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31 October 2014

MAINTENANCE MANUAL

FOR THE

LAK-17B FES sailplane

with Front Electric Sustainer system

Type (Muster): LAK-17

Model (Baureihe): LAK-17 FES

Serial Number: _____

Registration: _____

Date of Issue: _____

It is preliminary manual. The sailplane is not certified and has not shown compliance with airworthiness requirements

This sailplane is to be operated in compliance with the information and limitations contained herein.

List of Effective Pages

Section	Page	Date of issue	Section	Page	Date of issue
1	1/1	27 May 2014	**2 (Illustrations)**	2.3.9_02	27 May 2014
	1/2	27 May 2014		2.4.1_01	27 May 2014
	1/3	23 Jun. 2015		2.4.2_01	20 Dec. 2017
	1/4	27 May 2014		2.4.4_01	20 Dec. 2017
				2.4.4_02	27 May 2014
2	2/1	20 Dec. 2017		2.4.4_03	27 May 2014
	2/2	27 May 2014		2.4.4_04	27 May 2014
	2/3	27 May 2014		2.4.5_01	27 May 2014
	2/4	27 May 2014		2.4.6_01	27 May 2014
	2/5	27 May 2014		2.4.6_02	27 May 2014
	2/6	10 Dec. 2014		2.4.6_03	27 May 2014
	2/7	10 Dec. 2014		2.5.1_01	27 May 2014
	2/8	20 Dec. 2017		2.5.2_01	27 May 2014
	2/9	20 Dec. 2017		2.5.3_01	27 May 2014
	2/10	20 Dec. 2017		2.5.3_02	20 Dec. 2017
	2/11	10 Dec. 2014		2.5.3_02[a]	20 Dec. 2017
	2/12	27 May 2014		2.5.3_03	20 Dec. 2017
	2/13	20 Dec. 2017		2.5.3_04	20 Dec. 2017
	2/14	20 Dec. 2017		2.5.3_05	20 Dec. 2017
	2/15	20 Dec. 2017		2.5.4_01	27 May 2014
	2/16	20 Dec. 2017		2.5.5_01	27 May 2014
	2/17	20 Dec. 2017		2.6_01	20 Dec. 2017
2 (Illustrations)	2.2.1_01	27 May 2014		2.6_02	27 May 2014
	2.2.1_02	27 May 2014		2.6_03	20 Dec. 2017
	2.2.1_03	27 May 2014		2.6_04	20 Dec. 2017
	2.2.2_01	27 May 2014		2.6_05	20 Dec. 2017
	2.2.2_02	27 May 2014		2.6_06	20 Dec. 2017
	2.2.3_01	27 May 2014		2.6_07	20 Dec. 2017
	2.2.4_01	27 May 2014		2.7.1_01	27 May 2014
	2.2.5_01	27 May 2014		2.7.1_02	27 May 2014
	2.2.5_02	27 May 2014	**3**	3/1	20 Dec. 2017
	2.3.1_01	27 May 2014		3/2	27 May 2014
	2.3.1_02	27 May 2014		3/3	10 Dec. 2014
	2.3.1_03	27 May 2014		3/4	27 May 2014
	2.3.2_01	27 May 2014		3/5	27 May 2014
	2.3.3_01	27 May 2014		3/6	27 May 2014
	2.3.4_01	27 May 2014		3/7	27 May 2014
	2.3.4_02	27 May 2014		3/8	27 May 2014
	2.3.4_03	27 May 2014		3/9	27 May 2014
	2.3.5_01	27 May 2014		3/10	20 Dec. 2017
	2.3.5_02	27 May 2014		3/11	20 Dec. 2017
	2.3.6_01	27 May 2014		3/12	20 Dec. 2017
	2.3.6_02	27 May 2014	**3 (Illustrations)**	3.1.1_01	27 May 2014
	2.3.6_03	27 May 2014		3.1.6._01	27 May 2014
	2.3.6_04	27 May 2014		3.1.6._02	27 May 2014
	2.3.7_01	27 May 2014		3.1.6._03	27 May 2014
	2.3.7_02	27 May 2014		3.1.6._04	27 May 2014
	2.3.9_01	27 May 2014		3.1.6._05	27 May 2014

Section	Page	Date of issue	Section	Page	Date of issue
3 (Illustrations)	3.1.6._06	27 May 2014	**8**	8/1	27 May 2014
	3.1.6._07	27 May 2014		8/2	27 May 2014
	3.2._01	27 May 2014		8/3	27 May 2014
	3.3.1._01	27 May 2014		8/4	27 May 2014
	3.4.1._01	27 May 2014	**8(Illustrations)**	8.2_01	27 May 2014
	3.4.1._02	27 May 2014		8.2._02	27 May 2014
	3.4.2._01	27 May 2014		8.2_03	27 May 2014
	3.4.3._01	27 May 2014		8.3.3_01	27 May 2014
	3.4.3_02	27 May 2014			
	3.4.4._01	27 May 2014			
	3.4.7_01	27 May 2014			
	3.4.8_01	27 May 2014			
	3.4.9_01	27 May 2014			
	3.4.10_01	27 May 2014			
	3.4.11_01	27 May 2014			
4	4/1	19 Jan. 2015			
	4/2	27 May 2014			
5	5/1	19 Jan. 2015			
	5/2	27 May 2014			
	5/3	19 Jan. 2015			
	5/4	20 Dec. 2017			
	5/5	20 Dec. 2017			
	5/6	8 Nov. 2018			
	5/7	27 May 2014			
	5/8	27 May 2014			
	5/9	27 May 2014			
	5/10	27 May 2014			
6	Appr.6/1	19 Jan. 2015			
7	7/1	27 May 2014			
	7/2	27 May 2014			
	7/3	27 May 2014			
	7/4	27 May 2014			
	7/5	10 Dec. 2014			
7(Illustrations)	7.2_01	20 Dec. 2017			
	7.2_02	20 Dec. 2017			

Record of revisions

Any revision of the present Manual, except actual weighting data, must be recorded in the following table and in case of approved Sections endorsed by responsible airworthiness authority.

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

Rev. No	Affected Section	Affected pages	Date of isue	Approval	Date of approval	Date of Inspection	Signature
Rev.1	2	6	10 December 2014				
Rev.1	2	7	10 December 2014				
Rev.1	2	11	10 December 2014				
Rev.1	2	Fig. 2.6_01	10 December 2014				
Rev.1	2	Fig.2.6_03	10 December 2014				
Rev.1	2	Fig.2.6_04	10 December 2014				
Rev.1	2	Fig.2.6_05	10 December 2014				
Rev.1	2	Fig.2.6_06	10 December 2014				
Rev.1	3	1	10 December 2014				
Rev.1	3	3	10 December 2014				
Rev.1	7	6	10 December 2014				
Rev.2	4	1	19 January 2015				
Rev.2	5	1	19 January 2015				
Rev.2	5	3	19 January 2015				
Rev.2	5	5	19 January 2015				
Rev.2	6	1	19 January 2015				
Rev.3	1	3	23 June 2015				
Rev.3	2	Fig.2.6_03	23 June 2015				
Rev.3	2	Fig.2.6_04	23 June 2015				
Rev.3	5	6	23 June 2015				
Rev.4	2	1	20 December 2017				
Rev.4	2	8..10	20 December 2017				
Rev.4	2	13..17	20 December 2017				
Rev.4	2	Fig.2.4.2_01	20 December 2017				
Rev.4	2	Fig.2.4.4_01	20 December 2017				
Rev.4	2	Fig.2.5.3_02	20 December 2017				
Rev.4	2	Fig.2.5.3_02[a]	20 December 2017				
Rev.4	2	Fig.2.5.3_03	20 December 2017				
Rev.4	2	Fig.2.5.3_04	20 December 2017				
Rev.4	2	Fig.2.5.3_05	20 December 2017				
Rev.4	2	Fig.2.6_01	20 December 2017				
Rev.4	2	Fig.2.6_03	20 December 2017				
Rev.4	2	Fig.2.6_04	20 December 2017				
Rev.4	2	Fig.2.6_05	20 December 2017				
Rev.4	2	Fig.2.6_06	20 December 2017				
Rev.4	2	Fig.2.6_07	20 December 2017				
Rev.4	3	1	20 December 2017				
Rev.4	3	10..12	20 December 2017				
Rev.4	5	4..5	20 December 2017				
Rev. 5	5	6	8 November 2018				

Rev. No	Affected Section	Affected pages	Date of isue	Approval	Date of approval	Date of Inspection	Signature

Rev. No	Affected Section	Affected pages	Date of isue	Approval	Date of approval	Date of Inspection	Signature

Rev. No	Affected Section	Affected pages	Date of isue	Approval	Date of approval	Date of Inspection	Signature

SECTION 1

General

Page

1.1 INTRODUCTION....2
1.2 WARNINGS, CAUTIONS AND NOTES....2
1.3 DESCRIPTION OF SAILPLANE....2
1.4 ABBREVIATIONS....3
1.5 THREE VIEW DRAWING....4

1.1 Introduction

This Maintenance Manual contains information for pilots, technicians and mechanics about safe and proper maintenance of the LAK-17B FES sailplane with Front Electric Sustainer system. This information is given in accordance with requirements of CS 22.1529.

1.2 Warnings, cautions and notes

The following definitions apply to warnings, cautions and notes used in this manual.

Warning: Means that the non-observation of the corresponding procedure leads to an immediate or important degradation of the flight safety.

Caution: Means that the non-observation of the corresponding procedure leads to a minor or to a more or less long term degradation of the flight safety.

Note: Draws the attention to any special item not directly related to safety but which is important or unusual.

1.3 Description of sailplane

The LAK-17B FES is a new generation self-sustaining sailplane of FAI 15m-18m- open class designed according to CS-22 requirements. Glider is equipped with Front Electric Sustainersystem.

The sailplane has flaps, T-shaped tail, retractable main gear wheel, water ballast tanks:

Max capacity of water ballast	15m		18m		21m	
	ltr	US gal	ltr	US gal	ltr	US gal
	158	**41.7**	**188**	**49.6**	**200**	**52.8**
Inner wing tanks	158	41.7	158	41.7	158	41.7
Outer wing 21m tanks					42	11.1
Outer wing 18m tanks			30	7.9		
Outer wing 15m tanks	0	0				

The sailplane is made of composite materials. Wing shell is of three-layer construction (composite material – foam - composite material). Carbon rods GRAPHLITE SM 315 have been used in spar construction.

The airbrakes are located on the upper part of wing. The fuselage is of monocoque construction. Pilot seats and pedals of rudder control are adjustable. The cockpit canopy opens forward together with instrument panel. In case of emergency the canopy is ejected.

Main landing gear has a wheel of 5.00-5 size and a shock absorber.

The tow release is mounted near the main landing gear and (or) in front of pilot cockpit at the bulkhead.

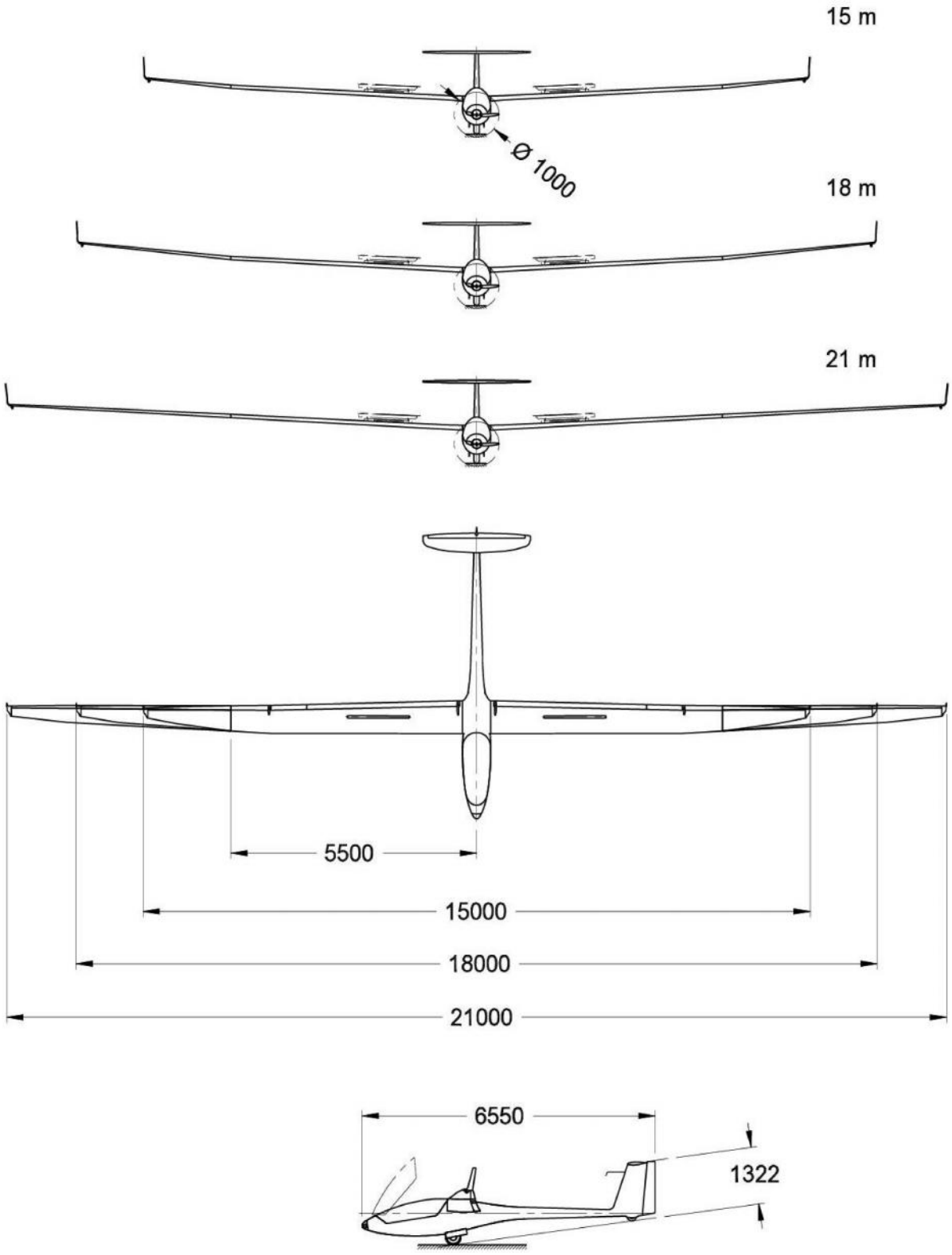
Technical data	b=15 m	b=18 m	b=21 m
Wing span	15 m (49,2 ft)	18 m (59,06 ft)	21 m (68.89 ft)
Wing area, m^2	9,18 m^2 (98,81 ft^2)	10,32 m^2 (111,08 ft^2)	11,58 m^2 (124,65 ft^2)
Wing aspect ratio	24,51	31,39	38.08
Wing dihedral angle, degrees	3	3	3
Fuselage length, m	6,555 m (21,5058 ft)		
Height, m	1,29 m (4,23 ft)		
Max airspeed in calm air, km/h	275	275	220
Max airspeed in rough air, km/h	190	190	190
Max flight mass, kg	550	600	600
Max wing loading, kg/ m^2	59,91	58,13	51,81
Min sink rate, m/s	yet not defined	0.53	yet not defined
Best L/D without ballast at 104 km/h	yet not defined	50.2	yet not defined
Best L/D with ballast at 121.5 km/h	yet not defined	50.2	yet not defined
g limits without water ballast	-2,65/+5,3	-2,65/+5,3	-2,65/+5,3
g limits with water ballast	-2,65/+5,3	-2,65/+5,3	-2,65/+5,3

1.4 Abbreviations

Abbreviations used in this document:

A - ampere,
Ah - ampere hour,
*C - degree Celsius,
C.G. - center of gravity,
cm - centimeter,
daN - decanewton,
g - gram,
h - hour,
kg - kilogram mass,
kG - kilogram force,
km - kilometer,
L/D - glide ratio,
ltr - liter,
m - meter,
mm - millimeter,
MPa - megapascal,
V - volt.

1.5 Three view drawing



SECTION 2

Description of sailplane and systems

Page

2.1 INTRODUCTION.... 2

2.2 AIRFRAME CONSTRUCTION.... 2

2.2.1 WING.... 2
2.2.2 FUSELAGE.... 3
2.2.3 VERTICAL TAIL.... 3
2.2.4 HORIZONTAL TAIL.... 4
2.2.5 LANDING GEAR.... 4

2.3 CONTROL SYSTEMS.... 4

2.3.1 AILERONS AND FLAPS CONTROL SYSTEM.... 4
2.3.2 AN ELEVATOR CONTROL SYSTEM.... 5
2.3.3 TRIMMER CONTROL SYSTEM.... 5
2.3.4 RUDDER CONTROL SYSTEM.... 6
2.3.5 AIRBRAKES CONTROL SYSTEM.... 6
2.3.6 WATER BALLAST CONTROL SYSTEM.... 6
2.3.7 TOW RELEASE CONTROL SYSTEM.... 7
2.3.8 MAIN LANDING GEAR CONTROL SYSTEM.... 7
2.3.9 LANDING GEAR BRAKE CONTROL SYSTEM.... 7

2.4 EQUIPMENT AND SYSTEMS.... 7

2.4.1 PITOT AND STATIC SYSTEM.... 7
2.4.2 FLIGHT AND NAVIGATION INSTRUMENTS.... 8
2.4.3 FCU INSTRUMENT.... 9
2.4.4 ELECTRIC AND RADIO EQUIPMENT.... 10
2.4.5 CANOPY VENTILATION SYSTEM.... 11
2.4.6 COCKPIT CANOPY AND ITS EMERGENCY JETTISON SYSTEM.... 12
2.4.7 COCKPIT EQUIPMENT.... 12
2.4.8 FASTENINGOF BAGGAGE.... 12

2.5 FES SYSTEM.... 12

2.5.1 GENERAL LAYOUT.... 12
2.5.2 MOTOR.... 13
2.5.3 BATTERIES.... 13
2.5.4 MOTOR CONTROLS.... 15
2.5.4 PROPELLER.... 15

2.6 PLACARDS AND MARKING OF CONTROLS.... 15

2.7 DATA FOR RIGGING.... 15

2.7.1 ALLOWED CLEARANCES IN CONNECTIONS OF AGGREGATES.... 15
2.7.2 ALLOWED CLEARANCES IN CONTROL SYSTEMS.... 16
2.7.3 ALLOWED FORCES IN CONTROL SYSTEMS.... 16

2.8 ILLUSTRATIONS.... 17

2.1 Introduction

In this section there is given description of sailplane aggregates, systems, equipment, tables and markings and information about proper sailplane maintenance.

2.2 Airframe construction

2.2.1 Wing

Sailplane wings (fig.2.2.1_01, fig.2.2.1_02) made of composite materials consist of four parts: right inner wing (pos. 1), left inner wing (pos. 2) and two outer wings with winglets.

The outer wings are of three different lengths. For wingspan 21m of length, the outer wings 4900 mm of length are used, for wingspan 18m of length, the outer wings 3500 mm of length (pos. 3) are used. For span 15m of length, the outer wings 2000 mm of length (pos. 4) with winglets are used.

The wing airfoils:

15m-

s (m)	c (m)	Profile
0.0	0.741	LAP7-150
1.2	0.711	LAP7-131/17
4.6	0.625	LAP7-131/17
6.7	0.38	LAP7-128/19
7.355	0.226	LAP93/148

18m-

s (m)	c (m)	Profile
0.0	0.741	LAP7-150
1.2	0.711	LAP7-131/17
4.6	0.625	LAP7-131/17
6.5	0.5	LAP7-129/18
8.0	0.38	LAP7128/19
8.855	0.226	LAP93/148

21m-

s (m)	c (m)	Profile
0.0	0.741	LAP7-150
1.2	0.711	LAP7-131/17
4.6	0.625	LAP7-131/17
6.812	0.5	LAP7-128/18
9.157	0.38	LAP7-128/19
10.408	0.226	LAP93/148

Construction of wings is of one spar monocoque type. Their spars are 2-T shape in section. Carbon rods GRAPHLITE SM 315 are used for spar shelves. Wing shells are stuck of two parts: an upper and lower shell parts. The shell is of three-layer construction. External and internal shell layers are made of carbon and glass fiber. Between them there is foam. Thickness of foam of wing shells is 6 mm.

Spars of right and left wings are joined together with the help of two pins. Spar panel of right wing is cut off pyramid-shaped. Spar panel of left wing is fork-shaped. An outer wing is connected to the wing with the help of outer wing spar pins. The pins are fixed by the help of special key.

There are an adjustable hubs in the wing root ribs to fasten the wings to the fuselage.

Wings have flaps and flap-aileron type ailerons. Their shell structure is analogical to the wing shells structure.

A flap has 6 hinges. Its length is 3.42 m, area 0.4 m^2.

Length of ailerons (wing 15m) is 3.55 m, area 0.32 m^2. With wing span of 18 m an aileron is extended to 5.05 m. Its area then is 0.445 m^2. With wing span of 21 m an aileron is extended to 6.605 m. Its area then is 0.565 m^2. As wing the outer wing is connected to the wing the part of an aileron on the outer wing is connected to an aileron on the wing automatically.

On an upper part of wing shell there are covers (pos. 16) of airbrakes. Their contour coincides with the wing surface.

Air gaps between wings and control surfaces are closed with seals (fig.2.2.1_03; fig.2.2.1._04). The Seals-Turbulator scheme also shows the positioning of turbulator.

The sealing tape on the lower part of the wing must close the gap and connect the control surfaces and the wing surfaces. On the upper part of the wing only the control surfaces are covered with sealing tape. Mounting the seals must ensure the free movement of control surfaces.

2.2.2 Fuselage

The sailplane fuselage (fig. 2.2.2_01, fig. 2.2.2_02) is made of composite materials, construction is monocoque. The fuselage is oval-shaped in section (fig. 2.2.2_02), slightly narrowing at top and turning into circle at the fuselage end part. The fuselage end part is cone-shaped turning into fin.

The fuselage shell is glued of two symmetric parts, right and left (pos. 2, 3). Shell gluing seams are in vertical plane (in upper and lower shell parts).

Glass and carbon fiber are used in shell construction. Kevlar is used in the pilot cockpit zone.

The fuselage is reinforced by a metal girder (pos. 4) at wing attachment to the fuselage zone. Landing gear (pos. 5) is fastened to it. The gear is fully retractable. Its recess has an hermetic hood in order to avoid getting dirt and dust inside the body. As the gear is retracted the landing gear door is closed.

The tail wheel (pos. 6) is fixed at the fuselage end part. The pilot cockpit is covered with a canopy (pos.1) which opens upward.

2.2.3 Vertical tail

The vertical tail (fig. 2.2.3_01) consists of a fin (pos. 1) and a rudder (pos. 2).

The fin is made together with the fuselage. The fin shell is of monocoque three-layer construction. Its internal and external layers are molded of composite materials and between them there is foam 6 mm of thickness. The frame of the fin consists of a spar (pos. 3) of three-layer construction., a rear wall molded together with right fin shell (pos. 4) and 3 ribs going from nose till the spar, an upper, middle and lower (pos. 5, pos. 6, pos. 7).

A water ballast tank (pos. 8) of capacity 8 ltr is fitted inside the fin between nose and spar and between lower and middle ribs.

Along the spar forward side a container for batteries (pos. 9) is mounted between the middle and upper ribs.

The radio aerial (pos. 10) is fixed in a nose of the vertical tail.

An elevator push-pull rod (pos. 12) is in the space between fin spar and rear wall.

A rudder (pos. 2) is hung up on the right fin shell with 3 suspended brackets of composite materials with bronze hubs (pos. 13). Shells of the rudder like ones of the fin are of three-layer construction (an external layer, foam 3 mm of thickness, an internal layer).

The wall of the rudder (pos. 14) is of three-layer construction, as well.

2.2.4 Horizontal tail

The horizontal tail (fig. 2.2.4_01) consists of a stabilizer (pos. 1) and an elevator (pos. 2 and pos. 3).

The stabilizer is made of composite materials and construction of its shell is similar to wings shell construction.

The elevator consists of two parts: left (pos. 3) and right (pos. 2). Control surfaces are partially balanced and made of composite materials. Each part of the elevator is fastened to the stabilizer with 3 pins.

The horizontal tail is attached onto the upper fin part (fig. 3.1.6_05).

The elevator is joined to control system automatically.

2.2.5 Landing gear

The landing gear consists of a retractable main wheel (fig. 2.2.5_01, pos. 5) and fixed tail wheel (fig. 2.2.2_01, pos. 6).

Landing gear main wheel type TOST 045100 with Simplex shoe brake (or BERINGER wheel with brake) is attached to metal girder (fig. 2.2.2_02, pos. 4) by the help of stands (fig. 2.2.5_01, pos. 6, pos. 7) and a shock absorber (fig. 2.2.5_01, pos. 8). The opening for the wheel is covered with a main wheel box (fig. 2.2.5_01, pos. 9). It protects the fuselage internal space from dust and dirt.

With main wheel up the landing gear door (fig. 2.2.5_02, pos. 2) is closed.

Tail wheel (fig. 3.4.8_01) 6x1 1/4” (or 200x50) of size is attached to fuselage shell with help of an axle (pos. 4), bolt (pos. 3) and washer (pos. 1).

2.3 Control systems

2.3.1 Ailerons and flaps control system

In order to ensure required rigidity and reduce unsteadiness, ailerons and flaps control system (fig. 2.3.1_01, fig. 2.3.1_02, fig. 2.3.1_03) is made of metal levers and rods. The ailerons are suspended, i.e. with changing flaps position ailerons deflect as well.

Movement from the control stick (pos.1) is transmitted by help of rods and intermediate bellcranks (pos. 4, 5) to coaxial ailerons-flaps shaft (pos. 7) which transfers this movement by help of an automatic joint to shaft in the wing (pos. 9). Further the bell crank (pos. 10) turns rotational movement to forward movement and transmits it to summary mechanism (pos. 11). From this mechanism the movement is transmitted by help of rods and differential bellcranks (pos. 12, 13, 14) to an aileron and deflects it in required direction. There are three ailerons. Aileron 2 is connected to control rod. The movement of aileron 2 is transmitted to aileron 1 and aileron 3 by the help of root and tip ribs of the ailerons. **Option:** if the outer wing have control rod (fig. 3.4.1_01), the aileron 3 moves independently.

The control handle of the flaps (pos. 2) is attached to the left side of the cockpit. Movement by help of rods and a bell crank (pos. 6) is transmitted onto coaxial shaft (pos. 7) and by help of an automatic joint is transmitted to flaps shaft (pos. 15) in the wing. The movement from the shaft is transmitted onto the flaps by help of the bell crank (pos. 16), summary unit (pos. 11) and differential bell cranks (pos. 12, 13, 14) deflects the ailerons.

The position of flaps is fixed by a plate at control handle in the cockpit.

Ailerons and flaps deflection angles are given in table 2-1.

Position of flaps	Hanging up angle ±1°		Ailerons deflection angle ±2°
	Flaps	Ailerons	
-1	-3°	-3°	-15° +22°
0	0°	0°	-16° +21°
+1	5°	5°	-20° +20°
+2	10°	10°	-22° +18°
+3	15°	14°	-24° +14°
L	20°	17°	-25° +10°

2.3.2 An elevator control system

The elevator control system (fig. 2.3.2_01) consists of metal rods and bellcranks. In order to ensure rigidity the main rod in the fuselage is supported by guide rollers (pos. 5).

Movement from the stick (pos. 1) by help of rods and intermediate bellcranks (pos. 2, 3, 4) is transmitted to the elevator and deflects it in required direction.

2.3.3 Trimmer control system

An adjustable trimmer for the elevator (fig. 2.3.3_01) takes over long-lasting loads on the control stick from the pilot and levels the sailplane in all ranges of airspeeds, C.G. positions and allowed flap angles.

The trimmer is mounted on the left side of the cockpit in a molded trimmer box (pos. 1). It consists of:

- a handle (pos. 2) with a hub welded, a fixing edge and a plate for springs,
- a bronze bar (pos. 3) the handle is moving along,
- a ring (pos. 4) screwed to the elevator's rod,
- a fixing plate with teeth (pos. 5) riveted on trimmer box side,
- two springs of the same tension *16x1.6 mm (pos. 6). The front spring connects the trimmer handle to a plate (pos. 7) on control stick shaft and the end spring – the handle with a ring (pos. 4) on the elevator's rod.

The trimmer has two inspection hatches (pos. 8 and 9) covered with a glass fiber lid (pos. 10) and fastened by screw M4 (pos. 11).

Max motion of the trimmer handle is 80 mm. As the handle moves it pulls or pushes the stick in the same direction.

The trimmer's handle has a drop-shaped tip (pos. 12) painted in green.

The trimmer forces (force measuring place on stick -hand holding center):

Trimmer position	Force on control stick, daN
forward	2.0 ÷ 2.5
backward	2.0 ÷ 2.5

2.3.4 Rudder control system

The rudder control system (fig. 2.3.4_01, fig. 2.3.4_02, fig. 2.3.4_03) is of combined type: steel cable from pedals to a bellcrank in the middle part of fuselage and steel rod ϕ16x1 mm, from the bellcrank till the rudder.

Pedals are adjustable according to a pilot height. The control handle of pedals is mounted on the right side of cockpit, on the ailerons control rod hood.

Pedals junction (pos. 1) is mounted on longitudinal pipe with holes for fixing drilled on it. Pedals cross pipe leans upon cockpit floor by textolite disks. The disks are fixed with wire pins at the ends of the cross pipe.

The control rod (pos. 8) in the cylinder-shaped fuselage is supported by two guides (pos. 9) molded on frames. An adjustable rod tip is connected to the rudder.

Rudder control cables (pos.4) are stretched by two turn buckles (pos.3) of non-standard construction.

Motion of the rudder is restricted by a bellcrank (pos.6) in the fuselage which is supported by two non-adjustable supports (pos. 7) mounted at the center section girder.

2.3.5 Airbrakes control system

The airbrakes control system (fig. 2.3.1_01, fig. 2.3.5_01, fig. 2.3.5_02) comprises the control handle (pos. 3), attached to the left side of a cockpit and rigid rods and bellcranks. Movement from control handle by help of an intermediate rod is transmitted to the shaft (pos. 8) which through an automatic joint transmits the movement to the shaft (pos. 17) in the wing. The bellcrank (pos. 18) transfers rotational movement into longitudinal one and through intermediate rods transmits it to lifting equipment consisting of a bell crank (pos. 19) and shoulders (pos. 20, pos. 21).

The airbrakes are fixed in the closed position by a over-center lock which prohibits spontaneous opening of the interceptors. Sudden breaking angle of the lock is adjusted by fixing bolt (pos. 22).

The airbrakes control handle also controls the hydraulic brake of the main landing gear wheel (fig. 2.3.9_02).

2.3.6 Water ballast control system

The water ballast control system (fig. 2.3.6_01, fig. 2.3.6_02, fig. 2.3.6_03, fig. 2.3.6_04) consist of integrated tanks in inner wings, outer wings and fin. The water ballast system of inner and outer wings is controlled by the handle (pos. 1) located at the right side of the cockpit. The movement of the handle is transmitted by rod (pos. 2) to a shaft in a fuselage (pos. 3). The movement of the shaft in a fuselage is transmitted by automatic joints to the wing shafts (pos. 4). The shaft in the wing lifts an arm (pos. 5) with a plug (pos. 6) and opens the water tank. The plug is sealed (pos. 7).

The movement of shaft (pos. 4) is transmitted by rod (pos. 8) to lever (pos. 9) and carbon rod (pos. 10). Adjustable rod end push the valve (pos. 14) of the inner wing tank water tap. The tank of the inner wing is filled through the opening located at the end of the inner wing, the front side of the rib.

The fin water ballast system is controlled by the handle (pos. 16) located at the right side of cockpit.

The movement of the handle is transmitted by the carbon rod (pos. 17) to the water tap of the fin tank (pos. 18). The fin water ballast tank is filled through the opening (pos. 19) at the top of the fin

The wing and fin water ballast tanks have drainage systems and openings for drainage.

Warning: *Before filling up the water tanks check that the drainage openings are not plugged up.*

2.3.7 Tow release control system

A towing hook (fig. 2.3.7_01, fig. 2.3.7_02, pos. 6) is arranged in central part of fuselage at the main frame and (or) in pilot cockpit at the bulkhead. If mounted, both towing hooks are operated is with one handle.

Movement from the control handle (pos. 1) on the left side of a cockpit by steel cable (pos. 2) is transmitted to the shoulder (pos. 5) which opens the hook. The cable looseness is eliminated by an adjustment junction which comprises the junction (pos. 3) and fixing nut (pos. 4).

The travel of the release handle in the case of only one hook is 55 mm. In the case of two hooks the release handle travel is 92 mm.

2.3.8 Main landing gear control system

The landing gear control system (fig. 2.2.5_01) controls retracting and releasing of the main wheel. It consists of a control rod (pos. 1) on the right side of cockpit , an intermediate rod (pos. 2) and a bellcrank (pos. 3). A gas spring (pos. 4) makes it easier to retract the wheel. The control handle in the retracted and released positions is fixed in the slots of plate (pos. 5).

2.3.9 Landing gear brake control system

The main wheel brake is of mechanical type, controlled by a handle (fig. 2.3.9_01, pos. 1) arranged on the control stick. Movement from the handle to the brake shoulder (pos. 5) is transmitted by the steel cable (pos.2). In order to eliminate loosening of the cable the adjustment junction is mounted on the cockpit floor under the pilot seat. The junction consists of cable support (pos. 3) and fixing nut (pos. 4).

The hydraulic brake (manufacturer: BERINGER) (**option**) is controlled by the air-brakes control handle (pos. 1) (fig. 2.3.9_02). The movement of air-brakes shaft (pos. 2) is transmitted to the master cylinder (pos. 4) by control rod (pos. 3). The master cylinder is connected to brake fluid reservoir. The brake fluid is transmitted by hoses (pos. 7) through the relief valve (pos. 6) to the piston caliper (pos. 5). To control the brake cylinder, only a half of the air-brakes control handle's travel is used.

To adjust the travel of the master cylinder, a threaded plate with slot (pos. 8) is used. The plate is fixed by nut (pos. 9).

The brake fluid DOT4 is used in the brake system. To fill the brake system, recommendations of the manufacturer shall be used (www.beringer.fr).

2.4 Equipment and systems

2.4.1 Pitot and static system

Pitot and static system of the sailplane is shown in fig. 2.4.1_01. The system consists of:

1. Static pressure receiving ports (pos. 9) which are located at a two sections on a fuselage skin from the inside (distances from sailplane nose to the ports is given at fig. 2.4.1_01). Static pressure receivers consists of a glass fiber tanks with air inlet as a holes drilled through the fuselage skin.
   There are static pressure lines S1 and S2. The air gets from three receivers located on the fuselage skin every 120°.

Warning: *During a sailplane preflight inspection the holes of static pressure receiver on the fuselage sides shall be checked for cleanliness.*

2. Pitot (pos. 10) is a steel pipe mounted on the fin and right against the air flow. This line is marked by the letter D.
3. Compensated pressure receiver (pos. 11) is a special Nix pipe mounted in fin. This line is marked by the letter N.
4. Flexible polyvinylchloride pipes of different colors transmit air pressure from receivers to corresponding measuring instruments on the sailplane instrument panel. Each separate pressure line has pipes of different colors:

   - red – for total pressure line (D),
   - yellow – for static pressure lines (S1 and S2),
   - green – for compensated pressure line (N).

2.4.2 Flight and navigation instruments

These flight and navigation instruments as option are mounted in the sailplane:

OPTION A	OPTION B
1) air-speed indicator LUN-1106, scale 50-300 km/h, with range markings	1) air-speed indicator WINTER 6 FMS 421
2) altimeter BD-10K or VB-10PS with altitude corrector	2) altimeter WINTER 4 FGH 20
3) mechanical variometer LUN-1141	3) variometer BOHLI
4) side-slip indicator LUN-1211	4) electronic variometer FILSER LX5000 or FILSER LX7000
5) compass KI-13	5) fly computer display FILSER LX5000 or FILSER LX7000
6) FCU instrument	6) side slip indicator LUN 1211
7) Radio ATR 600	7) radio Becker AR 4201 or Filser ATR 600
8) Fire warning system OPTION 1 or OPTION 2	8) FCU instrument
	9) Fire warning system OPTION 1 or OPTION 2

All the instruments, except for the compass KI-13A, are mounted in the instrument panel. The compass is attached to the canopy glass or on the instrument panel.

There is room left in the instrument panel for extra instruments (fig. 2.4.2_01).

It is possible to use other standard flight and navigation instruments and change instruments positions on the instrument panel (fig.2.4.2_01). These instruments must correspond with national regulations. Max instrument panel weight in flight – 4.1 kg.

2.4.3 FCU instrument

FES parameters are controlled by the FCU instrument, produced by LXNAV Company. The motor is operated with the Throttle knob located on the FCU instrument. Electronic safety devices are provided to avoid miss operation. The details of the instrument are given below.

Operation

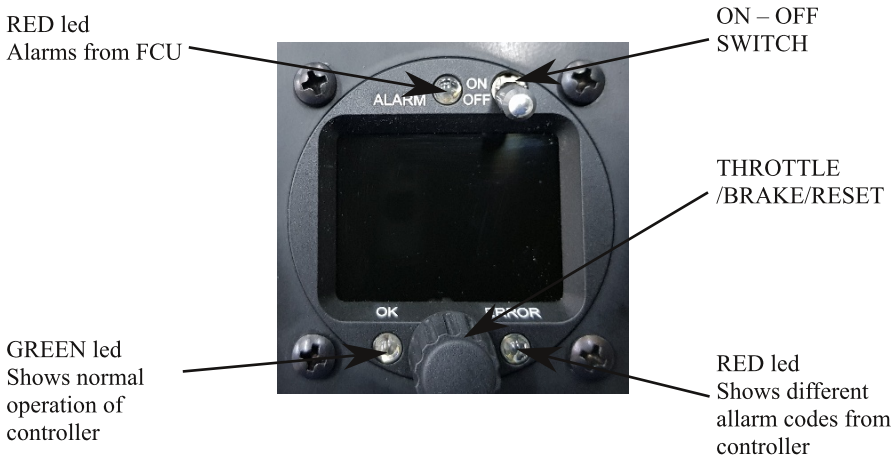
The FCU instrument was designed to control and improve safety of motor use. FCU instrument must be continuously switched on during flight.

Warning: *Keep FCU instrument power supply always switched on during flight!*

Instrument indications

The FCU instrument for LAK-17B FES sailplane has on its front side three LED showing the most important states of the system during all operation time. Additional a LCD display gives more detailed information about the same states and other values. On the front side are also “ON/OFF” main FCU switch and THROTTLE /BRAKE/RESET button. On the back side are connectors.

FES control unit instrument



Description	Description of function
Switch	ON/OFF for FCU instrument
Throttle, brake, reset	Power button from minimum to maximum RPM Push button to reset and second screen
LED 1 – red colour	alarms from FCU, see detailed specification of errors
LED 2 – green colour	if green LED is ON then controller is ready for operation
LED 3 – red colour	if red LED is blinking then something is wrong on controller – see error codes
LCD Color display	V meter, A meter, Power meter, Temperature of motor, controller, Bat1, Bat2, RPM, Alarm messages
Alarm buzzer	Voltage level in batteries reached minimum, release throttle or stop operation; Temperature of motor is too high, release throttle or stop operation

Buzzer

The buzzer gives additional acoustic information to the pilot during handling errors, dangerous motor states. After buzzer starting, reason is displayed on the LCD display.

Handling errors produce a pulsed buzzer tone.

High temperature of motor, low battery voltage produce a continuous buzzer tone.

Operating environment

The FCU instrument is designed for operating at environment of the -20 °C (-4 °F) to +60 °C (+140 °F) temperature range. At lower or higher temperatures FCU instrument can function improperly.

The FCU instrument was designed to improve safety of motor use. This important FCU function can only obtained when FCU instrument is always (continuous) switched on when operating the motor. Any other use is outside of manufacturer agreed FCU instrument operation mode.

If FCU instrument is switched off during motor run, all safety in motor operation is lost.

To have a sure detection for use outside agreed operation, FCU instrument stores error and operation information.

Warning: *Keep FCU instrument power supply always switched on during flight!*

More detailed functionality of FCU is described in separate FES FCU INSTRUMENT manual, version 1.80 (for FCU software version 3.06).

2.4.4 Electric and radio equipment

The sailplane electric system is shown at fig. 2.4.4_01. The sailplane may be equipped with other instruments (GPS or board computer) and an existing scheme enables to connect them easy.

Accumulator batteries of two types are used in sailplane:

- three accumulators NP 2.1-12 is fitted in a special container. The container is located in the fin (fig. 2.2.3_01);
- two FES battery packs from 14 high power Lithium Polymer cells each. FES battery packs are located in the FES battery box (fig.2.5.1_01).

LAK-17B FES two battery packs are wired in serial. One battery pack has 14 cells, so altogether 28 cells. Nominal capacity of each cell is 40 Ah, at middle voltage 3.7 V (minimum 3.2 V, maximum 4.2 V).

Min total allowed voltage of batteries: 90 V;
Max total voltage of batteries: 118 V;

Battery charger KOP1001 BMS version or two KOP602 BMS version. Charger is programmable and appropriate charging settings are programmed at delivery.

Approved Battery Management System:
-External FES-BMS-7R for GEN1 battery packs,
-FES-BMS-9R which is integrated in GEN2 battery packs.

More detailed data about battery packs are described in separate FES Battery pack GEN1 & GEN2 manual.

If FES was used during flight, take batteries out for recharging.

Caution:

-always turn off FCU instrument and all other instruments (Flight computer, Flarm, Radio, Transponder, PDA), before removing Power fuse;
-always remove Power fuse before removing + or – supply cable!
-immediately put safety covers on battery terminals to avoid potential short circuit;
-check voltage of each cell with Digital V-meter, on balancer connector;
-if there is big difference (more than 0,1V) in Voltage level between one or more cells please consult with manufacturer of FES system.

Use only supplyed charger, together with supplied battery management system (BMS). Read carefully instruction manual for charger and BMS before use, and be sure to connect batteries to BMS and charger properly, in correct order.

Warning: *never use any other chargers or BMS to charge your batteries, as this could be very dangerous, and could damage you and your batteries. Always charge batteries outside of your sailplane!*

The accumulators NP 2.1-12 are dry and hermetized, they don't release any toxic and explosive gas. During recharging no dangerous gas appears. The accumulators shall be recharged outside the sailplane.

The possible places to mount aerials for GPS, transponders, ELT are indicated at fig 2.4.4_04.

2.4.5 Canopy ventilation system

The canopy ventilation system (fig. 2.4.5_01) creates the required micro climate for a pilot and optimal working conditions in the sailplane cockpit. Air enters through an opening (pos. 1) in the sailplane nose and flows through channels on the right and left fuselage sides into the cockpit where it blows over the front part of canopy thus protecting it from covering with dew. The amount of air is valve-controlled, the valve (pos. 2) is located in the ventilation

opening. The valve is handle-controlled, the handle (pos. 9) is attached to the instrument panel. The handle can be fixed in any position.

2.4.6 Cockpit canopy and its emergency jettison system

The cockpit canopy and its emergency jettison system is shown at fig. 2.4.6_01, fig. 2.4.6_02, fig. 2.4.6_03.

The cockpit canopy is fastened to a holder (pos. 8) by help of fixator (pos. 2).

The fixator is controlled by the cockpit canopy emergency jettison handle (pos. 1). It is located in the upper part of the instrument block.

The cockpit canopy is fixed in position 'closed' by two handles (pos. 5) located on the left and right sides of canopy frame.

The cockpit canopy is ejected in an emergency by one pull up movement of the emergency jettison handle (pos. 1). The fixator (pos. 2) sets free the cockpit canopy spring. The spring (pos. 3) throws the front part of the canopy upwards. The cockpit canopy under influence of the air stream turns and touches the support (pos. 9.1) with its end part and detaches from the fuselage finally. The pin (pos. 9.2) does not allow the canopy to slide aside.

Warning: *the handle (Fig.2.4.6_01, pos.4) must be in the working position in flight.*

2.4.7 Cockpit equipment

The cockpit equipment consist of:

- safety belts,
- a pilot seat,
- a pocket of fabric (on the right side) for small things, documents.

The safety belts (4 point static harness restrain system – Carl F. Schroth GmbH. Shoulder belts) are attached to a supporting girder of a pilot shoulders width at the central fuselage part. The lap belts are attached to the anchor points located on a armrest on the left and right sides.

The pilot seat is made of glass fiber reinforced plastic with cuttings for a head supporter, a pipe glued for pulling through of an adjustment cable and a pipe for fixing of the seat in sockets which are in hoods of cockpit rods.

The back supporter of the seat is may be moved "forward-backward" on the ground and its inclination angle can be changed in flight by help of a fixable adjustment cable.

There are three positions at the upper part of a seat for adjustment of the head supporter according to pilot height.

Warning: *seat back must be properly fixed!*

A small pocket of the same decorative material as cockpit sides is on the right side to keep small things.

2.4.8 Fastening of baggage

Baggage is fastened in the central fuselage part on a partition wall above the landing gear recess and is fixed by rubber absorbers. Max allowed baggage weight is 7 kg.

2.5 FES system

2.5.1 General layout

General layout of the FES system can be found at fig.2.5.1_01.

For more information about FES elements see paragraphs 2.5.2 - 2.5.5 of this manual and separate FES MAINTENANCE MANUAL.

2.5.2 Motor

FES system motor is shown at fig.2.5.2_01. Motor. This motor allows gearless drive without the usually essential gear unit which cause power losses, additional weight, complexity and maintenances. Because of the little internal resistance of the motor, very good performances are achieved in a wide range and at an excellent efficiency.

Technical data and limitations of the motor

Brushless DC motor, type FES-LAK-M100 with the following specifications:

Out runner BLDC brushless synchronous permanent magnet motor with electronically controlled commutation system 3 phase. Rotor position by hall sensors.

Voltage range..... 90-180V
Max. rotation speed..... 4500 rpm/min
Nominal current.....150 A
Max. motor current.....Up to 220 A (according to the cooling)
External diameter of the rotor.....180 mm
Motor length..... 100 mm
Weight cca..... 7.3 kg
Nominal efficiency more than 95%.....>95% incl. controller
Max. temp. of the stator.....90° C

More detailed data about motor are described in separate “FES-LAK-M100 MOTOR manual”.

2.5.3 Batteries

The batteries packs are shown at fig.2.5.3_01.

LAK-17B FES has **two batteries packs** wired in serial. One battery pack has 14 cells, so altogether 28 cells. Nominal capacity of each cell is 40 Ah, at middle voltage 3.7 V (minimum 3.2 V, maximum 4.2 V).

Warning: *Flying with removed FES batteries are allowed only using the dummy boxes instead (fig. 2.5.3_02). See the section 3.4.11 of this manual for the use of these boxes.*

Batteries compartment cover has a safety valve (fig. 2.5.3_05) for smoke venting in case of battery fire.

The FES battery pack housing is reinforced and made from flame retardant glassfibre prepreg FR308. Additionally, a fire warning system is installed. There are two options of the batteries compartment fire detection systems:

Fire warning system OPTION 1

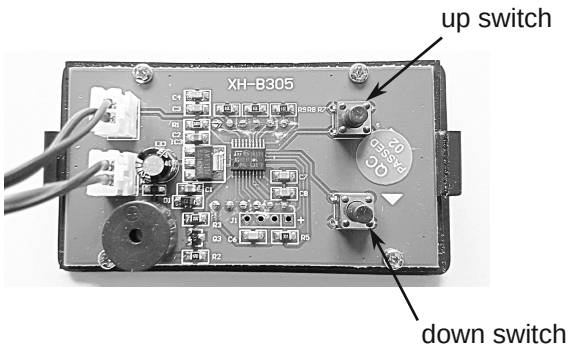
Digital temperature indicator with audible and visual alarm (pos. 1) on top of the instrument panel and a thermocouple (pos. 2) inside the batteries compartment (fig. 2.5.3_03). Alarm will activate when the temperature is greater than 90 °C. Temperature indicator specifications:

- Power requirement: DC 12 V;
- Measuring range: - 60 ~ 125 °C;
- Power consumption: 18 mA;
- Temperature probe: 10K/B3950, waterproof stainless steel probe;

Temperature indicator setting:

a) Long press up switch to set high temp value. Hold up and down switch at the same time to correction temperature. Set 90 °C temperature.

b) Long press down switch to set low temperature value. Hold up and down switch at the same time to correction temperature. Set -20 °C temperature.
The setting value are retained when power cut off. Temperature indicator will alarm when measuring temp. reach to the setting value.



Testing the fire warning system:

1. Make sure that the main battery (located in the fin) is connected.
2. Switch the “Main switch” to “ON” position.
3. The warning system works properly if the temperature indicator shows the batteries compartment’s inside temperature. The value should be close to the outside weather temperature if the FES system wasn’t turned on before.

Fire warning system OPTION 2

Audible and visual alarm system (fig. 2.5.3_04) which consists of flashing LED indicator (pos. 3), a buzzer (pos. 2), and a linear heat detector (pos. 5). The system will activate when the temperature inside the batteries compartment is greater than 88 °C.

This fire warning system is switched on all the time when the main battery is connected.

Testing the fire warning system:

Make sure that the main battery (located in the fin) is connected. Push the test button mounted in the instrument panel. The warning system works properly if the speaker makes a warning sound and the red LED is flashing. Release the button and the system should stop making warnings.

***

More detailed data about battery packs are described in separate FES Battery pack GEN2 with integrated BMS (Battery Management System) manual, v1.19.

2.5.4 Motor controls

The LAK-17B FES motor is controlled by help of FCU (FES control unit) instrument.

More detailed data about FES FCU instrument are described in separate "FES FCU Manual", latest approved revision.

2.5.5 Propeller

The propeller FES-LAK-P10-100 is shown at fig. 2.5.5_01.

Propeller is made of GFC and CFC. It is made in moulds, which were manufactured using modern CNC technology. This made possible to have very accurate propeller geometry. Carefully tested lacquer is used to protect the composite body against moisture and erosion. The special lacquer is resistant against fuel, oil and other chemical products. This type of lacquer has also an excellent flexibility. Tips can be painted red as a safety mark. More detailed data about propeller FES-LAK-P10-100 are described in separate "FES PROPELLER MANUAL" latest approved revision.

2.6 Placards and marking of controls

Each cockpit control (with exception of the primary flight controls) is marked (fig. 2.6_01, fig. 2.6_02, fig. 2.6_03, fig. 2.6_04, fig. 2.6_05, fig. 2.6_06, fig. 2.6_07) according to their purpose and operation mode.

The tables of limitations are shown at fig. 2.6_03, fig. 2.6_04.

Layout of placards inside the sailplane is shown in fig. 2.6_01.

2.7 Data for rigging

2.7.1 Allowed clearances in connections of aggregates

Allowed clearances of connection of sailplane aggregates are given in fig. 2.7.1_01 and fig. 2.7.1_02.

Max allowed gaps in connections of aggregates between openings and diameters of pins are given in table 2-2.

Table 2-2

Connection	Connected parts	Max allowed gap (mm)
Wing – fuselage	Spars connection pin (pos. 1) – spar hub (pos. 2)	0.32
Wing – fuselage	Fuselage lateral pin (pos. 3) – wing hub (pos. 4)	0.27
Stabilizer – fuselage	Fin pin (pos. 5) – stabilizer hub (pos. 6)	0.055
Stabilizer – fuselage	Stabilizer fixing pin (pos. 7) – fin hub (pos. 8)	0.055
Wing – wing tip	Wing lateral pin (pos. 10) – wing tip hubs (pos. 9)	0.046
Wing – wing tip	Clearance of opening of wing tip holder (pos. 11)	0.015

2.7.2 Allowed clearances in control systems

Clearances for the stick are defined according to schemes a) and b) of fig. 2-1 by measuring motion of the stick upper part. The elevator, ailerons and flaps shall be fixed in neutral position.

Clearances for ailerons, flaps and the elevator are defined according to scheme c) of fig. 2-1 by measuring motions of their rear edges (the root section of corresponding control). The control stick and flap control handle shall be fixed in neutral position.

Allowed motions are shown in table 2-3.

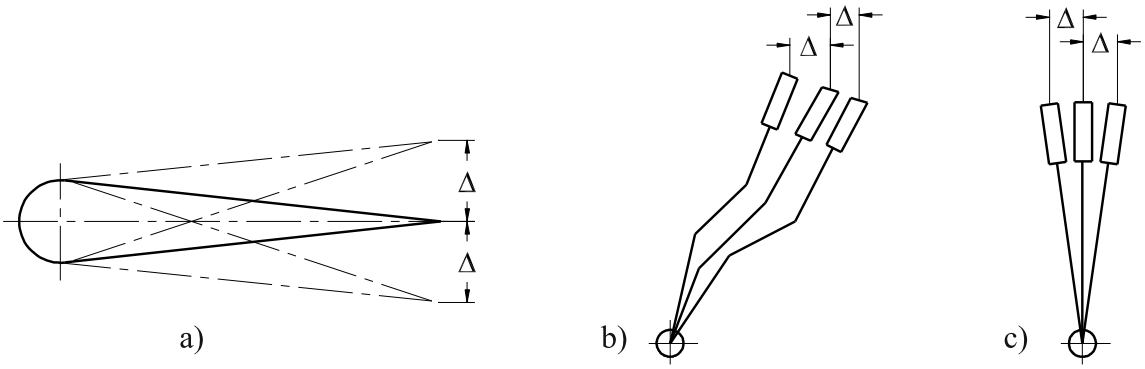


Fig. 2-1. Free play setting

Table 2-3

Pos. No	Measured motion	Motion Δ (mm) less than
1	Stick, forward - backward	2.0
2	Stick, left – right	2.0
3	Edge of left aileron	2.0
4	Edge of right aileron	2.0
5	Edge of left flap	2.0
6	Edge of right flap	2.0
7	Edge of left elevator	2.0
8	Edge of right elevator	2.0
9	Edge of rudder	1.5

2.7.3 Allowed forces in control systems

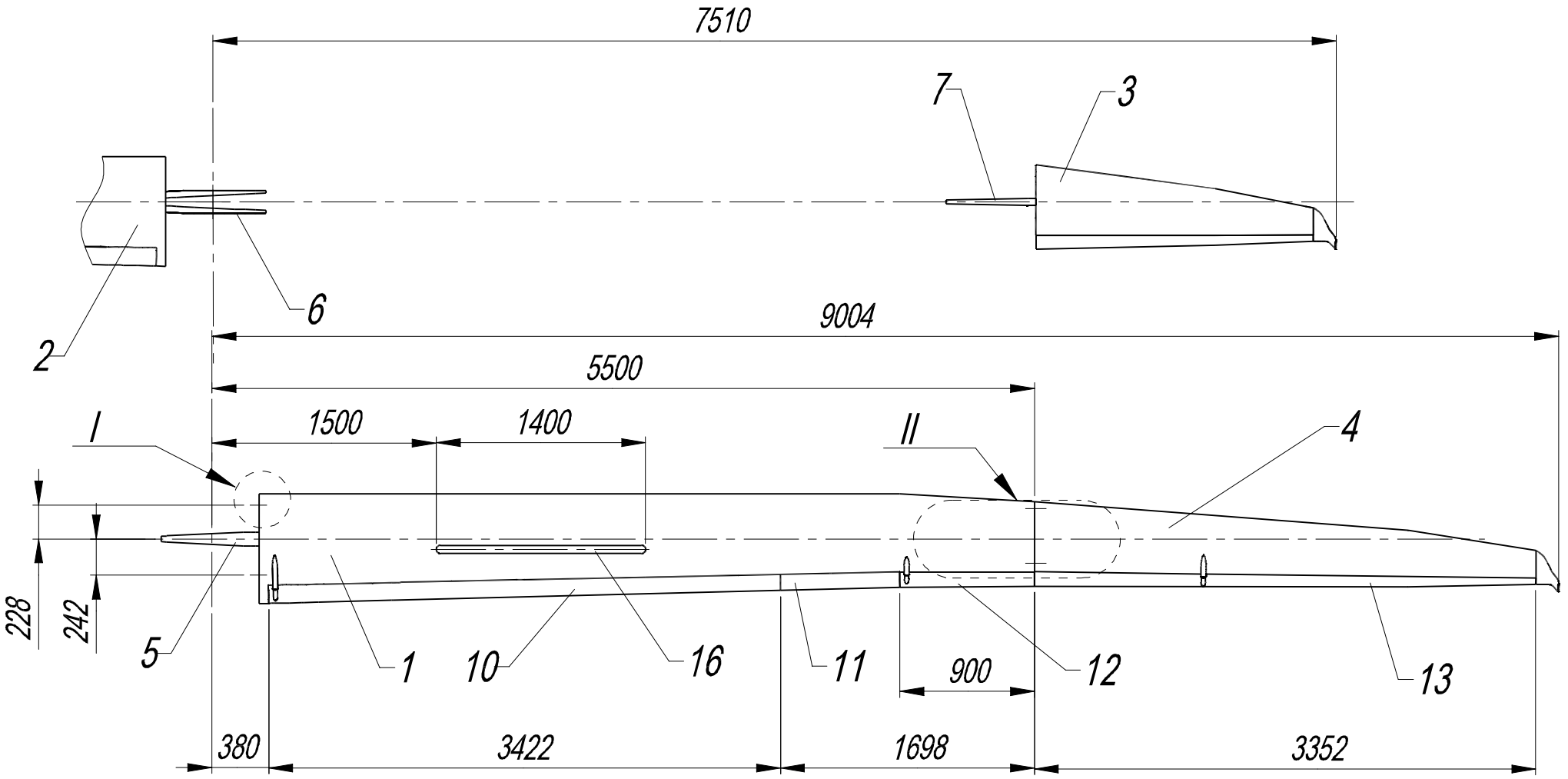
Allowed forces in control systems are given in table 2-4. Forces are measured by checked dynamometers.

Note: *Force of an elevator control system is measured with trimmer control handle in neutral position.*

Table 2-4

Control system	Force measuring place	Force, kg
Elevator	On stick – hand holding center	max 0.3
Ailerons	On stick – hand holding center	max 0.5
Flaps – flaps upward	On flaps control handle – hand holding center	max 1.0
Flaps – flaps downward	On flaps control handle – hand holding center	max 1.0
Rudder	On pedal upper cross pipe center	max 2.0
Airbrakes - airbrakes opening	On airbrakes control handle – hand holding center	max 15
Airbrakes - airbrakes closing	On airbrakes control handle – hand holding center	max 18
Towing hook – without loading	On towing hook opening handle	max 10
Cockpit canopy emergency jettison	On canopy emergency jettison handle – hand holding center	min 5 max 13
Landing gear – releasing	On gear control handle – hand holding center	max 20
Landing gear – retracting	On gear control handle – hand holding center	max 14

2.8 Illustrations



1. Right inner wing LAK-17B 20 00 00 00 SB
2. Left inner wing LAK-17B 20 00 00 00-01 SB
3. Right outer wing with winglet 15 m LAK-17B 22 00 00 00 SB
4. Right outer wing with winglet 18 m LAK-17B 21 00 00 00 SB
5. Right inner wing spar LAK-17B 20 30 00 00 SB
6. Left inner wing spar LAK-17B 20 40 00 00 SB
7. Right outer wing spar LAK-17B 22 01 00 00 SB
8. Wing skin upper LAK-17B 20 10 00 00 SB
9. Wing skin lower LAK-17B 20 11 00 00 SB
10. Flap LAK-17B 37 00 00 00 SB
11. Aileron No. 1 LAK-17B 35 01 00 00 SB
12. Aileron No. 2 LAK-17B 35 02 00 00 SB
13. Aileron of outer wing LAK-17B 35 03 00 00 SB
14. Lateral pin LAK-17B 20 22 00 04
15. Adjustable hub LAK-17A 21 00 00 00 02
16. Air brake LAK-17B 56 20 00 00 SB

Fig. 2.2.1_01. Wing

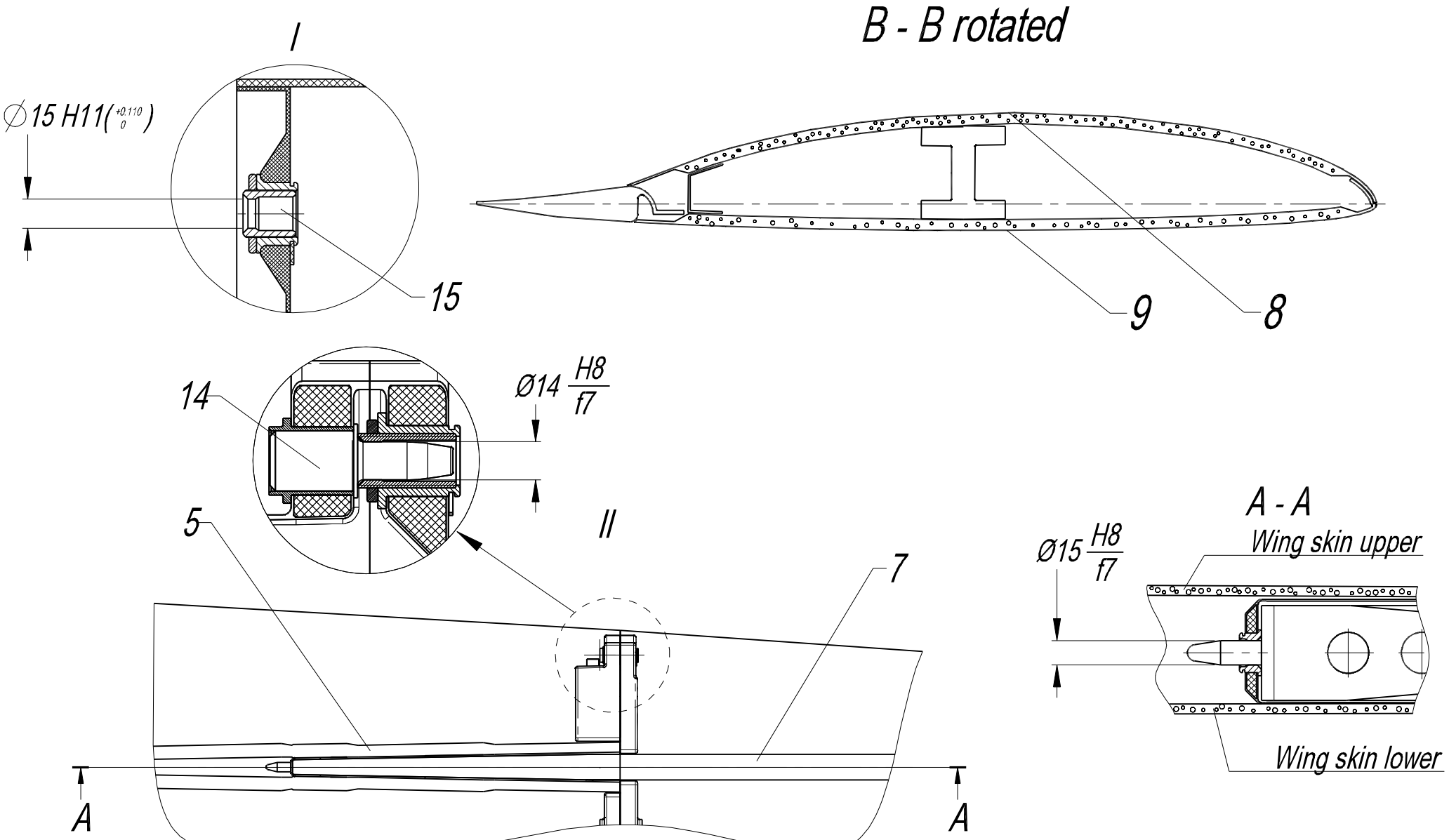
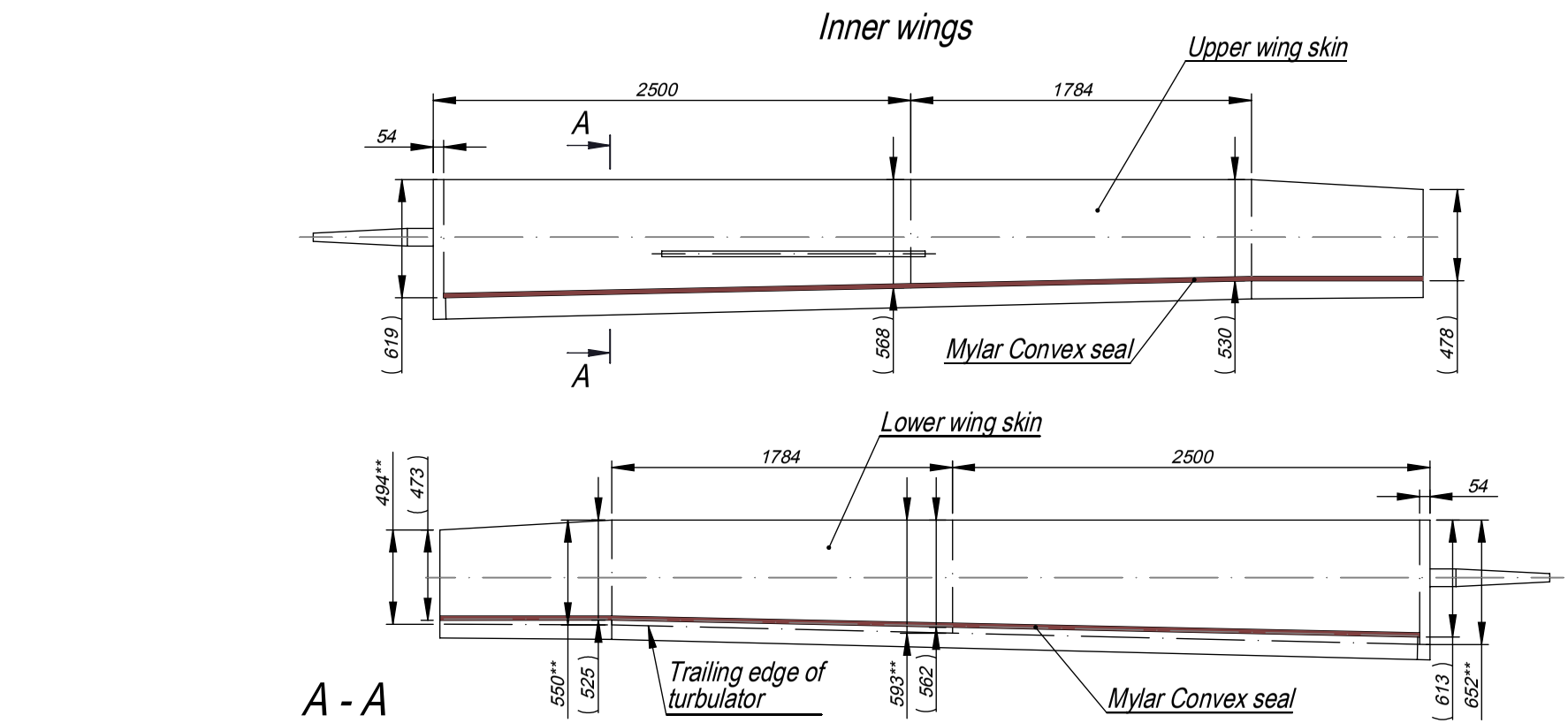
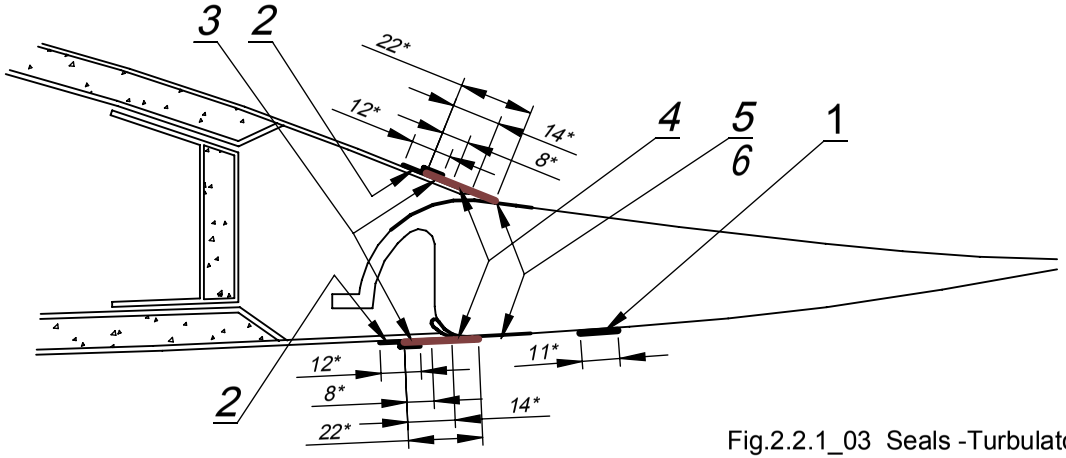


Fig. 2.2.1_02. Wing





1. 3D Turbulator tape 6/0.5/60° (total length 21.7m)
2. Anti Peel Adh. Tape 12mm (total length 41.4m)
3. Transfer Tape - 9mm (total length 41.4m)
4. Mylar Convex seal 22mm (total length 41.4m)
5. Sealing tape adhesive 35mm (total length 27.8m) for inner wings and 15m outer wings
6. Sealing tape adhesive 30mm (total length 13.6m) only for 18m outer wings

( ) dimensions to the trailing edge of sealing
*** dimensions to the trailing edge of turbulator*

Fig.2.2.1_03 Seals -Turbulator scheme

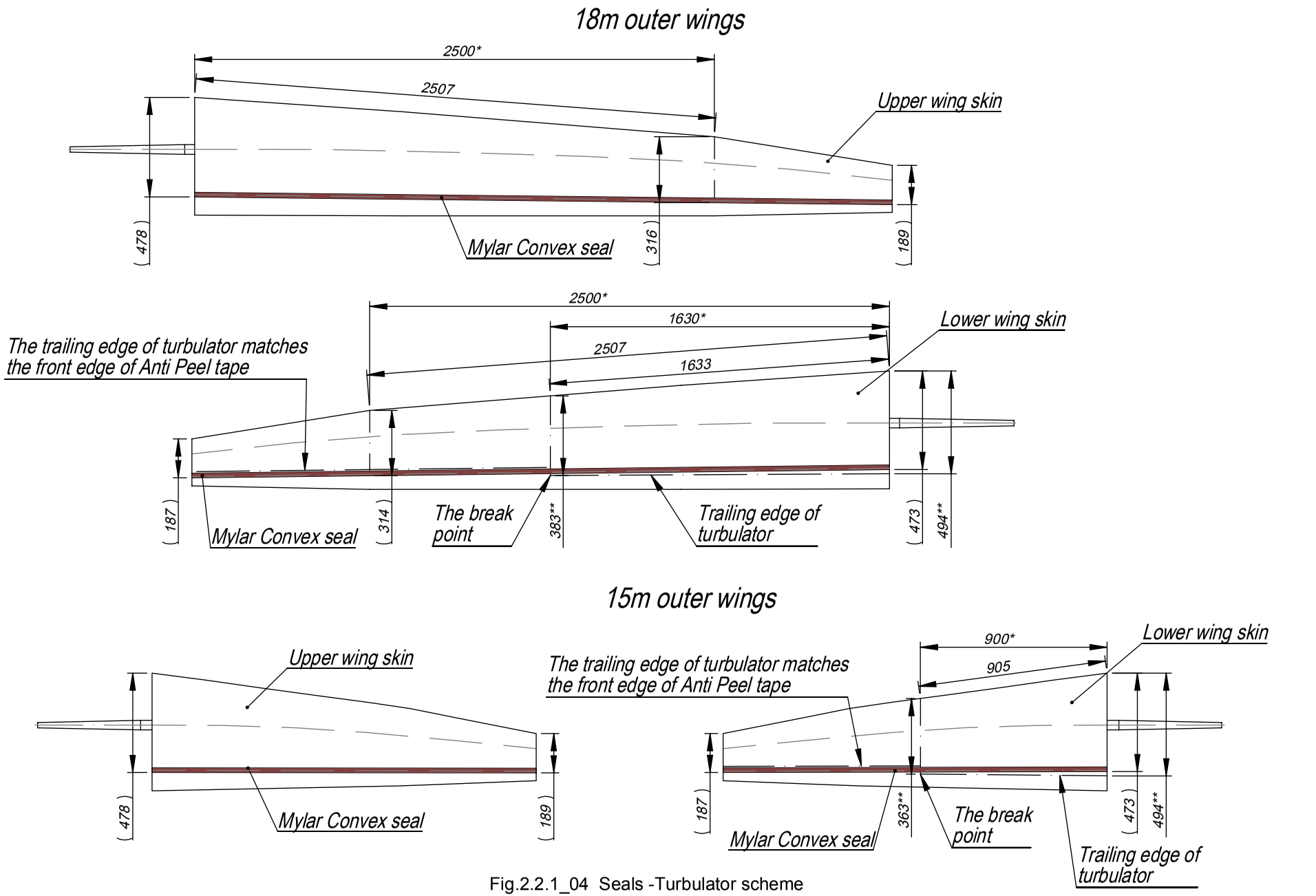
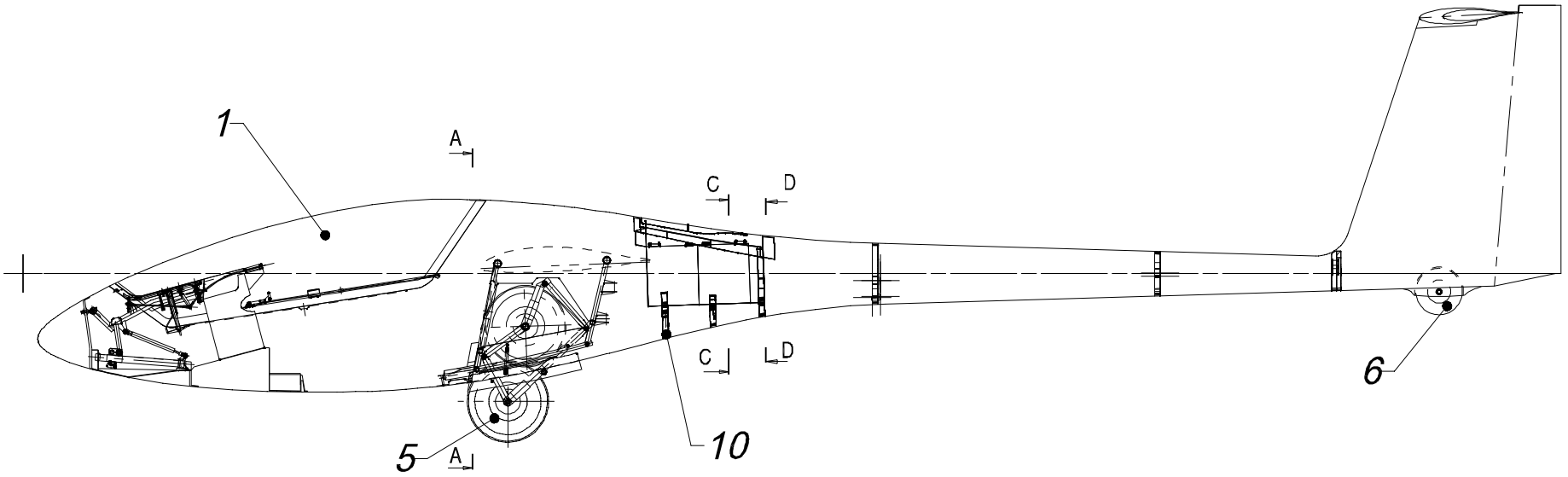
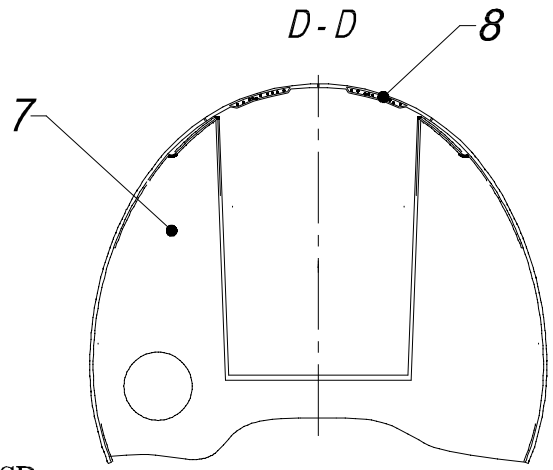
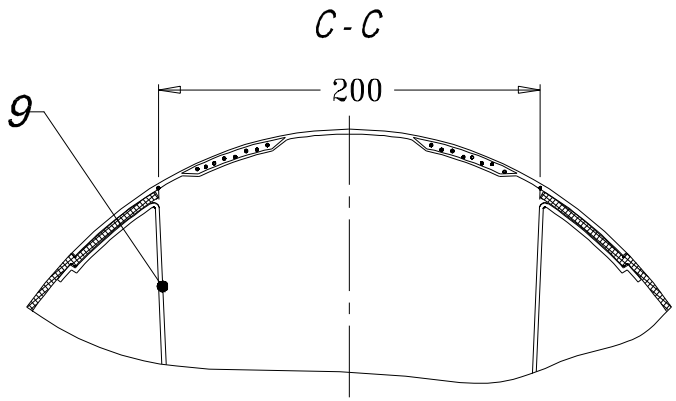


Fig.2.2.1_04 Seals -Turbulator scheme







1. Canopy LAK-17 02 00 00 00 SB
2. Right skin half LAK-17 01 00 01 00 SB
3. Left skin half LAK-17 01 00 02 00 SB
4. Girder structure LAK-17B 10 01 00 00 SB
5. Main gear wheel
6. Tail wheel
7. Bulkhead
8. Battery compartment cover
9. Battery box

Fig. 2.2.2_01. Fuselage

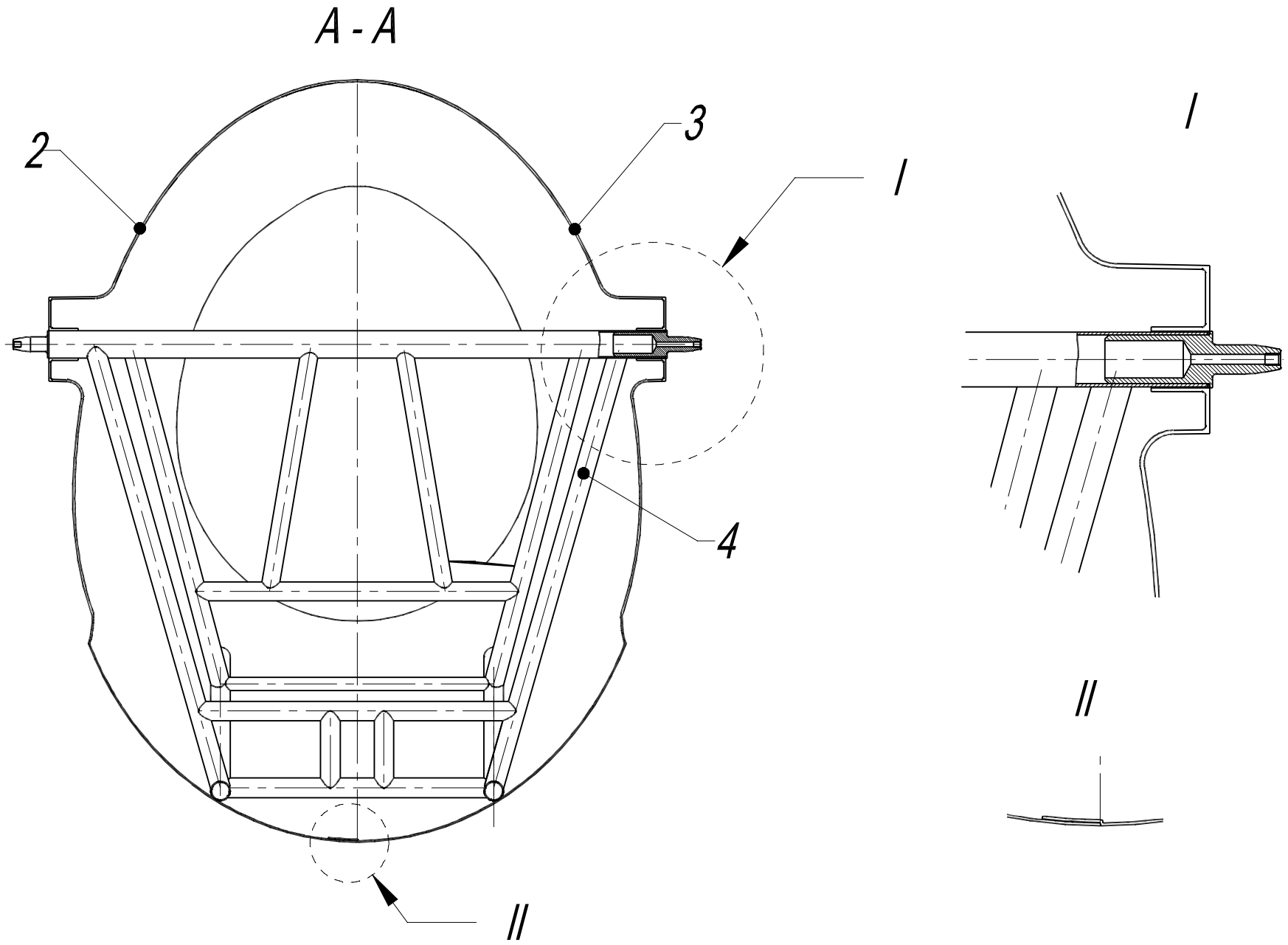
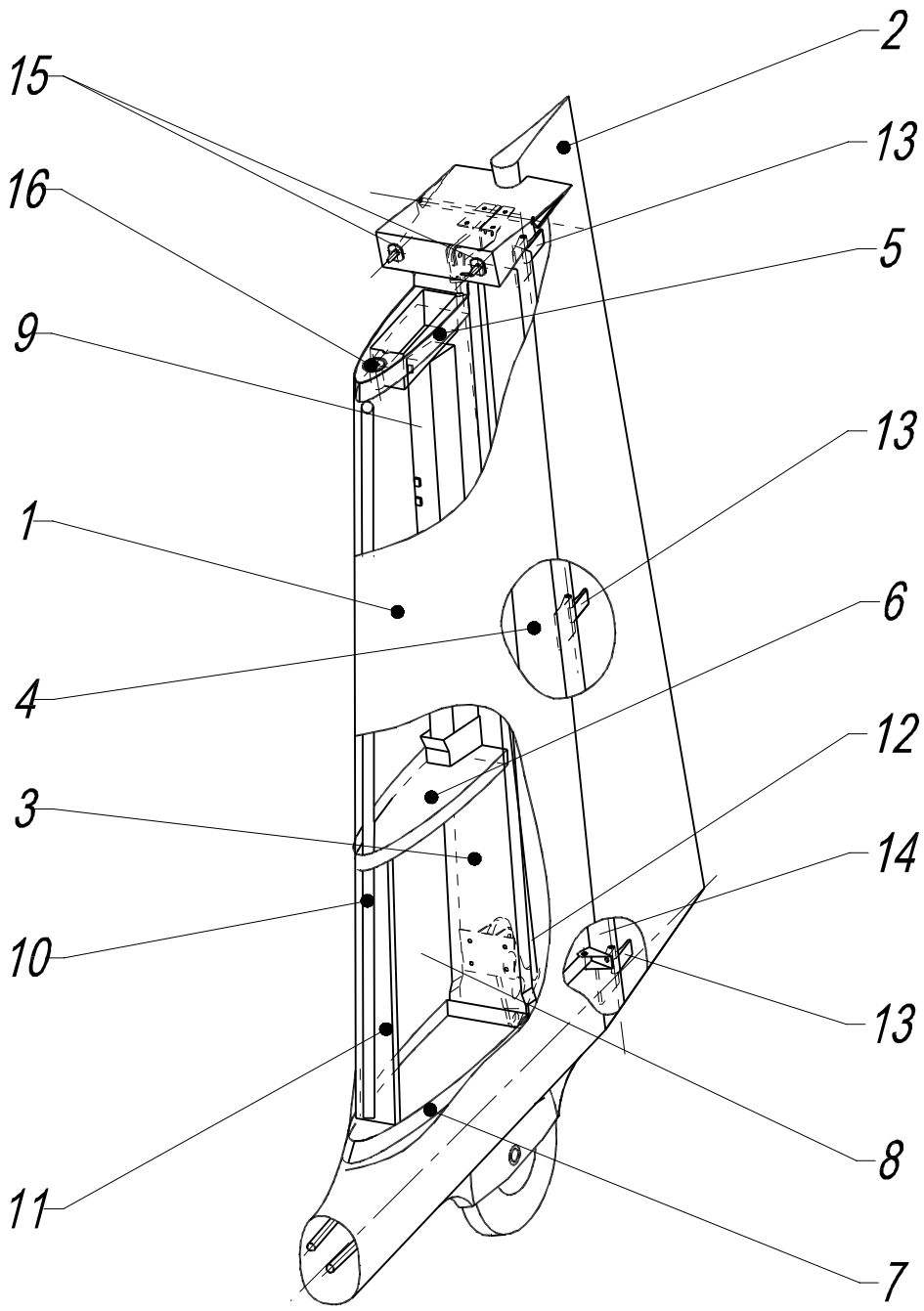
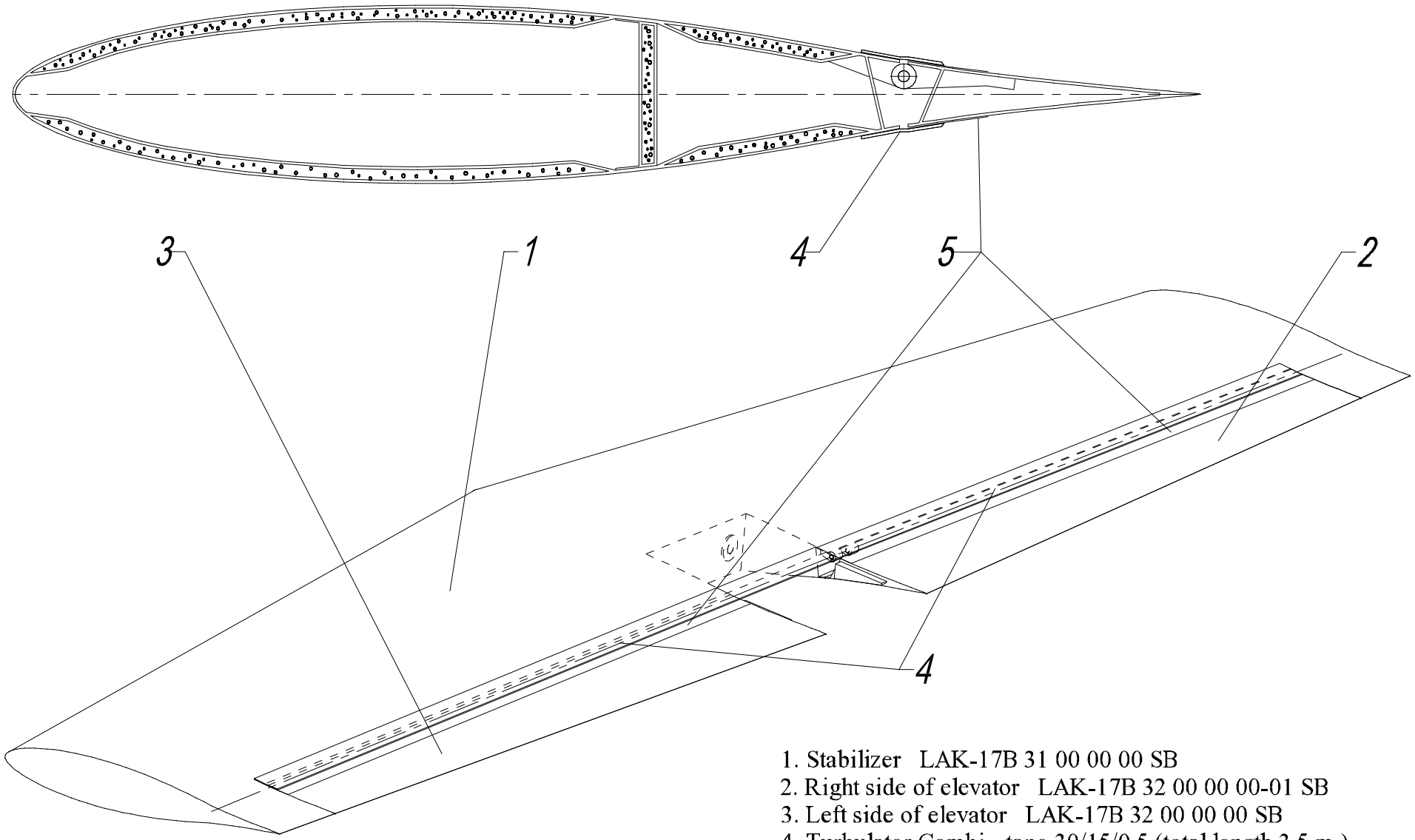


Fig. 2.2.2_02. Fuselage



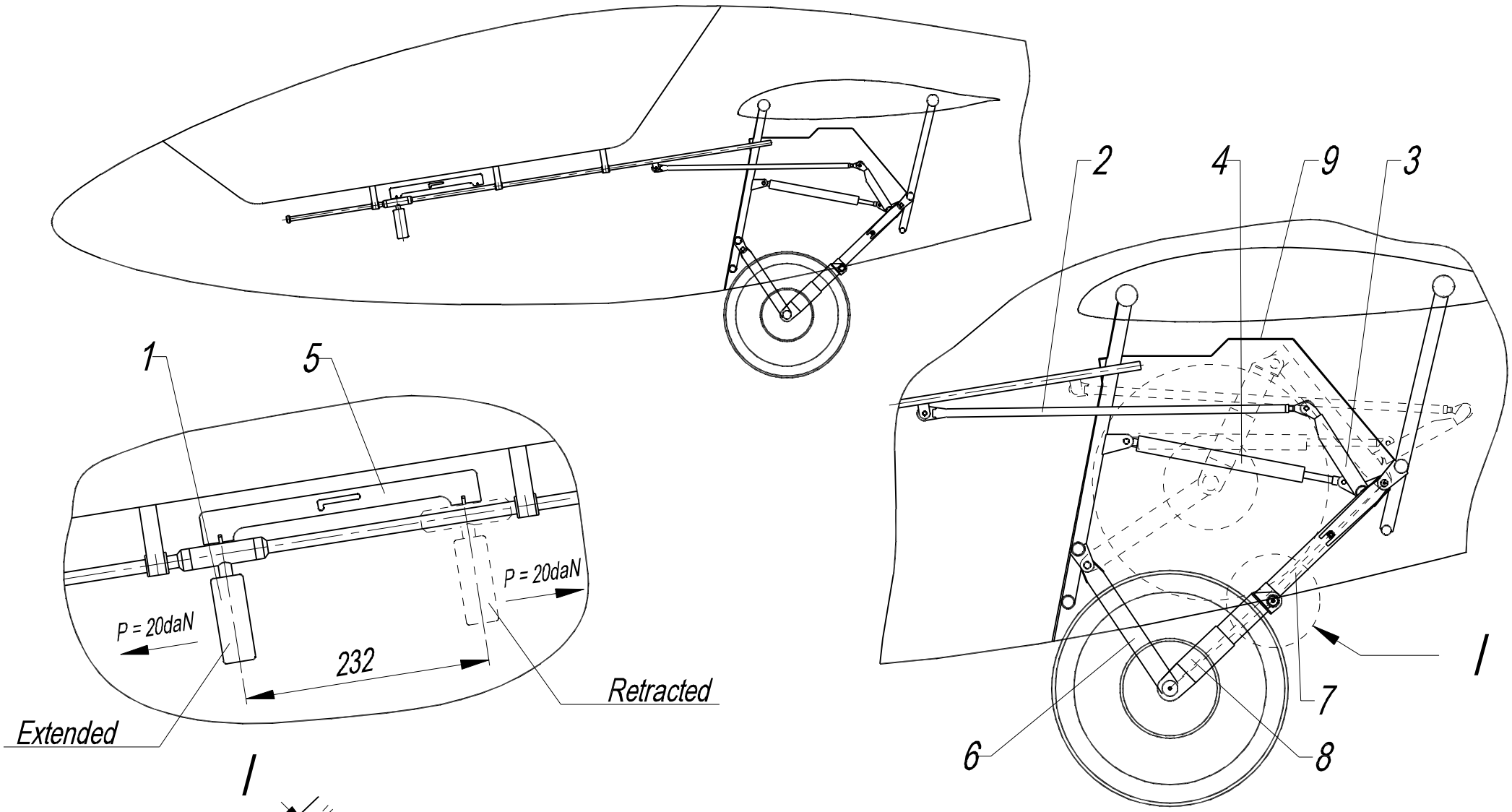
1. Fin LAK-17A 01 00 00 00 SB
2. Rudder LAK-17B 33 00 00 00 SB
3. Spar of fin LAK-17 00 02 02 00 SB
4. Rear wall
5. Upper rib LAK-17B 00 02 06 02
6. Middle rib LAK-17A 00 02 00 11
7. Lower rib LAK-17A 00 02 08 00 SB
8. Water ballast tank
9. Battery container
10. Radio aerial
11. Wall LAK-17A 00 02 00 07
12. Elevator control rod LAK-17 53 01 04 00 SB
13. Rudder hinges LAK-17 01 04 00 50 SB
14. Rudder wall LAK-17B 33 10 00 30 SB
15. Connection pins of stabilizer LAK-17 00 02 00 02
16. Stabilizer fixing hub LAK-17B 31 02 00 00 SB

Fig. 2.2.3_01. Vertical plane



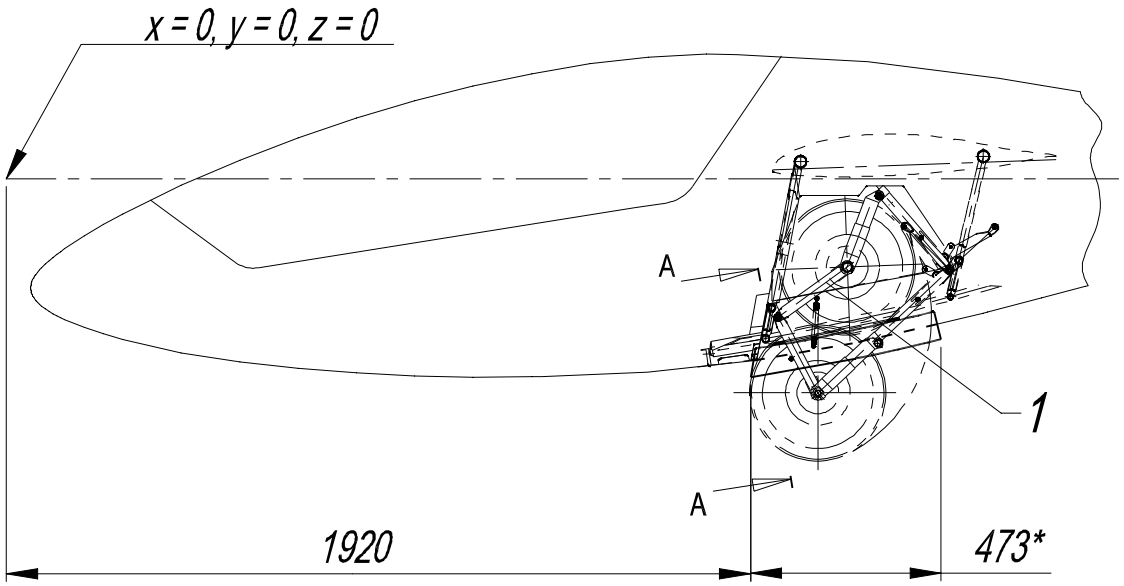
1. Stabilizer LAK-17B 31 00 00 00 SB
2. Right side of elevator LAK-17B 32 00 00 00-01 SB
3. Left side of elevator LAK-17B 32 00 00 00 SB
4. Turbulator Combi - tape 30/15/0.5 (total length 3.5 m.)
5. Teflon tape 30, adhesive (total length 3.5 m.)

Fig. 2.2.4_01. Horizontal plane



1. Control rod LAK-17A 59 01 10 00 SB
2. Intermediate rod LAK-17 55 01 05 00-01 SB
3. Bellcrank LAK-17A 41 01 00 00 SB
4. Gas spring
5. Plate LAK-17 59 01 40 00 SB
6. Stand LAK-17 41 03 00 00 SB
7. Stand LAK-17A 41 02 00 00 SB
8. Shock absorber LAK-17 41 04 00 00 SB
9. Hood

Fig. 2.2.5_01. Landing gear control



1. Strut LAK-17 41 03 00 00 SB
2. Door LAK-17A 48 01 00 00 SB
3. Spring LAK-17A 48 00 00 02
4. Bracket LAK-17A 48 01 00 03

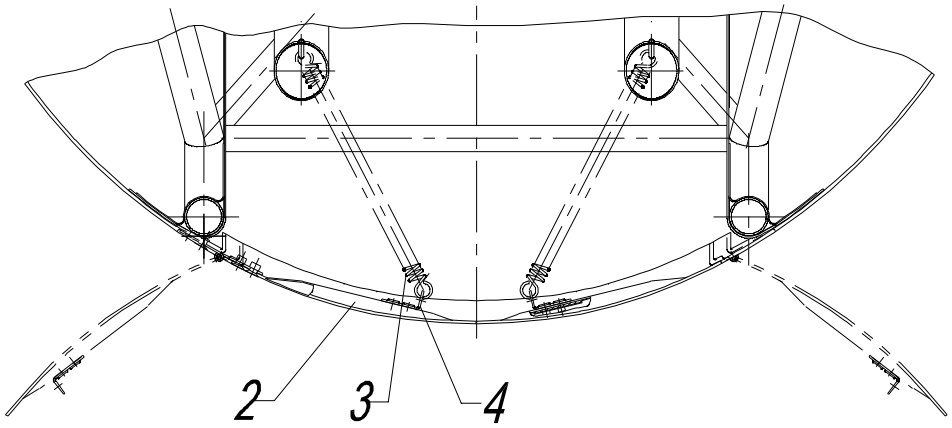
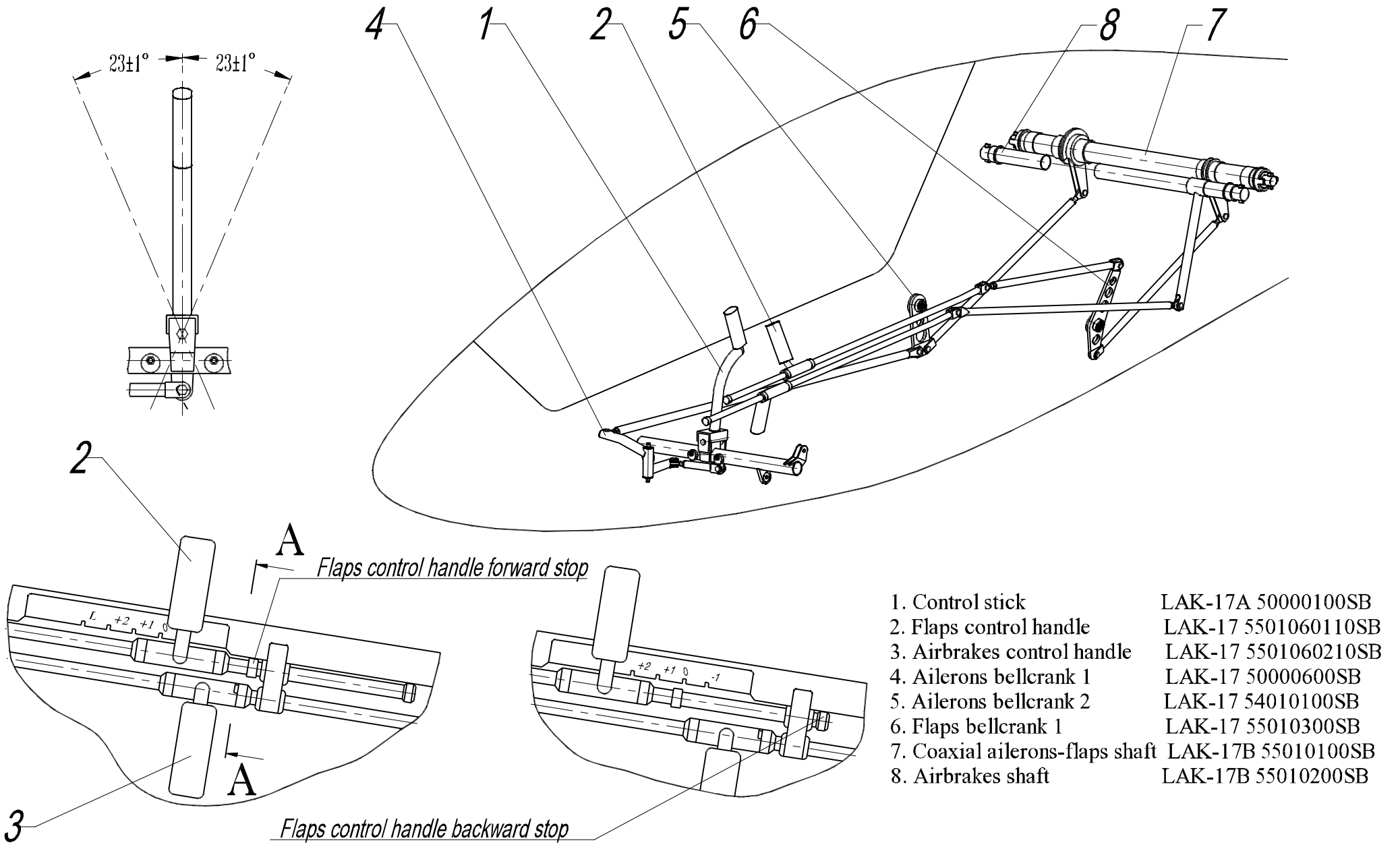


Fig. 2.2.5_02. Landing gear door



1. Control stick	LAK-17A 50000100SB
2. Flaps control handle	LAK-17 5501060110SB
3. Airbrakes control handle	LAK-17 5501060210SB
4. Ailerons bellcrank 1	LAK-17 50000600SB
5. Ailerons bellcrank 2	LAK-17 54010100SB
6. Flaps bellcrank 1	LAK-17 55010300SB
7. Coaxial ailerons-flaps shaft	LAK-17B 55010100SB
8. Airbrakes shaft	LAK-17B 55010200SB

Fig. 2.3.1_01. Control system of ailerons, flaps and airbrakes

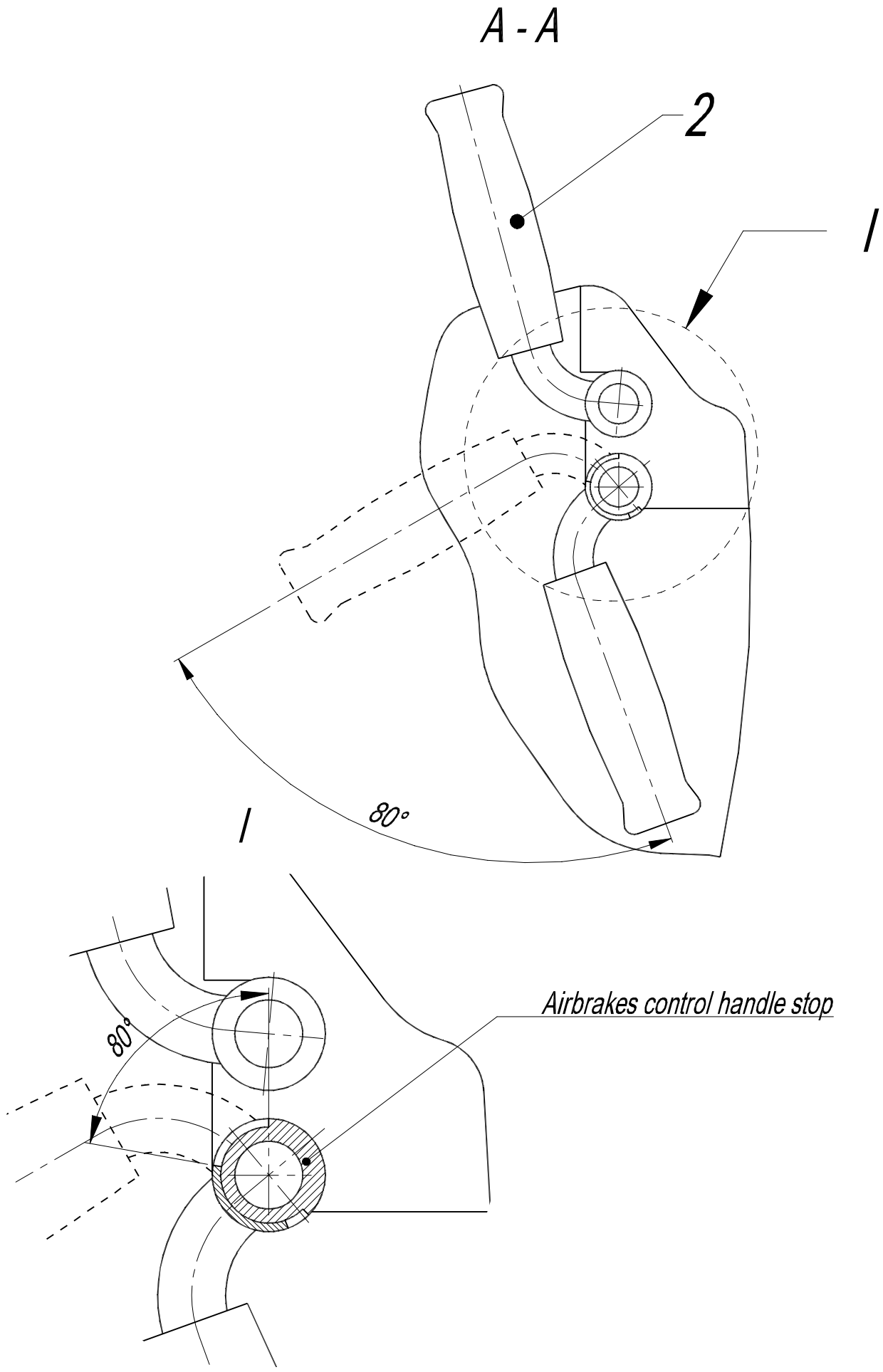
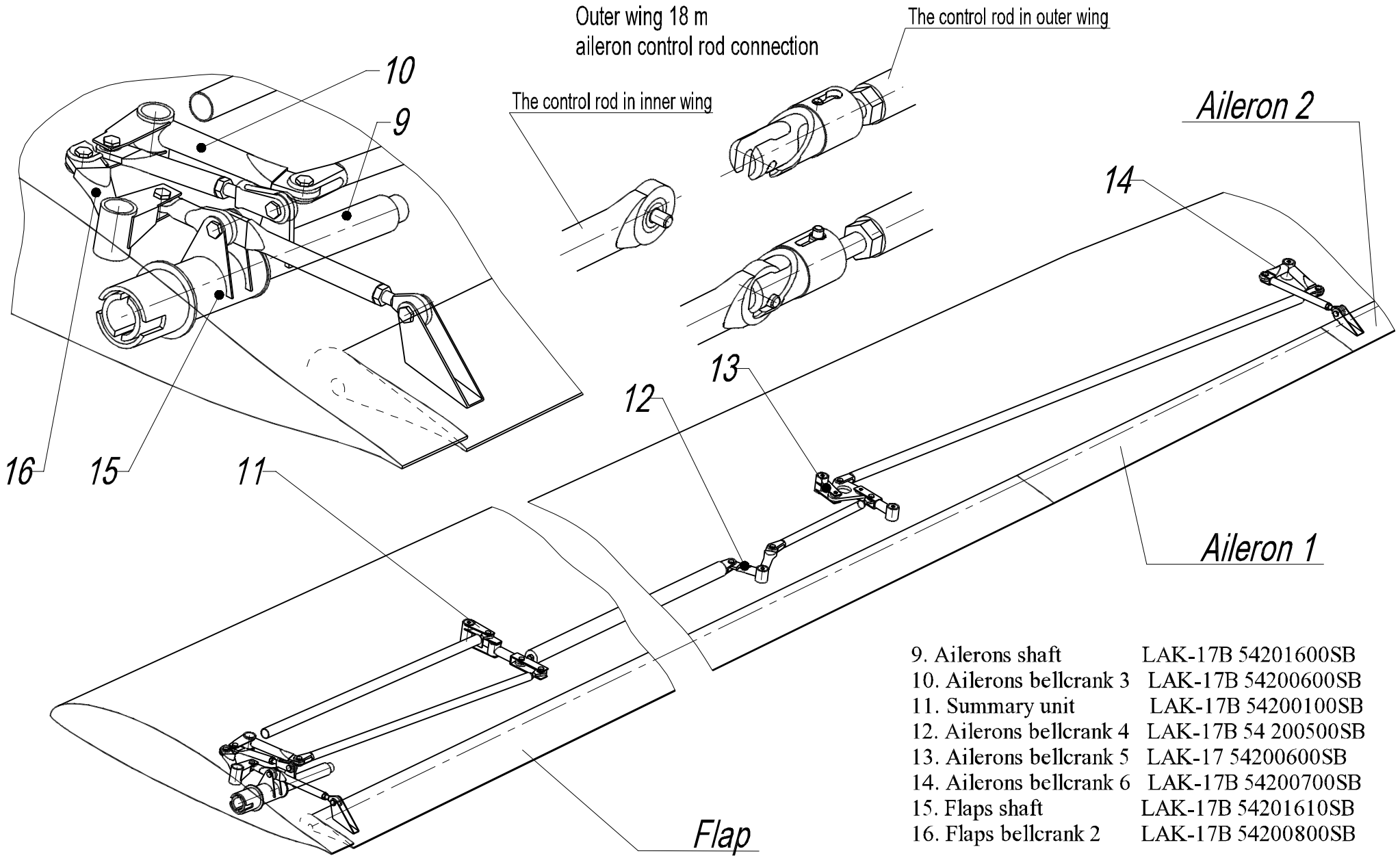
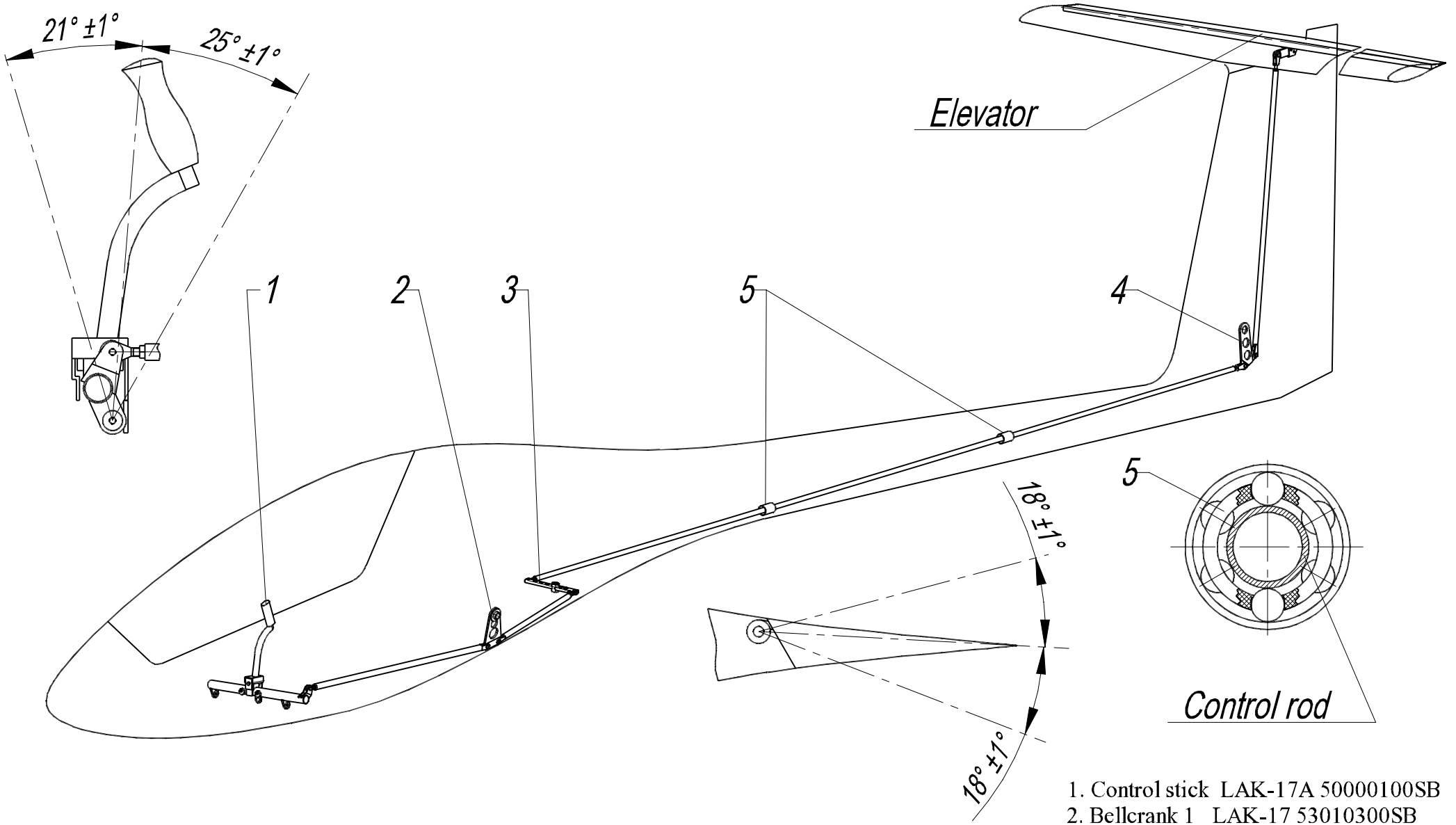


Fig. 2.3.1_02. Control system of ailerons, flaps and airbrakes



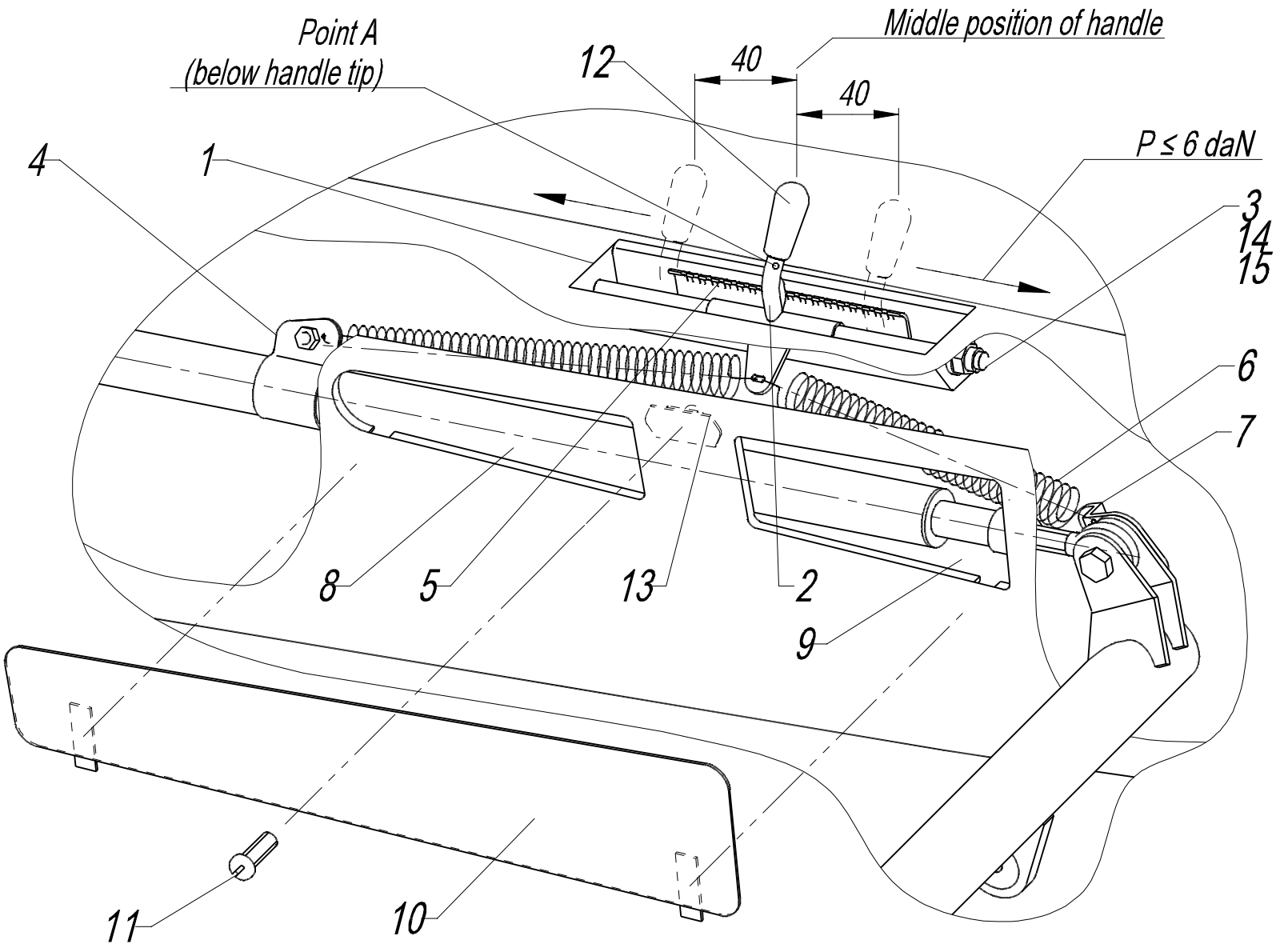
9. Ailerons shaft LAK-17B 54201600SB
10. Ailerons bellcrank 3 LAK-17B 54200600SB
11. Summary unit LAK-17B 54200100SB
12. Ailerons bellcrank 4 LAK-17B 54 200500SB
13. Ailerons bellcrank 5 LAK-17 54200600SB
14. Ailerons bellcrank 6 LAK-17B 54200700SB
15. Flaps shaft LAK-17B 54201610SB
16. Flaps bellcrank 2 LAK-17B 54200800SB

Fig. 2.3.1_03. Control system of ailerons, flaps and airbrakes



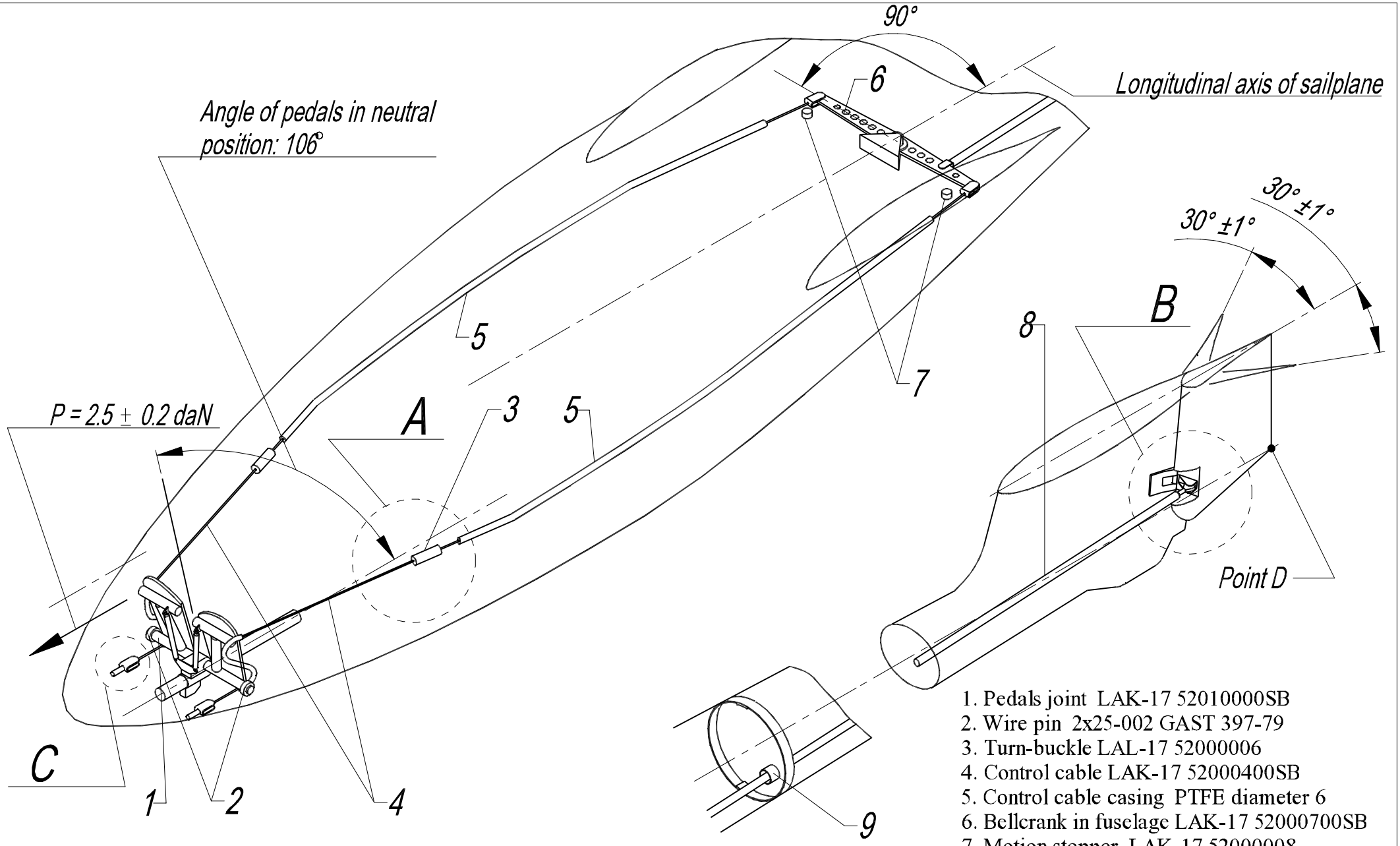
1. Control stick LAK-17A 50000100SB
2. Bellcrank 1 LAK-17 53010300SB
3. Bellcrank 2 LAK-17A 53010100SB
4. Bellcrank 3 LAK-17 53010200SB
5. Guide LAK-17A 53010900SB

Fig. 2.3.2_01. Elevator control



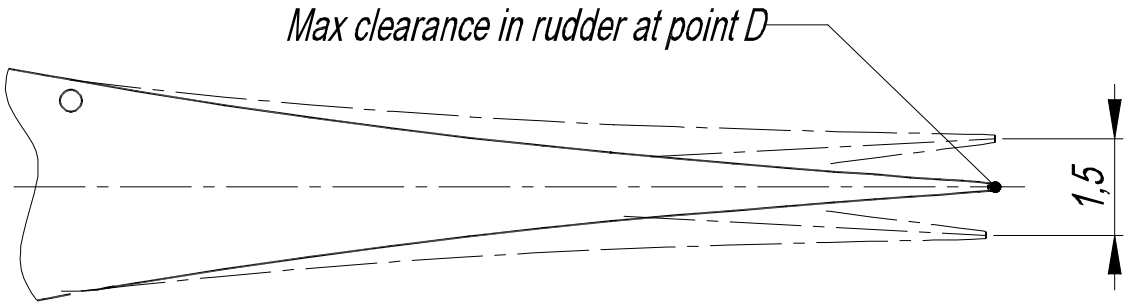
1. Trimmer box
2. Handle
   LAK-17A 64 01 01 00 SB
3. Bar LAK-17 64 01 00 01
4. Ring LAK-17A 64 01 00 03
5. Fixing plate G-01 64 01 00 05
6. Spring LAK-17B 64 01 00 02
7. Plate of shaft
   LAK-17A 50 00 02 12
8. Rear hatch
9. Front hatch
10. Cover
11. Screw M4
12. Tip LAk-17 64 01 00 06
13. Anchornut M4
14. Nut 3373A-6
15. Washer 3405A-1-6-10

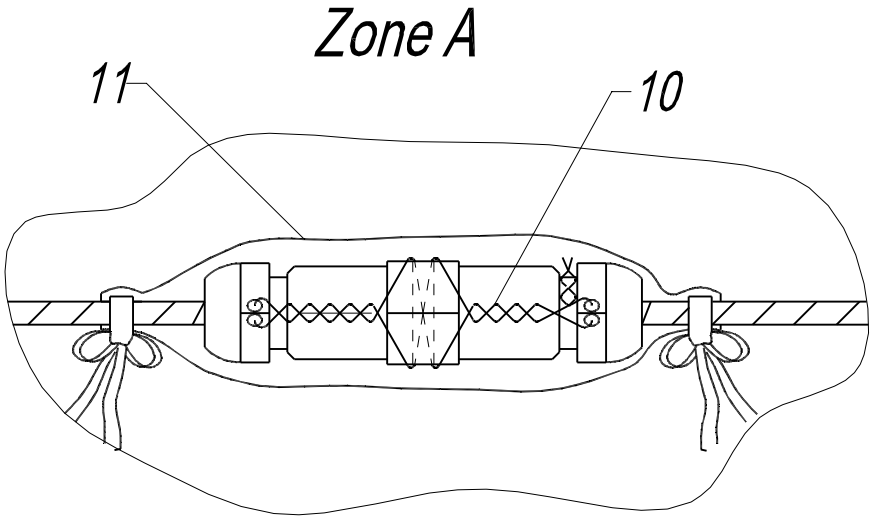
Fig. 2.3.3_01. Trimmer control

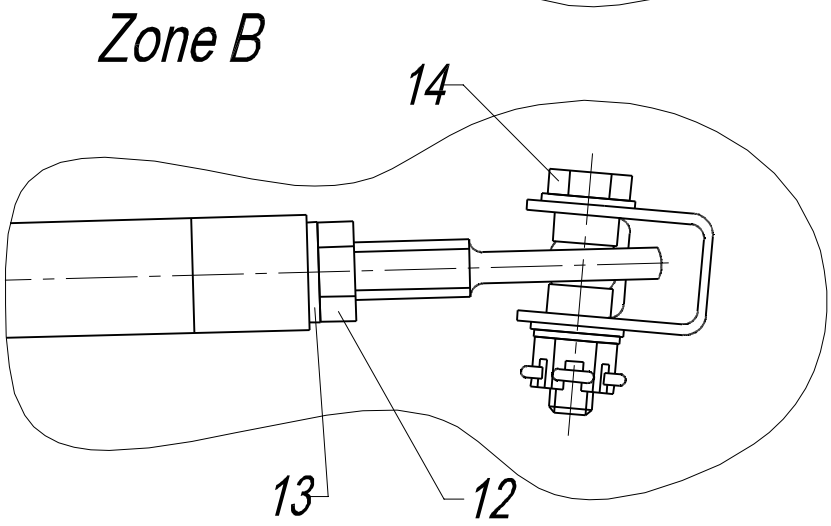


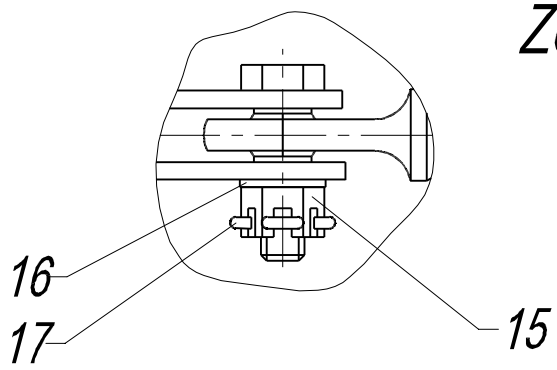
1. Pedals joint LAK-17 52010000SB
2. Wire pin 2x25-002 GAST 397-79
3. Turn-buckle LAL-17 52000006
4. Control cable LAK-17 52000400SB
5. Control cable casing PTFE diameter 6
6. Bellcrank in fuselage LAK-17 52000700SB
7. Motion stopper LAK-17 52000008
8. Control rod LAK-17 52000800SB
9. Guide LAK-17A53010900SB

Fig. 2.3.4_01. Rudder control









10. Lock wire KO 1,0 GOST 792-67
11. Turn-buckle casing
12. Nut 3310A-M8
13. Spring washer DIN 6797-8.2
14. Bolt 3027A-6-26-3
15. Crown nut 3346A-6
16. Washer 3405A-1-6-12
17. Wire pin 1,6x14-002 GOST 397-79

Fig. 2.3.4_02. Rudder control

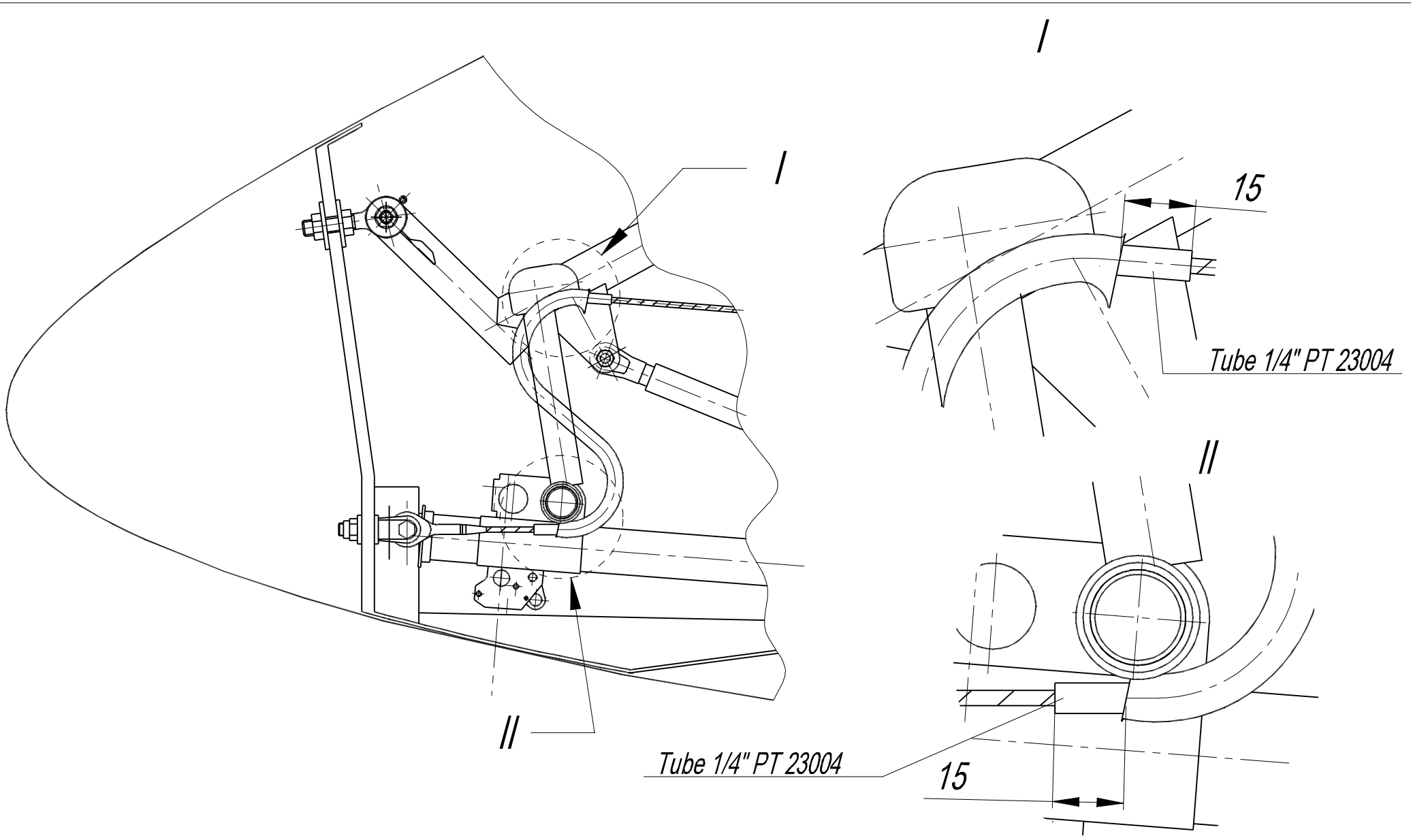
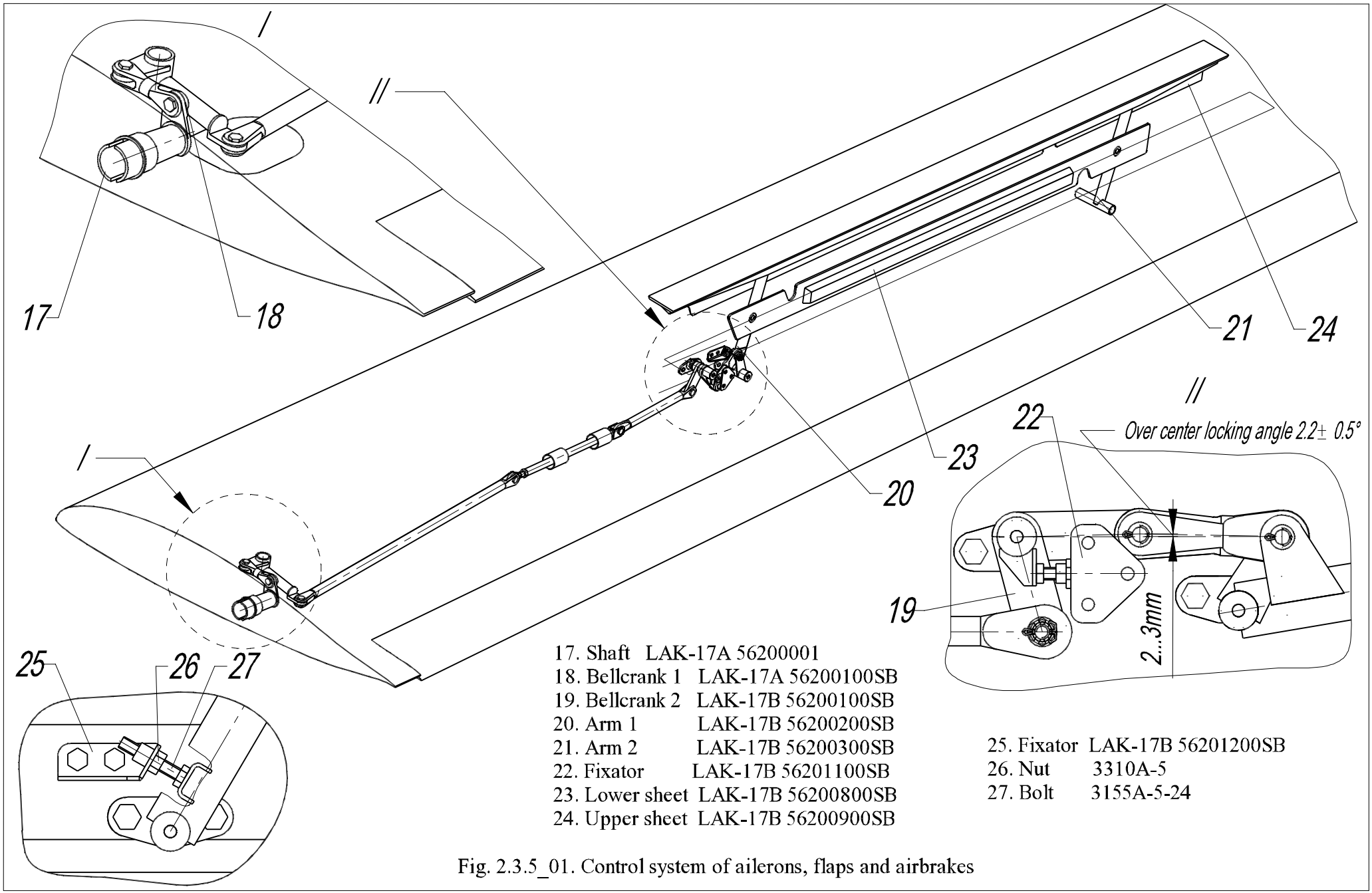


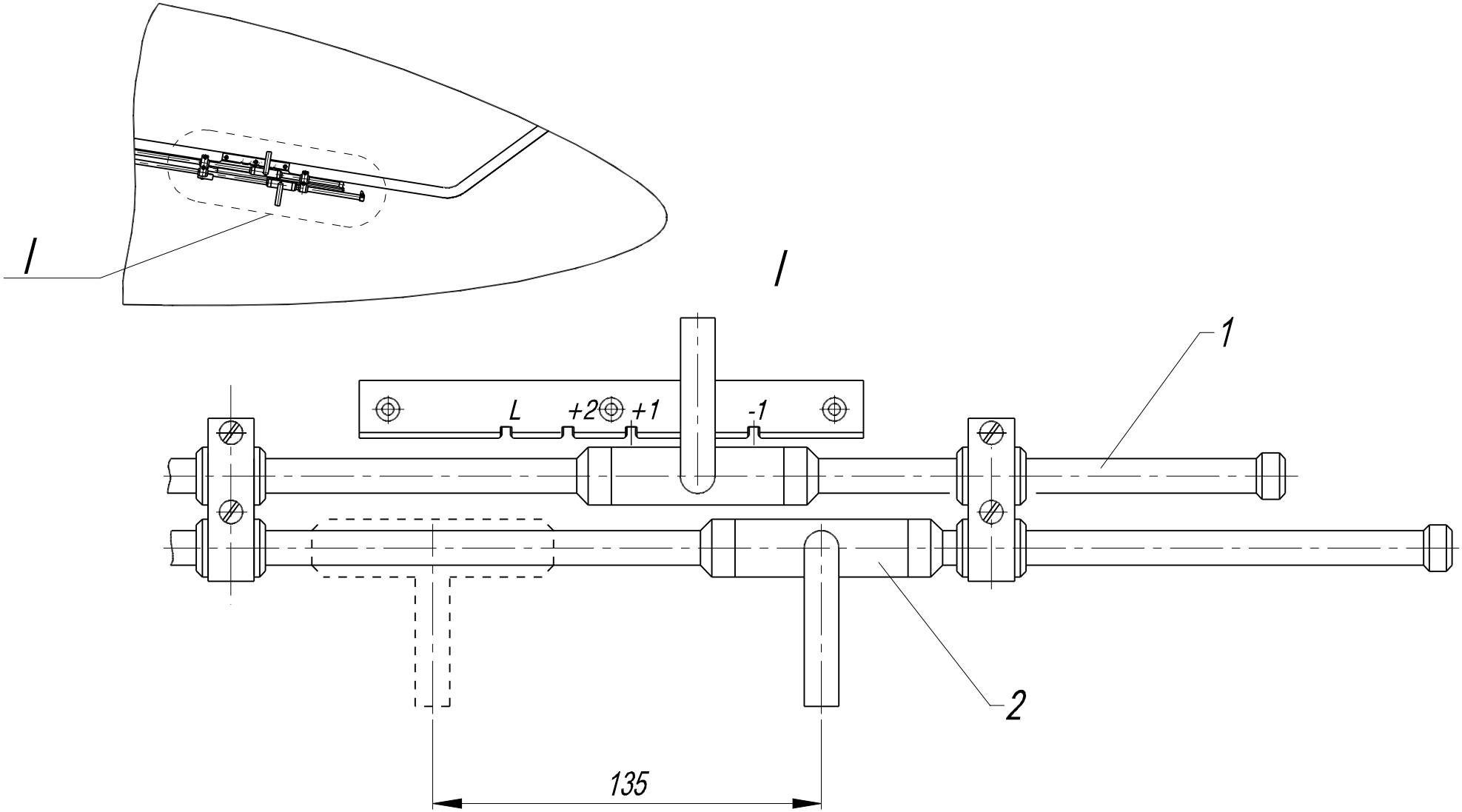
Fig. 2.3.4_03. Rudder control



17. Shaft LAK-17A 56200001
18. Bellcrank 1 LAK-17A 56200100SB
19. Bellcrank 2 LAK-17B 56200100SB
20. Arm 1 LAK-17B 56200200SB
21. Arm 2 LAK-17B 56200300SB
22. Fixator LAK-17B 56201100SB
23. Lower sheet LAK-17B 56200800SB
24. Upper sheet LAK-17B 56200900SB

25. Fixator LAK-17B 56201200SB
26. Nut 3310A-5
27. Bolt 3155A-5-24

Fig. 2.3.5_01. Control system of ailerons, flaps and airbrakes



1. Flaps control rod LAK-17 5501060100SB
2. Airbrakes control rod LAK-17A 5501060200SB

Fig. 2.3.5_02. Airbrakes control system

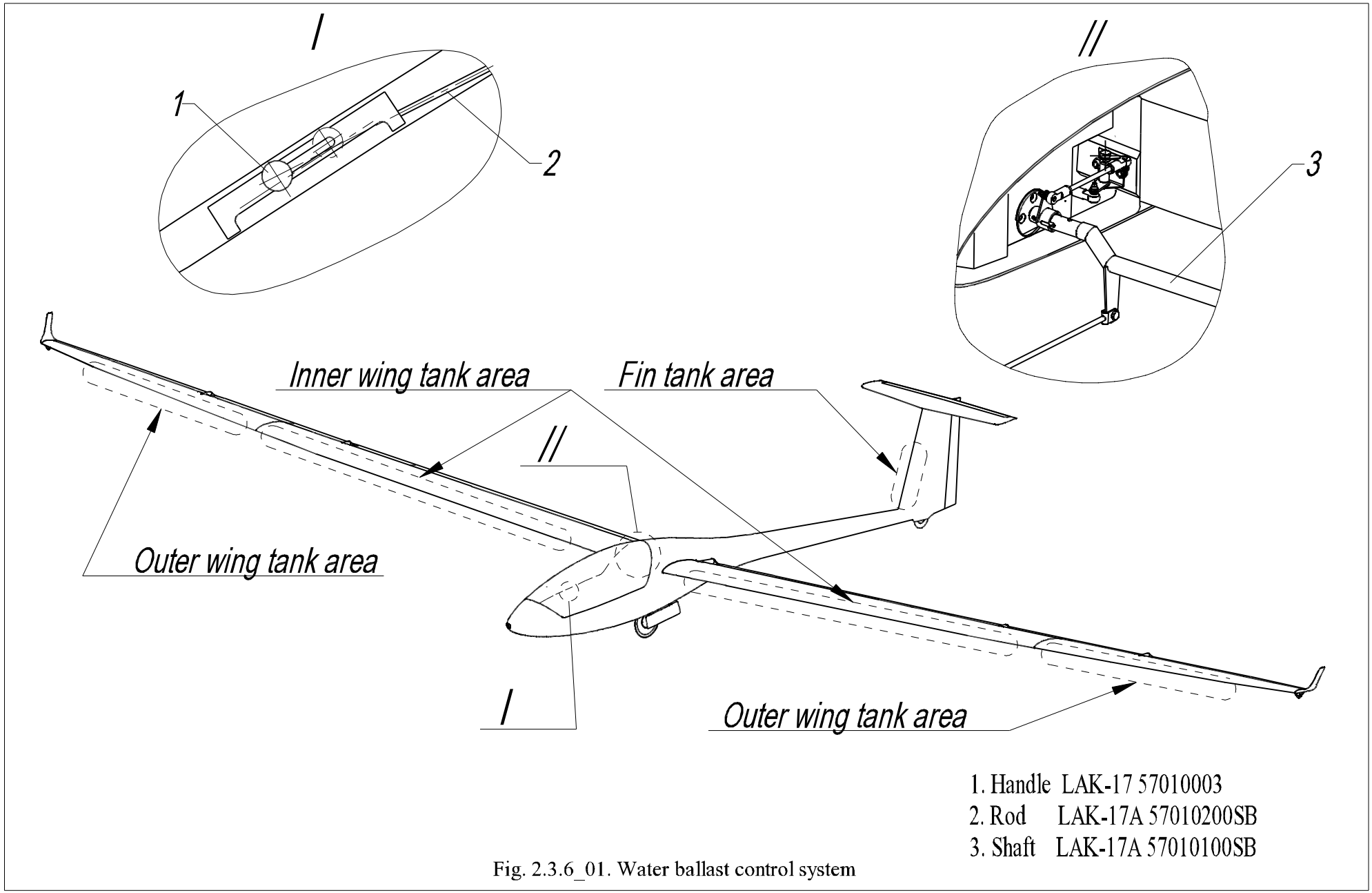


Fig. 2.3.6_01. Water ballast control system

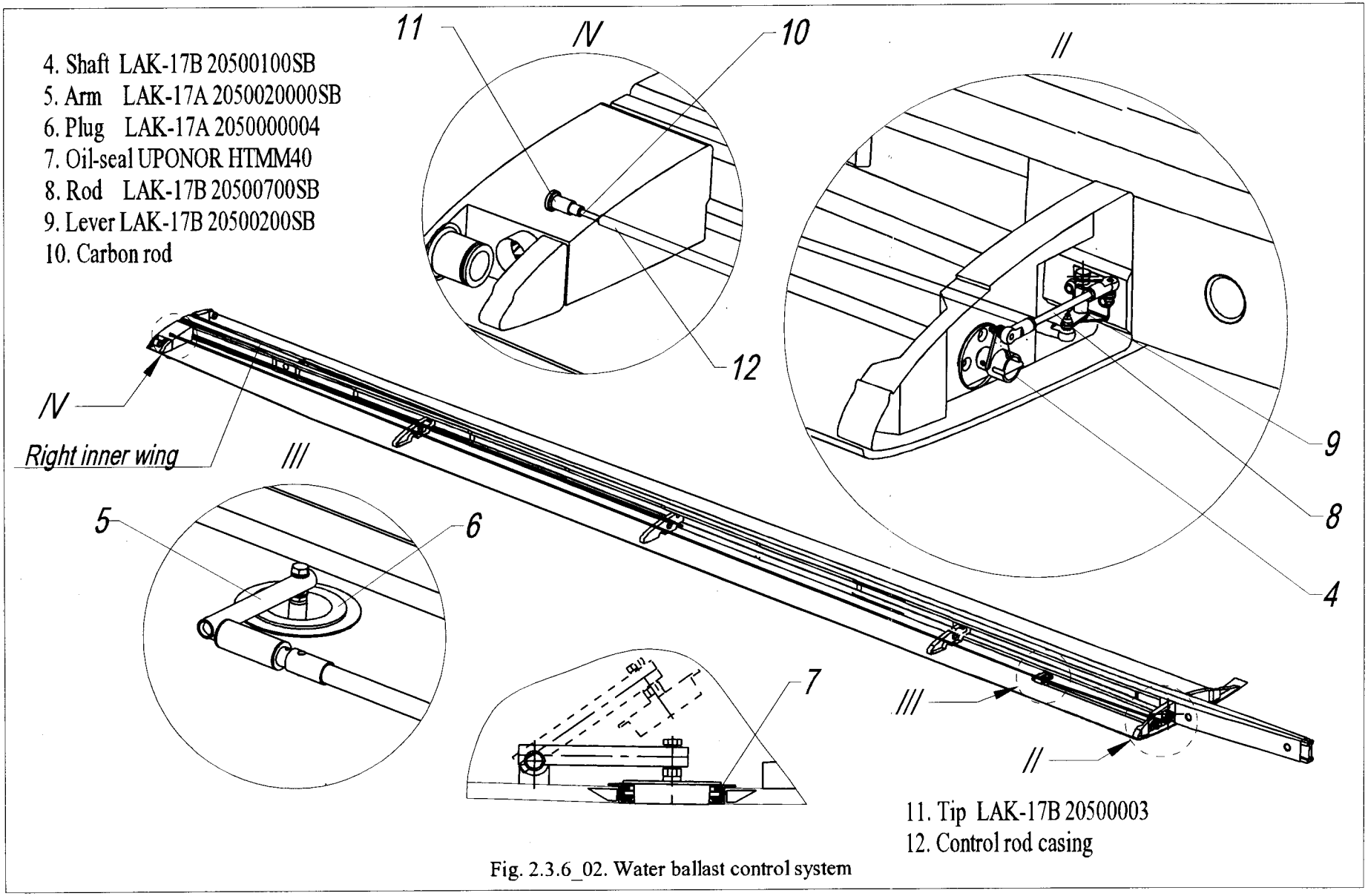
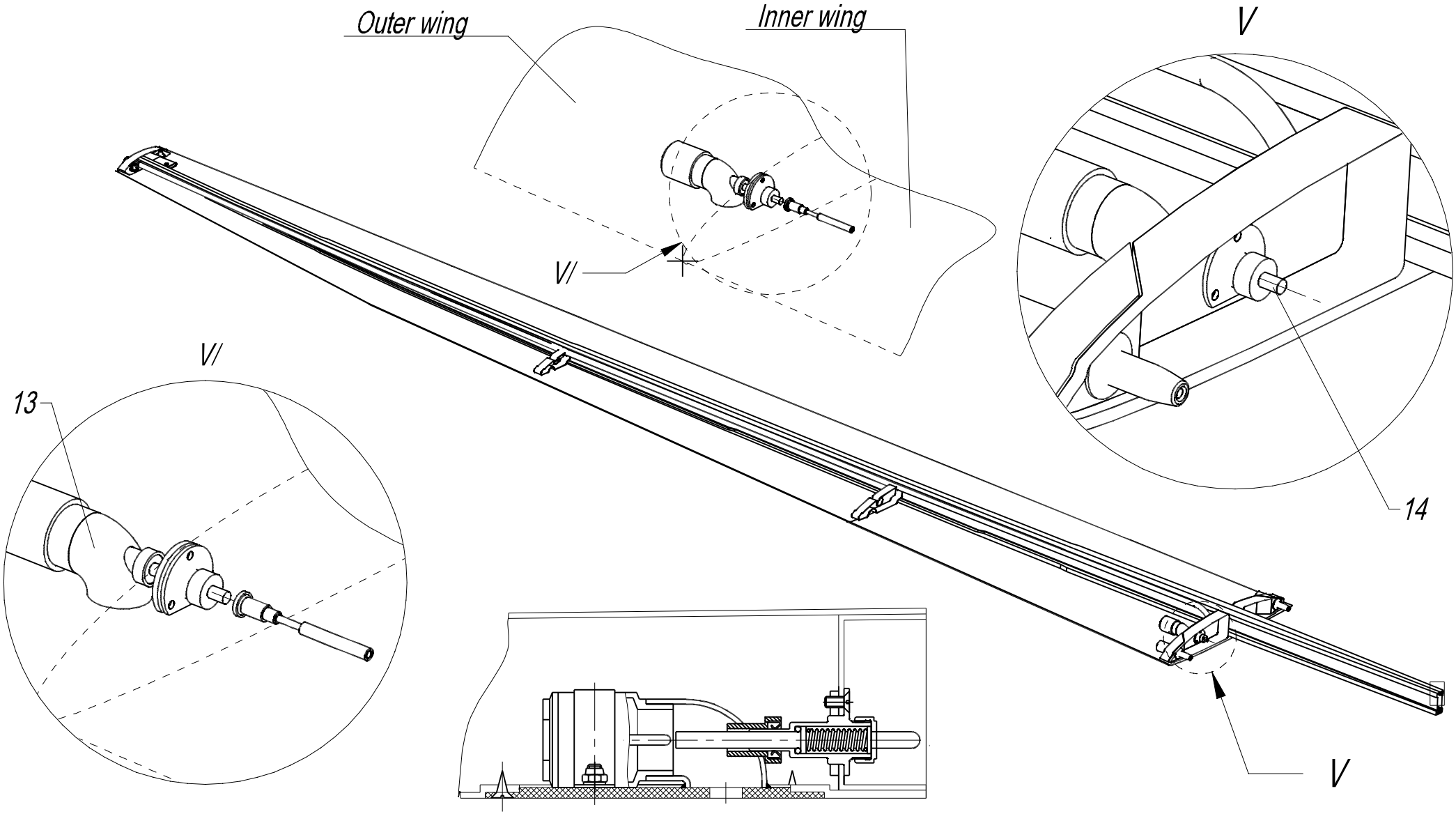


Fig. 2.3.6_02. Water ballast control system



13. Valve LAK-17B 20500600SB
14. Valve CONTROL TIP LAK-17B 20500300SB

Fig. 2.3.6_03. Water ballast control system

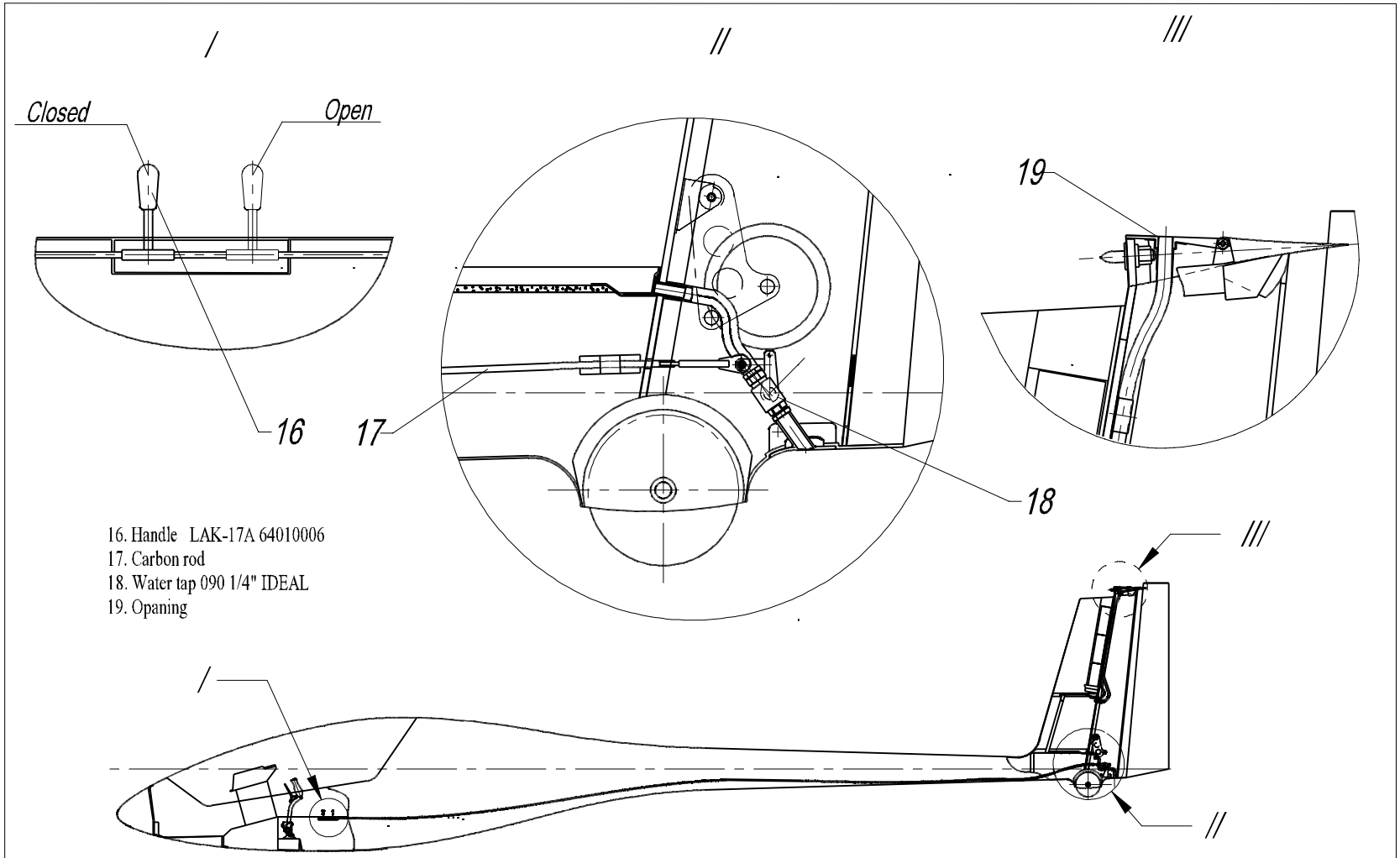


Fig. 2.3.6_04. Water ballast control system (option fin tank)

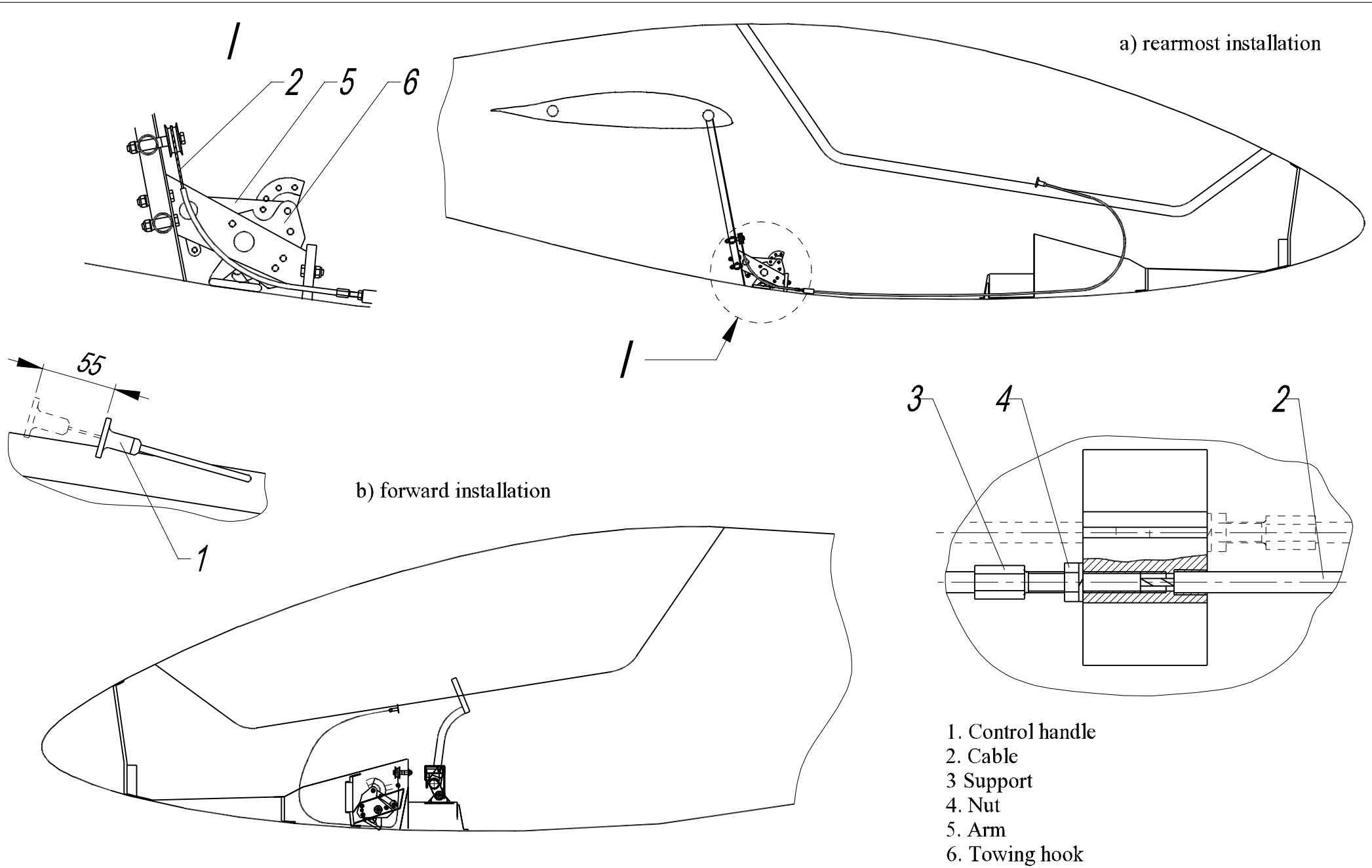


Fig. 2.3.7_01. Towing hook control

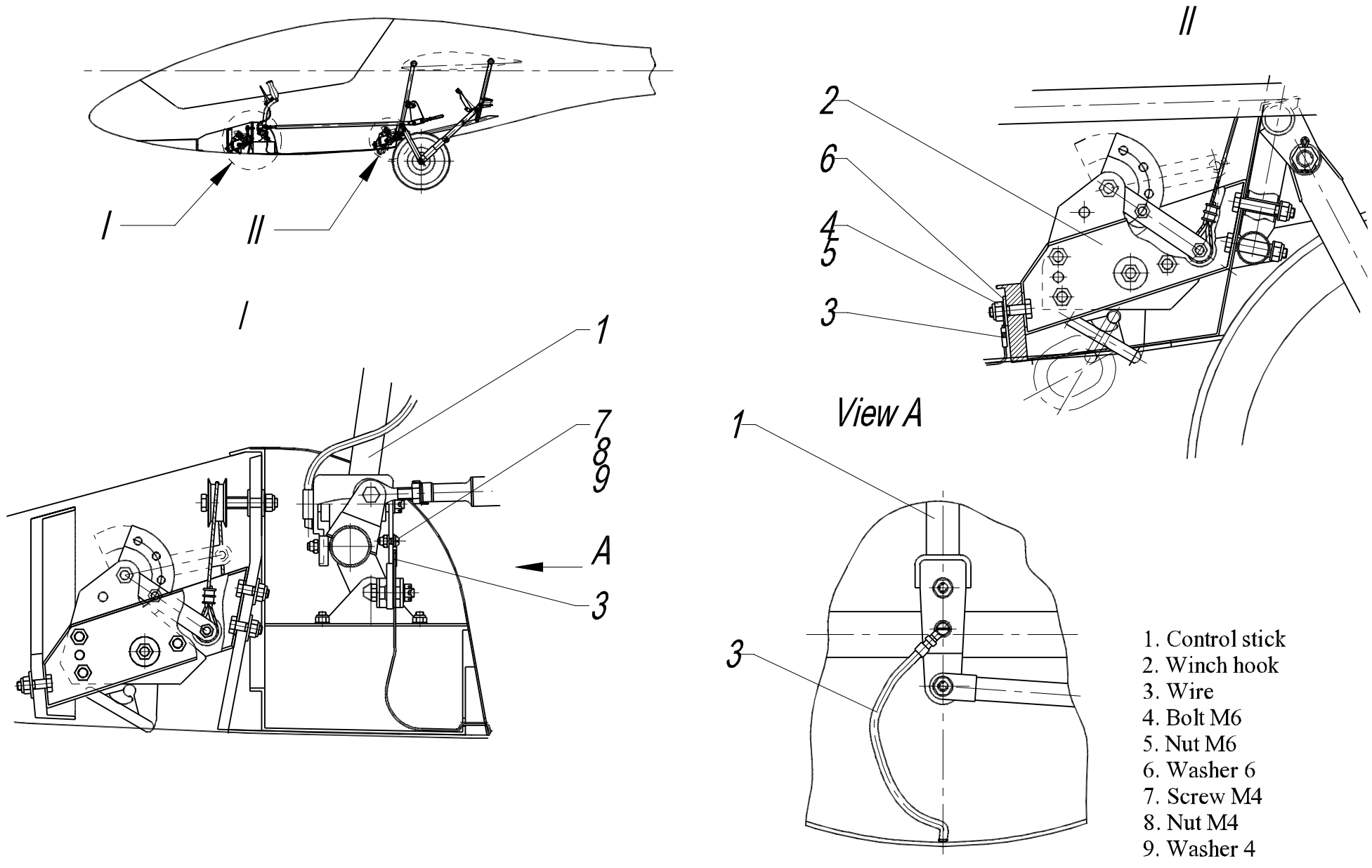
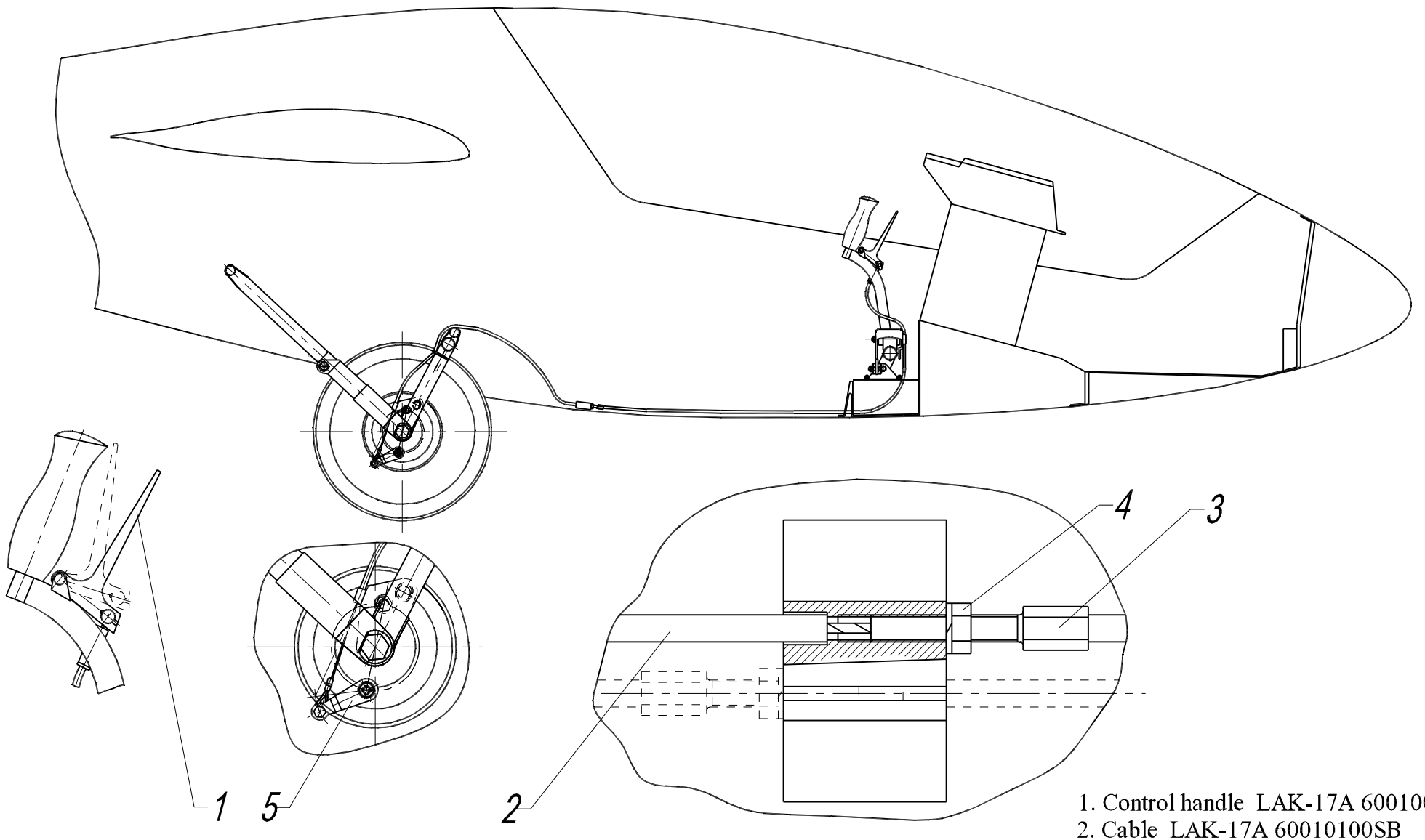


Fig. 2.3.7_02. Towing hook control (electrical bonding)



1. Control handle LAK-17A 60010001
2. Cable LAK-17A 60010100SB
3. Support LAK-17A 58010104
4. Nut 3310A-5
5. Arm

Fig. 2.3.9_01. Landing gear brake control

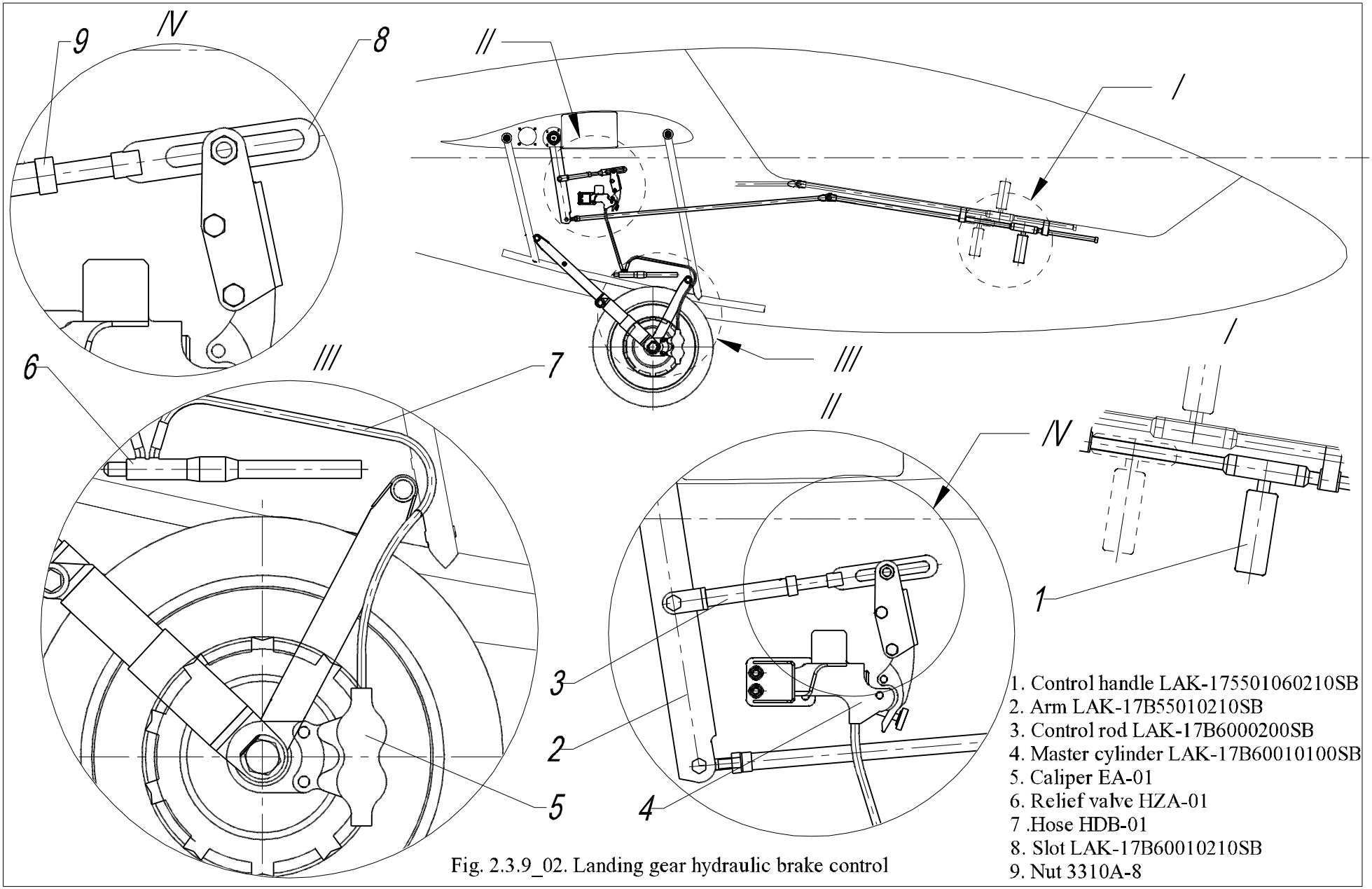
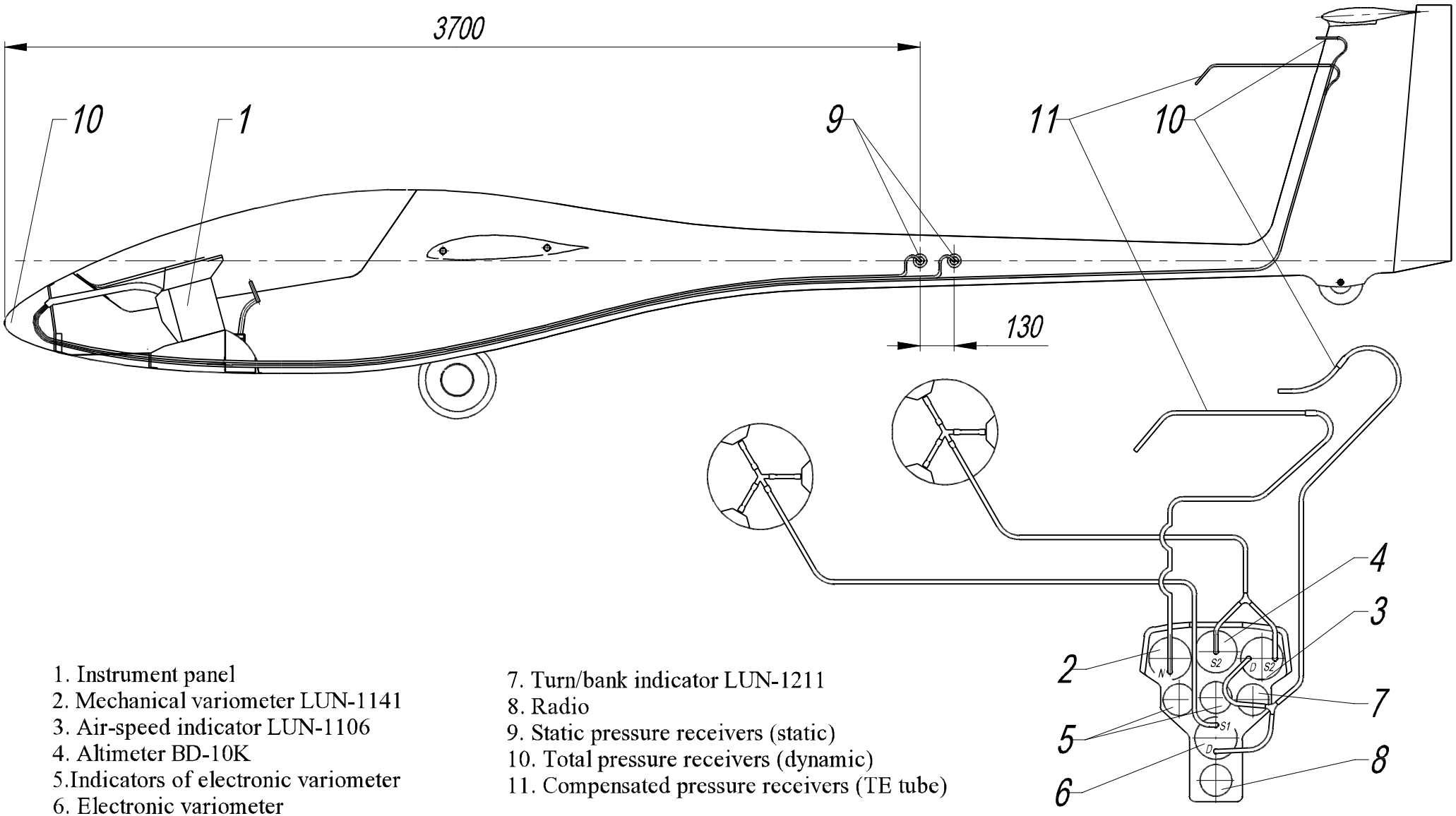


Fig. 2.3.9_02. Landing gear hydraulic brake control

1. Control handle LAK-175501060210SB
2. Arm LAK-17B55010210SB
3. Control rod LAK-17B6000200SB
4. Master cylinder LAK-17B60010100SB
5. Caliper EA-01
6. Relief valve HZA-01
7 .Hose HDB-01
8. Slot LAK-17B60010210SB
9. Nut 3310A-8



1. Instrument panel
2. Mechanical variometer LUN-1141
3. Air-speed indicator LUN-1106
4. Altimeter BD-10K
5. Indicators of electronic variometer
6. Electronic variometer
7. Turn/bank indicator LUN-1211
8. Radio
9. Static pressure receivers (static)
10. Total pressure receivers (dynamic)
11. Compensated pressure receivers (TE tube)

Fig. 2.4.1_01. Sailplane static and dynamic pressure system

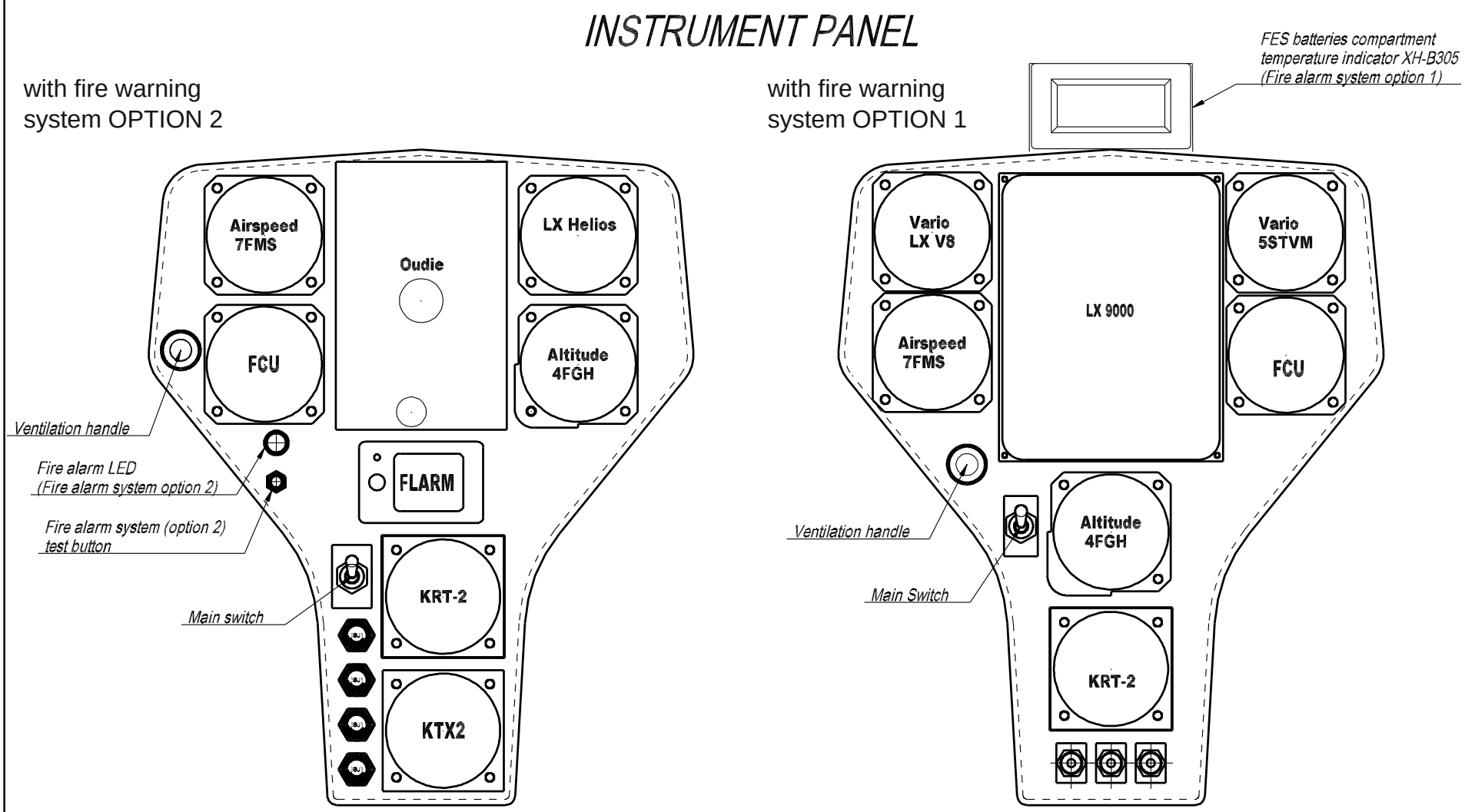


Fig. 2.4.2_01. Options of flight control and navigation instruments

FCC (FES connecting circuit)

DB 15 FEMALE Inside motor engine cable back side

Temp. sensor DS1820 for motor (botom view)

Motor type FES-SIL-M100

BLDC MOTOR

A C B

DB 15 MALE on cable back side (without plastic case)

DB 9 MALE on cable back side

FCU instrument front side fi57mm

FCU instrument rear side

DB 9 MALE

DB 15 MALE

12,3V Power supply from Instrument panel

DB 15 FEMALE on cable back side (Plastic case)

schottky diode

"Cabin closed ?" safety switch

DB 9 FEMALE on cable back side

FES Brdge

DB 9 FEMALE on cable back side

Other instruments Flight computer, Radio, Transponder, PDA, Flarm...

RADIO

FLIGHT COMPUTER

13,4V

fuse

13,4V

fuse

2A fuse

"Master switch" for Instruments

13,4V Power supply to Instrument panel

Tail of front selector switch

Capacitor (4700uF)

fuse

fuse

Cable BMS-CHARGER-PC

DB 9 MALE on cable back side

CHARGER FEMALE on cable back side

TO USB

Cable BMS-CHARGER

DB 9 MALE on cable back side

CHARGER FEMALE on cable back side

12V Pb battery 10Ah (located near landing gear or in BAT compartment)

12V Pb battery 3x2,1Ah (located in vertical stabilizer)

DC output voltage set to aproximately 14,1V

DC/DC

DC/DC converter XP DNR60

AVIATION PLUG FEMALE on cable back side

J2

AVIATION PLUG FEMALE on cable back side

J1

LXUI connector with 4 pins (back side view)

connector

cooling fans above controller

Solid state reley CRYDOM D2D07

MOTOR CONTROLLER KBL12401BC

LXUI connector with 8 pins (view from back side)

Shunt

Power fuse 325A

FES BATTERY PACK GEN 2 "A"

FES BATTERY PACK GEN 2 "B"

DATA connector

Removable connecting cable

Main contactor Kilovac EV200 with economizer

"RADSOK" pins

BMS-Charger cable

CHARGING SYSTEM for single pack

Programable CHARGER type KOP602 58V/9A BMS

230V AC 50/60 Hz 600W (10A fuse)

Fig. 2.4.4_01 Electrical system

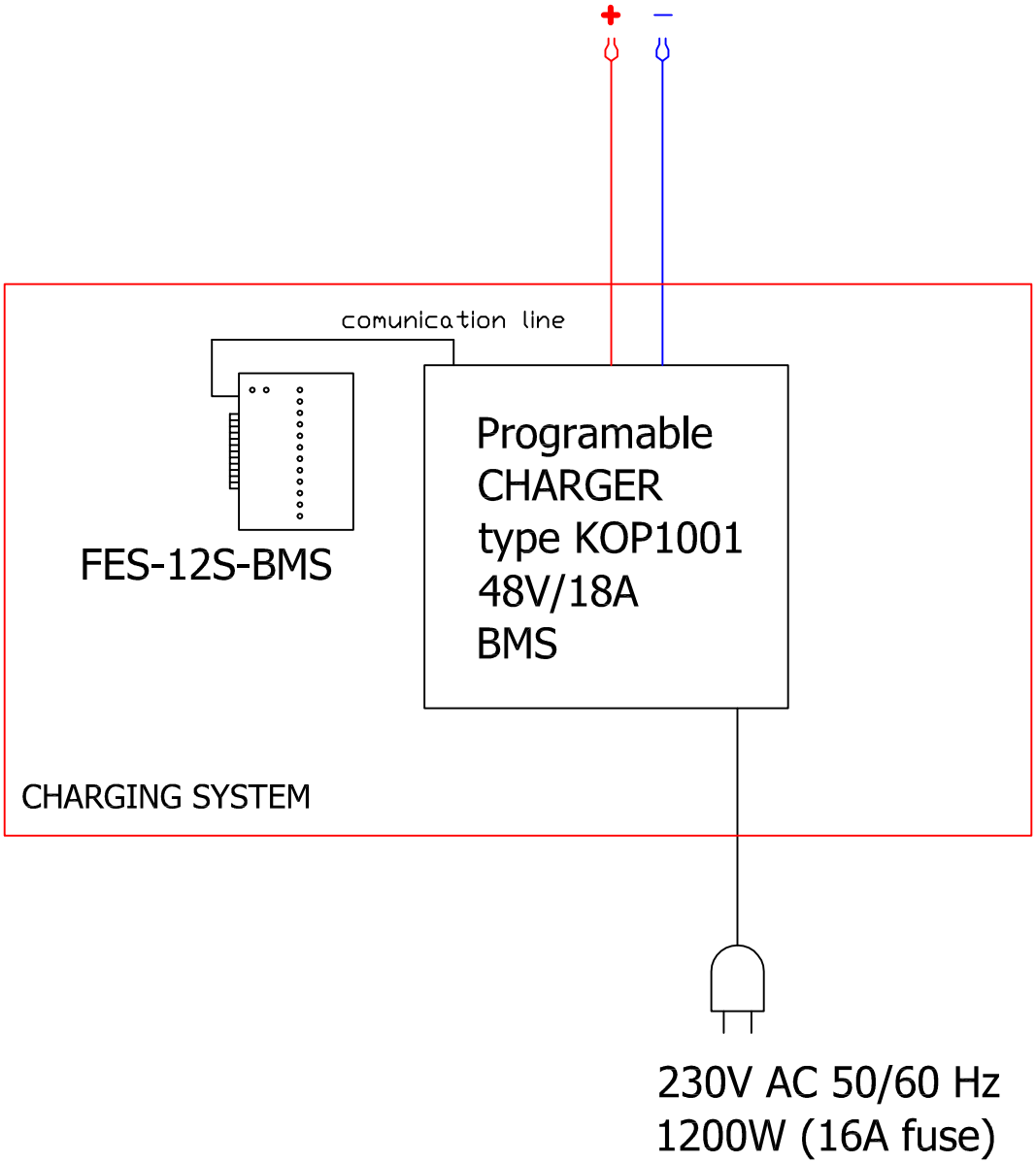


Fig.2.4.4_02 FES battery charging equipment

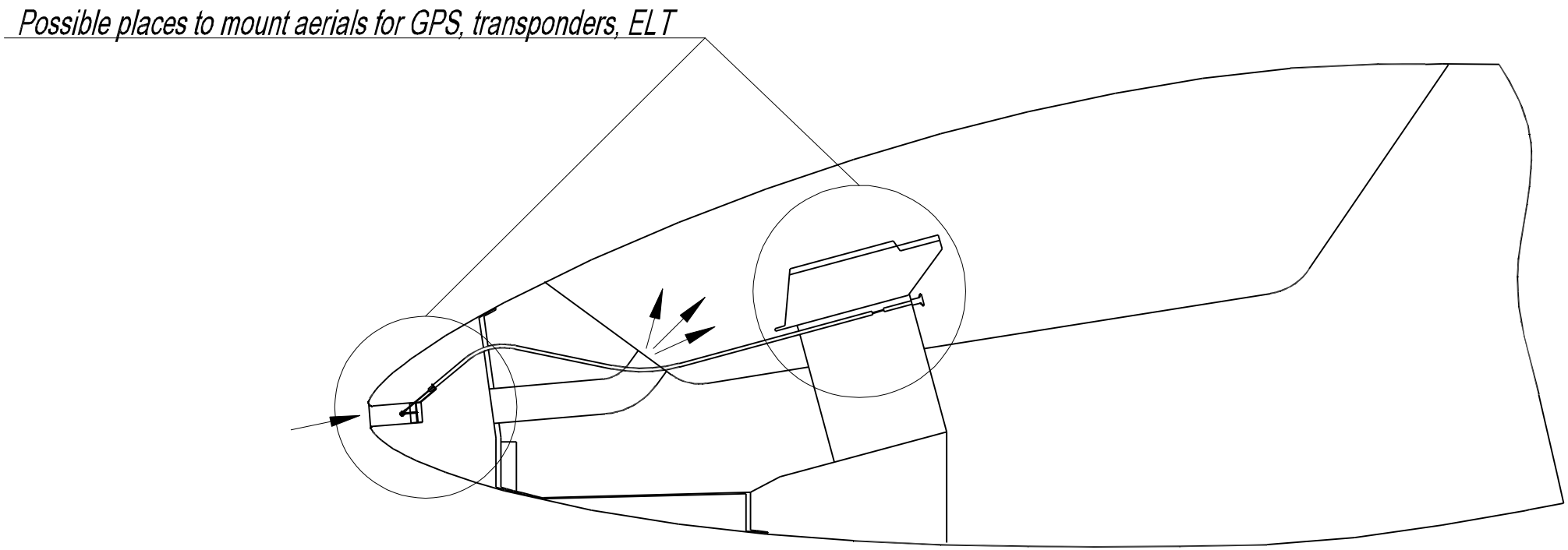
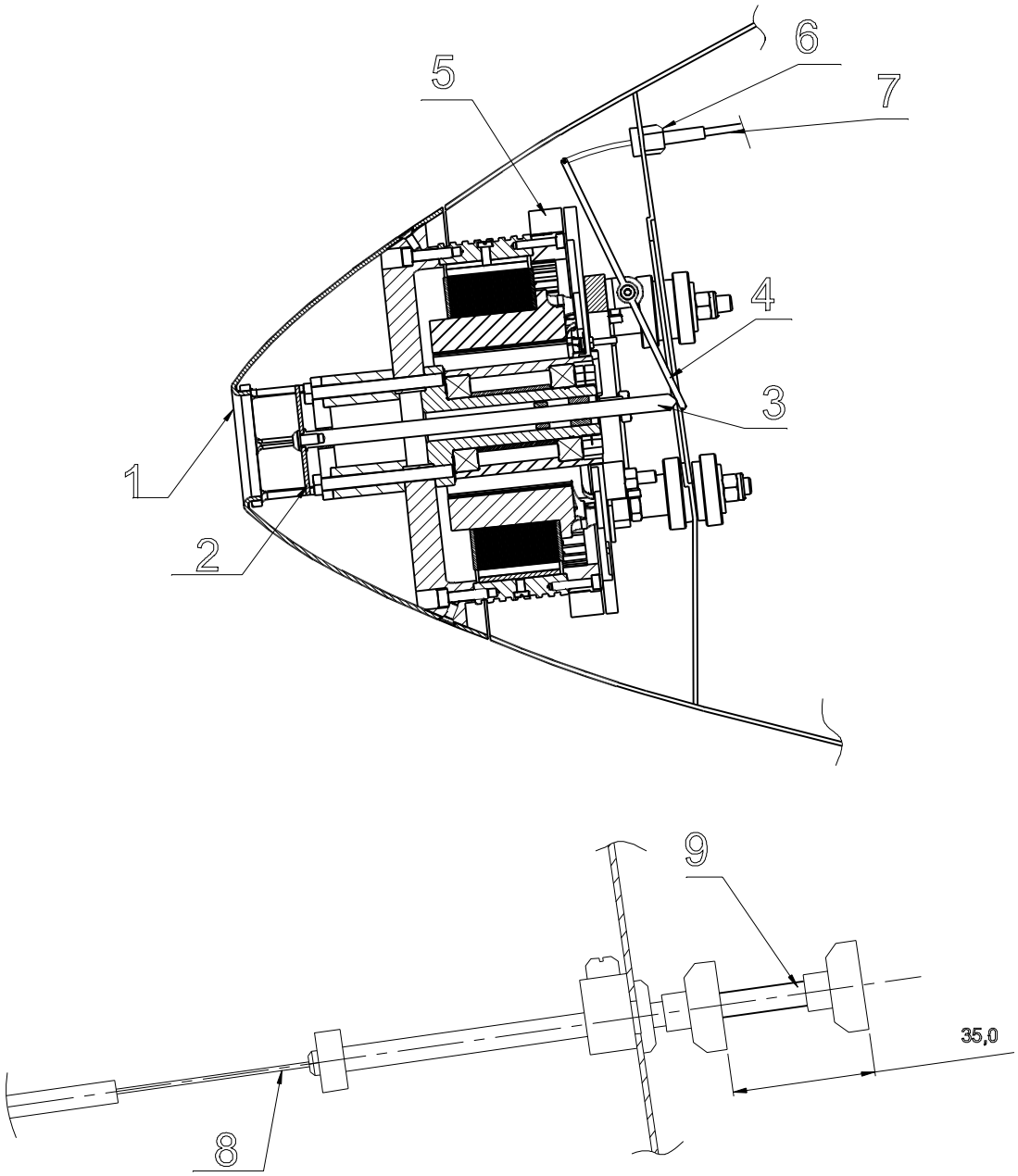
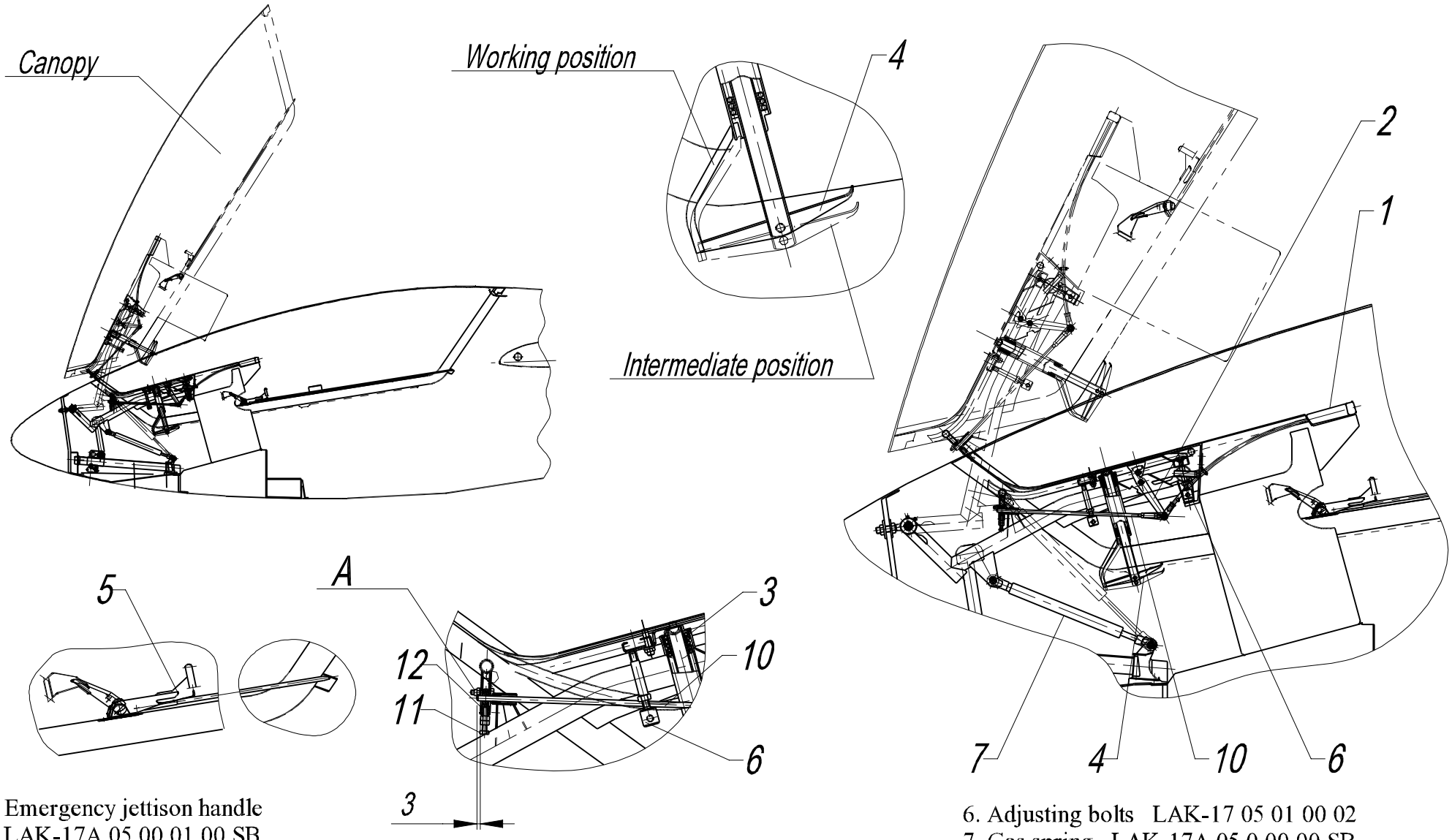


Fig. 2.4.4_04. Possible places to mount aerials for GPS, transponders, ELT



1. Ventilation opening
2. Ventilation valve plate
3. Ventilation pin
4. Ventilation level
5. Motor ventilator
6. Bouden holder
7. Bouden
8. 1.2 mm steel wire
9. Control handle

Fig. 2.4.5_01. Ventilation system



1. Emergency jettison handle
   LAK-17A 05 00 01 00 SB
2. Fixator LAK-17 05 01 01 20 SB
3. Spring LAK-12 62 01 01 19
4. Handle of spring type mechanism
   LAK-17 05 01 01 40 SB
5. Opening handle LAK-17A 02 00 02 00 SB

Fig. 2.4.6_01. Cockpit canopy

6. Adjusting bolts LAK-17 05 01 00 02
7. Gas spring LAK-17A 05 0 00 00 SB
8. Canopy holder LAK-17A 05 01 00 00 SB
9. Support LAK-17A 05 00 00 16
10. Pins LAK-17A 05 00 00 17
11 Adjusting bolt
12. Fixator

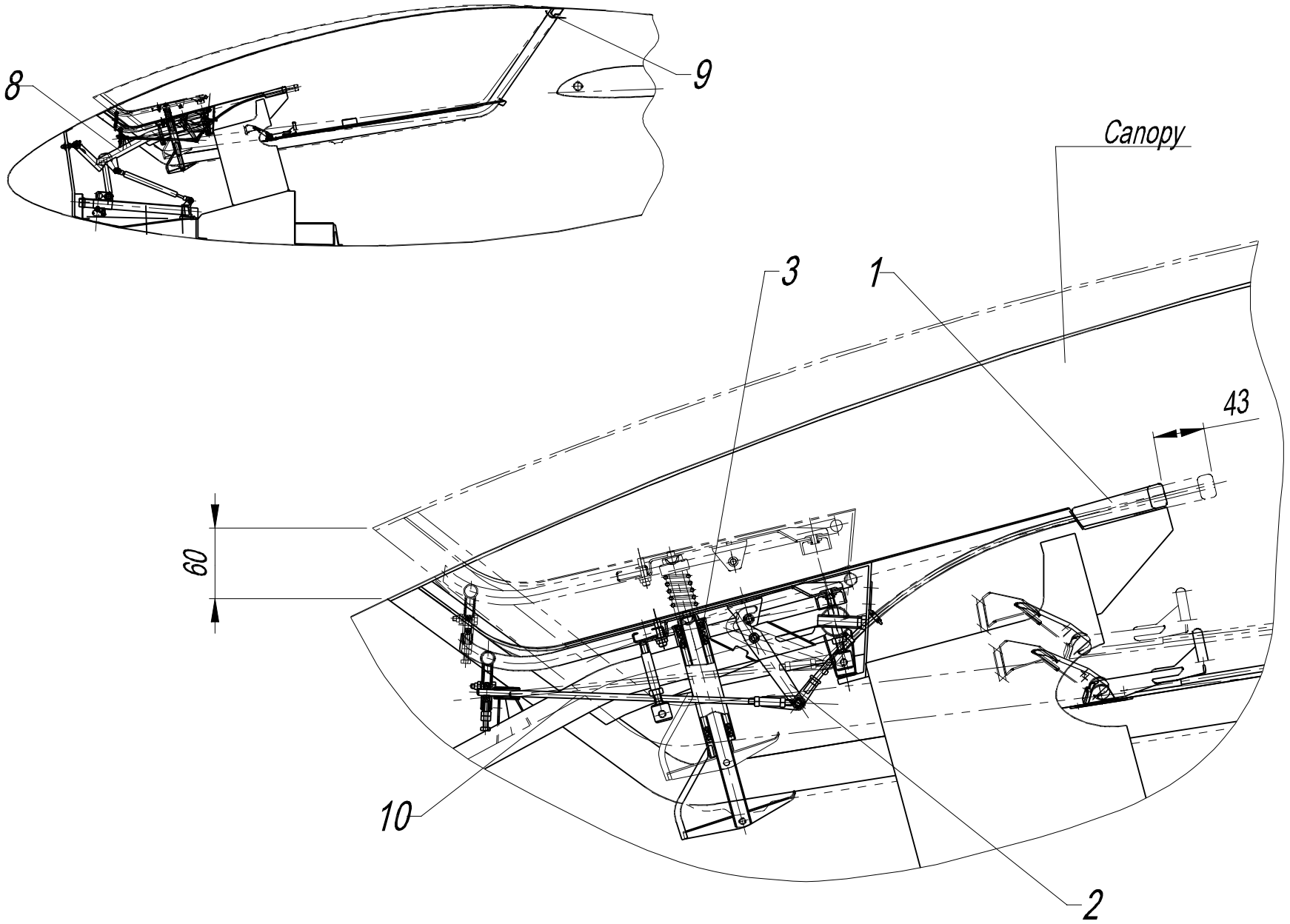
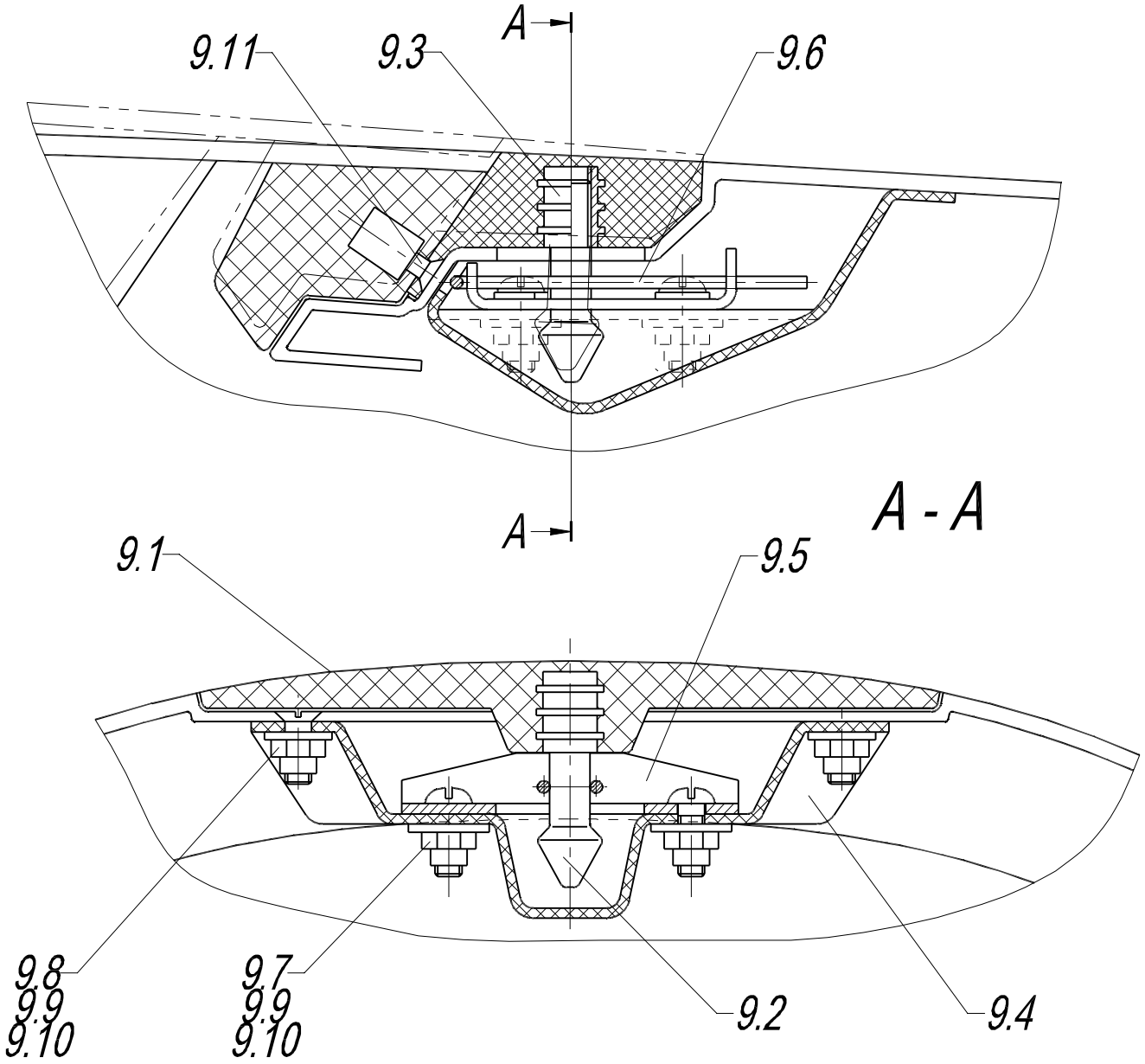


Fig. 2.4.6_02. Cockpit canopy



9.1. Support LAK-17A 05 04 00 00 SB
9.2. Pin LAK-17A 05 00 00 17
9.3. Hub LAK-17A 05 04 00 02
9.4. Box LAK-17A 05 00 00 16
9.5. Plate LAK-17A 05 03 00 01
9.6. Spring LAK-17A 05 03 00 02
9.7. Bolt 3051A-4-12
9.8. Bolt 3181A-4-12
9.9. Nut 3373A-4
9.10. Washer DIN 9021 A4.3
9.11. Bolt

Fig. 2.4.6_03. Cockpit canopy

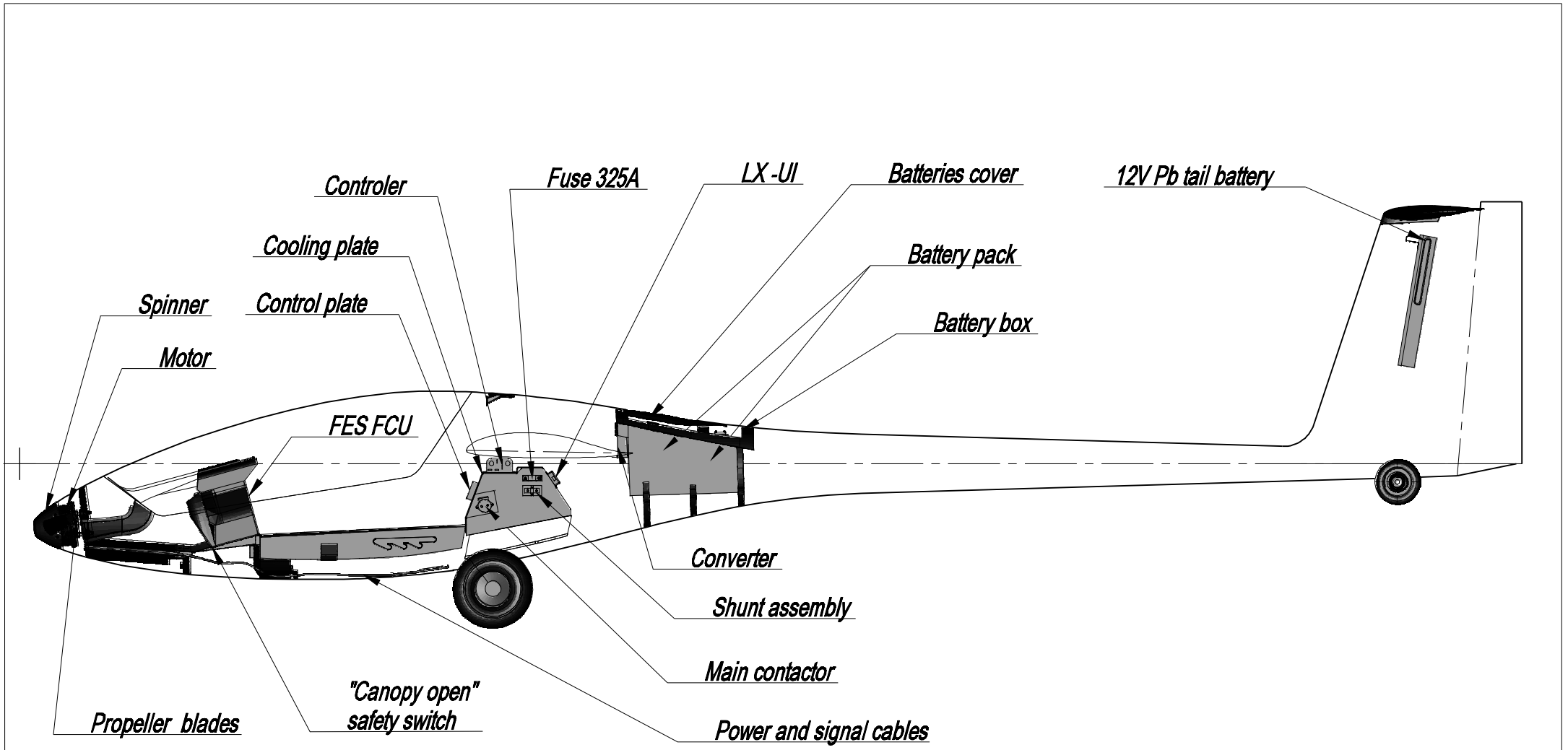


Fig. 2.5.1_01. General layout

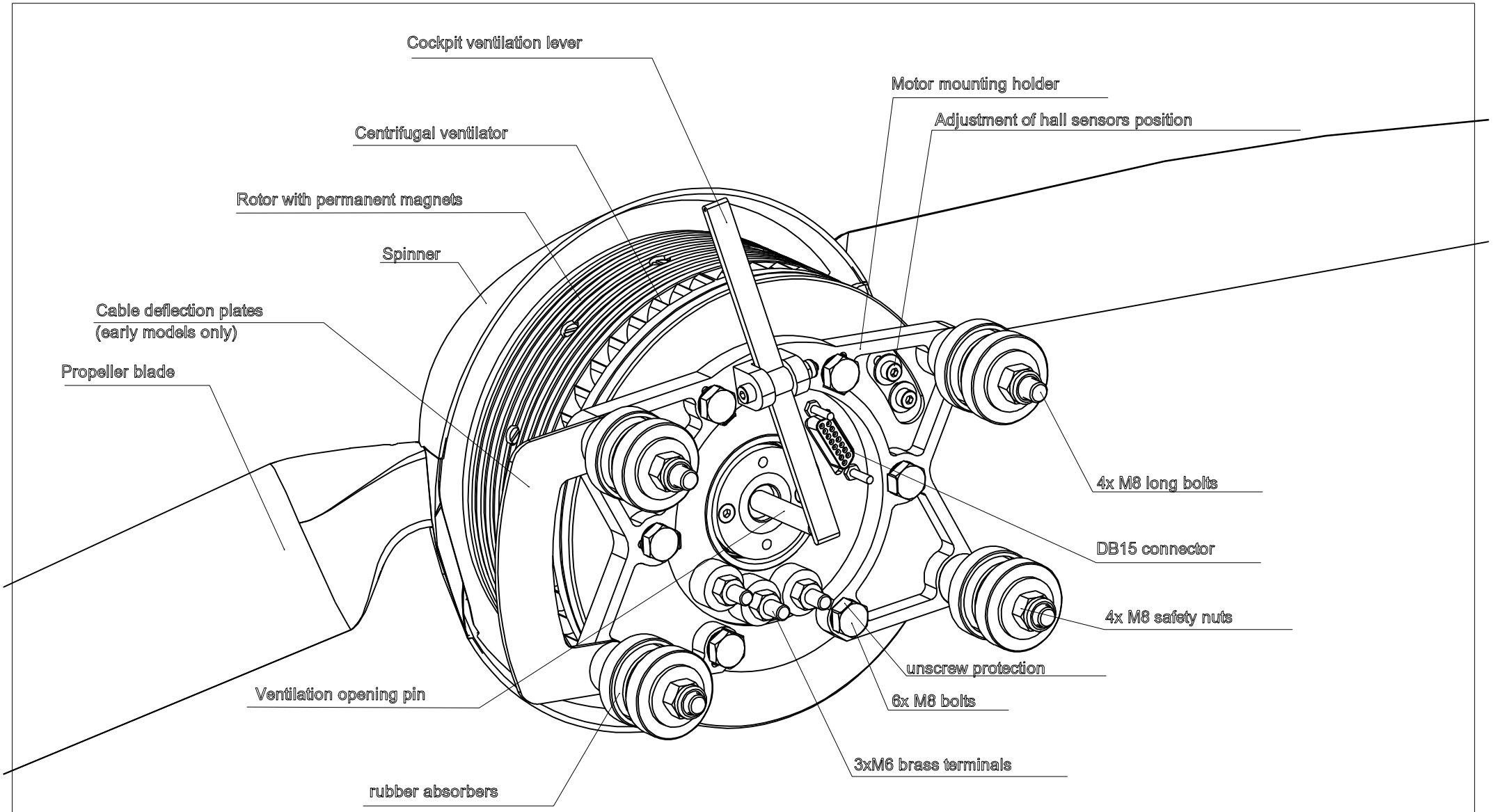


Fig.2.5.2_01 FES system motor

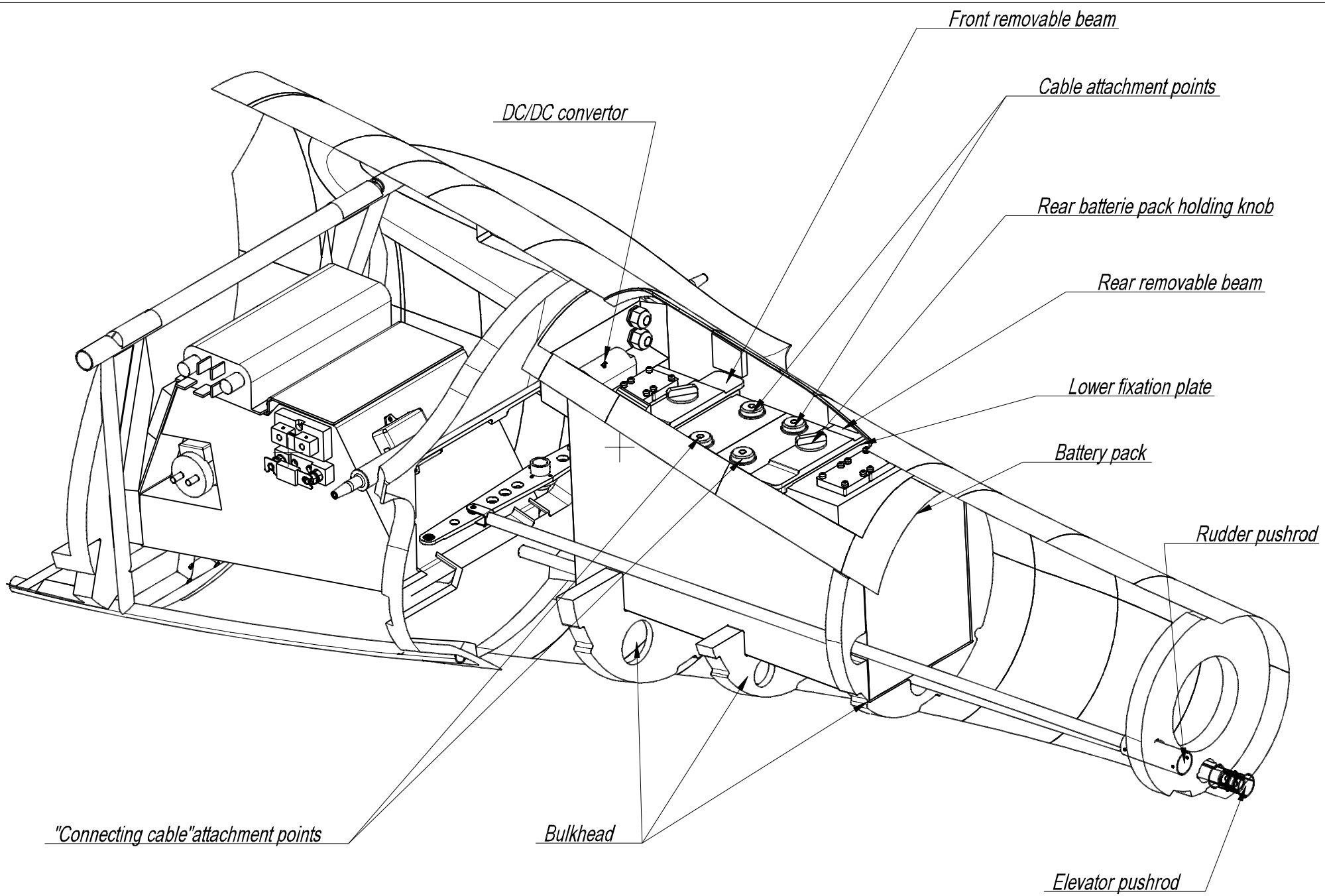
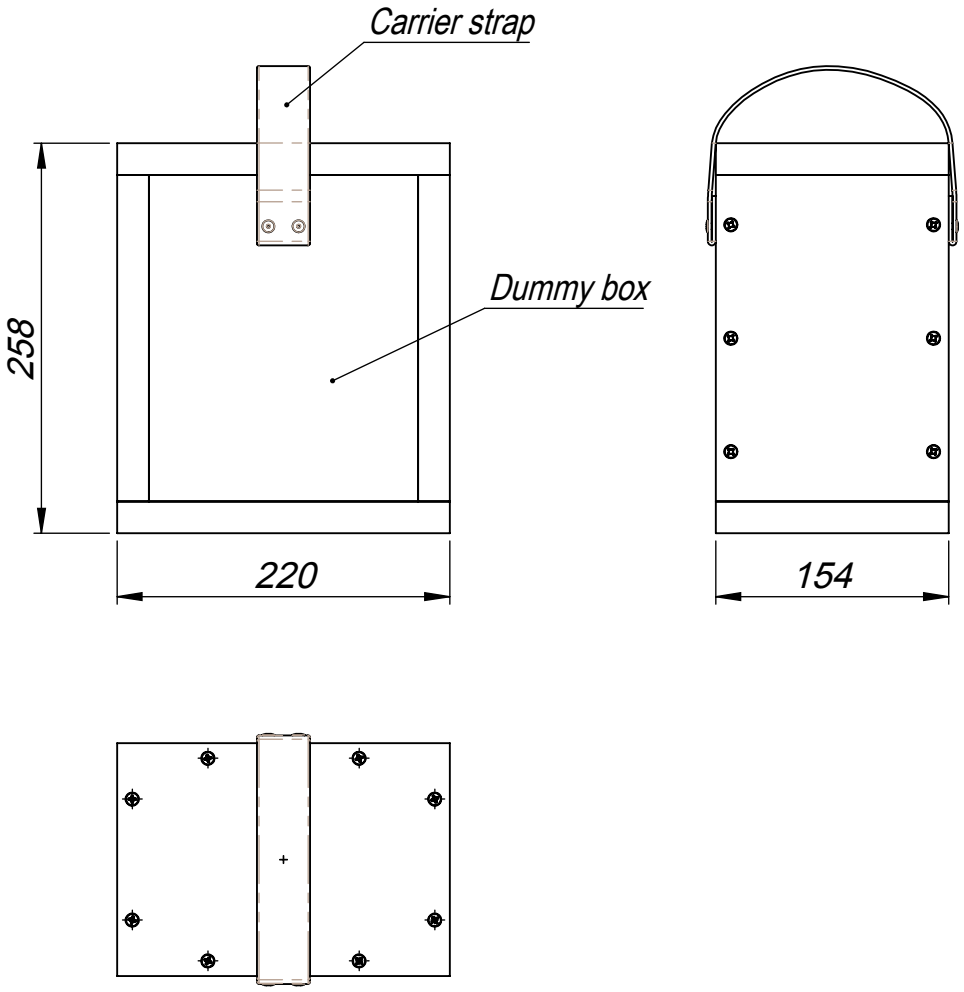


Fig. 2.5.3_01. Batterie compartment



Attention:

- *The overall dimensions of the box must be the same as the FES battery pack - 154x220x258mm*
- *The weight of the box must be between the limits of 16 ± 0.1kg*

Installing the dummy boxes, it must be exactly in the same place as FES batteries in the batteries compartment. Use the same fixation plates for the fixation as for the FES batteries. Refer to the LAK-17B FES Maintenance Manual section 3.4.12 for the more detailed dummy boxes installation/remove instructions.

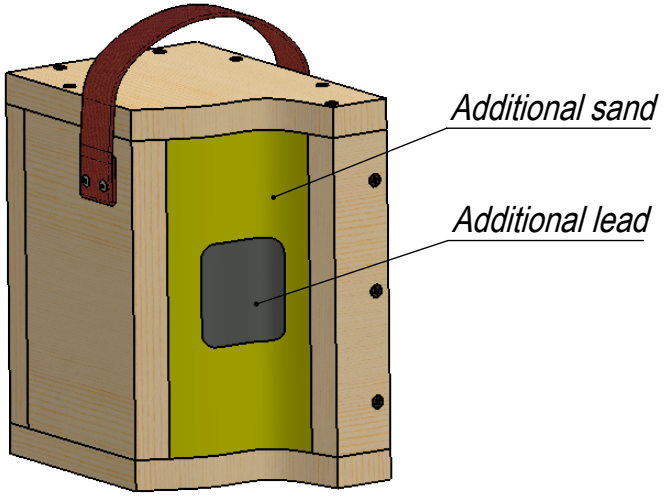
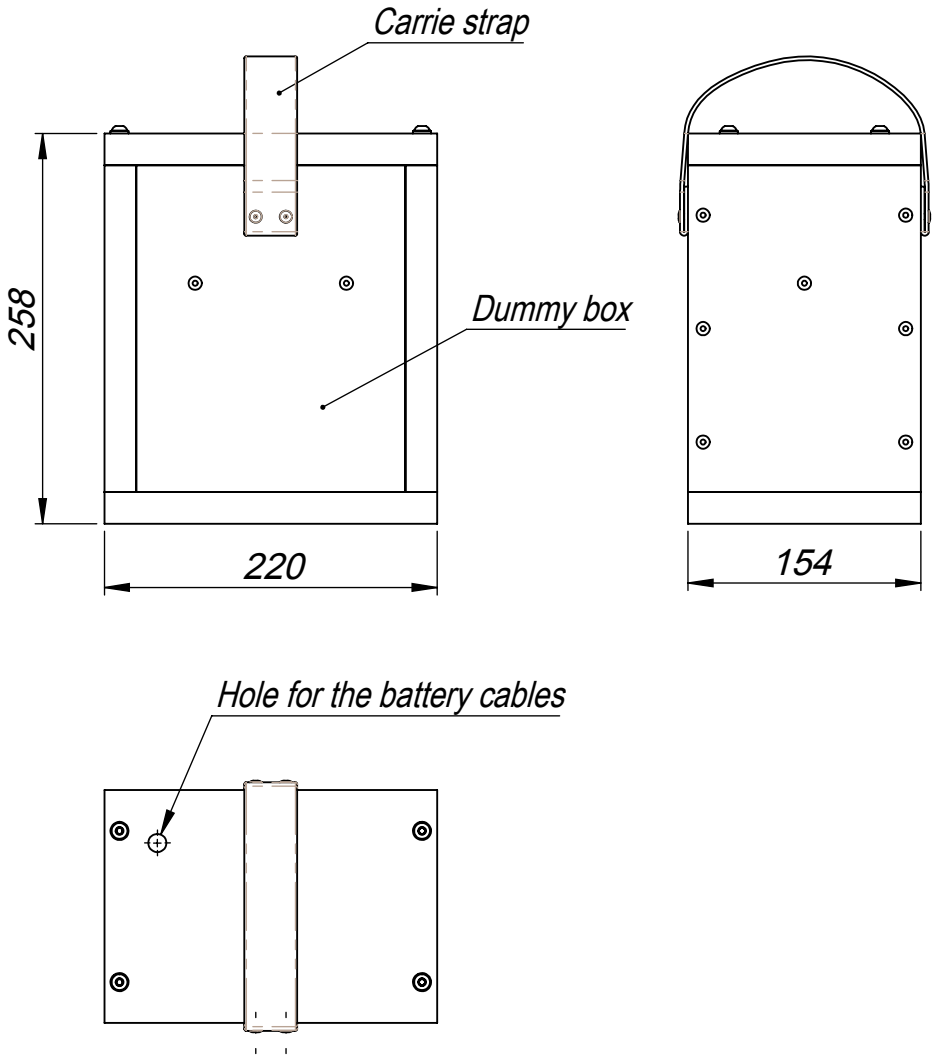


Fig. 2.5.3_02 Dummy box

Dummy box scheme (replacement for the FES battery pack)



Attention:

- The overall dimensions of the box must be the same as the FES battery pack - 154x220x258mm
- The weight of the box must be between the limits of 16 ± 0.1kg

Installing the dummy boxes, it must be exactly in the same place as FES batteries in the batteries compartment. Use the same fixation plates for the fixation as for the FES batteries. Refer to the LAK-17B FES Maintenance Manual section 3.4.12 for the more detailed dummy boxes installation/remove instructions.

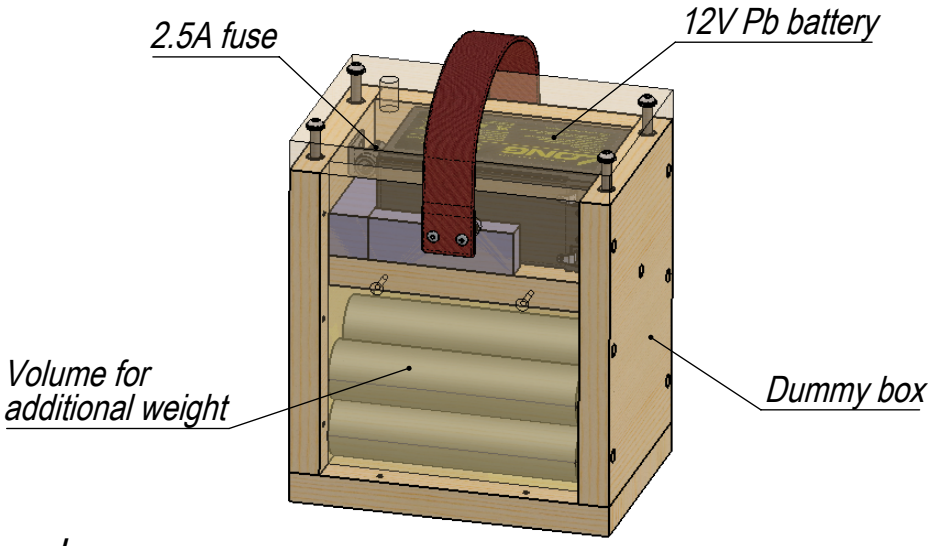
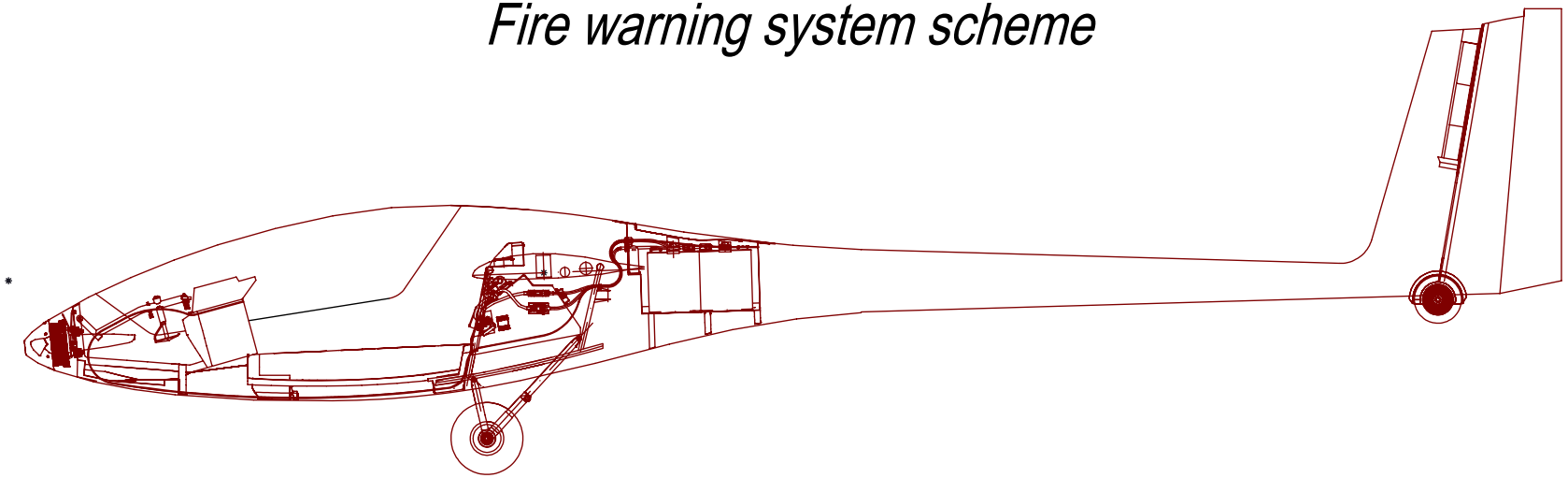
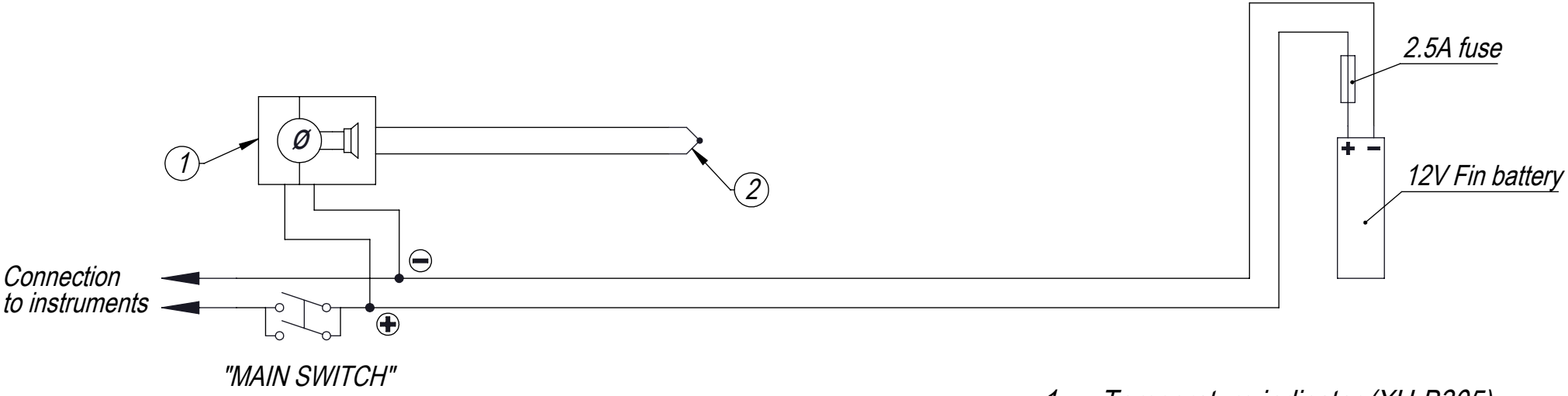


Fig. 2.5.3_02[a] Dummy box

Fire warning system scheme

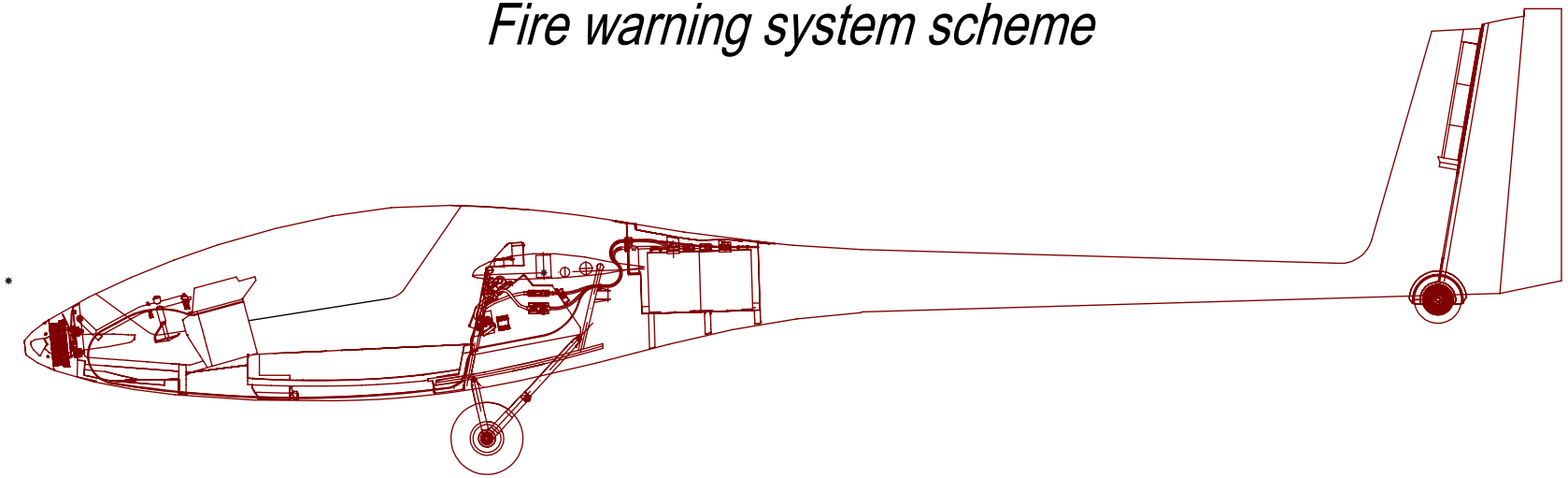


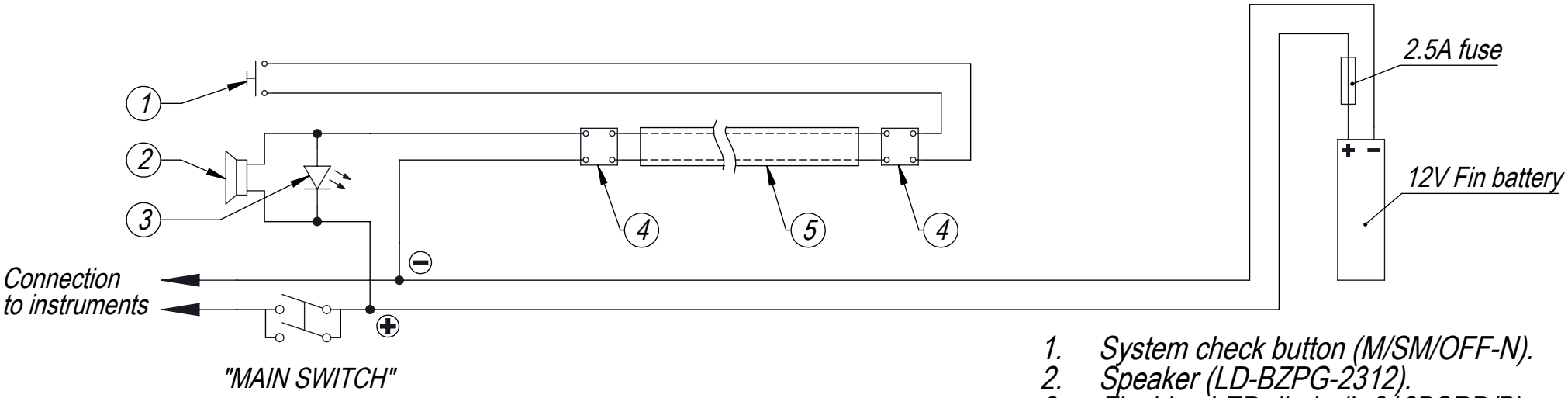


1. Temperature indicator (XH-B305).
2. Thermocouple (5m calibrated wire).

Fig. 2.5.3_03 Fire warning system scheme (option 1)

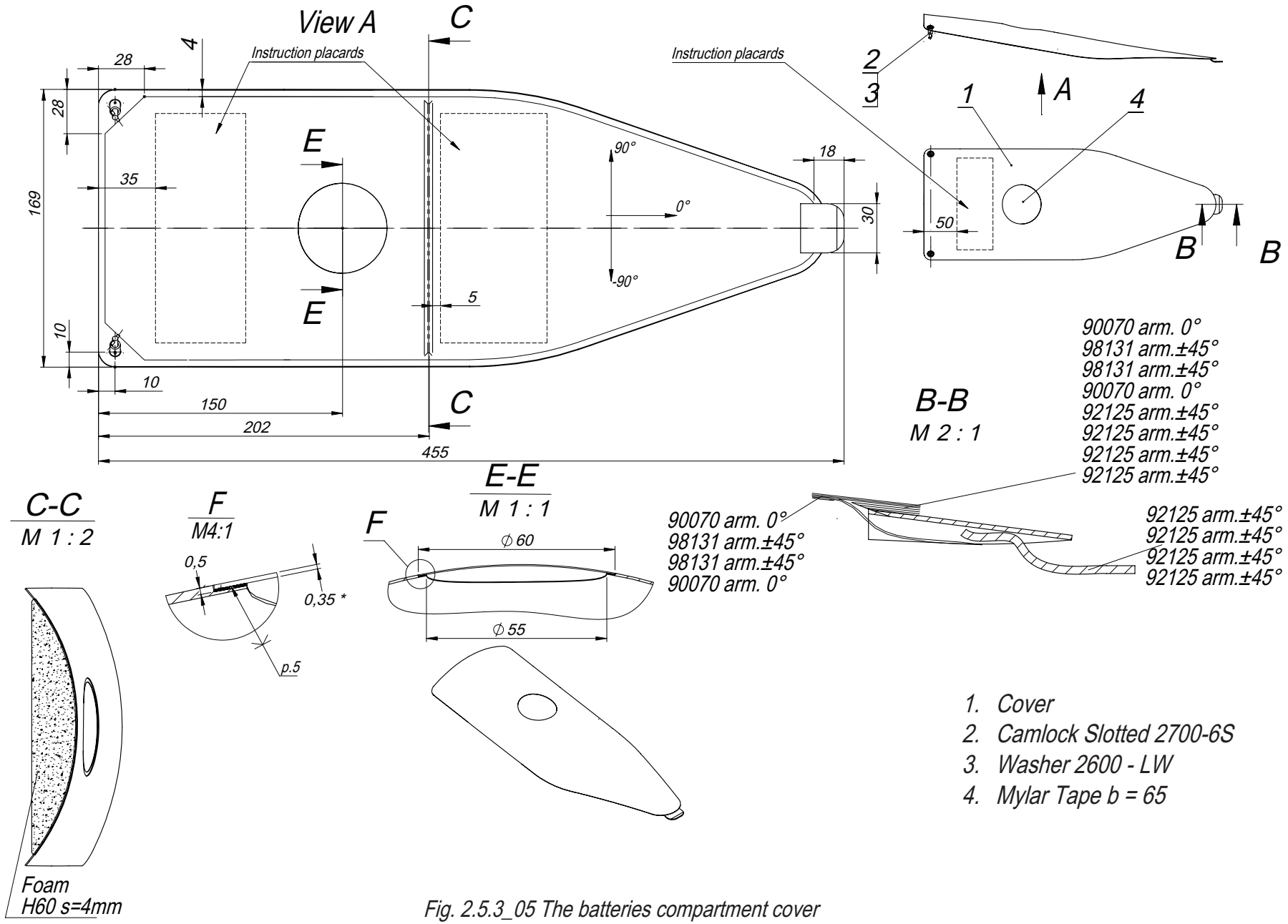
Fire warning system scheme





1. System check button (M/SM/OFF-N).
2. Speaker (LD-BZPG-2312).
3. Flashing LED diode (L-816BSRD/B).
4. Terminal block (2 pos.).
5. Signaline FT-88 Fixed Temperature Linear Heat Detector (88 °C).

Fig. 2.5.3_04 Fire warning system scheme (option 2)



1. Cover
2. Camlock Slotted 2700-6S
3. Washer 2600 - LW
4. Mylar Tape b = 65

Fig. 2.5.3_05 The batteries compartment cover

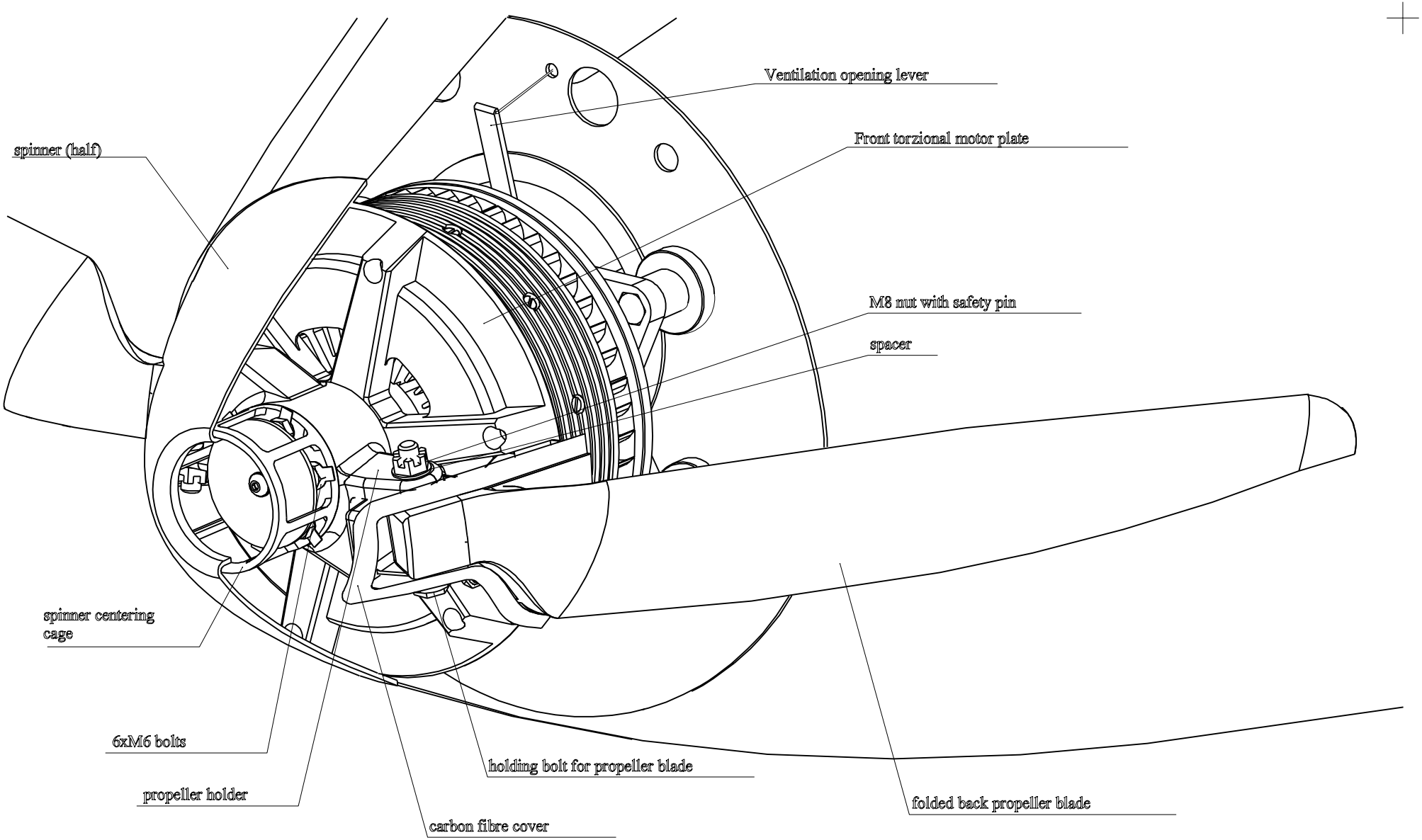


Fig. 2.5.5_01 Propeller

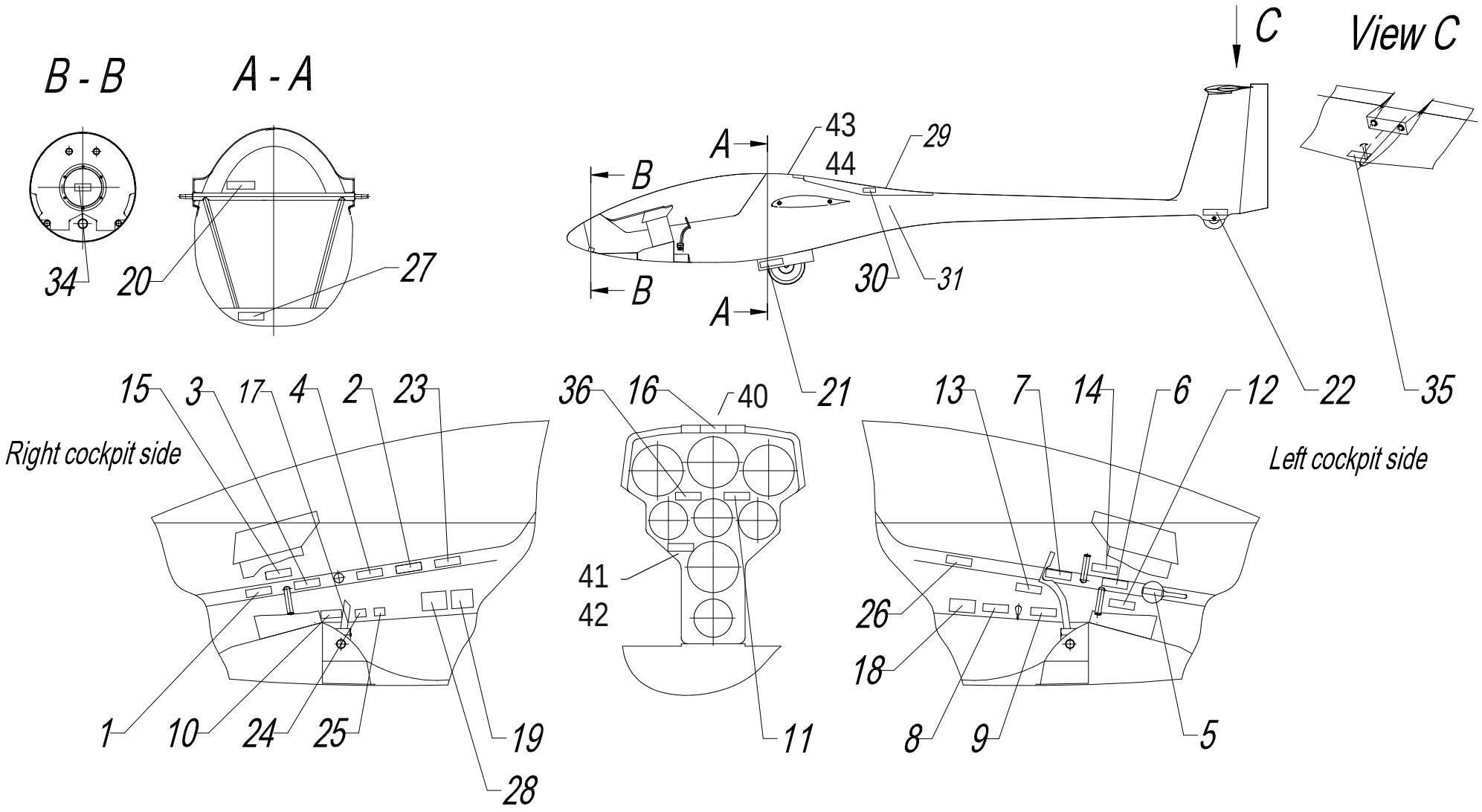
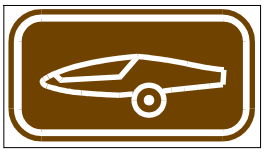
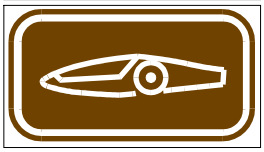


Fig. 2.6._01. Placards and marking of controls

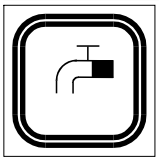
1.Landing gear extended



2.Landing gear retracted



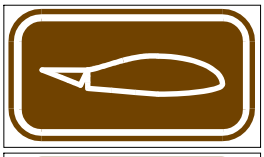
3.Water ballast closed



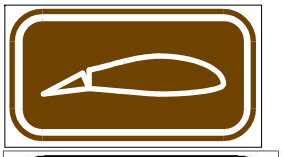
4.Water ballast opened

5.Tow release

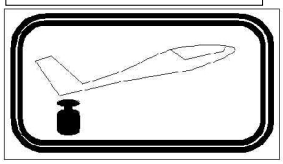
6.Negative flaps position



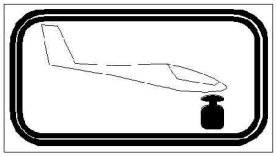
7.Positive flaps position



8.Trimmer in pitching position



9.Trimmer in diving position



10.Pedals adjustment

11. Cockpit ventilation

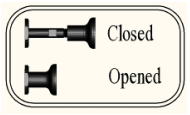
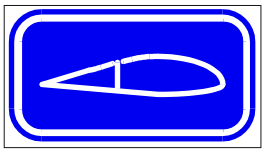
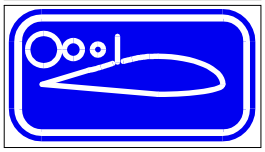


Fig.2.6_02. Placards and marking of controls

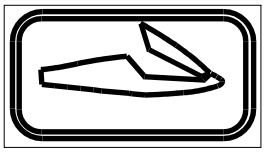
12. Air brakes retracted



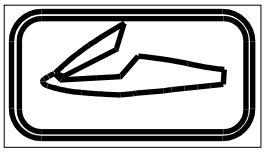
13. Air brakes extended



14. Canopy opening handle



15. Canopy opening handle



16. Canopy emergency jettison

17. Power switch

18. Before Take Off Check List

Before take-off checklist
• Preflight inspection completed • Lead ballast (for correct cockpit weight) • Tail dolly removed • Canopy jettison unlocked • Seat back and rudder pedals adjusted • Safety harness secured • All controls in reach • Positive control check • Altimeter set • Air brakes closed and locked • Trim set • Flaps set to take-of position • Canopy closed and latched • Wind direction • FCU instrument ON (if motor batteries are installed)
Check list for powered flight
• Batteries voltage checked • FES installation checked • FCU instrument ON

19. Table of operational limitations

LAK-17B FES 15/18*/21* m - AIR SPEED DATA & LOADING PLACARD						
Speed IAS:		km/h	kts	**Masses and loads**	kg	lbs
Never exceed	V_{NE}	275/220**	148/118**	Max mass with water ballast	550/600*	1212.5/1322.8*
Rough air	V_{RA}	190	102	Maximum cockpit load	110	242
Manoeuvring	V_A	190	102	Minimum cockpit load		
Aerotow	V_T	160	86			
Winch-launch	V_W	140	76	Recommended weak link	780	1753
Landing gear operation	V_L	205	110	** - airspeed limitation for 21 m wing configuration		
Max operation with motor running	V_{PE}	160	86			
Max speed to start motor	$V_{PO\ max}$	160	86	**Aerobatic manoeuvres are not permitted**		
Min speed to start motor	$V_{PO\ min}$	80	43			

Fig. 2.6_03. Placards and marking of controls

20. Baggage limitation table

Max baggage weight
7 kg (15,4 lbs)

21. Table of main wheel tyre pressure

Pressure in a main wheel tyre
from 2,3 to 2,5 bar

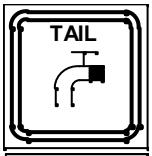
22. Table of tail wheel tyre pressure

Pressure in a tail wheel tyre
from 1,8 to 2,0 bar

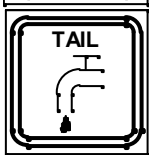
23. The airspeed limitation placard

m - **Altitude** - ft		km/h - V_{NE}, **IAS** - kts	
4000	13100	275/220*	148/118*
5000	16400	260/205*	140/111*
6000	19680	245/190*	132/103*
8000	26250	220/165*	119/89*
10000	32800	195/140*	105/76*

24. Fin water ballast closed (optional)



25. Fin water ballast open (optional)



26. Seat back adjustment

27. Manufacture data plate

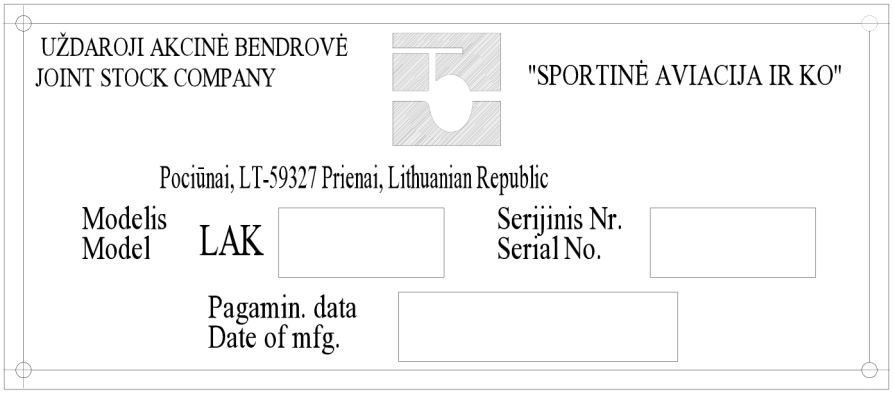


Fig. 2.6_04. Tables and marking of controls

28. Motor start / /stop

Starting the Motor
• FCU instrument ON • Turn on **Power Switch** • Ventilation is OPEN • Check if there is green LED, check Voltage level • Start motor with Throttle knob rotating in clockwise direction gently. • Use about 4kW of power for horizontal flight
Stopping the Motor
• **Reduce RPM** until propeller is stopped • Check prop is in right position • Power switch **OFF** • FCU instrument ON

29. Instalation/ removal of battery packs instruction placards

Instalation of Battery packs into sailplane

1. Inspect battery housing for any mechanical damage
2. Open cover
3. Check that Power switch is OFF
4. Check that FCU instrument and all other instruments are switched OFF
5. Insert first pack into the fuselage so that terminals are facing forward and slide it back to rear position.
6. Insert second pack into the fuselage so that terminals are facing rearward.
7. Place pair of fixation plates in the middle of rear pack, above holding strap and tighten fixation knob.
8. Place pair of fixation plates in the middle of front pack, above holding strap and tighten fixation knob.
9. Lift power cables from side support.
10. Plug in shorter cable, with 8mm pin in BLACK housing, to minus marked 8mm socket of front battery pack.
11. Plug in longer cable with 10mm pin in RED housing, to plus marked 10mm socket of rear battery pack.
12. Insert temperature sensor connector, to each battery pack.
13. Turn ON switch (BMS) on each battery pack.
14. Close cover

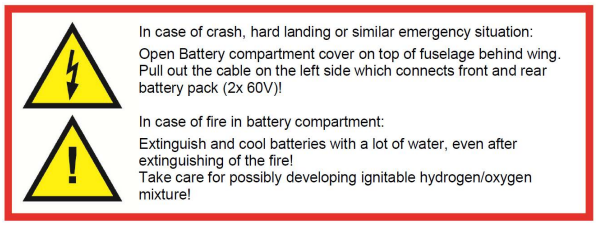
Taking Battery packs out of sailplane

1. Check that Power switch is OFF
2. Check that FCU instrument and all other instruments are switched OFF
3. Open cover
4. Take out connecting cable between the packs
5. Take out RED + and BLACK - power connectors
6. Fix supply cables to the side of battery compartment box
7. Remove both temperature sensor connectors, from each battery pack
8. Fix temperature sensor cable to the side of battery compartment box
9. Untighten battery pack fixation knobs
10. Take the fixation plate out
11. Firmly grip the front battery by a carrier strap
12. Lift it out of the fuselage and put it on safe place
13. Firmly grip the rear battery by a carrier strap and slide it forward along the bottom of the battery compartment
14. Lift the battery pack out of the fuselage and put it on safe place
15. Close cover

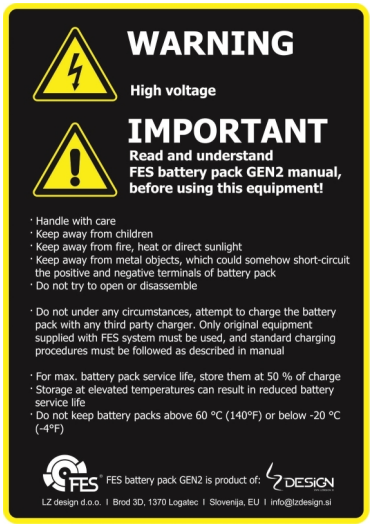
Take out connecting cable
Do not cut !!!

Fig. 2.6_05. Placards and marking of controls

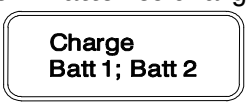
30. Instruction placard inside of battery compartment



31. Battery pack instruction placard



~~32. Batteries charge~~

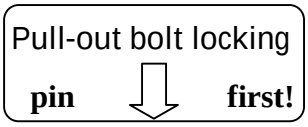


~~33. Battery fuses~~

34. Nose ballast (optional)

Nose ballast max. permitted 6 kg (13.2 lbs)	
Reduction of the min. cockpit load by:	**Lead weight required**
5 kg (11 lbs)	2,0 kg (4,4 lbs)
10 kg (22 lbs)	4,0 kg (8,8 lbs)
15 kg (33 lbs)	6,0 kg (13,2 lbs)

35. Stabilizer bolt



36. FCU instrument indication (LED) meanings (located as close as possible to FCU):

LED indications	
LED 1 -red	Alarms from FCU, see specifications of errors
LED 2 -green	Controller is ready for operation
LED 3 -red	Something is wrong

Fig.2.6_06. Placards and marking of controls

40.

FES Battery Compartment Temp.

On top of FES battery compartment temperature indicator (fire warning system Option 1).

41. 42.

FES Battery Fire Alarm

Fire Alarm Test

Near *fire warning system LED* and *fire warning system test button* (fire warning system Option 2).

43. On top of fuselage, between canopy and battery compartment:

Aircraft with electric propulsion

In case of emergency refer to Rescue card in Cockpit (on the right side in baggage compartment)!

44. Cockpit inner skin on the right, front area of baggage compartment, as detachable card:

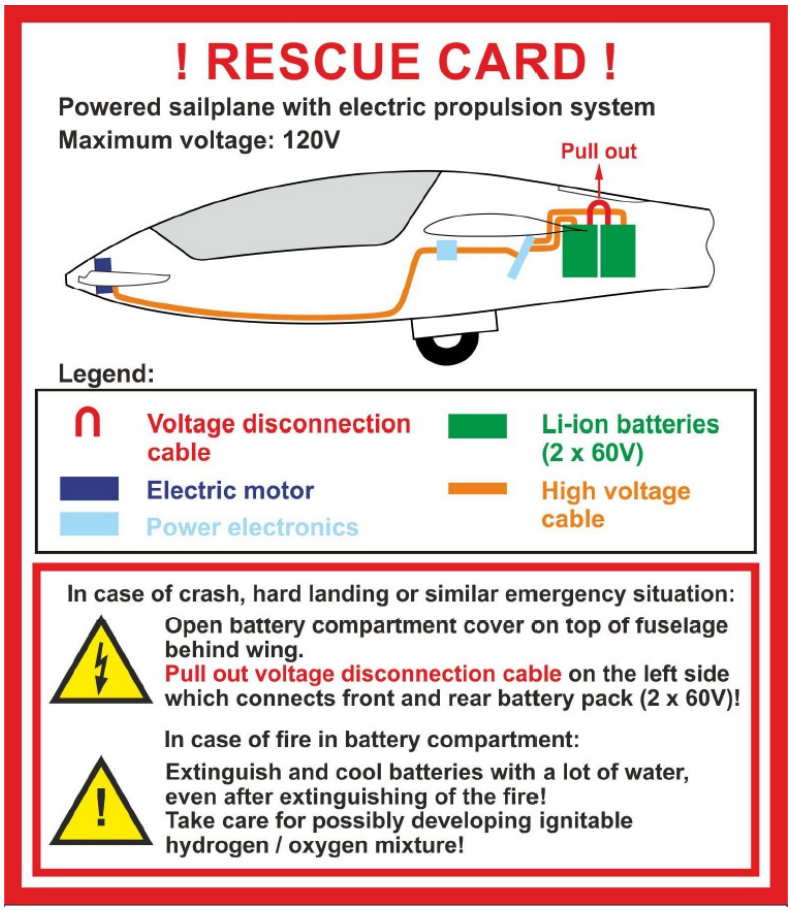
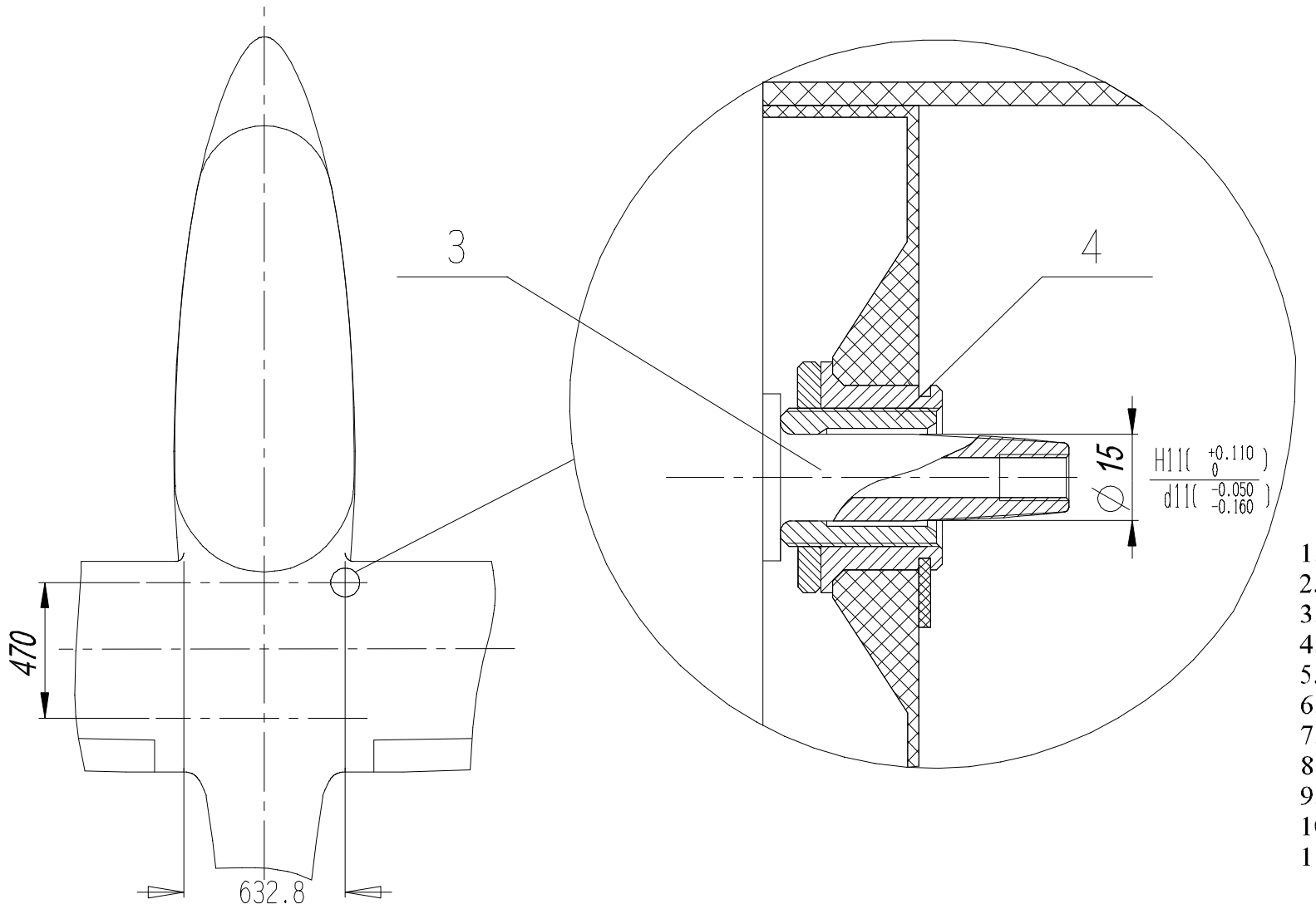


Fig. 2.6_07. Placards and marking of controls



1. Connection pin of wings spars
2. Spar hub
3. Pin of fuselage
4. Wing adjustable hub
5. Fin pin
6. Stabilizer hub
7. Stabilizer fixing hub
8. Fin hub
9. Wing tip hub
10. Pin of wing end rib
11. Holder of wing tip

Fig. 2.7.1_01. Alowed clearances of connection of sailplane aggregates

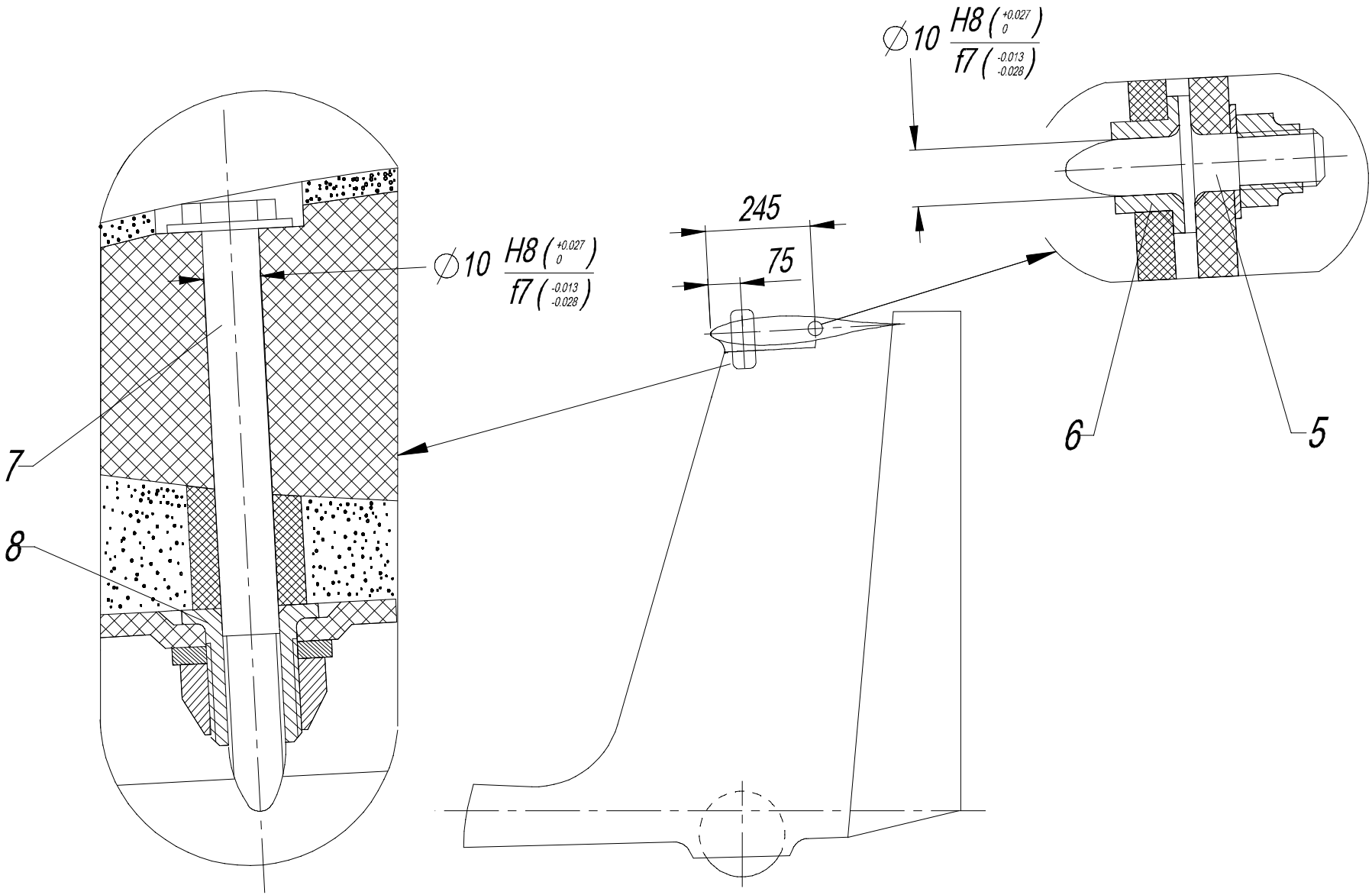


Fig. 2.7.1_02. Allowed clearances of connections of sailplane aggregates

SECTION 3

Sailplane maintenance

Page

3.1 SAILPLANE CURRENT MAINTENANCE....1

3.1.1 DAILY INSPECTION....1
3.1.2 POST FLIGHT INSPECTION....2
3.1.3 GROUND HANDLING....2
3.1.4 STORING AND TRANSPORTATION....3
3.1.5 CLEANING AND KEEPING CLEAN....3
3.1.6 RIGGING AND DE-RIGGING OF A SAILPLANE....3

3.2 LUBRICATION SYSTEM....5

3.3 ADJUSTMENT....6

3.3.1 ADJUSTMENT OF AIRBRAKES....6
3.3.2 ADJUSTMENT OF MAIN WHEEL BRAKE CONTROL SYSTEM....6
3.3.3 ADJUSTMENT OF COCKPIT CANOPY EMERGENCY JETTISON SYSTEM....6
3.3.4 ADJUSTMENT OF RUDDER CONTROL SYSTEM....7
3.3.5 ADJUSTMENT OF FES SYSTEM....7

3.4 DE-RIGGING AND RIGGING OF SAILPLANE PARTS....7

3.4.1 DE-RIGGING AND RIGGING OF AILERONS....7
3.4.2 DE-RIGGING AND RIGGING OF A FLAP....8
3.4.3 DE-RIGGING AND RIGGING OF A RUDDER....8
3.4.4 DE-RIGGING AND RIGGING OF AN ELEVATOR....8
3.4.5 DE-RIGGING AND RIGGING OF A TRIMMER....9
3.4.6 DE-RIGGING AND RIGGING OF A COCKPIT CANOPY....9
3.4.7 REMOVAL AND INSTALLATION OF MAIN LANDING GEAR WHEEL....9
3.4.8 REMOVAL AND INSTALLATION OF TAIL WHEEL....10
3.4.9 TAKING OUT AND MOUNTING OF AN INSTRUMENT PANEL....10
3.4.10 TAKING OUT AND MOUNTING OF PILOT COCKPIT FLOOR....10
3.4.11 REMOVING AND INSTALLING THE FES BATTERY PACKS OR THE DUMMY BOXES....10
3.4.12 REMOVING AND INSTALLING THE MOTOR....12
3.4.13 MOUNTING AND REMOVAL OF THE PROPELLER....12

3.5 ILLUSTRATIONS....12

3.1 Sailplane current maintenance

3.1.1 Daily inspection

Note: *Check the sailplane technical log-book and airworthiness certificate.*

The daily inspection must be performed each day and is essential for flight safety (refer to the fig.3.1.1_01).

1. Check the sailplane fore part of fuselage;
2. Check the cockpit:
   - the cockpit canopy glass,
   - operation of cockpit canopy lock, canopy jettison system,
   - wings connection pins fastening,
   - operation of towing hook,
   - operation of water ballast system,
   - operation of control systems of ailerons, flaps, an elevator, rudder and airbrakes,
   - operation of control system of pilot cockpit ventilation,

- operation of the trimmer,
- operation of flight instruments,
- radio communication,
- safety belts.

3. Check the main wheel tire and operation of wheel brake.
4. Check the left wing:
   - upper and lower wing surfaces,
   - leading edge,
   - upper and lower surfaces of ailerons and flaps,
   - deflections of ailerons and flaps and their clearances,
   - airbrakes for proper function and locking,
   - fixing of ailerons and flaps attachment to wing,
   - outer wings and winglets or installed, locked and secured,
   - clearance in respect of the fuselage.
5. Check function of control systems (of an aileron, flap, airbrake), their connections to corresponding control systems in the fuselage.
6. Check the fuselage surface.
7. Check the stabilizer, elevator and rudder:
   - surfaces,
   - deflections and clearances of controls,
   - fixing of joint of the stabilizer attachment to the fin,
   - clearance of the stabilizer with respect to the fin.
8. Check the right wing (analogically as for the left wing according to i.4).
9. Check the FES system:
   - all bolted, screwed connections and their securing,
   - propeller for tight fit and any cracking,
   - electrical wires,
   - visual check of the propeller, remove insects from blades,
   - batteries boxes fitting.

Warning: ***make sure that Power switch is switched off before you turn propeller by hand.***

- turn the propeller one revolution by hand listen for abnormal sounds which may indicate motor damage,
- check Voltage of Batteries on LCD color display. With fully charged batteries voltage should be slightly above 100V.

Caution: ***after a hard landing or if high loads have been experienced a complete inspection according to the Maintenance Manual Section 5.5 must be performed. Contact the manufacture for assistance if required.***

3.1.2 Post flight inspection

1. Check the sailplane according to subchapter 3.1.1 “Daily inspection” items.
2. Make records in a sailplane log-book.

3.1.3 Ground handling

It is necessary on the ground:

- to fasten the stick with pilot’s safety belts,
- to cover the glass of the closed pilot cockpit canopy with a cloth.

Ground-towing

- the sailplane is to be ground-towed by a car with a special rope ~ 10 m of length having metal rings,
- the end of the rope with rings is to be attached to towing hook,
- max ground-towing speed in aerodrome is 6 km/h,
- during ground-towing the stick shall be fastened with safety belts, motor stopped and a sailplane cockpit canopy shall be closed.

3.1.4 Storing and transportation

During winter season or if a sailplane is not in use for a long time it is recommended to de-rig it. Sailplane metal surfaces of connection junctions shall be lubricated with oil. A sailplane shall be stored in a hangar or in a trailer.

If a sailplane is stored in a hangar it is recommended to support its wings.

A sailplane shall be transported just by a special trailer. During transportation of a sailplane its joints shall be protected from dust and dirt. A sailplane being stored in a hangar, trailer and transported shall be cloth-covered.

If the sailplane is planed to be stored for more as two months, take batteries out and store it in dry place at room temperature.

Caution: ***make sure that there is no water in the fin and wing tanks before winter season.***

3.1.5 Cleaning and keeping clean

Caution: ***static pressure holes shall be protected with tape from water during washing.***

Caution: ***remove tape from static pressure holes after washing the sailplane.***

Warning: ***after removal of tape check that the holes are not obstructed.***

The sailplane shall be washed with clean water using a soft cloth. After washing check drainage openings are clear of water. Avoid cleaning with huge amount of water around area of FES motor, and batteries compartment.

3.1.6 Rigging and de-rigging of a sailplane

Caution: ***It's not allowed to rig or de-rig inner wings with outer wings installed. These must first be removed from the wing.***

3. Use a sailplane rigging team of 2 persons (or 3 - if special rigging equipment isn't used).
4. Rigging equipment: fuselage supporter (holder), wing tip supporter (holder `1.2 m of height).
5. Rigging procedures (fig. 3.1.6_01, fig. 3.1.6_02, fig. 3.1.6_03, fig. 3.1.6_04, fig. 3.1.6_05):
   - clean and lubricate all pins, hubs and connection joint of control systems,
   - put the fuselage onto supporters (in case of absence of them one person shall hold the fuselage). Open the cockpit canopy,
   - fit the spar end (fork) of the left wing (pos. 1) into the fuselage window on the left side and push the wing along longitudinal axis so that pins on the fuselage (pos. 2) enter the connection (pos. 3) sockets in the wing rib. During this procedure the stick, control handles of flaps, airbrakes and water ballast shall be in such position

that pins in control shafts of ailerons and flaps and in control shafts of airbrakes and water ballast (pos. 7, 8, 9) turn at an angle which coincide with cuttings of corresponding shafts end in the wing, thus control of ailerons, flaps, airbrakes and water ballast in the left wing connects automatically. Support the left wing end (if there is no supporter one person shall hold the wing end),

- water ballast shall be in such position that pins in control shafts of ailerons and flaps and in control shafts of airbrakes and water ballast (pos. 7.8.9) turn at an angle which coincide with cuttings of corresponding shafts end in the wing, thus control of ailerons, flaps, airbrakes and water ballast in the left wing connects automatically. Support the left wing end (if there is no supporter one person shall hold the wing end),
- fit the spar end of the right wing (pos. 4) into the fuselage window on the right side and push the wing along longitudinal axis so that the spar end of the right wing enters the fork of the left spar (pos. 1) and pins on the fuselage enter connection sockets in the wing rib. Connection of control systems of ailerons, flaps, airbrakes and water ballast is analogical to connection of the left side of the wing,
- place both spar fixation pins (pos. 5) into hubs (pos. 6) fully (after adjustment of hubs on the ends of the left and right spar) and fix pin handles with pin-fixators (pos. 10) which are fitted into special forks (pos. 11) on inside board of the fuselage. In order to improve the aerodynamic cleanness of the surface, the connection slot between fuselage and wing later is covered with sticky tape.

Note: ***fixation pins of spars have to enter into spar hubs smoothly by pushing them with hands without applying any significant force or other devices. If pins stop interrupt assembling and check pins and hubs for proper cleaning and damage of their surfaces.***

- to connect left and right outer wings: pull out the plugs located at the leading edges of inner wings,
- connect a special key (pos. 20) by turning handle (pos 21) clockwise,
- unlock the pin (pos. 22) of spar (pos 13) by turning the key until stop (the upper grip of key should move towards the fuselage). Pull the pin out of spar by pulling the key backwards until stop,
- fit spar ends of outer wings (pos. 13) into recesses correspondingly in end ribs of left and right inner wings and push them to the end until hubs in ribs of outer wings (pos. 14) push onto the corresponding them connection pins in end ribs of inner wings (pos. 15) and coverings of outer wings and inner wings ends come together without any slots. It is necessary to hold the ailerons of outer wings and inner wings in such position that tongues on ailerons ends of outer wings coincide with corresponding sockets on the ends of wing ailerons. **Option:** if aileron control system in the outer wing has control rod it shall be connected to aileron control rod in inner wing,
- in order to improve an aerodynamic cleanness of surface the connection slot between wing tips and wings later is covered with sticky tape,
- pull the pin (pos. 22) in to the spar by pulling the key towards the wing until stop. Lock the pin of spar by turning the key until stop (the upper grip of key should move towards the wing tip),
- unscrew the key by turning the handle (pos. 21) counter clockwise and pull in the plugs.

Caution: ***check the reliability of the winglets connections to the outer wing by trying to pull them out by their ends applying force of 10-20 kg. With fixators down they have to***

hold the winglets reliably not allowing any movement. If the winglets move or the slot between outer wings in their coverings connection place has increased separate the ends, find out the reason and eliminate it.

- when the stabilizer is being connected (fig. 3.1.6_06, fig. 3.3.6_07) the elevator shall be set in neutral position,
- put on the stabilizer with an elevator so that protrudes on the elevator's left and right sides (pos. 2) enter the recesses of control lever of the elevator (pos. 1) and the two hubs in spar of the stabilizer (pos. 4) push onto the pins (pos. 3) fully, thus control of the elevator connects automatically,
- insert the connection bolt (pos. 6) through the opening in the stabilizer from above and
- screw it into thread of hub (pos.5) fully with a 13 mm hexagonal wrench. Connecting the stabilizer the fixator (pos. 7) locks the connection bolt automatically.

Note: ***after the sailplane rigging is finished check the operation of control systems of the elevator, ailerons, flaps, airbrakes and water ballast. Also check the wings for looseness with respect to fuselage in plane of wing chords (forward – backward). If there is looseness wing shall be separated from fuselage and hubs in wing root ribs (fig. 3.1.6_01, pos. 3) shall be adjusted.***

6. All the main de-rigging procedures of the sailplane shall be done in the opposite order.

Warning: ***Before unscrewing the connection bolt of the stabilizer unlock the bolt (fig. 3.1.6_07, pos.7).***

3.2 Lubrication system

Lubricants:

- Grease - the greases we recommend are lithium based pressure-resistant anti-corrosion greases like AeroShell Grease 33 or lithium-soap greases (multi-purpose greases for rolling element bearings). The same greases can be used for long time preservation of the components.
- Oil - if needed, it is recommended to use oils conforming to the SAE 5W-40 requirements.

Do the lubrication as shown at the scheme fig. 3.2_01 annually as apart of inspection at the end of flight season:

1. Control stick joint.
2. Rudder pedals joint.
3. The canopy opening and emergency jettison system.
4. Shafts of ailerons, flaps and airbrakes and hinges of rods.
5. Levers and hinges of airbrakes.
6. Hinges of flaps and connection joint of lever.
7. Hinges of ailerons and connection joint of lever.
8. Hinges of ailerons of outer wing.
9. Hinges of elevator and connection joint of lever.
10. Hinges of rudder and connection joint of lever.
11. Towing hook.

12. Main landing gear.
13. Tail wheel.
14. Propeller blades attachment point.

When re-lubricating, clean old oil or grease before applying new.

3.3 Adjustment

3.3.1 Adjustment of airbrakes

If airbrake (fig. 3.3.1_01, pos. 1) extension occurs unexpectedly in flight it is necessary to tighten the springs of the lids (pos. 2) by help of nuts (pos. 3). Check the springs proper tightening by lifting the lid upward. The lid has to lift up with force not less than 13.5 kg.

3.3.2 Adjustment of main wheel brake control system

The control system of the main wheel brake (fig. 2.3.9_01) is adjusted with help of these procedures:

- take away a pilot seat,
- loosen the nut (pos. 4),
- turn support of wire (pos. 3) into required position,
- fix the support screwing up the nut (pos. 4).

If there is no enough travel of a wire adjuster (pos.3), than it is necessary to change position of brake shoulder (pos. 5).

Note: ***Excessive cable loosening increases idle motion of the handle (pos. 1) and decreases brake effectiveness (increases sailplane braking distance).***

Too small cable loosening decreases idle motion of the handle (pos. 1) and increases brake effectiveness (decreases sailplane braking distance).

Adjustment of hydraulic brake system (fig. 2.3.9_02).

To adjust the travel of the master cylinder, a threaded plate with slot (pos. 8) is used. The plate is fixed by nut (pos. 9).

The brake fluid DOT4 is used in the brake system. To fill the brake system, recommendations of the manufacturer shall be used (www.beringer.fr).

3.3.3 Adjustment of cockpit canopy emergency jettison system

The cockpit canopy emergency jettison system (fig. 2.4.6_01, fig. 2.4.6_02) is adjusted by help of bolts (pos. 6). By screwing of the bolts the frame contour of the cockpit canopy is coincided with the contour of the fuselage cockpit frame. The cockpit canopy has to lay on the fuselage without any protrusions. The gap between the canopy frame and the fuselage frame shall be 0.5…1 mm along all of the perimeter.

Force on the handle of the canopy emergency jettison (pos. 1) while opening the canopy shall be 4 … 9 daN.

3.3.4 Adjustment of rudder control system

Adjustment of cables (fig. 2.3.4_01, fig. 2.3.4_02). Control cables (pos. 4) are adjusted by help of turnbuckles (pos. 3) (zone A). Allowed turns out for each turnbuckle end –no more than 3 thread turns. Tension force of cable after adjustment is 1.5 ± 0.1 daN.

After adjustment of cables turnbuckles are locked with lock wire ϕ1.0 mm (pos. 10). Refer to fig. 2.3.4_02 (zone A).

Inclination angle of pedals in neutral position (106°) is checked with domestic goniometer by pressing its edge against pedal plane.

In order to avoid of differentiation of rudder deflection the axis of the bellcrank in the fuselage (pos. 6) shall be perpendicular to a sailplane axis.

Adjustment of the rod (pos.8): the rod is adjusted by turning of rod end. After adjustment make sure that the rod end doesn't screw out of bounds of control opening. The end nut (pos. 12) shall be screwed up and fixed with spring washer (pos. 13) and crown nut (pos. 15) for connection of the rod to the control shall be fixed with wire pin (pos.17). The force keeping the rudder pedals aligned (with rudder connected) as measured by dynamometer at the level of the pedals' upper cross pipes and at initial pedal motion moment, must be 2,5 ± 0,2 daN. Motion of pedals shall be smooth and even.

3.3.5 Adjustment of FES system

The following FES system items has to be checked and adjusted if out of allowable range:

1. Gap between spinner and fuselage, should be around 0.5÷1.0 mm. You can adjust the gap with 4 nuts on back side of mounting wall.
2. Closing and opening of ventilation. With ventilation knob, fully rearward, ventilation should be fully closed. If not adjust it with small screw which hold wire inside of instrument panel.

3.4 De-rigging and rigging of sailplane parts

3.4.1 De-rigging and rigging of ailerons

De-rigging of ailerons (see fig. 3.4.1_01, fig. 3.4.1_02):

- loosen and remove the nut (pos. 6),
- take off washer (pos 5),
- pull the aileron towards the end of wing until the hinge pins (pos. 3) are separated from wing.

Installation of the ailerons shall be done in reversed order

De-rigging of control rod (see fig. 3.4.1_01, fig. 3.4.1_02):

- remove the rivet (pos. 1),
- remove the intermediate hubs (pos. 2).

Connecting aileron control rod:

- set the rod into control bracket,
- fit intermediate hubs (pos. 2),

- push through the new rivet and rivet it (pos. 1).

Note: ***riveting shall be done according to repair technology current acceptable practices using rivet ordered from manufacturer.***

Note: ***outer wing aileron control rod is optional. Basic models of LAK-17B FES has no control rod and the ailerons are connected to the inner wing automatically.***

3.4.2 De-rigging and rigging of a flap

De-rigging of flap (see fig. 3.4.2_01):

- loosen and remove the nut (pos. 6),
- take off washer (pos 5),
- pull the flap towards the end of wing until the hinge pins (pos. 3) are separated from wing.

Installation of the ailerons shall be done in reversed order.

De-rigging of control rod (see fig. 3.4.2_01):

- remove the rivet (pos. 1),
- remove the intermediate hubs (pos. 2).

Connecting control rod:

- set the rod into control bracket,
- fit intermediate hubs (pos. 2),
- push through the new rivet and rivet it (pos. 1).

Note: ***riveting shall be done according to repair technology current acceptable practices using rivet ordered from manufacture.***

3.4.3 De-rigging and rigging of a rudder

Note: ***Full disconnection of rudder from fin (see fig. 3.4.3_01, fig. 3.4.3_02) is possible just after peeling off tightening tapes (pos. 4, pos. 5, pos. 6).***

A rudder is removed in such order:

- peel off tightening tapes (pos. 4, pos. 5),
- remove a pin from a rudder control rod,
- turn a rudder sideways, peel off plastic tape (pos. 6) from the rudder nose,
- remove wire split pins from three hinge pins of the rudder (pos. 7) and discard. While removing a wire split pin from the third hinge pin keep previous rudder axis,
- remove the rudder hinge pins.
- remove the rudder.

Assembling of a rudder shall be done in the opposite order.

Note: ***before sticking plastic tape (pos. 6) on again, surfaces to be taped shall be cleaned of old glue remainders. Use glue of 88 H type.***

3.4.4 De-rigging and rigging of an elevator

1. Operations used for de-rigging of an elevator (fig. 3.4.4_01):
   - take away wire split pins (pos. 3) and discard,
   - take away washers(pos. 2),

- pull out hinge pins (pos. 1).

2. Operations used for rigging of an elevator:

- fit the elevator into the hinge brackets,
- push through the hinge pins (pos. 1),
- put on washers (pos. 2),
- lock the hinge pins with wire split pins (pos. 3).

3.4.5 De-rigging and rigging of a trimmer

It is possible to de-rig and rig a trimmer (Fig.2.3.3_01) through the inspection hatch (pos.9). Disconnecting of springs is done when they are squeezed together as much a possible.

Other trimmer parts are not supposed to be de-rigged.

3.4.6 De-rigging and rigging of a cockpit canopy

1. De-rigging of the cockpit canopy (fig. 2.4.6_01, fig. 2.4.6_02):

- release the cockpit canopy by pulling the canopy emergency jettison handle (pos. 1) up and keeping the canopy from falling down,
- take away the cockpit canopy.

2. Rigging of the cockpit canopy:

- squeeze the spring (pos. 3) by pulling the handle (pos. 4) down and fixing it in the intermediate position,
- position on the cockpit canopy on the cockpit,
- attach the cockpit canopy to the fixator (pos. 2) pushing the canopy emergency jettison handle (pos. 1) forward till canopy is engaged,
- correct the cockpit canopy position with adjustment bolts (pos. 6),
- release the spring (pos. 3) switching the handle (pos. 4) into working position.

Warning: ***after rigging of the cockpit canopy make sure the spring device is switched into working position.***

3.4.7 Removal and installation of main landing gear wheel

Warning: ***deflate the tire before doing the disassembly of the main wheel.***

These operations shall be done to remove the main landing gear wheel (fig. 3.4.7_01):

- unbend the edge of the washer (pos. 1) from the bolt (pos. 2) head,
- unscrew the bolt (pos. 2),
- take out the washer (pos. 1),
- disconnect the lever of wheel brake (pos. 3),
- pull out the axle of wheel (pos. 4) together with hub (pos. 5, pos. 6) and washer (pos. 7),
- remove landing gear wheel (pos. 8) with a tyre (pos. 13),
- to remove tire unscrew the nut (pos. 9) and take out bolts (pos. 12) joining halves of the wheel body, take away the tyre with an inner tube.

Assembling and attachment of the wheel shall be done in opposite order.

Note: ***when assembling wheel before screwing the bolts (pos. 12) joining halves of the wheel body it is necessary to move the tyre slightly from side to side.***

3.4.8 Removal and installation of tail wheel

To remove the tail wheel (fig. 3.4.8_01) do these operations:

- unbend edges of the lock washer (pos. 1) from surfaces of the hub (pos. 2) and the bolt (pos. 3),
- unscrew the bolt (pos. 3),
- pull out the axle of wheel (pos. 4),
- remove the wheel (pos. 5).

Installation of the wheel shall be done in opposite order.

3.4.9 Taking out and mounting of an instrument panel

Do the following operations to take out the instrument panel (fig. 3.4.9_01):

- unscrew four bolts (pos. 1) attaching the instrument panel (pos. 2) to the hood (pos. 3),
- disconnect pipes from the instrument panel,
- remove the instrument panel (pos. 2).

Mounting of the instrument panel shall be done in opposite order.

3.4.10 Taking out and mounting of pilot cockpit floor

The cockpit floor (fig. 3.4.10_01) consists of two removable parts: a stick hood (pos. 1) and a hood of cockpit bottom (pos. 2).

Removal of the stick hood:

- unscrew four bolts (pos. 3),
- take away the stick hood.

Removal of the hood of a cockpit bottom:

- unfasten studs (pos. 4),
- take away the hood of a cockpit bottom (pos. 2).

Mounting shall be done in an opposite order.

3.4.11 Removing and installing the FES battery packs or the dummy boxes

To remove battery packs from the glider:

1. Check that Power switch is OFF;
2. Check that FCU instrument and all other instruments (Flight computer, Flarm, Radio, Transponder, PDA...) are switched OFF;
3. Open cover;
4. Take out connecting cable between the packs;
5. Take out RED "+" and BLACK "-" power connectors;
6. Fix supply cables to the side of battery compartment box;
7. Remove both temperature sensor connectors, from each battery pack;
8. Fix temperature sensor cable to the side of battery compartment box;
9. Untighten battery pack fixation knobs;
10. Take the fixation plate out;
11. Firmly grip the front battery by a carrier strap;
12. Lift it out of the fuselage and put it on safe place;

13. Firmly grip the rear battery by a carrier strap and slide it forward along the bottom of the battery compartment;
14. Lift the battery pack out of the fuselage and put it on safe place;
15. Close cover.

Install the FES battery packs into the batteries box:

1. Open cover;
2. Check that Power switch is OFF;
3. Check that FCU instrument and all other instruments (Flight computer, Flarm, Radio, Transponder, PDA...) are switched OFF;
4. Insert first pack into the fuselage so that terminals are facing forward and slide it back to rear position;
5. Insert second pack into the fuselage so that terminals are facing rearward;
6. Place pair of fixation plates in the middle of rear pack, above holding strap and tighten fixation knob;
7. Place pair of fixation plates in the middle of front pack, above holding strap and tighten fixation knob;
8. Lift power cables
9. Plug in shorter cable, with 8mm pin in BLACK housing, to "-" marked 8 mm socket of front battery pack;
10. Plug in longer cable with 10 mm pin in RED housing, to "+" marked 10 mm socket of rear battery pack;
11. Insert temperature sensor connector, to each battery pack;
12. Turn ON switch (BMS) on each battery pack;
13. Close cover.

For more detailed information refer to the separate FES Battery pack GEN2 with integrated BMS (Battery Management System) manual, v1.19.

To remove the dummy boxes from the glider:

1. Open cover.
2. Untighten battery packs/dummy boxes fixation knobs.
3. Take the fixation plates out.
4. Firmly grip the front box by a carrier strap.
5. Lift it out of the fuselage and put it on safe place.
6. Firmly grip the rear box by a carrier strap and slide it forward along the bottom of the battery compartment.
7. Lift the dummy box out of the fuselage and put it on safe place.
8. Close cover. from side support;

To install the dummy boxes into the batteries box:

1. Open cover;
2. Insert first box into the fuselage and slide it back to rear position;
3. Insert second box into the fuselage and slide it to the first one;
4. Place pair of fixation plates (the same as used for the FES batteries fixation) in the middle of the rear dummy box, above carrier strap and tighten fixation knob;
5. Place pair of fixation plates (the same as used for the FES batteries fixation) in the middle of the front dummy box, above carrier strap and tighten fixation knob;
6. Check that FES batteries power cables and temperature sensor cable are firmly fixed to the side of battery compartment;
7. Close cover.

For more information about the dummy boxes, refer to the 2.5.3_02 illustration.

3.4.12 Removing and installing the motor

To remove the motor from the glider:

1. Open ventilation (fully forward position);
2. Remove plastic cover from center of front motor mounting rib;
3. Unscrew DB15 cable connector from motor rear wall;
4. Unscrew 3 self-locking nuts from rear motor wall and disconnect 3 power cables. Mark them as A, B, C;
5. Unsecure 5 screws M8 and unscrew them out. Hold motor assembly, and carefully take it out of fuselage.

To assemble motor back on glider, follow the reverse order.
Take care about additional items:

1. Open ventilation fully – lever pushed forward;
2. Always use only new special parts for securing M8 motor fixation screws;
3. Make sure that power cables are connected in the same order A, B, C like before and use only new M6 self-locking nuts. Make sure that there is no contact between cables and aluminum mounting wall;
4. For screwing DB15 connector use special screws locking glue Loctite 270 (for M2.5 fixing screws).

After motor is reinstalled, check the following:

- Spinner is in the center of fuselage;
- Gap between spinner and fuselage is 0.5 ÷ 1.0 mm;
- All bolted connections assembled correctly and secured;
- Start the motor on a ground and run it for a few minutes to check:
  - Motor rotating direction, smooth run of motor
  - Braking of propeller works OK
  - FES instrument is functioning properly.

3.4.13 Mounting and removal of the propeller

For mounting and removal of the propeller blades refer to the propeller manual.
Mounting of a propeller must be checked by a licensed inspector.

3.5 Illustrations

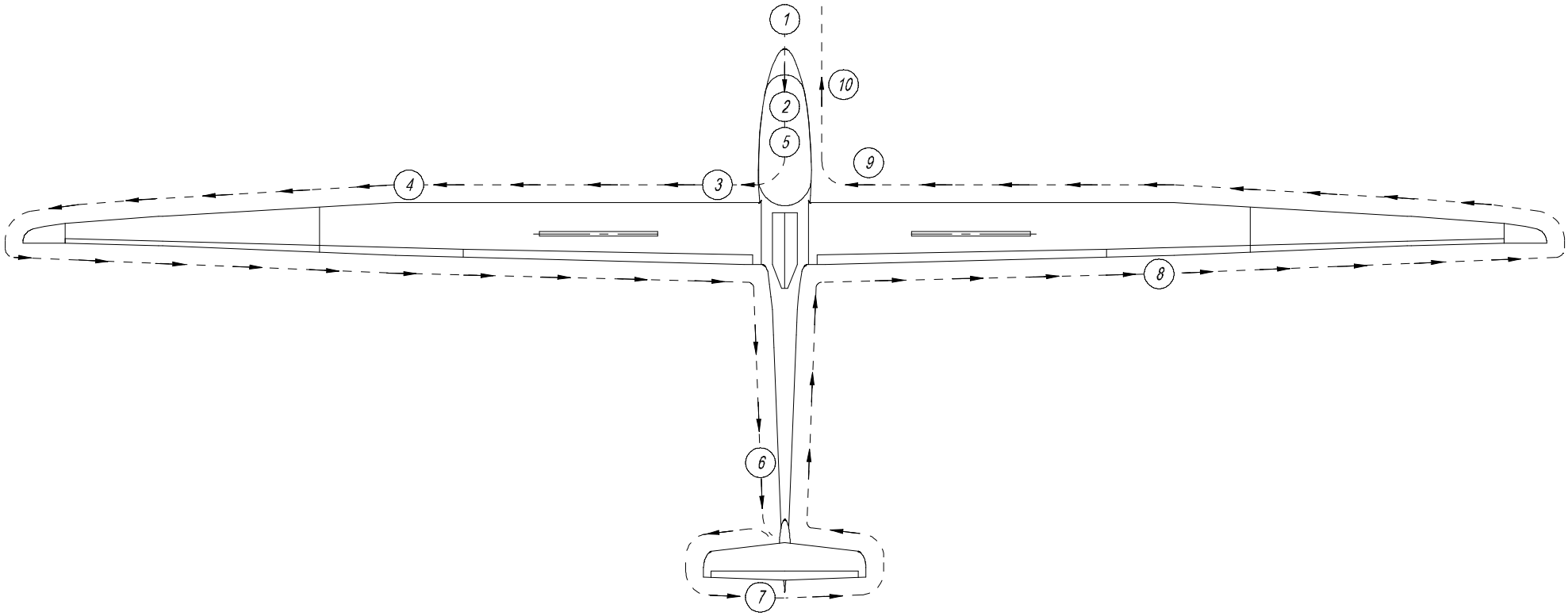
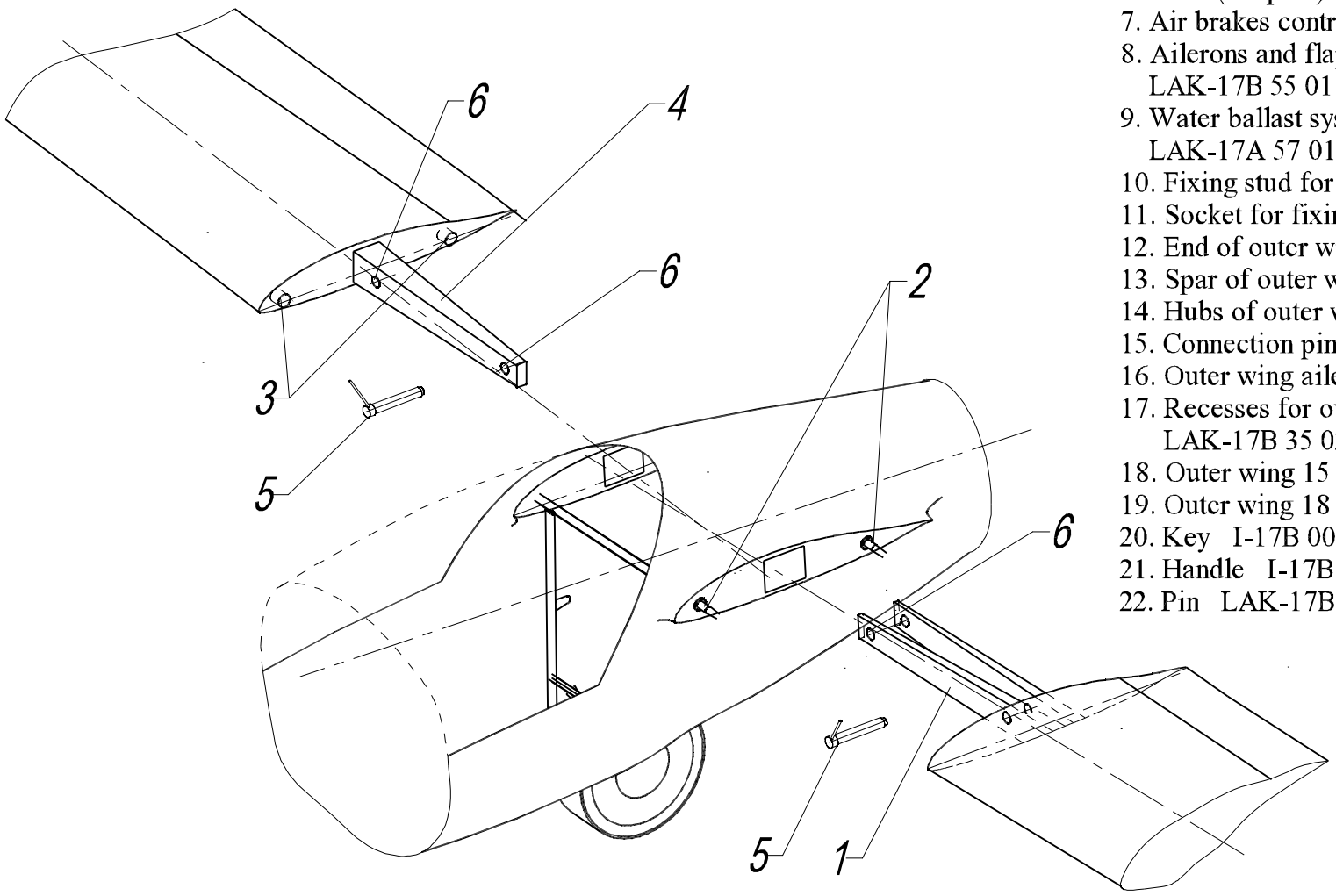


Fig. 3.1.1_01. Scheme of preflight inspection



1. Spar of left wing LAK-17B 20 40 00 00 SB
2. Connection pins (on fuselage) LAK-17A 10 00 00 01
3. Connection sockets LAK-17A 21 00 00 01-02
4. Spar of right wing LAK-17B 20 30 00 00 SB
5. Spars fixing pins LAK-17B 00 01 01 00 SB
6. Hubs (in spars) LAK-17B 20 30 00 05-06
7. Air brakes control shaft LAK-17B 55 01 02 00 SB
8. Ailerons and flaps coaxial control shafts LAK-17B 55 01 01 00 SB
9. Water ballast system control shaft LAK-17A 57 01 01 00 SB
10. Fixing stud for spar pin
11. Socket for fixing stud of spar pin LAK-17A 20 00 00 01
12. End of outer wing spar LAK-17B 21 01 03 00 SB
13. Spar of outer wing LAK-17B 22 01 00 00 SB
14. Hubs of outer wing rib LAK-17B 21 00 00 02
15. Connection pins of inner wing rib LAK-17B 20 22 00 04
16. Outer wing aileron control plate LAK-17B 35 03 00 01
17. Recesses for outer wings aileron control plate LAK-17B 35 02 00 02
18. Outer wing 15 m LAK-17B 22 00 00 00 SB
19. Outer wing 18 m LAK-17B 21 00 00 00 SB
20. Key I-17B 00 01 00 00 SB
21. Handle I-17B 20 00 01 01 01
22. Pin LAK-17B 20 31 00 00 SB

Fig. 3.1.6_01. Rigging of wing

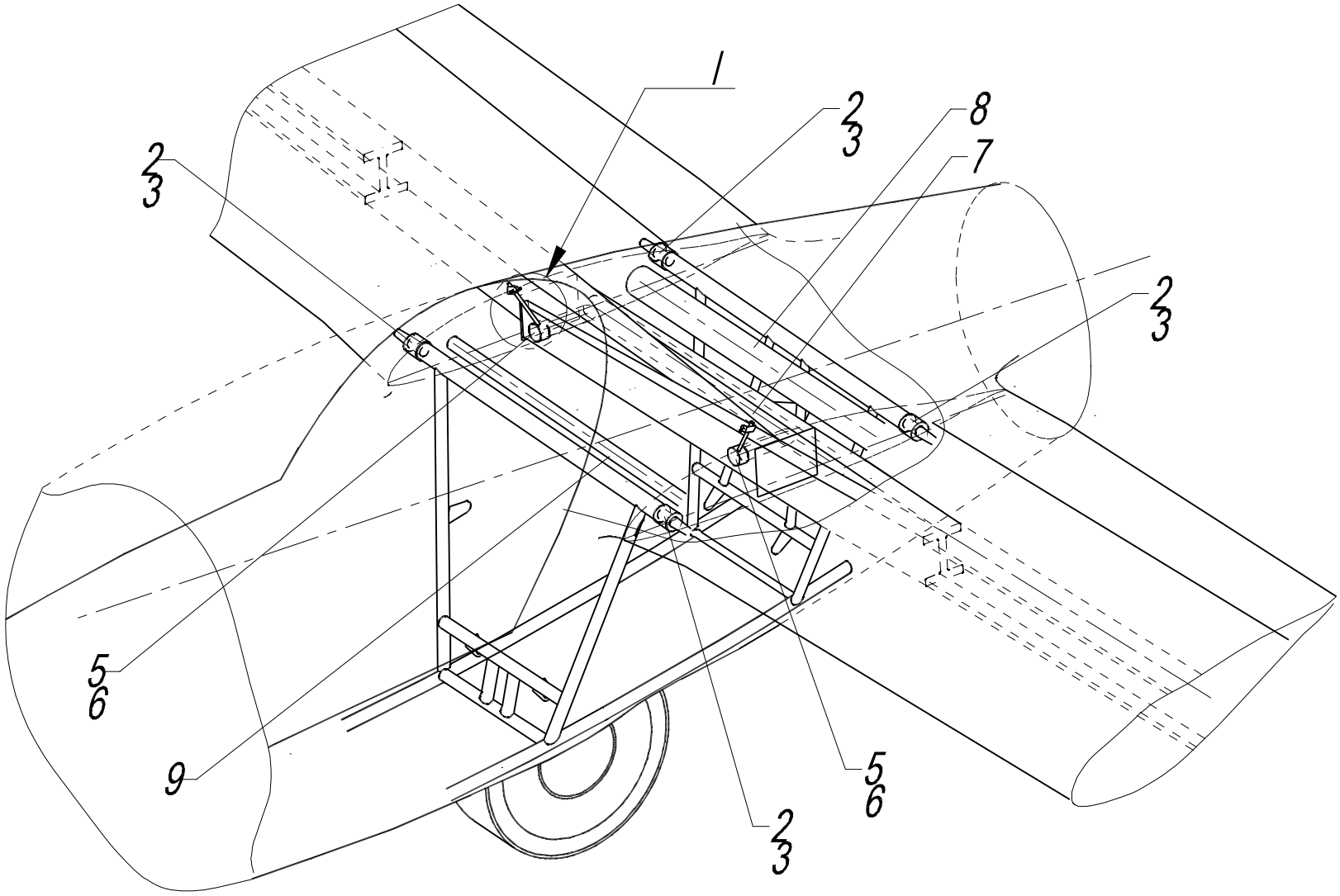


Fig. 3.1.6_02. Rigging of wing

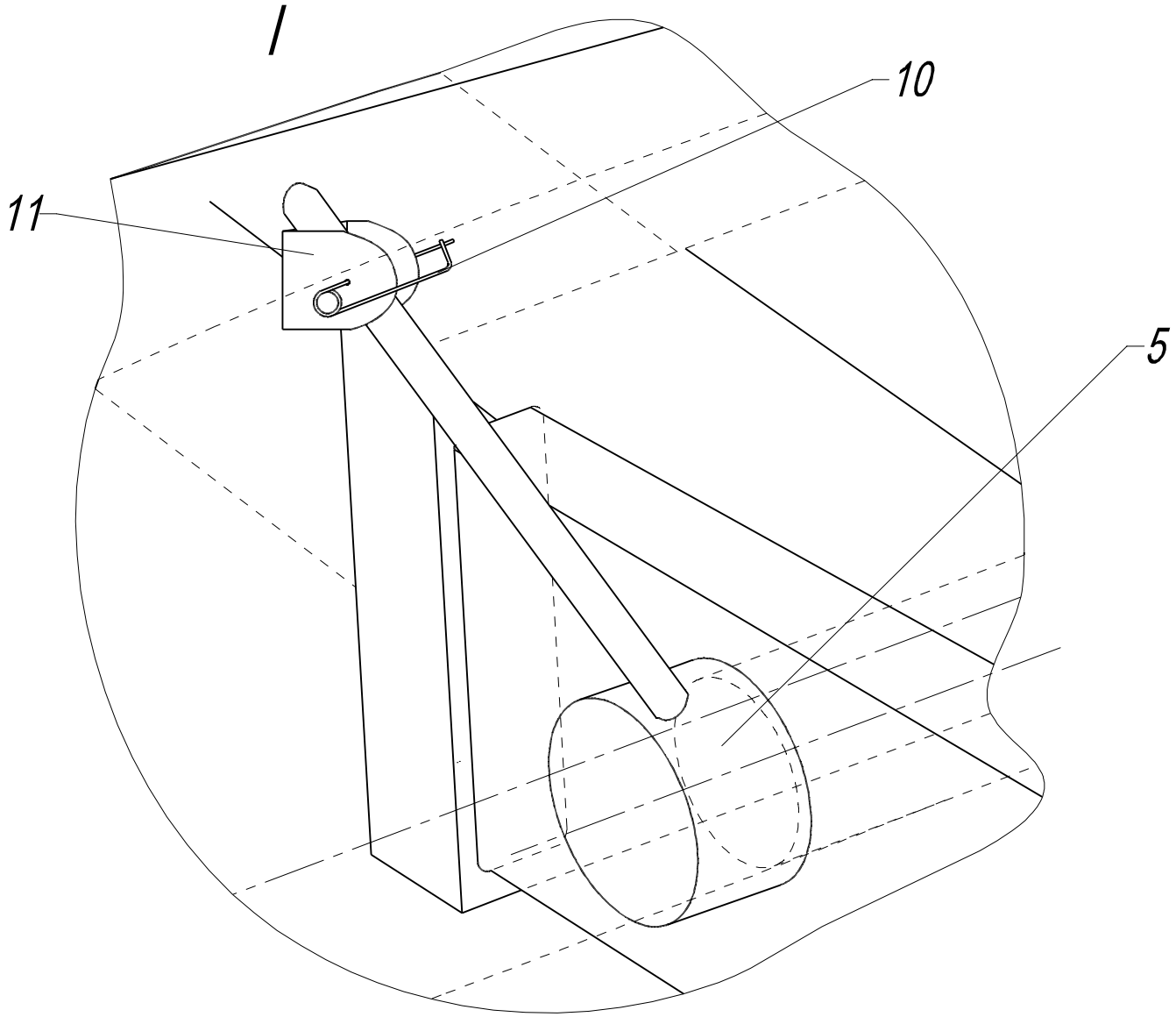


Fig. 3.1.6_03. Rigging of wing

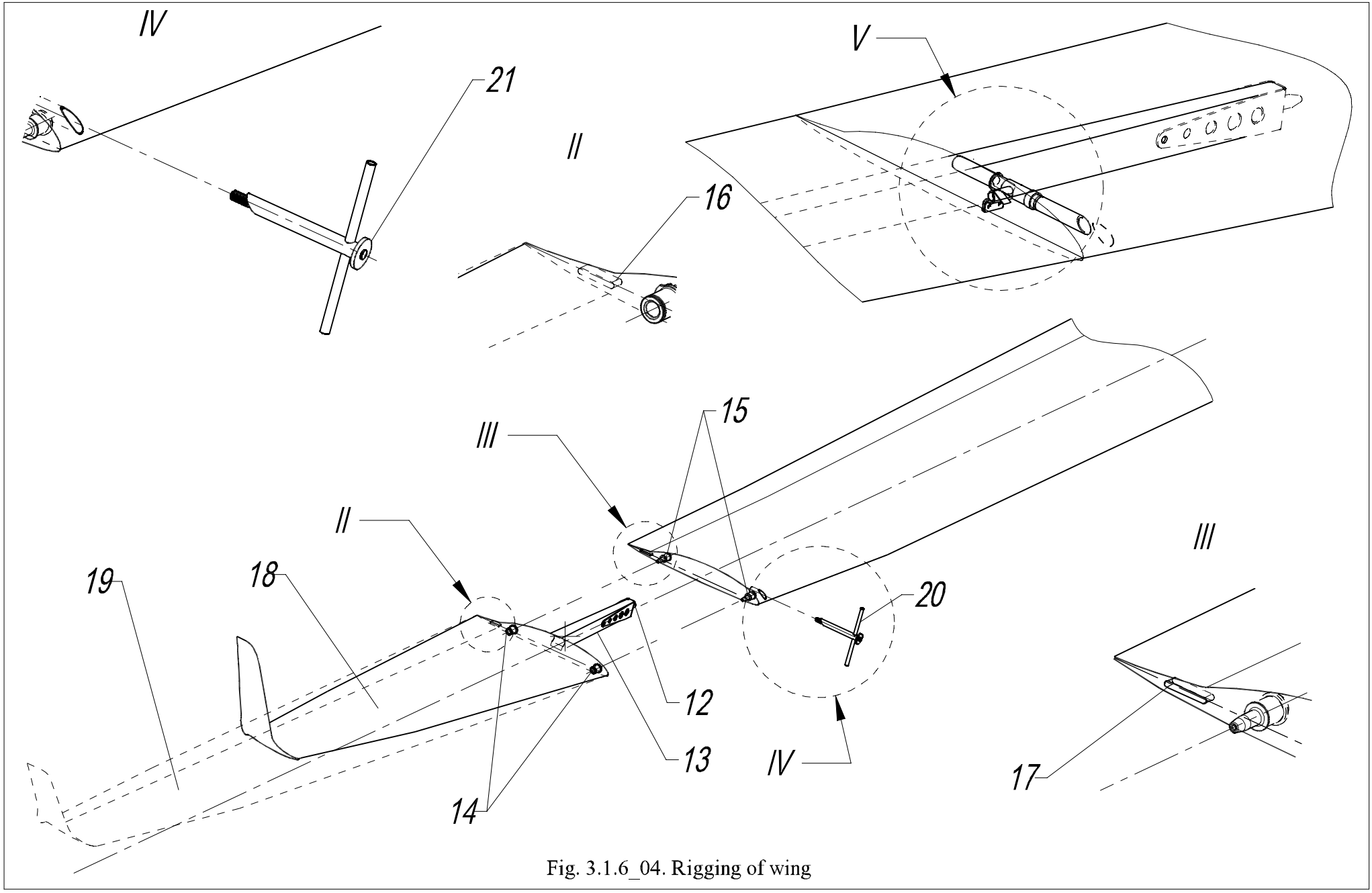


Fig. 3.1.6_04. Rigging of wing

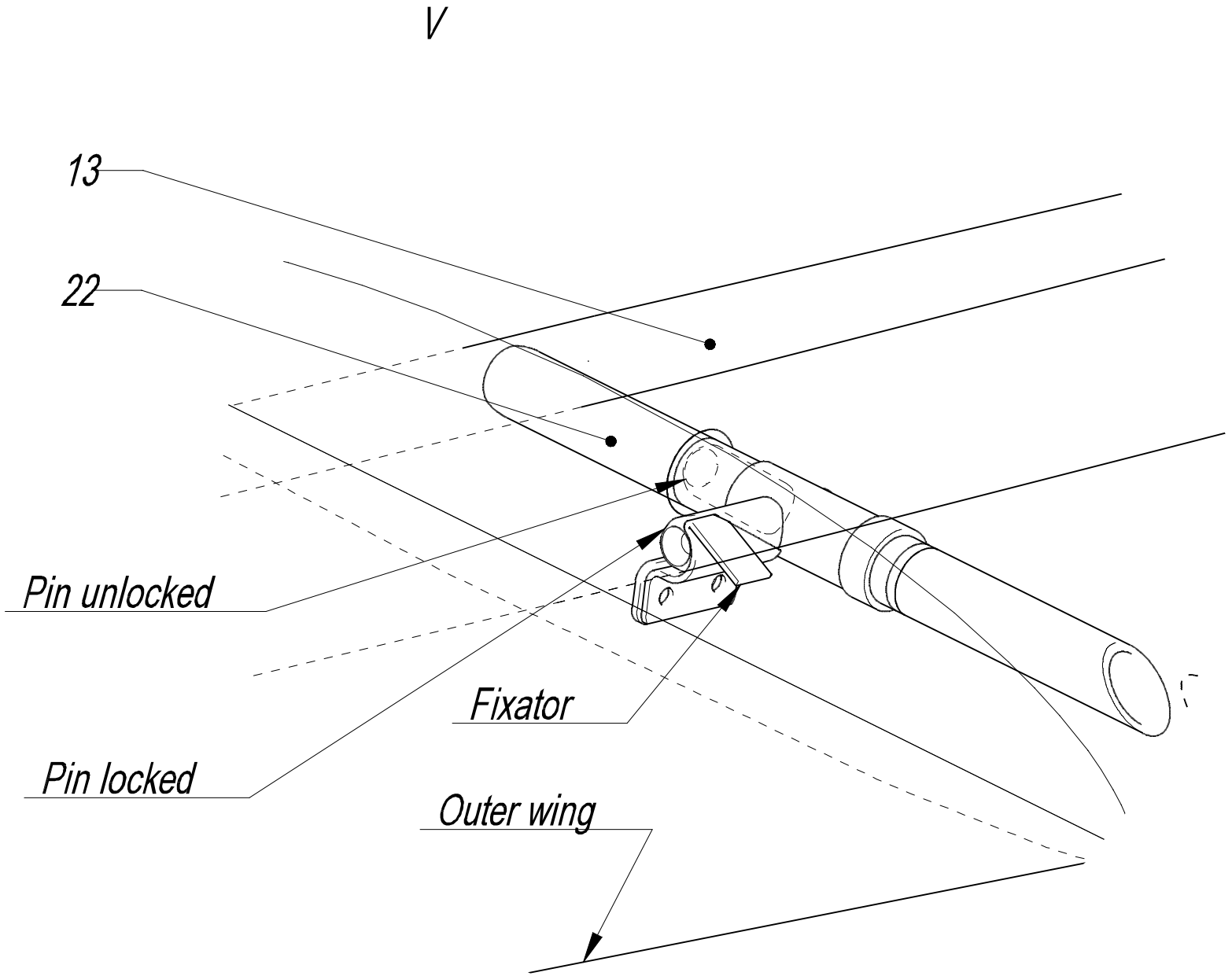
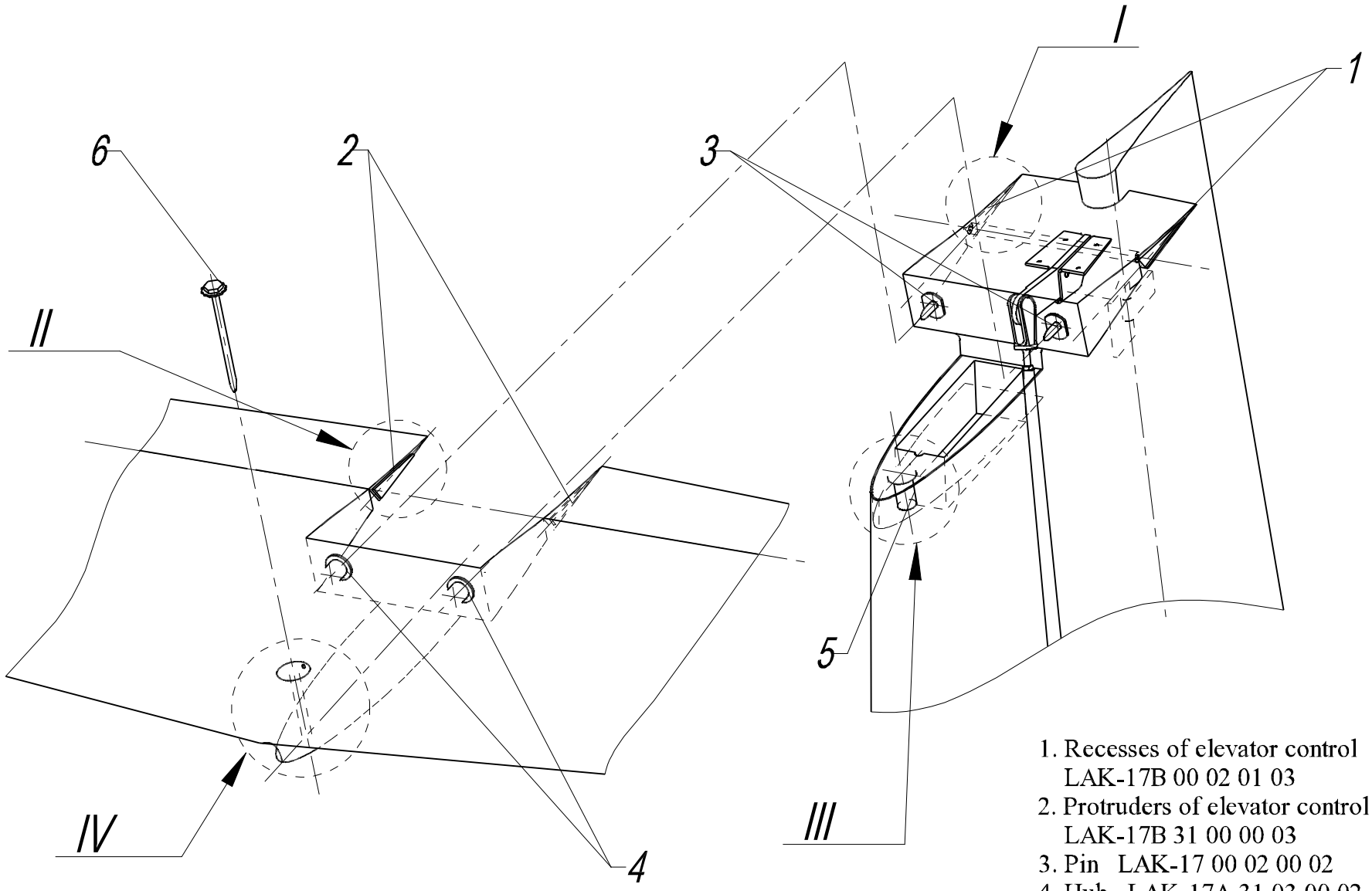


Fig. 3.1.6_05. Rigging of wing



1. Recesses of elevator control LAK-17B 00 02 01 03
2. Protruders of elevator control LAK-17B 31 00 00 03
3. Pin LAK-17 00 02 00 02
4. Hub LAK-17A 31 03 00 02
5. Fin hub LAK-17B 31 02 00 00 SB
6. Connection bolt LAK-17B 00 02 00 04
7. Fixator LAK-17B 00 02 06 10 SB

Fig. 3.1.6_06. Mounting of stabilizer on fin

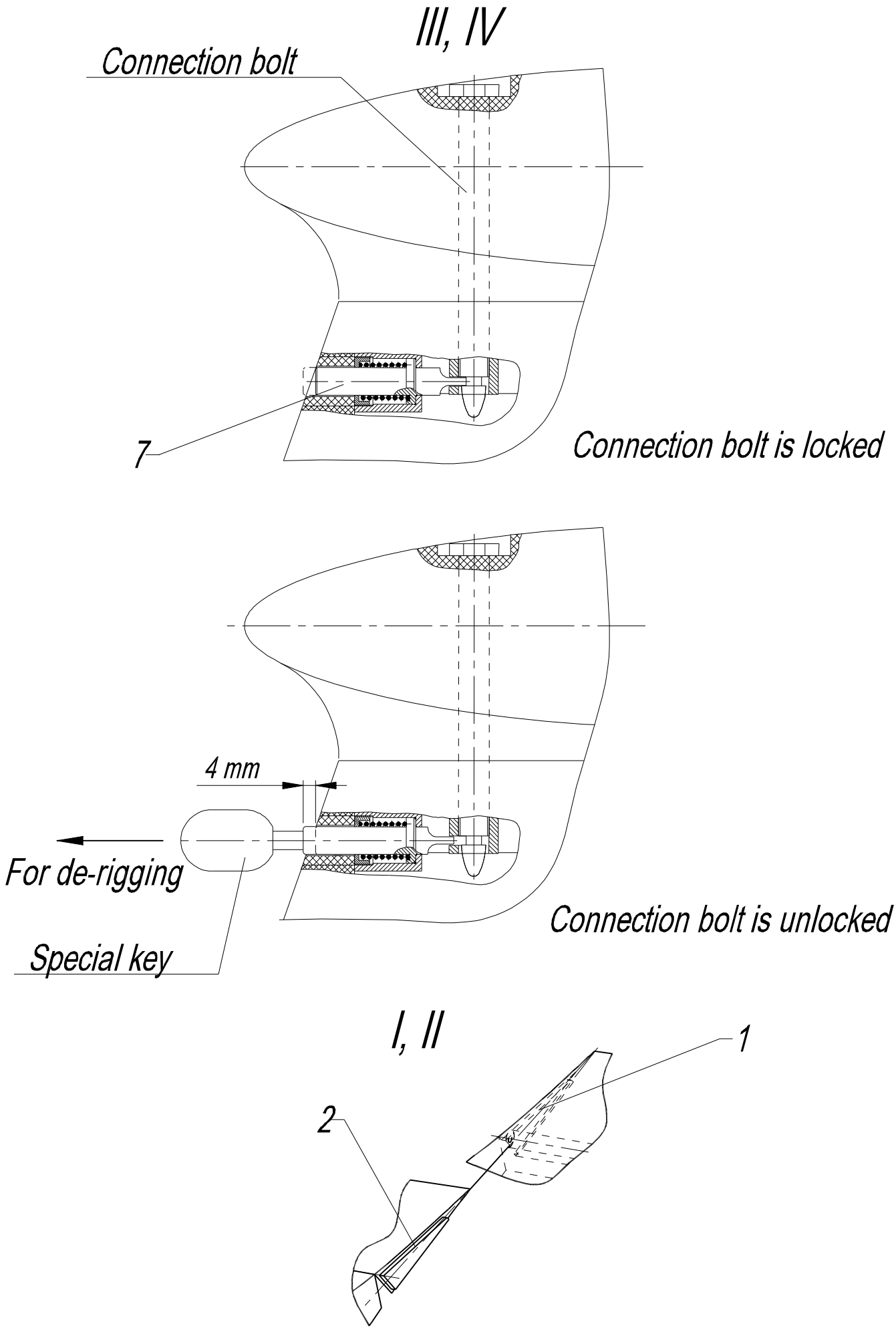


Fig. 3.1.6_07. Mounting of stabilizer on fin

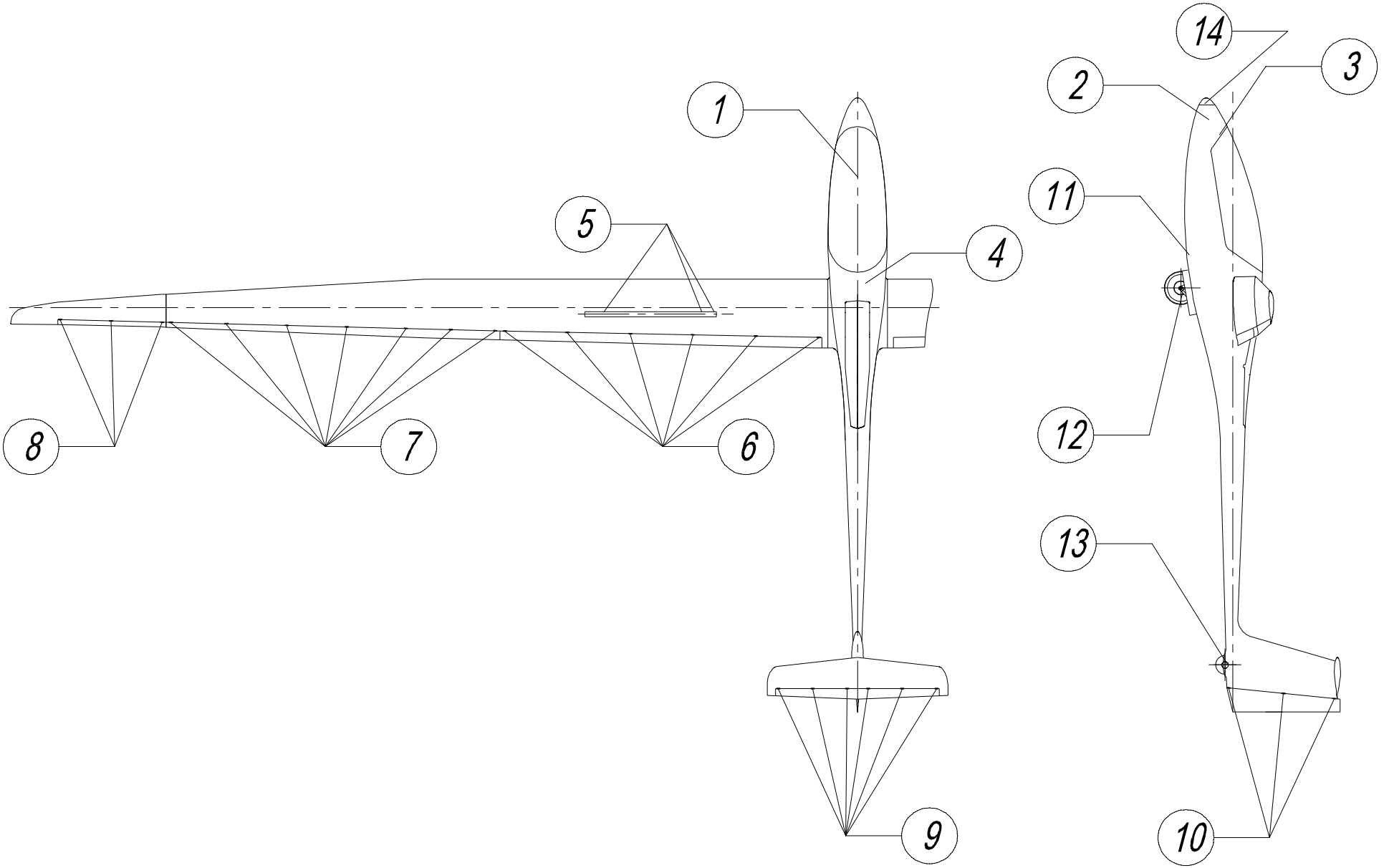
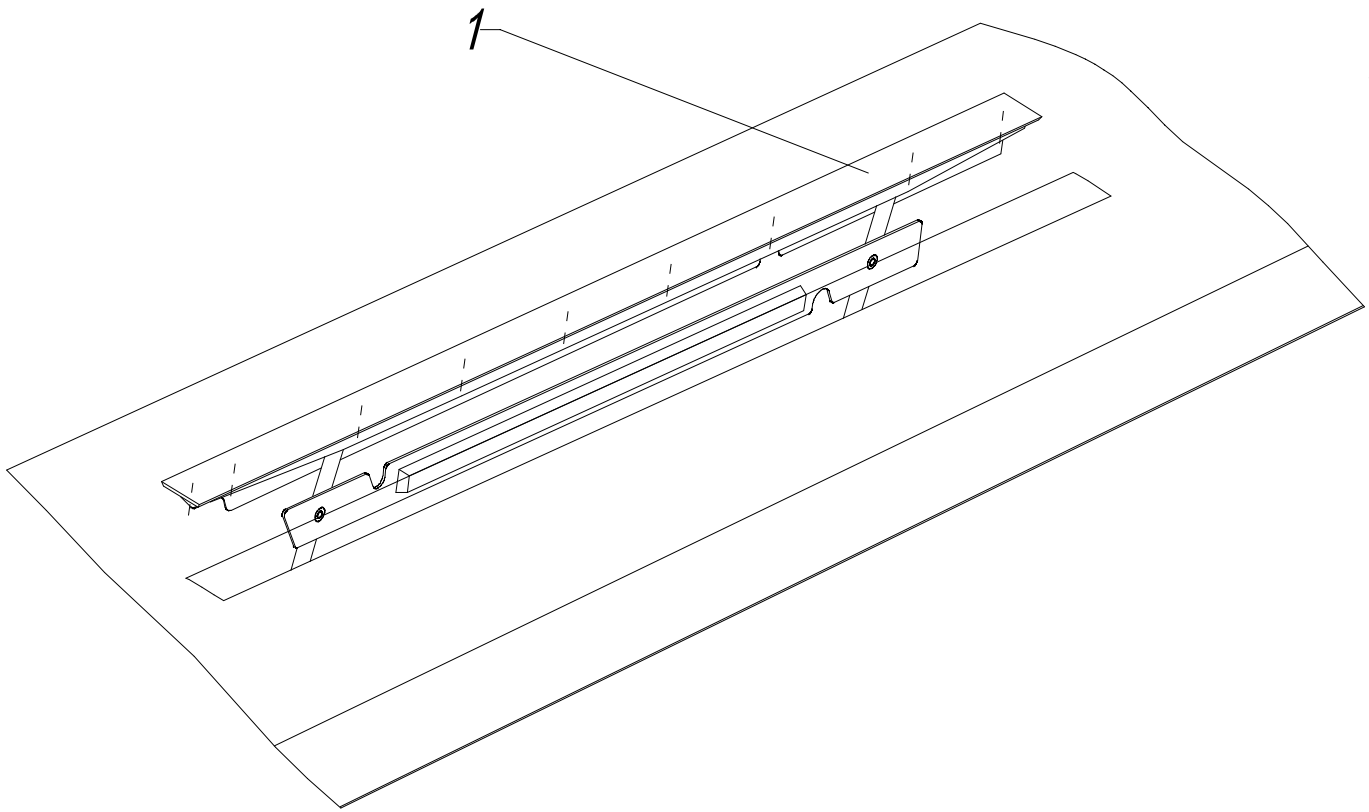
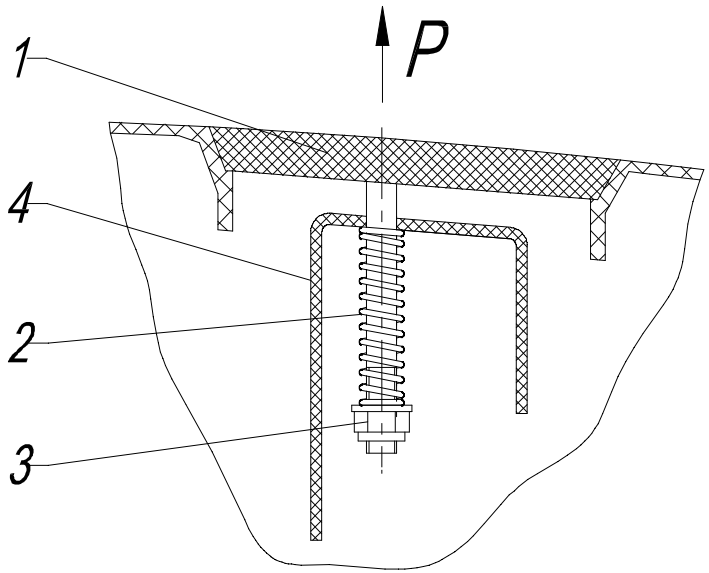


Fig. 3.2_01. Lubrication scheme





1. Cover LAK-17B 56 20 09 00 SB
2. Spring LAK-17A 56 20 00 09
3. Nut 3373A-4
4. Lower sheet LAK-17A 56 20 10 00 SB

Fig. 3.3.1_01. Adjustment of airbrakes covers

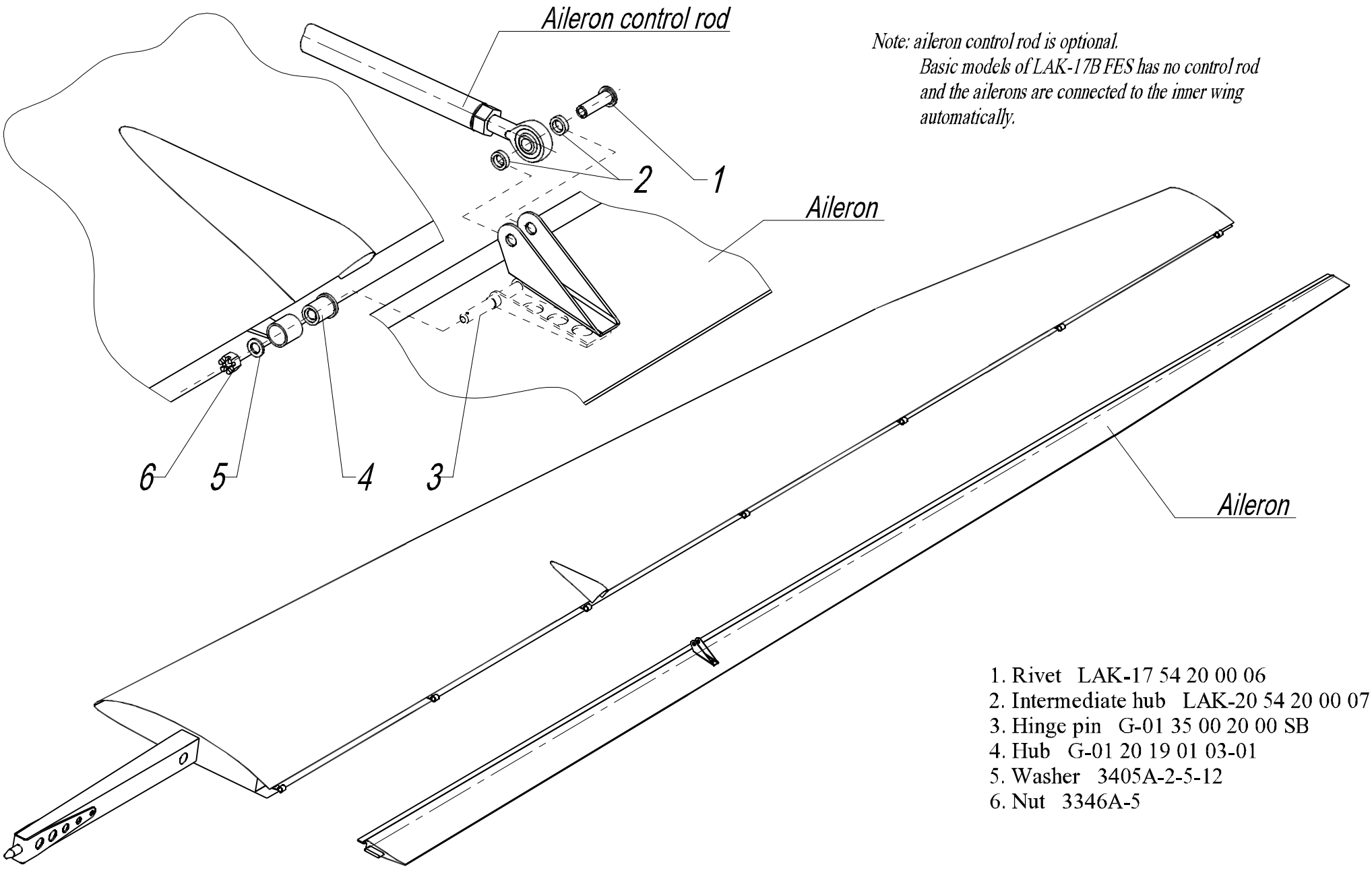
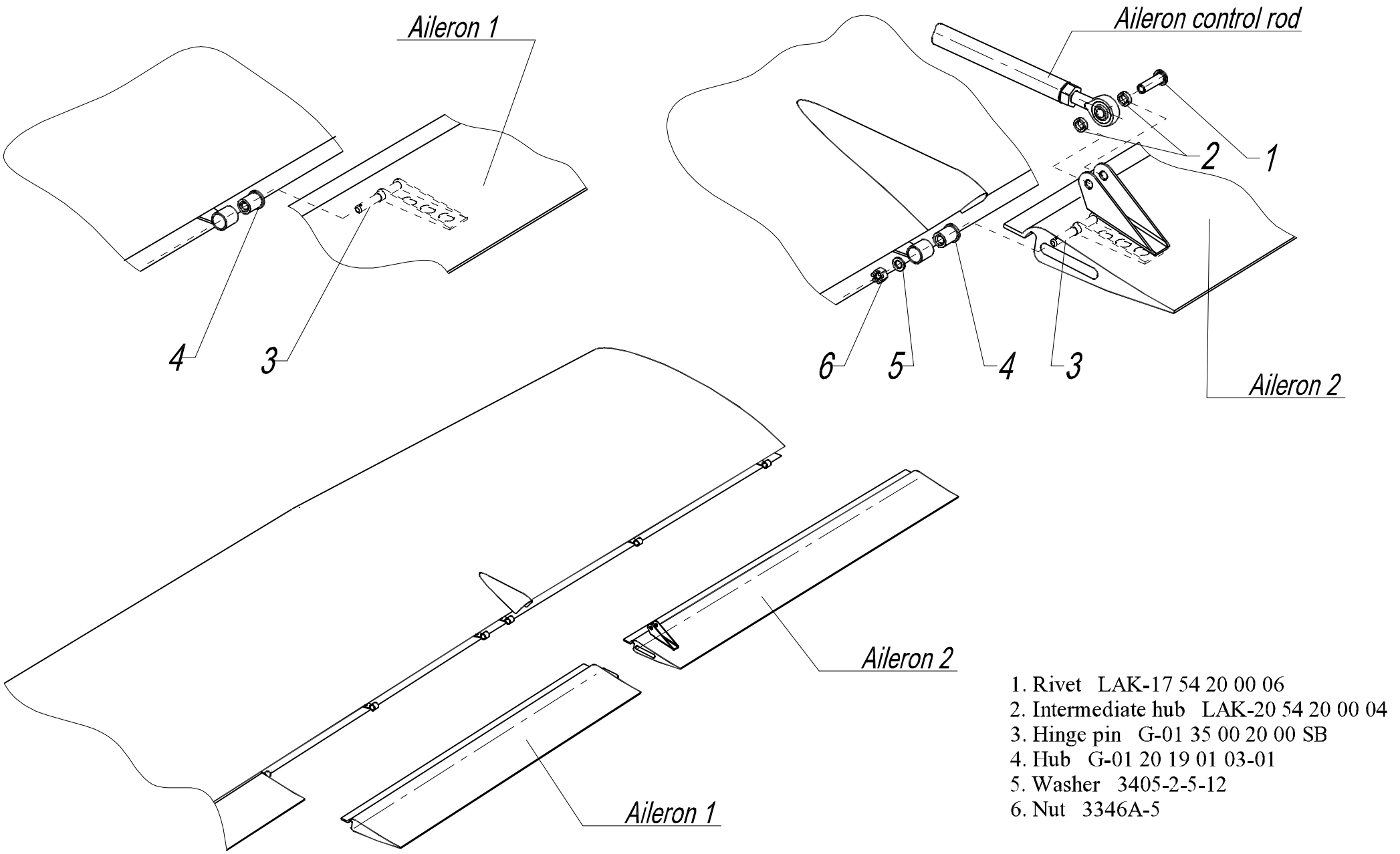
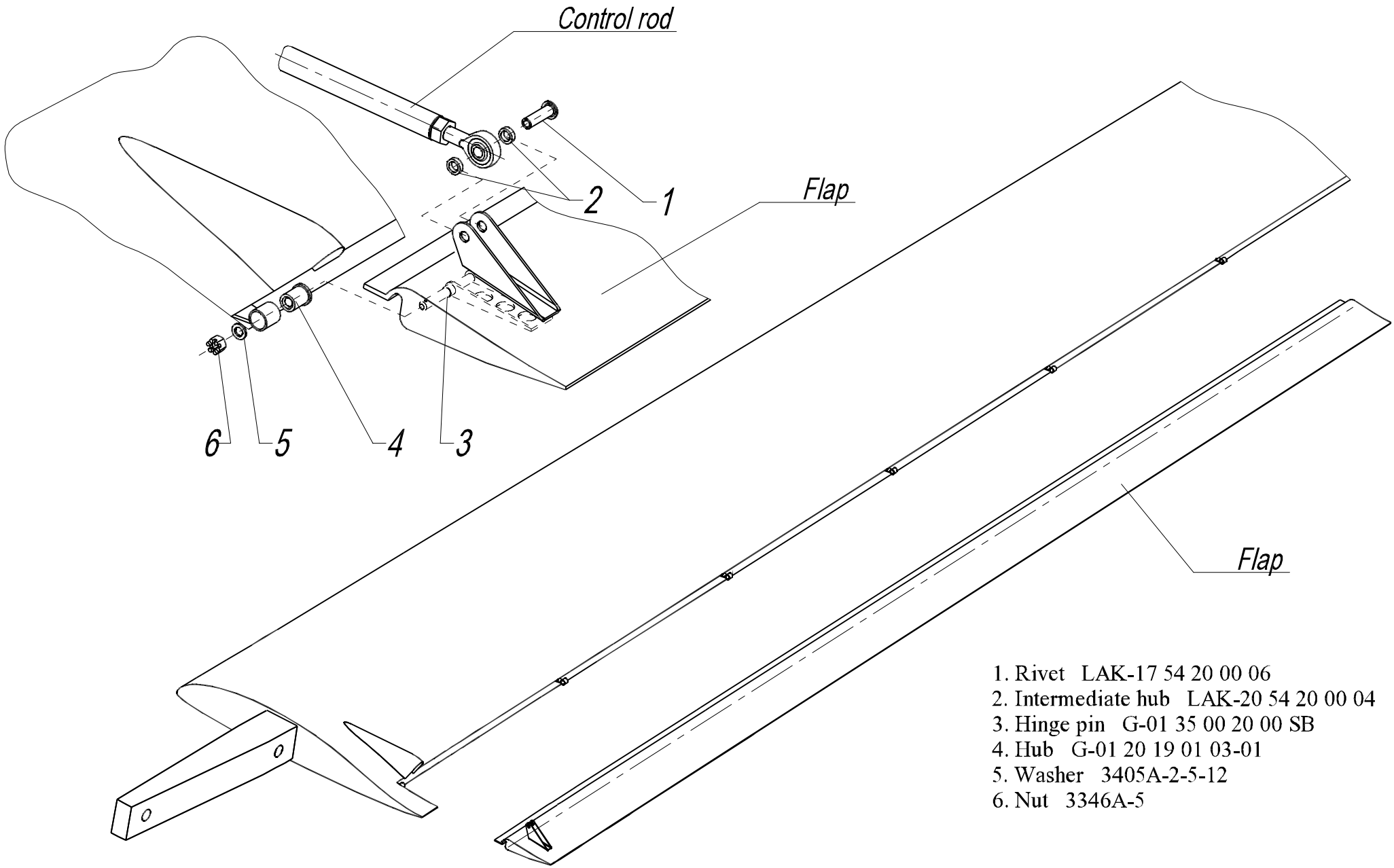


Fig. 3.4.1_01. Mounting of aileron of outer wing



1. Rivet LAK-17 54 20 00 06
2. Intermediate hub LAK-20 54 20 00 04
3. Hinge pin G-01 35 00 20 00 SB
4. Hub G-01 20 19 01 03-01
5. Washer 3405-2-5-12
6. Nut 3346A-5

Fig. 3.4.1_02. Mounting of ailerons of inner wing



1. Rivet LAK-17 54 20 00 06
2. Intermediate hub LAK-20 54 20 00 04
3. Hinge pin G-01 35 00 20 00 SB
4. Hub G-01 20 19 01 03-01
5. Washer 3405A-2-5-12
6. Nut 3346A-5

Fig. 3.4.2_01. Mounting of flaps

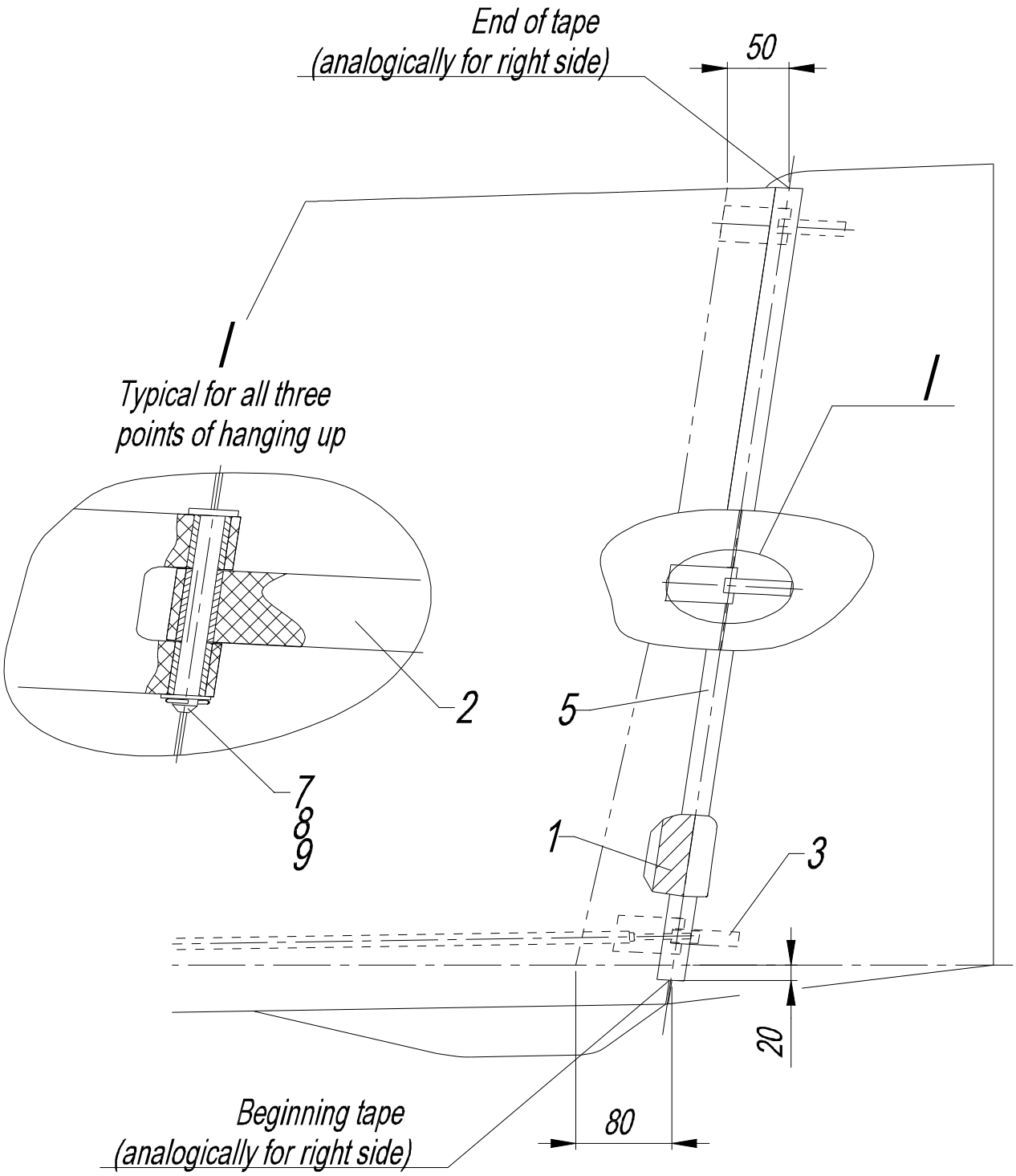
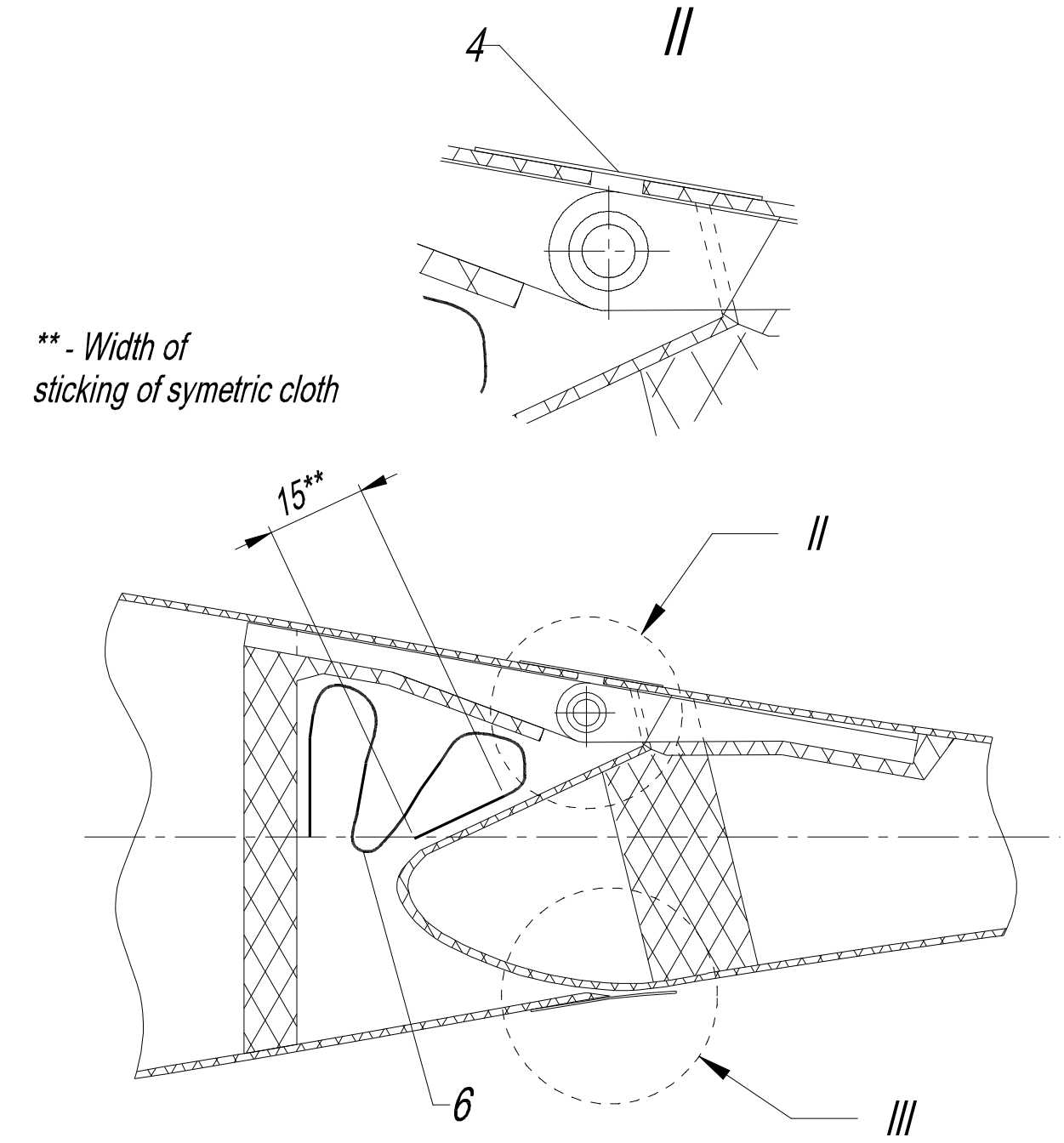
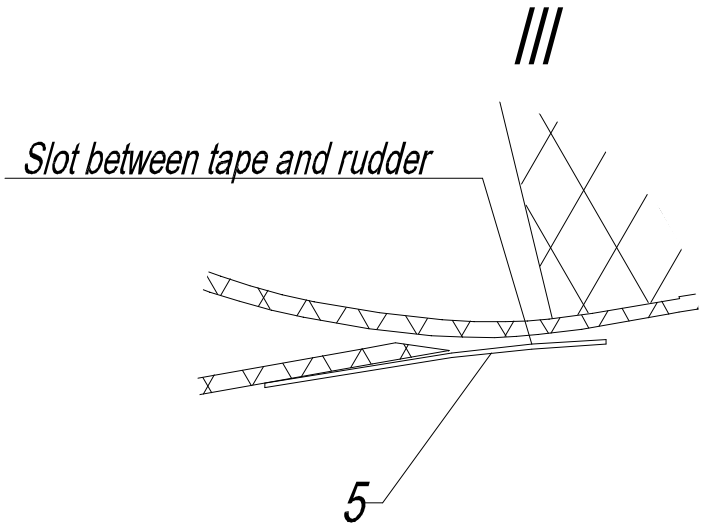


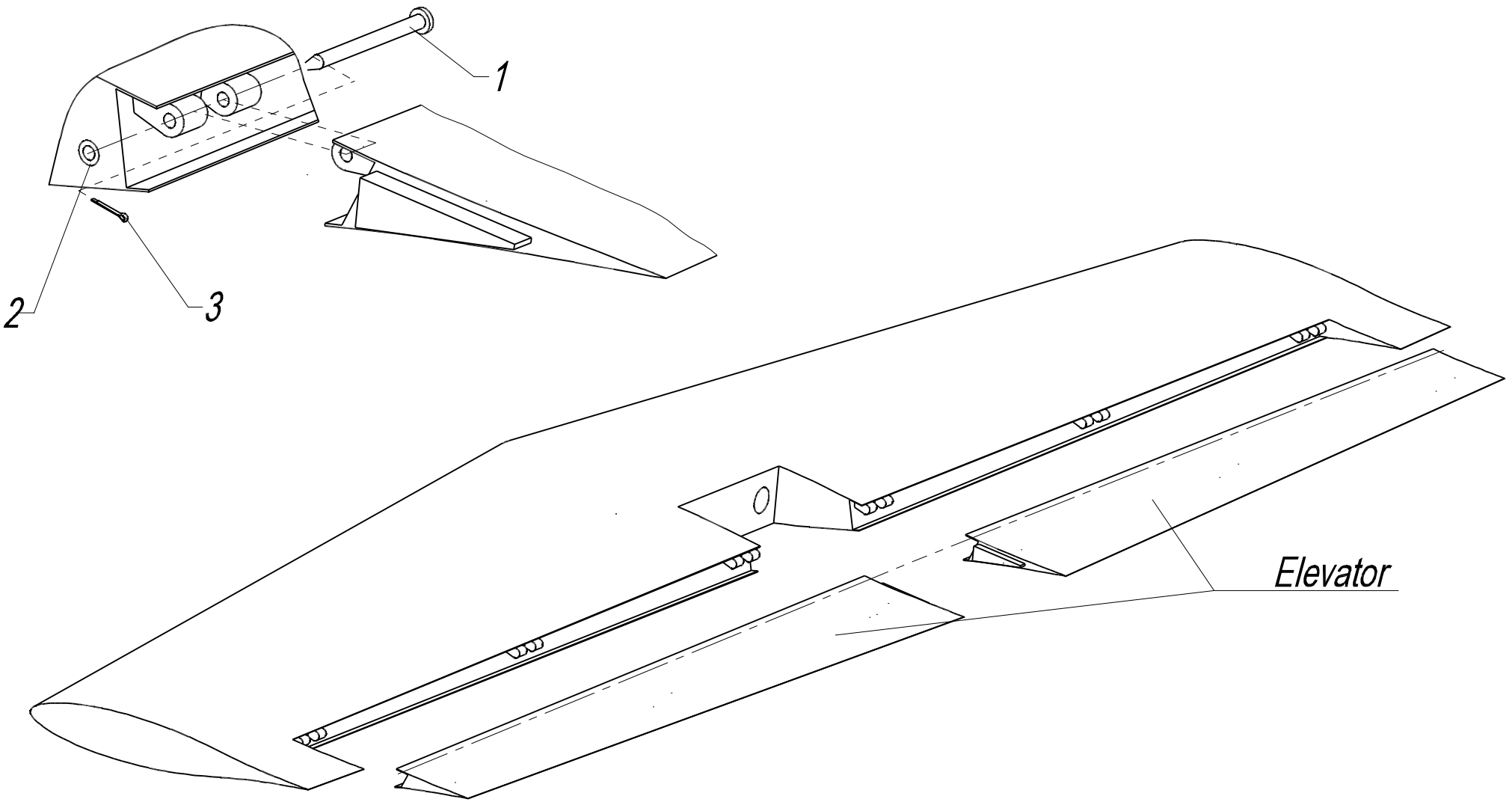
Fig. 3.4.3_01. Hanging of rudder





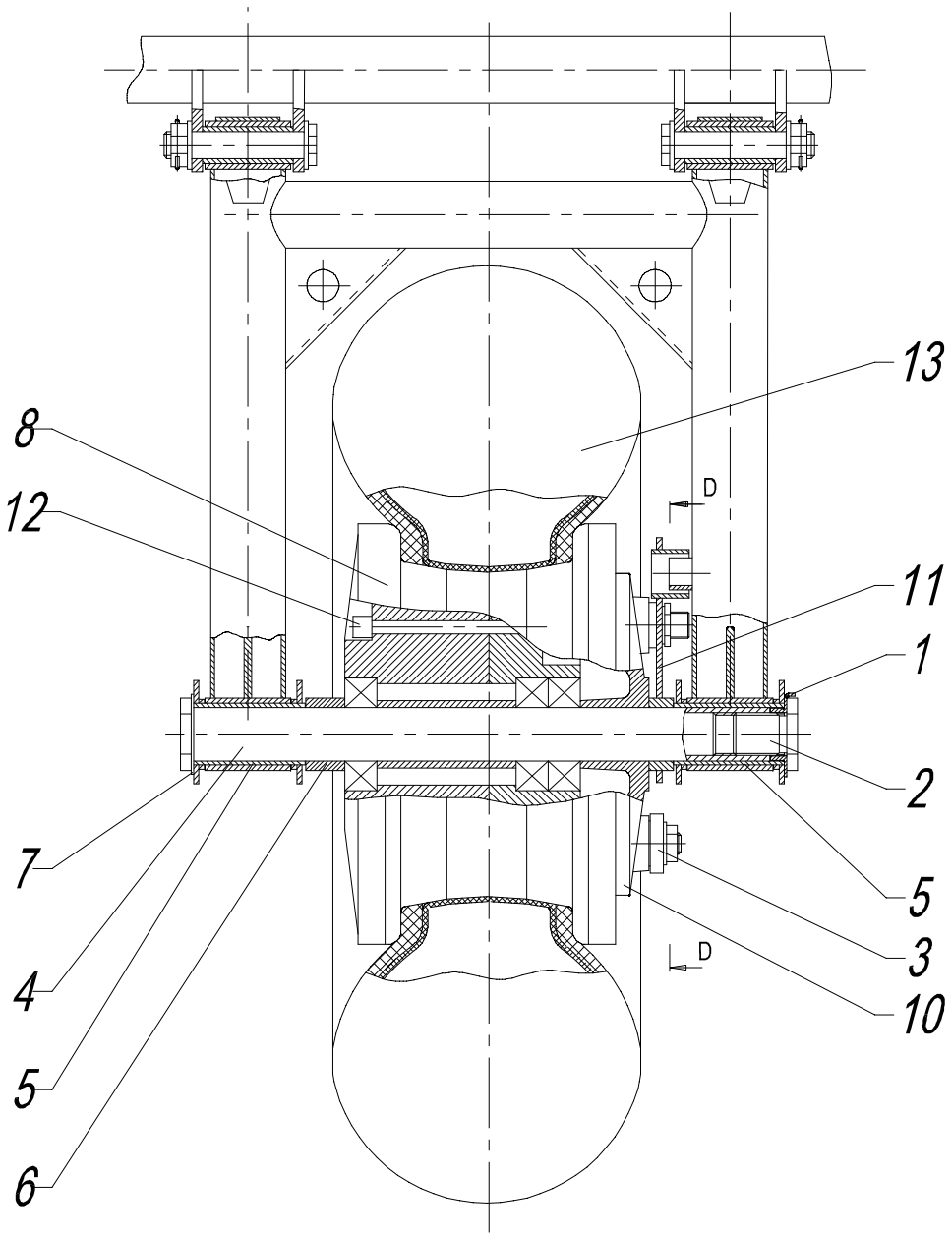
1. Rudder nose LAK-17B 33 10 00 30 SB
2. Joint of hanging up LAK-17 01 04 00 50 SB
3. Control bracket LAK-17B 33 00 00 02
4. Tightening tape PROFILBAND 22/12
5. Tightening tape
6. Synthetic cloth
7. Hinge pin LAK-17 00 02 00 05-01
8. Washer 3405A-0.5-4-8
9. Wire split pin

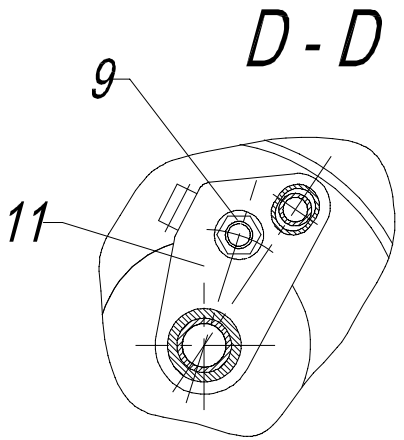
Fig. 3.4.3_02. Hanging of rudder



1. Hinge pin LAK-17 00 02 00 05
2. Washer 3405A-0.5-4-7
3. Wire split pin LN94-10 010

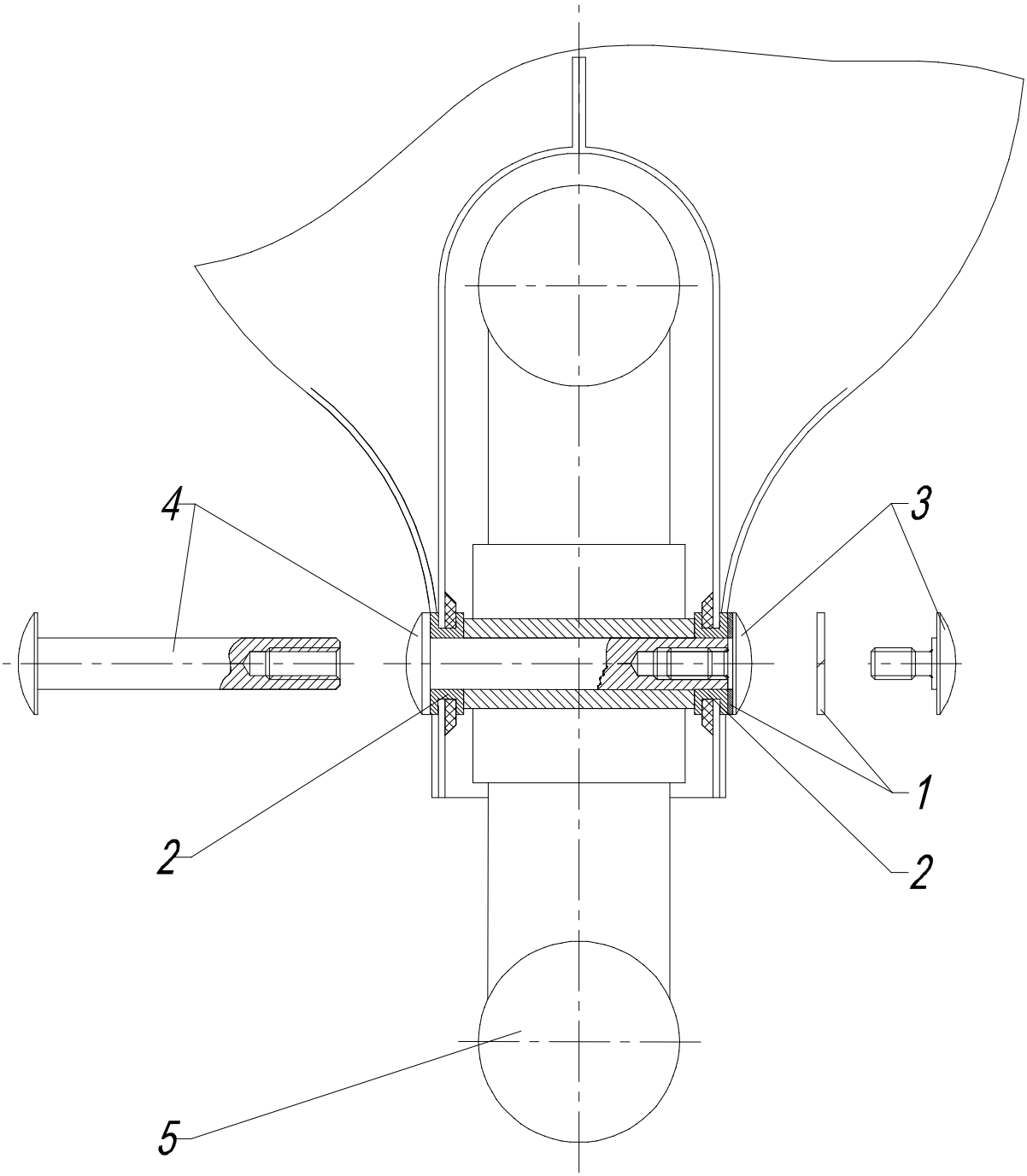
Fig. 3.4.4_01. Rigging of elevator





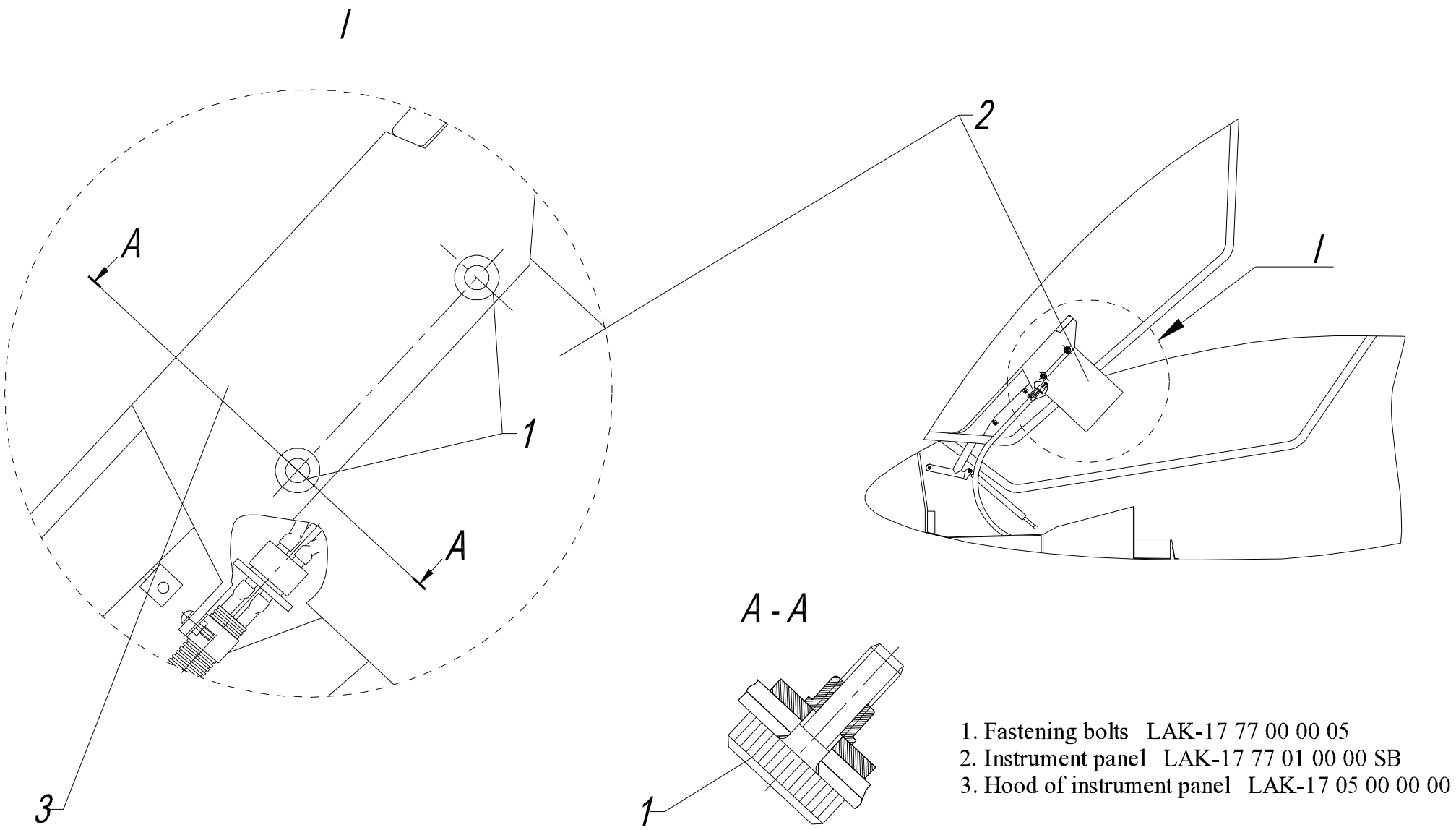
1. Washer LAK-17A 41 00 00 06
2. Bolt LAK-17 41 00 00 04
3. Brake lever
4. Axle LAK-17 41 00 00 02
5. Hub LAK-19 41 00 00 02
6. Hub LAK-17A 41 00 00 05
7. Washer LAK-17A 41 00 00 07
8. Wheel P/N 045100
9. Nut LAK-17A 41 00 00 08
10. Simplex shoe brake
11. Plate LAK-17A 41 05 00 00-01 SB
12. Bolt
13. Tyre 5.00 - 5"

Fig. 3.4.7_01. Main landing gear wheel



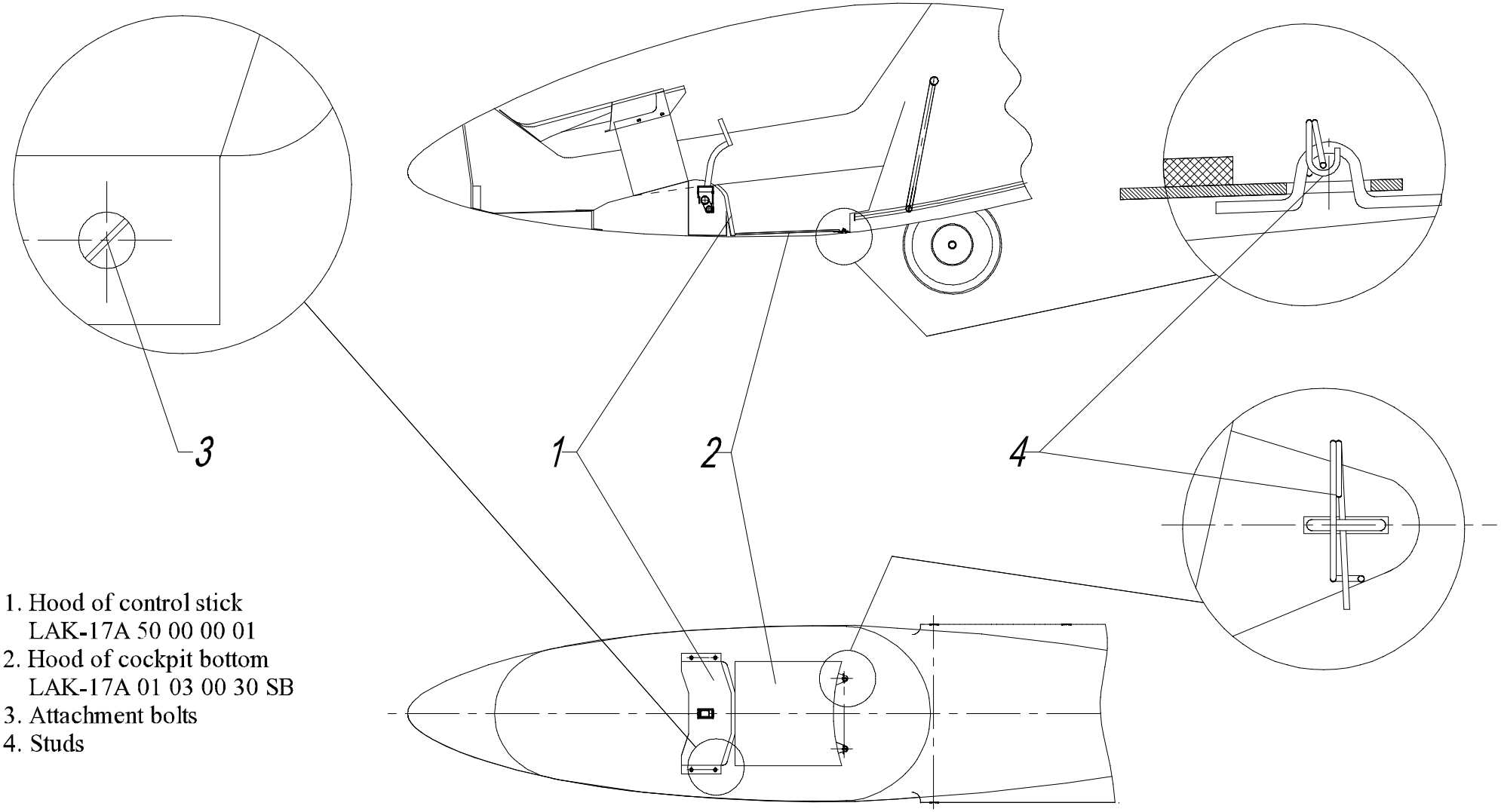
1. Washer DIN 127 - A12
2. Supporting hub LAK-17A 00 02 05 02
3. Bolt LAK-17A 00 02 00 08
4. Wheel axle LAK-17A 00 02 00 10
5. Wheel 200x50

Fig. 3.4.8_01. Rigging and de-rigging of tail wheel



1. Fastening bolts LAK-17 77 00 00 05
2. Instrument panel LAK-17 77 01 00 00 SB
3. Hood of instrument panel LAK-17 05 00 00 00

Fig. 3.4.9_01. Removal and mounting of instrument panel



1. Hood of control stick
   LAK-17A 50 00 00 01
2. Hood of cockpit bottom
   LAK-17A 01 03 00 30 SB
3. Attachment bolts
4. Studs

Fig. 3.4.10_01. Taking out and putting in of cockpit floor

SECTION 4

Maintenance of the sailplane instruments and equipment according to their own maintenance documents

4.1 INTRODUCTION 1

4.2 LIST OF THE SAILPLANE INSTRUMENTS AND EQUIPMENT WHICH ARE SERVICED ACCORDING TO THEIR OWN MAINTENANCE DOCUMENTS 1

4.1 Introduction

Here in this section is given the list of the sailplane instruments and equipment which service shall be done according to their own maintenance documents. Their servicing and repair shall be done independently of the sailplane maintenance requirements in Section 5.

4.2 List of the sailplane instruments and equipment which are serviced according to their own maintenance documents

No	Part	Type	Document
1	Air - speed indicator	LUN 1106, WINTER 6 FMS421, 7FMS	Instrument maintenance instruction
2	Altimeter	WINTER 4 FGH 10; 4 HM 6, WD-10-C	Instrument maintenance instruction
3	Mechanical variometer	LUN-1141, WINTER 5 STV-5, vario Sage SV	Instrument maintenance instruction
4	Electronic variometer	FILSER LX5000, LX7000; LX160, LX9000, Butterfly vario	Operation manual
5	Fly computer display	FILSER LX5000, LX7000 ILEC SN10	Operation manual
6	Radio	Becker AR 4201, Dittel FSG-2T, ATR500, ATR833 VHF	Operation manual
7	Compass	KI-13A, C2400	Instrument maintenance instruction
8	Side - slip indicator	LUN-1216, Winter QM II Small Ball Bank indicator	Instrument maintenance instruction
9	Tow Release	TOST G 88	Certificate, Operating manual
10	4-point static harness restrain system	Carl F. Schroth GmbH	Certificate
11	Main gear wheel with mechanical brake / tyre or Main gear BERINGER wheel and brake system	TOST 045100 / Aero Trainer, 6 ply 5.00-5" Wheel with brake: Aerotec® 2 piston caliper EA-01 and stainless steel Disc DSC-006	Maintenance manual
12	Tail wheel	Barum Rubena T3 / V12s or TOST 200x50	Maintenance manual
13	Motor	FES-LAK-M100	FES motor Manual
14	Propeller	FES-LAK-P10-100	FES propeller FES-LAK-P10-100 manual
15	Battery charger	KOP1001 BMS version, or two KOP602 BMS version	FES Battery pack manual
16	Battery Management System	External FES-BMS-7R for GEN1battery packs	FES Battery pack GEN1 manual
		FES-BMS-9R which is integrated in GEN2 battery packs	FES Battery pack GEN2 manual
17	FES Battery Pack GEN1	SLPB100216216H_40Ah_A1	FES Battery pack GEN1 manual
18	FES Battery Pack GEN1	SLPB100216216H_40Ah_A1	FES Battery pack GEN2 manual
19	Transponder	Filser TRT 600; TRT 800; Microair T2000; Becker ATC 4401	Instrument operator and installation instructions. Antennas types and installation as per manufacturer recommendations.

SECTION 5

Periodical inspections

Page

5.1 INTRODUCTION 1
5.2 SAILPLANE INSPECTION PERIODS 1
5.3 INSPECTION AFTER EVERY 100 FLIGHT HOURS 1
5.4 ANNUAL INSPECTION 5
5.5 INSPECTION AFTER ROUGH LANDING, AFTER GROUND LOOP 5
5.6 RECOMMENDATIONS FOR EXTENDED STORAGE 5
5.7 INSPECTION OF THE SAILPLANE AFTER EVERY 1000 FLIGHT HOURS 6

5.1 Introduction

In section 5 there is defined a list of inspections to ensure safe sailplane operation during its lifetime.

The periodical inspections shall be performed by qualified staff authorized to perform the work.

All inspections are general visual inspections unless specified otherwise.

Clean the sailplane prior conduction any inspections. Also to inspect the sailplane wings and horizontal stabilizer has to be removed.

5.2 Sailplane inspection periods

The sailplane inspections shall be performed :

1. After every 100 flight hours;
2. Annual inspection;
3. After rough landings, after ground loops;
4. At the end of flight season or before long storing in a hangar or in a trailer;
5. After every 1000 flight hours.

5.3 Inspection after every 100 flight hours

It is necessary to check thoroughly the sailplane after every 100 flight hours. A sailplane shall be checked by qualified staff having a license for those works.

Inspection after every 100 flight hours **Date……..**

No	Checking	Conformity Yes / No	Signature
100	**Flight Manual and Maintenance Manual revision**		
101	Sailplane airworthiness certificates revision		
102	Sailplane log-book revision		
103	Sailplane airworthiness bulletins revision		
104	Sailplane technical bulletins revision		

Inspection after every 100 flight hours **Date……..**

No	Checking	Conformity Yes / No	Signature
105	Sailplane weight, instruments in the instrument panel list and its' weights revision		
106	Sailplane instruments and equipment which are serviced according to their own maintenance documents revision		
200	**Wing inner, wing outer 15m, 18m and 21m, winglet**		
201	Surfaces of wings (paint cracks, pealing paint) condition		
202	Defects of skin (cracks, holes, etc)		
203	Joint adhesive tape condition		
204	Drainage and ventilation openings for cleanliness		
205	Spar ends (cracks, delaminations, hubs) state		
206	Root ribs		
207	End ribs		
208	Ailerons, its hinges, pins, clearances of the ailerons, control connections, tip ailerons control plates		
209	Flaps, its hinges, pins, clearances of the flaps, control connections		
210	Airbrakes, clearances of airbrakes, state of metal parts		
211	Water ballast tanks, ballast control system in the wings		
212	Wing fixators (connections)		
213	Spars fixing pins, hubs in spars		
300	**Fuselage**		
301	Surfaces of fuselage (painting, cracks,) condition		
302	Defects of skin (cracks , holes, etc)		
303	Joint adhesive tape condition		
304	Drainage and ventilation openings for cleanliness		
305	Attachment of cockpit canopy, cockpit canopy		
306	Cockpit canopy emergency jettison system		
307	Static and total pressure receivers state, tightness of connections		
308	Bulkheads, fuselage root ribs, landing gear box state		
309	Seat adjustment system, pilot seat state		
310	Connection pins on fuselage state		
311	Surfaces of fin (paint, cracks) condition		
312	Rudder, its hinges, pins, control connections		
313	Stabilizer and fuselage connection pins, bolts and bolt fixation		
314	Elevator automatic conection unit on the top of the fin		
315	Water ballast control system		
316	Condition of external surfaces of accessible metal parts (corrosion)		
317	Check for foreign objects inside of a fuselage.		
400	**Horizontal tail**		
401	Surfaces of horizontal tail (paint, cracks) condition		
402	Defects of skin (cracks, holes, etc)		
403	Bonding areas		
404	Elevator root ribs		

Inspection after every 100 flight hours **Date……**

No	Checking	Conformity Yes / No	Signature
405	Stabilizer hubs		
406	Elevator, its hinges, pins, clearances of the elevator, control connections		
407	Elevator and stabilizer connection state		
500	**Rudder**		
501	Surfaces of rudder (paint, cracks) condition		
502	Defects of skin (cracks, holes, etc)		
503	Bonded areas		
504	Rudder, its hinges, pins, clearances of the rudder, control connections		
600	**Landing gear**		
601	Stands, shock absorbers, gas-spring and control system state		
602	Main wheel (pressure in wheel tire, cracks, corrosion)		
603	Main wheel retracting and releasing mechanisms - pay special attention to the condition of the retraction lever located at the wheel box.		
604	Landing gear brake		
605	Tail wheel (pressure in wheel tire, cracks)		
700	**Control systems**		
701	Elevator control system (movement, friction, clearances, fixings)		
702	Ailerons control system (movement, friction, clearances, fixings)		
703	Flaps control system (movement, friction, clearances, fixings)		
704	Airbrakes control system (movement, friction, clearances, fixings)		
705	Rudder control system (movement, friction, clearances, fixings)		
706	Pedals adjust system		
707	Trimmer control system operation		
708	Tow release control system (movement, friction, clearances, attachments)		
709	Attachment of cockpit canopy and its emergency jettison system operation		
710	Canopy ventilation control system		
711	Water ballast control system operation		
800	**Instruments**		
801	Instrument panel mounting		
802	Airspeed indicator system functioning		
803	Altimeter system functioning		
804	Accumulators batteries, electric wiring installation		
805	Radio station, navigation instruments mounting, operation		
806	Radio aerial, cable installation		

Inspection after every 100 flight hours **Date……..**

No	Checking	Conformity Yes / No	Signature
807	Microphone, loudspeaker installation, operation		
808	Towing hook state, its life time according maintenance documents, springs, control cables		
809	Pilot harness restraint system, its life time according maintenance documents		
810	Baggage compartment		
811	Placards and markings		
812	C of G data		
813	FES instrument wiring and functioning		
814	Fire warning system functioning		
815	Visual inspection of the battery packs		
900	**Sailplane rigged**		
901	Wing-fuselage connection reliability, clearances		
902	Horizontal tail- fuselage connection reliability, clearances		
903	All control systems neutral position, controls easy movement		
904	Control surfaces deflections, stops		
905	Friction in all control systems, clearances		
906	Rigged parts fixators state		
907	Main wheel brake operation		
908	Airbrakes functioning, forces on control handle		
909	Flaps operation, flap hinges		
910			
911			
912			
1000	**FES system**		
1001	FCU instrument wiring and functioning		
1002	Inspect ventilation opening - closing		
1003	Inspect propeller as per propeller manual		
1004	Inspect motor as per motor manual		
1005	Check mounting of the motor on a motor frame		
1006	Check gap between spinner and fuselage		
1007	Check all bolted connections		
1008	Check power cables for any damage		
1009	Check battery packs		
1010	Check 12V battery condition - if installed		
1011	Inspect controller and main contactor		
1012	Perform ground test run of the motor		
1013	Check functioning of the propeller brake		
1014	Check functioning of the propeller positioning		
1015			
1016			
1100	**Conclusion checking**		
1101	Checking records revision		
1102	Maintenance manual changes revision		

Inspection after every 100 flight hours **Date**

No	Checking	Conformity Yes / No	Signature
1103	Jobs according airworthiness and technical bulletins revision		
1104	Sailplane log-book records revision		
1105			
1106			

5.4 Annual inspection

It is necessary to check the sailplane every 12 months in accordance with the 100 flight hours inspection. Also:

1. Check water ballast tanks for water leaks through the valves and water ballast control shaft.
2. Check technical condition of safety belts and their attachments.
3. Check technical condition and sealing of static, dynamic pressure pipes and moisture collection tanks.
4. Check FES system for possible cracks on propeller blades.
5. ~~Check if there was any update of FES manuals on FES website under download section.~~

5.5 Inspection after rough landing, after ground loop

After rough landing, ground loop:

1. Check surfaces of sailplane wings, the fuselage, the stabilizer and controls. Pay special attention to wings root ribs, ends of wings spars, technical condition of connection junctions of wings and fuselage, stabilizer and fin;
2. Check friction forces of all control systems of the sailplane;
3. Check main landing gear wheel and tail wheel and operation of wheel brake;
4. Check the sailplane instruments and their operation;
5. Check Battery packs if there is any visible damage;
6. Check the FCU instrument for proper operation;
7. Check if there is any damage on the propeller blades in case they touched the ground;
8. Check motor attachment and spinner.

5.6 Recommendations for extended storage

Before winter storage at the end of the flight season or before extended storage in a hangar or in a trailer:

1. Check for any technical bulletins that need to be implemented;
2. Check condition of external surfaces of accessible metal parts. Pay special attention to protect surfaces that can be damaged by corrosion;
3. Clean and lubricate bearings and sailplane connections according to requirements of section 3.2;
4. Ensure the water ballast tanks are fully drained.

5. Remove FES batteries boxes, and store them at dry place at room temperature. The best storage voltage is 3.7V per cell (cca 52V per pack, or cca 104V on FCU total voltage measurement).

5.7 Inspection of the sailplane after every 1000 flight hours

It is necessary to check thoroughly the sailplane after every 1000 flight hours.
The sailplane shall be checked by qualified staff having a license for those works.

It is necessary:

1. To check the sailplane according to "Inspections after every 100 flight hours" and "Annual inspection".
2. To measure existing clearances in connection joints of the fuselage and wings.

   Allowed clearances and tolerances:

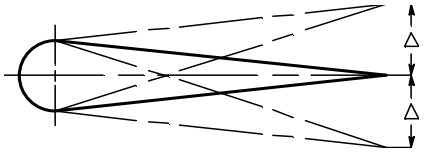
   a) between the wings connection pins and openings in spars consoles Δ = 0.32 mm ~~(fig.2.7.1_04);~~
   b) between the fuselage pins and wing hubs Δ = 0.27 mm ~~(fig.2.7.1_01);~~
   c) between the hubs of inner wings and lateral pins of outer wings Δ = 0.046 mm ~~(fig. 2.7.1_03);~~
   d) tolerance of opening of fixation plate of winglet spar Δ = 0.015 mm ~~(fig. 2.7.1_3);~~

3. To measure existing clearances in connection joints of fuselage and stabilizer

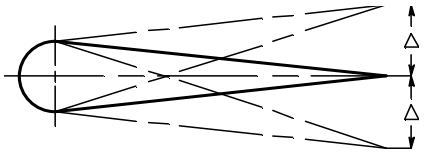
Allowed clearances:

   a) between the fin pins and hubs of the stabilizer Δ = 0.055 mm ~~(fig. 2.7.1_02);~~
   b) between the stabilizer fixation pin and an opening of stabilizer Δ = 0.32 mm ~~(fig. 2.7.1_02);~~

4. To measure the elevator's clearance with respect to rear elevator edge at root rib. Allowed clearance is $\Delta = \pm$ 2 mm.



5. To measure clearances of the ailerons and flaps with respect to rear controls edges at their root ribs. Allowed clearance is $\Delta = \pm$ 2 mm.



6. Measure wear in the hinges of the elevator, rudder, ailerons and flaps. Allowed radial clearance between the hole diameter and axis is Δ = 0.1 mm.
7. Measure play at the control stick upper part with an elevator and ailerons fixed. Allowed clearance is $\Delta = \pm$ 2 mm (refer to paragraph **2.7.2**).
8. To measure clearance in attachment joint of the landing gear. Allowed clearance between an opening and axis is $\Delta = \pm$ 0.15 mm.
9. To measure friction forces in the control systems:

   a) ailerons control – 0.5 daN,
   b) elevator control with trimmer in neutral position – 0.3 daN,

c) rudder control (measure in upper point of pedals) – 2 … 2.5 daN,
d) adjustment of pedals according to pilot height – 15 daN,
e) airbrakes control:

- at opening – 15 daN,
- at closing - 18 daN,

f) ventilation control – 3 daN,
g) landing gear control:

- at expanding – 20 daN,
- at retracting – 14 daN,

h) towing hook control:

- without loading on towing hook – 10 daN,
- with loading on towing hook – 12 daN,

i) emergency opening of a canopy – 13 daN,
j) water ballast control – 4 daN.

Note: 1. Measurements according i.4 and 5 are taken with the control stick fixed.
2. Measurements according i.4, 5, 6, 7, 8, 9 shall be taken after cleaning and lubrication of movable surfaces of control systems.

10. To check balancing of ailerons, flaps, elevator and rudder according to the scheme shown in fig. 7.4_1 if repair or/and repainting of these control surfaces was done.
11. To check the trimmer condition.
12. To check the fuselage girder structure and its attachment to the fuselage. Pay special attention to:

- splits in glass fiber reinforced plastics,
- splits in sticking seams,
- condition of girder welding seams,
- deformations of the girder pipes,
- condition of attachment joints of landing gear,
- condition of attachment joint of the towing hook.

13. To check glass fiber reinforced plastics for cracks and splits around these metal parts and joints:

- spar hubs,
- hubs of wing root ribs,
- connection joints of stabilizer and fuselage,
- control and hinge joints of ailerons, flaps, elevator and rudder,
- attachment joints of safety belts,
- fastening joints of cockpit canopy.

Splits on glass fiber reinforced plastics shall be repaired.

14. To check surfaces of ends of wing spars (Fig.5.7_01), surfaces of external wing root ribs, paying special attention to connection zones of root ribs to spar ends and wing shells. If there are some splits or other damage on glass fiber reinforced plastics it is necessary to repair the damaged place.

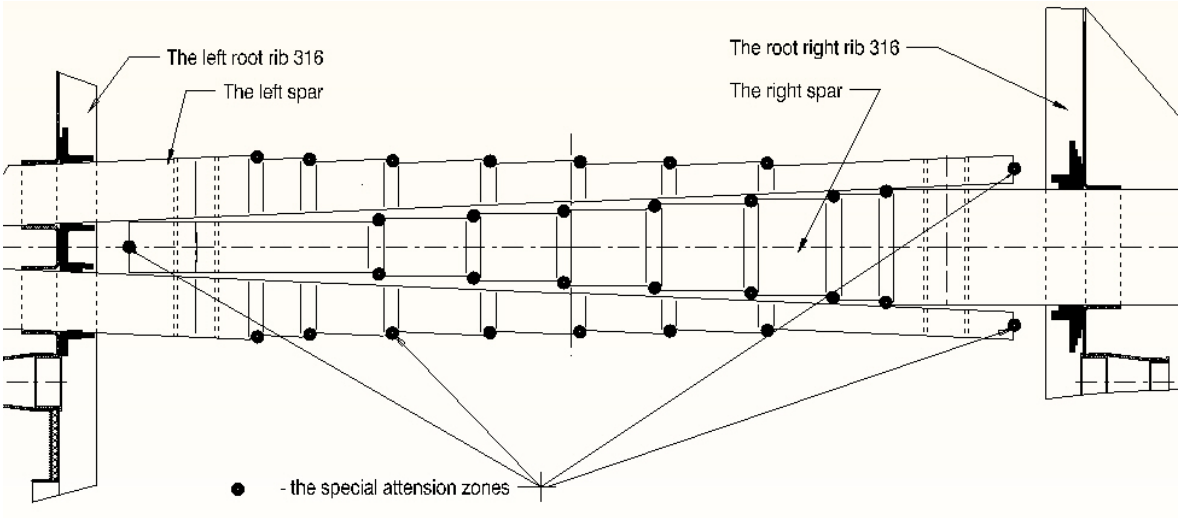
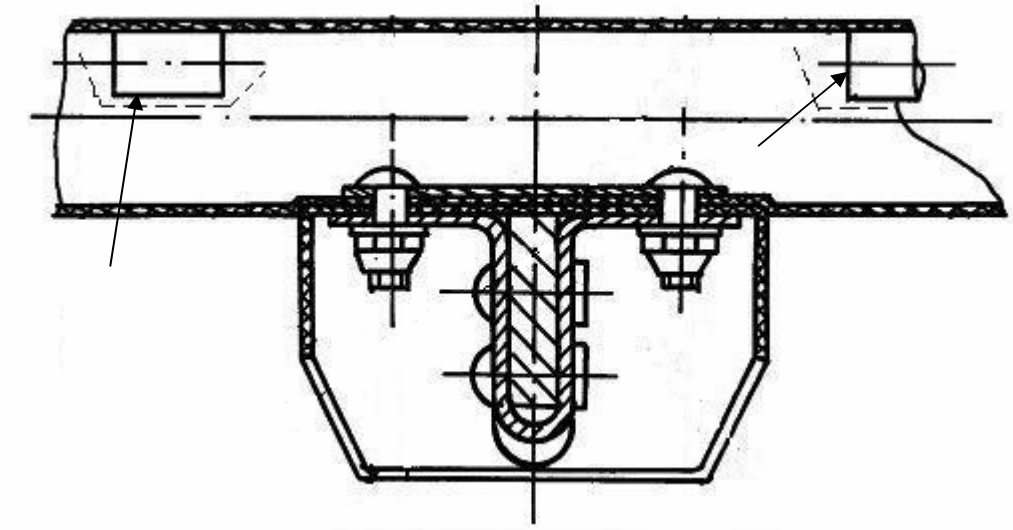


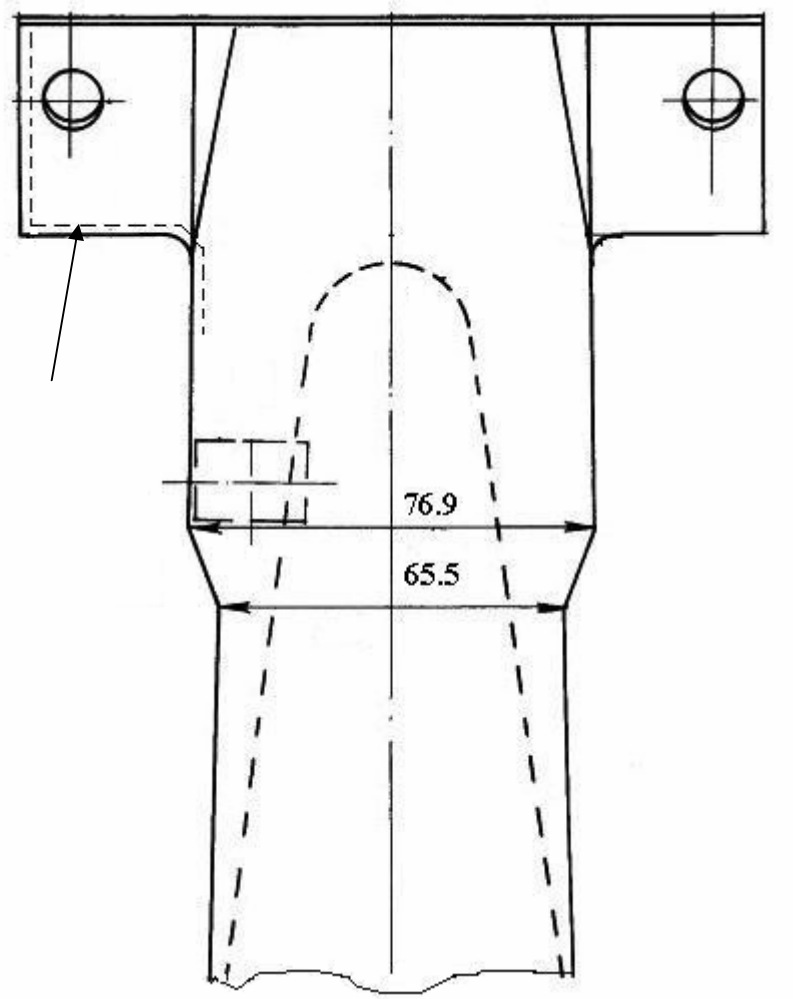
Figure 5.7_01. The wing spar

15. To check external surfaces of wings, ailerons, flaps, fuselage, stabilizer, elevators and rudder. The special attention zones:

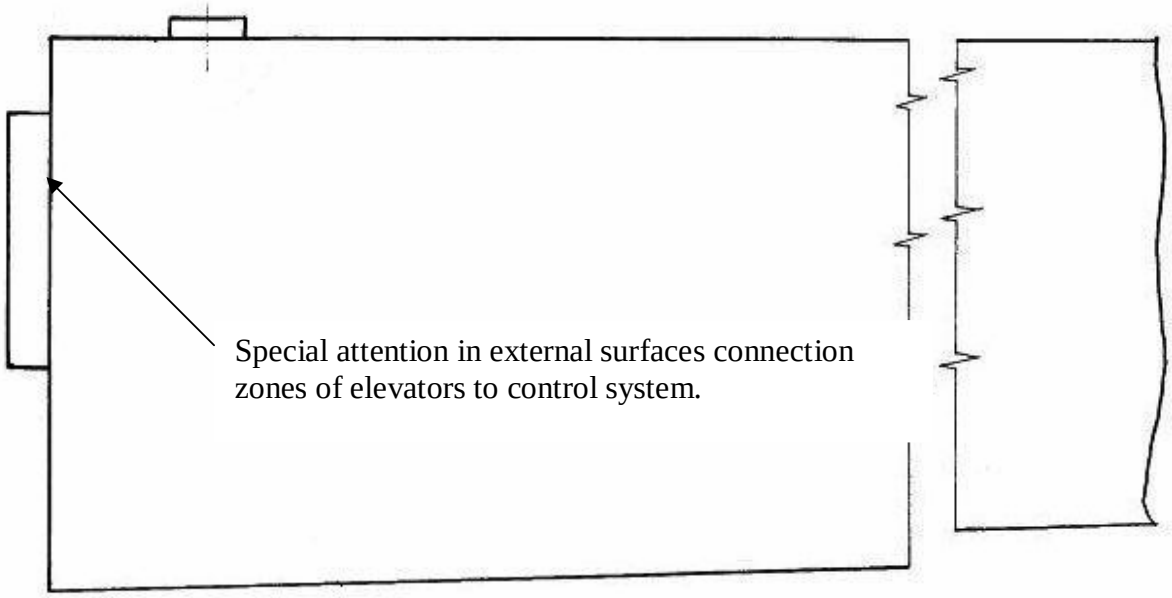
    a) the surfaces around hinge joints of control unit of elevators on the horizontal tail:



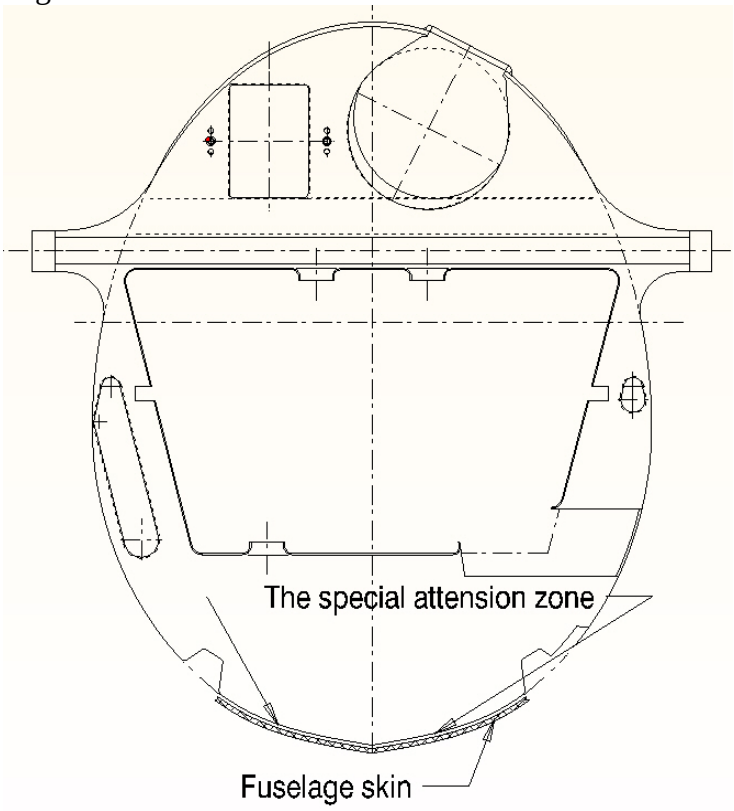
b) the glued zones of the vertical tail spar onto the upper fin part:



c) the elevator root rib:



d) the fuselage bulkhead:



In zones where paint has cracks it is necessary to clean off the paint and check glass fiber reinforced plastic for cracks and if necessary to repair the damage.

Initial clean off of paint shall be done with glass-paper No 180, No 220 finishing with No 320 or even finer.

16. To check external surfaces of galvanized coating of metal parts. Zones with damaged protective galvanized or paint coating, if they are not damaged by corrosion reducing strength, may be repaired. After careful cleaning off of the surface with glass-paper till metallic glitter and dust are removed, protective primer and enamel layers are put on following manual and directions of producers of these coatings.
17. To check towing hook, sailplane instruments and additional equipment following corresponding manufacturers' instructions.
18. To check technical condition and tightness of connections of static and dynamic pressure pipes and moisture collecting tanks.
19. To check technical condition of instrument markings and placards. Replace them if necessary.
20. Repair shall be done following guides given in Section 8 of this Manual. If damaged isn't included in it repair shall be done according to recommendations of manufacturer of the sailplane.
21. To check water ballast tanks in wings and fin for sealing.
22. To check FES system for proper operating.
23. Propeller blades for possible cracks.
24. After doing all the work the sailplane shall be weighed and C of G shall be recorded.

SECTION 6

The sailplane life limits

Service life of sailplane is 6000 flight hours.

The following FES system parts have limited service life:

- refer to the current release of the manual for each FES component for service life limits.

The continued airworthiness of the sailplane is ensured by prescribed inspections and technical maintenance works done during its use :

1. Annual sailplane inspection before starting the flight season according to requirements of Section 5 of “Maintenance Manual”;

2. Daily (before every flight day) and preflight sailplane inspection according to requirements of Section 4 of “Flight Manual” and Section 3 of “Maintenance Manual”;

3. Special sailplane inspection after a rough landings, ground loops, exceeding of allowed loadings and etc. according to requirements of section 5 of “Maintenance Manual”;

4. Inspection and works according to requirements of bulletins issued for the sailplane;

5. Inspection and works according to requirements of maintenance documents (Section 4 of “Maintenance Manual’) of parts with limited lifetime (towing hook, safety belts, instruments, FES system and others);

6. Inspection after every 1000 flight hours according to requirements of Section 5 of “Maintenance Manual”;

Checking of a sailplane, maintenance and necessary repair works shall only be done by qualified staff having permission to do the work.

In the case of damage of the sailplane structure not included in the “Maintenance Manual” the repair shall be agreed to by the manufacturer of the sailplane.

SECTION 7

Weights and center of gravity

Page

7.1 INTRODUCTION....1

7.2 DEFINITION OF SAILPLANE WEIGHT AND C.G. 2

7.3 WEIGHT OF NON-LIFTING PARTS OF THE SAILPLANE....3

7.4 CHECKING OF CONTROL WEIGHTS AND BALANCING 4

7.5 CALCULATION OF LOADING LIMITS....4

7.1 Introduction

Information about weighing of the sailplane, definition of center of gravity after sailplane repair, repainting or mounting of additional instruments or equipment is given in this section.

Position of center of gravity is defined by the distance from the leading edge of wing root section (datum) towards the sailplane tail.

Positioning scheme of the sailplane during weighing and definition of C.G. is shown in fig.7.1_01.

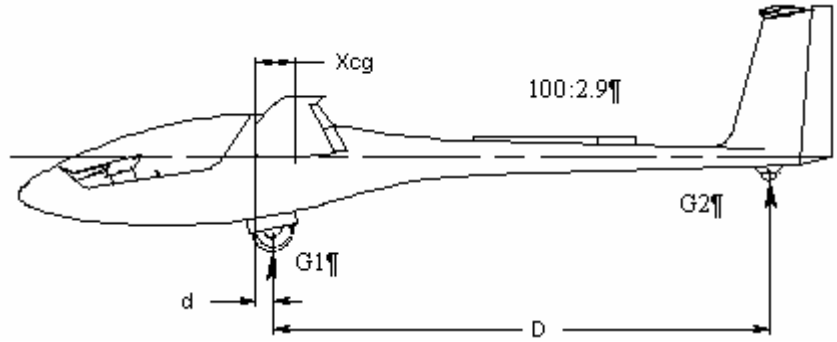
Approved in flight positions of C.G.:

Pos. No	Parameter	Approved boundaries, mm	
		LAK - 17B	LAK – 17B FES
1	Foremost C.G. limit	206	206
2	Rearmost C.G. limit	328	328

Empty weight center of gravity is defined for the 15m/18m wing configuration, glider ready to fly, excluding weight of pilot and parachute.

Warning: ***due to flutter reasons it is not allowed to add additional masses to the fin battery or the fin battery compartment.***

The permissible range of center of gravity position in dependence of glider's empty weight, pilot weight is given at the end of this section.



Center of gravity of sailplane:

$$Xcg = \frac{\boldsymbol{G}2 * \boldsymbol{D}}{\boldsymbol{G}1 + \boldsymbol{G}2} + \boldsymbol{d},\ \text{mm}$$

Fig. 7.1_01. Sailplane weighting and center of gravity definition scheme

The maximum approved take-off and landing weight is 550 kg (1212,5 lbs) for 15m wing and 600 kg (1322,8 lbs) for 18m and 21m wing.

Min pilot weight - see cockpit loading placard.
Max pilot weight -110 kg.

The given pilot weight includes parachute weight.

Abbreviations used:

DP – reference point (datum point): leading edge of wing root section,
DL –positioning line (datum line): upper side of fuselage boom placed at slope 1000 : 29.
Theoretical data of D and d: D=4007.2 mm, d=116.1 mm.

7.2 Definition of sailplane weight and C.G.

For definition the sailplane weight and C.G. it is necessary:

1. To weigh the sailplane parts separately:

Pos. No	Sailplane part	Marking	Weight, kg
1	Right inner wing with controls	Gw.in.r	
2	Left inner wing with controls	Gw.in.ll	
3	Fuselage with rudder	Gfz	
4	Stabilizer with elevator	Gst	
5	Outer wing /15 m right	Gw.out15m.r	
6	Outer wing /15 m left	Gw.out15m.l	
7	Outer wing /18 m right	Gw.out18m.r	
8	Outer wing /18 m left	Gw.out18m.l	
9	Winglet right	Gwl.r	
10	Winglet left	Gwl.l	

In order to define C.G. with a pilot - weigh the pilot and define his weight Gpil.

Empty sailplane weight:

a) wing of 15 m
Gemp = Gemp15m = Gw.in.r + Gw.in.l +Gw.out15m.r+Gw.out15m.l+Gwl.r+Gwl.l Gfz + Gst,
b) wing of 18 m
Gemp = Gemp18m = Gw.in.r + Gw.in.l +Gw.out18m.r+Gw.out18m.l+Gwl.r+Gwl.l + Gfz + Gst.
c) wing of 21 m
Gemp = Gemp21m = Gw.in.r + Gw.in.l +Gw.out21m.r+Gw.out21m.l+Gwl.r+Gwl.l + Gfz + Gst.

Weight of sailplane including a pilot Go:

a) wing of 15 m
Go = G15m = Gemp15m + Gpil,
b) wing of 18 m
Go = G18m = Gemp18m + Gpil.

c) wing of 21 m
Go = G21m = Gemp21m + Gpil.

2. To assemble the sailplane.

3. To place sailplane tail on weighing-machine. To position the sailplane with help of an auxiliary equipment according to requirements of fig. 7.1_01.

   To seat a pilot into a cockpit, if C.G. with pilot is being defined.
4. To define weight of the sailplane tail part weighting auxiliary equipment.
5. To measure the distance D (mm) from center of main landing wheel axle to tail wheel axis.
6. To measure the distance d (mm) from center of main wheel axle to reference point DP.

Note: ***The distances D and d are measured on the ground according to corresponding projections of measurement points.***

7. To weigh an equipment of sailplane positioning and determine the weight of sailplane tail G2 by subtracting the weight of an auxiliary equipment from the weight of sailplane tail part with an auxiliary equipment.
8. To calculate C.G.:

a) C.G. of empty sailplane

$$Xcgemp = \frac{G2 * D}{Gemp} + d, \text{ mm}$$

b) C.G. of sailplane with a pilot:

$$Xcg = \frac{G2 * D}{Go} + d, \text{ mm}$$

Note: ***weights G2, Gemp, Go are assumed for corresponding weighing variant.***

9. To check if position of C.G. is within an allowed range.

If C.G. is outside the allowed boundaries position the sailplane C.G. shall be corrected by the help of lead ballast (Fig.7.2_01, Fig.7.2_02):

- required mass of lead for correction of C.G. position can be calculated or determined by actual balancing and checking the sailplane C.G.,
- lead ballast of required size can be supplied by Joint Stock Company “Sportinė Aviacija ir Ko”,
- depending on how position of C.G. shall be corrected, lead shall be attached on partition wall in fore body behind pedals joint or on rear wall of fin after removal of rudder.

7.3 Weight of non-lifting parts of the sailplane

Weight of non-lifting parts of the sailplane includes weight of pilot, fuselage, stabilizer with elevator, rudder, instruments and equipment.

Maximum weight of non-lifting parts of the sailplane is 276,3 kg (609,14 lbs).

The maximum approved take-off and landing weight is 550 kg (1212,5 lbs) for 15m wing and 600 kg (1322,8 lbs) for 18m wing and 21m wing. Max sailplane weight shall not be exceeded.

7.4 Checking of control weights and balancing

After repairs or repainting of controls their weights and position of C.G. shall be checked.

For this purpose a control being checked shall be removed from the lifting surface and positioned horizontally (fig. 7.4_01) by help of auxiliary equipment. Friction in supports must be minimal.

A component P of weight, kg, is to be defined by help of a appropriate scales. Shoulder r, mm, - the distance between rotation axis of the control and weighing point is to be measured by a ruler.

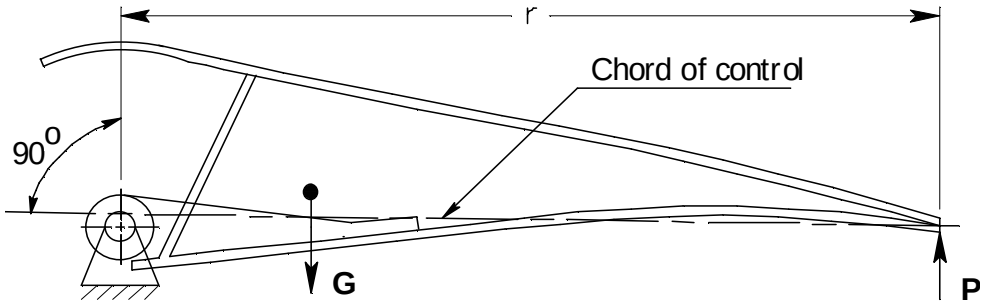


Fig. 7.4_01. Scheme of control positioning and weighting

Static moment of a control M = P * r; kg * mm

Note: ***reaction P is defined with plane of control chord positioned horizontally.***

Approved boundaries for control weights and static moments:

Control	Approvedboundaries of control weight. kg	Approved static moment of control, kg * mm
EL1 EL2	0.55 ÷ 0.7 0.8 ÷ 0.98	20.0 ÷ 24.0 24.0 ÷34.0
Flap	2.3 ÷ 2.9	78 ÷ 110
Outer wing 21m aileron (EL3) Outer wing 18m aileron (EL3) Outer wing 15m aileron (EL3)	2.5 ÷ 2.7 1.5 ÷ 1.8 0.8 ÷ 0.88	70 ÷ 74 45 ÷ 56 17 ÷ 22
Elevator	0.36 ÷ 0.43	15.8 ÷ 17.4
Rudder	2.5 ÷3.25	50 ÷ 90

If weight of a control and static moment are not within the approved tolerances, contact the company “Sportinė Aviacija”.

7.5 Calculation of loading limits

Center of gravity position after loading glider (additional instruments, equipment, water ballast, pilot) is defined by

$$X_{CG} = \frac{\sum_n G_n * X_n}{\sum_n G_n}, \text{ mm}$$

Where: G_n = the glider component mass, kg;

X_n = distance between glider component mass C.G. and datum point (DP), mm;

- distance "-", if mass C.G. is ahead of the datum point;
- distance "+" if mass C.G. is behind of the datum point;

n = number of glider component masses;

ΣG_n = sum of glider all components masses;

$\Sigma G_n * X_n$ = sum moments of glider all components masses;

The C.G. calculation table

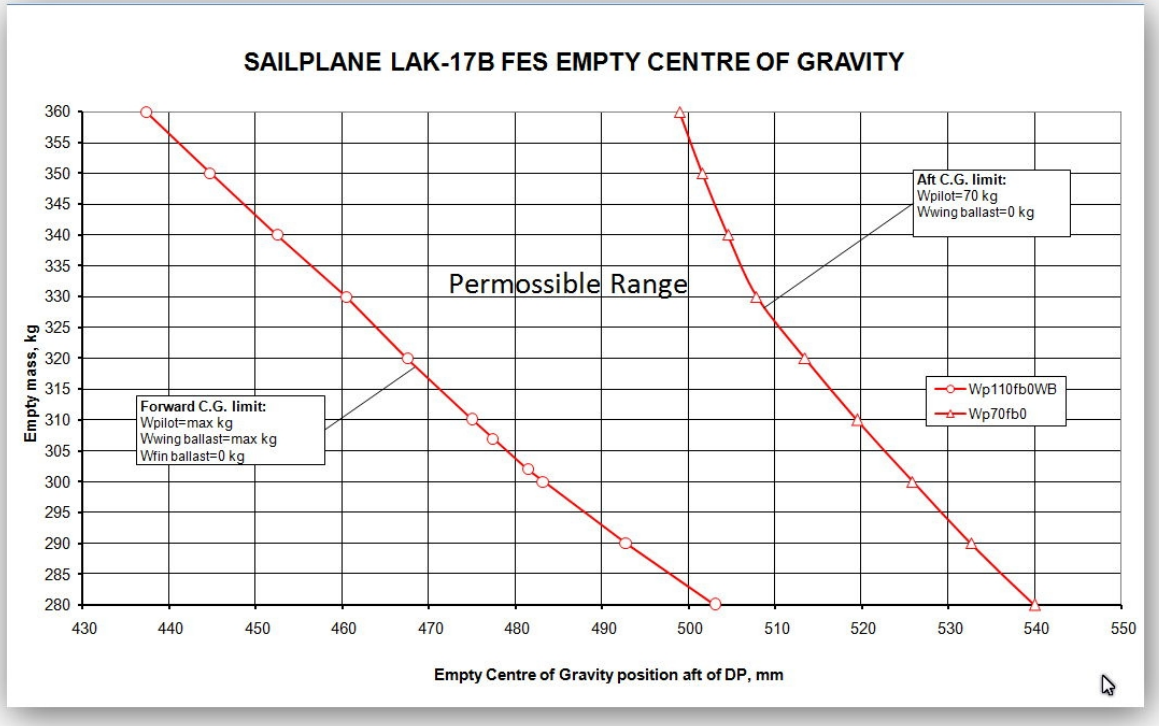
No	Component	Weight G_n kg	Distance from DP X_n mm	Moment =Weight *Distance; $G_n * X_n$ kg * mm
1.	Empty glider			
2.	Pilot			
3.	Battery in fin	3.5	4192	
4.	Battery in baggage compartment	2.6	157	
5.	Water ballast in wings		168	
6.	Water ballast in fin		4003	
7.	Instrument N1 in instrument panel		-1010	
8.	Instrument N2 in instrument panel			
-				
n-1	Removable ballast in fuselage nose		-1785	
n	Baggage weight			
	ΣG_n=		**$\Sigma G_n * X_n$=**	

**** - these data for columns Weight G_n and Distance X_n should be taken from current "Weight and balance record" table (glider Flight Manual paragraph 6.4) as G_n = "Empty weight of the sailplane" and X_n = "C.G. location".***

Note: ***the glider empty weight and empty weight center of gravity is defined by weighing data.***

- Pilot: actual pilot weight with parachute,
  distance from DP = -520, when pilot seat is in the rearmost position;
  distance from DP = -670, when pilot seat is in the foremost position.
- Water ballast in wings: actually filled water ballast weight.
- Water ballast in fin: actually filled water ballast in fin tank weight.
- Baggage weight: baggage in baggage compartment weight.

The permissible range of empty glider center of gravity is given below:


SAILPLANE LAK-17B FES EMPTY CENTRE OF GRAVITY
Empty mass, kg
360
355
350
345
340
335
330
325
320
315
310
305
300
295
290
285
280
430
440
450
460
470
480
490
500
510
520
530
540
550
Permossible Range
Aft C.G. limit:
Wpilot=70 kg
Wwing ballast=0 kg
Forward C.G. limit:
Wpilot=max kg
Wwing ballast=max kg
Wfin ballast=0 kg
Wp110fb0WB
Wp70fb0
Empty Centre of Gravity position aft of DP, mm

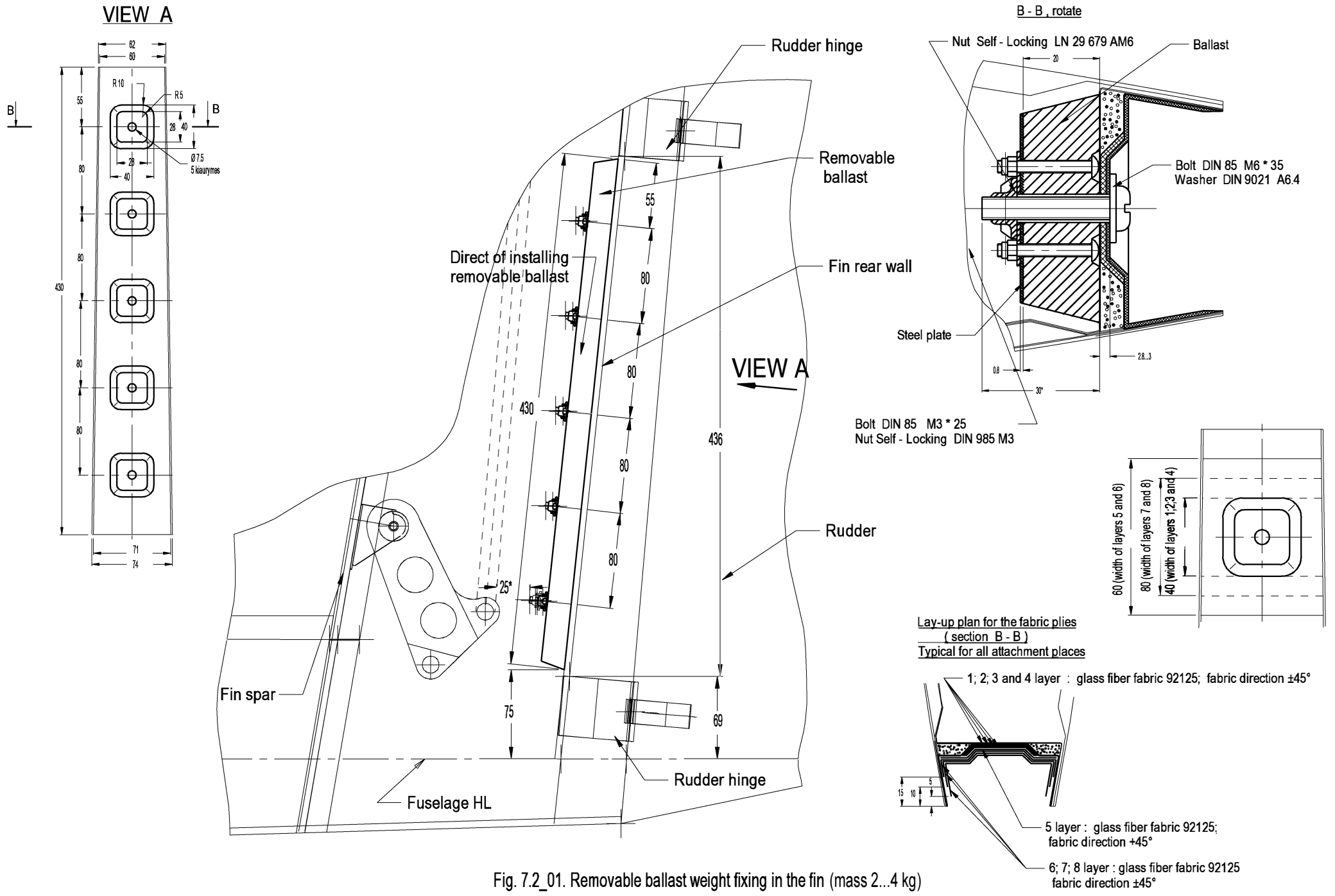


Fig. 7.2_01. Removable ballast weight fixing in the fin (mass 2...4 kg)

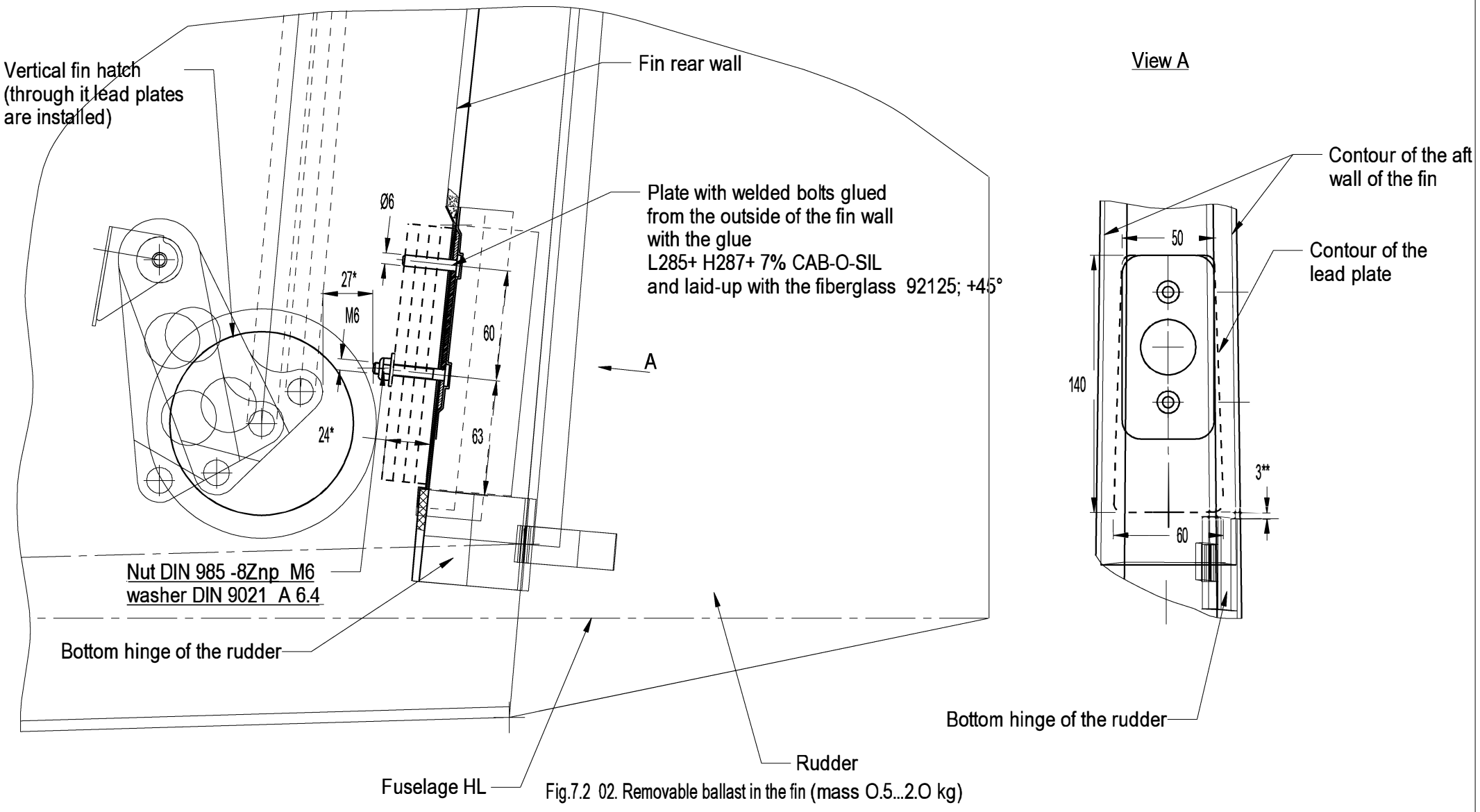


Fig.7.2 02. Removable ballast in the fin (mass O.5...2.O kg)

SECTION 8

Repair

Page

8.1 INTRODUCTION....2

8.2 MAIN REQUIREMENTS FOR REPAIR WORK....2

8.3 REPAIR OF PARTS OF ADVANCED COMPOSITES....2

8.3.1 CONDITIONS FOR REPAIR WORKS....2
8.3.2 CLASSIFICATION OF DAMAGE....2
8.3.3 TYPICAL REPAIR OF SAILPLANE AGGREGATES SKINS....3
8.3.4 MATERIALS USED FOR REPAIR....3

8.4 REPAIR OF METAL PARTS AND PAINT....4

8.5 ILLUSTRATIONS....4

8.1 Introduction

General requirements for repair of minor sailplane damage are given in this section. Repair of minor FES demages are described in separate FES maintenance manual.

8.2 Main requirements for repair work

1. Repair work shall be performed only by qualified and authorized staff.
2. Major repairs shall be agreed to by local CAA in order to avoid possible sailplane airworthiness violation.
3. If there are some doubts about repair classification ("major" or "minor") contact the manufacturer of the sailplane.
4. In respect to the sailplane zone being repaired (fig. 8.2_01, fig. 8.2_02) work may be carried out by:
   - zone 1 – a person having corresponding permission,
   - zone 2 – repair factory certified by local CAA
   - zone 3 – the sailplane manufacturer.
5. After repair of controls, repainting of a sailplane it is necessary to check weights and positions of C.G. of controls having been repaired and C.G. of the sailplane.
6. No additional color marking on the white upper surface is allowed.

8.3 Repair of parts of advanced composites

8.3.1 Conditions for repair works

Premises where repair is carried out must be clean, warm and properly lighted. Temperature during repair must be ≥ + 20°C and humidity ≤ 65%.

The optimal processing temperature for resin- hardener systems lies in range between 20° C and 25°C. Heat treatment must be performed keeping temperature of 50-60°C for 15 hours.

Advanced composite repairs should only be performed by adequately trained and qualified trained and qualified repair persons.

8.3.2 Classification of damage

The sailplane construction is divided into three zones with allowed sizes of damage in them (fig. 8.2_1, fig. 8.2_2, table 8.3.2_01).

Table 8.3.2_01

Pos. No	Repair damage	Zone 1	Zone 2
1	An opening	∅ 100 mm	∅ 40 mm
2	Crack (split)	200 mm	100 mm
3	Damage of leading edge	100 mm – for ailerons, flaps 40 mm – for wings	40 mm – for fin, stabilizer
4	Damage of trailing edges	200 mm	
5	Damage of paint coating	Without restrictions	

It is allowed to repair these constructive damages in the certified repair station:

1) composite material delamination, cracks at structural joints,
2) damage of wing roots and end ribs,
3) cracks and fractures of metal constructions,
4) cracks and delamination of skins of fuselage, wings, stabilizer, controls, wings tips and damages in a structural parts.

For the above it is necessary to get corresponding technical information and recommendations from the manufacturer of the sailplane.

Damage of wings spars may only be repaired by the manufacturer of the sailplane.

8.3.3 Typical repair of sailplane aggregates skins

Typical repair works of sailplane aggregates skins are shown in fig. 8.3.3_01.

If a part of advanced composites is damaged partially not through (fig. 8.3.3_01,a) its repair must be performed as follows:

- make round edges of a damaged zone,
- take out foam of opening (fig. 8.3.3_01,b) and check the internal layer for damage,
- if an internal layer is not damaged, prepare an upper coating for repair (fig. 8.3.3_01,b),
- glue in foam,
- after glue polymerization, sand the repaired zone with sand paper and then lay-up on it the required number of repair layers of cloth at given angle of reinforcement (fig. 8.2_01, fig. 8.2_02).

Caution: ***during repair the required temperatures for processing of the resin- hardener systems must be kept.***

If a part of advanced composites is damaged through (fig. 8.3.3_01,d) repair must be performed as follows:

- make round edges of a damaged zone,
- take out foam around the opening (fig. 8.3.3_01,e),
- prepare an upper coating for repair (fig. 8.3.3_01,e),
- glue in a plate on prepared internal layers according to requirements of fig. 8.3.3_01,e (if edges of internal layers are flexible, it is necessary to glue technological plate from bottom side),
- after glue polymerization, sand the repaired zone with sand paper and then, lay-up on it the required number of repair layers of cloth at given angle of reinforcement (fig. 8.2_01, fig. 8.2_02, fig.8.3.3_01,f).

Caution: ***during repair the required temperatures for processing of the resin-hardener systems must be kept.***

8.3.4 Materials used for repair

The following fabric types are used for repair of parts of advanced composites:

Table 8.3.4_01

Type (Interglass No)	Weaving type	Mass g/m2	Cloth thickness, mm	Manufacturer
Glass fabric				
90070	Plain	81	0.1	Interglass AG
92110	Twill 2/2	163	0.18	Interglass AG
92125	Twill 2/2	280	0.35	Interglass AG
Carbon fabric				

Type (Interglass No)	Weaving type	Mass g/m2	Cloth thickness, mm	Manufacturer
98131	Twill 2/2	163	0.2	Interglass AG
98151	Twill 2/2	245	0.35	Interglass AG
469	Plain	93	0.15	C. Cramer & Co
Kevlar fabric				
98613	Twill 1/3	170	0.35	Interglass AG

For repair work resin- hardener systems Laminating resin L 285 - Hardener 285,286,287 are used.

Caution: ***resin and hardener must be stored in carefully sealed containers. Resin and hardener may crystallize at temperatures below +15 °C. The crystallization is visible as a clouding or solidification of contents of the container. Before using the resin and the hardener must be heated in order to destroy the crystallization of them. Slow warming till 50 °C - 60 °C in vessels with water and stirring of them will make the content transparent without loss of their quality. Only fully transparent products must be used. Do not heat over an open flame! Use individual protective appliances while stirring (gloves, glasses, respirator).***

Preparation of binding material:

Table 8.3.4_02

Mixture ratios	Resin L-285	Hardener 287/286/287
Parts by weight	100	38 ÷ 40
Parts by volume	100	47 ÷ 50

The given mixing ratio of components must be observed as exactly as possible. More or less hardener will not speed up or slow down the reaction – just cause only partial hardening which will not be corrected any way. Mixture of resin and hardener must be stirred thoroughly until there is no cloudiness in a vessel.

Pay special attention to walls and corners of the vessel.

The optimal processing temperature for resin- hardener systems lies in range between 20*C and 25*C. Higher temperature is possible but it will shorten an effectiveness duration of the resin. Temperature rise by 10*C makes an effectiveness duration twice shorter.

8.4 Repair of metal parts and paint

Damaged galvanized and paint coatings on metallic parts which are not damaged by corrosion, etc. affecting the strength of the part, may be restored by replacing the coating in accordance with manufactures' recommendations. Metallic parts damaged by corrosion, etc. may only be repaired in accordance with instructions obtained from the sailplane manufacture.

8.5 Illustrations

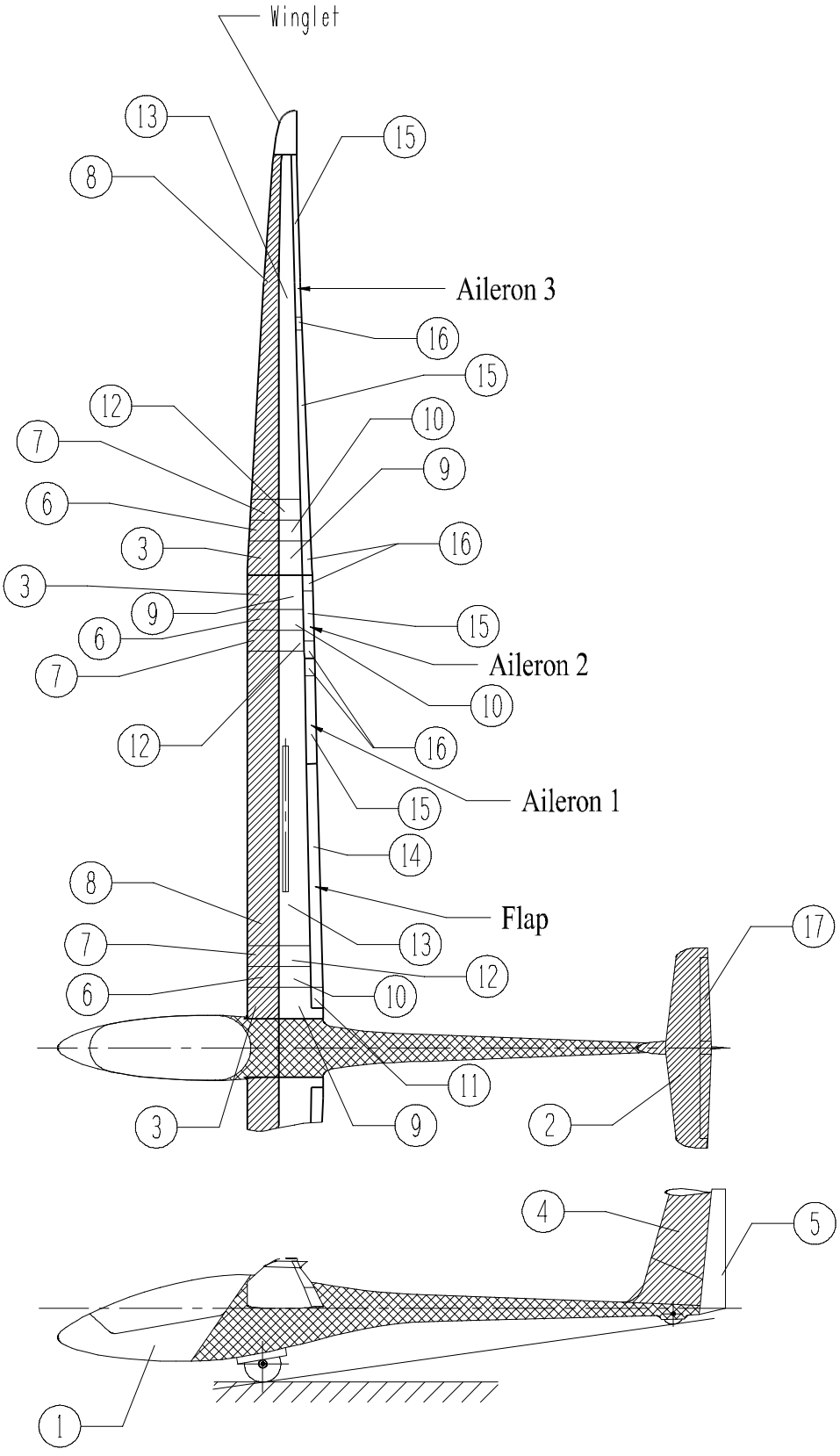


Fig.8.2_01. Repair zones of sailplane

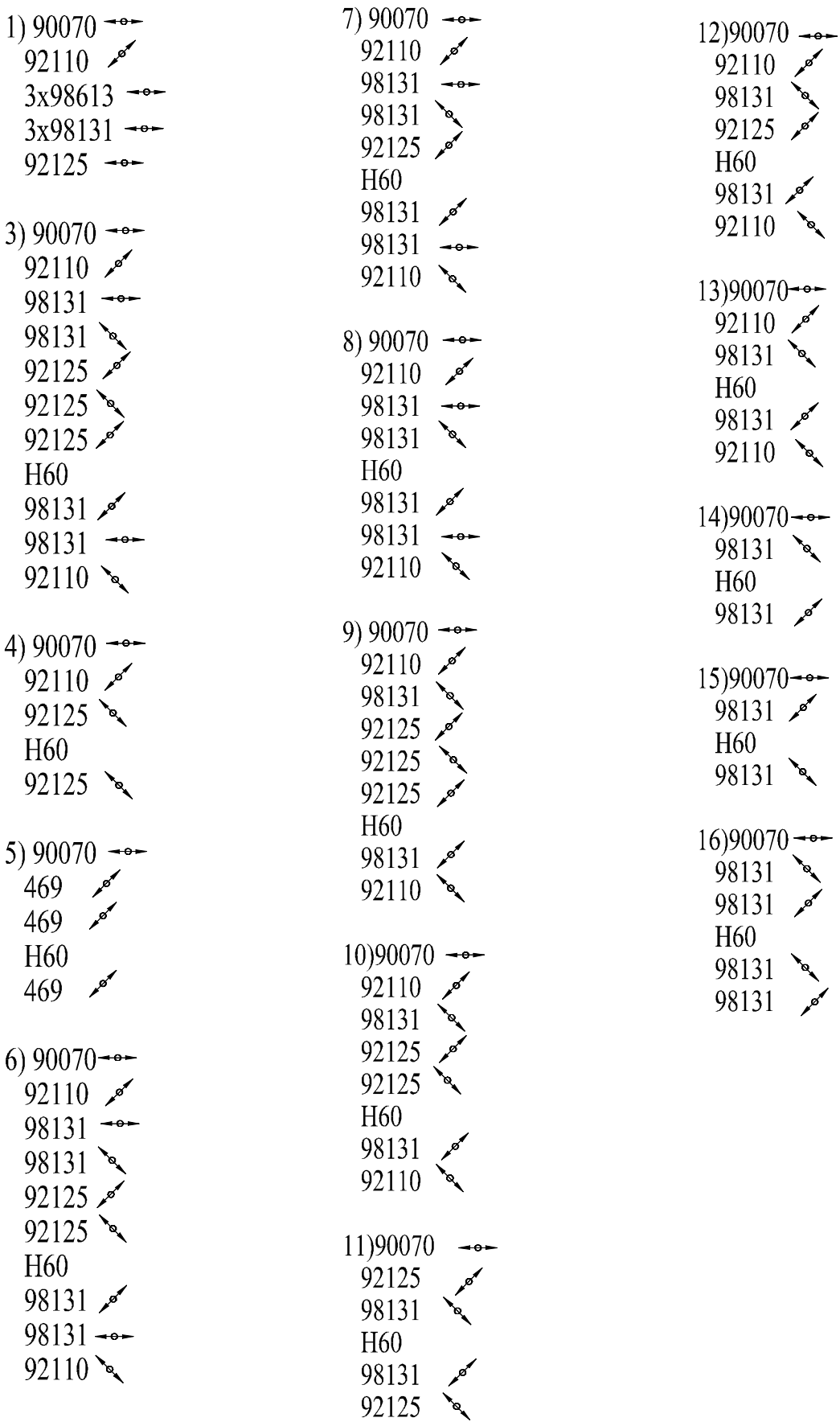
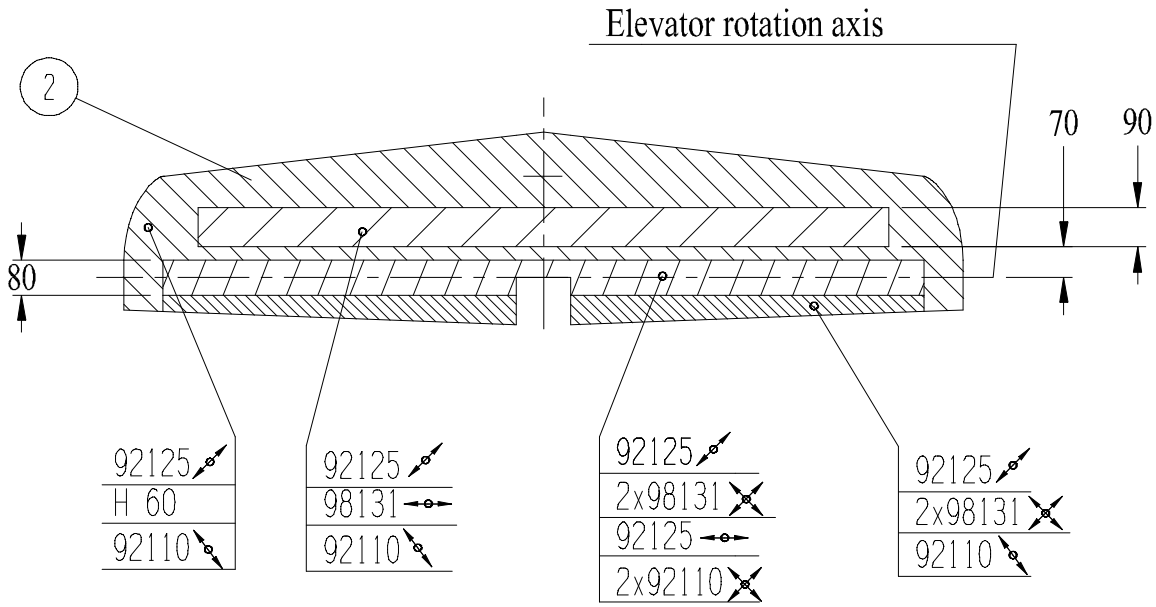


Fig.8.2_02. Repair zones of sailplane

An upper surface of stabilizer and elevator



A lower surface of stabilizer and elevator

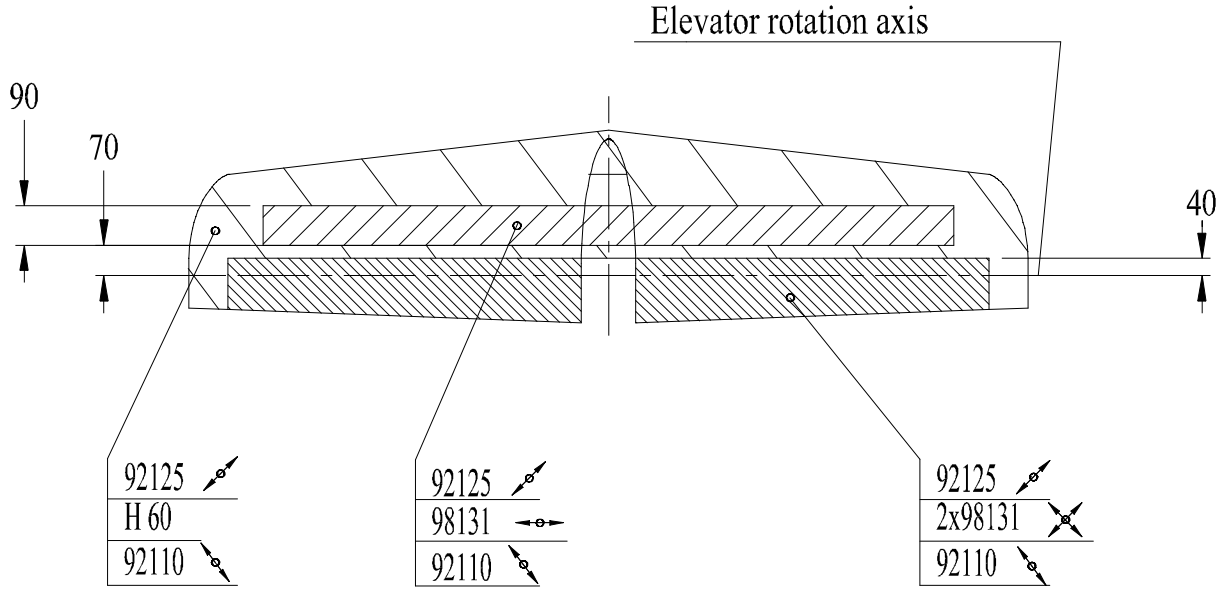
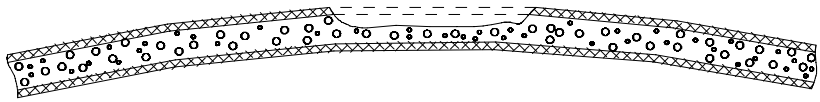


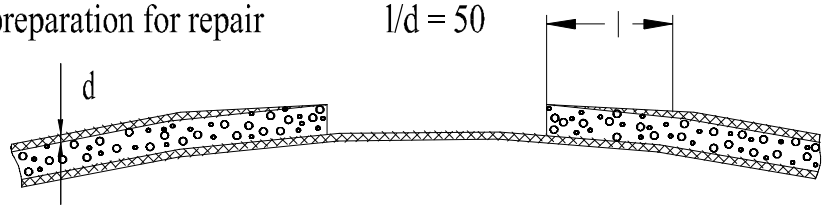
Fig.8.2_03 Repair zones of sailplane

Repair of partially damaged skin

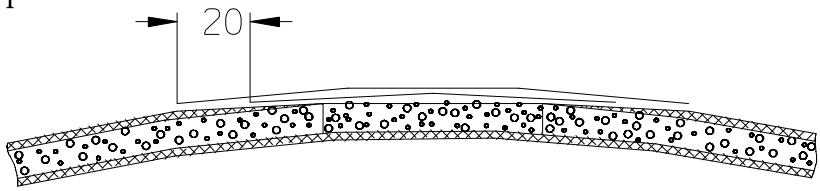
a) partial damage



b) preparation for repair l/d = 50

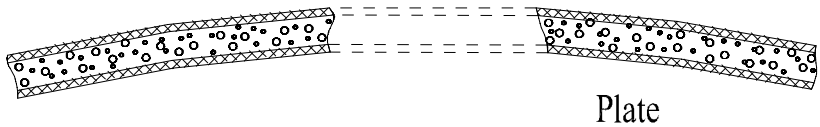


c) repair

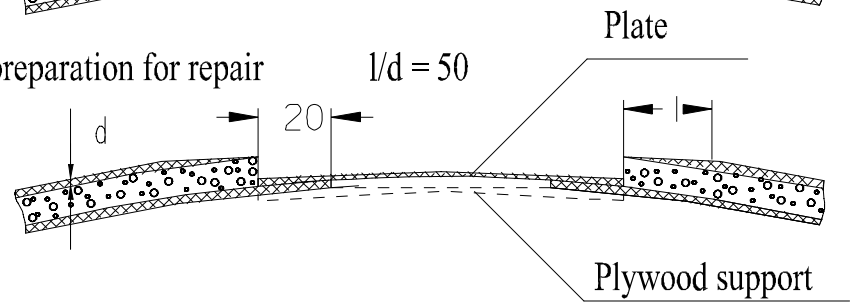


Repair of skin damaged through

d) through damage



e) preparation for repair l/d = 50



f) repair

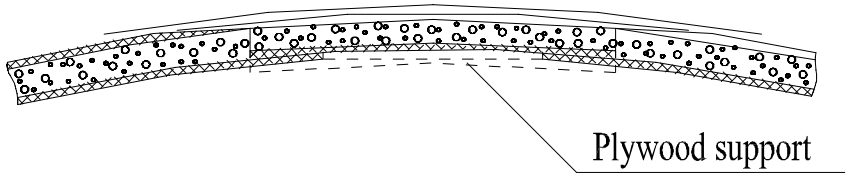


Fig.8.3.3_01 Typical repair of skin of composite skin sandwich