane manufacturer developed two versions of longitudinal trim system control solution.

2 |

1. Longitudinal trim control lever on a cockpit LH side board. Un-locking of trimming device is achieved by rotating the lever. Setting up the longitudinal trim is done by moving the lever forward or backward. Locking of mechanism is accomplished in desired position after releasing lever which returns to the original position influenced by the spring.
2. Longitudinal trim locking trigger on control stick and trimming device adjustment grip on a cockpit LH side board. Un-locking of trimming device is achieved by pressing the trigger on control stick. Setting up the longitudinal trim is done by moving the control stick forward or backward. Use the adjustment grip on a cockpit LH side board to accurate positioning. Locking of mechanism is accomplished automatically after releasing trigger on control stick.

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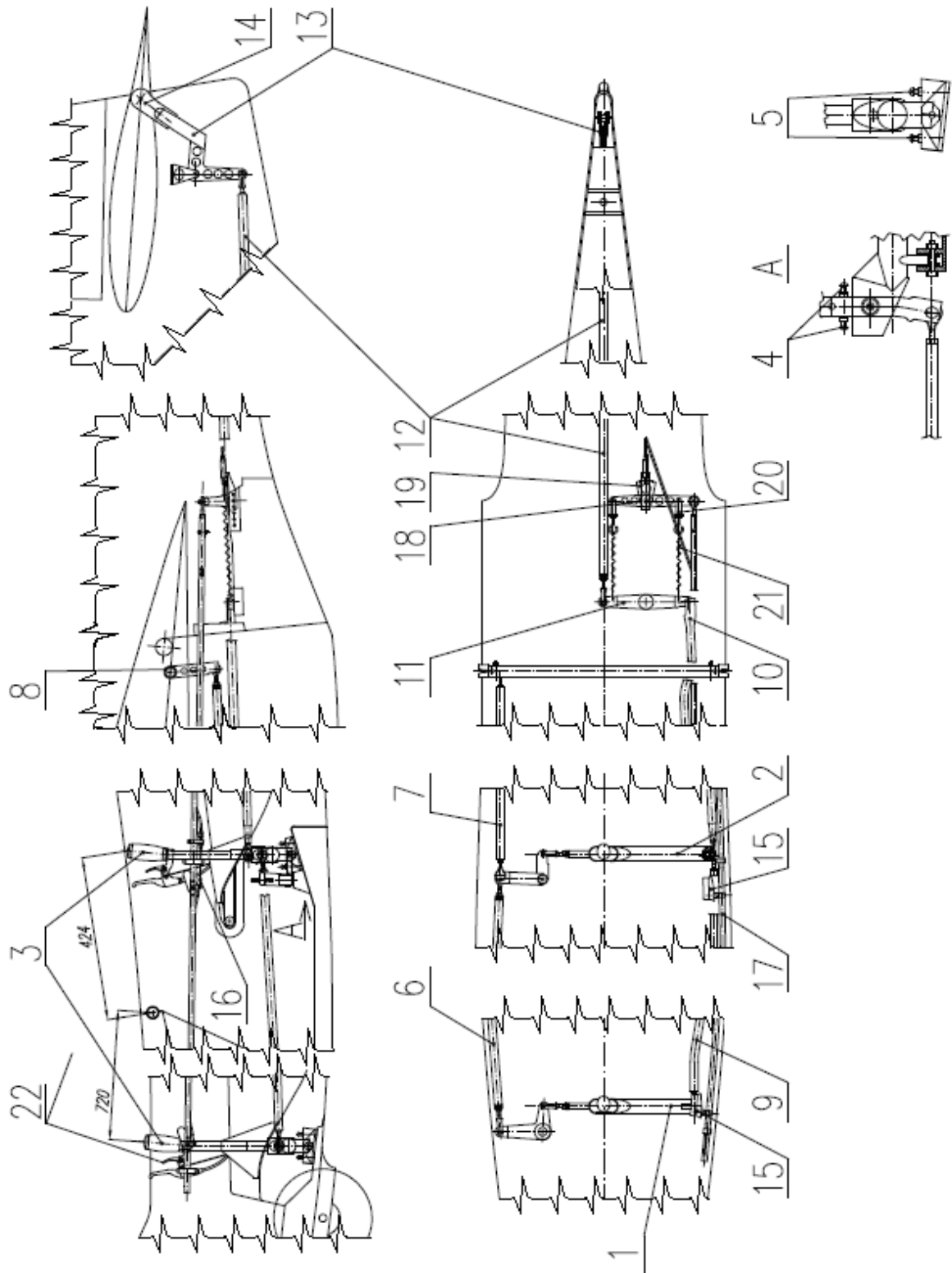


Fig. 2-12. Elevator, aileron and trimmer control system in fuselage

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Legend to Fig. 2–13.

- 1 - Long pushrod in left wing
- 2 - Long pushrod in right wing
- 3 - Pushrod
- 4 - Aileron
- 5 - Aileron driving lever
- 6 - Aileron hinges
- 7 - Castellated nut
- 8 - Pushrod pass
- 9 - Aileron intermediate driving lever
- 10 - Aileron driving lever fitted to rib No. 1 in left wing
- 11 - Aileron driving lever fitted to rib No. 1 in right wing
- 12 - Aileron driving latch pins
- 13 - Outer aileron clutch
- 14 - Inner aileron clutch
- 15 - Circlip
- 16 - Washer

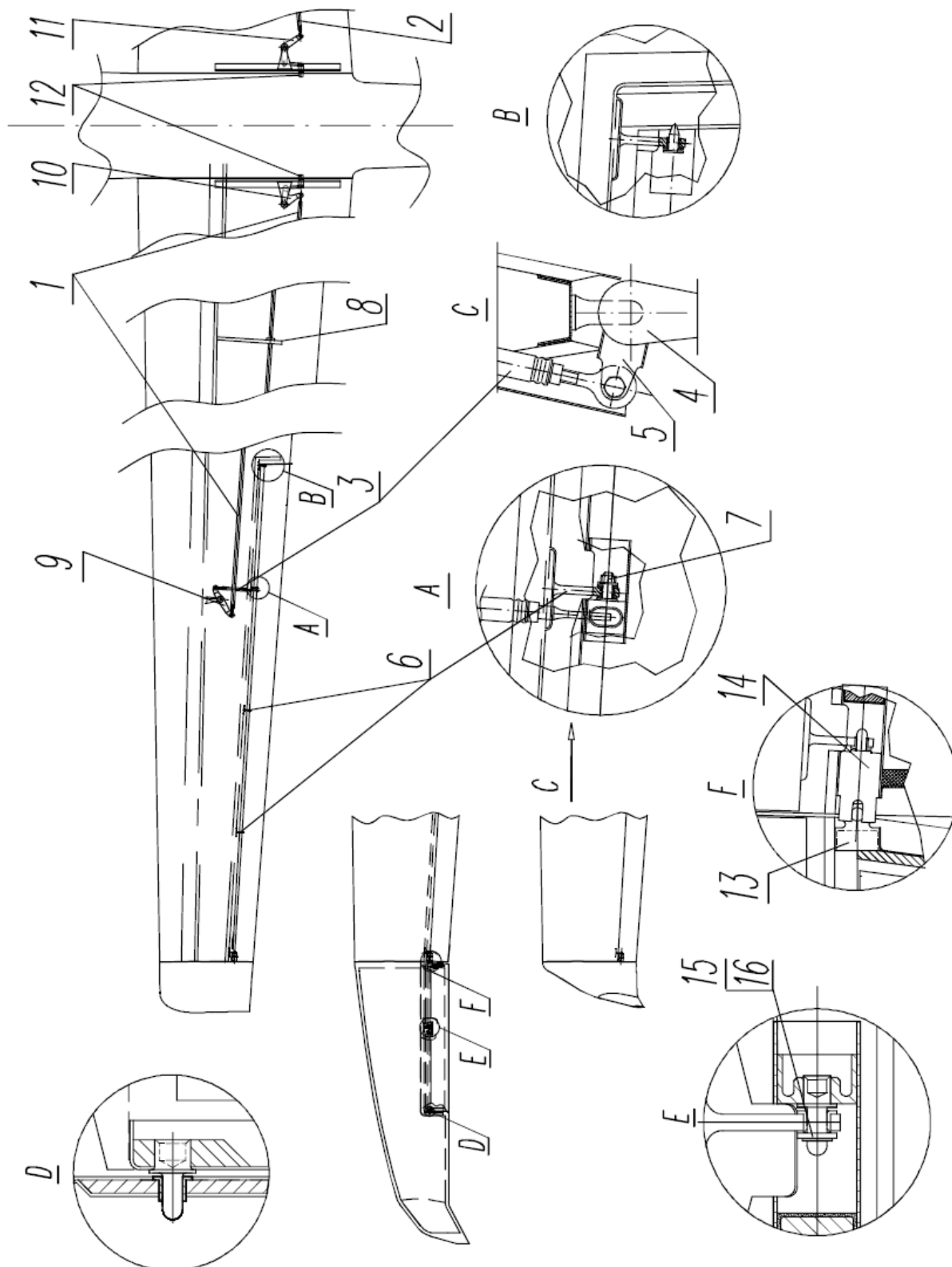


Fig. 2-13. Aileron control system in wings

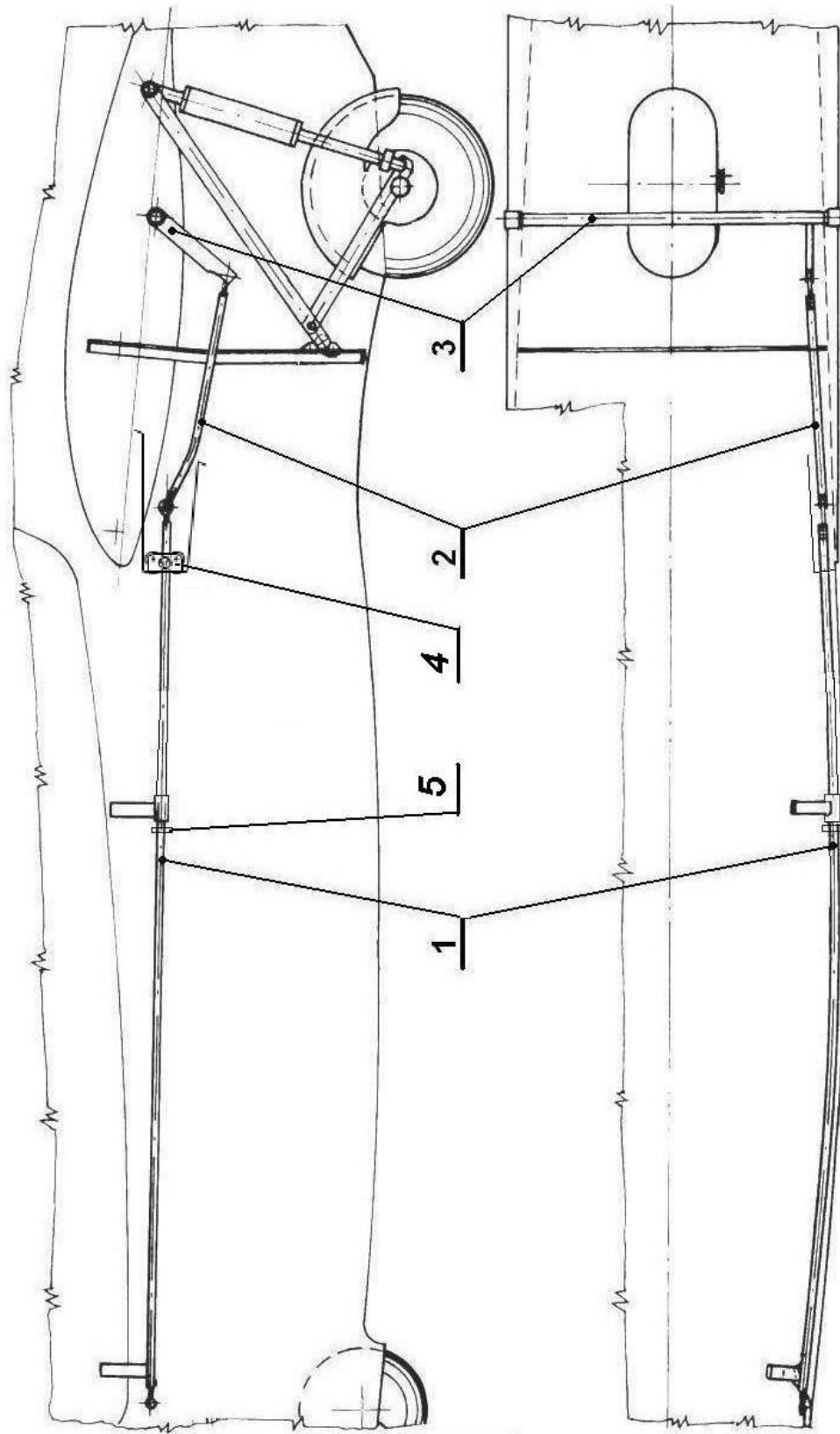
SECTION 2. ASSEMBLING & DISASSEMBLING, SYSTEMS DESCRIPTION	TECHNICAL SERVICE MANUAL	SZD-54-2 „Perkoz”
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2.14. Airbrake control system

Legend to Fig. 2–14.

- 1 - Airbrake driving pushrod in cockpit
- 2 - Airbrake driving short pushrod
- 3 - Airbrake driving torsional tube in fuselage
- 4 - Roller guide
- 5 - Open loop slider

2



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Fig. 2-14. Airbrake control system in fuselage

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Legend to Fig. 2–15.

- 1 - Adjustable pushrod
- 2 - Special adjustable pushrod
- 3 - Bevel gears assembly
- 4 - Airbrake driving latch pin connected to bevel gears assembly
- 5 - Intermediate lever
- 6 - Console
- 7 - Airbrake arm
- 8 - Airbrake upper plate
- 9 - Airbrake lower plate
- 10 - Cover
- 11 - Spring tension adjustment screw
- 12 - Spring
- 13 - Wing root rib

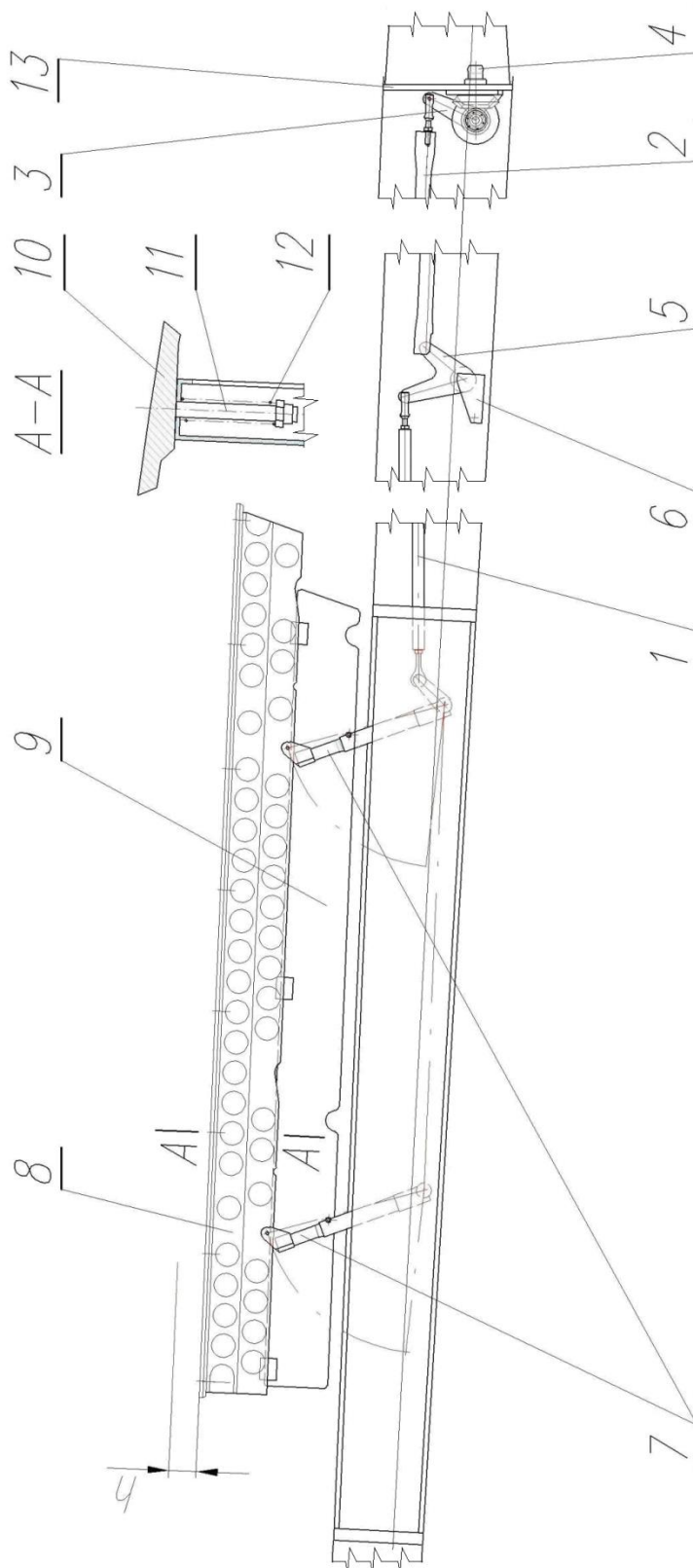


Fig. 2-15. Airbrake control system in wing

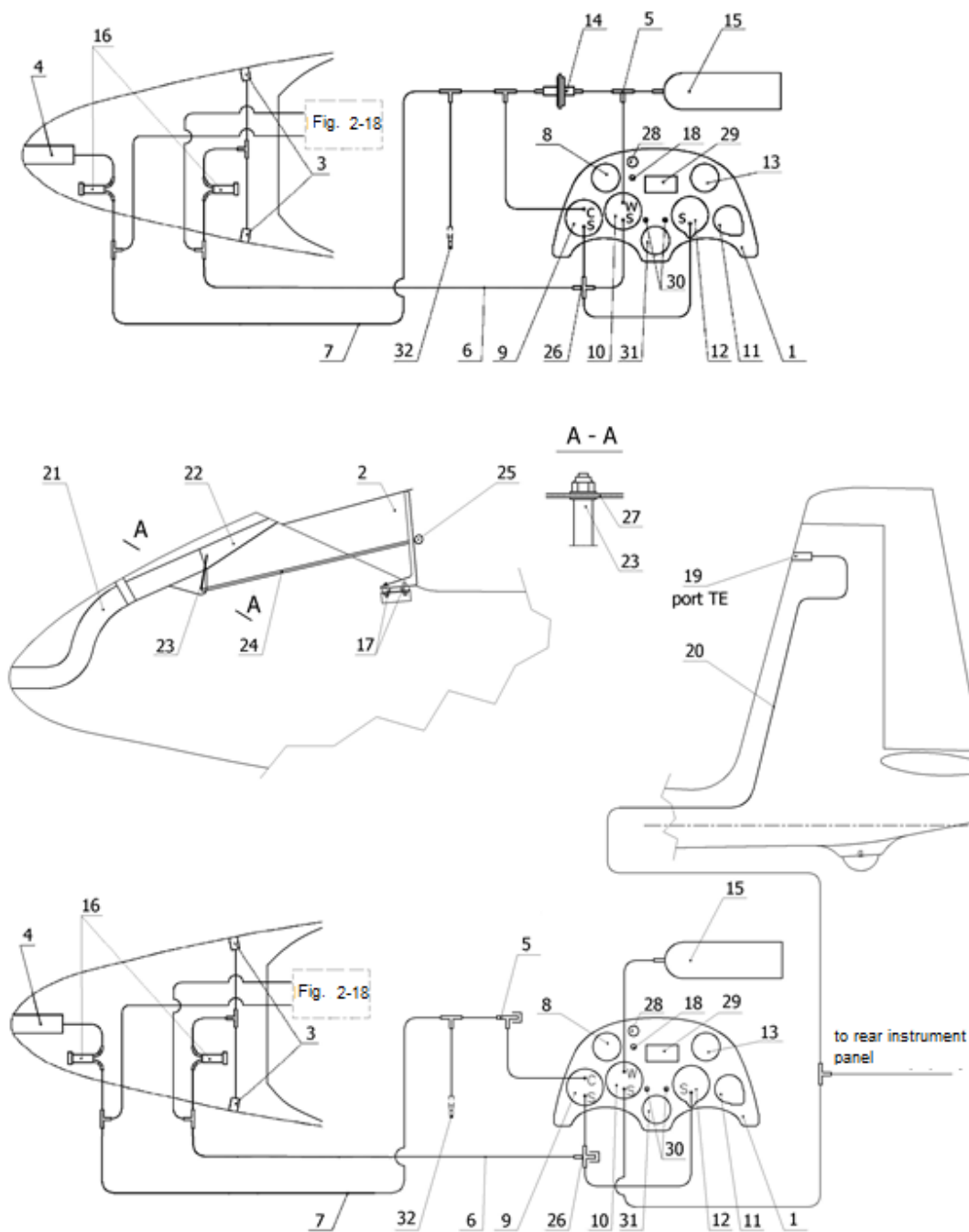
SECTION 2. ASSEMBLING & DISASSEMBLING, SYSTEMS DESCRIPTION	TECHNICAL SERVICE MANUAL	SZD-54-2 „Perkoz”
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2.15. Front instrument panel

Flight instrument installation diagram on front instrument panel is presented in Fig. 2–16. (example configuration with typical equipment).

Legend to Fig. 2–16.

- 1 - Instrument panel
- 2 - Instrument panel casing
- 3 - Static pressure vent
- 4 - Air intake and total air pressure vent
- 5 - T-pipe
- 6 - Static air pressure conduit
- 7 - Total air pressure conduit
- 8 - Electrical turn indicator
- 9 - Airspeed indicator
- 10 - Variometer
- 11 - Accelerometer
- 12 - Altimeter
- 13 - Compass
- 14 - Variometer compensator (standard option)
- 15 - Variometer's compensating vessel
- 16 - Dehydrator
- 17 - Instrument panel suspension
- 18 - Turn indicator switch
- 19 - Total energy probe „K-1” (alternative option) or blind slot
- 20 - Total energy probe „K-1” conduit
- 21 - Flexible ventilation conduit
- 22 - Inlet throat of ventilation installation
- 23 - Throttle lever of ventilation conduit
- 24 - Vent pull rod
- 25 - Vent pull rod handle
- 26 - Pipe cross
- 27 - Nut
- 28 - SP3 stall warning device switch
- 29 - Bank indicator
- 30 - Fuses
- 31 - Transceiver
- 32 - Reducing connector



Standard option with
variometer compensator

2

Alternative option with
total energy probe „K-1”

2

Fig. 2-16. Front instrument panel installation diagram

C – Total pressure
S – Static pressure
W – Compensated pressure

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2.15.1. Front instrument panel mounting and dismounting

Operation sequence in dismounting:

1. Remove casing (2) of the instrument panel (1).
 In order to do so, release latch locks situated on both sides lower part of the casing, on edges of the canopy outline. Next raise gently front of the casing and move it towards yourself.
2. Disconnect static (6) and total (7) pressure conduits.
3. Disconnect electrical and radio system cables from instruments.
4. Disconnect vent pull rod (24) from throttle vent lever (23).
 To achieve this unscrew nut (27), pull rod will slide of the lever opening while removing the instrument panel (ref. section A-A).
5. Unscrew four nuts and remove the instrument panel from suspension (17).

Mounting is to be accomplished in reverse sequence.

2.15.2. SP3 stall warning device installation

Warning device SP3 is an optional accessory.

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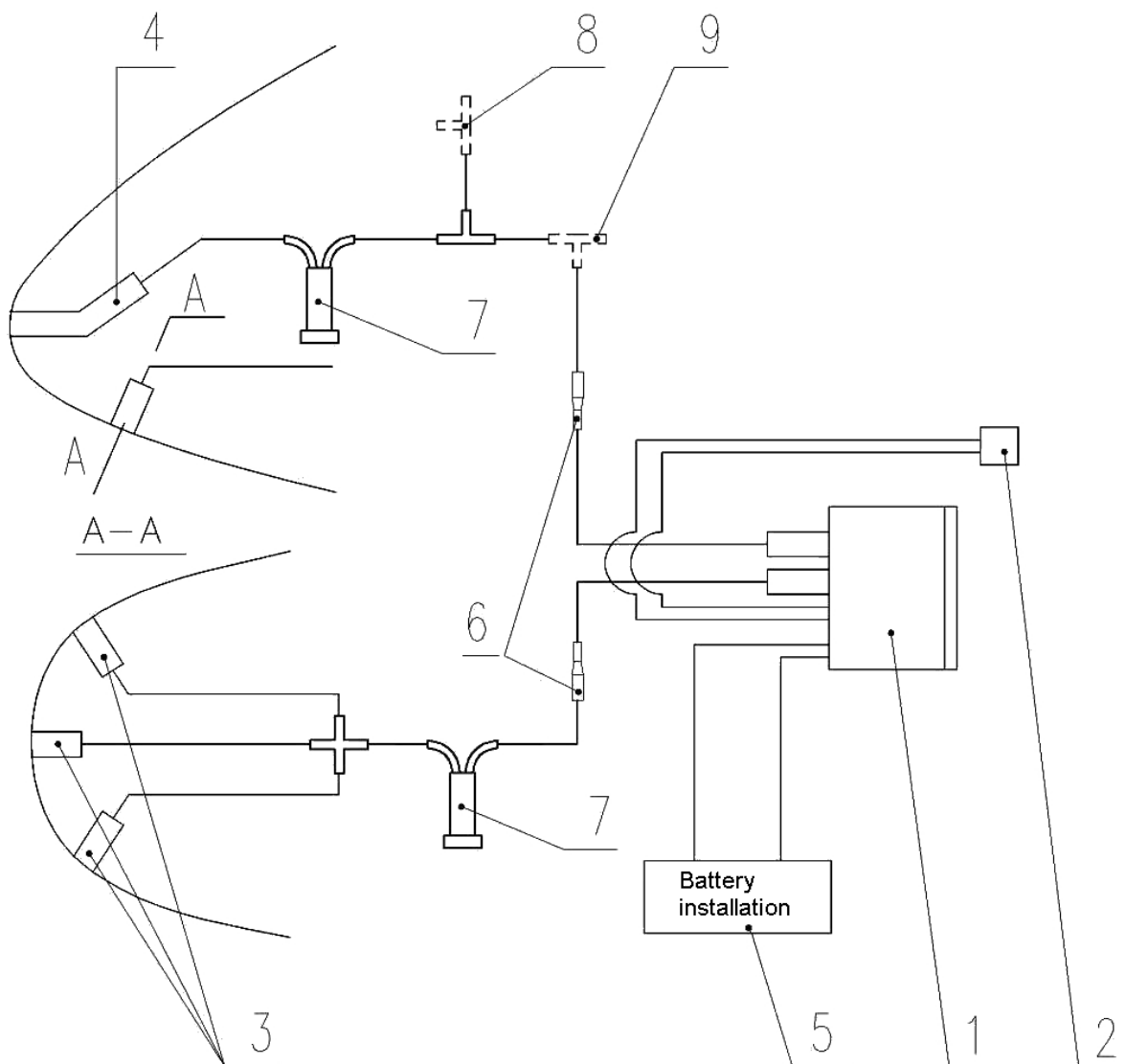


Fig. 2-17. SP3 stall warning device installation

- 1 - SP3 stall indicator
- 2 - Instrument's panel switch
- 3 - Pressure vent
- 4 - Air intake and total air pressure vent
- 5 - Accumulator 12V
- 6 - Reducing connector
- 7 - Dehydrator
- 8 - T-pipe in rear instrument panel
- 9 - T-pipe in front instrument panel

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2.16. Rear instrument panel

Flight instrument installation diagram on rear instrument panel is presented in Fig. 2–18. (example configuration with typical equipment).

CAUTION :

It is not allowed to dismount rear instrument panel casing from sailplane, on which there is mounted a mandatory front cabin headrest.

Legend to Fig. 2–18.

- 1 - Instrument panel
- 2 - Instrument panel casing
- 3 - Static pressure vent
- 4 - Air intake and total air pressure vent
- 5 - Static air pressure conduit
- 6 - Total air pressure conduit
- 7 - Airspeed indicator
- 8 - Variometer
- 9 - Electric turn indicator
- 10 - EFIS
- 11 - Accelerometer
- 12 - Altimeter
- 13 - Variometer compensator (standard option)
- 14 - Variometer's compensating vessel
- 15 - Dehydrator
- 16 - Rear instrument panel casing fixing screws
- 17 - Washers
- 18 - Rear instrument panel fixing screws
- 19 - Pressure conduits connector
- 20 - T-pipe on total energy probe „K-1” conduit

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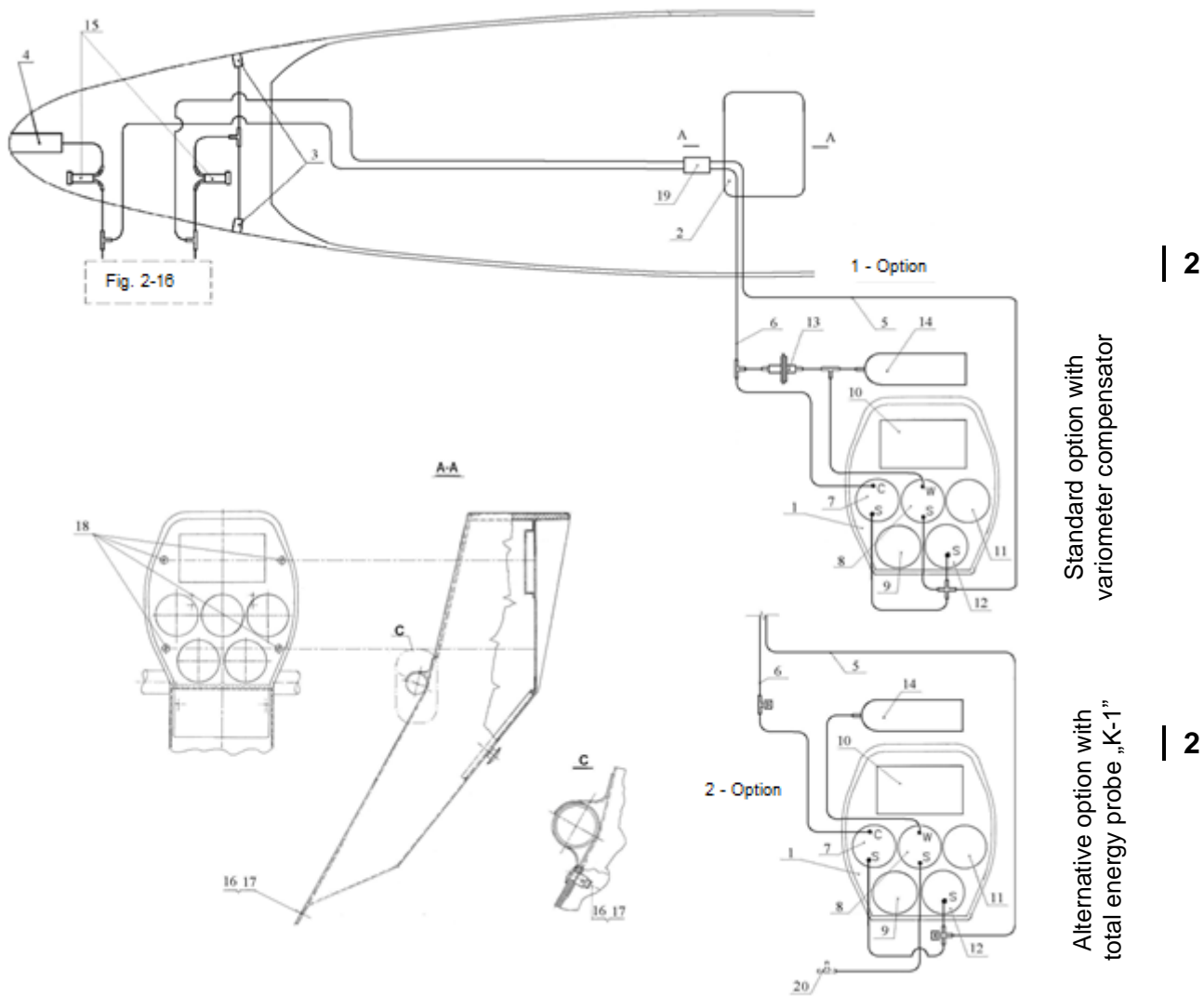


Fig. 2-18. Rear instrument panel installation diagram

C – total pressure
S – static pressure
W – compensated pressure

2.16.1. Rear instrument panel mounting and dismounting

Operation sequence in dismounting:

1. Disconnect conduits (5) and (6) from connector (19) and disconnect electrical installation cables.
2. Unscrew fixing screws (18).
3. Remove instrument panel (1).

Mounting is to be accomplished in reverse sequence.

2.17. Electric system

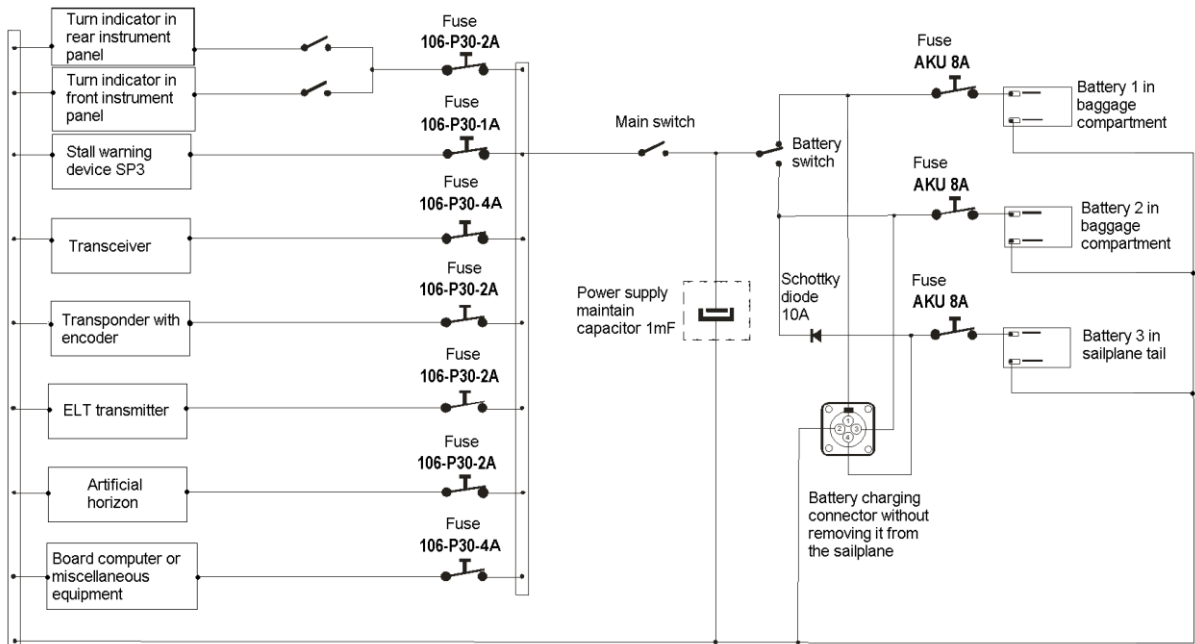


Fig. 2-19. Scheme of electric installation

Electrical circuit name	Electrical protection	Conductor cross	Maximum current density
Turn indicators circuit	Automatic fuse 106-P30-2A	AWG 20	0,002 A/cmil
SP-3 stall warning device circuit	Automatic fuse 106-P30-1A	AWG 24	0,0023 A/cmil
Transceiver circuit	Automatic fuse 106-P30-4A	AWG 20	0,004 A/cmil
Transponder circuit	Automatic fuse 106-P30-2A	AWG 20	0,002 A/cmil
ELT transmitter circuit	Automatic fuse 106-P30-2A	AWG 20	0,002 A/cmil
Artificial horizon circuit	Automatic fuse 106-P30-2A	AWG 20	0,002 A/cmil
Board computer or miscellaneous equipment circuit	Automatic fuse 106-P30-4A	AWG 20	0,004 A/cmil
Battery 1 circuit	Automatic fuse AKU 8A	AWG 16	0,004 A/cmil
Battery 2 circuit	Automatic fuse AKU 8A	AWG 16	0,004 A/cmil
Battery 3 circuit - optional	Automatic fuse AKU 8A	AWG 16	0,004 A/cmil

Scheme shows extended version of electric installation that can be powered with three batteries.

In minimum version one battery can power only SP3 stall warning device, transceiver and turn indicators. It can be mounted in luggage compartment (Fig. 2–22.) or in container in vertical stabilizer (Fig. 7–4.). A conductor (2×AWG 16) terminated in front cabin with coiled loop with sealed ends is led to the container by factory.

When powered with three or two batteries, switching to additional one should be done after supply voltage drops to 10,5 V. A signal for switching is such voltage indication on mounted equipment, e.g. transceiver, or LEDs flashing at stall warning device SP3 provided it is installed.

Extending electrical installation according to above scheme, use copper, multi-wire, insulated, aviation conductors LYc-L according to BN-80/3053-21 or LGY according to DIN 72551-6.

It is possible to charge batteries mounted on sailplane according to charging parameters:

- maximum charging current of 650 mA,
- maximum disable voltage of 14,8 V.

2.18. Removing rear seat pan

Mounting of rear seat pan is presented in Fig. 2–20.

In order to remove the rear seat pan (1):

1. Thread safety belts through seat pan slots so they would find on the bottom of cabin, untie and loosen control stick pouch astringent tie string.
2. By rotating knob (2) towards bottom of seat pan (when standing on the LH side of the cabin, leftwards) remove bolts (5) from sockets (7).
3. Move the seat pan backwards and upwards in order to remove front tube (3) from the guide (4).
4. In this position rotate seat pan - right side upwards, then move it forward and take it out from fuselage.

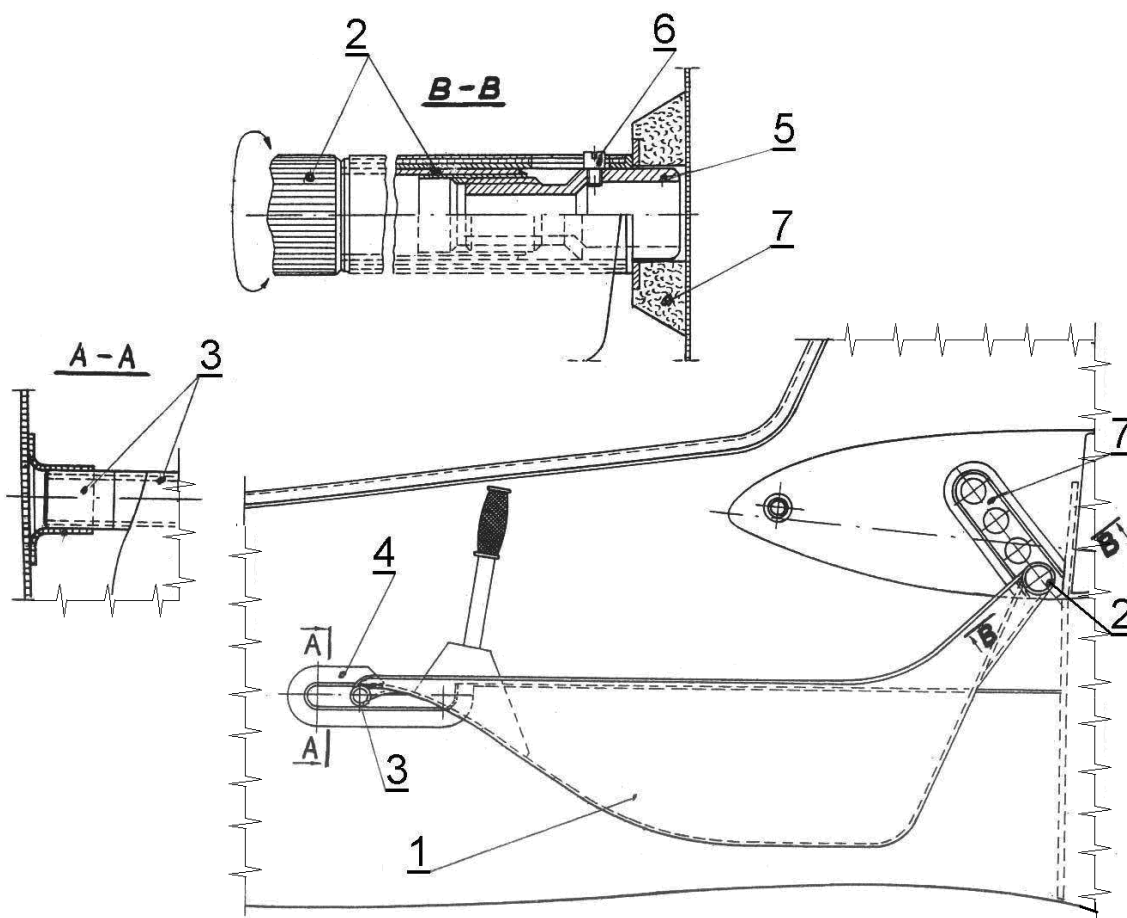


Fig. 2-20. Rear seat pan mounting

- 1 - Seat pan
- 2 - Rear tube with a knob sliding out the supporting bolts (5)
- 3 - Front supporting tube
- 4 - Guide laminated to fuselage board
- 5 - Supporting bolt
- 6 - Guiding screw
- 7 - Backrest socket with seat pan position regulation openings

2.19. Tow releases control system

Tow releases control system scheme is presented in Fig. 2–21. Sailplane is equipped with front tow release TOST E and CG tow release TOST G. Adjustment is done at turnbuckle (17) connected to CG tow release lever (2). Adjust string length with turnbuckle to run concurrently front and rear release with total handle (3) pinching in front seat and independently handle (4) in rear seat. Recommended adjustment is to leave few millimetres play of additional movement at the end of CG tow release lever (2) for pinched front handle (3) after fully opening front tow release.

Legend to Fig. 2–21.

- 1 - Front tow release lever
- 2 - CG tow release lever
- 3 - Front pilot tow release handle
- 4 - Rear pilot tow release handle
- 5 - CG tow release handle flexible mounting
- 6 - Front tow release cable
- 7 - CG tow release cable
- 8 - Pulley
- 9 - Cable
- 10 - Rear pilot tow release control cable
- 11 - Front pilot tow release control cable
- 12 - Cable guide
- 13 - Spring
- 14 - Cables tubing
- 15 - Front tow release box
- 16 - CG tow release box
- 17 - Cable turnbuckle by CG tow release lever

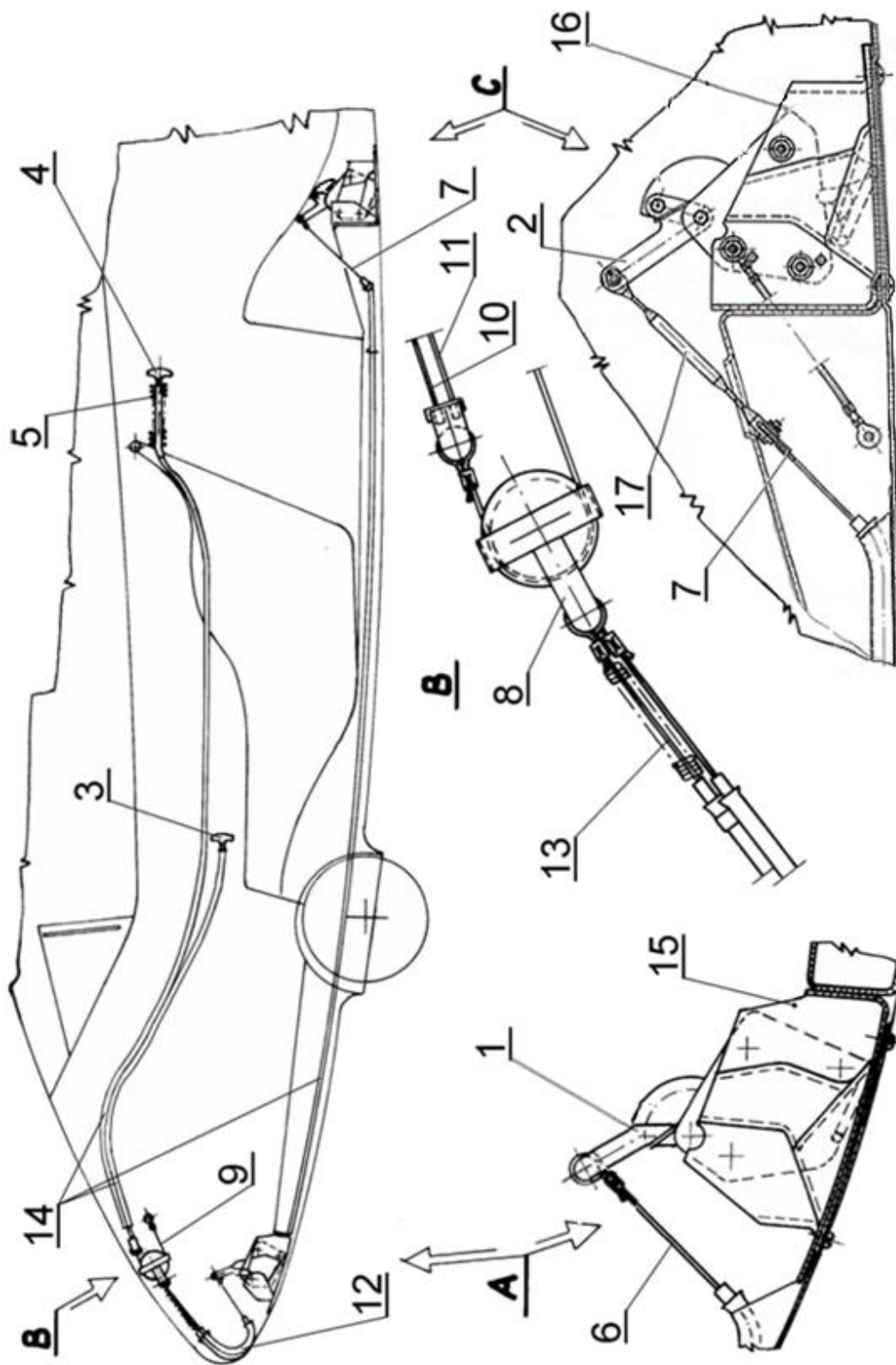


Fig. 2-21. Tow releases control system

2.20. Battery and equipment mounting in luggage compartment

On the glider, for additional equipment power supply, the battery can be mounted in the luggage compartment (Fig. 2–22.) or in the tail (Fig. 7–4.).

It is permissible to install an additional battery, next to the first one, by drilling the appropriate holes in the reinforcement plates in the floor (position as shown in the figure below).

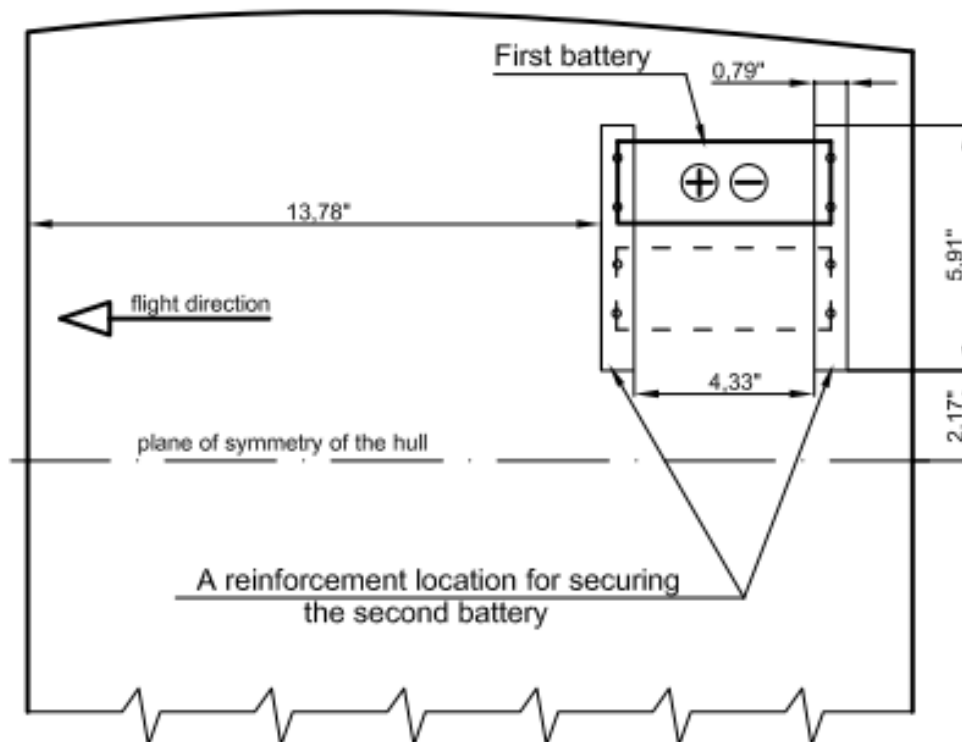


Fig. 2-22. Battery mounting in sailplane luggage compartment

On the floor of the luggage compartment it is possible to install additional equipment of total weight (including two batteries) up to 44 lb. The floor at the mounting bolts of the equipment should be strengthened as follows:

In screws designated areas cut out at least 0,8" diameter of lower skin and foam core of the floor leaving upper skin intact. Paste adapted to cut glass fibre composite 0,24" thick plate on aerosil thickened composition in cut foam place. Skin should be repaired by one layer 92125 fabric arranged obliquely with 1,2" overlap according to repair instructions in Section 17.

Prepared reinforcements may be loaded with weight distributed over several attachment points, a value of 2,2 lb at single point.

2.21. Sailplane drainage system

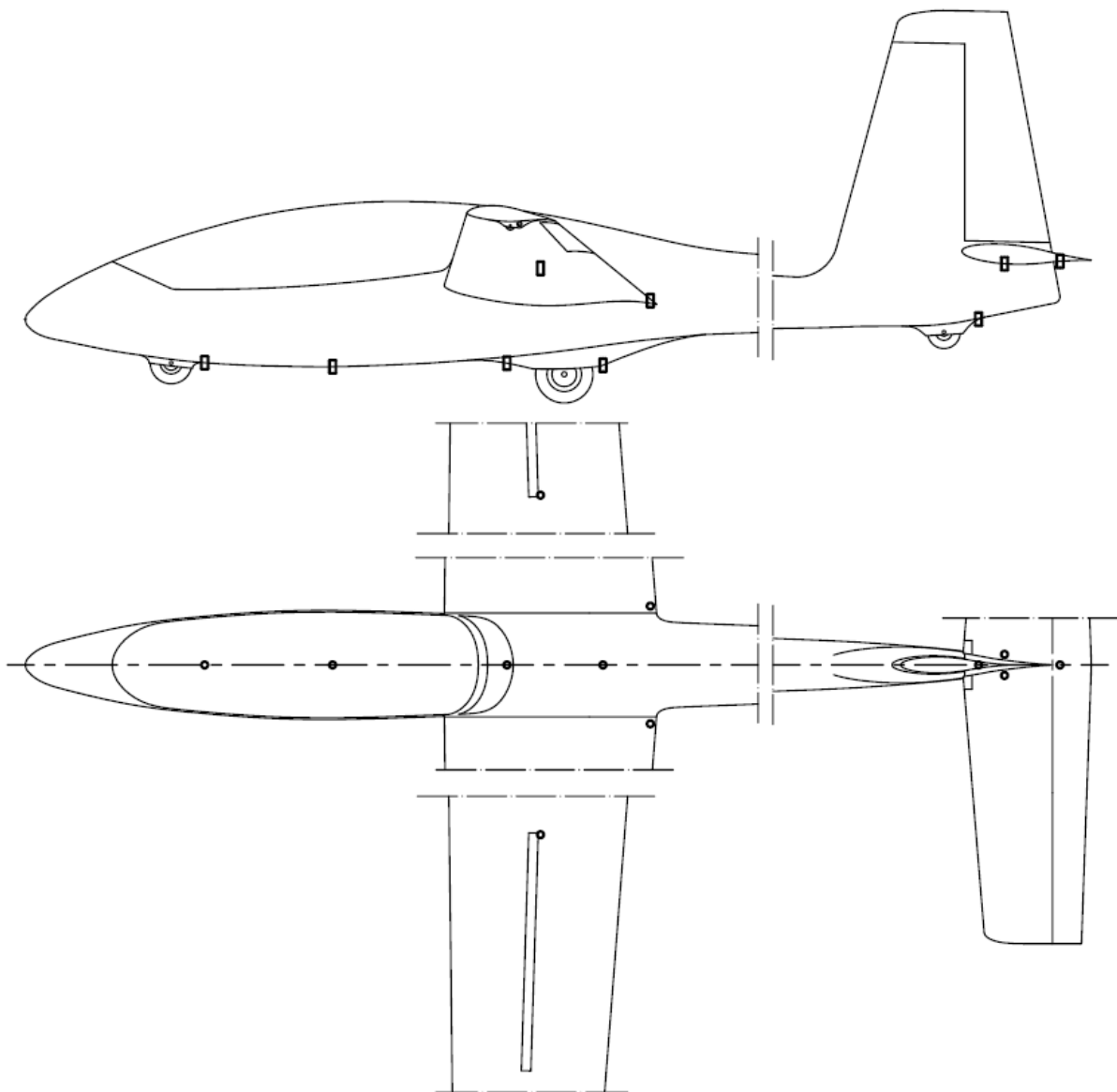


Fig. 2-23. Sailplane drainage holes layout scheme

Presented in Figure sailplane drainage system consists of:

- Five $\varnothing 0,16$ " drainage holes in fuselage shell
- Two $\varnothing 0,16$ " drainage holes in lower shell of every wing
- Two $\varnothing 0,16$ " drainage holes in lower shell of horizontal stabilizer
- One $\varnothing 0,16$ " drainage hole in lower shell of elevator

SECTION 3.

TECHNICAL SPECIFICATION, TOLERANCES AND ADJUSTMENT

3.1. Tire pressure

Working pressure in landing gear wheels:

- nose wheel: **17,4 psi**
- main wheel: **58,0 psi**
- tail wheel: **36,3 psi**

3.2. Cables tension

Rudder circuit and rear pedals driving cable tension
(item 16 and 19 – Fig. 2–11.) **44 ± 4,4 lbf**

Front rudder pedals driving cable tension
(item 17 and 18 – Fig. 2–11.) **11 ± 4,4 lbf**

3.3. Fuselage control devices motion resistance forces

Normal motion resistance forces values, expressed in [lbf], measured at the centre of handles (foot pedals plate) in neutral position:

Aileron control system	0,9 ÷ 2,2
Elevator control system („nose up” position)	1,3 ÷ 4
Rudder control system (measurement at upper foot pedal plate)	11,2 ÷ 13,5
Airbrake control system (opening)	19,1 ÷ 31,5
Trimmer control system	max: 14,6
Wheel brake control system (force required to move the lever, measured in centre of it)	max: 4,5
Canopy jettison handle by front and rear seat	13,5 ÷ 33,7
Canopy lock handle by front and rear seat	22,5 ÷ 33,7
Force required to actuate tow release by front or rear pilot, without towing line being tensed	22,5 ÷ 29,2

3.4. Allowable backlashes and tolerances in mounting connections and sailplane control systems

3.4.1. Allowable control stick play

Maximum allowable control stick play, measured at stick's top when control surfaces are blocked:

- in elevator control system: $\pm 0,08''$
- in aileron control system: $\pm 0,08''$

If it is found that self-aligning bearing is the cause of excessive control system play, it should be replaced together with a part in which it is mounted.

3.4.2. Backlashes in the connections of torsional tubes with drivers in aileron and airbrake control systems

If excessive backlash is found in connections of torsional tubes with drivers in aileron and airbrake control systems, drivers' pegs in latch pins (7) and (8) Fig. 2-1. should be replaced with oversize ones (standard oversizes: $0,2441^{-0,0012}$; $0,2520^{-0,0012}$; $0,2598^{-0,0012}$ in) and if necessary grind slots in torsional tubes endings (5) and (6) Fig. 2-1., individually matching the dimension (a) Fig. 3-1. with backlash $+0,002''$ for every oversize.

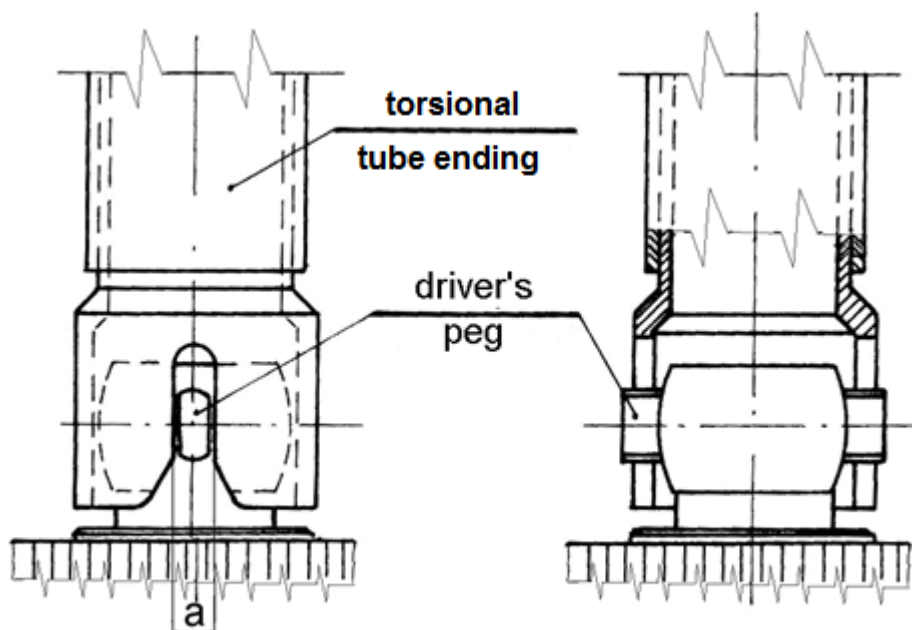


Fig. 3-1. Driver connection scheme

3.4.3. Maximum allowable backlashes on sailplane main unit connection fittings

Allowed backlash between bolt and opening or between socket and ball, in wing-wing, wing-fuselage, wing-wingtip (plane, winglet or long wingtip) and horizontal stabilizer-fuselage connections, is:

- for diameters up to 0,71” inclusive **0,004”**
- for diameters greater than 0,71” **0,006”**

3.4.4. Maximum allowable radial backlash in control surfaces hinges

Allowable radial backlash in elevator, rudder and ailerons hinges: **0,004”**

3.4.5. Allowable play – airbrake plates shift

Shift „h” (Fig. 2–15.) should not be greater than **0,2”**.

This dimension is the result of all backlashes in airbrake control system. Measurements should be made on assembled sailplane, separately on right and left wing, with airbrake drive handle immobilized in “open” position. Lift manually the plate in top position within the scope of perceptible play and not pulling the cover from the plate.

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3.5. Adjustment of sailplane assemblies and control systems

3.5.1. General notes

After adjustment of turnbuckles threads may not be visible. When adjusting pushrod ends it should be checked whether inspection holes are closed by thread. Deflections and tolerances of deflection of control surfaces and airbrakes are presented in Fig. 6–1. Levelling points are marked with letter „S” in this Figure.

3.5.2. Adjustment of aileron control system in wing

Adjustment of aileron control system in wing (Fig. 2–13.) is done at the pushrod ends (3) and eventually at pushrod ends (1) and (2) through an opening in wing root rib.

3.5.3. Adjustment of airbrake control system in wing

Adjustment of airbrake control system in wing (Fig. 2–15.) is done at pushrod end (1) near the connection with airbrake arm driving lever (7) in airbrake box, and on pushrod (2) near the connection with bevel gear assembly driving lever (3).

3.5.4. Adjustment of aileron control system in fuselage

Adjustment of aileron control system in fuselage (Fig. 2–12.) is done at pushrod ends (6) and (7).

NOTE:

Adjustment should be done on fully mounted sailplane with ailerons and control sticks in neutral position.

Maximum aileron deflections are set using limiters – regulation screws (4) located at the front (1) and rear (2) flying control.

3.5.5. Adjustment of elevator control system

Adjustment of elevator control system (Fig. 2–12.) is done at pushrod ends (9), (10) and (12).

Control sticks' neutral position in elevator control system is presented in Fig. 2–12.

Maximum elevator deflections are set using limiters – regulation screws (5) located at the front (1) and rear (2) flying control.

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3.5.6. Adjustment of cables tension in rudder control system

Adjustment of cables tension in rudder control system (Fig. 2–11.) is done by using five turnbuckles (20).

Tension forces of cables (16), (17), (18), (19) are provided in item 3.2.

cable (16) diameter	2,5 [mm]	(0,098")
cable (17) diameter	3,0 or 3,2 [mm]	(0,118" or 0,126")
cable (18) diameter	3,0 or 3,2 [mm]	(0,118" or 0,126")
cable (19) diameter	3,0 or 3,2 [mm]	(0,118" or 0,126")

Foot pedals by front and rear seat are provided with adjustable deflection limiters. Adjustment of rudder deflections is done by using pedals deflection limiters. When front and rear pedals are fully deflected to the limiters, the rudder itself should not be in contact with its own deflection limiter. At the front and rear seat, the adjustment should be started by setting the pedals in neutral position shown in Fig. 2–11.

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3.5.7. Adjustment of airbrake control system in fuselage

Airbrake control system in fuselage (Fig. 2–14.) consists of pushrod (1), in the front - hung on the telescopic guide, whereas in the rear - connected to intermediate pushrod (2), and then this one to torsional tube lever (3). Adjustment can be done at pushrod (1) or (2).

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3.5.8. Adjustment of trimmer control system

Trimmer control system – **Version 1** (Fig. 2–12.) consists of: 2 green trimmer control levers (15) located at LH side cockpit board by front and rear seat, trimmer locking cable (16), pushrod (17), 2 springs (21) with tighteners (20), trimmer locking lever (18) with locking device (19).

Trimmer control system – **Version 2** (Fig. 2–12.) consists of: 2 green trimmer locking triggers (22) on both control sticks, trimmer locking cable (16), 2 springs (21) with tighteners (20), trimmer locking lever (18) with locking device (19), pushrod (17) with ball handles (15) for front and rear pilot.

Trimmer neutral position adjustment is done:

- at pushrod (17) end
- by tightener (20) regulation screw

Operation sequence in adjusting:

- dismount tailplane
- set trimmer to „nose heavy” position. Force required to move control stick to neutrum position should be 3,6 – 4,5 lbf.
- set trimmer to „tail heavy” position. Force required to move control stick to neutrum position should be 5,2 – 6,3 lbf.

3.5.9. Adjustment of wheel brake

Wheel brake driving system is presented in Fig. 2–8. Cables (11) can be adjusted on the ends at levers mounted to control sticks, or on the ends under rear seat pan.

Brake shoes do not require any adjustment.

3.5.10. Adjustment of rear seat pan

Adjustment of rear seat pan is done by placing its rear support in one of four available positions and moving the seat pan forward or rearward at the same time (Fig. 2–20.). In order to do so:

1. Unlock the seat pan by rotating knob (2) located in central part of backrest tube, until bolts are slid into the tube.
2. Set the seat pan in appropriate position.
3. Lock the seat pan by rotating knob (2) until bolts are slid out of tube.

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SECTION 4.

SPECIAL TOOLS SPECIFICATION

4.1. Tire pumping end

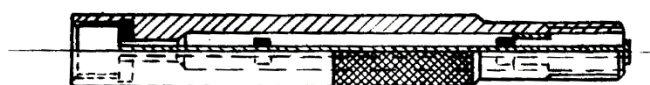


Fig. 4-1. Tire pumping end

4.2. Wingtips mounting key

Directions for use the key is presented in item 2.2. (Fig. 2–2., pos. 6 and Fig. 2–4., pos. 10)

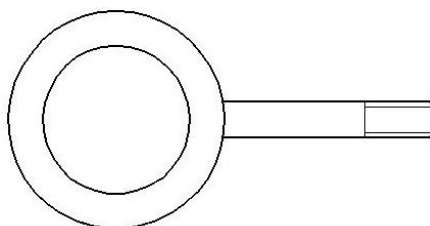


Fig. 4-2. Wingtips mounting key

4.3. Rear fitting assembly key

Directions for use the key is presented in item 2.1. (Fig. 2-1., pos. 21).

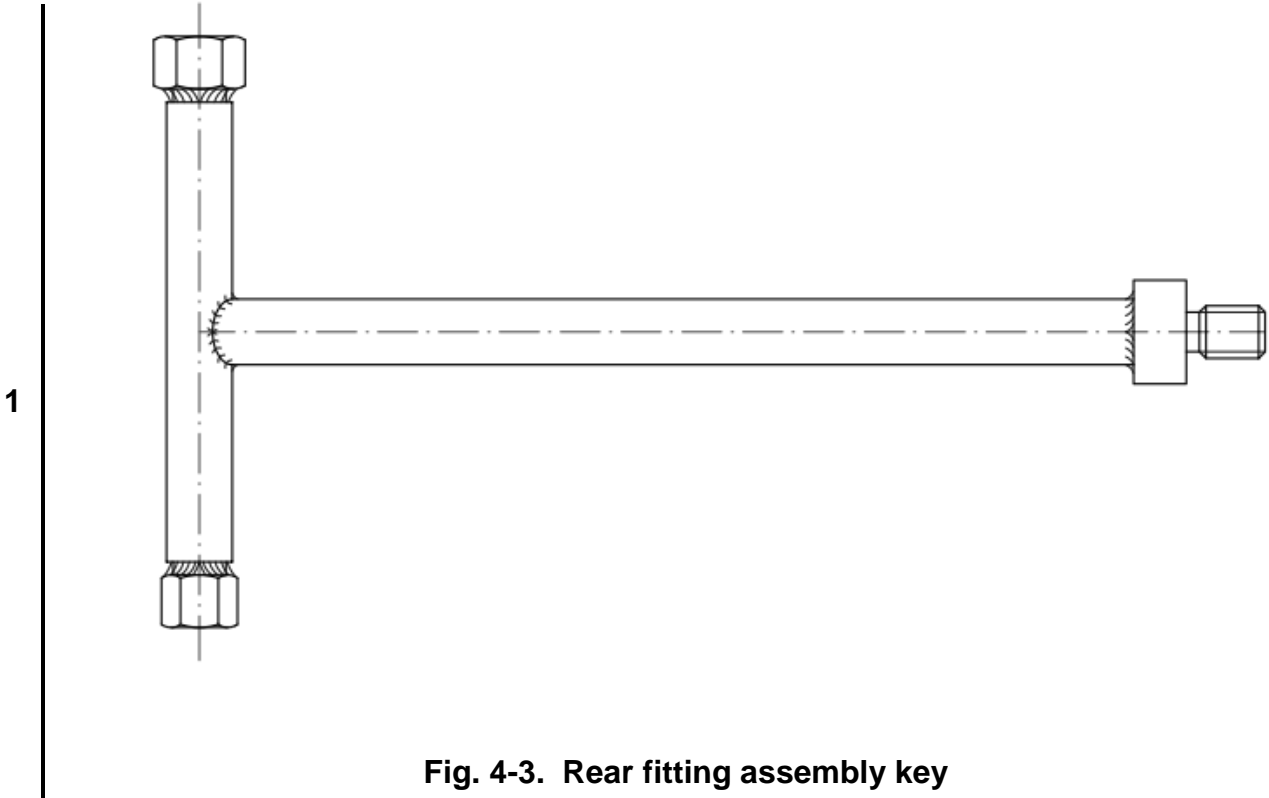


Fig. 4-3. Rear fitting assembly key

4.4. Mounting wrench

This wrench and directions for use are presented in item 2.1. (Fig. 2-1., pos. 12).

SECTION 5.

LUBRICATION INSTRUCTION

5.1. General

All mounting elements, rolling and slide bearings, and cables in Bowdens are subject to lubrication.

Lubrication scheme is presented in Fig. 5–1.

5.1.1. Rolling and slide bearings lubrication

Rolling and slide bearings should be lubricated with general purpose grease ŁT 43 (PN-72/C-96134).

Equivalent to above mentioned are American greases:

- Shell - Alvania G2 , Alvania R2
- Mobil - Mobilux 2
- Esso - Beacon 2

NOTE:

**All these greases may be mixed with ŁT 43.
There is no need to remove ŁT 43 grease before applying other grease.**

5.1.2. Mounting elements lubrication

Mounting elements should be lubricated with technical – high-melting and chemical neutral reaction – vaseline.

5.1.3. Bowden cables lubrication

Bowden cables should be lubricated with cold-test machine oil. Its kinematic viscosity should be about 0,09 in²/s in temperature 104 °F and its acid value should not exceed 0,20 mg KOH/g.

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5.1.4. Elements not requiring lubrication

Rolling and sliding grommets manufactured from POM (polyacetal) and cables in polyamide tubes do not require lubrication.

NOTE:

The frequency of lubrication of every assemblies and elements is provided in individual subsections of Section 16. Periodic maintenance.

Legend to Fig.. 5–1.

2 |

- 1 - Hinges, bearings of aileron driving lever, long wingtip aileron clutch
- 2 - Aileron driving latch pin bearings in wing root rib
- 3 - Aileron and elevator control systems bearings
- 4 - Elevator hinges
- 5 - Sleeves in wing root rib together with spar root pins and wing front pins
- 6 - Wing-fuselage rear connection
- 7 - Rudder hinges and parts of control system
- 8 - Horizontal stabilizer fitting sleeves and pins
- 9 - Airbrake plates and arms bearings
- 10 - Airbrake driving latch pin bearings in wing root rib
- 11 - Front foot pedals bearings and guide
- 12 - Rear foot pedals bearings
- 13 - Airbrake pushrod guide
- 14 - Canopy hinges and locks
- 15 - Main landing gear axles (swingarm and shock absorbers)
- 16 - Main wheel bearings
- 17 - Nose wheel bearings
- 18 - Tow releases
- 19 - Tail wheel bearings
- 20 - Wing-fuselage connecting assembly
- 21 - Wing-wingtip (plane or winglets) connection

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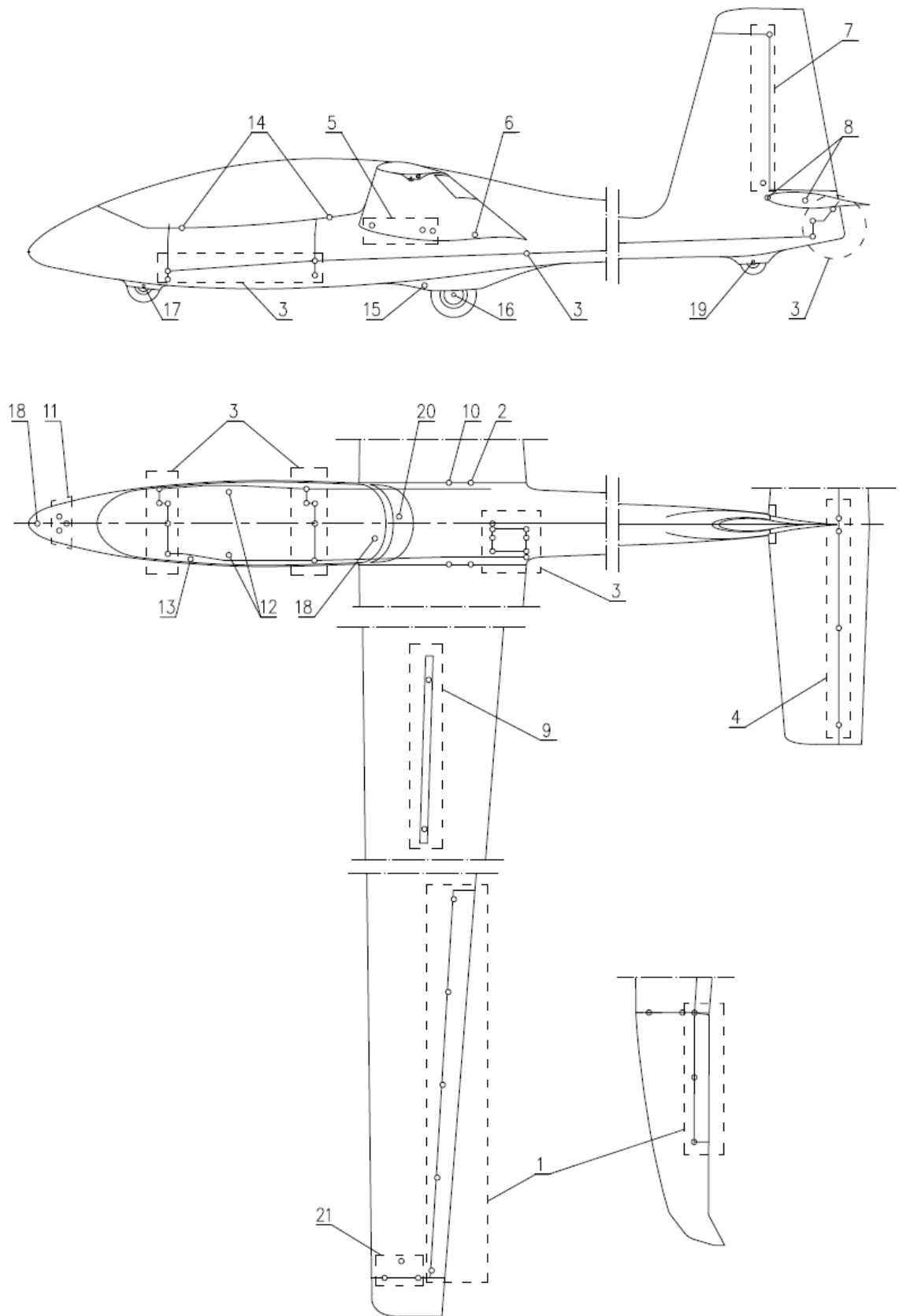


Fig. 5-1. Lubrication scheme

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SECTION 6.

SAILPLANE ALIGNMENT AND CONTROL SURFACES DEFLECTION INSPECTION

Sailplane alignment and control surfaces deflection inspection should be performed in accordance to Fig. 6–1. Forms of records of sailplane alignment and control surfaces movements are provided in Section 18.

Alignment points are marked with letter „S” on Figure. Alignment points on sailplane are marked with laminated $\varnothing 0,05$ ” brass wires with painted red areola.

Ways of control surfaces deflection adjusting are given in item 3.5. of this Manual.

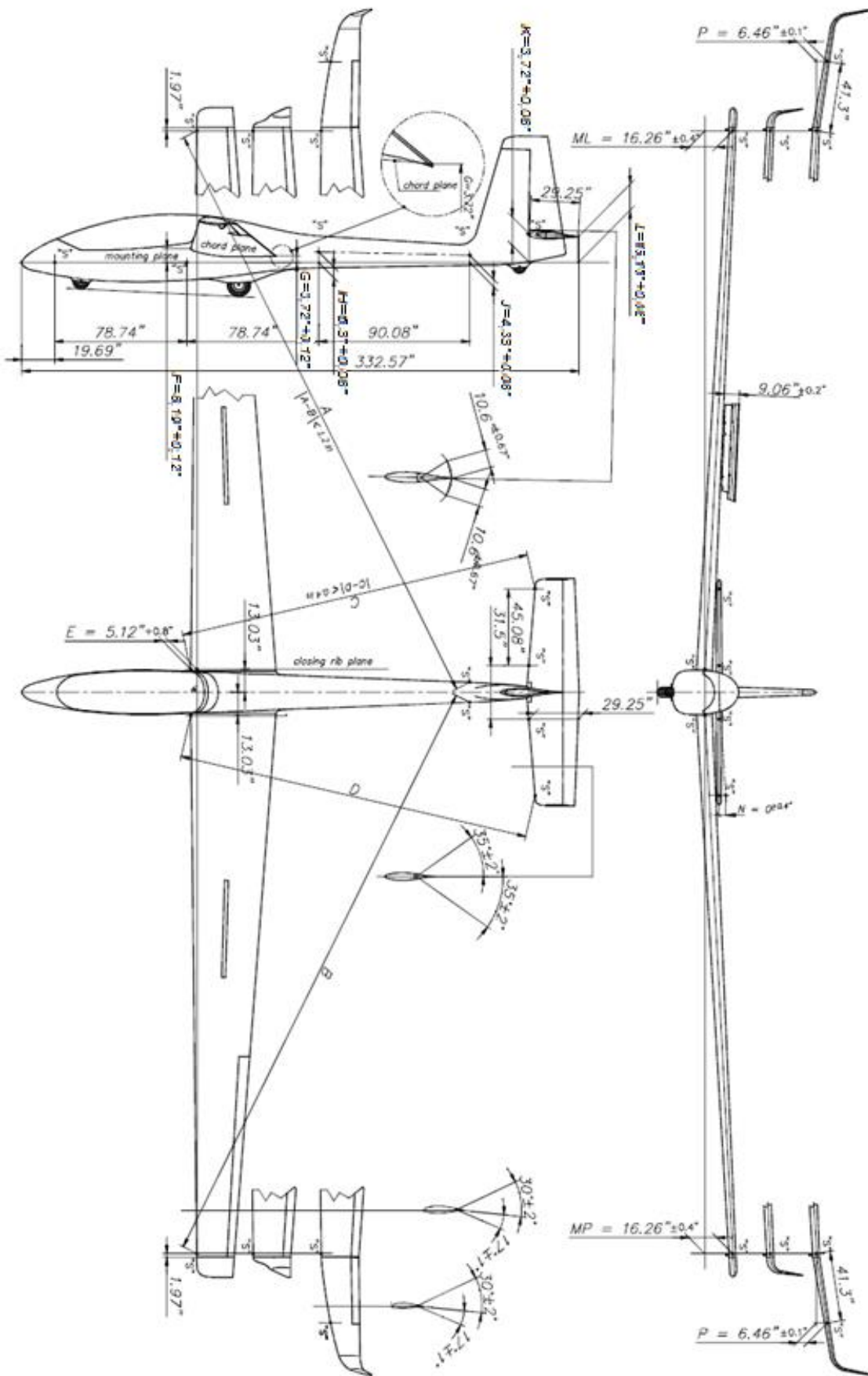


Fig. 6-1. Sailplane alignment and control surfaces deflection

SECTION 7.

SAILPLANE WEIGHING

7.1. Method of weighing

Method of sailplane weighing is presented in Fig. 7–1. Weighing should be carried out on two scales with measurement accuracy $\pm 0,44$ lb. Method applies to determination of mass and CG position of sailplane without pilots, as well as mass and CG position of sailplane in flight configuration, that is with crew.

„Sailplane without pilots” term is explained in item 7.2.

Scales minimum weighing capacity at weighing sailplane without pilots must not be less than:

- scale under front support (sailplane nose wheel) – 660 lb;
- scale under rear support (sailplane tail wheel) – 440 lb.

It is recommended to use both scales with capacity min. 660 lb, which will prevent any damage to one of them by mistaken replacement at the supports. In case of weighing a sailplane with crew it should be used scales with capacity min. 1100 lb under front support.

During weighing it should be used a „Record of sailplane weighing and determining of CG” which is provided in Section 18. Weighing should be done in sailplane configuration with plane wingtips (not with winglets). Check sailplane completeness, compatibility of equipment with current „Equipment list” and remove from interior any unnecessary items.

Supports should be placed under nose and tail landing wheel. Supports height should be of adequate value so that chord line of wing root rib is in horizontal position. Sailplane levelling should be checked with elastic transparent tube with inner diameter of min. 0,25” filled with liquid (no air bubbles) by relating liquid level to alignment point on leading edge and point on trailing edge at the same distance from wing-fuselage parting plane. For one point exactly positioned on a liquid level in tube, deviation for the second one must not be greater than 0,08”.

Chord line of wing root rib horizontal position can be obtained by using bar (wedge) with an inclination 27:1000 arranged on upper conical portion forming tail boom of the fuselage, within 31,5” of trailing point of root aerofoil (Fig. 7–1.). Level difference between ends of bar, for 27,6” long wedge, must not be greater than 0,04”.

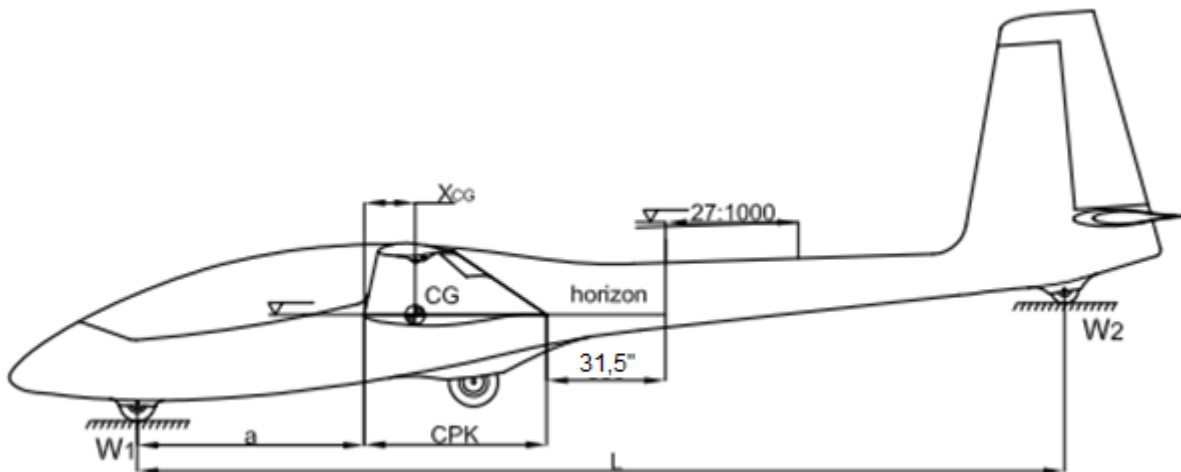


Fig. 7-1. Sailplane weighing

CPK – chord line of wing root rib

L – horizontal distance between nose and tail wheel axles adopted in calculations is 259,45”

X_{CG} – location of sailplane centre of gravity relative to reference datum [in]

a – horizontal distance between nose wheel axle and reference datum adopted in calculations is 63,19”

m – sailplane mass [lb]

w_1 – indication of front scale [lb]

w_2 – indication of rear scale [lb]

In case of serious damage to fuselage or rear or front undercarriage, dimensions „a” and „L” after repairs have to be checked and actual values used in CG position calculations.

Reference datum is a plane perpendicular to plane made by root aerofoil chords, and passing through points on leading edge of root aerofoils.

Mass and CG position are derived from these formulas:

$$m = w_1 + w_2$$

$$X_{CG} = b - a$$

$$b = \frac{w_2 \times L}{w_1 + w_2}$$

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7.2. Sailplane without pilots mass and CG position

„Sailplane without pilots” term means sailplane with any equipment in instrument panels and luggage compartment, compatible with current „Equipment list”, ready to flight, but without pilots, parachutes, balancing weights and hand luggage.

Mass value (m_{bp}) and CG position (X_{bp}) of sailplane without pilots, determined by weighing, must be registered in weighing table in Section 6.4. of Flight Manual. Sailplane without pilots centre of gravity must be within the range specified in the chart (Fig. 7–2.) – crosshatched area.

If centre of gravity does not fall within the required range, add or reduce existing appropriate fixed ballast in the front or back of the fuselage. Ballast in the front, in durable manner, should be placed in space under the cover, under front balancing weights described in item 1.4. In sailplane tail (vertical stabilizer) ballast should be placed in cylindrical container inserted into wall opening (Fig. 7–3.). As a rear fixed ballast may also be used a battery mounted in container in vertical stabilizer (Fig. 7–4.). Changing the fixed ballast requires reweighing to verify final value of the mass (m_{bp}) and CG position (X_{bp}). Fixed ballast mass (front or rear) must be entered in the sailplane weighing record (item 18.2.).

Newly manufactured sailplane is weighed as „empty” (with minimal equipment according to item 8.1.). In factory weighing records for wing span 57,42 ft and 65,62 ft, there is provided its mass (m_p) and centre of gravity position (X_p), which values do not need to be within the range specified in the chart (Fig. 7–2.).

(paragraph removed).

Every change of mass and CG position of sailplane without pilots, resulting for example from carried out repairs, painting or installing/removing additional equipment, must be determined on basis of subsequent weighing. Only when installing/removing additional equipment in certain places, i.e. instrument panels or luggage compartment, it is allowed to determine new value of sailplane without pilots mass and CG position with calculation method (see item 7.3.).

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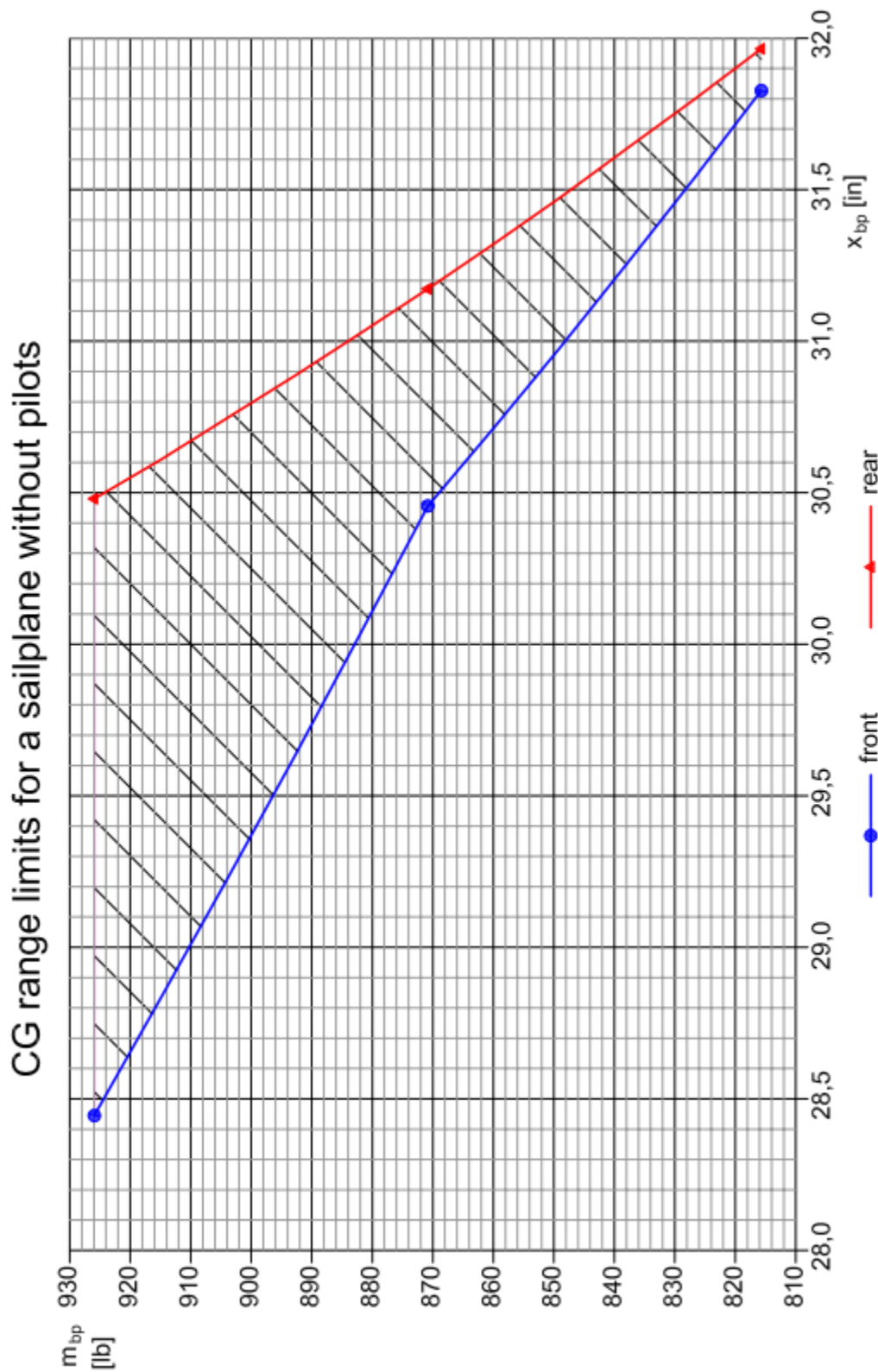


Fig. 7-2. CG range limits for a sailplane without pilots

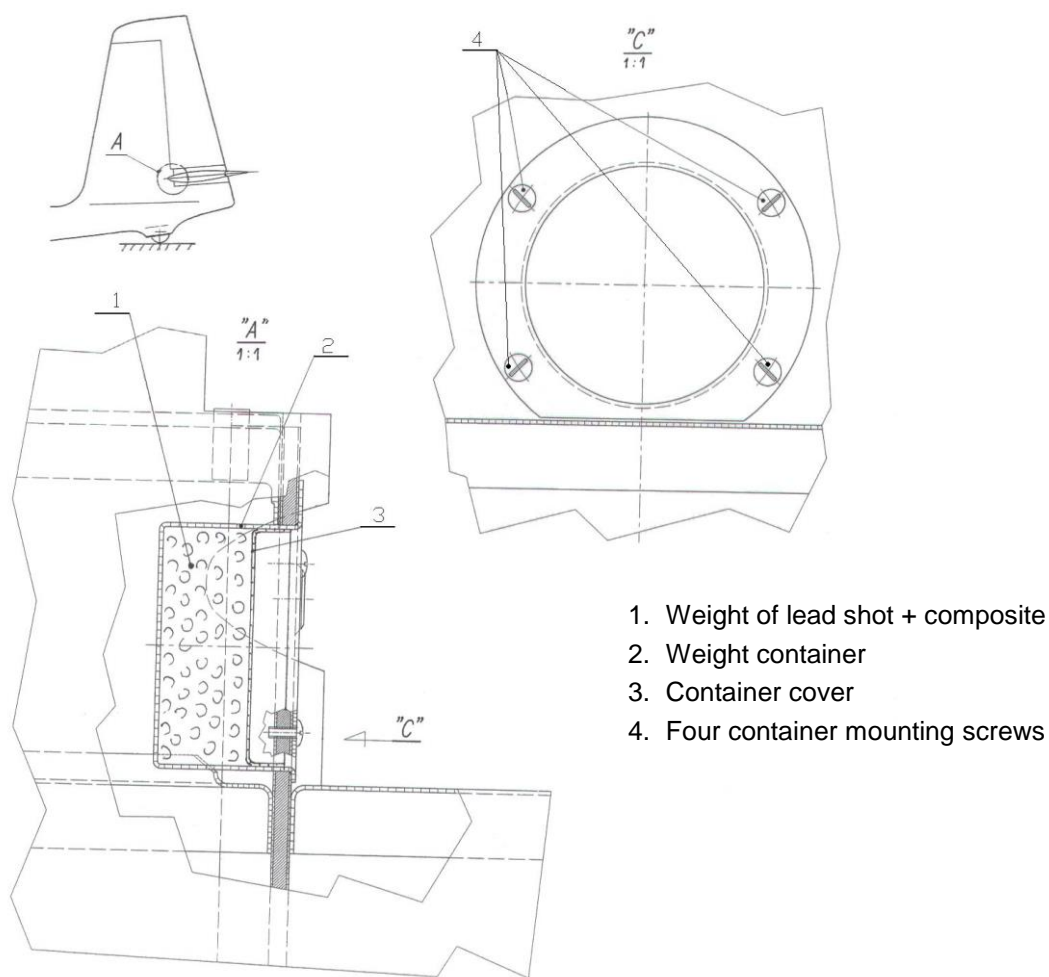


Fig. 7-3. Location of balancing weight in sailplane tail

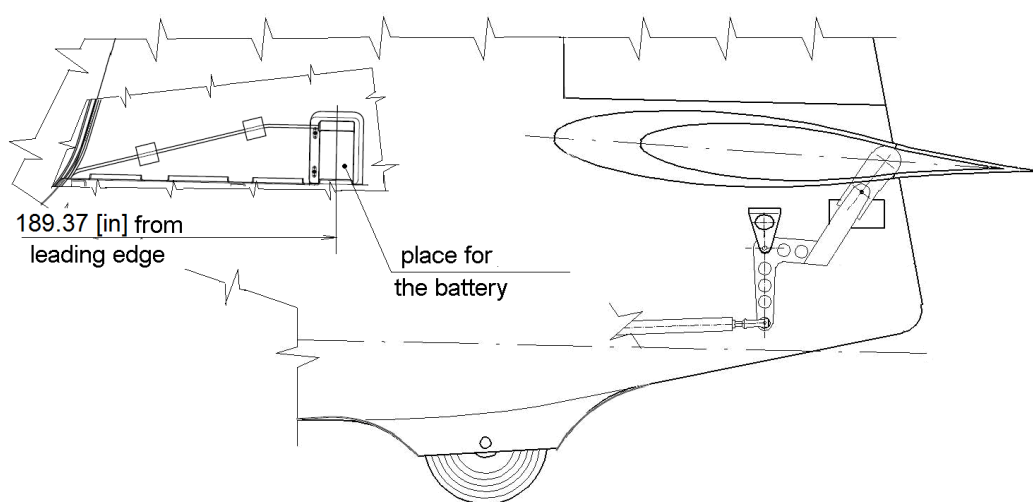


Fig. 7-4. Battery mounting in sailplane tail

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7.3. Calculation of sailplane without pilots CG position

In case of mounting or dismounting additional equipment in instrument panels or in luggage compartment, also battery in tail, it is allowed to determine new values of sailplane without pilots mass and centre of gravity position with calculation method. Keep in mind the following restrictions:

2

- Weight of any instrument panels (front or rear), including additional equipment, must not exceed 11 lb.
- Mass of additional equipment in luggage compartment (including batteries) together with hand luggage must not exceed 44 lb.
- Resulting sailplane without pilots CG position must be within range specified in chart (Fig. 7–2.).

Calculations should be performed using „Calculation record of sailplane without pilots CG”, a pattern of which is presented in Section 18., and based on current and previous „Equipment list” and previous „Record of sailplane weighing and determining of CG” or „Calculation record of sailplane without pilots CG”.

Hitherto values of m_{bp} and X_{bp} are given in sailplane without pilots Weighing Table provided in Flight Manual in item 6.4. These values are marked with $(m_{bp})_0$ and $(X_{bp})_0$ in following calculations.

New values of sailplane without pilots mass (m_{bp}) and CG position (X_{bp}) should be calculated from the following formulas:

$$(m_{bp})_1 = (m_{bp})_0 + \Delta m_{t1} + \Delta m_{t2} + \Delta m_b + \Delta m_{ao}$$

$$(X_{bp})_1 = \frac{((m_{bp})_0 \times (X_{bp})_0) - (\Delta m_{t1} \times 68,5) - (\Delta m_{t2} \times 22,44) + (\Delta m_b \times 31,5) + (\Delta m_{ao} \times 189,37)}{(m_{bp})_1}$$

where:

$(m_{bp})_0$ - hitherto sailplane without pilots mass

$(X_{bp})_0$ - hitherto sailplane without pilots CG position (in inches)

Δm_{t1} - instruments mass increment in front instrument panel

68,5 - mass Δm_{t1} position

Δm_{t2} - instruments mass increment in rear instrument panel

22,44 - mass Δm_{t2} position

Δm_b - equipment mass increment in luggage compartment

31,5 - additional equipment CG position in luggage compartment

Δm_{ao} - battery mass increment in tail

189,37 - mass Δm_{ao} position

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Masses increments (Δm_{t1} , Δm_{t2} , Δm_b , Δm_{ao}) may assume positive or negative values, because weight of mounted equipment is added and dismantled – subtracted. If equipment at particular place has not changed, then mass increment in appropriate place is equal to 0. These increments values are given in the list of equipment changes on reverse of „Calculation record of sailplane without pilots CG” (item 18.4.)

Mounting or replacement of additional equipment on sailplane may move sailplane without pilots CG (X_{bp}) beyond the range specified in chart on Fig. 7–2. Achieving correct position can be obtained by using additional fixed ballast described in item 7.2. Following formulas for mass of front and rear ballast should be used interchangeably, i.e., they are true only if one of the ballast has changed, either front or rear.

Front ballast mass (m_{bn}) determines from the formula:

$$m_{bn} = \frac{(m_{bp})_1 \cdot ((X_{bp})_1 - (X_{bp})_k)}{(X_{bp})_k + 66,22}$$

Rear ballast mass (m_{bt}) determines from the formula:

$$m_{bt} = \frac{(m_{bp})_1 \cdot ((X_{bp})_k - (X_{bp})_1)}{199,21 - (X_{bp})_k}$$

where:

$(m_{bp})_1$ – sailplane without pilots mass for new equipment

$(X_{bp})_1$ – sailplane without pilots appointed CG position for new equipment

$(X_{bp})_k$ – sailplane without pilots expected CG position with additional ballast

It is recommended to adopt for calculation $(X_{bp})_k$ value in the middle of range allowed for $(m_{bp})_1$ before adding ballast.

The final value of sailplane without pilots mass (m_{bp}) and corresponding CG position (X_{bp}) are as follows (see: record in item 18.4.):

$$m_{bp} = (m_{bp})_1 + m_{bn} \quad \text{or} \quad m_{bp} = (m_{bp})_1 + m_{bt}$$

$$X_{bp} = \left\{ \begin{array}{l} (X_{bp})_1 - \text{without ballast} \\ (X_{bp})_k - \text{with ballast} \end{array} \right\}$$

These values should be recorded in sailplane without pilots Weighing Table in item 6.4. in Flight Manual.

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Example:

Sailplane after equipment changing has a mass $m_{bp} = 860$ lb and corresponding CG position $X_{bp} = 30,3$ in.

To bring it into correct X_{bp} position ballast should be placed on back of sailplane at position shown in Fig. 7-3.

$(X_{bp})_k$ value is assumed as recommended $(X_{bp})_k = 31$ in.

Additional balancing ballast mass is:

$$m_{bt} = \frac{860 \cdot (31 - 30,3)}{199,21 - 31} = 3,6 \text{ lb}$$

Final values entered in record are as follows:

$$m_{bp} = 860 + 3,6 = 863,6 \text{ lb}$$

$$X_{bp} = (X_{bp})_k = 31 \text{ in}$$

2

SECTION 8. EQUIPMENT

8.1. Minimum equipment

The minimum equipment, foreseen by sailplane manufacturer and compliant with CS-22 certification specification, comprises two tow releases (front and CG), two sets of 5-point safety harness and the following instruments in the instrument panel at front seat.

- airspeed indicator with range of indications 0 ÷ 160 or 200 kn
- altimeter with range of indications 0 ÷ 30 000 ft
- accelerometer with range of indications -5 through +7 g at least
- *(item removed)*.

NOTE:

Relevant national regulations may require mounting an additional, different minimum equipment (e.g. in Poland – compass, in Germany – transceiver, etc.).

Equipment maintenance should be carried out in accordance with guidelines specified in Section 16.

Below are listed the minimum equipment types, that have been approved by the sailplane Type Certificate Holder.

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8.1.1. Airspeed indicators

Manufacturer	Type	Certificate / Approval
PZL	Ø3,15", PR-400s	BS.3G 100
Winter (up to 160 kn)	Ø3,15", 6 FMS 5-2	TS 10.210/03
	Ø3,15", 6 FMS 4	TS 10.210/15
	Ø2,24", 7 FMS 4	TS 10.210/19

It is mandatory to mark airspeed indicator dial in accordance with scheme specified in item 2.3. in Flight Manual.

8.1.2. Altimeters

Manufacturer	Type	Certificate / Approval
PZL	Ø3,15", W-10s	BS.3G 100
	Ø3,15", W-12s	
Winter	Ø3,15", 4 FGH 10	TS 10.220/46
	Ø2,24", 4 FGH 20	TS 10.220/47
	Ø2,24", 4 FGH 40	TS 10.220/48

8.1.3. Accelerometers

Manufacturer	Type	Certificate / Approval
Falcon Gauge	Ø2,24", GM510-2	MIL-A-5885 C
	Ø3,15", GM510-3	

8.1.4. Stall warning unit

Content was moved to the item 8.2. Additional equipment, point 8.2.6.

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8.1.5. Safety harnesses

Manufacturer	Type	Certificate / Approval
Gadringer	Lap belt 540202	EASA.21O.10039345 TCDS 40.070/32
	Shoulder belt 270002	EASA.21O.10039416 TCDS 40.071/05
	Crotch belt 130302	EASA.21O.10039342 TCDS 40.072/4
ZS Jeżów	Lap belt J5.10.00	TCDS 40.070/34
	Shoulder belt J5.70.00	TCDS 40.071/23
	Crotch belt J5.90.00	TCDS 40.072/5

8.1.6. Batteries

Content was moved to the item 8.2. Additional equipment, point 8.2.7.

2

8.1.7. Tow releases

Manufacturer	Type	Certificate / Approval
Richard Tost Fluggeratebau 8000 Munchen – Germany	front – TOST E	TCDS 60.230/1
	CG – TOST G	TCDS 60.230/2

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8.2. Additional equipment

Additional equipment and accessories (e.g. variometers, on-board computers, flight recorders) can be mounted on sailplane provided that they have no mutual effect on its own performance and do not impinge on operational safety in any way.

NOTES:

Additional equipment can be installed in front and rear instrument panel and on luggage compartment floor. Follow mass limitation given in item 7.3. Additional equipment mounting must be done in accordance with instructions given in item 2.20. Mounting in other places will require from Type Certificate Holder to develop appropriate instruction and approve it by Aviation Authority.

Instruments electrical installation requires using appropriate current fuses. Current consumption of any instrument must not exceed 3A.

After mounting or replacing additional equipment, new sailplane without pilots mass and CG position should be determined by weighing or appropriate calculations in accordance with guidelines specified in Section 7.

Additional equipment types, that have been approved by the sailplane Type Certificate Holder, are listed below. Equipment maintenance should be carried out in accordance with guidelines specified in Section 16.

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8.2.1. Variometers and related accessories

Total energy variometers

Manufacturer	Type	Certificate / Approval
PZL	Ø3,15", PR-03 +10 m/s -6 m/s	BS.2G 111 BS.3G 100
	Ø2,24", PR-04 ±5 m/s	
	Ø3,15", WRS-5E ±5 m/s	
Winter	Ø3,15", 5 STV5, ±10 kn	TS 10.230/13
	Ø2,24", 5 STVM 5, ±10 kn	TS 10.230/13

Total energy compensators

Manufacturer	Type	Certificate / Approval
PZL	KWEC - 2	Certified with variometer
Allstar PZL Glider	K-1 tube	Normalized part

Compensating vessels

Manufacturer	Type	Certificate / Approval
PZL	TM-420	Certified with sailplane
Winter	compensating vessel	

8.2.2. Artificial horizon

Manufacturer	Type	Certificate / Approval
Kelly/R.C. Allen	Ø3,15", RC Allen RCA26AK-3 14v	EASA.IM.210.10040839 TSO C4c

8.2.3. Compasses

Manufacturer	Type	Certificate / Approval
PZL	Ø2,36", BS-1	BS.3G 100
Winter	Ø2,24", Airpath C-2300	TS 10.220/47

All compasses are subject to compensation in sailplane ready to flight configuration. Deviation chart must be placed in a conspicuous position in sailplane cockpit, near the compass.

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8.2.4. Turn and bank indicators

Manufacturer	Type	Certificate / Approval
Mid-Continent	Ø3,15", Turn & Bank Indicator	TSO C3b
Gauting Apparatebau	Ø2,24", WZ 402 Ø3,15", WZ 404	TCDS 10.241/8

8.2.5. Bank indicators and inverted flight bank indicators

Manufacturer	Type	Certificate / Approval
PZL	PH-01	Normalized part
Winter	QM I, II or III	
Falcon Gauge	Ø2,24", SI-2Q	

8.2.6. Stall warning device

Manufacturer	Type	Certificate / Approval
LAMERS - S.T.U. (Allstar PZL Glider)	SP3	Certified with sailplane FA-05/95

8.2.7. Batteries

Manufacturer	Type	Certificate / Approval
CSB	XTV 1272 12 V, maintenance-free, gel, min. capacity 5 [Ah], recommended 6,5 ÷ 7,2 [Ah]	Declaration of Conformity (CE), ISO 9001:2000, ISO 14001:2004. Recommended compliance with quality requirements: 896-2, DIN 43534, BS 6290p.4, EUROBAT and/or UL 1989.
Europower	EP 7,2-12 12 V, maintenance-free, gel, min. capacity 5 [Ah], recommended 6,5 ÷ 7,2 [Ah]	

2

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8.2.8. Transceiver

| 2

Manufacturer	Type	Certificate / Approval
Unimor Radiocom	Ø2,24", RS - 6112	CAA PL Z-FC-23/02 ETSO 2C37e
XCOM Transceiver	Ø2,24", 760 VHF	TSO C37d, C38d
Becker	COMM 2000-Systems	TCDS 10.911/48
	AR 3201	TCDS 10.911/76
	Ø2,24", AR 4201	EASA.21O.10038538 JTSO 10.911/87
	Ø2,24", AR 6201	EASA.21O.1249 ETSO 2C37c, 2C38e
Fliser Electronic	Ø2,24", ATR 600	LBA.0.10.911/106 JTSO
	ATR 600 A	LBA.0.10.911/114 JTSO
	ATR 720	TCDS 10.911/70
	ATR 720 A	TCDS 10.911/74
	ATR 720 B	TCDS 10.911/80
Funkwerk	Ø2,24", ATR 500	LBA.0.10.911/113 JTSO
	Ø2,24", ATR 833A	EASA.21O.270 ETSO 2C37e, 2C38e
Dittel Avionic	Ø2,24", KRT 2 8,33 KHz	ETSO 2C169a
Dittel Messtechnik GmbH (Funkwerk)	FSG 60 M	TCDS 10.911/72
	FSG 50	TCDS 10.911/71
	FSG-40-System	TCDS 10.911/45
	Ø2,24", FSG 90	EASA.21O.1305 LBA.0.10.911/98 JTSO
	Ø2,24", FSG 2T	EASA.21O.1304, LBA.0.10.911/103 JTSO

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2 | 8.2.9. Emergency Locator Transmitter

Manufacturer	Type	Certificate / Approval
ACK Technologies	ELT ACK E-01 3,86 lb	TCDS 10.915/9 TSO C91a, C142a, C126
	ELT ACK E-04 2,09 lb	EASA.IM.210.10028407 ETSO 2C91a, 2C142a, 2C126
Oroliia S.A.S.	ELT Kannad 406 (GPS) 1,87 lb	EASA.210.1098 ETSO 2C91a, 2C126
Ameri-King	AK-450 ELT 2,62 lb AK-451 ELT 2,14 lb	ETSO 2C91a, 2C126
Artex	ME 406 2,05 lb	EASA.IM.210.416

2 | 8.2.10. Transponders

Designed for aircraft and certified to TSO, JTSO or ETSO transponder can be mounted on sailplane.

Manufacturer	Type	Certificate / Approval
Becker	Ø2,24", BXP 6401-2-(02) Mode S 50000ft	EASA.210.322 ETSO, TSO - 2C112a
	Ø2,24", BXP 6401-1-(01) Mode S 15000ft	
	Ø2,24", ATC4401-1-250 Mode A and C 50000ft	JTSO, TSO - 2C74c LBA.O.10.930/062JTSO
	Ø2,24", ATC4401-1-175 Mode A and C 15000ft	
Funkwerk	Ø2,24", TRT 800 H Mode S 35000ft	EASA:210.269 LBA.O.10.930/072ETSO
	Ø2,24", TRT 800 ATC Mode S 15000ft	
Microair	Ø2,24", T2000 SFL Mode A and C 62000ft	10.930/066 JTSO

8.3. Other additional equipment

Other, not listed above, equipment can be mounted on specific sailplane. Oxygen system, transponder, transceiver and ELT have to be of approved type. They must not interfere mutually and endanger operation safety. Mounting requires from Type Certificate Holder to develop supplements to TSM and FM, containing installation and maintenance instructions, and to approve it by Aviation Authority.

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SECTION 9.

INSPECTION OF CONTROL SURFACES BALANCE

Schemes of control surfaces balance inspection are presented in Figure 9–1.

Ailerons balance inspection should be carried out separately for each aileron.

Measurement results must be recorded in balance records, patterns are provided in Section 18.

1. Weigh aileron, elevator or rudder and determine the mass „m_i” [lb].
2. Mount aileron, elevator or rudder rotatable on two hinges in such way that movement resistance is as small as possible when deflecting.

NOTE:

Mount aileron and elevator on two hinges in a way to prevent excessive elastic bending.

3. Calculate allowable value of balance force „P_{R-i}” with the following formulas:

a) for aileron

- main $P_{R-AC} = 0,1790 \times m_{AC}$ [lbf]
- wingtip $P_{R-AE} = 0,1296 \times m_{AE}$ [lbf]

b) for rudder $P_{R-R} = 0,0635 \times m_R$ [lbf]

c) for elevator $P_{R-E} = 0,0858 \times m_E$ [lbf]

Above formulas include use of [lb] as unit of mass and [lbf] as unit of force.

4. Determine the point of force „P_{ZM-i}” application according to dimensions presented in Fig. 9–1. pos. A, B, C.
5. Measure the force „P_{ZM-i}” using dynamometer scaled in [lbf] as presented in the figure, read the value. Aileron, elevator or rudder chord plane should be levelled.
6. Measured force value „P_{ZM-i}” compare with calculated according to formulas in item 3. value „P_{R-i}” .

7. Control surface balance is appropriate when:

- | | |
|--|-----------------------------|
| – for main aileron | $P_{ZM-A-C} \leq P_{R-A-C}$ |
| – for wingtip aileron | $P_{ZM-A-E} \leq P_{R-A-E}$ |
| – for rudder (with balancing weight) | $P_{ZM-R} \leq P_{R-R}$ |
| – for elevator (with balancing weight) | $P_{ZM-E} \leq P_{R-E}$ |

Control surfaces rebalancing is necessary after performing repairs (repair structure, painting). In this case, proceed as follows:

Weigh aileron, elevator or rudder before performing repairs. Weight of these elements after repair should correspond to the mass before repair with an acceptable mass increments:

- | | |
|-------------------|------------|
| – main aileron | + 0,055 lb |
| – wingtip aileron | + 0,022 lb |
| – rudder | + 0,110 lb |
| – elevator | + 0,055 lb |

When making repairs pay attention not to add weight to trailing areas. Painting should be done by and experienced professional. If P_{ZM-i} after repairing does not comply inequality given in item 7., then ailerons, elevator or rudder should be grinded and painted again.

Legend to Fig. 9–1.

A – Scheme of method of main aileron and wingtip aileron balance inspection

B – Scheme of method of rudder balance inspection

C – Scheme of method of elevator balance inspection

G_{AC}, G_{AE}, G_R, G_E – weight of main aileron, wingtip aileron rudder, elevator ($G_i = m_i \times g$)

$P_{ZM-A-C}, P_{ZM-A-E}, P_{ZM-R}, P_{ZM-E}$ – measured balance force of main aileron, wingtip aileron, rudder, elevator

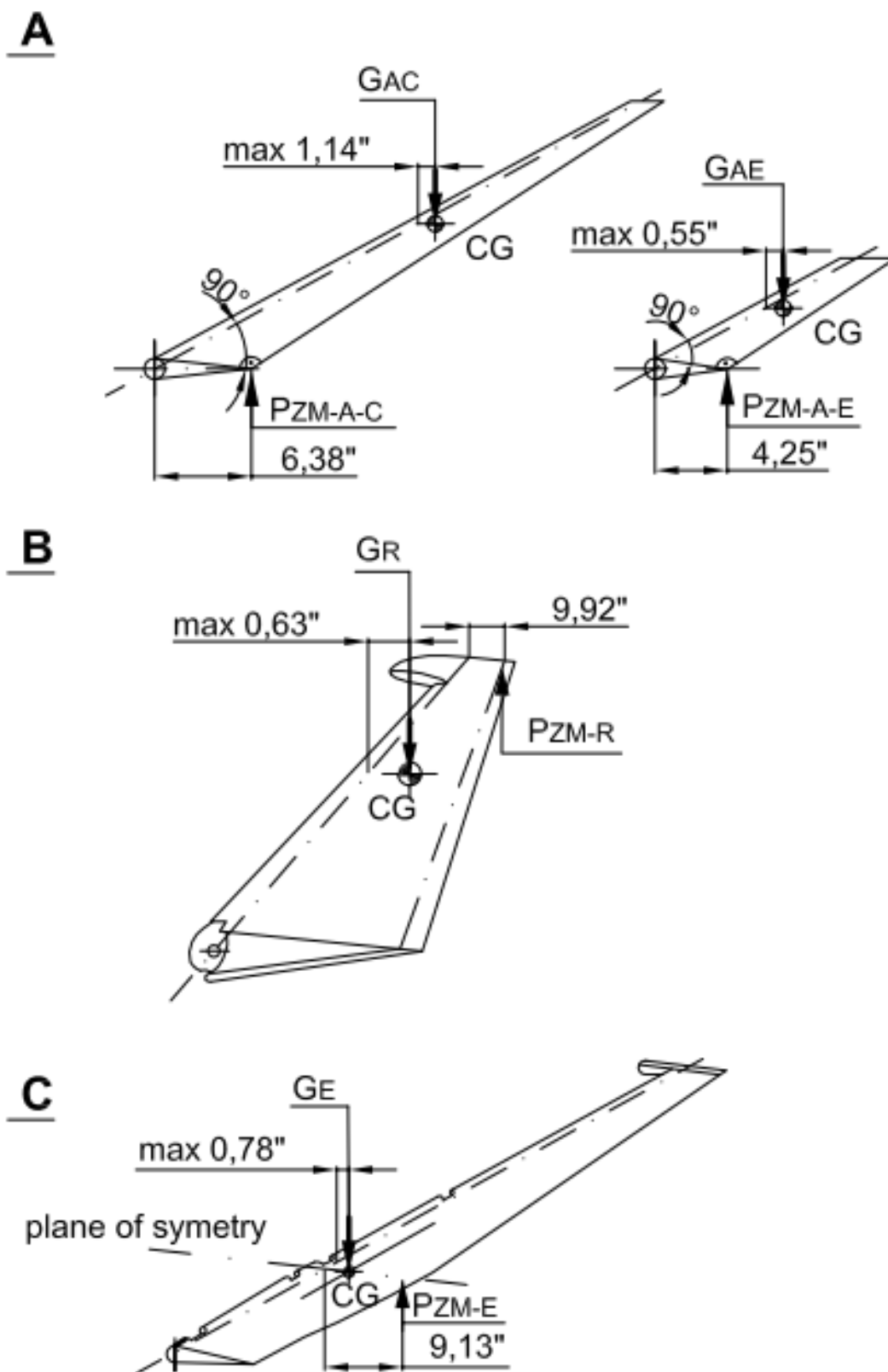


Fig. 9-1. Inspection of control surfaces balance

SECTION 9. INSPECTION OF CONTROL SURFACES BALANCE	TECHNICAL SERVICE MANUAL	SZD-54-2 „Perkoz”
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SECTION 10.

AIRWORTHINESS LIMITATIONS

10.1. Sailplane service life

Sailplane flight allowance is based on assessment of its technical condition. The periodic maintenance is specified in Section 16.

The sailplane provisional service life is 3000 flying hours and will be extended gradually on a way of bulletins issued by Type Certificate Holder.

10.2. Service life of elements installed on sailplane

10.2.1. Crew safety harness

Service life of crew safety harness – in accordance with limitations specified by manufacturer of harness.

10.2.2. Tow releases

Service life of tow releases and maintenance for them – in accordance with instructions of release manufacturer, and data in certificates of origin.

10.2.3. Board instruments

Service life for PZL Warszawa II produced board instruments – on a base of technical condition. The periodic maintenance according to guidelines in Section 16.

Service life and periodic maintenance for board instruments from other manufacturers – according to instrument certificates and instructions from instrument manufacturer.

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SECTION 11.

LIST OF MAINTENANCE DOCUMENTS OF ASSEMBLIES APPROVED REGARDLESS OF SAILPLANE

1. Tow releases operating instructions.
2. Board instruments operating instructions.
3. Main landing wheel and hydraulic brake accessories operating instructions. | 2

NOTE:

Above list applies to sailplane with minimal equipment

4. Stall warning device ANTI-STALL SP3. Technical Service Manual, Issue I | 2
23.03.1995 - optional equipment.

Instructions for equipment mounted on particular aircraft are delivered with sailplane.

SECTION 11. LIST OF MAINTENANCE DOCUMENTS OF ASSEMBLIES APPROVED REGARDLESS OF SAILPLANE	TECHNICAL SERVICE MANUAL	SZD-54-2 „Perkoz”
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SECTION 12.

CLEANING AND MAINTENANCE

12.1. Canopy perspex

Wash perspex with plenty of warm (not hot! – up to 122 °F) water, wipe with soft clean cloth or sponge.

In case if on perspex surface are greasy stains or oil type contamination, it is allowed to add to water small amount of detergent or aqueous solution of soap. After washing rinse thoroughly, wipe with soft clean cloth and allow to dry.

12.2. Painted exterior surfaces

Wash painted surfaces with warm water with mild detergent, rinse and wipe. Avoid rinsing with water under pressure, use soft sponges or cloths. Be careful not to get wet (not flooded) total and static pressure ports placed in sailplane nose and on vertical stabilizer leading edge.

Painted surface may be maintained with wax or silicone polishing paste.

SECTION 12. CLEANING AND MAINTENANCE	TECHNICAL SERVICE MANUAL	SZD-54-2 „Perkoz”
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SECTION 13.

SAILPLANE TRANSPORT AND STORAGE IN A HANGAR

13.1. Sailplane transport at the airfield

Sailplane (with or without crew) can be towed in front tow release with possibility to freely perform turns.

Rope length should be at least 13 ft.

Sailplane can also roll on the wheels forward and backward. Press the tail or lift the front part of fuselage when turning.

During sailplane transport canopy must be closed and secured, leaving windows open.

Airbrakes can be open or closed.

It is recommended to block one control stick (any) with lap belts of pilot safety harness.

In case of transporting a sailplane equipped with winglets, it is recommended to disassembly them first and transport with plane wingtips or without wingtips. Anyway, if a sailplane equipped with winglets is transported indeed, it is unacceptable to hold winglet “under the arm” – this could lead to serious injury!

13.2. Storage in a hangar

In case of expected long sailplane out of service, it is recommended to dismount main units.

If the sailplane is stored in fully assembled state, the ends of wings should be supported.

Lubricate fittings and metal parts.

Put on individual covers on main units.

Set the fuselage in profiled supports placed in second pilot control stick plane and at tail boom, whereas wings – with chord plane in vertical position – should be supported at leading edges in the mid-span and at spar roots close to root rib.

Reduce air pressure in tires.

13.2.1. Sailplane lifting and moving

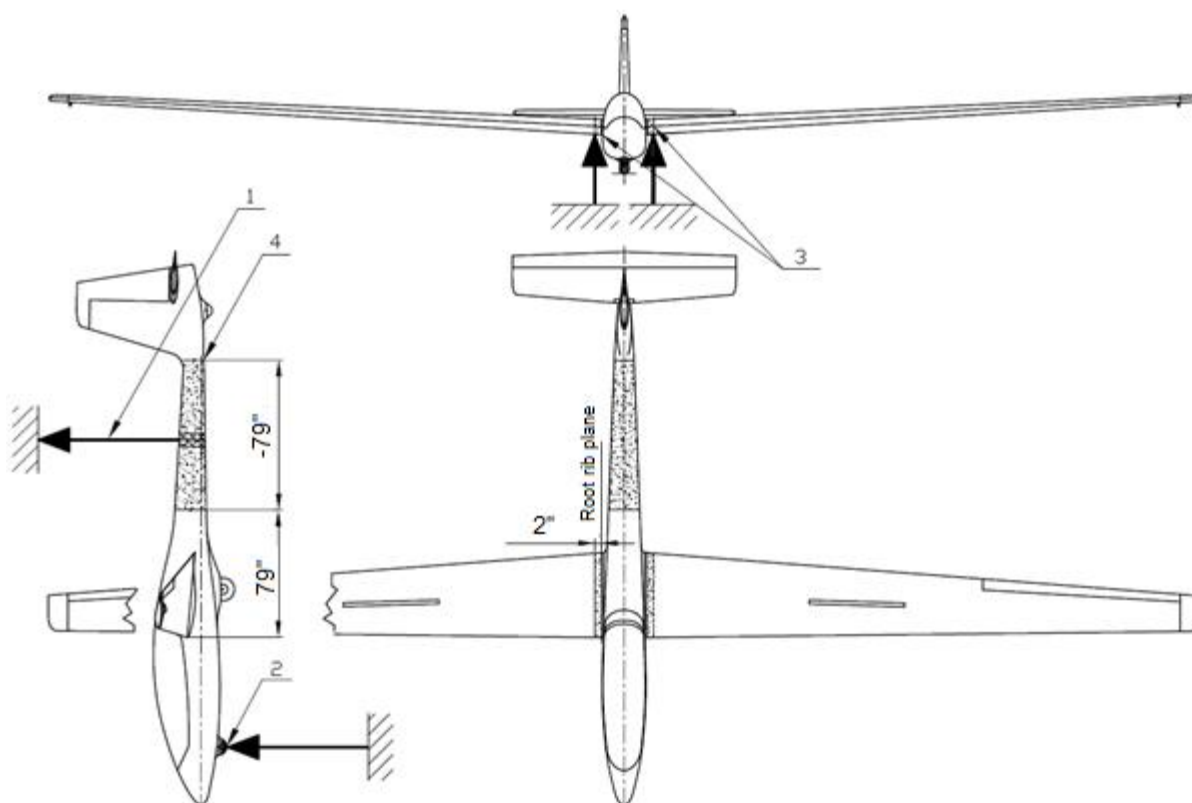


Fig. 13-1. Sailplane lifting and moving

Two methods of sailplane lifting are permitted:

1. With polyester tape [1] wrapped around tail boom in designated area [4], hanging on crane or winch, and with nose wheel support [2] placed on a hydraulic lift.
2. With two profiled supports [3] with minimum width of 2”, supporting wings in root rib planes, placed on hydraulic lifts.

NOTE:

Sailplane cannot be lifted by horizontal stabilizer and by wings in different way as Manual provides.

13.2.2. Sailplane hanging

Sailplane can be stored in a hangar by hanging it under ceiling by two polyester tapes with minimum width of 2”, wrapped around the fuselage. First tape should support the fuselage in rear cabin control stick plane, and second one in tail boom in position indicated in Fig. 13–2. To prevent structure damages protect these sites with soft material, such as felt.

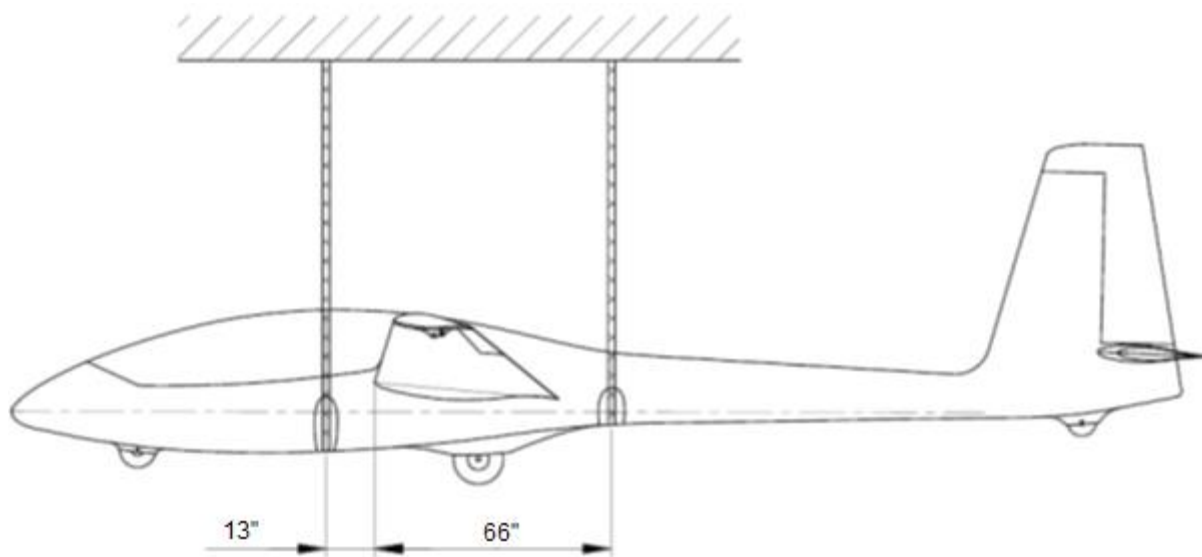


Fig. 13-2. Sailplane hanging areas

SECTION 13. SAILPLANE TRANSPORT AND STORAGE IN A HANGAR	TECHNICAL SERVICE MANUAL	SZD-54-2 „Perkoz”
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SECTION 14.

DISMOUNTED SAILPLANE TRANSPORT

14.1. Transport in sailplane trailer

When transporting sailplane in a trailer, main units can be attached by external surfaces with wide brackets lined with soft fabric or with tape, and additionally:

- wing – by spar roots (close to rib),
- exchangeable wingtips – by spar roots and pegs,
- fuselage – by frame rear bolts, provided its front part is supported in bracket and tail boom is immobilized with bracket as well or with tape, and by its main landing and tail wheel elements.

For transport the following should be done:

- plane wingtips mounted on the wings,
- control stick immobilized by safety harness,
- airbrake handle in cockpit immobilized in „closed” position,
- aileron and airbrake control system torsional tube ends immobilized in openings in fuselage shell,
- fittings and bearings protected from dust and dirt,
- canopy covered with flannel cover.

When transporting sailplane in open trailer, main units external surfaces should be covered with individual covers, and in case of precipitation – an additional foil.

14.2. Transport in container

If sailplane is sent by railway transport or road transport, then loading and securing in the container must be made according to special documentation.

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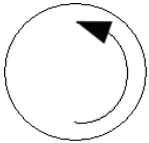









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SECTION 15.

INFORMATION TABLES

15.1. Pictograms

Meaning	Pictogram	Location
Trimmer control		LH cockpit board by front and rear lever
Unlocking of trimmer control		Front and rear lever (Only if locking system through lever rotating)
Aerodynamic brake control		Front and rear handle of the airbrake control pushrod
Canopy lock		LH side on canopy opening handles
Emergency canopy jettison		RH side on handles knobs
Ventilation control		Ventilation control cable handle
Foot pedals adjustment		Foot pedals adjustment cable grip
Tow hook release		Front and rear tow hook release grip
Allowed mass in baggage compartment		RH cockpit board in baggage compartment
Removable balance weights		RH cockpit board in front of front seat pan
Wheel brake		Front and rear control stick

15.2. Terms of use tables

15.2.1. Limitation table “Maximum allowed airspeed”

2

Aero-towing and winch-launching allowed airspeed IAS kn (mph)	V _T	89 (102)
	V _W	78 (89)

Location :

- Front and rear instrument panel, close to airspeed indicator.

15.2.2. Limitation table „Allowed V_{NE} values for various flight altitudes”

2

	Flight altitude [1000 ft]	0 ÷ 9,8	13,1	16,4	19,7	23,0	26,2	29,5	32,8
U	V_{NE} IAS kn (mph)	132 (152)	125 (144)	119 (137)	112 (129)	106 (122)	100 (115)	94 (109)	89 (102)
A	V_{NE} IAS kn (mph)	145 (167)	138 (158)	131 (150)	124 (142)	117 (135)	110 (127)	104 (120)	98 (113)

Location :

- Front instrument panel and LH cockpit board by rear seat

15.2.3. Tables „Pressure in tires”

17,4 psi	58,0 psi	36,3 psi
Nose Wheel	Main Wheel	Tail Wheel

Location :

- painted near particular wheels on sailplane fuselage.

15.2.4. Table “Manoeuvring loads and loading”

SZD-54-2 „Perkoz”			CATEGORY	
MANOEUVRING LOADS AND LOADING			U	A
Manoeuvring load factor limits			n =	+5,3 -2,65
Maximum in-flight mass			[lb]	1356 1301
Pilot with parachute mass	front seat (m ₁)	max	242 lb	
		min	121 lb	
	rear seat (m ₂)	max	242 lb	
Application of balancing weights		m ₁	m ₂	weights
One Pilot on Board		121÷139 lb	-	26,4 lb
		139÷154 lb	-	min. 13,2 lb
		≥154 lb	-	acceptable
Crew – 2 People		121÷139 lb	<121 lb	26.4 lb
		139÷154 lb	<121 lb	min. 13,2 lb
		<154 lb	≥121 lb	conditionally
		154÷209 lb	any	conditionally
		≥209 lb	any	forbidden
Maximum mass in baggage compartment			44 lb	
Solo flying on front seat only				
Maximum total load on both seats and in baggage compartment – see Individual Loading Plan for this sailplane!				

2

Location:

- LH cockpit board by front and rear seat

15.2.5. Table „Individual loading plan”

For every individual sailplane, after every change to the mass of sailplane without pilots (resulting of equipment modification or airframe repair) the new table must be prepared – using the sample showed below and method of filling given in item 6.5. of the FM.

2


	SZD-54-2 Perkoz INDIVIDUAL LOADING PLAN			
	Sailplane mass without pilots [lb]		57,4[ft]	
			65,6[ft]	
	Max. mass of the load (crew + baggage + ballancing weights)		Utility 57,4[ft]	
		Acro 65,6[ft]		
One Pilot on Board				
Balancing weights (13,2[lb] each)	Pilot mass with parachute [lb]			
	front seat			
	min.	max.		
2	121	139		
1+2	139	154		
0+2	154	242		
date signature				

Crew - 2 People			
Balancing weights - see placard "Manoeuvring loads and loading"			
Pilot mass with parachute [lb]			
rear seat	front seat -max.		
	Utility		Acro
	57,4[ft]	65,6[ft]	
121			
132			
143			
154			
165			
176			
187			
198			
209			
220			
231			
242			

Location :

- RH cockpit board by front and rear seat.

15.2.6. Table „Approved manoeuvres”

SZD-54-2 Perkoz ALLOWED AEROBATICS MANOEUVRES		
Acro		Utility
spin	inverted spin	spin
loop	inverted loop	loop
stall turn	inverted s.t.	stall turn
climbing turn	tail slide	climbing turn
steep turn	Immelman turn	steep turn
lazy eight	eight	lazy eight
Cuban eight	inverted C.e.	
half roll and half loop	controlled half roll and half loop	
flick roll	inverted f.r.	
flick roll downward	inverted f.r.d.	
flick roll in downward angle	inverted f.r.d.a.	
slow roll	barrel roll	

Location :

- RH cockpit board by front and rear seat.

15.2.7. Table „Pre- flight checklist”

PRE-FLIGHT CHECKLIST	
1. No loose items in a cockpit	CHECK
2. Parachutes	PUT-ON
3. Safety belts	FASTEN
4. Controls full deflection	CHECK
5. Airbrakes	CLOSE AND LOCK
6. Trimming device for take-off	SET
7. Accelerometer to „0”	SET
8. Altimeter set	CHECK
9. Canopy	CLOSE AND LOCK
10. Transceiver	CHECK
11. Stall warning device	ON
12. Towing cable connection	CHECK

Location :

- RH cockpit board by front and rear seat.

15.2.8. Compass deviation table

Deviation	
Compass.....	
Sailplane.....	
Cabin.....	
-6° (-) 0° (+) 6°	
0°	0°
30°	30°
60°	60°
90°	90°
120°	120°
150°	150°
180°	180°
210°	210°
240°	240°
270°	270°
300°	300°
330°	330°
360°	360°
-6° (-) 0° (+) 6°	
..... radio OFF radio ON	
Compensated by.....	
Date.....	

Location :

- Front and rear instrument panel, close to compass (if compass is installed).

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SECTION 16.

PERIODIC MAINTENANCE

16.1. General rules for periodic maintenance

When performing maintenance work, the information and recommendations contained in this Technical Service Manual should be observed.

The periodic overhauls can be accomplished by persons appropriately approved and experienced in this area – in agreement with airworthiness Authority.

Sailplane overhaul after hard landing or after other exceedance of operation limits is to be made as in periodic maintenance.

Sailplane main overhaul is to be done by appropriately approved (Part 145, Part M/F etc.) maintenance organization.

At every sailplane rigging the mating parts should be lubricated – see Section 5. Lubrication instruction.

Completed maintenance work must be certified in accordance with applicable requirements and using the current forms required in maintenance organization. Specification of completed maintenance work, in accordance with table contained in item 16.10., should have a form of sailplane verification record.

Records of sailplane weighing, made in accordance with instruction given in Section 7. and 9., must be enclosed to sailplane documents. Record samples in Section 18.

16.2. Periodic maintenance of SP3 stall warning device

Periodic maintenance work scheduled for every 100 flying hours or every 12 months, and these after 1000 flying hours are to be made in accordance with Service Manual for SP3 stall warning device, if it is installed in the glider.

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16.3. Periodic maintenance of board instruments

- Service and periodic maintenance for board instruments produced by PZL Warszawa Il is to be done in accordance with items 16.10.2. and 16.10.3. and bulletin BE-001/SZD/2011.
- Service and periodic maintenance for board instruments from other producers is to be done in accordance with certificates and instructions from instrument producer.
- Compass compensation is to be performed every 24 months. National regulations may require a different compensation period.
- Service and periodic maintenance for additional equipment installed on sailplane (acc. to item 8.2.) is to be done in accordance with certificates and instructions from equipment producer.
- Service and periodic maintenance for GM510 accelerometer is to be done in accordance with technical requirements specified in the document No. 542.3.10.01.
- Service and periodic works of additional equipment, marked in item 8.2. by asterisk (*), is to be done according to requirements described in TSM supplement for this equipment.
- Service and periodic maintenance for other additional equipment (acc. to item 8.3.) is to be done in accordance with requirements provided in supplements to TSM for this equipment.

16.4. Periodic maintenance of radio and electronic equipment

Service of radio and electronic equipment is to be done in accordance with instructions prepared by producer of this equipment.

16.5. Periodic maintenance of tow releases

Periodic maintenance of tow releases is to be done in accordance with instructions prepared by manufacturers of releases.

16.6. Periodic maintenance of wheels

Service of TOST main wheel is to be done in accordance with Installation and service manual of TOST wheels.

Service of nose and tail wheels performed according to item 16.10.7.16.

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16.7. Rules for operations of cables

Maximum service life of cable in control systems is 12 years. All cables that have reached 12 year in service must be replaced with new ones

Operation of cable is held on a basis of assessment of its technical condition. Within annual inspection, for all cables inspect carefully:

- correct position on pulley,
- technical condition and securing of turnbuckles,
- condition of cotter pins on cable connecting bolts,
- condition of cable on the area of contact with pulleys, and in front pedal „S-shaped” tubes.

There must be no further operations of cables corroded, with broken single wires, with wires worn more than half of their diameter, with guides having evidence of wear or with jammed, not rotating pulleys.

Lubrication of cables in Bowden housing is to be done in accordance with item 5.1.3.

Replacement of cables, and repair of guides and pulleys should be certified in accordance with applicable regulations.

In pre-flight inspection, verification of the points of cable connection to pedals, and of cotter pins on cable connecting bolts is mandatory.

16.8. Inspection of non-accessible areas in control systems

These inspections refer to:

- aileron control system in a wing (Fig. 2–13.),
- airbrake control system in a wing (Fig. 2–15.).

If resistance to motion identified in the concerned control circuits are within limits given in item 3.3. of this Manual, and the control stick play does not exceed $\pm 0,08$ ”, and no other malfunction evidence occurs (like noise at pushrod movement, knocks, skidding, discontinuous action, rubbing), then the condition of control system is considered correct.

Otherwise and always, whenever there are doubts to the proper operation of system, an inspection of control system elements should be done by making the inspection cut-outs in wing skin and possible disassembling of concerned elements. As an option, borescope inspection might be acceptable.

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16.9. Inspection of main units subjected to fatigue loads

The listed below parts and units, essential to fatigue resistance, within periodic maintenance should be subjected to special inspection:

- 1 - spar root pin (1), Fig. 2-1.
 - 2 - rear fitting (14), socket nut (23) and locking pin (18), Fig. 2-1.
 - 3 - fuselage rear pin (16), Fig. 2-1.
 - 4 - main bolt (10), Fig. 2-1.
 - 5 - stabilizer pins (4), Fig. 2-6.
 - 6 - stabilizer fastening vertical bolt (1), Fig. 2-6
 - 7 - wing spars (27) at the root rib (24), Fig. 2-1.
 - 8 - spar root (27) end in a place of spar fitting (22) installation, Fig. 2-1.
 - 9 - place of installation
 - front pins (3), Fig. 2-1.
 - rear fitting (14) sockets, Fig. 2-1. (rib inner and outer side – area of socket nut (23)),
 - sleeve (2) in root rib (24), Fig. 2-1.
 - ball socket (9) in main frame, Fig. 2-1.
 - main bolt (10) sleeve in spars (27), Fig. 2-1.
 - long wingtip spar pins (1), Fig. 2-4.
 - pins (4) and sleeves (5), Fig. 2-4.
 - nest sockets (2), Fig. 2-4.
 - 10 - root rib (24) bonded joint to wing skin (25), especially in the area of rear fitting (14) socket, Fig. 2-1.
 - 11 - stabilizer pins (4) installation area, Fig. 2-6.
 - 12 - fuselage fitting (3) installation area in rear web (13), Fig. 2-6.
- metal parts – surface peeling, cracks, shape deviations,
– composite parts – white spots, delamination, debonding.

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16.10. Maintenance work and actions carried out on a sailplane

Below, there is a list of maintenance work and actions, that should be performed in accordance with given schedule.

NOTE:

After first 50 flying hours since new, an overhaul must be performed in a scope like for 12 mth / 300 h periodic overhaul.

Column description:

12 mth / 300 h - periodic overhaul performed every 12 months (annual) or every 300 flying hours – whichever occurs first;

HL - overhaul after hard landing or after landing with ground loop;

1000 h - main overhaul, to be made after every 1000 flying hours.

Hard landing definition:

For a “hard landing” is considered such, in which the structure could be tensioned beyond the level anticipated within operation limits. To category of hard landing included are also cases of belly rubbing, pancaking, excessive cross-wind, ground loop landing, or hitting an obstacle with wing or with other structure part.

In every case, hard landing is an indication for mandatory structure overhaul, in accordance with the specification below.

The structure overhaul is mandatory also after exceedance of operation limitations (maximum airspeed, manoeuvring airspeed, manoeuvring loads etc.) and after flight in strong turbulence (e.g. rotor cloud turbulence).

Reference explanation:

Actions marked with asterisk (*) on main inspection list are to be performed after full disassembly of unit/system.

During maintenance actions marked by (z) special attention should be paid to parts and places listed in item 16.9. due to fatigue character of load.

- 1 - Additional actions for instruments are to be completed in accordance with maintenance programme after 50 or 100 flying hours, contained in Manual for the concerned instrument
- 2 - Additional actions for instruments are to be completed in accordance with maintenance programme after 500 flying hours, contained in Manual for the concerned instrument
- 3 - Additional actions for instruments are to be completed in accordance with maintenance programme after every 12 months, contained in Manual for the concerned instrument
- 4 - Additional actions for instruments are to be completed in accordance with maintenance programme after 300 flying hours, contained in Manual for the concerned instrument

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Actions	12 mth 300 h	HL	1000 h
16.10.1. Complete structure inspection on rigged sailplane			
1 - Verify condition of sailplane external surfaces.	X	X	X
2 - Inspect cockpit against possible loose items, that might enter into-, and lock control system.	X		X
3 - Inspect seat pan condition, and verify of rear seat locking and adjustment.	X	X	X
4 - Verify unrestricted operation of aileron and airbrake control system - to do so, disassemble cover on control stick at front seat as well as rear seat pan, and check fuselage interior against foreign objects.	X	X	X
5 - Check condition of pilot safety harnesses.	X	X	X
6 - Check condition of canopy perspex for transparency, scratches and cracks.	X	X	X
7 - Check reliable operation of canopy locking.	X	X	X
8 - Verify emergency jettison of canopy by test.	X		X
9 - Check correct connection between sailplane units and reliable locking at joint points.	X	X	X
10 - Check the backlash in joints at wing-fuselage connection. This is accomplished after previous removal of wingtips: long or short (plane) or winglets. Backlash in joints is verified by rapid moving the wing tip with moderate force. In case of excessive backlash, these are perceptible in a form of mutual displacements of mating elements and possibly audible knocks.	X	X	
11 - Verify backlash at stabilizer-fuselage connection – analogous to check in wing-fuselage connection.	X	X	
12 - Verify backlash in elevator and rudder hinges – possible backlash is perceptible when pulling with varying force at trailing edge.	X	X	
13 - Measure backlash value at all joints in fittings of main units (item 3.4.3.) and at control surface hinges (item 3.4.4.).			X
14 - Verify correct operation of cockpit controls and measure resistance to motion of these circuits (item 3.3.).	X	X	X
15 - Verify backlash in aileron and stabilizer control system – this is accomplished by measurement of play on top of control stick grip (item 3.4.1.).	X	X	X

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Action	<u>12 mth</u> 300 h	HL	1000 h
16 - Verify allowed play – travel of airbrake plate (item 3.4.5.).	X	X	X
17 - Verify tension of circuit cable in rudder control system (item 3.2.).	X	X	X
18 - Check cable connections and securing (with cotter pins) in rudder control system.	X		X
19 - Verify condition and reliable operation of tow releases and their actuating system (Fig. 2–21.).	X	X	X
20 - Verify condition of main landing gear. Verification includes condition and wear of tire, shock-absorption, brake efficiency and tightness (no leakage) of wheel brake hydraulic installation.	X	X	X*
21 - Verify condition of wheel brake actuating system (Fig. 2–8. and item 3.5.9.).	X	X	X*
22 - Verify sailplane alignment (Section 6.).			X
23 - Verify deflections of sailplane control surfaces (Section 6.).	X	X	X
16.10.2. Inspection of instruments and pneumatic installation Check visually board instruments, their mounting in instrument panel, technical condition, dials neutral position, instrument panel suspension. Check leakproofness of pneumatic installation and instruments correct operation. Check condition of the inserts in steam traps. Scheme of instruments pneumatic installation is presented in Fig. 2–16. and Fig. 2–18.	X ¹	X ¹	X* ²
16.10.3. Check operation of electric turn indicator (if installed) Switch the turn indicator on, check zero attitude and conformance between instrument indications and direction of fuselage yaw. Scheme of turn indicator Installation is presented in Fig. 2–19.	X ³	X ³	X* ⁴
16.10.4. Check electric connection between CG tow release and control sticks in a cockpit Check electric wiring between CG tow release hook and metal, non-insulated part on both control sticks.	X		X
16.10.5. Check operation and correct fitting of additional installations Additional installations comprise e.g. radio equipment, as well as all other devices installed.	X	X	X

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Action	12 mth 300 h	HL	1000 h
16.10.6. Verify reliable de-rigging and rigging of sailplane main units De-rigging and rigging of sailplane main units comprises connection between: wing - wingtip (long, short, winglet), wing - fuselage, horizontal stabilizer - fuselage.	X	X	X
16.10.7. Complete structure inspection on de-rigged sailplane			
1 - Verify condition of wing spar roots (27) and of fittings (22) installed in them, and check connection between spars and root ribs (24), Fig. 2-1. In verification of spar-rib corner, pay special attention to white spot occurrence.	X^Z	X^Z	X^Z
2 - Verify wing root rib (24), pay special attention to sleeve (2) and rear fitting (14), and mounting of them, Fig. 2-1.	X^Z	X^Z	X^Z
3 - Verify main bolt (10) connecting spars with frame, pins (1) in spar roots, front pins (3) and locking pins (18) at rear fittings as well as condition of elastic locking claws (17), Fig. 2-1. – surface smoothness control (sparse scratches and local seizures acceptable).	X^Z	X^Z	X^Z
4 - Verify - from inner side - socket nut (23) and rear fitting (14) mounting, Fig. 2-1.		X^Z	X^Z
5 - Verify condition of fuselage rear pins (16), Fig. 2-1.	X^Z	X^Z	X^Z
6 - Verify pins (1) and (4) of wingtips (short, long or winglets), Fig. 2-2., Fig. 2-4. – surface smoothness control (sparse scratches and local seizures acceptable).	X^Z	X^Z	X^Z
7 - Verify condition of inner structure in the wing root area – visual inspection, through openings for aileron control system in root rib.	X	X	X
8 - Disassemble aileron from wing. Verify aileron hinges and mounting of them in aileron and in wing or long wingtip. Check bonding of rear web with wing skin. Aileron condition verification. Before re-assembling, lubricate aileron hinges and connection of pushrod with aileron driving lever (see Section 5).	X		X

1

Action	<u>12 mth</u> 300 h	HL	1000 h
9 - Verify mounting of airbrake and its actuation system in airbrake box and through inspection openings in wing bottom skin. Verify condition of airbrake metal elements accessible in a box, as well as condition of springs and plate covers. In necessity, lubricate the movable mating parts (see Section 5). Check adherence of airbrake covers.	X		X*
10 - Check reliable connections in fuselage central portion, as well as condition of formers, truss of fuselage frame (15) Fig. 2–8., floors and wing-fuselage front & rear fittings (after wing de-rigging).	X	X	X
11 - Verify flying controls and mounting of them, as well as condition of pushrods in aileron & elevator control systems over the cockpit portion. In necessity, lubricate mating parts (see Section 5).	X	X	X
12 - Disassemble the rudder. Verify the remaining part of fuselage inner structure, in particular condition of the fin spar, webs and ribs, condition of rudder bottom and top hinges. Check sockets (mating with bolts (7)) condition and fixing in the rudder lower fitting (9), as well as condition of lever (5) and its suspension, Fig. 2–11. For the lever (5) check fixing and condition of driving bolts (7).	X	X	X
13 - Check condition of rudder structure as well as bottom and upper hinges. Check reliable and correct installation of mass balance in the rudder aerodynamic balance horn. Before reassembling the rudder, lubricate all movable joints – hinges, bolt sockets in the rudder lower fitting, bolts, as well as lever suspension (see Section 5).	X	X	X
14 - Dismount elevator from stabilizer. Verify condition of stabilizer pins (4), stabilizer fastening vertical bolt (1), mating sleeves (5) and fuselage fitting (3) Fig. 2–6. Verify condition of elevator hinges and installation of these in stabilizer and in elevator. Verify condition of stabilizer and elevator structure. Before re-assembling the horizontal stabilizer, lubricate all fittings in connection and movable joints (see Section 5). Check reliable and correct installation of mass balance in elevator.	X^Z	X^Z	X^Z
15 - Inspect visually elements and assemblies in control systems – flying controls, pushrods, levers and pedals. In necessity lubricate movable joints between parts (see Section 5).	X	X	X*

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Action	<u>12 mth</u> 300 h	HL	1000 h
16 - Verify condition of landing gear. Pressure in tires – see item 3.1. Check condition of nose and tail wheel tires. Check smooth rotation of the wheels (no jams).	X	X	X*
17 - Verify condition of cables in accordance with guidelines of item 16.7.	X	X	X
16.10.8. Verify mass balance of control surfaces in accordance with Section 9.			X
16.10.9. Complete sailplane weighing in accordance with Section 7.			X
16.10.10. Perform test flight			X
16.10.11. Check the patency of all drainage holes (see item 2.21., Fig. 2–23. Sailplane drainage holes layout scheme)	X	X	X

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SECTION 17.

SAILPLANE REPAIRS

17.1. Introductory remarks

This manual provides guidance for composite sailplane minor damages repairing by organizations approved acc. to Part 145 or Part M/F (or equivalent outside the EASA), which demonstrated ability to perform composite structures repairs (damages are classified in item 17.2.2.) and metal processing (17.6.3.).

The second group of damages, more serious than specified in item 17.2.2. but not requiring factory repair yet, will be investigated individually by Type Certificate Holder having regard to the factual condition and qualified to the appropriate category of damage repairs – minor or major. Depending on the classification of repair it can be done by mechanic with licence for composite structures repair or certified service workshop, approved for the composite structures repair, based on approved repair procedure.

Damages, which the possibility of repair by the abovementioned organizations themselves are excluded, are given in item 17.2.2.

Complete and familiarize with the following documents before proceeding to repair:

- aircraft log book,
- Technical Service Manual,
- service history, maintenance status, parts and components with a limited lifetime status,
- airworthiness directives and bulletins status,
- previous repairs certificates,
- review and inspection records.

If relevant regulations or repair contractor status require, starting repair should be reported to state aviation authority appropriate for user's location.

After repair a new mass (m_p) and centre of gravity position (X_p) for “empty” sailplane with minimal equipment should be determined by weighing according to item 8.1. For sailplane with additional equipment mounted and possible fixed ballast specify new mass „without pilots” (m_{bp}) and corresponding CG position (X_{bp}) and prepare a new table „Individual loading plan” in accordance with item 6.5. in Flight Manual.

This manual refers to the „Workshop manual of performing strength laminates” IW-76/412,4.

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17.2. Composite structures repairing

17.2.1. Repair conditions

In addition to requirements listed in the introduction the following conditions in a room, where repair of composite structures is performed, should be assured for lamination time:

- a) relative humidity $\leq 85\%$,
- b) temperature ≥ 66 °F.

After lamination (or bonding) temperature ≥ 66 °F should be maintained in the room for a minimum 10 hours, that is until complete composite hardening. It is required after hardening that repaired sites were heated for 15 hours at +122 till +140 °F. Temperature measurement should be made with a thermometer covered against direct heating by heat source (blower, radiator), placed next to the repair site.

Room where the repair is done should be clean, dry, free from dust and well lighted. In addition, it is desirable to well-functioning, efficient ventilation.

Performing composite repairs personnel must be authorized to perform the strength composites and have a workshop practice in the composite sailplanes construction or repair.

Further given directions allow to make the correct repair.

17.2.2. Damages classification

Due to different severity level of assemblies that can be damaged, as well as different repair methods of various defects, sailplane is divided into 3 zones.

The table below shows for guidance types and size of defects for each zone.

No.	Type of defect	Size of defect [in]		
		ZONE I	ZONE II	ZONE III
1	Holes and dents	∅ 6"	6" × 4,33" along assembly or at small angle to axis thereof	4" × 2" along assembly or at small angle to axis thereof
2	Cracks	6" – in any direction	4" – only along the span (length) of the assembly	
3	Leading edge debonding	4" – wings, ailerons and stabilizers		
4	White spots	As 1 or 2 for zone I, but around main fittings UNACCEPTABLE		
5	Trailing edge debonding	8"		
6	Damaged paint	any		

When in doubt in interpretation of type or size of defects communicate with Type Certificate Holder, who will transmit its views on the matter after familiarize with description and photographic documentation of defect.

Damage repairs in the following cases are only performed by Type Certificate Holder:

- fittings torn out or damaged composite structure (white spots) around main fittings;
- broken spar flange;
- damaged wing root rib or spar root;
- broken fuselage or wing, horizontal stabilizer, aileron, rudder, elevator;
- in case of fuselage skin is damaged in area where inner fuselage reinforcement exists, for example cabin cut-out frame;
- in case of damages requiring replacement wing or fuselage shells;
- in any other case, where professional repair cannot be assured.

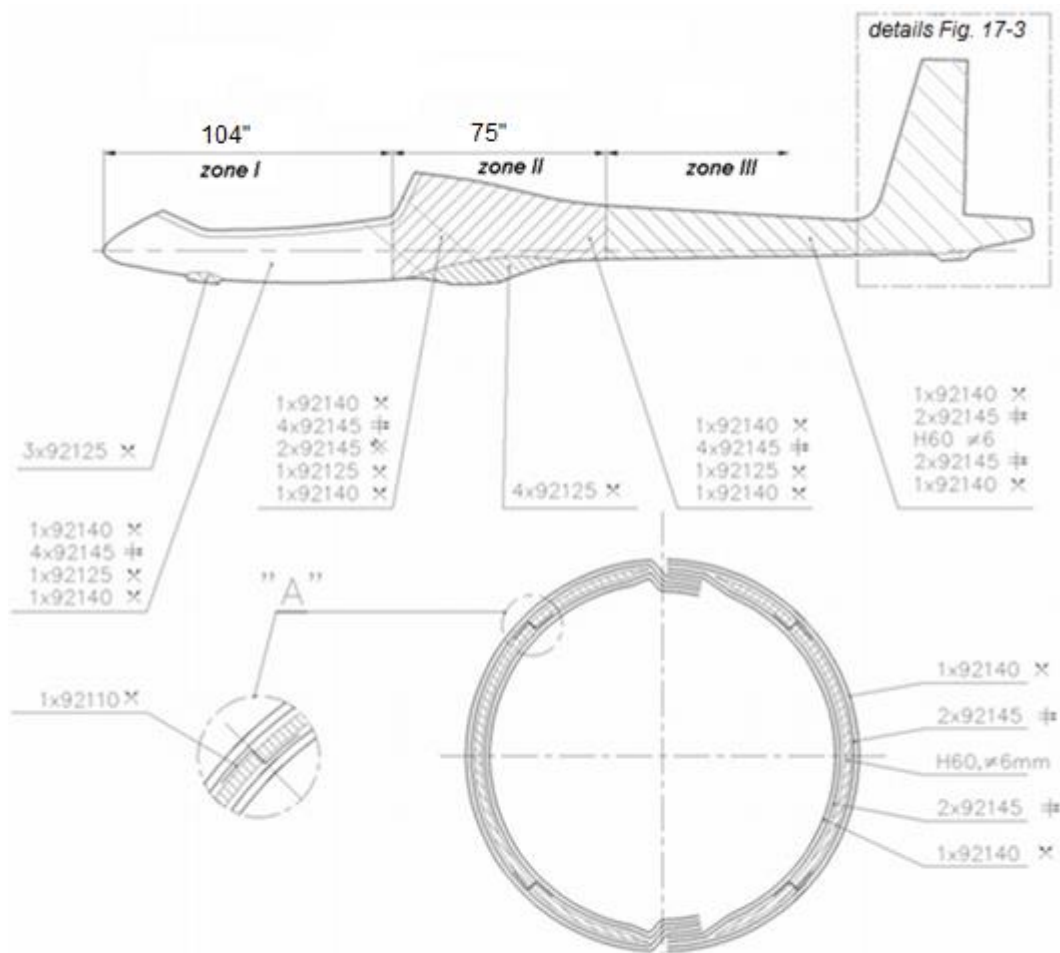


Fig. 17-1. Zoning and material specification for fuselage repairs

Zone I – wing
 Zone III – aileron, wingtip
 (long, short plane or winglet)

For wingtips structure description:
 W 1 – applies to winglet,
 W 2 – applies to plane wingtip,
 W 3 – applies to long wingtip.

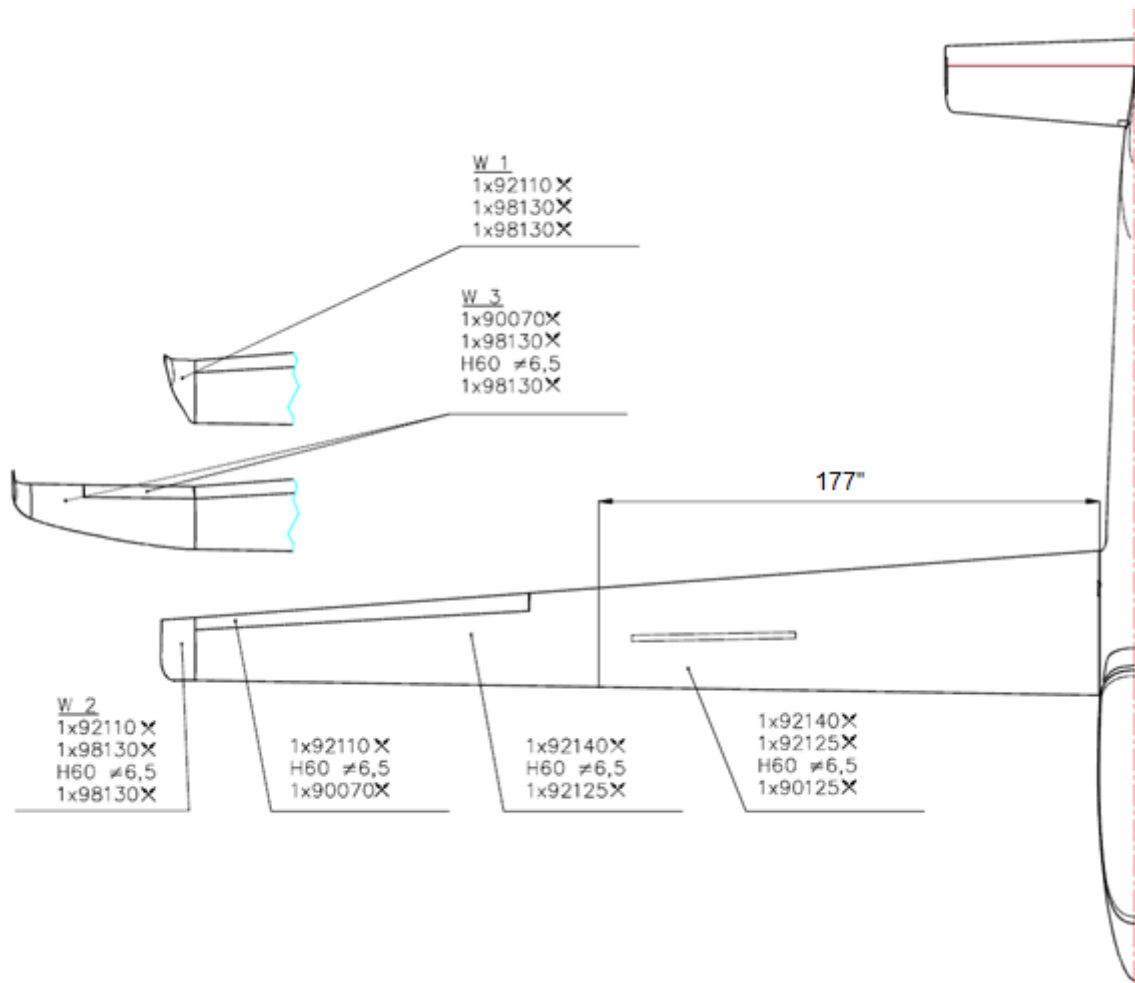


Fig. 17-2. Zoning and material specification for wing repairs

Zone III – vertical stabilizer and rudder

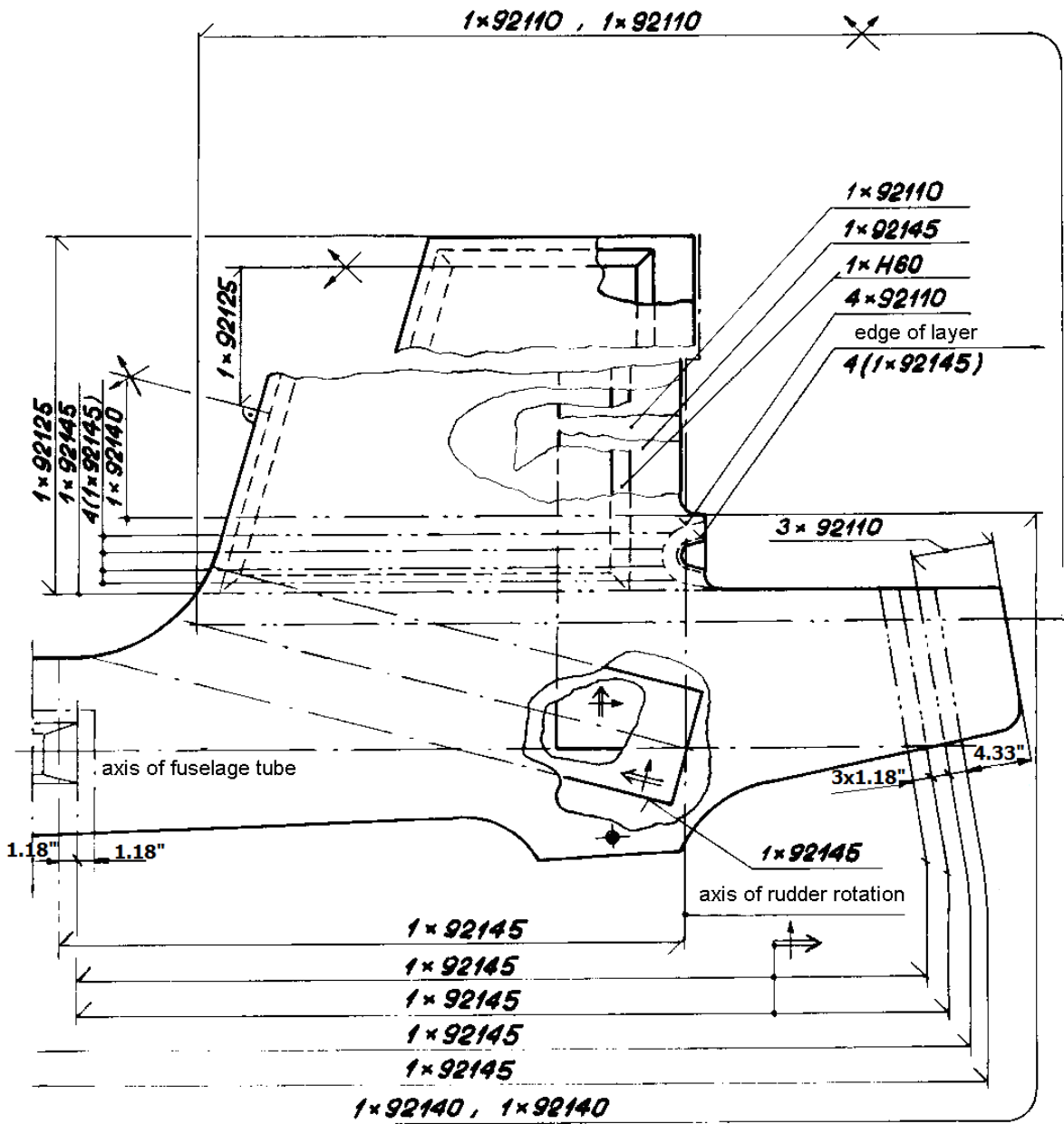


Fig. 17-3. Material specification for vertical stabilizer repairs

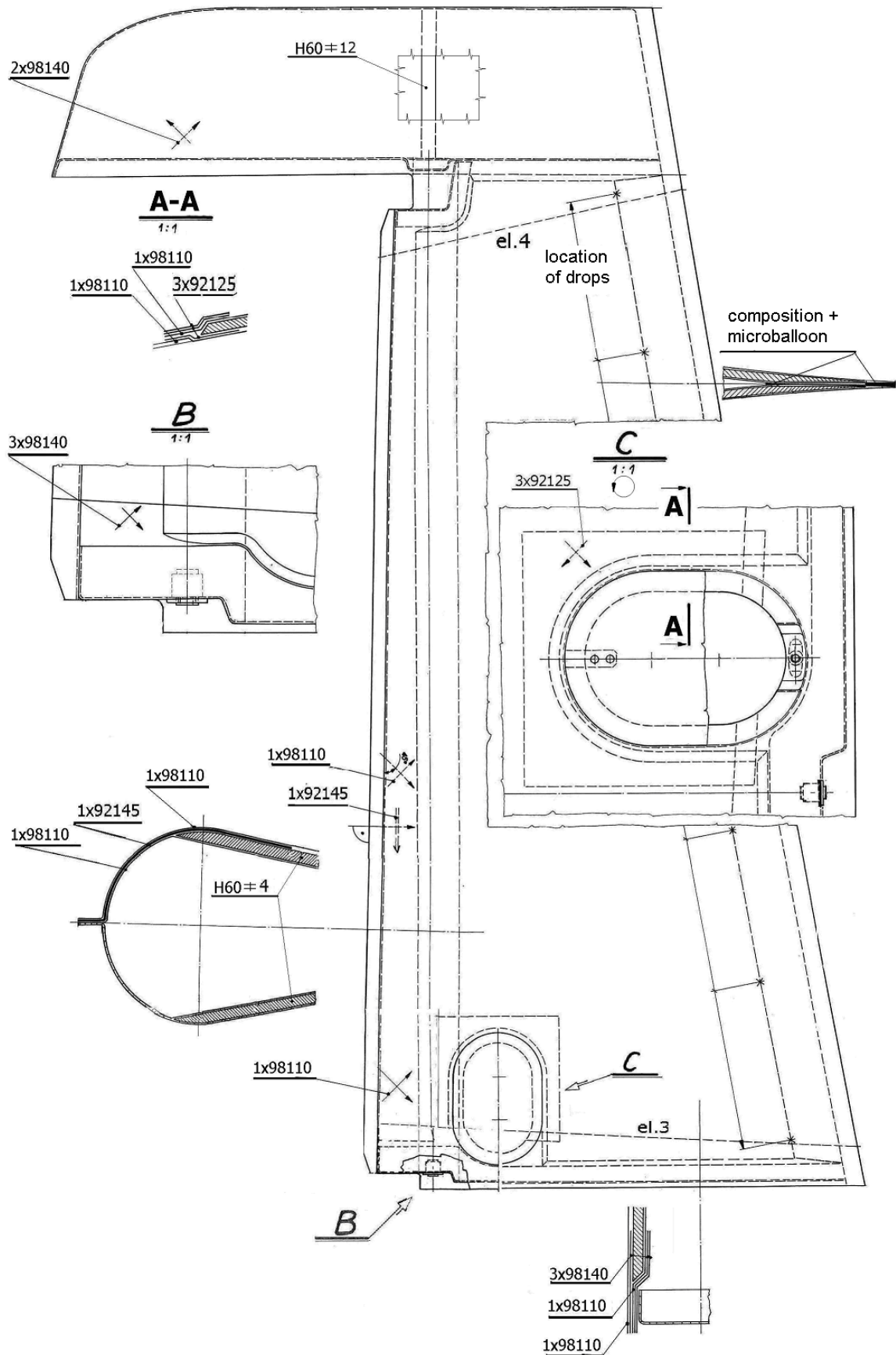


Fig. 17-4. Material specification for rudder repairs

Zone III – horizontal stabilizer and elevator

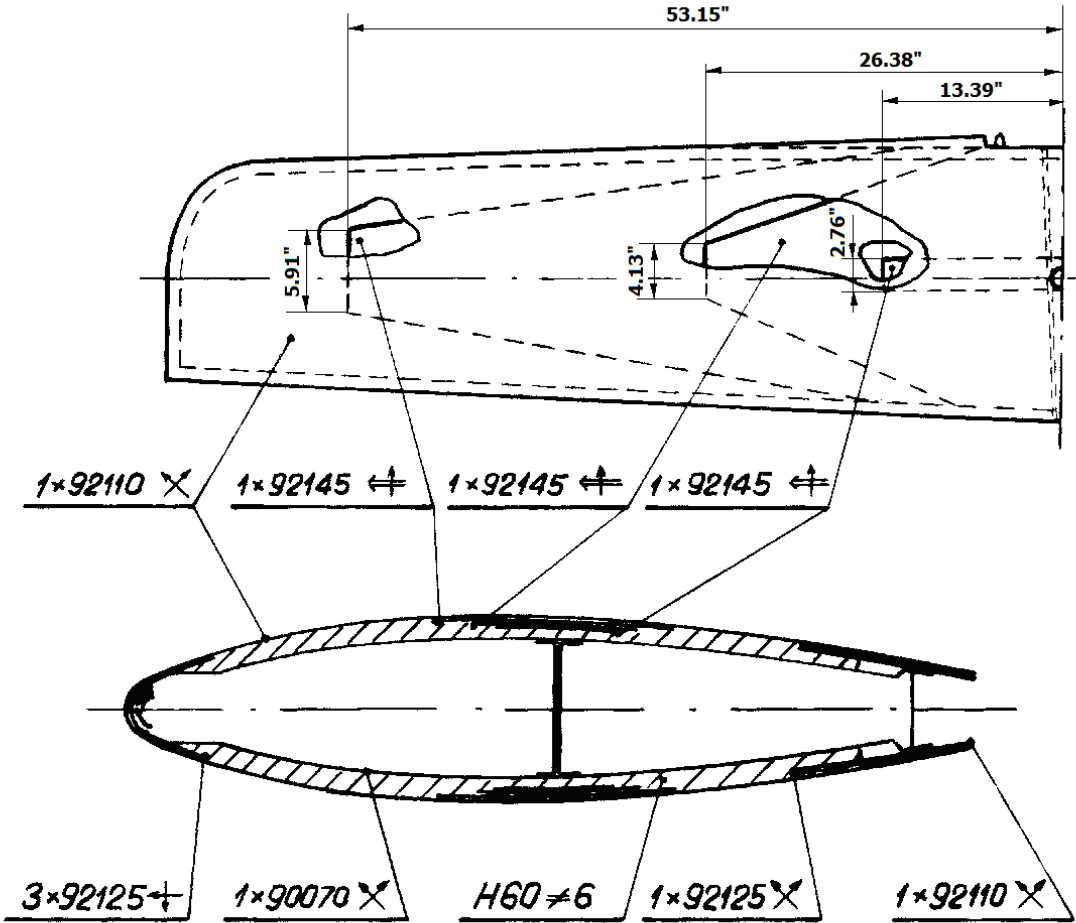


Fig. 17-5. Material specification for horizontal stabilizer repairs

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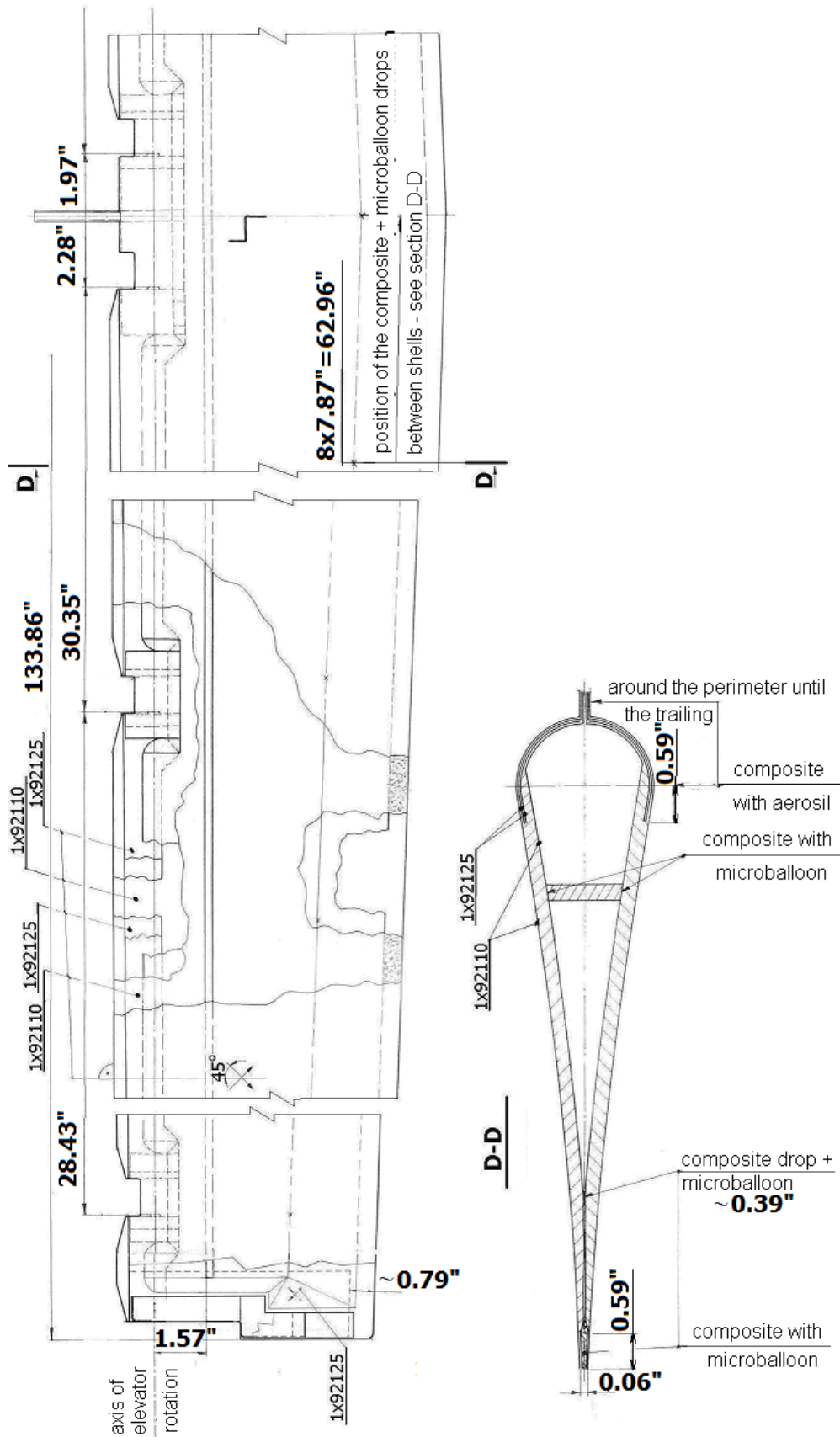


Fig. 17-6. Material specification for elevator repairs

17.3. Typical composite structures repairs

All repairs of composite parts should be performed in accordance with flow charts shown below and also with respect to:

- 2 |
- use of materials specified and further described in items from 17.3.1. to 17.3.6. inclusive,
 - preparation of surfaces before laminating or gluing by degreasing, grinding with sandpaper (grit size - approx. 180) and dust removal,
 - materials protection from grease, dirt and moisture,
 - proper and adequate dosage of hardener,
 - working life of mixed composition (composition L-285/H286 in room temperature - approx. 70 min.),
 - composition hardening time that is minimum 10 hours in temperature ≥ 66 °F,
 - composition extra hardening time in higher temperature (for L-285/H286 composition – minimum 15 hours in temperature 131 °F).

17.3.1. Sandwich shell laminate-foam-laminate

17.3.1.1. Damage to the sandwich outer layer (shallow dent, loss)

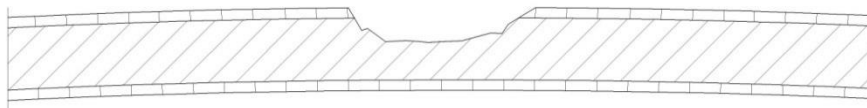


Fig. 17-7. Damage to the sandwich outer layer

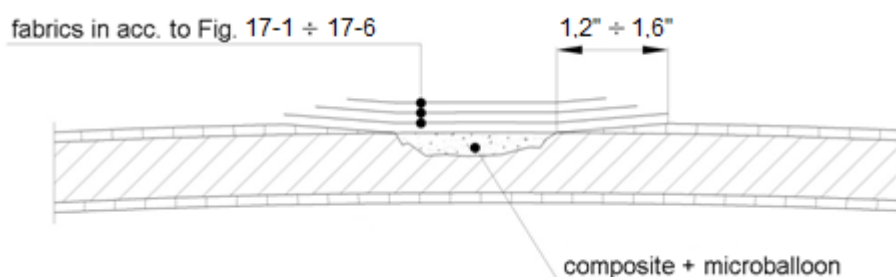


Fig. 17-8. Repair of damaged sandwich outer layer

In case of damage to the outer side of sandwich structure (like at Fig. 17–7.), the repair should be performed as follows:

- remove damaged parts of the structure,
- make chamfer in outer layer acc. to Fig. 17–8.,
- foam loss supplement with composition with microballoon,
- laminate outer layer according to fabrics specification in Fig. 17–1. ÷ Fig 17–6.,
- perform repair of paint coating according to item 17.4.

17.3.1.2. Damage to sandwich outer layer with foam damaged

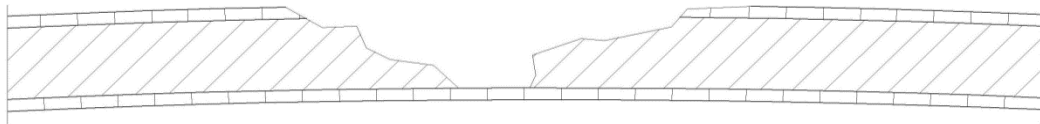


Fig. 17-9. Damage to sandwich outer layer and foam

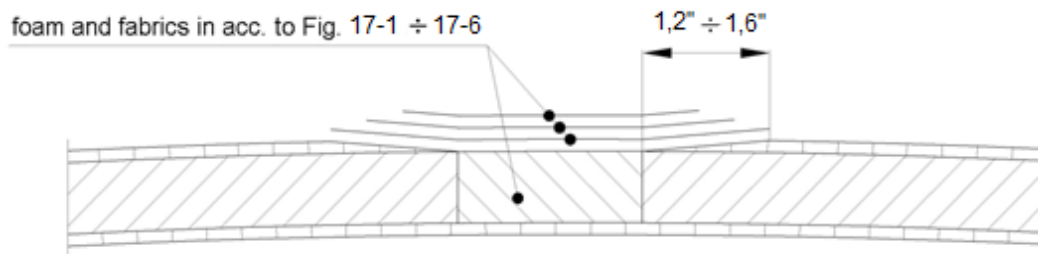


Fig. 17-10. Repair of damaged sandwich outer layer and foam

In case of damage to the outer side of sandwich structure (like at Fig. 17–9.), the repair should be performed as follows:

- remove damaged parts of the structure, check if the inner layer is not damaged,
- make chamfer in outer layer acc. to Fig. 17–10.,
- fit the foam into the hole and paste it on composition with microballoon,
- lute foam with composition with colloidal silica, clean chamfer surfaces,
- laminate outer layer according to fabrics specification in Fig. 17–1. ÷ Fig. 17–6.,
- perform repair of paint coating according to item 17.4.

17.3.1.3. Damage to sandwich structure with puncture through



Fig. 17-11. Through damage

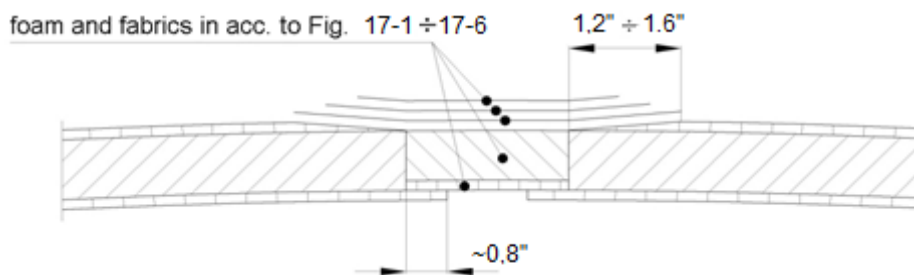


Fig. 17-12. Repair of through damage

In case of damage to the sandwich structure related to puncture it through, the following must be done:

- remove damaged parts of structure, make chamfer acc. to Fig. 17–12.,
- laminate inner layer part on a piece of polyethylene foil, harden, fit into hole in the shell,
- grind surfaces to be joined and paste renovated inner layer part acc. to Fig. 17–12.,
- fit the foam into the hole and paste it on composition with microballoon, lute foam with composition with colloidal silica,
- laminate outer layer according to fabrics specification in Fig. 17–1. ÷ Fig. 17–6.,
- perform repair of paint coating according to item 17.4.

NOTE:

Inner layer is made from very thin fabric. If repairer fail to leave intact inner layer rim during cleaning of the hole in accordance with Fig. 17–2. it is necessary to enlarge the hole and re-prepare the rim.

17.3.2. Solid laminate shell

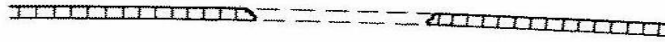


Fig. 17-13. Solid laminate shell damage

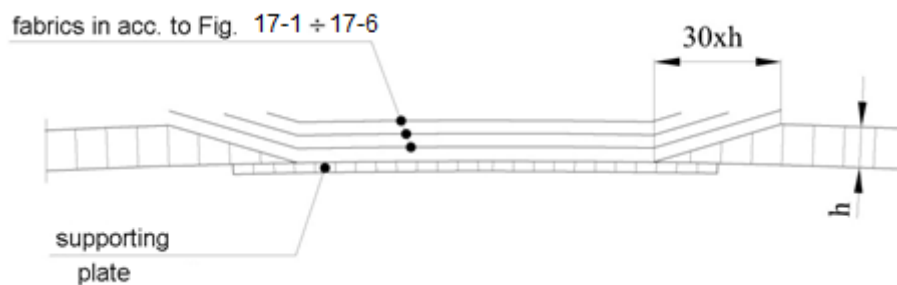


Fig. 17-14. Repair of solid laminate shell

In case of damage to the solid laminate shell (Fig. 17–13.), the repair should be performed as follows:

- smooth the edges and make them regular shape,
- measure thickness of the damaged structure and make a chamfer with a length of 30 times larger than the measured thickness,
- secure the hole by sticking the supporting plate of thin composite or plywood to the shell on its inner side (Fig. 17–14.) and pull it upward with wire or suction cup,
- after plate glue joint hardening, laminate the shell in acc. to Fig. 17–14., keeping fabric layout provided in Fig. 17–1. ÷ Fig. 17–6.

17.3.3. Debonding

After removal of old glue joint in debonding area and its cleaning, the repairing process comprises on re-gluing of the surfaces with laminating composition thickened with filling materials listed in item 17.5.

Until hardening process is completed, glued surfaces need to be immobilized with respect to each other, for instance trailing edges by spring clamps through two slats, leading edges by bands loaded with weights or rubber strips.

17.3.4. Fuselage central section skin repair – zone II**NOTE:**

**In case of holes in the shell of diameter smaller than $\varnothing 3,15''$ and lack of access from the inside it is recommended to wet repair.
In case of holes in the shell of diameter larger than $\varnothing 3,15''$ it is recommended to dry repair.**

17.3.4.1. Wet repair

- make supporting plate 3 × 92125,
- make edge chamfer 30 × h,
- stick composite supporting plate from the inner side,
- laminate fabrics acc. to Fig. 17–1. and Fig. 17–15.

NOTE:

Instead of the last layer 92140 apply two layers of fabric 92110.

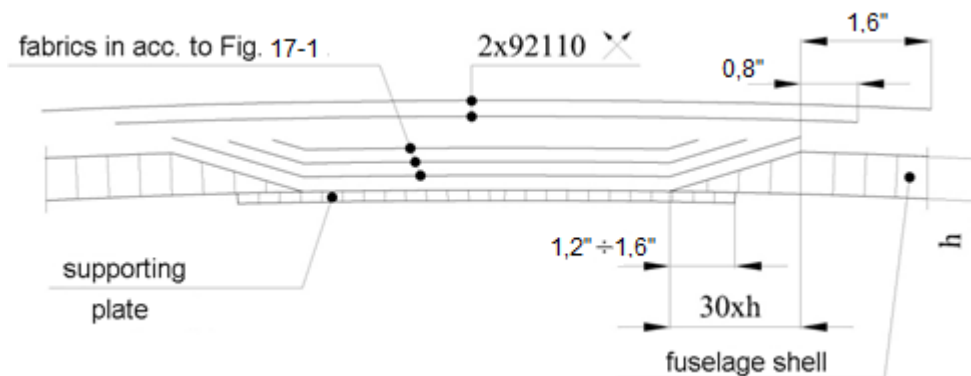


Fig. 17-15. Wet repair

17.3.4.2. Dry repair

- smooth the hole edges and make them regular shape,
- form composite shell piece of similar curvature (next to the damaged area or on another sailplane specimen, laminating fabrics acc. to Fig. 17–1.),
- make a chamfer on the damaged edge at length of 1,6''
- adjust formed composite piece to chamfered edge,
- paste composite piece in fuselage shell and exert a pressure with bands (wrap fuselage),
- laminate 1 × 92110 in gluing areas from inner and outer side.

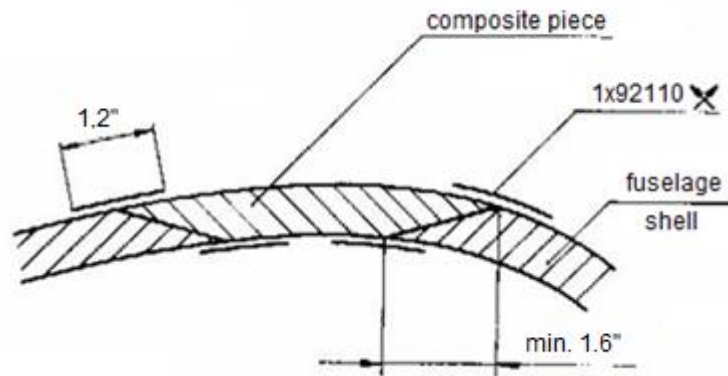


Fig. 17-16. Dry repair

17.3.5. Repair of rear (sandwich) fuselage part – zone III

17.3.5.1. Area excluding detail “A” on Fig. 17-1.

17.3.5.1.1. Damage to sandwich outer shell
(shallow dent, loss)

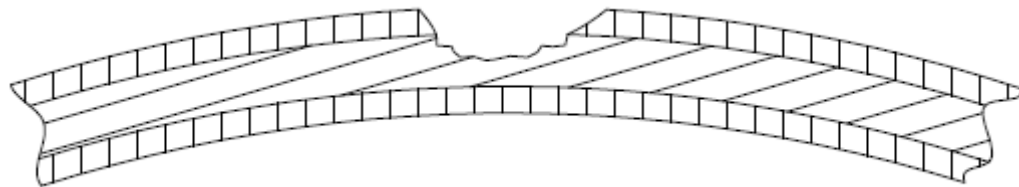


Fig. 17-17. Damage to sandwich outer shell

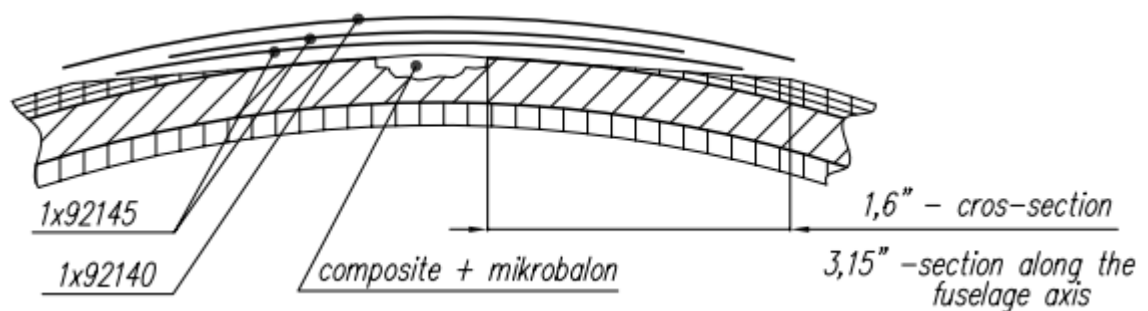


Fig. 17-18. Repair of damage to sandwich outer shell

In case of sandwich outer shell damage (Fig. 17-17.), repair should be performed as follows:

- Remove damaged parts of structure,
- Make chamfer on outer shell acc. to Fig. 17-18.,
- Supplement loss of foam by composition with microballoon,
- Laminate 2 layers of 92145 fabric, keeping direction acc. to Fig. 17-1. Size of first layer should cover the outer contour of chamfer in original 92145 layers. Use peel ply. Leave for hardening.
- Remove peel ply, adjust shape to shell,
- Laminate one layer of 92140, direction acc. to Fig 17-1.,
- Leave for hardening,
- Adjust shape to shell,
- Perform repair of paint coating according to item 17.4.

17.3.5.1.2. Damage to sandwich outer shell and foam

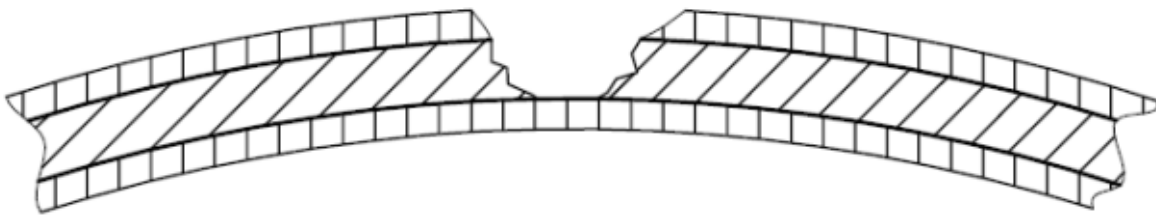


Fig. 17-19. Damage to sandwich outer shell and foam

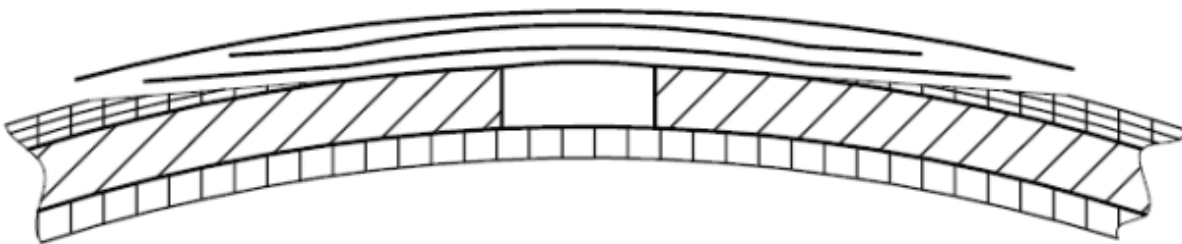


Fig. 17-20. Repair of damage to sandwich outer shell and foam

In case of sandwich outer shell and foam damage (Fig. 17–19.), repair should be performed as follows:

- Remove damaged parts of the structure, check if inner shell is not damaged,
- Make chamfer on outer shell acc. to Fig. 17–18.,
- Fit the new foam into the hole and paste it on composition with microballoon to inner shell and core material. For easier shape adjustment, grooves should be made on inner foam side, groove width, $\sim 0,04$ ", deep $\sim 0,2$ ", spacing $\sim 0,4$ ".
- Further operations acc. to item 17.3.5.1.1.

17.3.5.1.3. Sandwich structure trough damage

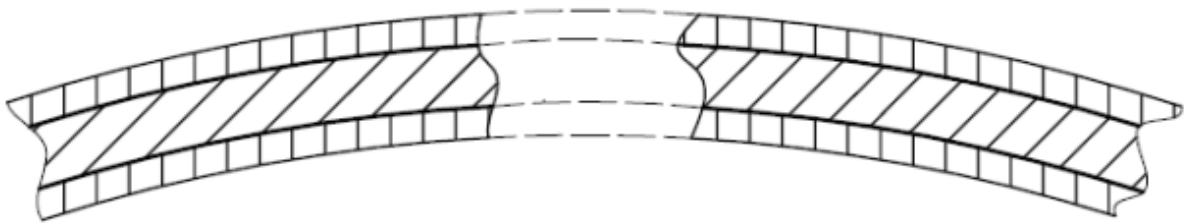


Fig. 17-21. Sandwich structure trough damage

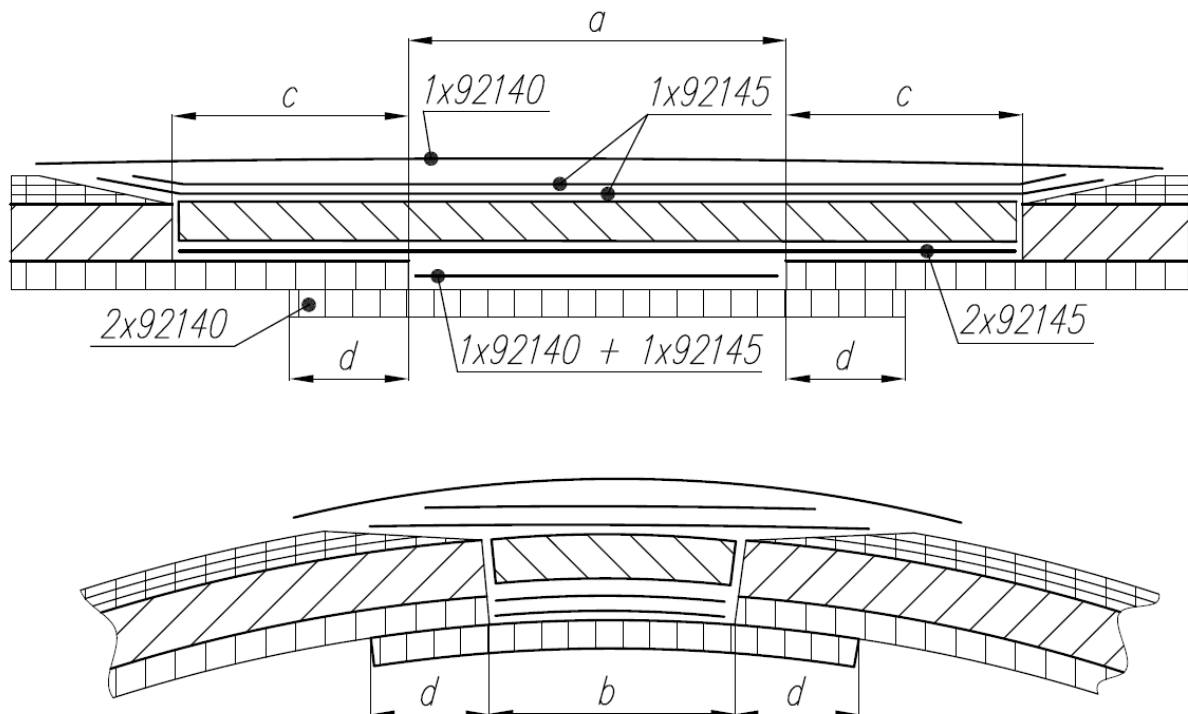


Fig. 17-22. Repair of sandwich structure trough damage

In case of sandwich trough damage (Fig. 17–21.), repair should be performed as follows:

- 2 |
- Remove damaged parts of the structure, increase hole dimensions to $a = 4,8''$, $b = 2,4''$,
 - On undamaged fuselage part, near to place of repair, laminate supporting plate, structure 2x92140, bigger than hole by $d = 1,2''$ in each direction,
 - Stick supporting plate on composition with aerosil. Pull it outwards by wire or suction cup, harden glue joint,
 - Widen outer shell and foam hole in fuselage axis by $c = 3,6''$,
 - Chamfer outer shell acc. to Fig. 17–18.,
 - Fill in the hole in inner shell with 2 fabric layers: 1x92140 and 1x92145,
 - Reconstruct remaining layers of shell by laminating 2x92145,
 - Fit the new foam into the hole and paste it on composition with microballoon like in item 17.3.5.1.2.,
 - Further operations acc. to item 17.3.5.1.1.

17.3.5.2. Area of detail “A” on Fig. 17–1.

17.3.5.2.1. Sandwich outer shell damage (shallow dent, shallow or deep foam damage)

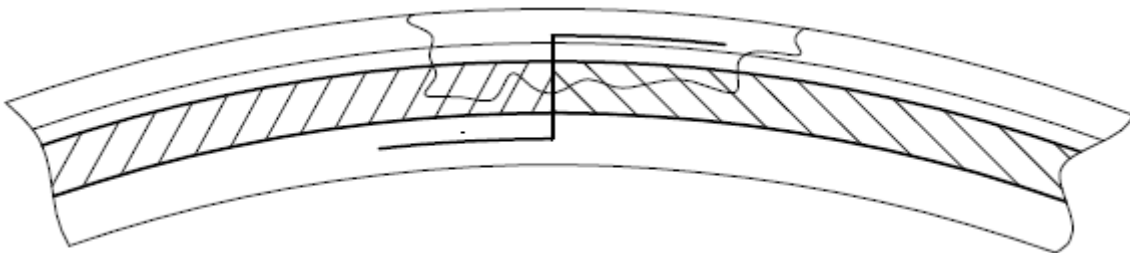


Fig. 17-23. Damage to sandwich outer shell, detail “A”

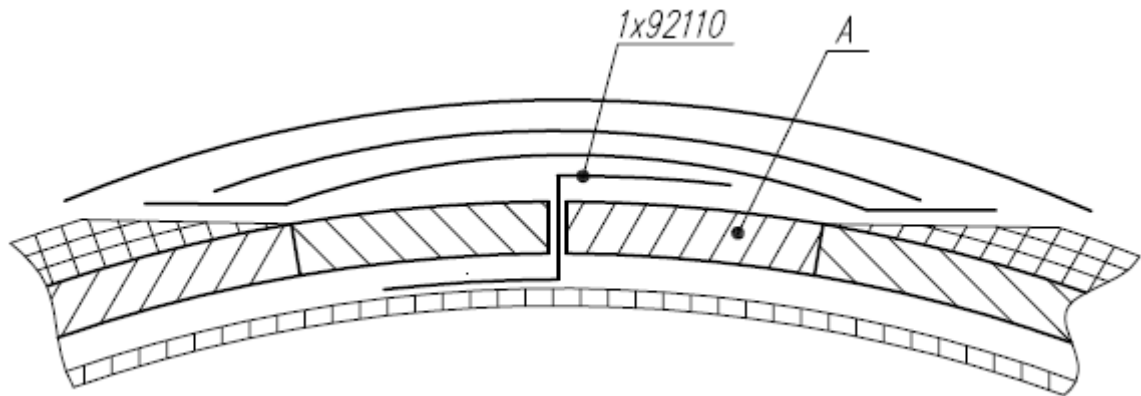


Fig. 17-24. Repair of damage to sandwich outer shell, detail “A”

In case of damage to sandwich outer shell (Fig. 17–23.) repair should be performed as follows:

- Remove damaged parts of the outer shell, make removed shape regular (circle, rectangular, square),
- Remove foam together with connecting layer 1x92110 acc. to hole in outer shell.
- Chamfer outer shell acc. to Fig. 17–18. Fabric 92110 should not be chamfered (cut acc. to hole in outer shell),
- Fit a foam part “A” (to the web of connection layer), paste it on composition with microballoon,
- Laminate connection layer 1x92110 along the hole,
- Fit and paste the second part of foam,
- Further operations acc. to item 17.3.5.1.1.

17.3.5.2.2. Trough damage

Repair should be performed as follows:

- Remove damaged parts of the structure, widen hole acc. to item 17.3.5.1.3,
- Perform further operations acc. to item 17.3.5.1.3 through inner shell rebuilt, (2x92145 fabrics),
- Foam and connection layer rebuild perform acc. to item 17.3.5.2.1,
- Further operations acc. to item 17.3.5.1.1.

17.3.6. Inner structure debonding

In case of inner structure debonding (Fig. 17–25.) the repair should be performed as follows:

- cut out the debonded part of inner structure – if there is an access,
- precisely clean repair zone, remove old glue joint and grind expected laminating areas,
- cover repair areas with composition with colloidal silica,
- laminate reinforcement bracket acc. to Fig. 17–26.

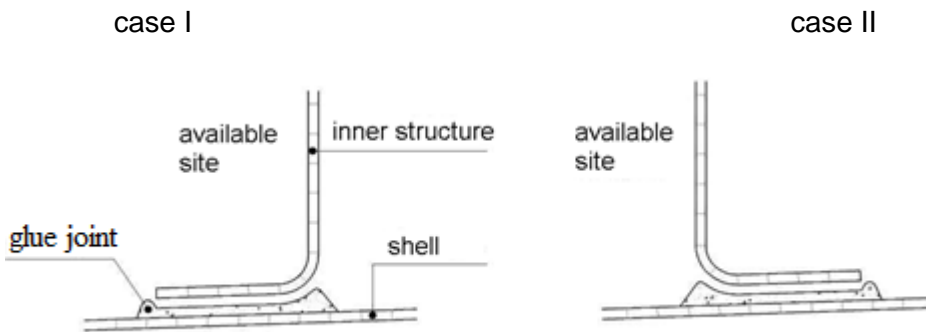


Fig. 17-25. Inner structure debonding

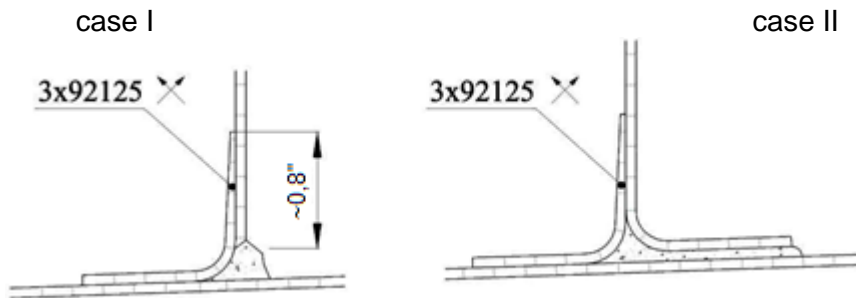


Fig. 17-26. Repair of inner structure debonding

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17.4. Painting

After composite structure repairing, repaired place should be grinded dry with sandpaper „120”, next it should be filled with epoxy resin with addition of talc and titanium white. After filler is hardened, grind it dry with sandpaper “120” and then “220”.

Repaired area deviations should not exceed 0,012”. Wings control can be done with rigid (along the span) or flexible (along the chord) straight edge. Fuselage control can be made by soft straight edge.

After grinding with sandpaper „220” spray two times crosswise polyurethane or acrylic enamel. Sailplane outer surfaces should be painted with white paint, not getting yellow (apart from wing tips and tailplane tips).

After enamel hardening grind it with sandpaper „220”, „320”, „400”, „600”, and then polish it with buffing paste.

Ailerons, rudder and elevator after repair and painting must be balanced in accordance with guidelines specified in Section 9. of this Manual.

NOTE:

Sailplane upper surfaces (both wings, tailplane and fuselage) can be painted only in white (except for plane wingtips and long wingtips area outside aileron span). It is not allowed to place on them any additional markings or patterns in different colours.

It is acceptable to place competition starting markings on vertical stabilizer.

17.5. Materials for typical repairs of composite structures

When performing any repair there should be used materials listed below, providing that they have conformity certificate and not past due. As laminate composition L285 epoxy resin is to be used with hardeners H285, 286 or 287, manufactured by M. G. Scheufler (Germany).

Hardener H285 / H286 / H287 weight ratio is 40 (+0; -2) parts per 100 parts of resin L285.

Both components of the composition are to be thoroughly mixed until the composition become homogeneous. If laminating composition is to be used as a glue in a thicker glue-joint, one of the filling materials is to be added.

Composition lifetime depends on the hardener used and the temperature.

Apart from above mentioned laminating compositions, other may be used in repairs providing that they have proper permits issued by authority. It is forbidden to use more than one composition in one repair.

Fabrics types and number of layers used for various parts of sailplane repair are presented in Figures 17–1. to 17–6. inclusive and in the following table.

	Interglas Catalogue No.	Fabric weave	Basis weight [g/m ²]	1 laminate layer thickness (manually formed) [in] (mm)
glass	90070	plain	80	0,0039 (0,10)
	91110	cross 1/3	110	0,0067 (0,17)
	92110	cross 2/2	160	0,0079 (0,20)
	92125	cross 2/2	280	0,0138 (0,35)
	92140	cross 2/2	395	0,0197 (0,50)
	92145	plain asymmetric 6 × 7	215	0,0110 (0,28)
carbon	98110	plain	93	0,0039 (0,10)
	98130	plain	163	0,0098 (0,25)
	KDU-1001	unidirectional	300	0,0157 (0,40)

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If unit performing the repair in agreement with state authority wishes to use other fibreglass fabric, approved for aviation production, must follow the rule that quantity of fabrics used needs to be at least equal to total „basis weight” of fabrics given in Fig. 17–1. to 17–6. In parts made of roving use E-glass roving 2280 tex.

When repairing sandwich shell, foam loss is to be filled with PCV foam, that is in common use in aviation industry, with density of 3,7 lb/ft³ or 2,5 lb/ft³, in accordance to notes given in the figures.

Instead of foam recommended by manual, other sandwich core materials used in composite sailplanes may be implemented, especially if damage is minor.

If laminating composition needs to be thickened for gluing or luting there must be used following filling materials:

- brown microballoon,
- fibres cut to length 0,12” ÷ 0,24”, made of above mentioned roving,
- colloidal silica (aerosil).

In filling materials selecting follow the rule:

- foam and trailing edges gluing with the addition of microballoon,
- joints, fittings, etc. gluing with addition of cut fibreglass and colloidal silica (aerosil).

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17.6. Non-composite parts repair

17.6.1. Metal parts repair

All damaged metal parts repairs are possible only with approval of authority and after obtaining Type Certification Holder opinion.

Possible welding works could be made only by aviation welders at inert gas shield. Before starting repairs, information about heat treatment of repaired element should be absolutely obtained.

Damages to protective galvanic (anodizing, zinc plating) or paint coverings, providing that damage has not caused a corrosion weakening material strength, can be repaired by grinding to bare metal, degreasing, covering with protective prime coat and outer enamel. There can be applied paint products used in aviation or for repairing automotive paint damages, following the instructions specified by paint products manufacturer.

17.6.2. Rudder control system cables replacement

In rudder control system (ref. Fig. 2–11.) following cables are used:

- 1 - Cable (item 16) – $\varnothing 2,5$ mm (0,098”), 7 x 7 acc. to PN-M-80235:1991, terminated at both ends with a thimble C 3 (material PA6N) acc. to BN-78/3813-45.
- 2 - Cables (items 17, 18, 19) – $\varnothing 3,2$ mm (0.0126”), 7 x 19 acc. to PN-M-80235:1991, terminated at both ends with a thimble C 3,5 (material PA6N) acc. to BN-78/3813-45.

Nominal cable tensile breaking force:

- | | |
|----------------------------------|----------|
| - for cable $\varnothing 2,5$ mm | 1124 lbf |
| - for cable $\varnothing 3,2$ mm | 1686 lbf |

2 | In case of cable replacement, it should be first tensed with force being equal to 0,5 to 0,6 of nominal tensile breaking force in time of minimum 3 minutes. Thimbles are to be fixed to cable by plaiting or clamping. When thimbles are to be clamped, only tools with authority permit may be used in the process. Sequence of actions – threading and clamping – comes from rudder control system design (ref. Fig. 2–11.).

In case of using bushing in accordance with ZN-73/L-383320 clamping should be done on whole length of bushing, diameter w/o fin should be: for 2,5 mm cable – $0,22+0,01$ ”, and for 3,2 mm cable – $0,27+0,01$ ”.

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corrected

Alternatively, copper, galvanized NICOPRES bushes can be used: 28-2-G for 2,5 mm cables and 28-3-M for 3,2 mm cables. Clamp tool and process should be consistent with Advisory Circular 43.13-1B (FAA, September 8th, 1998).

17.6.3. Reaming of main bolt sleeves and rear fittings

During renovation reaming at connecting spars main bolt sleeves and connecting wing to fuselage rear fittings, general rule is obligatory to keep the same type of fit as before. New bolt and locking pins should be ordered from the manufacturer, giving reaming step. Each of the steps of reaming and their respective dimensions are provided in the table below.

From time to time reamer should be removed from hole to clean of swarfs between cutting edges and to inspect condition of reamed surface.

During reaming lubrications should be done with machine oil.

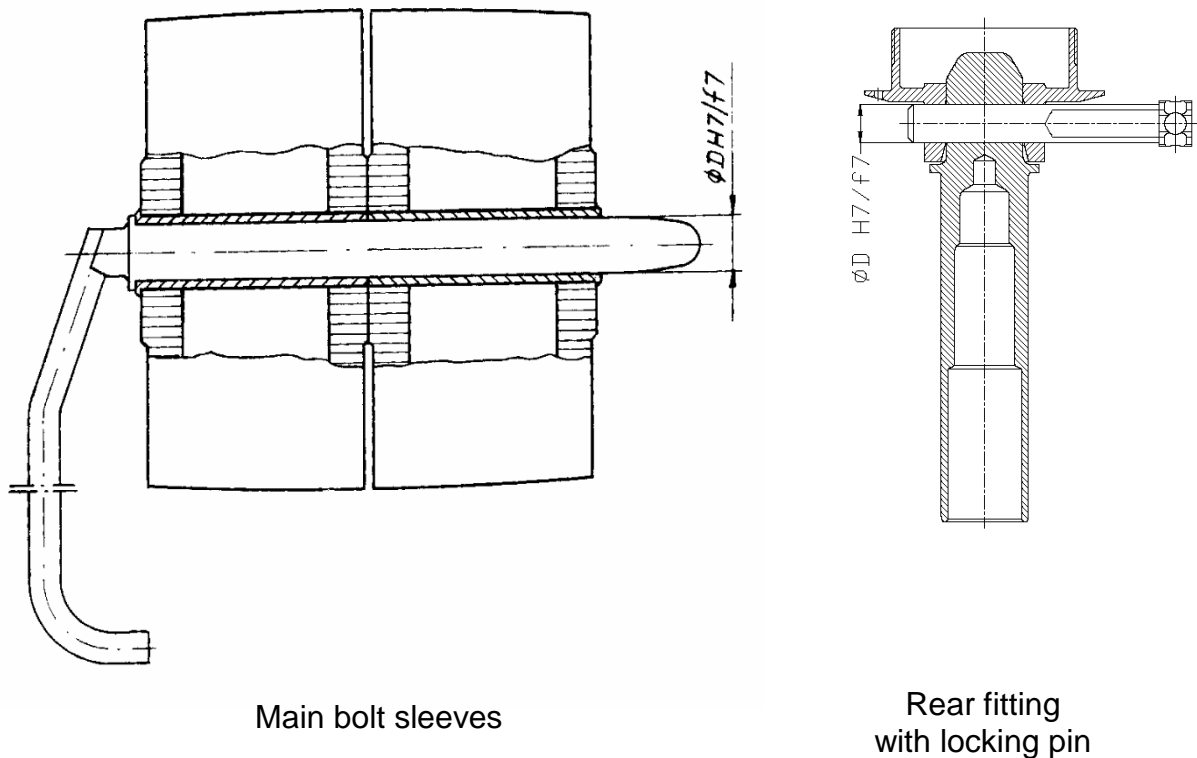


Fig. 17-27. Reaming of connecting spars main bolt sleeves and rear fittings

		Main bolt	Locking pin
Nominal dimension	D	22 (0,866”) H7	14 (0,551”) H7
1st reaming step	D ₁	22,25 (0,876”) H7	14,1 (0,555”) H7
2nd reaming step	D ₂	22,5 (0,886”) H7	14,2 (0,559”) H7
3rd reaming step	D ₃	22,75 (0,896”) H7	14,3 (0,563”) H7

17.6.4. Canopy perspex

Sailplanes canopy is made of organic glass, methyl polymethacrylate. In case of inner minor microcracks appearance (caused by ageing of material exposed to sunlight), the only recommendation is to replace whole canopy or perspex. The same recommendation applies when there are holes in canopy or more than 6” long cracks.

To avoid further cracking of short cracks:

- drill small hole at the end of the crack not longer than 2”,
- glue together the crack not longer than 6”.

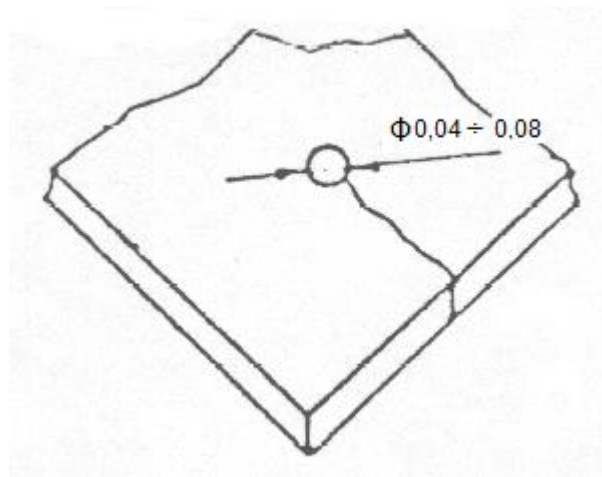


Fig. 17-28. Way to avoid further cracking of perspex

Cracks or complementing parts are to be glued with the use of dedicated organic glass glue in accordance to glue manufacturer guidelines.

17.6.5. Parts replacement

Design and method of sailplane construction allow the user to replace following worn out or damaged parts:

1. Main bolt connecting spars (item 10, Fig. 2–1.) with dimensions:
 - a) nominal d = 22 (0,866”) f7
 - b) after 1st sleeves reaming (I) d = 22,25 (0,876”) f7
 - c) after 2nd sleeves reaming (II) d = 22,5 (0,886”) f7
 - d) after 3rd sleeves reaming (III) d = 22,75 (0,896”) f7

2. Locking pin (item 18, Fig. 2–1.) with dimensions:
 - a) nominal d = 14 (0,551”) f7
 - b) after 1st reaming (I) d = 14,1 (0,555”) f7
 - c) after 2nd reaming (II) d = 14,2 (0,559”) f7
 - d) after 3rd reaming (III) d = 14,3 (0,563”) f7

3. Main, nose and tail undercarriage parts
4. Airbrake covers
5. Airbrake plates
6. TOST tow releases
7. Removable cockpit equipment:
 - a) front and rear instrument panel
 - b) instrument panel casing
 - c) front pedal, part or set
 - d) rear left and right foot pedal
 - e) Rear pedals brackets
 - f) assembly of rear pilot seat pan
 - g) front and rear pilot safety harnesses

8. Canopy:
 - a) perspex without frame
 - b) perspex with frame

9. Control surfaces:
 - a) rudder
 - b) elevator
 - c) ailerons

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10. Horizontal stabilizer
11. Wings:
 - a) complete wings
 - b) replaceable wingtips:
 - flat wingtip
 - winglet
 - long wingtip
12. Complete fuselage
13. Control system parts
14. Wing root ribs sockets sleeves, mounting socket of horizontal stabilizer and fuselage sockets of wings front pins
15. Aileron hinges bushings and elevator pins
16. Stabilizer fastening vertical bolt and mating fuselage fitting
17. Front and rear pilot headrest elements

2

Additionally it is possible to replace wing, empennage and fuselage complete shells or their parts. This replace could be done only with original tooling by sailplane manufacturer or with tooling approved by Type Certificate Holder.

TOST tow release (item 6) should be ordered in Richard Tost Fluggeratebau company, 8000 Munchen – Germany, rest of the parts – in glider manufacturer.

Gabringer – Gurte safety belts:

- lap belts 540202
- shoulder belts 270002
- crotch belts 130302

If the purchaser has no certainty that he would perform the replacement right, every part listed in item 17.6.5. should be ordered with replacement manual.

Parts 11a and 12 can be replaced only by certified organization due to required fit and backlash between fuselage and wing and proper regulation of fuselage-wing controls connections.

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17.7. Primary and secondary structure

17.7.1. Primary structure

These are elements involved in the transmission of loads and connecting the other elements of sailplane. Breaking the continuity of the structure may cause direct loss of durability and strength of whole sailplane.

Such structure includes composite assemblies and metal parts and assemblies listed below.

17.7.1.1. Composite assemblies:

1. Upper and lower wings shell, left and right (25) Fig. 2–1.
2. Wings spars (27) Fig. 2–1.
3. Root ribs (24) Fig. 2–1.
4. Aileron (4) Fig. 2–13.
5. Wingtip aileron (9) Fig 2–3.
6. Front main former (27) Fig. 2–8.
7. Rear lower former (28) Fig. 2–8.
8. Horizontal stabilizer mounting web (6) Fig. 2–6.
9. Rear web (13) Fig. 2–6.
10. Fuselage shell left and right (26) Fig. 2–1.
11. Horizontal stabilizer (11) Fig. 2–6.
12. Elevator (12) Fig. 2–6.
13. Rudder (13) Fig. 2–11.
14. CG tow release box (16) Fig. 2–21.
15. Front tow release box (15) Fig. 2–21.

17.7.1.2. Metal parts and assemblies:

1. Main bolt (10) Fig. 2–1.
2. Spar fitting (22) Fig. 2–1.
3. Spar root pin (1) Fig. 2–1.
4. Wing front pin (3) Fig. 2–1.
5. Rear fitting (14) Fig. 2–1.
6. Socket nut (23) Fig. 2–1.
7. Locking pin (18) Fig. 2–1.
8. Fuselage rear pin (16) Fig. 2–1.
9. Frame tube (15) Fig. 2–1.
10. Stabilizer fastening vertical bolt (1) Fig. 2–6.
11. Aileron clutch (6) Fig. 2–5.

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17.7.2. Secondary structure

These are other elements in composite structure which damage will not affect durability and strength of sailplane structure.

Such structure includes elements like: casings, windows, inspection openings etc.

1. Inspection openings at wing lower surface,
2. inspection openings at vertical stabilizer,
3. Canopy sliding windows.

17.8. Assemblies interchangeability

Manufacturer provides production interchangeability of following assemblies:

- wings,
- fuselage,
- ailerons,
- horizontal stabilizer,
- elevator,
- rudder,
- 2 | • canopy,
- main undercarriage and nose and tail wheel,
- control systems assemblies and parts,
- instrument panels,
- 2 | • flat wingtips or winglets and long wingtips.

NOTE:

Production interchangeability means possibility to correct mounting mating assemblies made at separate workplaces.

In specific cases this might require mutual reaming of connecting fittings and matching contours.

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SECTION 18.

ANNEXES

18.1. Equipment list

The list includes sailplane equipment at day of signing. Mass data from the list are also used after changing equipment to determine the mass (m_{bp}) and CG position (X_{bp}) of sailplane without pilots with calculation method.

At the time of removal of the equipment enter the date in column “Dismantled”. Make new updated list at each equipment change (installing or removing).

Intentionally left blank

EQUIPMENT LIST

Serial No.:

Registration No.:

No.	Description	Type	Serial No.	Mass [lb]	Dismantled date
	Front instrument panel				
1	Airspeed indicator				
2	Altimeter				
3	Accelerometer				
4	Stall warning unit	SP3			
5	Compass				
6	Inverted flight bank indicator				
7	Total energy variometer of range ± 10 kn				
8	Total energy compensator				
9	Compensating vessel				
10	Electric turn and bank indicator				
11	Transceiver				
12	Transponder				
13	Variometer ± 60 kn				
14					
15					
16					
17					
18					
19					
20					
21					
	Rear instrument panel				
1	Airspeed indicator				
2	Altimeter				
3	Accelerometer				
4	Compass				
5	Inverted flight bank indicator				
6	Total energy variometer of range ± 10 kn				
7	Total energy compensator				
8	Compensating vessel				
9	Electric turn and bank indicator				
10	Transceiver				

No.	Description	Type	Serial No.	Mass [lb]	Dismantled date
	Rear instrument panel (continuing)				
11	Transponder				
12	Variometer ± 60 kn				
13					
14					
15					
16					
17					
18					
19					
	Luggage compartment				
1	Battery				
2					
3					
4					
5					
6					
	Other equipment				
1	I pilot safety harness				
2	II pilot safety harness				
3	Front tow release				
4	CG tow release				
5	Battery in vertical stabilizer				
6					
7					
8					
9					
10					
11					

Prepared by: Date: Signature

NOTE

Complete and sign new list after each equipment change. List should be copied to both sides of single sheet of paper, completed and stored at the end of Technical Service Manual with corresponding “Record of sailplane weighing and determining of CG” or (if done) “Calculation record of sailplane without pilots CG”.

18.2. Record of sailplane weighing and determining of CG

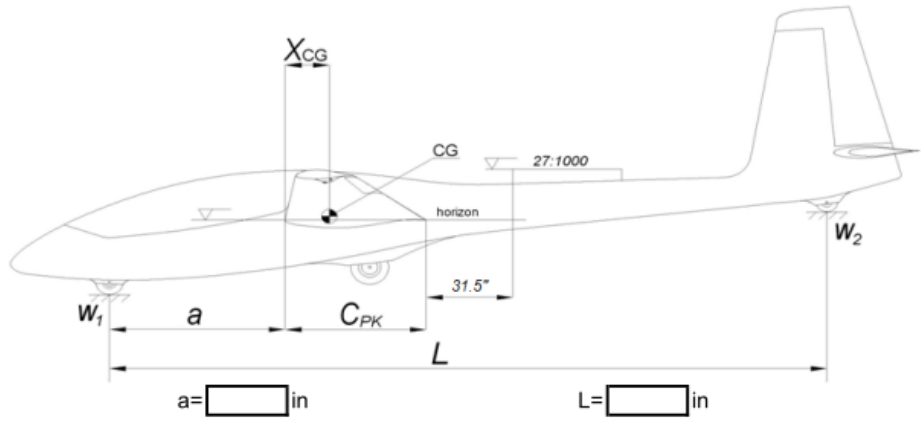
RECORD
of sailplane weighing and determining of centre of gravity
"empty"/ " without pilot"*, span: 57.42/65.62* ft

Model: Serial no.:
 Equipment list date: **

A. Assemblies weighing

(1) Left wing lb (2) Right wing lb
 (3) Horizontal tailplane lb (4) Rudder lb
 (5) Fuselage with equipment lb

B. Sailplane weighing and determining of centre of gravity



Scales indication
 $w_1 =$ $\text{ lb} \qquad \qquad \qquad w_2 =$ lb

Sailplane mass: $m = w_1 + w_2 =$ lb
Including fixed ballast: front lb
 rear lb

2 | Extreme permissible position of the centre of gravity fromin,*** toin.***
 (see graph 7.2 in TSM)

Position of the centre of gravity:

$$b = \frac{w_2 \times L}{w_1 + w_2} =$$

$$X_{CG} = b - a =$$
 in

prepared by Date & signature	checked by Date & signature
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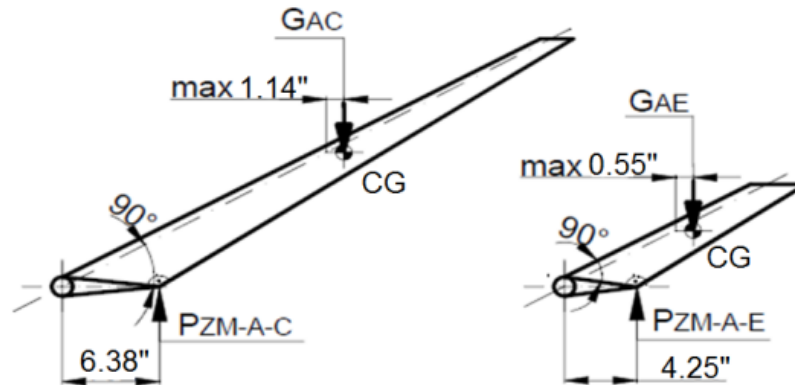
* - delete as applicable
 ** - for "empty" sailplane please write: "as p.8.1 TSM" and "additional, required by national rules"
 *** - for "empty" sailplane please write "*"

corrected

18.3. Elevator, rudder and ailerons balance records

AILERON BALANCE RECORD 65.62 [ft]

Model: Serial no.:



Aileron mass:

m_{AL-C} = Left lb
 m_{AL-E} = Left lb

m_{AP-C} = Right lb
 m_{AP-E} = Right lb

Measured value of balance force:

$P_{ZM-AL-C}$ = Left lbf \leq
 $P_{ZM-AL-E}$ = Left lbf \leq
 $P_{ZM-AP-C}$ = Right lbf \leq
 $P_{ZM-AP-E}$ = Right lbf \leq

Calculated value of balance force:

$P_{R-A-C} = 0,1790 \times m_{A-C}$
 $P_{R-A-E} = 0,1296 \times m_{A-E}$
 P_{R-AL-C} = Left lbf
 P_{R-AL-E} = Left lbf
 P_{R-AP-C} = Right lbf
 P_{R-AP-E} = Right lbf

Condition for the proper ailerons balance:

$$P_{ZM-A} \leq P_{R-A}$$

prepared by

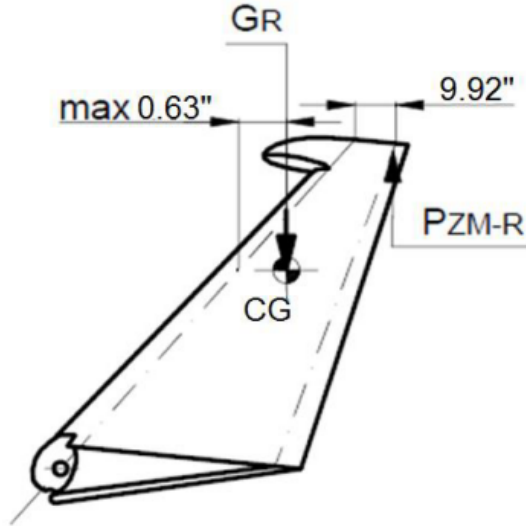
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checked by

Date & signature

RUDDER BALANCE RECORD

Model:
Serial no.:



Rudder mass:

$m_E =$ lb

Measured value of balance force:

$P_{ZM-R} =$ lbf

Calculated value of balance force:

$$P_{R-R} = 0,0635 \times m_R$$

$P_{R-R} =$ lbf

≤

Condition for the proper rudder balance:

$$P_{ZM-R} \leq P_{R-R}$$

prepared by

Date & signature

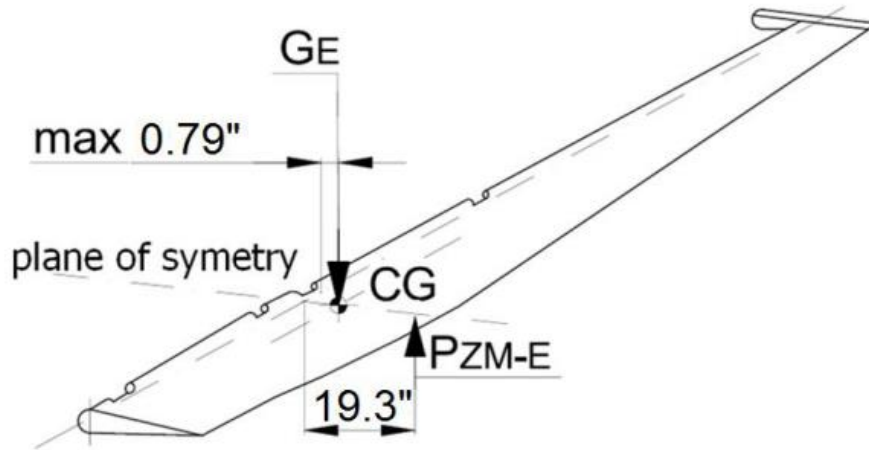
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ELEVATOR BALANCE RECORD

Model:

Serial no.:



Elevator mass:

$$m_E = \text{ } \text{ lb}$$

Measured value of balance force:

$$P_{ZM-E} = \text{ } \text{ lbf}$$

Calculated value of balance force:

$$P_{R-E} = 0,0858 \times m_E$$

$$P_{R-E} = \text{ } \text{ lbf}$$

Condition for the proper elevator balance:

$$P_{ZM-E} \leq P_{R-E}$$

prepared by Date & signature

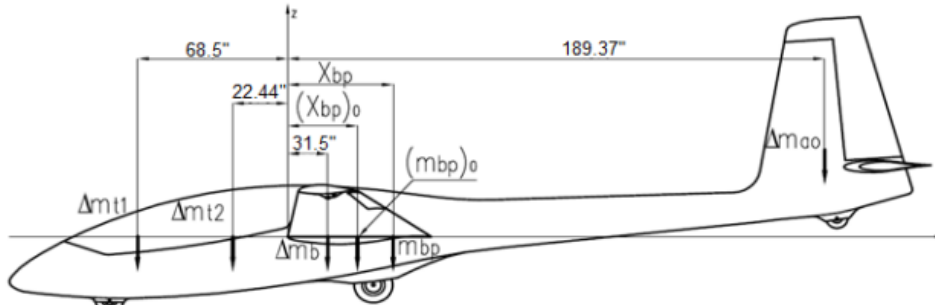
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18.4. Calculation record of sailplane without pilots CG

CALCULATION RECORD
of sailplane without pilots CG

Model: Serial no.:

Equipment list date:
 Previous equipment list date: , corresponding
 Protocol of weighing / calculating $m_{bp}(x_{bp})$ date:



$(m_{bp})_0 =$ lb $X_{bp0} =$ in
 $\Delta m_{t1} =$ lb $\Delta m_b =$ lb
 $\Delta m_{t2} =$ lb $\Delta m_{ao} =$ lb

$$(m_{bp})_1 = (m_{bp})_0 + \Delta m_{t1} + \Delta m_{t2} + \Delta m_b + \Delta m_{ao}$$

$$(X_{bp})_1 = \frac{((m_{bp})_0 \times (X_{bp})_0) - (\Delta m_{t1} \times 68.5) - (\Delta m_{t2} \times 22.44) + (\Delta m_b \times 31.5) + (\Delta m_{ao} \times 189.37)}{(m_{bp})_1}$$

$(m_{bp})_1 =$ lb $(X_{bp})_1 =$ in

Fixed ballast:

$(X_{bp})_k =$ in

m_{bn} front ballast mass is determined by the formula:

$$m_{bn} =$$
 lb

m_{bt} rear ballast mass is determined by the formula:

$$m_{bt} =$$
 lb

$$m_{bn} = \frac{(m_{bp})_1 \cdot ((X_{bp})_1 - (X_{bp})_k)}{(X_{bp})_k + 66.22'}$$

$$m_{bt} = \frac{(m_{bp})_1 \cdot ((X_{bp})_k - (X_{bp})_1)}{199.21' - (X_{bp})_k}$$

The final values :

$$m_{bp} = (m_{bp})_1 + m_{bn} \quad \text{or} \quad m_{bp} = (m_{bp})_1 + m_{bt}$$

$m_{bp} =$ lb

$$X_{bp} = \left\{ \begin{array}{l} (X_{bp})_1 - \text{without ballast} \\ (X_{bp})_k - \text{with ballast} \end{array} \right\}$$

$X_{bp} =$ in

prepared by
Date & signature

checked by
Date & signature

CALCULATION RECORD
of sailplane without pilots CG
(reverse)

List of changes in equipment

Record in the list only removed equipment - mass with sign (-) in column (- Δm_i) and newly mounted with sign (+) in column (+ Δm_i). Resulting mass increment values (Δm_{t1} , Δm_{t2} , Δm_b , Δm_{ao}) with corresponding sign (+) or (-) use for calculations on first page of record.

No.	Description	Type	Mass [lb]	
			Dismounted	Mounted
	Front instrument panel		- Δm_{t1i}	+ Δm_{t1i}
1				
2				
3				
4				
5				
	Mass sum in column			
	Front instrument panel mass increment $\Delta m_{t1} = \Sigma(-\Delta m_{t1i}) + \Sigma(+\Delta m_{t1i})$			
	Rear instrument panel		- Δm_{t2i}	+ Δm_{t2i}
1				
2				
3				
4				
5				
	Mass sum in column			
	Rear instrument panel mass increment $\Delta m_{t2} = \Sigma(-\Delta m_{t2i}) + \Sigma(+\Delta m_{t2i})$			
	Luggage compartment		- Δm_{bi}	+ Δm_{bi}
1				
2				
3				
4				
5				
	Mass sum in column			
	Luggage compartment mass increment $\Delta m_b = \Sigma(-\Delta m_{bi}) + \Sigma(+\Delta m_{bi})$			
	Other equipment		- Δm_{ao}	+ Δm_{ao}
1	Battery in vertical stabilizer			

Prepared by: _____ Date: _____ Signature _____

18.5. Record of control surfaces movements

Record of control surface movements

Type: SZD-54-2
Serial No.: 542.A.

CONTROL SURFACE	DIRECTION OF MOVEMENTS	SPECIFIED	MEASURED
LEFT AILERON	UP	30°±2°	
	DOWN	17°±1°	
RIGHT AILERON	UP	30°±2°	
	DOWN	17°±1°	
LEFT AIRBRAKE	UP	9,06 ^{mm} ±0,2°	
RIGHT AIRBRAKE	UP	9,06 ^{mm} ±0,2°	
ELEVATOR	UP	35°±2°	
	DOWN	35°±2°	
RUDDER	LEFT	10,6 ^{mm} ±0,67°	
	RIGHT	10,6 ^{mm} ±0,67°	

Carried out:

Checked by:

Date:

Date:

18.6. Glider alignment record

Glider alignment record

DIMENSION	SPECIFIED [in]	MEASURED [in]
A	---	
B	---	
A-B	<1,18	
C	---	
D	---	
C-D	<0,4	
E	5,12+0,79	
FL	8,19+0,12	
FP	8,19+0,12	
GL	3,72+0,12	
GP	3,72+0,12	
HL	6,3+0,08	
HP	6,3+0,08	
JL	4,33+0,08	
JP	4,33+0,08	
K	16,8+0,08	
L	15,16+0,08	
ML	16,26±0,4	
MP	16,26±0,4	
N	0±0,4	
P	6,46±0,08	

Index L – left side
Index P – right side

Carried out:

Checked by:

Date:

Date:

18.7. Measurement record for glider control systems friction and activation forces

Measurement record for glider control systems friction and activation forces

Type: SZD-54-2 „Perkoz”.

Serial No.: 542.A.....

No.	Driving type	Required [lbf]	Measured [lbf]	
			Front seat	Rear seat
1.	AILERON	0,9 + 2,25		
2.	ELEVATOR	1,35 + 4,05		
3.	TRIMMING CONTROL SYSTEM	max. 14,6		
4.	RUDDER	11,2 + 13,5		
5.	AIRBRAKE - OPENING	19,1 + 31,5		
6.	AIRBRAKE - CLOSING	max. 45,0		
7.	TOW RELEASES	22,5 + 29,2		
8.	CANOPY LOCK - OPENING	22,5 + 33,7		
9.	CANOPY LOCK - CLOSING	22,5 + 33,7		
10.	CANOPY JETTISON	13,5 + 33,7		
11.	RUDDER DRIVING SYSTEM CABLE TENSILE	40,5 + 49,5		

Carried out:

Checked by:

Date:

Date:

2

SECTION 19. SUPPLEMENTS

19.1. Introduction

Section 19. contains supplements necessary for the safe and effective use of the sailplane with mounted equipment and systems not supplied as standard.

19.2. List of inserted supplements

Date of issue	Supplement No.	Supplement title	Confirmation of the application on S/N

19.3. Supplements – List of actual pages

Supplement No.	Page	Date of issue	Supplement No.	Page	Date of issue