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MAINTENANCE MANUAL
FOR THE SELF-SUSTAINING SAILPLANE
LAK-19T

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

LAK-19T	MAINTENANCE MANUAL	LAK-19T
---------	--------------------	---------

List of Effective Pages

Section	Page	Date of Issue	Section	Page	Date of Issue
1	1/1	01 Mar 2006		2/40	01 Mar 2006
	1/2	01 Mar 2006		2/41	01 Mar 2006
	1/3	01 Mar 2006		2/42	01 Mar 2006
	1/4	01 Mar 2006		2/43	01 Mar 2006
2				2/44	01 Mar 2006
	2/1	01 Mar 2006		2/44a	30 Jan 2008
	2/2	01 Mar 2006		2/45	01 Mar 2006
	2/3	01 Mar 2006		2/46	01 Mar 2006
	2/4	01 Mar 2006		2/47	01 Mar 2006
	2/5	30 Jan 2008		2/48	01 Mar 2006
	2/6	01 Mar 2006		2/49	01 Mar 2006
	2/7	30 Jan 2008		2/50	01 Mar 2006
	2/8	30 Jan 2008		2/51	01 Mar 2006
	2/9	01 Mar 2006		2/52	01 Mar 2006
	2/10	01 Mar 2006		2/53	01 Mar 2006
	2/11	01 Mar 2006		2/54	01 Mar 2006
	2/12	01 Mar 2006		2/55	01 Mar 2006
	2/13	01 Mar 2006		2/56	01 Mar 2006
	2/14	01 Mar 2006		2/57	01 Mar 2006
	2/15	01 Mar 2006		2/58	01 Mar 2006
	2/16	01 Mar 2006		2/59	01 Mar 2006
	2/17	01 Mar 2006		2/60	01 Mar 2006
	2/18	30 Jan 2008		2/61	01 Mar 2006
	2/19	01 Mar 2006		2/62	01 Mar 2006
	2/20	01 Mar 2006		2/63	01 Mar 2006
	2/21	01 Mar 2006		2/64	01 Mar 2006
	2/22	01 Mar 2006		2/65	01 Mar 2006
	2/23	01 Mar 2006		2/66	01 Mar 2006
	2/24	01 Mar 2006		2/67	01 Mar 2006
	2/25	01 Mar 2006		2/68	01 Mar 2006
	2/26	01 Mar 2006		2/69	01 Mar 2006
	2/27	01 Mar 2006		2/70	01 Mar 2006
	2/28	01 Mar 2006		2/71	01 Mar 2006
	2/29	01 Mar 2006		2/72	01 Mar 2006
	2/30	01 Mar 2006		2/73	01 Mar 2006
	2/31	01 Mar 2006		2/74	01 Mar 2006
	2/32	01 Mar 2006		2/75	01 Mar 2006
	2/33	01 Mar 2006		2/76	01 Mar 2006
	2/34	01 Mar 2006	3	3/1	01 Mar 2006
	2/35	01 Mar 2006		3/2	01 Mar 2006
	2/36	01 Mar 2006		3/3	01 Mar 2006
	2/37	01 Mar 2006		3/4	01 Mar 2006
	2/38	01 Mar 2006		3/5	01 Mar 2006
	2/39	01 Mar 2006			

LAK-19T	MAINTENANCE MANUAL	LAK-19T
---------	--------------------	---------

Section	Page	Date of Issue	Section	Page	Date of Issue
	3/6	30 Jan 2008		7/4	30 Jan 2008
	3/7	01 Mar 2006		7/5	01 Mar 2006
	3/8	01 Mar 2006		7/6	01 Mar 2006
	3/9	30 Jan 2008		7/7	01 Mar 2006
	3/10	30 Jan 2008		7/8	01 Mar 2006
	3/11	30 Jan 2008		7/9	01 Mar 2006
	3/12	01 Mar 2006		7/10	01 Mar 2006
	3/13	30 Jan 2008		7/11	01 Mar 2006
	3/14	30 Jan 2008		7/12	01 Mar 2006
	3/15	01 Mar 2006		7/13	01 Mar 2006
	3/16	01 Mar 2006		7/14	01 Mar 2006
	3/17	01 Mar 2006		7/15	01 Mar 2006
	3/18	01 Mar 2006		7/16	01 Mar 2006
	3/19	01 Mar 2006		7/17	01 Mar 2006
	3/20	01 Mar 2006		7/18	01 Mar 2006
	3/21	01 Mar 2006		7/19	01 Mar 2006
	3/22	01 Mar 2006		7/20	01 Mar 2006
	3/23	30 Jan 2008			
	3/24	01 Mar 2006	8	8/1	01 Mar 2006
	3/25	01 Mar 2006		8/2	30 Jan 2008
	3/26	01 Mar 2006		8/3	01 Mar 2006
	3/27	30 Jan 2008		8/4	01 Mar 2006
	3/28	01 Mar 2006		8/5	01 Mar 2006
	3/29	01 Mar 2006		8/6	01 Mar 2006
	3/30	01 Mar 2006		8/7	01 Mar 2006
	3/31	01 Mar 2006			
	3/32	01 Mar 2006	9	9/1	01 Mar 2006
4	4/1	01 Mar 2006			
5	5/1	15 Jan 2018			
	5/2	01 Mar 2006			
	5/3	30 Jan 2008			
	5/4	01 Mar 2006			
	5/5	15 Mar 2008			
	5/6	01 Jul 2016			
	5/7	01 Jul 2016			
	5/8	20 Jun 2022			
	5/9	27 Mar 2008			
	5/10	20 Jun 2022			
6	Appr. 6/1	15 Jan 2018			
7	7/1	01 Mar 2006			
	7/2	01 Mar 2006			
	7/3	01 Mar 2006			

LAK-19T	MAINTENANCE MANUAL	LAK-19T
---------	--------------------	---------

Record of revisions

Any revision of the present Manual, except actual weighing 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 Issue	Approval	Date of Approval	Date of Insertion	Signature
Rev. 1	0	i	30 Jan 2008				
Rev. 1		ii	30 Jan 2008				
Rev. 1	2	2/5	30 Jan 2008				
Rev. 1		2/7	30 Jan 2008				
Rev. 1		2/8	30 Jan 2008				
Rev. 1		2/18	30 Jan 2008				
Rev. 1		2/44a	30 Jan 2008				
Rev. 1	3	3/6	30 Jan 2008				
Rev. 1		3/9	30 Jan 2008				
Rev. 1		3/10	30 Jan 2008				
Rev. 1		3/11	30 Jan 2008				
Rev. 1		3/13	30 Jan 2008				
Rev. 1		3/14	30 Jan 2008				
Rev. 1		3/23	30 Jan 2008				
Rev. 1		3/27	30 Jan 2008				
Rev. 1	5	5/3	30 Jan 2008				
Rev. 1	7	7/4	30 Jan 2008				
Rev. 1	8	8/2	30 Jan 2008				
Rev. 2	5	5/5	15 Mar 2008				
Rev. 3	5	5/8	27 Mar 2008				
Rev. 3		5/9	27 Mar 2008				
Rev. 3		5/10	27 Mar 2008				
Rev. 3	6	6/1	27 Mar 2008				
Rev. 4	5	5/6	01 Jul 2016				
Rev. 4		5/7	01 Jul 2016				
Rev. 5	0	i	15 Jan 2018				
Rev. 5		ii	15 Jan 2018				
Rev. 5		iii	15 Jan 2018				
Rev. 5	5	5/1	15 Jan 2018				
Rev. 5		5/10	15 Jan 2018				
Rev. 5	6	6/1	15 Jan 2018				
Rev. 6	0	i	20 Jun 2022				
Rev. 6		ii	20 Jun 2022				
Rev. 6		iii	20 Jun 2022				
Rev. 6	5	5/8	20 Jun 2022				
Rev. 6		5/10	20 Jun 2022				

LAK-19T	MAINTENANCE MANUAL	LAK-19T
---------	--------------------	---------

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

LAK-19T	MAINTENANCE MANUAL	LAK-19T
---------	--------------------	---------

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

LAK-19T	MAINTENANCE MANUAL	LAK-19T
---------	--------------------	---------

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

LAK-19T	MAINTENANCE MANUAL	LAK-19T
---------	--------------------	---------

Contents

	Section
General.....	1
Description of the sailplane and systems.....	2
Sailplane maintenance.....	3
Maintenance of a sailplane instruments and equipment according to their own maintenance documents.....	4
Periodical inspections.....	5
The sailplane life limits.....	6
Weights and center of gravity.....	7
Repair.....	8
Appendixes.....	9

Data: 01 March 2006	Rev. No.0
---------------------	-----------

LAK-19T	MAINTENANCE MANUAL	Section 1	Page 1/1 Total pages 4
---------	--------------------	--------------	---------------------------

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

LAK-19T	MAINTENANCE MANUAL	Section 1	Page 1/2 Total pages 4
---------	--------------------	--------------	---------------------------

1.1 Introduction

This Maintenance Manual contains an information for pilots, technicians and mechanics for safe and proper maintenance of a self-sustaining sailplane LAK-19T. An information is given in accordance with requirements of JAR22.1529.

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-19T is a new generation self-sustaining sailplane of the Standard class designed according to JAR-22 requirements. Glider is equipped with sustaining retractable power-plant, powered by the Solo 2350 engine (26.28 HP at 5500 RPM) and propeller LAK-P4-90.

The sailplane has T-type tail, retractable main gear wheel, water ballast tanks 180 ltr of capacity in the wings and water ballast tank 8 ltr of capacity in the fin.

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.

Date: 01 March 2006		Rev. No.0
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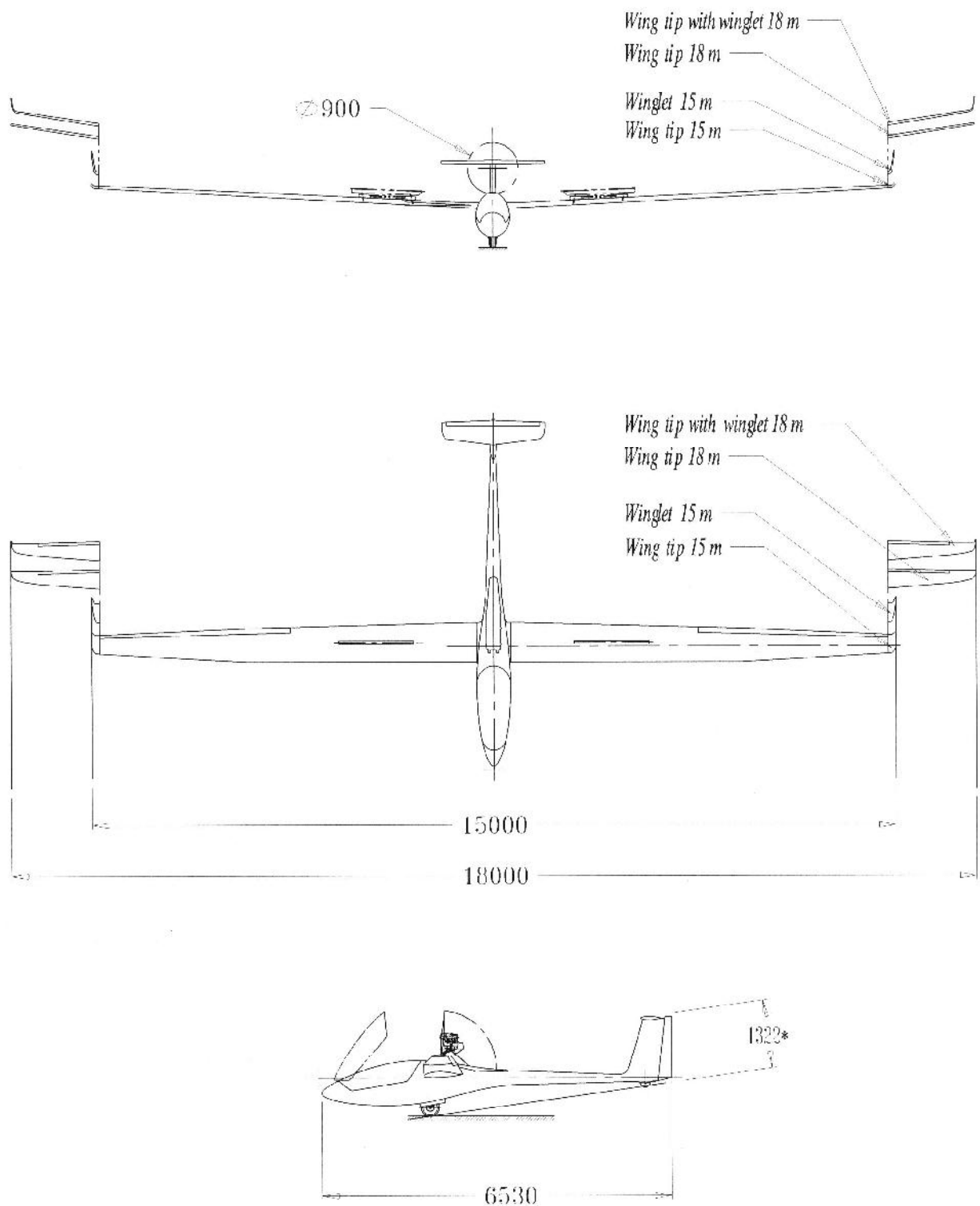
Technical data	b=15 m	b=18 m
Wing span	15.0	18.0
Wing area, m ²	9.06	9.8
Wing aspect ratio	24.8	33.06
Wing dihedral angle, degrees	3°	3°
Fuselage length, m	6.53	6.53
Height, m	1.29	1.29
Max airspeed in calm air, km/h	275	275
Max airspeed in rough air, km/h	190	190
Max flight mass, kg	480	500
Max wing loading, kg/ m ²	53	51
Min sink rate, m/s	0.6	0.5
Best L/D without ballast at 95 km/h	46	49
Best L/D with ballast at 115 km/h	47	50
g limits without water ballast	-2.65/+5.3	-2.65/+5.3
g limits with water ballast	-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 the sailplane and systems

	Page
2.1 Introduction	2
2.2 Airframe construction	2
2.2.1 Wing	2
2.2.2 Fuselage	4
2.2.3 Vertical tail	4
2.2.4 Horizontal tail	5
2.2.5 Landing gear	5
2.3 Control systems	5
2.3.1 Ailerons control system	5
2.3.2 An elevator control system	5
2.3.3 Trimmer control system	6
2.3.4 Rudder control system	6
2.3.5 Airbrakes control system	6
2.3.6 Water ballast control system	7
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	8
2.4 Equipment and systems	8
2.4.1 Pitot and static system	8
2.4.2 Flight and navigation instruments	9
2.4.3 Motor control unit MCU LAK-17AT.....	9
2.4.4 Electric- and radio equipment	15

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/2 Total pages 76
---------	--------------------	--------------	----------------------------

2.4.5	Canopy ventilation system	15
2.4.6	Cockpit canopy and its emergency jettison system	16
2.4.7	Cockpit equipment	16
2.4.8	Fastening of baggage	16
2.5	Power plant	17
2.5.1	General layout.....	17
2.5.2	Power-plant extension/retraction system.....	17
2.5.3	Fuel system.....	17
2.5.4	Propeller brake.....	17
2.5.5	Controls of cylinders de-compressing valves.....	17
2.5.6	Power-plant bay door.....	18
2.5.7	Engine support cable.....	18
2.6	Placards and marking of controls.....	18
2.7	Data for rigging	19
2.7.1	Allowed clearances in connections of aggregates.....	19
2.7.2	Allowed clearances in control systems	19
2.7.3	Allowed forces in control systems	21
2.8	Illustrations	22

2.1 Introduction

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

2.2 Airframe construction

2.2.1 Wing

Sailplane wings (fig. 2-1a, fig. 2-1b) made of composite materials consist of four parts: right wing (pos. 1), left wing (pos. 2) and two wing tips connected at distance of 7350 mm from wing symmetry axis. The wing tips are of two different lengths. For wing span 18 m of length the wing tips

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/3 Total pages 76
---------	--------------------	--------------	----------------------------

1650 mm of length (pos. 3) are used. Here are two configurations of the 18 m wing tips: (a) without winglet; (b) with integral (not removable) winglet. For span 15 m of length the wing tips 150 mm of length (pos. 4) or winglets are used.

The wing (pos. 1, pos. 2) is a combination of three trapeziums with airfoils: LAP92-130/15 mod, LAP92-130/15 and LAP92-150/15.

The wing tip b=1650 mm (pos. 3) is also a combination of three trapeziums with airfoils: LAP93-147, LAP93-148.

Construction of wing and wing tips is of one spar monocoque type. Their spars (pos. 5, 6 and 7) 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 (pos. 8 and pos. 9). 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. Thickness of foam of wing tip shells is 3 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. A wing tip (pos. 3 or pos. 4) is connected to the wing with the help of wing tip spar (pos. 7), pins (pos. 14) and fix (pos. 13).

There are an adjustable hubs (pos. 15) in the wing root ribs to fasten the wings to the fuselage.

The shell structure of an ailerons is analogical to the wing shells structure.

Length of ailerons (pos. 11) is 3.55 m, area 0.265 m². With wing span of 18 m an aileron is extended to 4.7 m. Its area then is 0.315 m². As wing tip (pos. 3) is connected to the wing the part of an aileron on the wing tip (pos. 12) is connected to an aileron (pos. 11) 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.

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/4 Total pages 76
---------	--------------------	--------------	----------------------------

2.2.2 Fuselage

The Sailplane fuselage (fig. 2-2a, 2-2b) is made of composite materials, construction is monocoque. The fuselage is oval-shaped in section (fig. 2-2b), slightly narrowing at top and turning into the circle section at the fuselage end. The fuselage end section is cone-shaped turning into the fin.

Fuselage is glued of two symmetric shells, right and left (fig. 2-2b, pos. 2,3). Shells gluing seams are located in vertical plane (in upper and lower shell parts).

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

The fuselage is reinforced by metal frame (fig. 2-2b, pos. 4) at wing attachment to the fuselage zone. Landing gear (fig. 2-2a, pos. 5) is fastened to the frame. The gear is fully retractable. It's opening has sealed cover in order to avoid getting of dirt and dust inside the fuselage. As the gear is retracted landing gear door is closed.

Tail wheel (fig. 2-2a, pos. 6) is fixed at the end of the fuselage. The pilot cockpit has canopy (fig.2-2a, pos.1), which opens forward.

There is an opening in a central part of the fuselage for installation of the power-plant. The opening is reinforced with carbon fiber beams (fig. 2-2a, pos. 13; 14) to increase stiffness of the fuselage in this area. For detailed description of the power-plant and systems related to it refer to Section 2.5 of this manual.

2.2.3 Vertical tail

The vertical tail (fig. 2-3) 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.

Warning: for the glider with power-plant installed, fin battery has to be removed. Only the baggage compartment batteries can be installed.

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

Note: if pilot weight is 100...110 kg (220,5...242 lbs), it is possible to remove one baggage compartment battery and replace it by installing battery in the fin. This moves c.g. of the glider back by 32...34 mm. Re-weighing or re-calculation of the c.g. position is mandatory in this case.

The radio antenna (pos. 10) is located and fixed in a nose of the vertical fin.

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 pins (pos. 15) are mounted on the upper part of the fin spar to connect the fin to horizontal tail (stabilizer) and a special hub with thread (pos. 16) is on the upper fin rib to fix the joined stabilizer with a pin.

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/5 Total pages 76
---------	--------------------	--------------	----------------------------

2.2.4 Horizontal tail

The horizontal tail (fig. 2-4) 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. 3-3a).

The elevator is joined to control system automatically.

2.2.5 Landing gear

The landing gear consists of a retractable main wheel (fig. 2-2a, pos. 5) and fixed tail wheel (fig. 2-2a, pos. 6).

Landing gear main wheel type TOST 055191 with Cleveland disk brake of hydraulic type, connected to air brakes control system, is attached to metal girder (fig. 2-2b, pos. 4) with the help of stands (fig. 2-11, pos. 6, pos. 7) and a shock absorber (fig. 2-11, pos. 8). The opening for the wheel is covered with a main wheel box (fig. 2-11, pos. 9). It protects the fuselage internal space from dust and dirt.

Mechanical wheel brake system is optional.

With main wheel up the landing gear door (fig. 2-21, pos. 2) is closed.

Tail wheel (fig. 3-12) 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 control system

In order to ensure required rigidity and to reduce unsteadiness, ailerons control system is made of metal rods and levers (fig. 2-5a and 2-5b).

Movement from the control stick (pos. 1 fig. 2-5a) by rods and intermediate levers (pos. 2, pos.3) is transmitted to a shaft (pos. 4) which in its turn with help of automatic connection transmits the movement to the shaft (fig. 2-5b pos. 5) in the wing. The lever (pos. 6) turns rotational movement into sliding one and by help of rods and levers (pos. 7) the aileron is deflected in required direction.

In order to ensure rigidity the central rod in wing is supported by ball guides (pos. 8).

Ailerons deflection angles are : $-21 \pm 2^\circ$
 $+18 \pm 2^\circ$

2.3.2 An elevator control system

The elevator control system (fig. 2-6) consists of metal rods and bellcranks. In order to ensure rigidity the main rod in the fuselage is supported by guide rollers (pos. 5).

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/6 Total pages 76
---------	--------------------	--------------	----------------------------

Movement from the stick (pos. 1) by help of rods and intermediate bellcranks (pos. 2, pos. 3 and pos.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. 2-7) 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 $\varnothing 16 \times 1.6$ 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. 2-8a, fig. 2-8b, fig. 2-8c) is of combined type: steel cable from pedals to a bellcrank in the middle part of fuselage and steel rod $\varnothing 16 \times 1$ 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

An air brakes control system (fig.2-12a and fig.2-12b) consists of control handle (fig.2-12a pos.1), fastened to the left side of a cockpit, rigid rods and levers. Movement from the control

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/7 Total pages 76
---------	--------------------	--------------	----------------------------

handle by an intermediate lever (pos. 2) is transmitted to the shaft (pos. 3) which in its turn transmits movement by help of automatic connection to the shaft (fig.2-12b pos. 12) in wing.

The lever (pos. 13) converts rotational movement to sliding one and by help of intermediate levers transmits it to lifting mechanism, consisting of the bellcrank 2 (pos. 14) and arm's (pos. 15, pos.16). Brakes in closed position are fixed by cinematic lock which protects against spontaneous opening of brakes. The lock turning-point is regulated by bolt of fixer (pos. 17).

Control system of air brakes is connected with control system of landing gear brake. Landing gear brake operates just in the end part of movement of air brake handle.

2.3.6 Water ballast control system

The glider is equipped with wing tanks 180 liter of capacity and fin tank 8 liter of capacity. There are three possible configurations of water ballast system. (1) The standard configuration is when both wing and tail ballast tanks are installed and both are operated with one handle simultaneously (fig. 2-9a and fig. 2-9b). (2) The optional configuration when wing and fin water ballast valves open independently can be installed (fig. 2-9e). If the sailplane has an independent (optional) control system for the fin tank valve - the water ballast valve control knob of the fin tank is located on the right side of the cockpit wall. (3) The optional configuration with no fin tank can be installed (fig. 2-9d).

In general water ballast system operates as follows: by pulling the handle (pos. 1) on the right side of the pilot cockpit backward movement by help of the rod (pos.2) is transmitted to the cross rod (pos. 3). The cross rod (pos. 3) rotating by help of the coupling (pos. 4), the shaft (pos. 5), the coupling (pos.6) and the bellcrank (pos. 7) opens valves (pos. 8) in the left and right wings water ballast tanks (pos. 10). The valves (pos. 8) have rubber sealing (pos. 9). When the handle (pos. 1) is returned to initial position valves (pos. 8) are being closed. The shaft (pos. 5) is fastened in supports (pos. 16 and pos. 17) which keep it from moving in axial directions. The shaft (pos. 5) connection with the support (pos. 17) is hermetized with a rubber pipe.

Water ballast is poured into wing tanks through valves (pos. 8) by help of special equipment.

Water ballast is poured into a fin tank through an opening (pos. 12) and a pouring pipe (pos. 13).

Water is poured out from the fin tank after a valve (pos. 25) is open (fig. 2-9c).

The wing and fin water ballast tanks have drainage systems and openings for drainage (pos. 19 and pos. 20).

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

2.3.7 Tow Release control system

A towing hook (fig. 2-10, 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).

2.3.8 Main landing gear control system

The landing gear control system (fig. 2-11) 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

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/8 Total pages 76
---------	--------------------	--------------	----------------------------

retracted and released positions is fixed in the slots of plate (pos. 5).

2.3.9 Landing gear brake control system

Landing gear brake is of hydraulic type, connected to air brakes control system (fig. 2-12a) and it is controlled with help of air brakes handle (pos.1). Movement from the handle is transmitted to the lever (pos. 5) just in the end part of handle movement due to cutout in the tip (pos. 10) of the rod (pos.4). The lever (pos. 5) while turning presses onto piston of cylinder (pos. 6) and causes pressure in the system. Liquid within hose (pos. 9) under pressure flows into brake cylinder (pos. 7) which, in its turn, being under pressure causes braking of wheel disk of gear.

Hydroliquid is poured into reservoir (pos. 8) and by hoses (pos.9) flows into aggregates of hydrosystem.

The mechanical wheel brake system is optional (Fig. 2-12). The main wheel brake is controlled by a handle (fig. 2-12, 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).

2.4 Equipment and systems

2.4.1 Pitot and static system

Pitot and static system of the sailplane is shown in fig. 2-13. 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. 2-13). Static pressure receivers consists of a glass fiber tanks with air inlet as a holes drilled through the fuselage skin.

There is static pressure lines are 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 in the fuselage nose 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).

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/9 Total pages 76
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2.4.2 Flight and navigation instruments

These flight, navigation and power-plant instruments as option are mounted in the sailplane:

OPTION A	OPTION B
1) air-speed indicator WINTER 6 FMS 421, with range markings	1) air-speed indicator WINTER 6 FMS 423, with range markings
2) altimeter WINTER 4 FGII 10	2) altimeter WINTER 4 HM 6
3) mechanical variometer WINTER 5 STV-5	3) variometer WINTER 5 STVM 5-2
4) Electronic variometer Filser LX 160	4) electronic variometer FILSER LX5000
5) compass KI-13A	5) fly computer display FILSER LX5000
6) ILEC motor control unit MCU LAK17AT	6) side slip indicator LUN 1216
7) Radio ATR 600	7) radio Dittel FSG-2T
	8) ILEC motor control unit MCU LAK17AT
	9) Transponder Filser TRT 600

All the instruments, except for the compass KI-13, 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 an electronic variometer and a radio (fig. 2-14).

It is possible to use other standard flight and navigation instruments and change instruments positions on the instrument panel (fig.2-14). These instruments must correspond with national regulations.

Max instrument panel weight in flight - 4.1 kg.

2.4.3 Motor control unit MCU, type LAK-17AT

Motor control unit MCU LAK-17AT, manufactured by Industrie und Luftfahrtelektronik GmbH, Germany, controls operation of the power-plant. The details of the instrument are given below.

MCU Operation

The MCU was designed to improve safety of engine use. This important MCU function can only be obtained when MCU is always (continuous) switched on when operating the engine. Any other use is outside of manufacture agreed MCU operation mode.

If MCU is switched off during engine run, all safety in engine operation is lost.

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

Caution: *Keep MCU power supply always switched on during engine run!
Do not switch to other battery during engine run (like MCU power supply off / power supply on)!
Keep extract switch in top position during engine run!
If MCU inadvertently was switched off during engine run, stop engine first (ignition off), switch on MCU again and after that start engine again!*

Warning: *Squeeze danger - be careful when retracting or extracting engine on ground! It is extremely dangerous to operate engine on ground (e.g. for tests)!*

Disclaimer:

ILEC is not responsible for accidents and damages caused by MCU during engine run outside the certified operation mode.

Date: 01 March 2006	Rev. No.0
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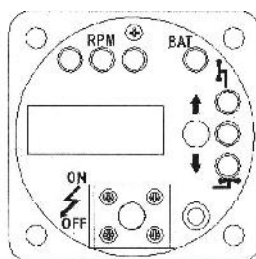
Abbreviations

CHT	Cylinder Head Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCU	Motor Control Unit
RPM	Rotations Per Minute

MCU Description

The MCU for LAK17AT* sailplane has on its front side, seven LED showing the most important states of the engine 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 switches for ignition on/off, engine ex-/retract and a button for display choice. On the back side are two different connectors placed for signal/power interfacing and ignition.

* - LAK-19T uses the same ILEC MCU as it is used for LAK-17AT.



Power up sequence

After powering up, MCU activates for two seconds all LED outputs, the buzzer output and the "88888888" display content. This procedure is for testing all indicators. The pilot should have a look during power up at MCU to recognize if all indicators work well.

LCD Display Description

The LCD display shows different information about engine, fuel tank, battery state and also advice during wrong handling. To change between different display pages simply press the white display button. Each short press on the button changes to the next display page. After last page, the first page comes again. When stopping on another page than the main page after a certain time the display switches automatically back to the main page. Also automatic switching to the most important display value is performed when engine parameters over or under run.

Pos.	Description	Run display example	Engine off/cold	Error
1	Rotations per minute (RPM) -main page	RPM 5500	RPM-----	RPM-----
2	Cylinder head temperature (CHT)	CHT230°C	CHT-----	CHT275°C (blinking)
3	Fuel tank level	FUEL 5L	FUEL 5L	FUEL ---
4	Battery voltage	BAT12,5V	BAT12,5V	BAT11,4V (blinking)
5	Engine hours	1,23h	1,23h	-
6	Fuel type correction		[100]	-
7	Fuel type calibration		Calibr.? (only retracted)	ERROR (after calibration)

The following handling errors are displayed automatically:

Display	Required handling to go on
IGNI.OFF	Switch ignition off
IGNI.ON	Switch ignition on
PROPSTOP	Change state of propeller stop
EXTRACT	Extract engine

The following system errors are displayed automatically:

Display	Reason	Possible Error reason
SWITCH R	Time overflow retract procedure	Limit switch retracted, wiring, spindle relays, spindle engine, fuse, battery voltage....
SWITCH E	Time overflow extract procedure	Limit switch extracted, wiring, spindle relays, spindle engine, fuse, battery voltage....
SWITCH O	Time overflow door open procedure	Limit switch door opened, wiring, door relays, door engine, fuse, battery voltage....
SWITCH C	Time overflow door close procedure	Limit switch door closed, wiring, door relays, door engine, fuse, battery voltage....

In retracted engine position the Display shows the following moving text:

ILEC MCU LAK17AT xxxxx Hy.yy Sz.zz

Explanation:

xxxxx: Serial number
Hy.yy: Hardware version
Sz.zz: Software version

Buzzer

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

Handling errors produce a pulsed buzzer tone.

High RPM, high CHT, low fuel level, low battery voltage and malfunction produce a continuous buzzer tone.

A continuous buzzer tone of low fuel level and low battery voltage can be switched off for a time of four minutes by pressing the display button, while a buzzer tone caused by High RPM and high CHT cannot be switched off. After four minutes the buzzer signal switches on again (when the alarm is still active). It is possible to switch it off (acknowledge) again by the display button.

All buzzer alarms are switched off, when engine is fully retracted in fuselage!

Reason	Buzzer	Display	LED	Remark
4500<RPM<5800	-	RPM	Green RPM on	
5800<=RPM<6500 (<5min)	-	RPM	Yellow RPM on	
5800<=RPM<6500 (>=5min)	continuous	RPM (blinking)	Yellow RPM blinking	
RPM>=6500	continuous	RPM (blinking)	Red RPM blinking	MCU does not limit max. RPM!
CHT>=275°C	continuous	CHT (blinking)	-	
Battery voltage<=11.5V	Continuous (reset able)	BAT (blinking)	Red BAT blinking	Acknowledge by white display button (4 min.)
Fuel<=2L	Continuous (reset able)	FUEL (blinking)	-	Acknowledge by white display button (4 min.)
Time overflow extract procedure	Continuous (reset able)	SWITCH E	-	Acknowledge by display button or extract/retract switch in center position
Time overflow retract procedure	Continuous (reset able)	SWITCH R	-	Acknowledge by display button or extract/retract switch in center position
Time overflow open door procedure	Continuous (reset able)	SWITCH O	-	Acknowledge by display button or extract/retract switch in center position
Time overflow close door procedure	Continuous (reset able)	SWITCH C	-	Acknowledge by display button or extract/retract switch in center position
Push retract switch while ignition is on.	Pulsed	IGNI.OFF	RED handling blinking	
Increasing RPM while ignition is off.	Pulsed	IGNI.ON	RED handling blinking	
Ignition is on and propeller is blocked by propeller stop.	Pulsed	PROPSTOP	RED handling blinking	
Push retract switch while ignition is off and propeller is unblocked by propeller stop.	Pulsed	PROPSTOP	RED handling blinking	
Push retract switch while propeller is not in retract position	Pulsed	PROP.POS	RED handling blinking	
Switch ignition on while engine is not fully extracted	Pulsed	EXTRACT	RED handling blinking	

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/13 Total pages 76
---------	--------------------	--------------	-----------------------------

Engine extract / retract

To extract the engine the switch on the right side of the LCD display has to be switched to top. First the door opens till the limit switch for opened door activates. After this the engine extracts till the limit switch for engine is activated and then the door closes back.

To retract the engine the same switch has to be switched down. First the door opens before engine retracts. Door opening is finished when limit switch of the door is activated. Engine retract stops when the limit switch in full retract position is activated. After this the door closes till the limit switch of the closed door activates. Is the engine partly extracted, always the door opens before the engine extracts/retracts.

Caution: *It is strongly recommended to let the re-/extract switch during engine run in top position after extract procedure!*

All tract operation stops when switching the ex-/retract switch to centered position.

Ignition switch

The manual ignition switch is placed under the LCD display. This ignition switch works independent from MCU electronic.

When switched to top – ignition is on.

In lower position - ignition is switched off.

LED

Above the LCD display three LED sign three RPM ranges.

Left green LED signs RPM of 4500 till 5800.

Middle yellow LED signs RPM of 5800 till 6500.

Right red LED (blinking) signs RPM above 6500.

On the right side of the RPM LED is the low battery LED which is blinking at battery voltage lower than 11,5V.

Extracted position green LED

Handling error red LED

Retracted position green LED

Engine hours

Engine hours counted at RPM higher than 2000 and stored in non-volatile EEPROM.

Cylinder head temperature

The MCU is calibrated for use with the hardened CHT sensor from Alfano. This sensor can be ordered via internet at <http://www.alfano.bc/anglais/default.htm> Part No: A- 211

The CHT sensor is shipped with a TNC connector which shouldn't be removed. The original cable length of the sensor is too short for connection to ILEC MCU, so it has to be connected via adapter.

Fuel tank sensor

The fuel tank sensor measures fuel level by capacitive method in a tube. Different fuel level results in different output frequency.

Date: 01 March 2006	Rev. No.0
---------------------	-----------

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/14 Total pages 76
---------	--------------------	--------------	-----------------------------

Remark:

Separate fuel sensor lines in wiring harness from ignition lines and power lines!

Calibration of fuel type

Two stroke engines use a mix of oil and gasoline. The share of oil but also gasoline of different company influences the fuel level sensor indications. With an easy procedure in MCU this trouble could be solved.

When you are sure that the fuel tank is total fulfilled. Choose the calibration page (press display button 6 times from RPM display) on MCU display. Press the display button for about five seconds. This procedure generates a new fuel type correction factor, which is displayed after five seconds.

Is the new correction factor outside 71% and 129%, an error message is displayed. This error must be acknowledged by pressing the display button. In this case old correction factor is restored.

Caution:

It is absolutely dangerous to do a calibration with partly filled fuel tank, because MCU will measure and display wrong fuel quantity!

The calibration procedure is only possible when engine is fully retracted!

Fuel type calibration should be made when using different gasoline and oil.

In best case do it after every filling fuel tank!

RPM sensor

The MCU is calibrated for use with INSOR IPCT1214 sensor. This sensor can be ordered via internet at: <http://www.schoenbuch-electronic.de>

This sensor is well suited for sensing the magnet in the flying wheel (one pulse per rotation).

The radial sensing distance is 2mm to 6mm to flying wheel. The sensing can be easily checked by the LED on the backside of the sensor. The output is on when the LED is on. For connection to MCU lengthen the cable you need for your glider.

Remark:

To reduce electrical interference, avoid mounting the RPM sensor in next distance to ignition coils! Separate RPM sensor lines in wiring harness from ignition lines and power lines!

Technical Data

Voltage range	7 V to 15 V
Power consumption	40mA at 12V (without external sensors, one limit switch and LED active)
Temperature range operational	-20°C to +60°C
Max. Output current	2A
Current at each switch input	10mA
Fuse	2A built in (self restoring)

Note: All switch inputs are switched in active state to GND. The propeller stop switch is active when propeller is not blocked for running. All outputs drive +12V in active state.

Date: 01 March 2006	Rev. No.0
---------------------	-----------

MCU Ignition Connector:

right	Ignition line 2
center	Ignition GND
left	Ignition line 1

Connector Fuel Tank Sensor:

blue	GND
pink	+5V
yellow	Fuel signal

Connections Buzzer:

black	GND
red	+12V

Connections RPM Sensor:

blue	GND
brown	+12V
black	RPM signal

2.4.4 Electric and radio equipment

The sailplane electric system is shown in fig. 2-15; 2-15a. The sailplane may be equipped with other instruments (GPS or board computer) and an existing scheme enables to connect them easy. Electric wiring runs on a left side of the fuselage.

Accumulator batteries of two types are used in sailplane. One of them consisting of three accumulators NP 2.1-12 is fitted in a special container. The container is located in the fin (fig.2-3). Another two batteries NP 7-12 are located in the baggage compartment (fig.2-15b).

The accumulators NP 2.1-12 and NP 7-12 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 in fig 2-20.

Warning: for the glider with power-plant installed, fin battery has to be removed. Only the baggage compartment batteries can be installed.

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

Note: if pilot weight is 100...110 kg (220,5...242 lbs), it is possible to remove one baggage compartment battery and replace it by installing battery in the fin. This moves c.g. of the glider back by 32...34 mm. Re-weighing or re-calculation of the c.g. position is mandatory in this case.

2.4.5 Canopy ventilation system

The canopy ventilation system (fig. 2-16) 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 (pos. 2) 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

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/16 Total pages 76
---------	--------------------	--------------	-----------------------------

air is valve-controlled, the valve (pos. 3) is located in the ventilation opening. The valve is handle-controlled, the handle (pos. 4) 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 in fig. 2-18a, fig. 2-18b and 2-18c.

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.2-18a, pos.4) must be in the working position in flight.

2.4.7 Cockpit equipment

The cockpit equipment is:

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

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.

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/17 Total pages 76
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2.5 Power plant

2.5.1 General layout

General layout of the power-plant system can be found at Fig.2-17. Detailed description of the power-plant systems can be found below. LAK-19T power-plant installation is the same as it is in LAK-17AT. For this reason most of the power-plant parts has identification the same as for LAK-17AT.

2.5.2 Power-plant extension/retraction system

Power-plant extension/retraction system is shown at a Fig.2-22. Engine retracts in to the power-plant bay in the fuselage and is attached to the engine frame box p.12. Engine p.1 is mounted on the engine frame p.3 which pivots on a mounts p.4 and is actuated by electrical spindle mechanism p.8 throughout the system of push-rods p.7 and shaft p.5. To assist electrical mechanism, gas spring p.9 is installed in a retraction system. To support engine from moving forward, support cable p.11 is installed.

2.5.3 Fuel system

Fuel system is shown at the Fig.2-23. It consists of the fuel tank p.1 located in a central part of the fuselage. Fuel tank has 7.5 ltr capacity. Fuel level sensor p.7 installed in it. Fuel is filled through the fast connection p.9 located on a right side of the power-plant box. Fuel tank breather p.12 is provided. Breather exits in to the main wheel well. Fuel drain p.6 also exits in to the main wheel well and can be reached when landing gear is extended.

Engine fuel feeding line consists of: fuel strainer p.5 located in a fuel tank; fuel shut-off valve p.4 located on a right hand side of the fuselage shell in a power-plant box and is controlled from the cockpit by the handle p.8; fuel filter p.10; electrical fuel pump p.2, vacuum fuel pump p.3 located on the engine. Fuel strainer p.5 can be removed for cleaning unscrewing it from a fuel tank.

To fill the fuel, special filling system with electrical fuel pump is provided.

2.5.4 Propeller brake

Propeller brake scheme is provided in a Fig.2-24. The brake is mounted on a engine frame p.1. The brake is actuated by the cable p.3 with the handle p.9 located on a right side of the cockpit wall. Brake handle and it's functions are identified with the placard. Brake is fixed in "on" and "off" position by locking handle in the guiding palate p.8. On an engine frame, next to the propeller brake limit switch is located which is pressed "on" when propeller brake is on and free when propeller brake is off. This limit switch gives signal to the MCU which is controlling power-plant extension/retraction process.

2.5.5 Controls of cylinders de-compressing valves

Cylinders de-compressing valves controls are shown at a Fig.2-25. De-compressors are controlled by the handle p.1 located forward of control stick. The handle and it's functions are identified with the placard. Actuating cable p.4 runs in a bowden p.6 up to the engine and actuates arm p.3 which presses on a plate p.8 which consequently presses and opens the de-compression valves. Pull on a handle p.1 to "open" and release to "close".

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/18 Total pages 76
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2.5.6 Power-plant bay door

Power-plant bay door and their actuating system is shown at a Fig.2-26a; 2-26b; 2-26c. Door consist of two main doors and two small forward doors. Door is actuated by the electrical spindle mechanism p.19 which is controlled by MCU. Spindle mechanism has internal limit switches which should be adjusted so that spindle mechanism is switched off when door is closed or open. Electric spindle mechanism actuates system of pushrods and levers which open and closes the door.

The push-rods p.2 has springs inside for allowing some tensioning in a system and so guarantying proper closing of the door with pretension.

2.5.7 Engine support cable

Construction of engine support cable is given at Fig.2-27. One end of the engine support cable p.3 is attached to the engine. The other end in extended position is bottoming at the cable guiding sleeve p.1. When engine is retracted cable is pulled in to the fuselage by rubber bungce p.8 which is pretension and guided by the guide p.2. Guide is hang on a mount p.4 at the rear and fixed with the bolt p.7.

2.6 Placards and marking of controls

Each cockpit control (with exception of the primary flight controls) is marked (fig. 2-19a, 2-19b, 2-19c, 2-19d, 2-19e, 2-19f) according to their purpose and operation mode.

A tables of limitations are shown in fig. 2-19c, 2-19d, 2-19e, 2-19f.

Layout of placards inside the sailplane is shown in fig. 2-19a.

2.7 Data for rigging

2.7.1 Allowed clearances in connections of aggregates

Allowed clearances for connections of wing and fuselage, wing and wing tip, wing spars are given in fig. 2-20a, fig. 2-20b, fig. 2-20c, fig. 2-20d.

Max allowed gaps in connections of aggregates between openings and diameters of pins are given in 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 and ailerons shall be fixed in neutral position.

Clearances for ailerons 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 handle shall be fixed in neutral position.

Allowed motions are shown in table 2-3.

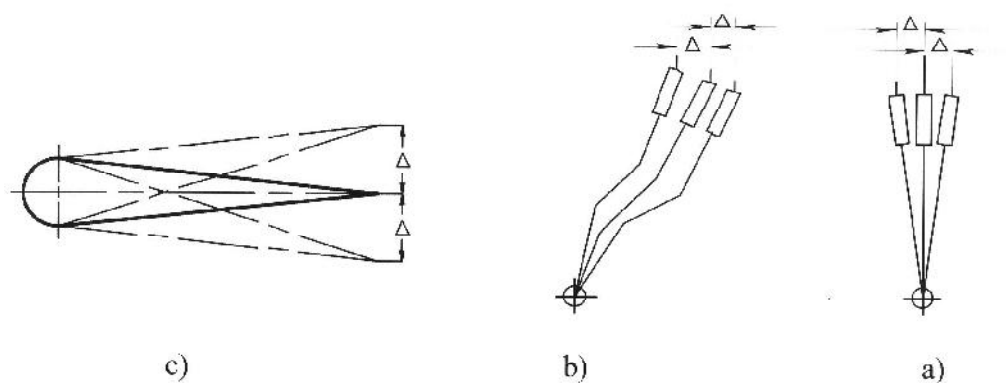


Fig. 2-1. Free play setting

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 elevator	2.0
6	Edge of right elevator	2.0
7	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.

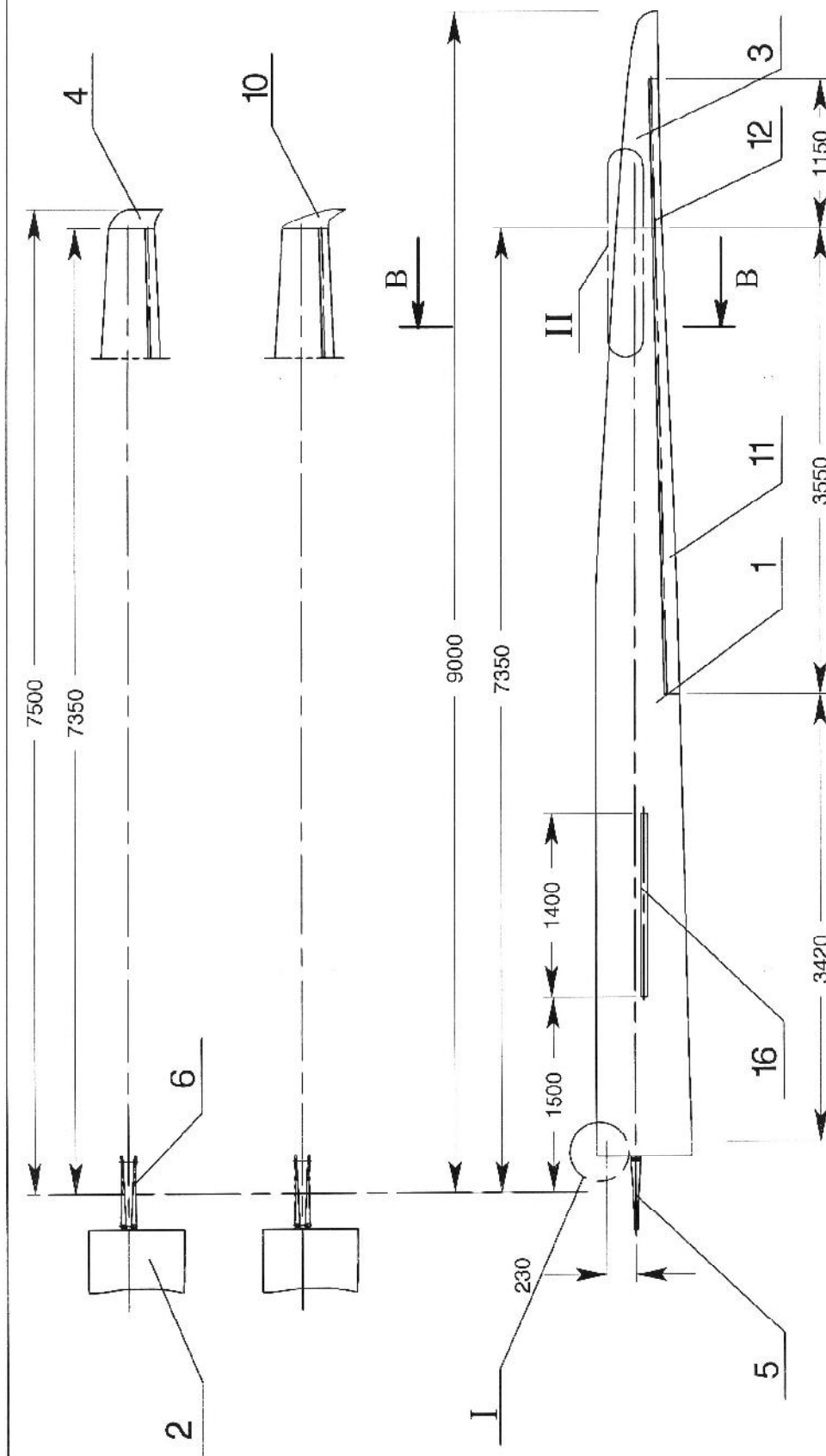
Note: Force of an elevator control system is measured with trimmer control handle in neutral position.

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
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

LAK-19T	MAINTENANCE MANUAL	Section 2	Page 2/22 Total pages 76
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2.8 Illustrations



- | | | |
|------------------------------|-------------------------|--------------------|
| 1. Right wing | 7. Spar of wing tip | 13. Fixator |
| 2. Left wing | 8. Wing skin upper | 14. Lateral pin |
| 3. Right wing tip L = 1650mm | 9. Wing skin lower | 15. Adjustable hub |
| 4. Right wing tip L = 150mm | 10. Winglet | 16. Air brake |
| 5. Right wing spar | 11. Aileron | |
| 6. Left wing spar | 12. Aileron of wing tip | |

Fig.2 - 1a. Wing

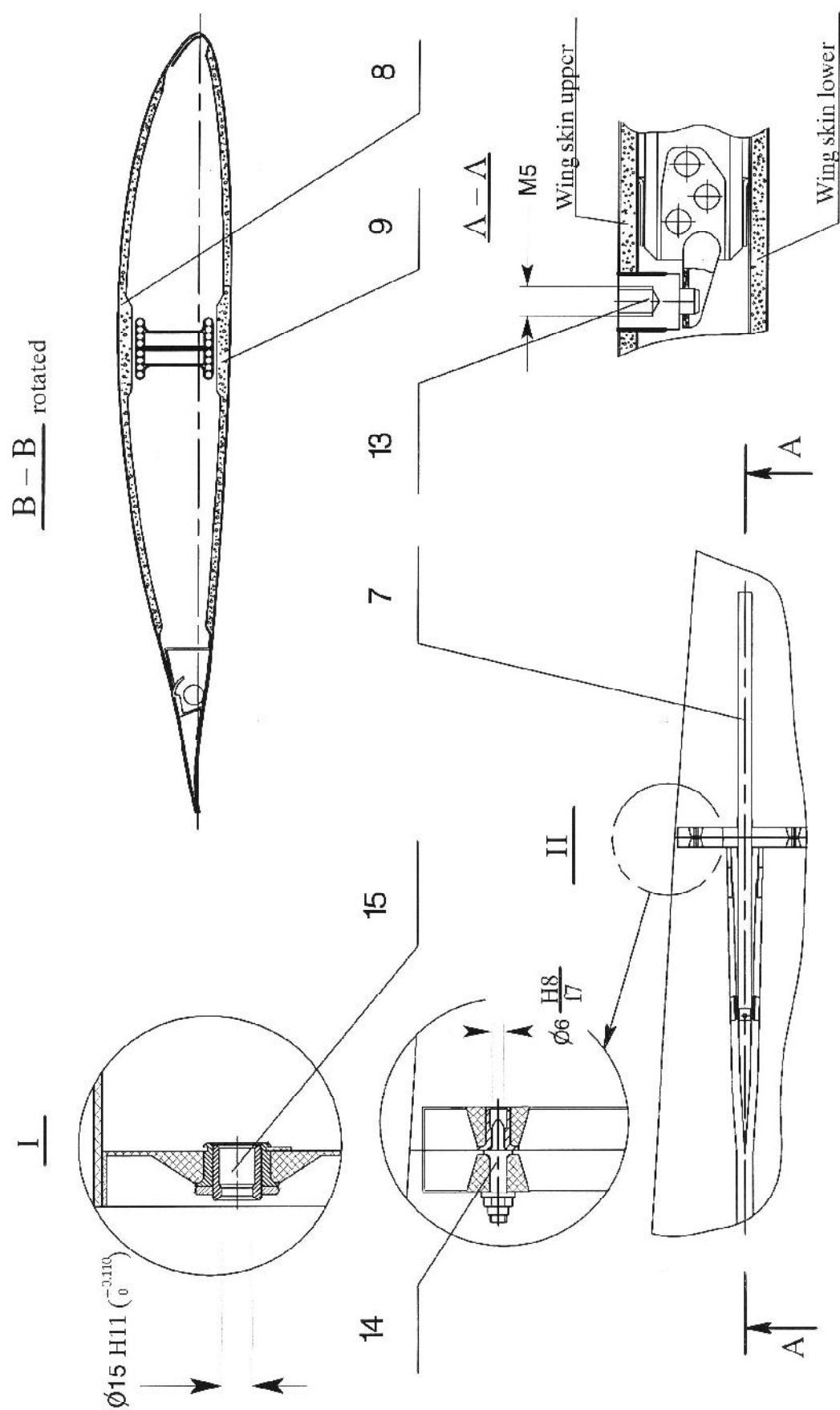
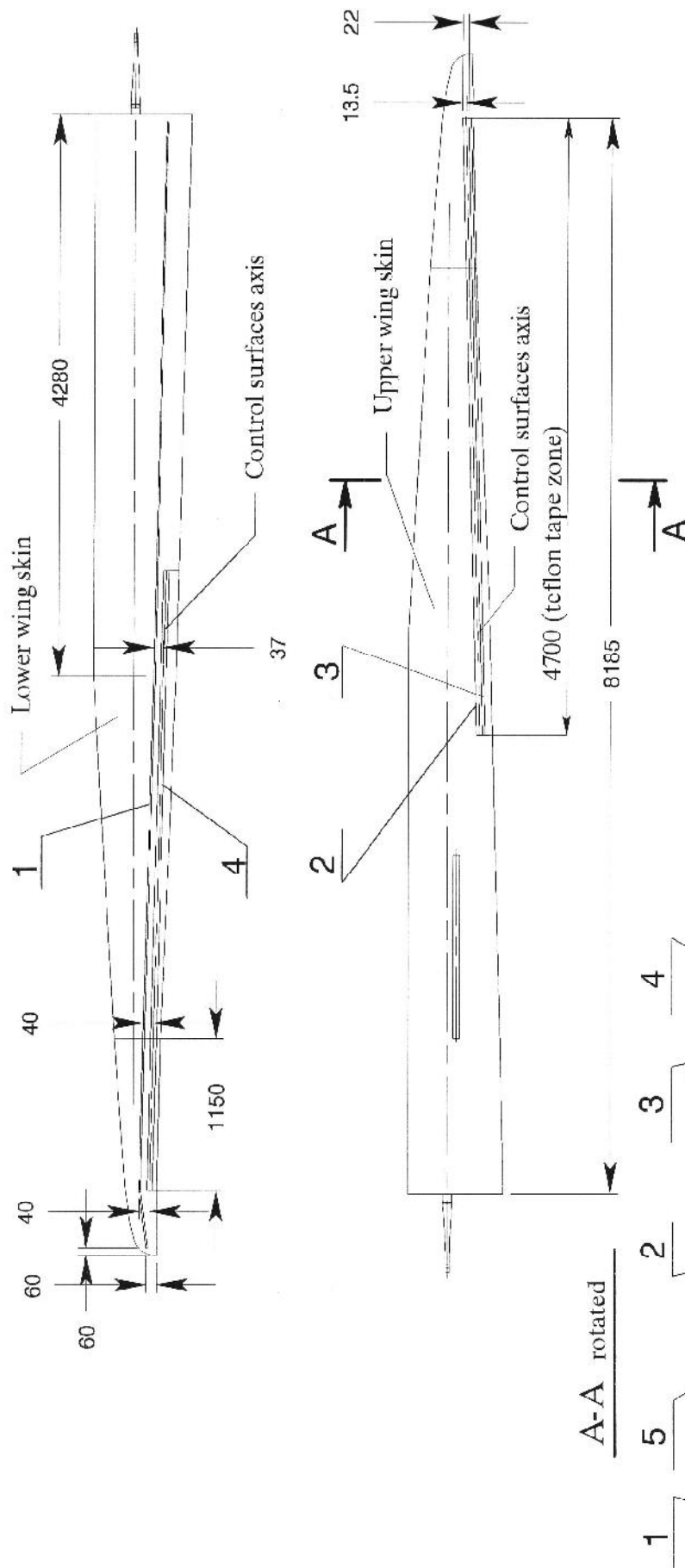


Fig.2 - 1b. Wing



1. 3-D-Turbulator tape 6/0.5/60° (total length = 17.2 m)
2. Pre-bent-mylar seals adhesive tape 22/12 (total length = 16.3 m)
3. Teflon tape 30, adhesive (total length = 9.4 m)
4. Tape PVC-25 mm width (total length = 16.3 m)
5. Tape PVC-15 mm width (total length = 16.3 m)

Fig.2-1c. Wing

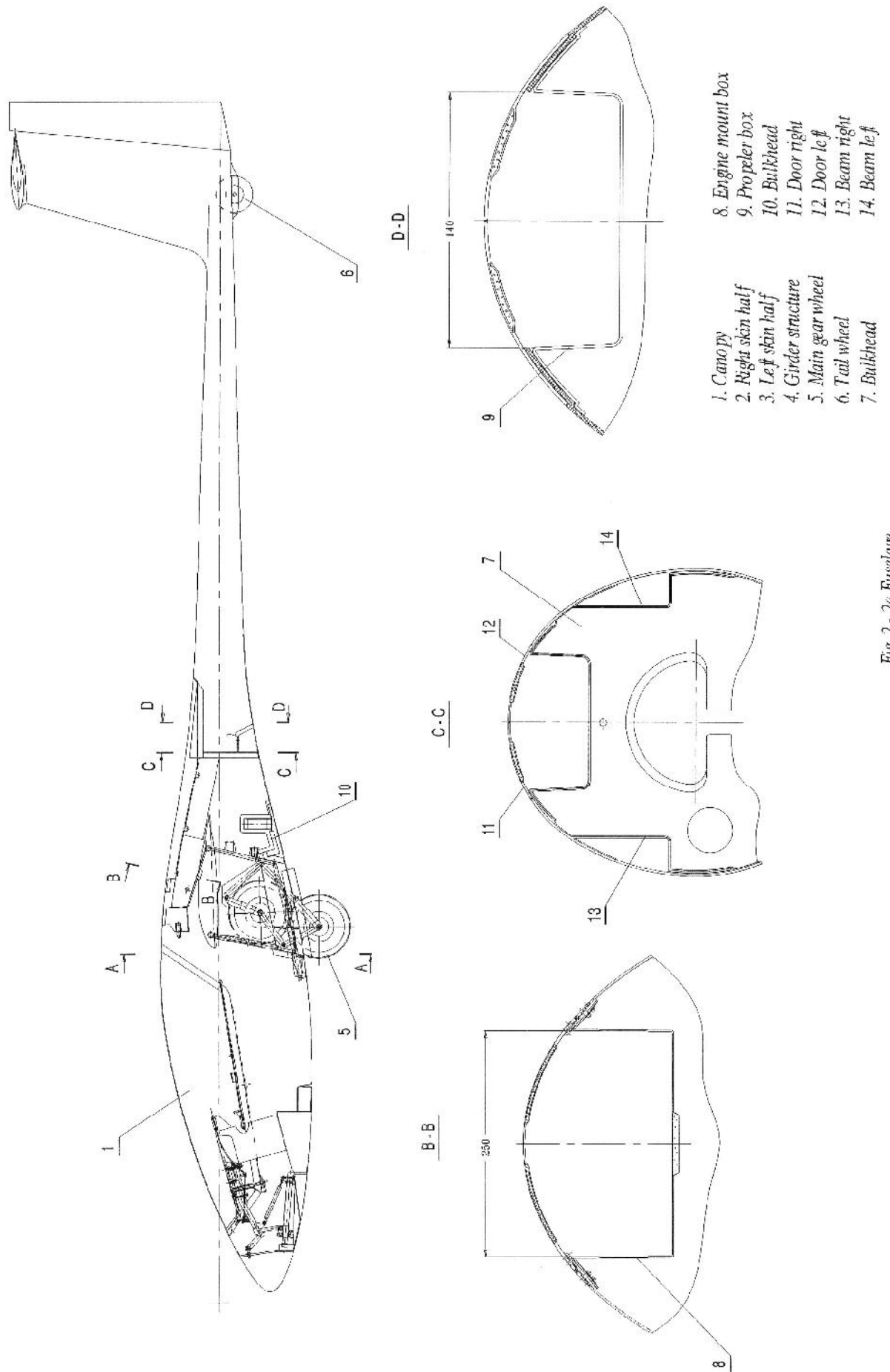
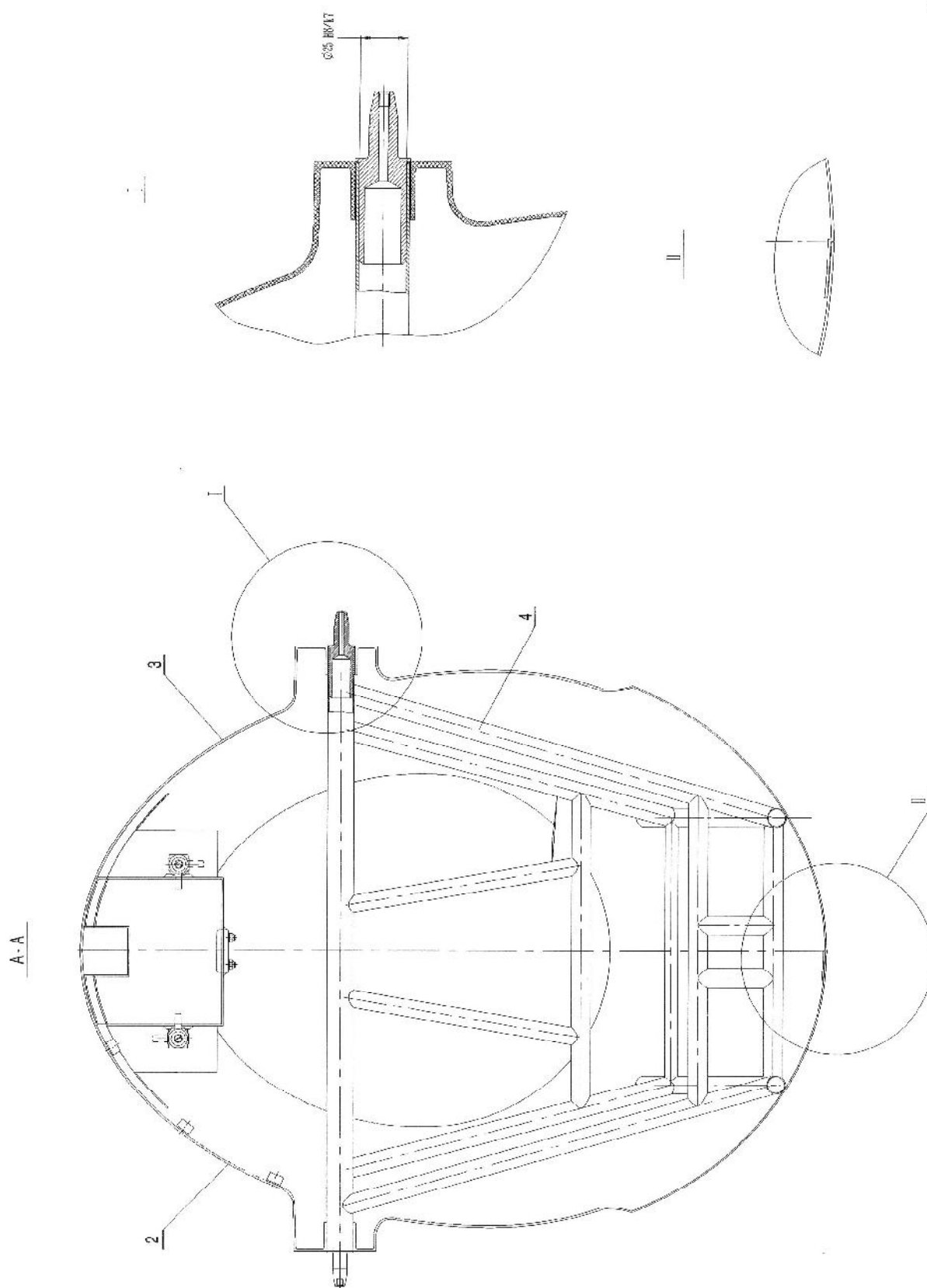
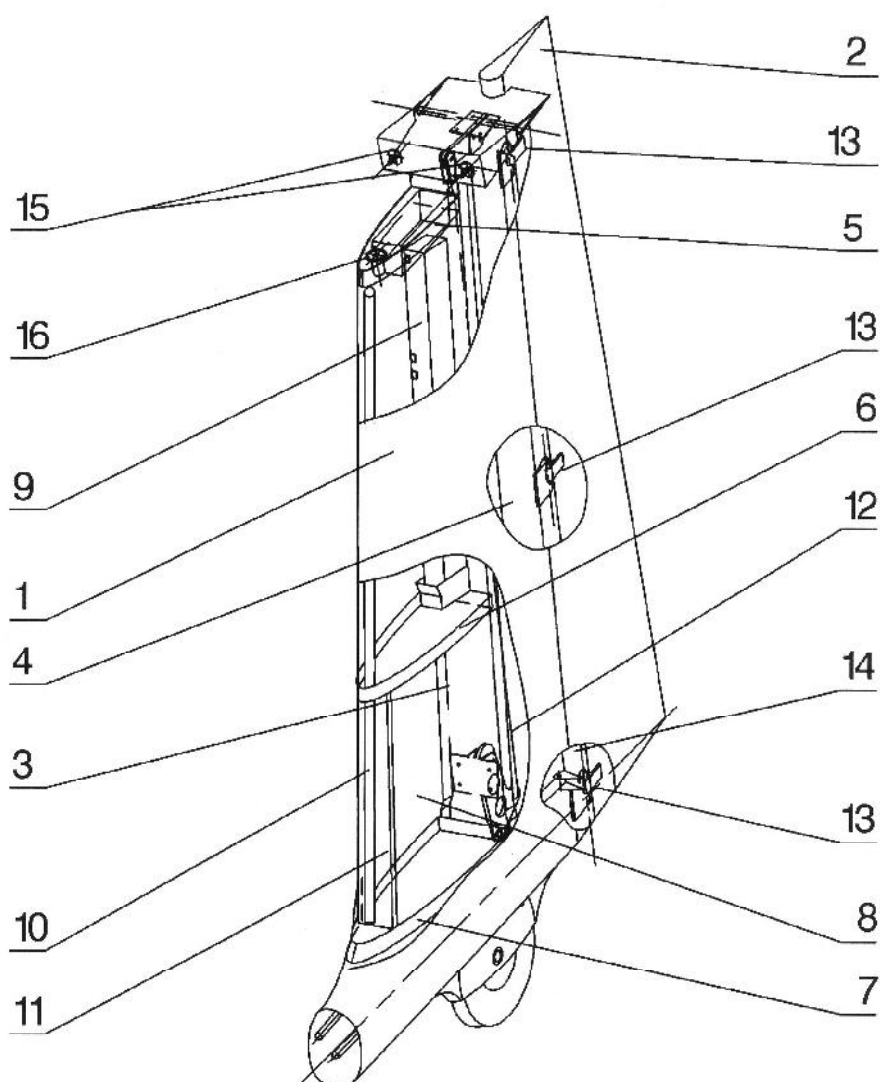


Fig 2 - 2a Fuselage





- | | |
|-----------------------|-----------------------------------|
| 1. Fin | 10. Radio aerial |
| 2. Rudder | 11. Wall |
| 3. Spar of fin | 12. Elevators control rod |
| 4. Rear wall | 13. Rudder hinges |
| 5. Upper rib | 14. Rudder wall |
| 6. Middle rib | 15. Connection pins of stabilizer |
| 7. Lower rib | 16. Stabilizer fixing hub |
| 8. Water ballast tank | |
| 9. Battery container | |

Fig.2 - 3. Vertical plane

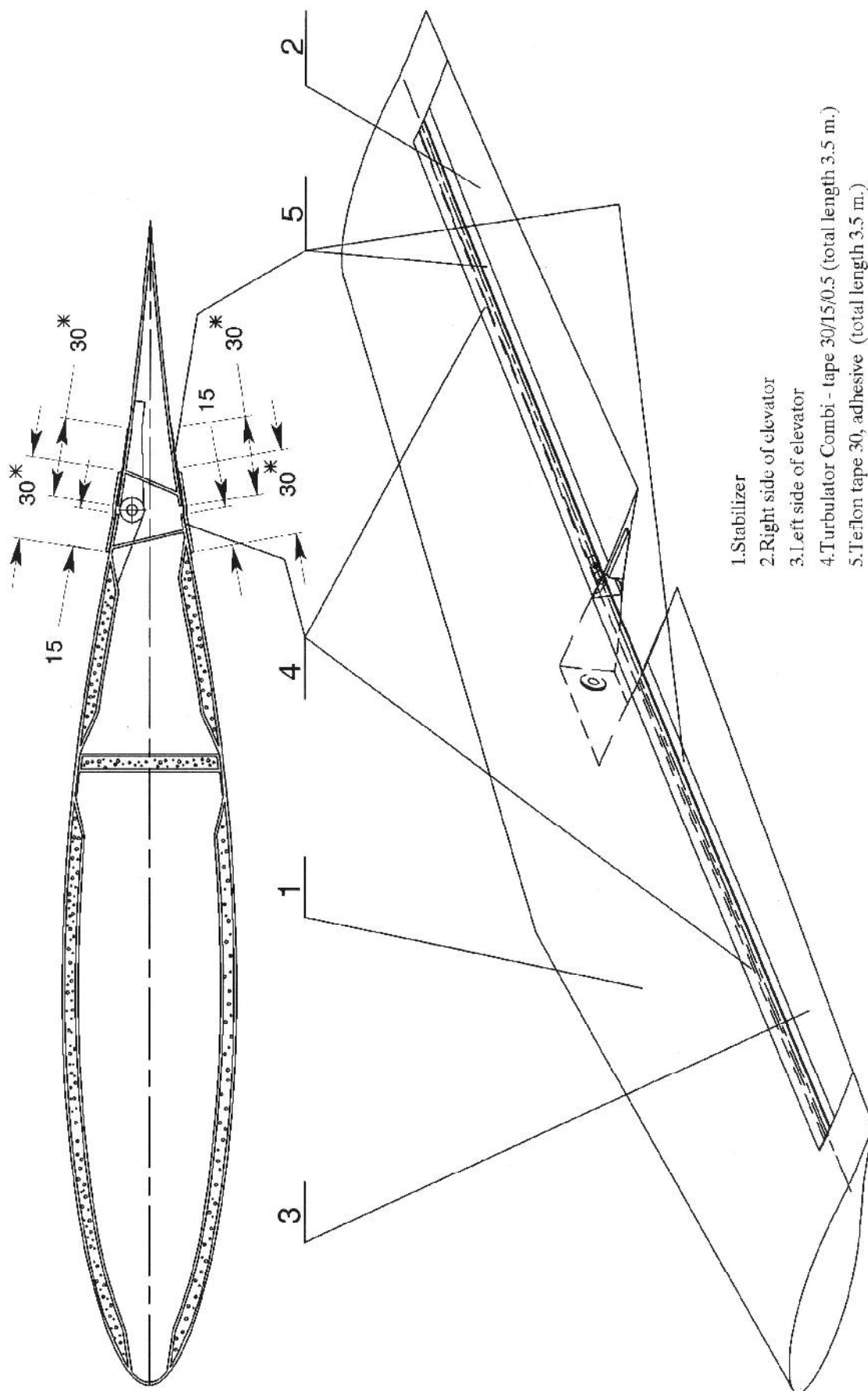


Fig.2-4. Horizontal plane

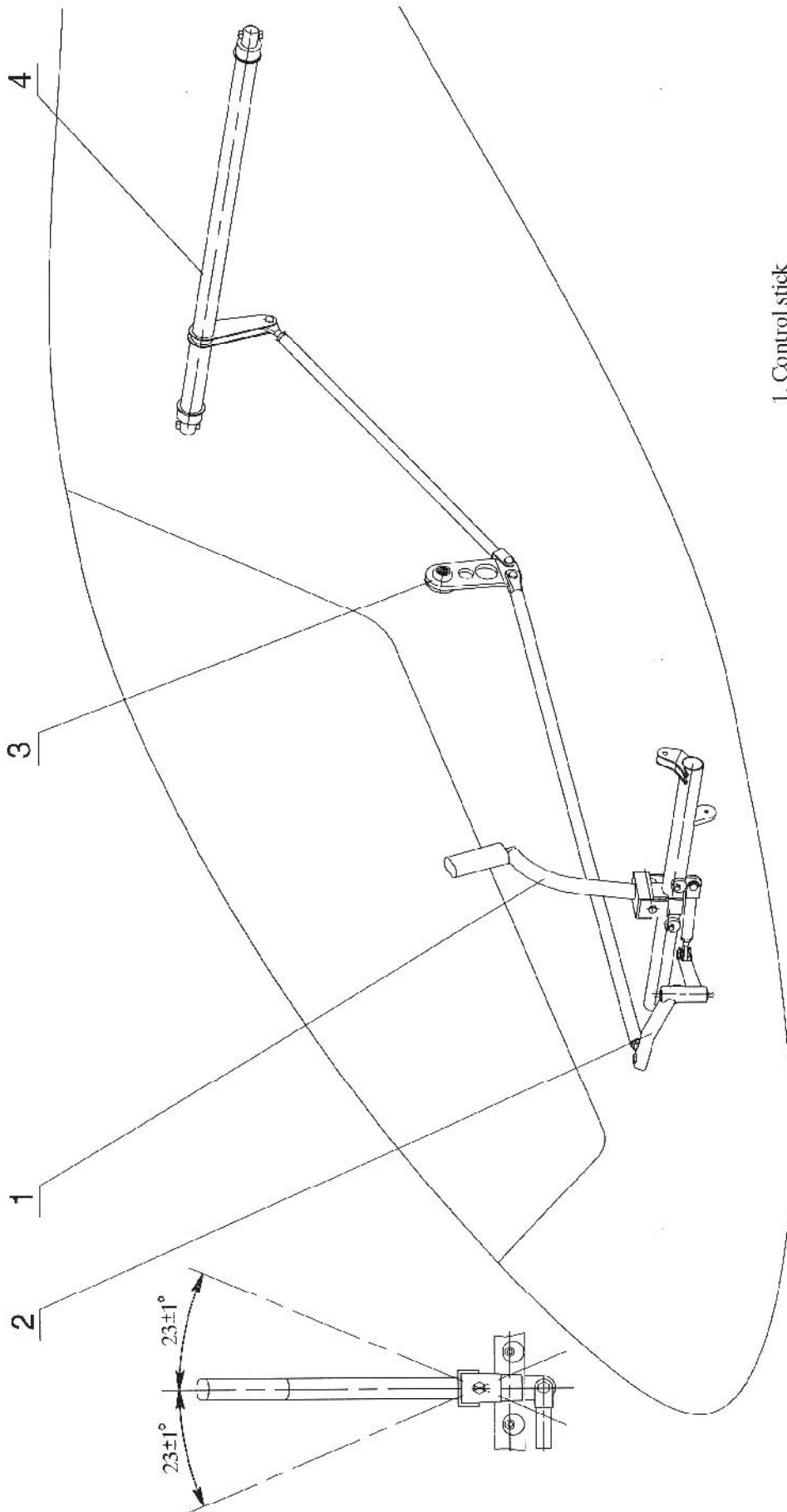


Fig.2 - 5a. Control system of ailerons

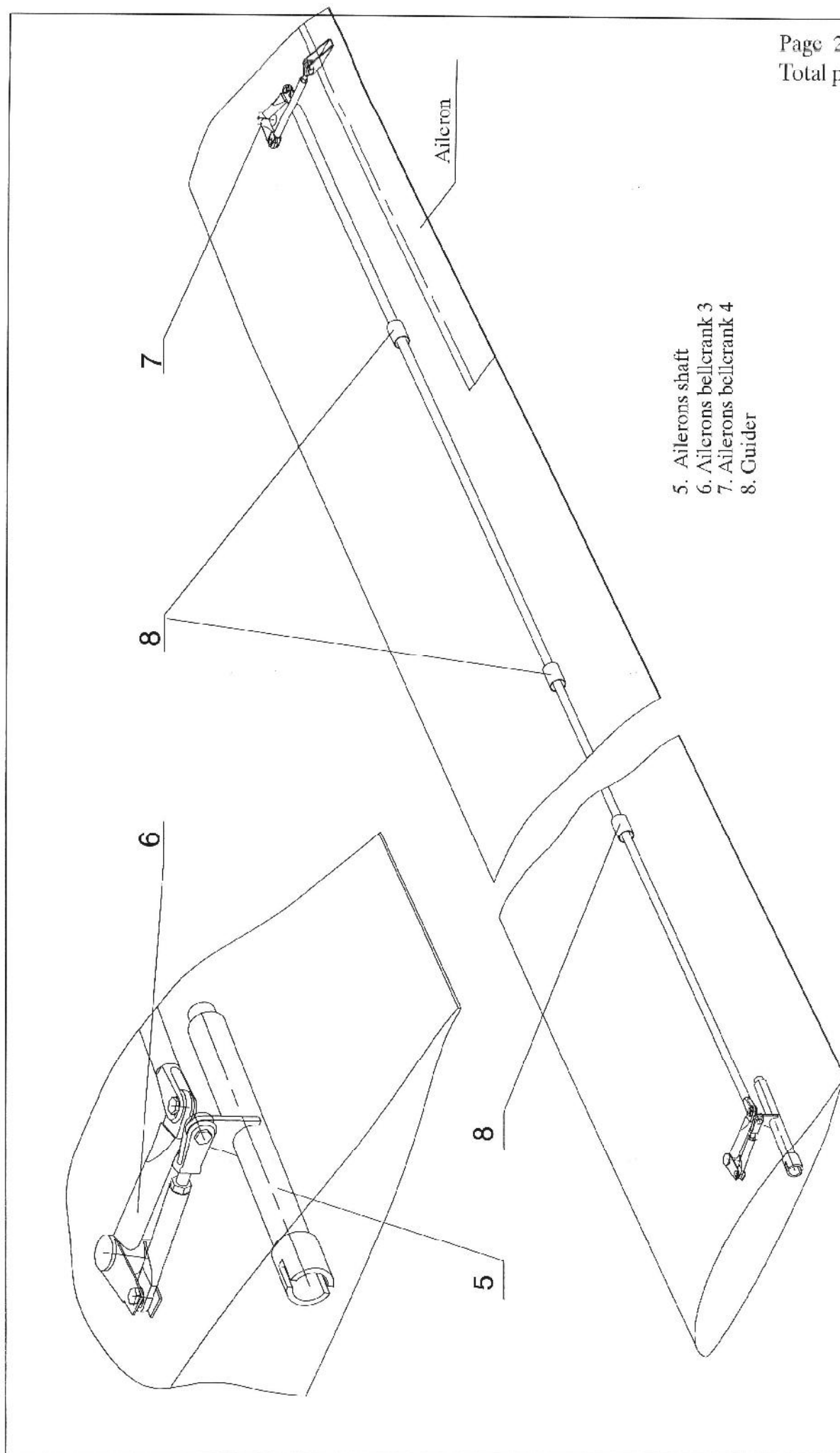
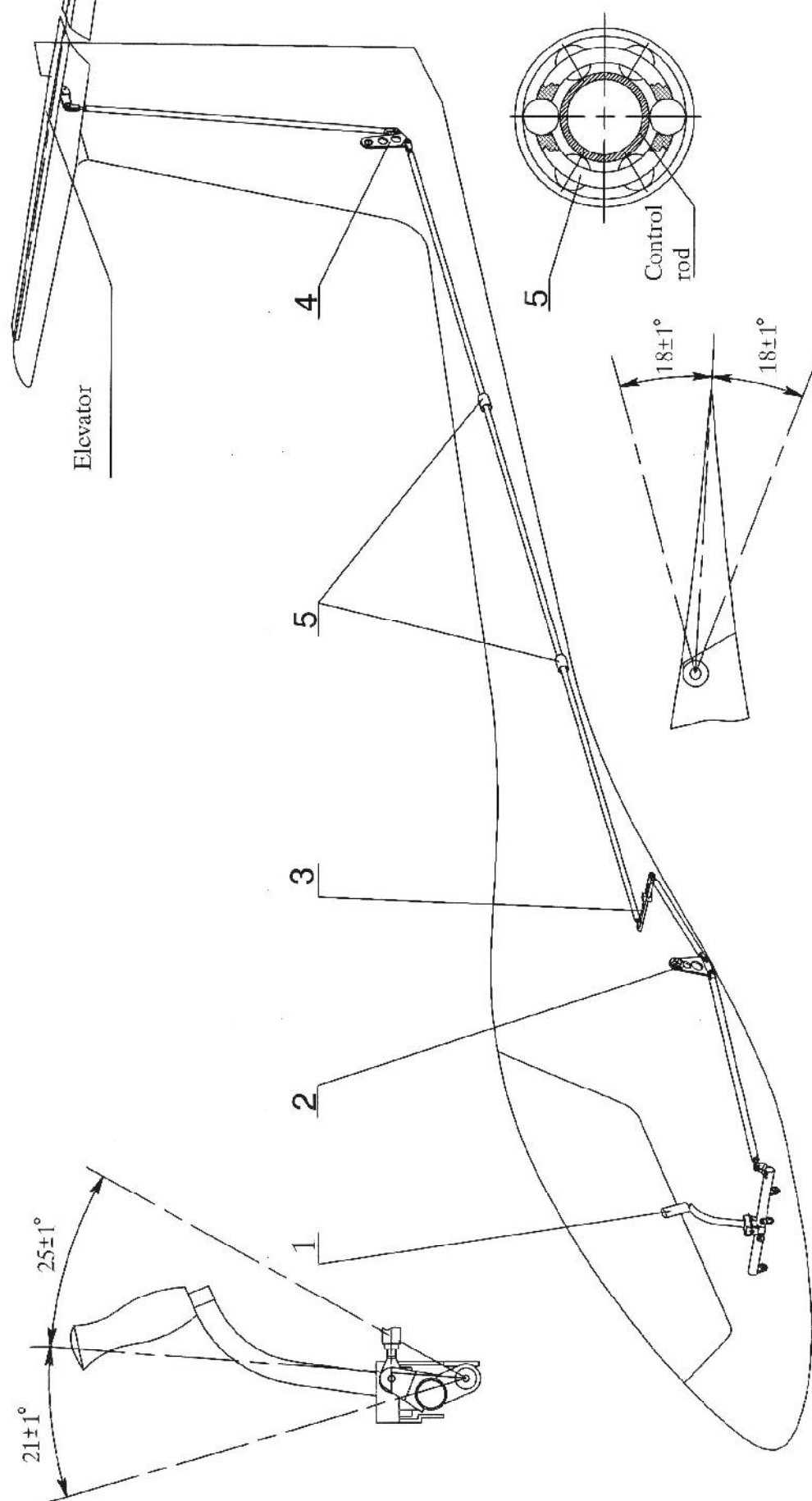


Fig.2 - 5b. Control system of ailerons



1. Control stick
2. Bellcrank 1
3. Bellcrank 2
4. Bellcrank 3
5. Guide

Fig.2 - 6. Elevator control

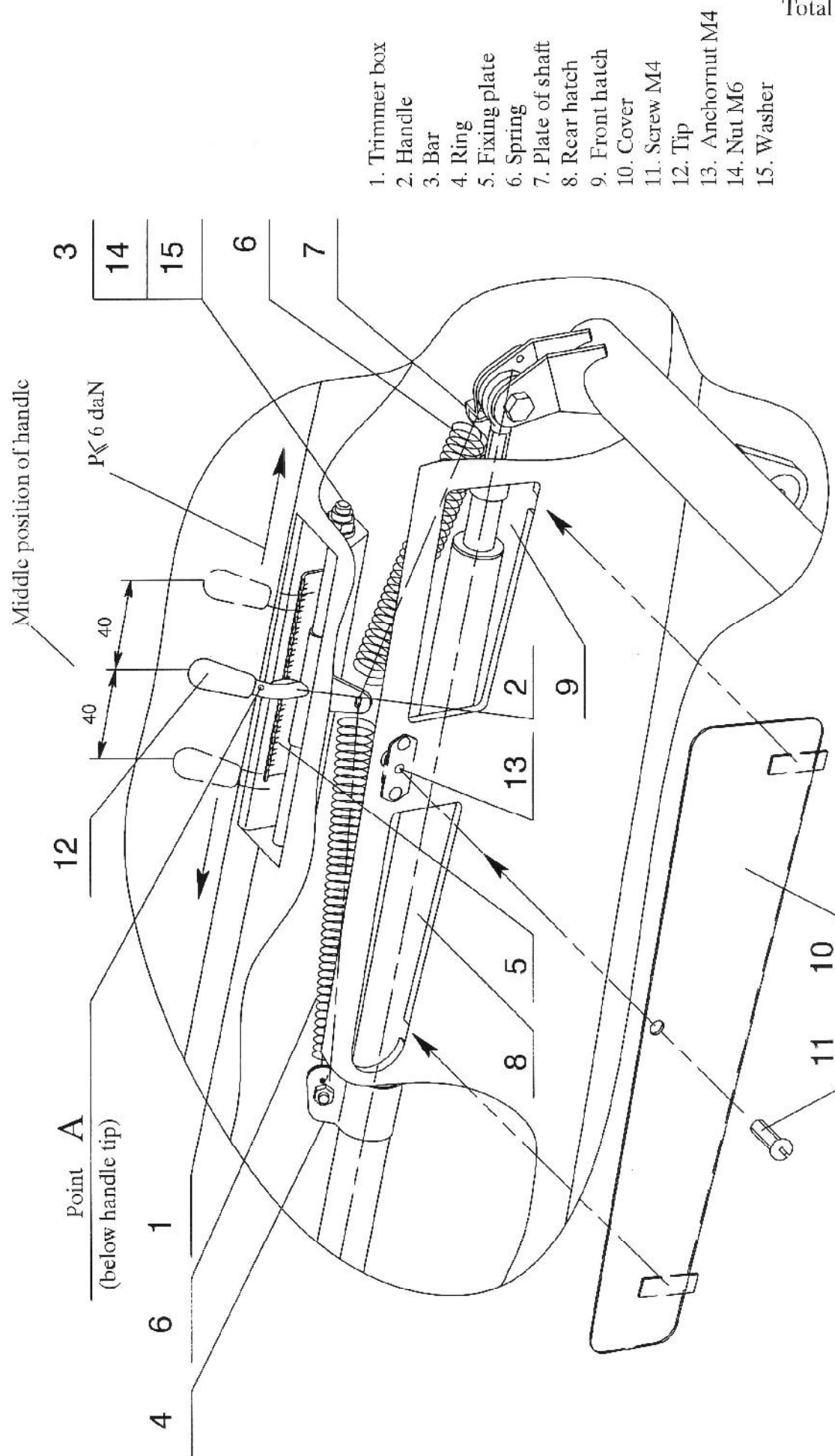


Fig2 -7. Trimmer control

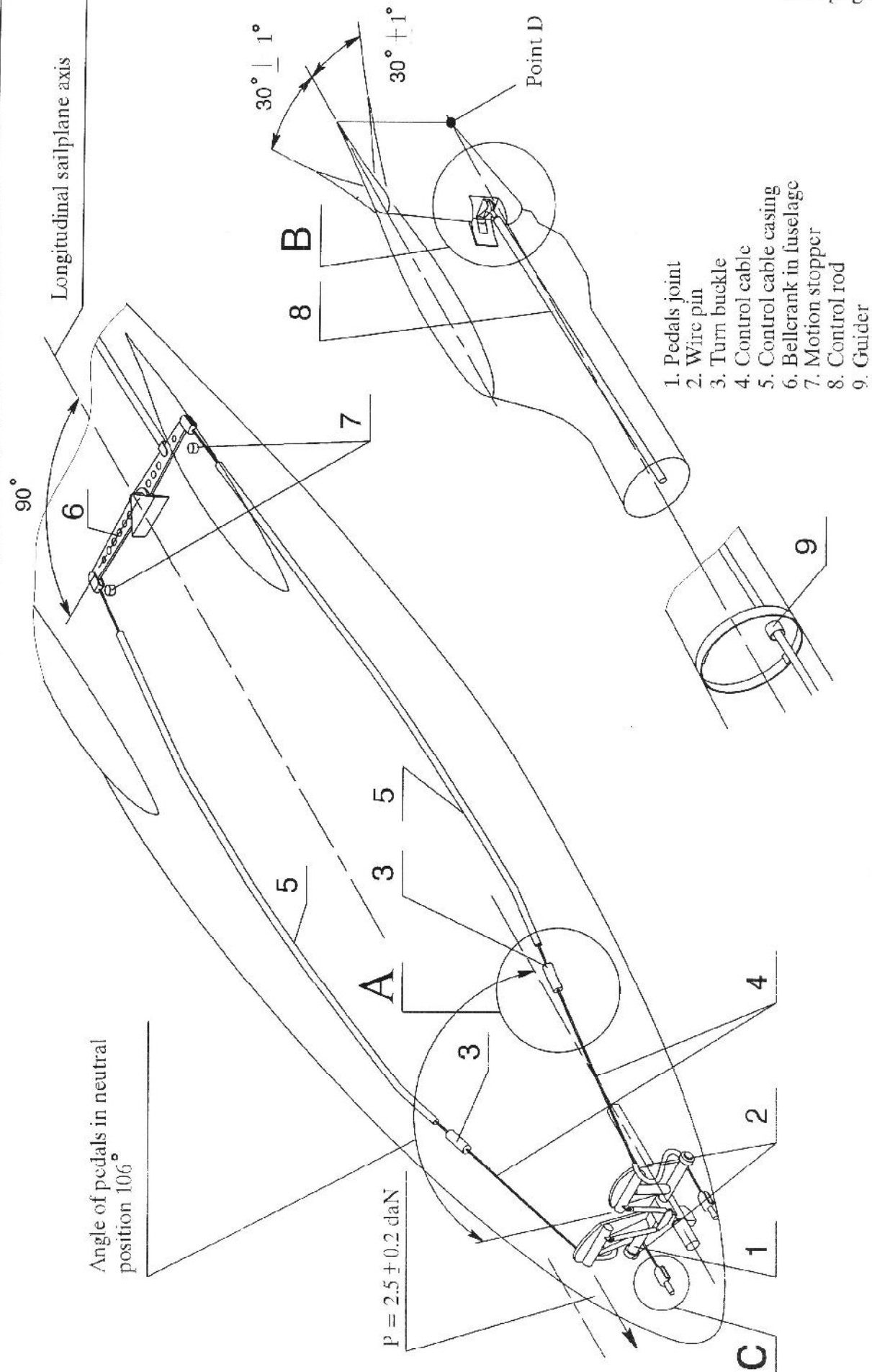


Fig.2 - 8a. Rudder control

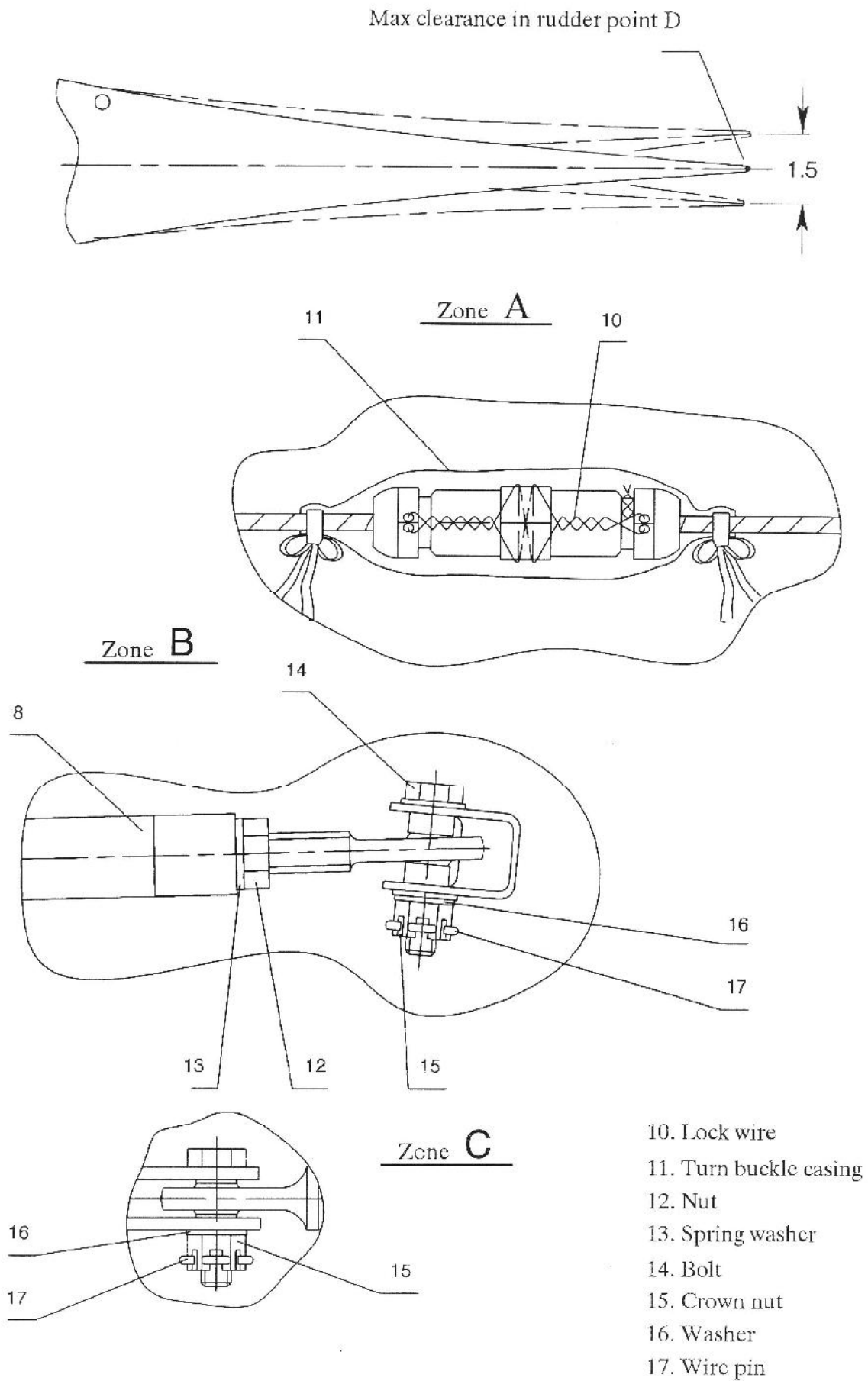


Fig.2 - 8b. Rudder control

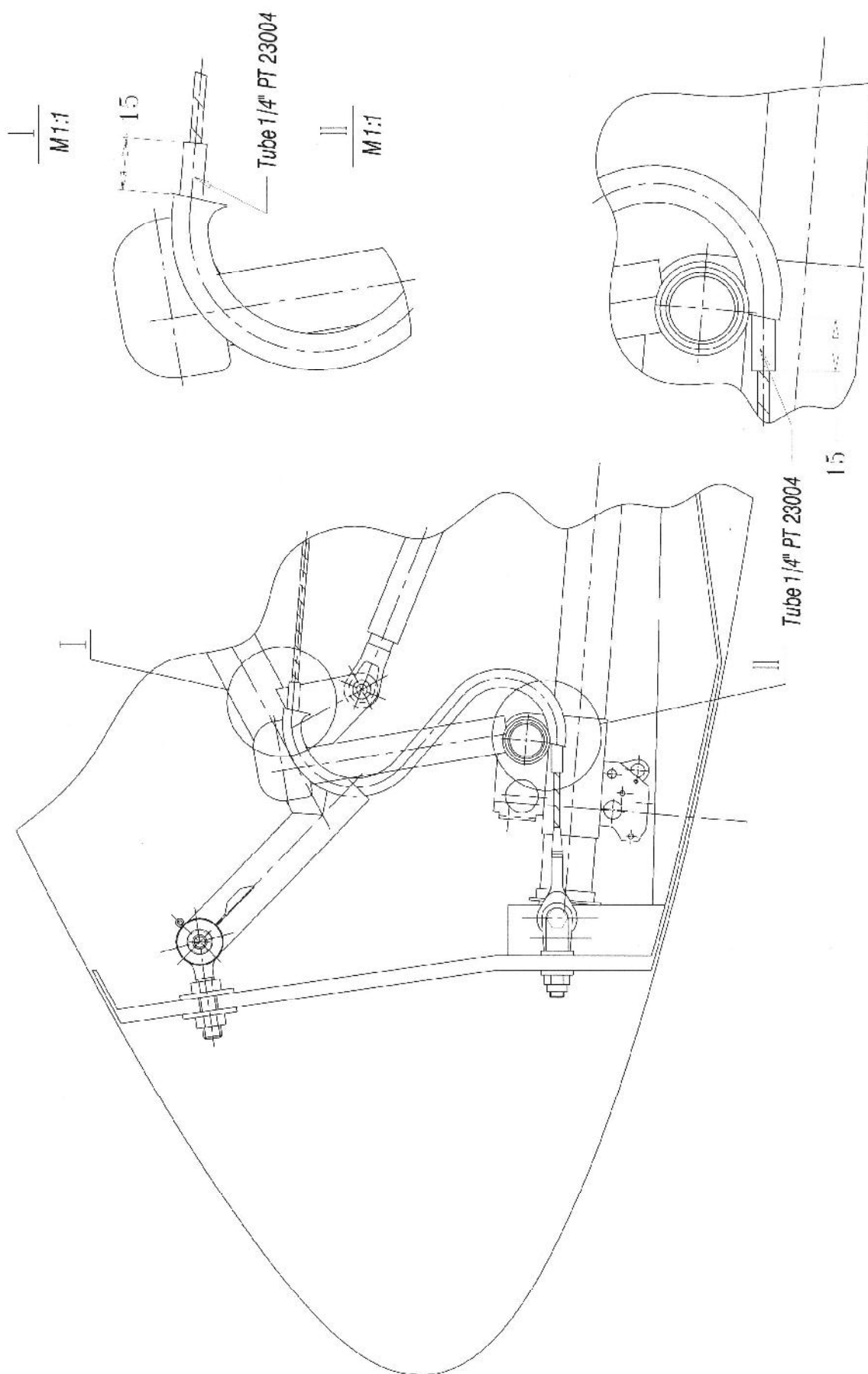


Fig 2-8c. Rudder control.

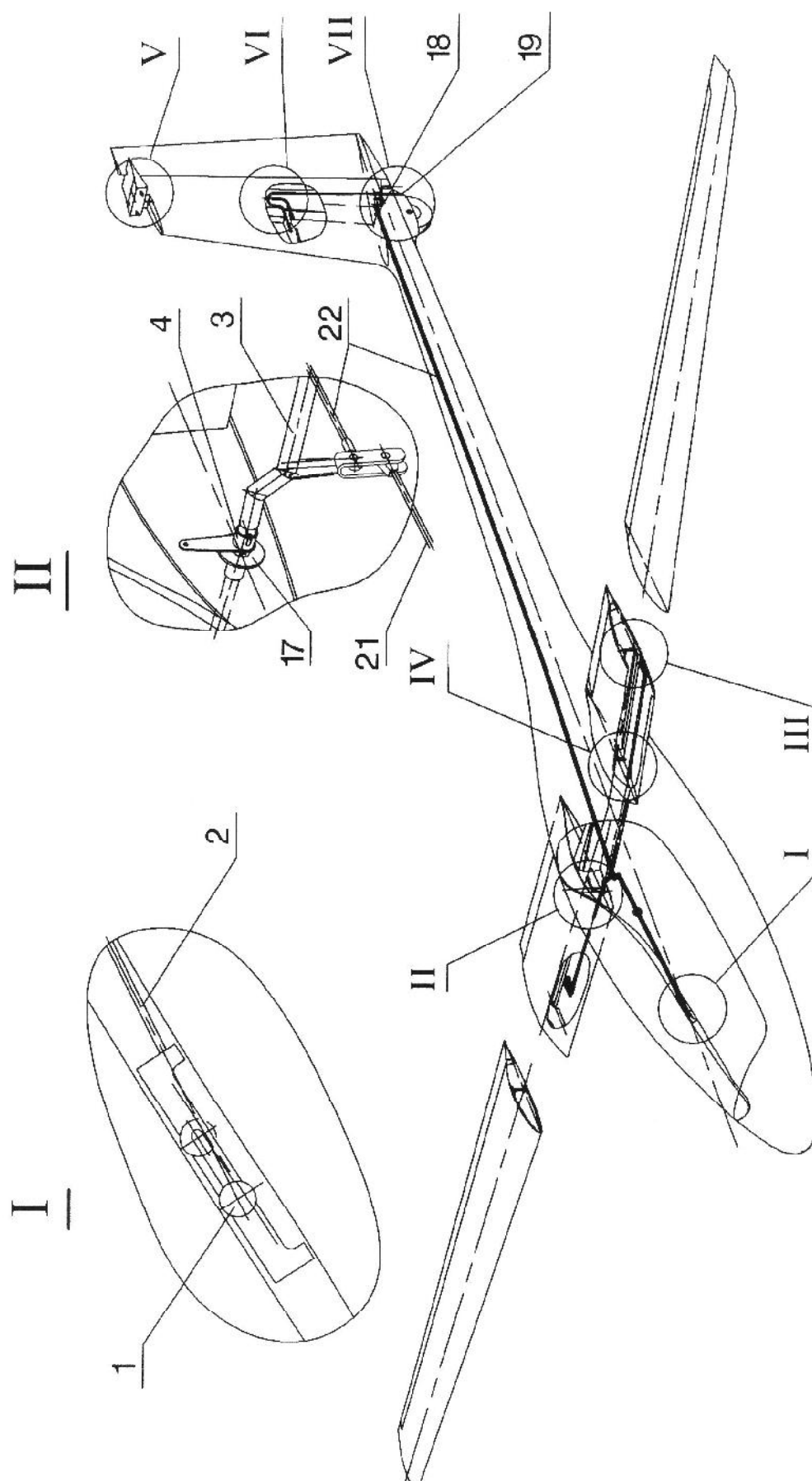


Fig.2 - 9a. Water ballast control system

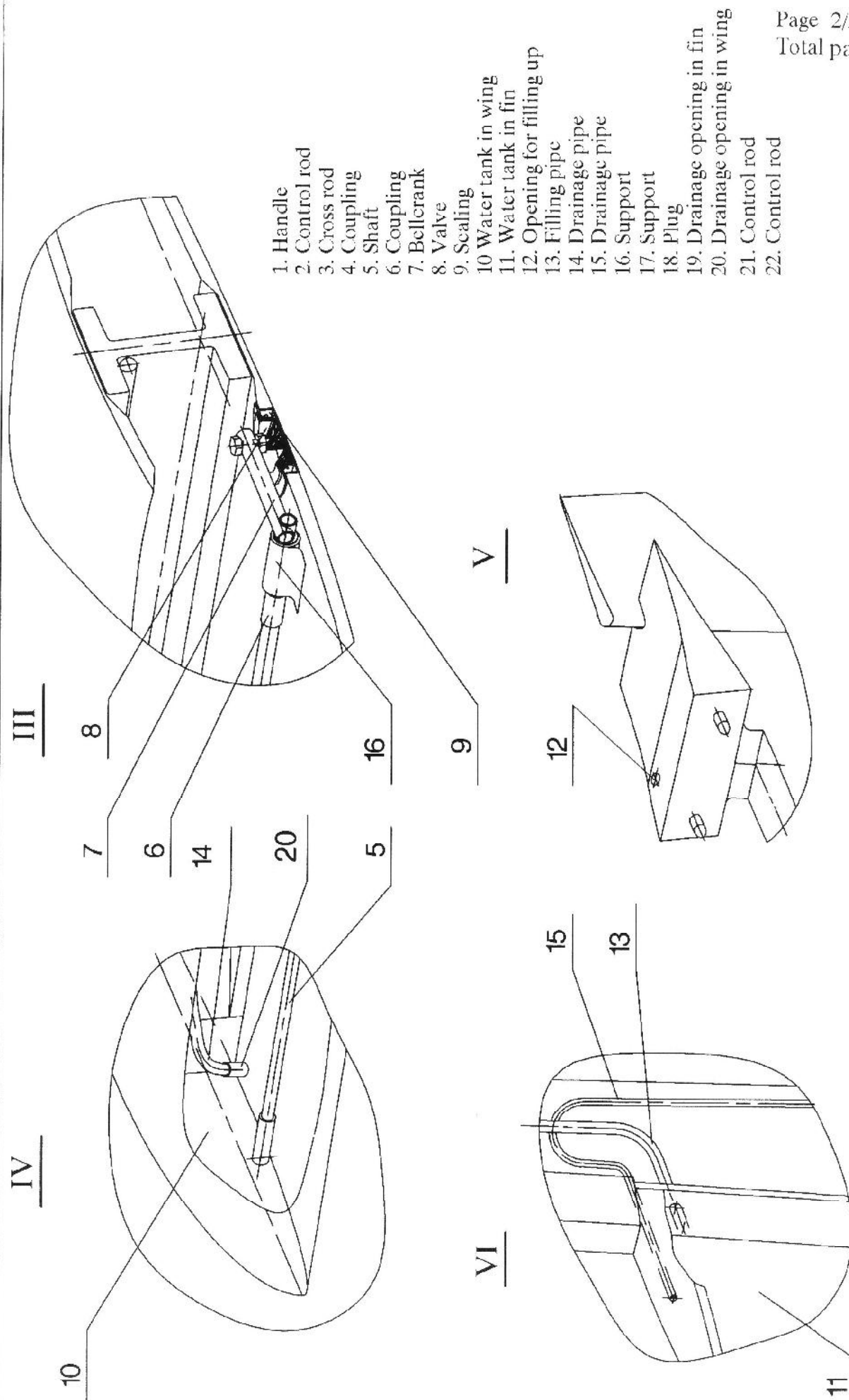
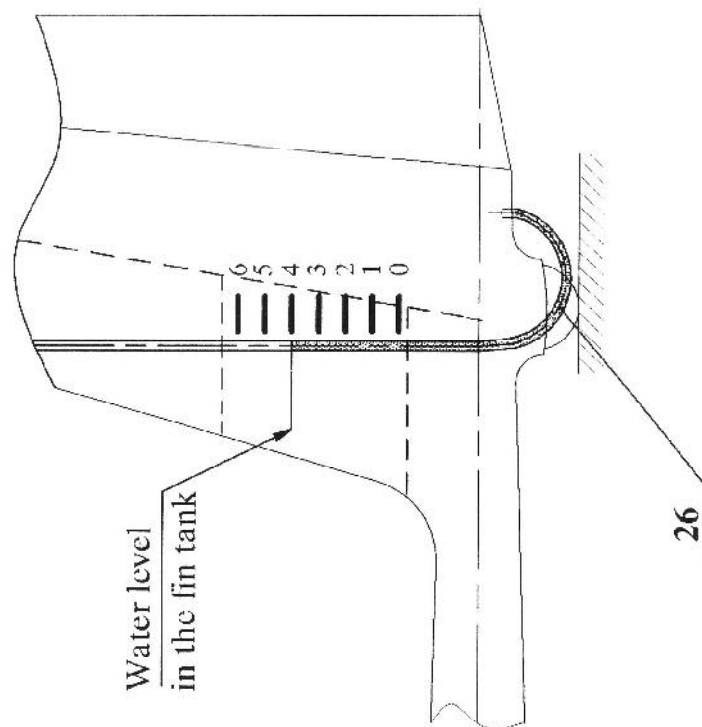
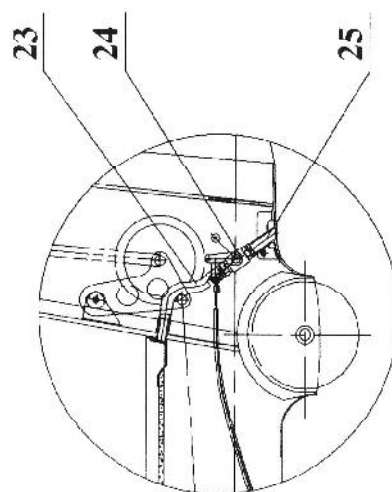


Fig.2 - 9b. Water ballast control system



VII



- 23. Pouring pipe
- 24. Valve
- 25. Support
- 26. Water level indicator

Fig.2 - 9c. Water ballast control system

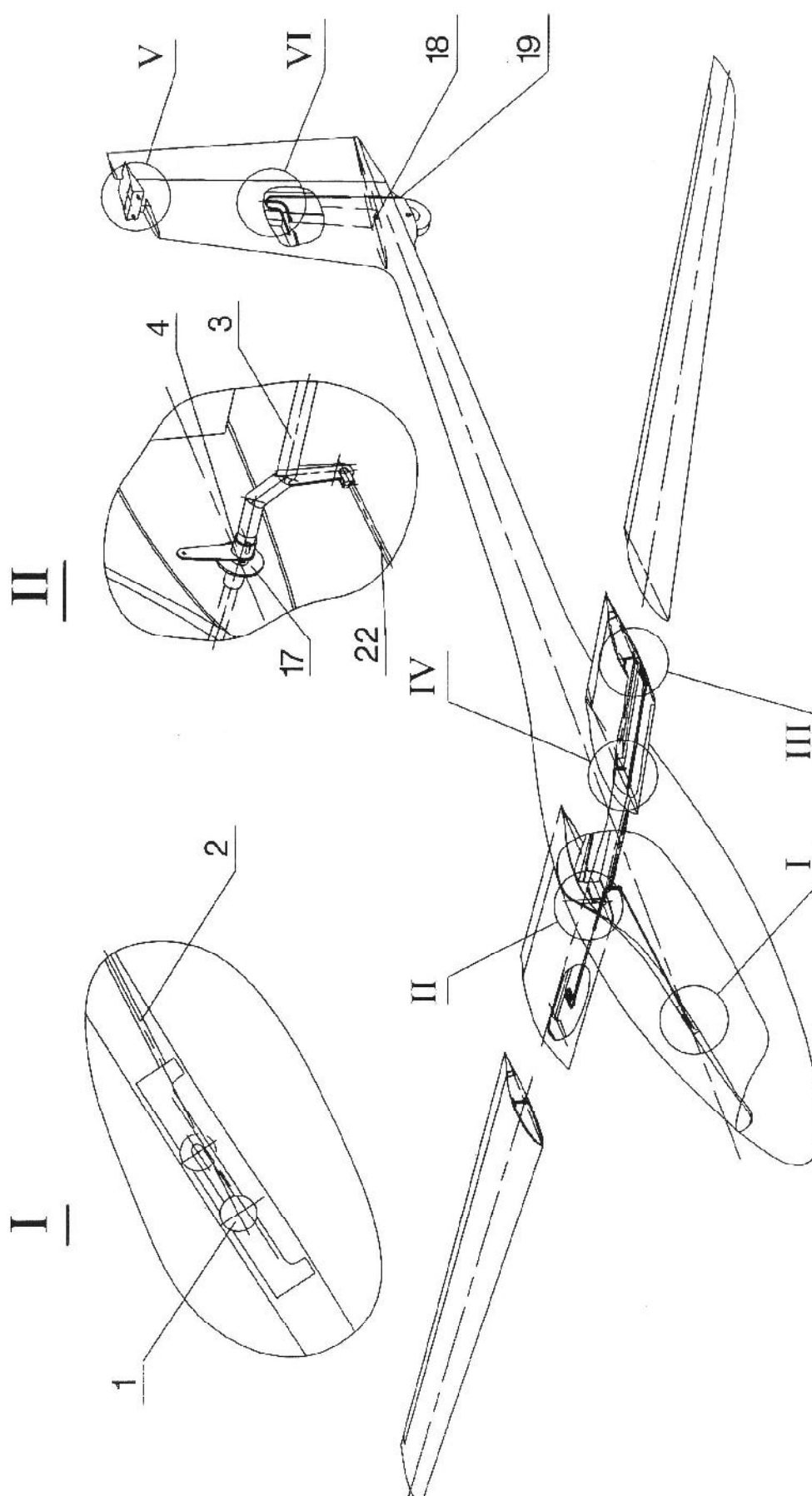


Fig.2 - 9d. Water ballast control system (option - wing tanks)

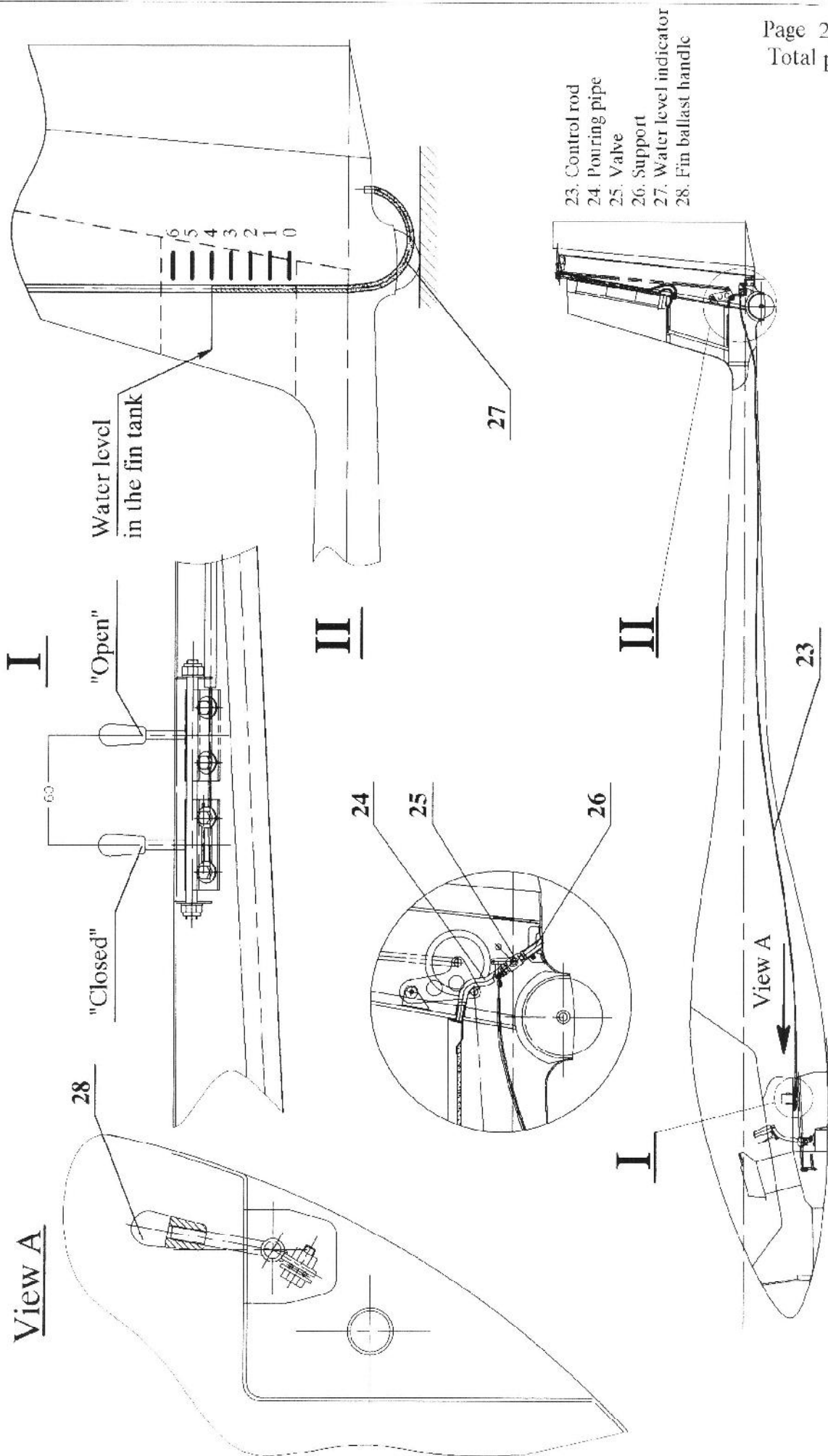
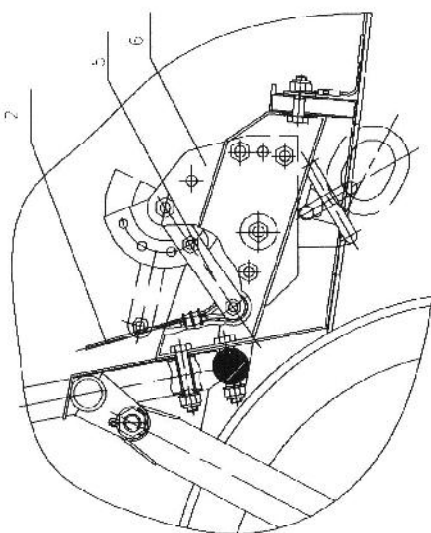
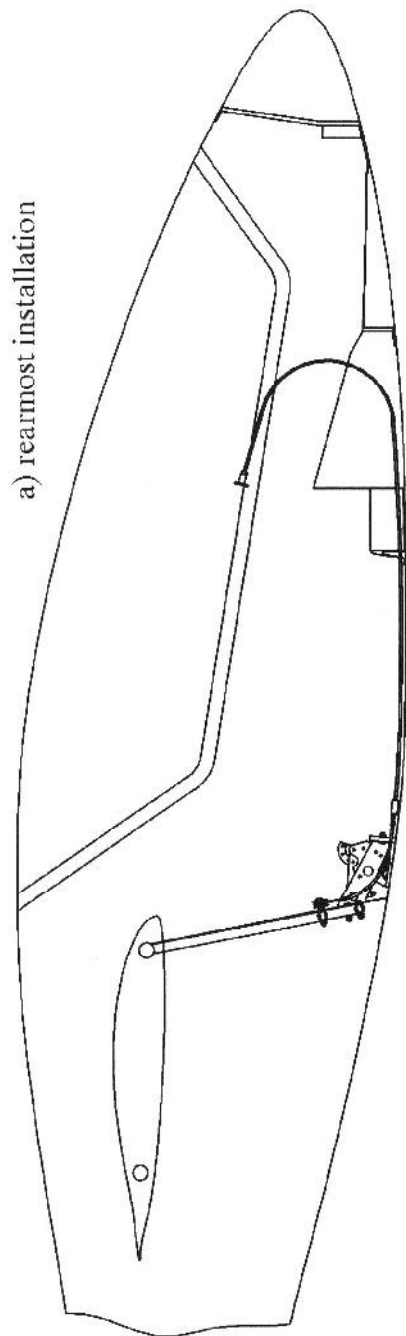
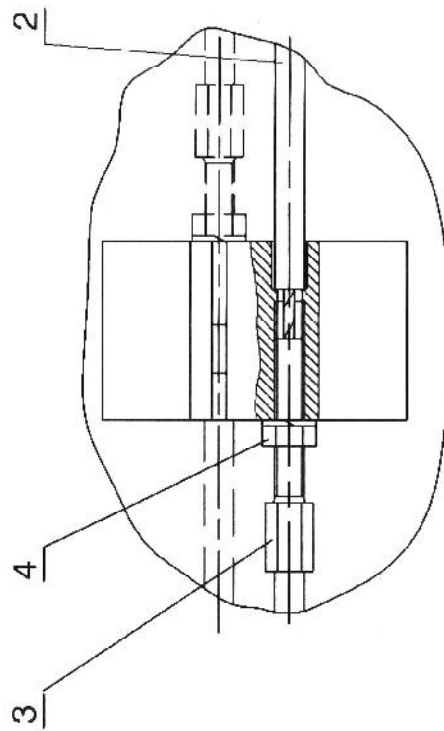
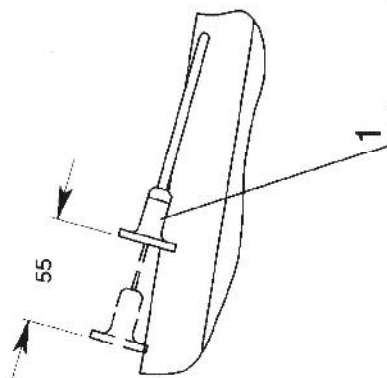


Fig.2 - 9e. Water ballast control system (option fin tank)

a) rearmost installation



b) forward installation



1. Control handle
2. Cable
3. Support
4. Nut
5. Arm
6. Towing hook

Fig.2 - 10. Towing hook control

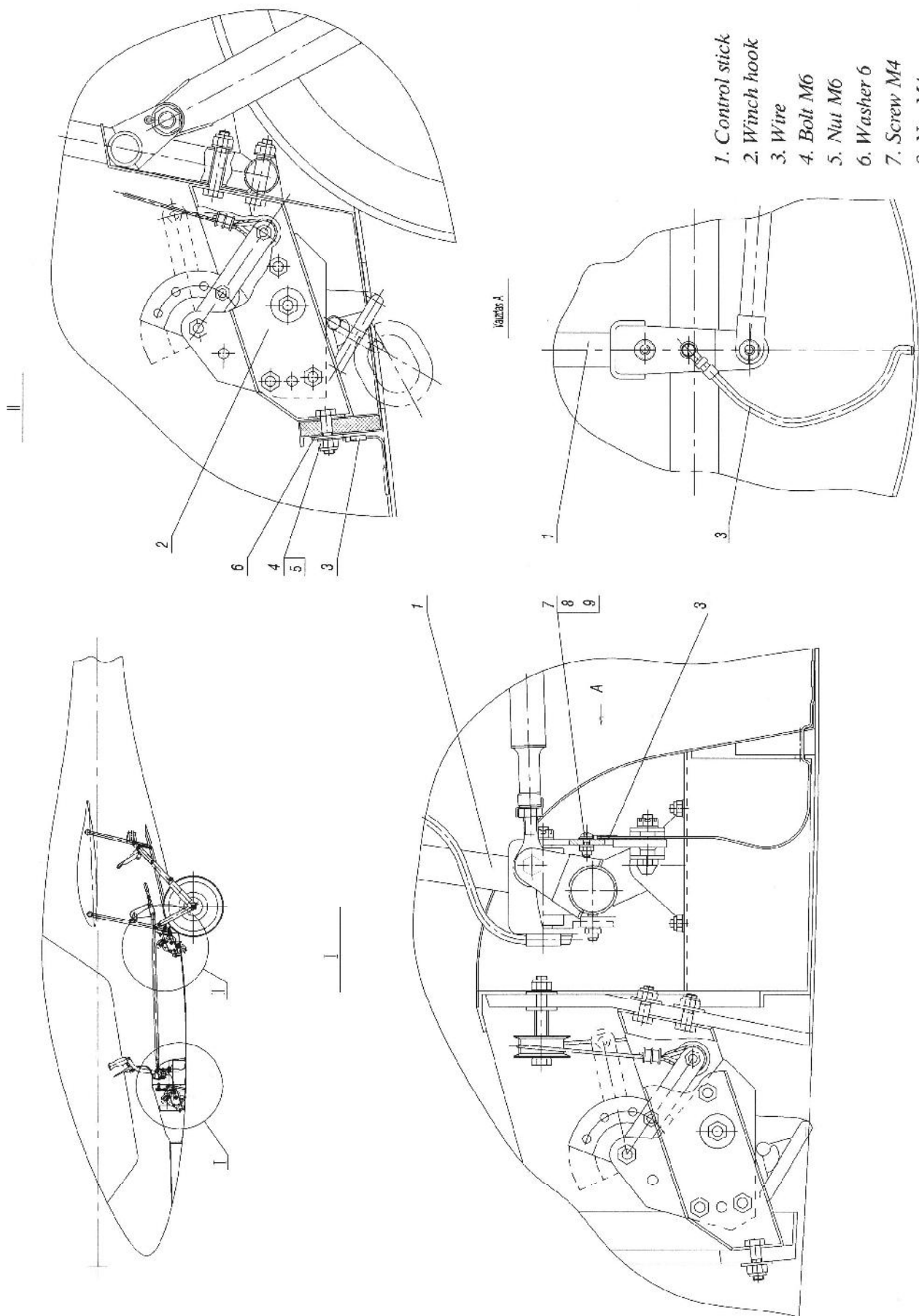
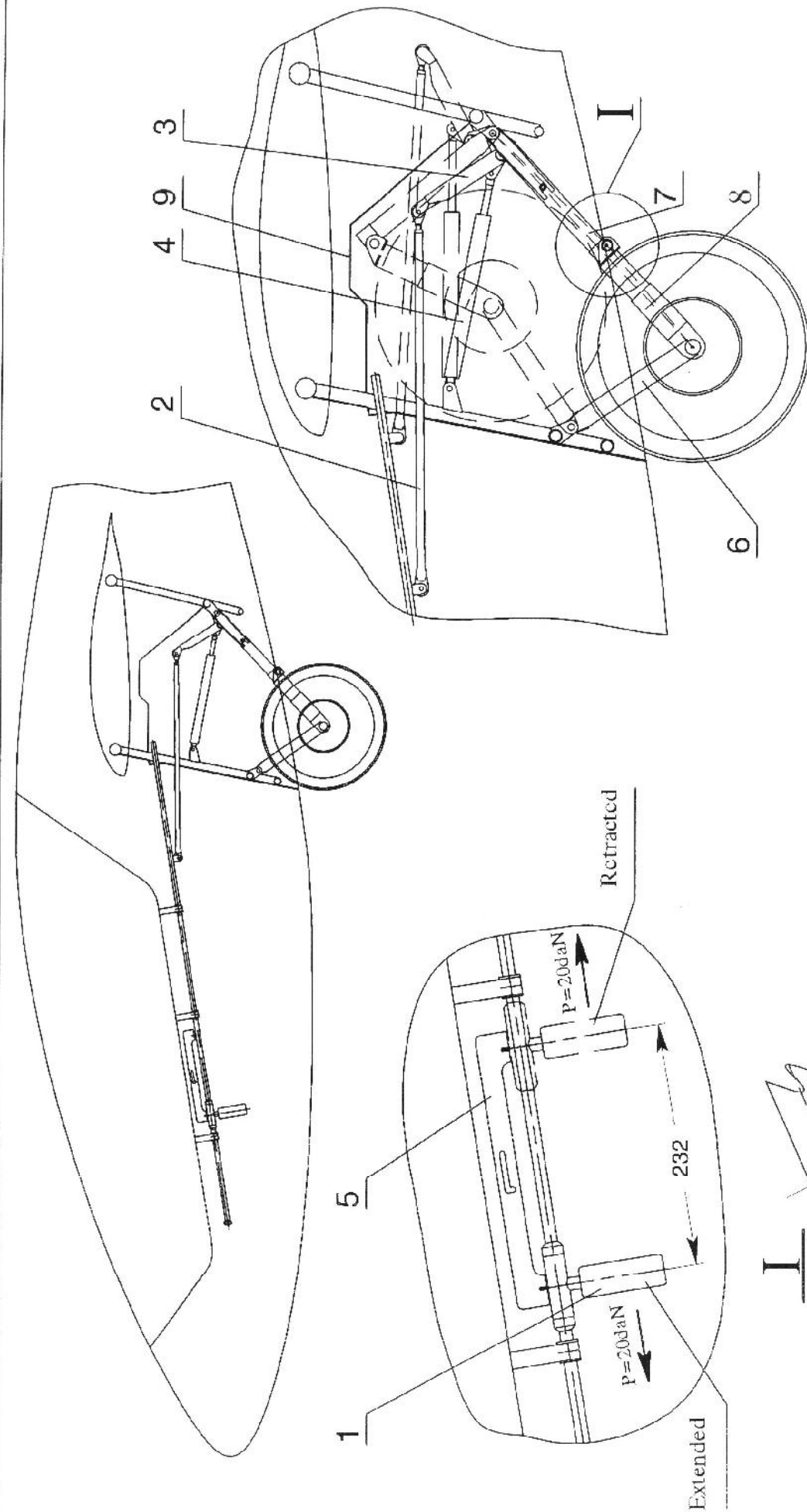


Fig 2-10a. Towing hook control (electrical bonding)



- | | |
|---------------------|-------------------|
| 1. Control rod | 5. Plate |
| 2. Intermediate rod | 6. Stand |
| 3. Bellcrank | 7. Stand |
| 4. Gas spring | 8. Shock absorber |
| | 9. Hood |

Fig.2 - 11. Landing gear control

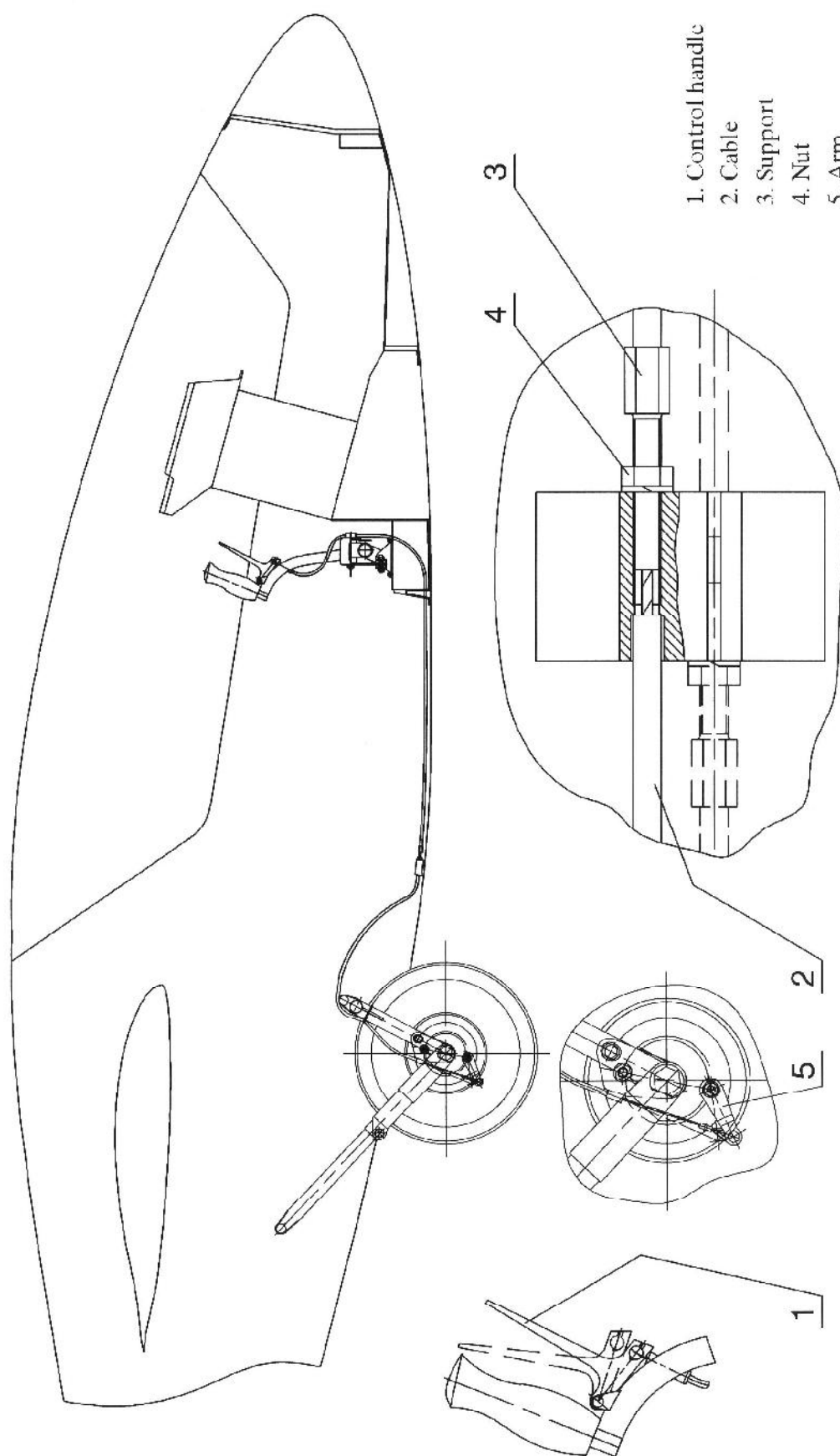


Fig.2 - 12. Mechanical wheel brake control

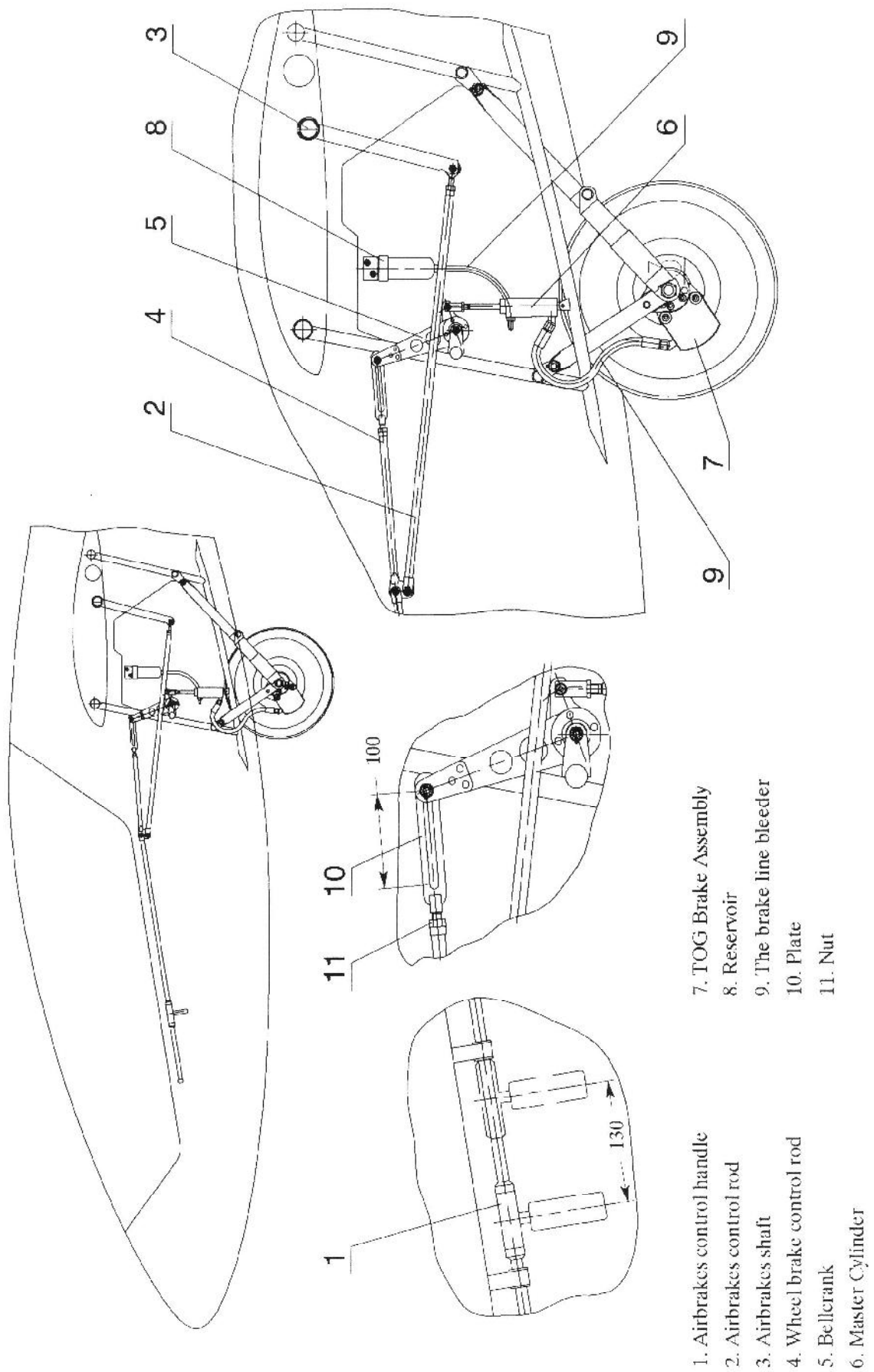


Fig.2 - 12a. Control system of airbrakes and wheel brake

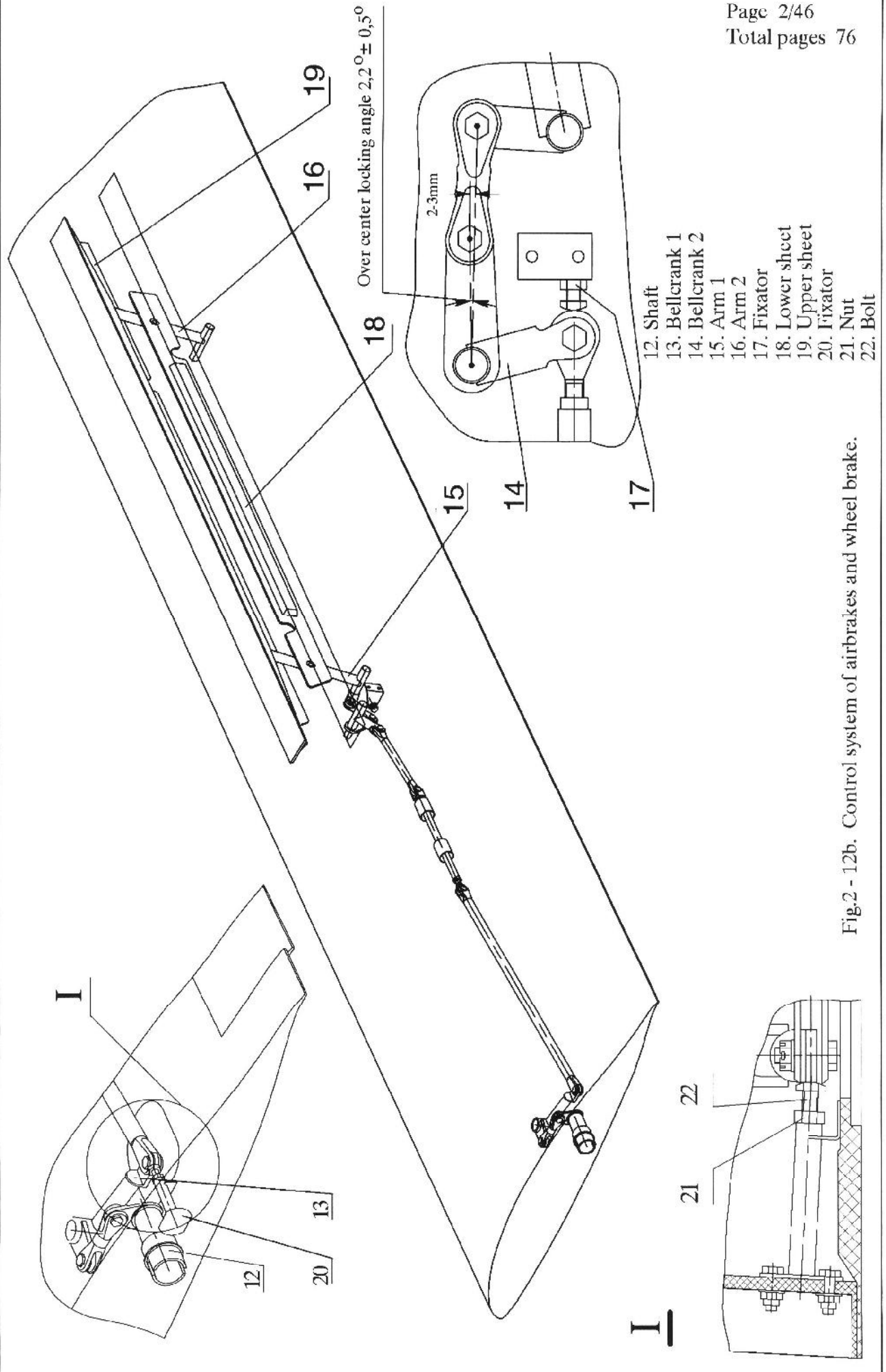
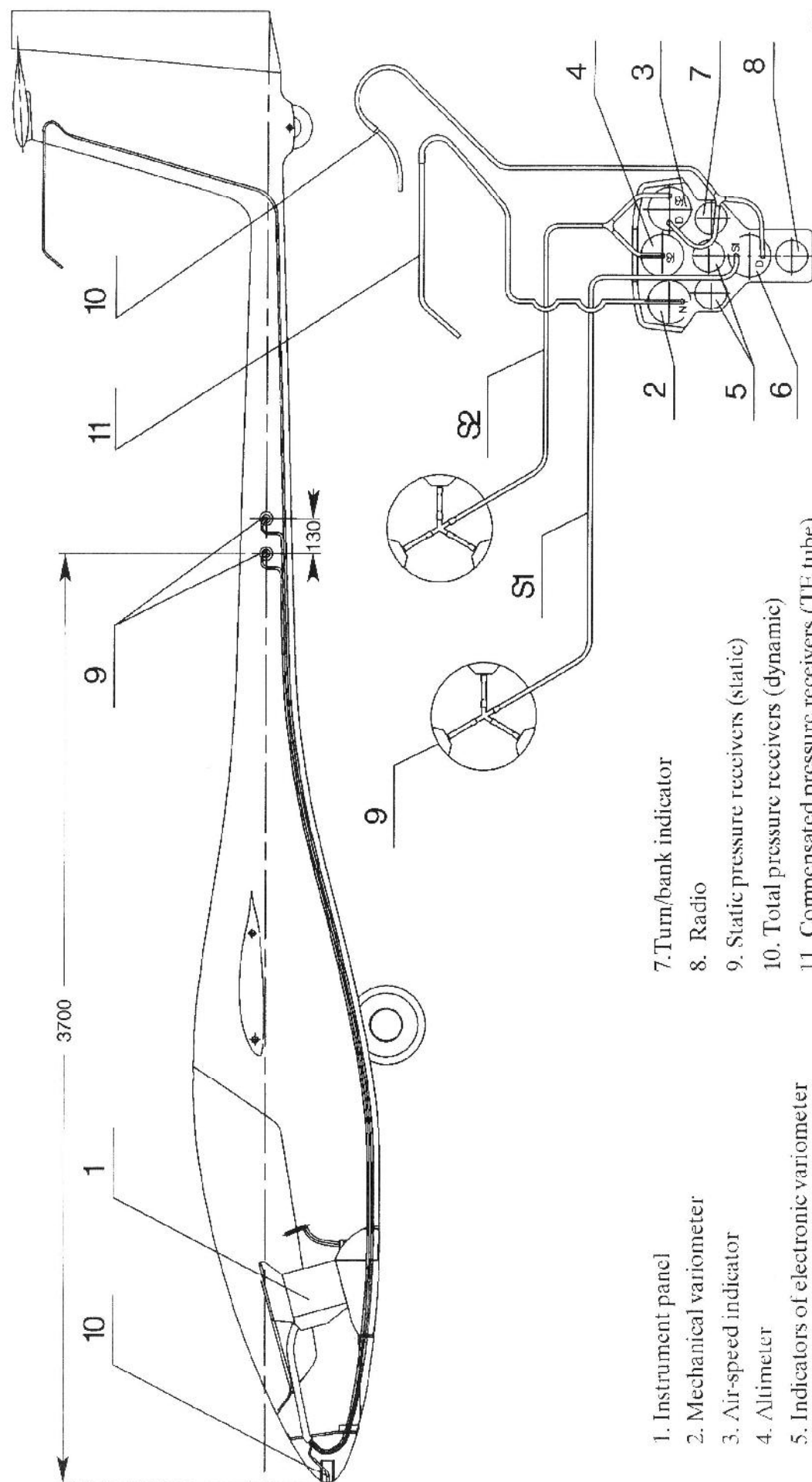


Fig.2 - 12b. Control system of airbrakes and wheel brake.



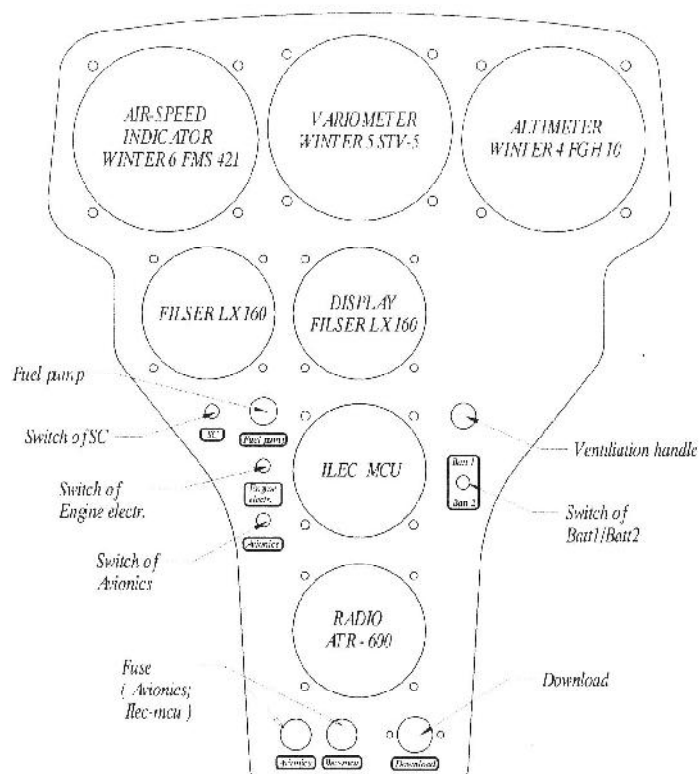
1. Instrument panel
2. Mechanical variometer
3. Air-speed indicator
4. Altimeter
5. Indicators of electronic variometer
6. Electronic variometer

7. Turn/bank indicator
8. Radio
9. Static pressure receivers (static)
10. Total pressure receivers (dynamic)
11. Compensated pressure receivers (TE tube)

Fig.2 - 13. Sailplane static and dynamic pressure system

INSTRUMENT PANEL

OPTION A



OPTION B

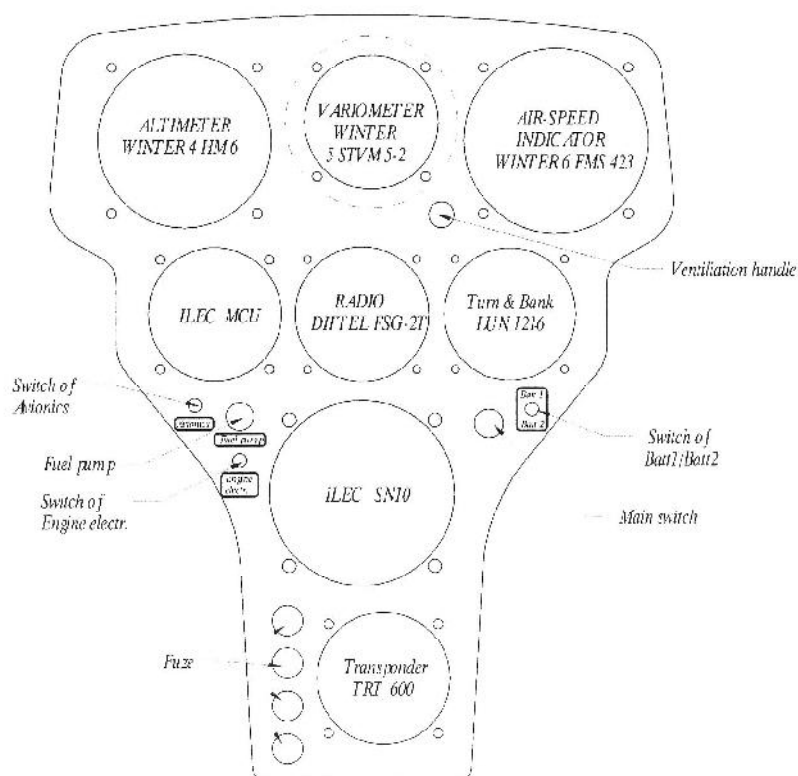
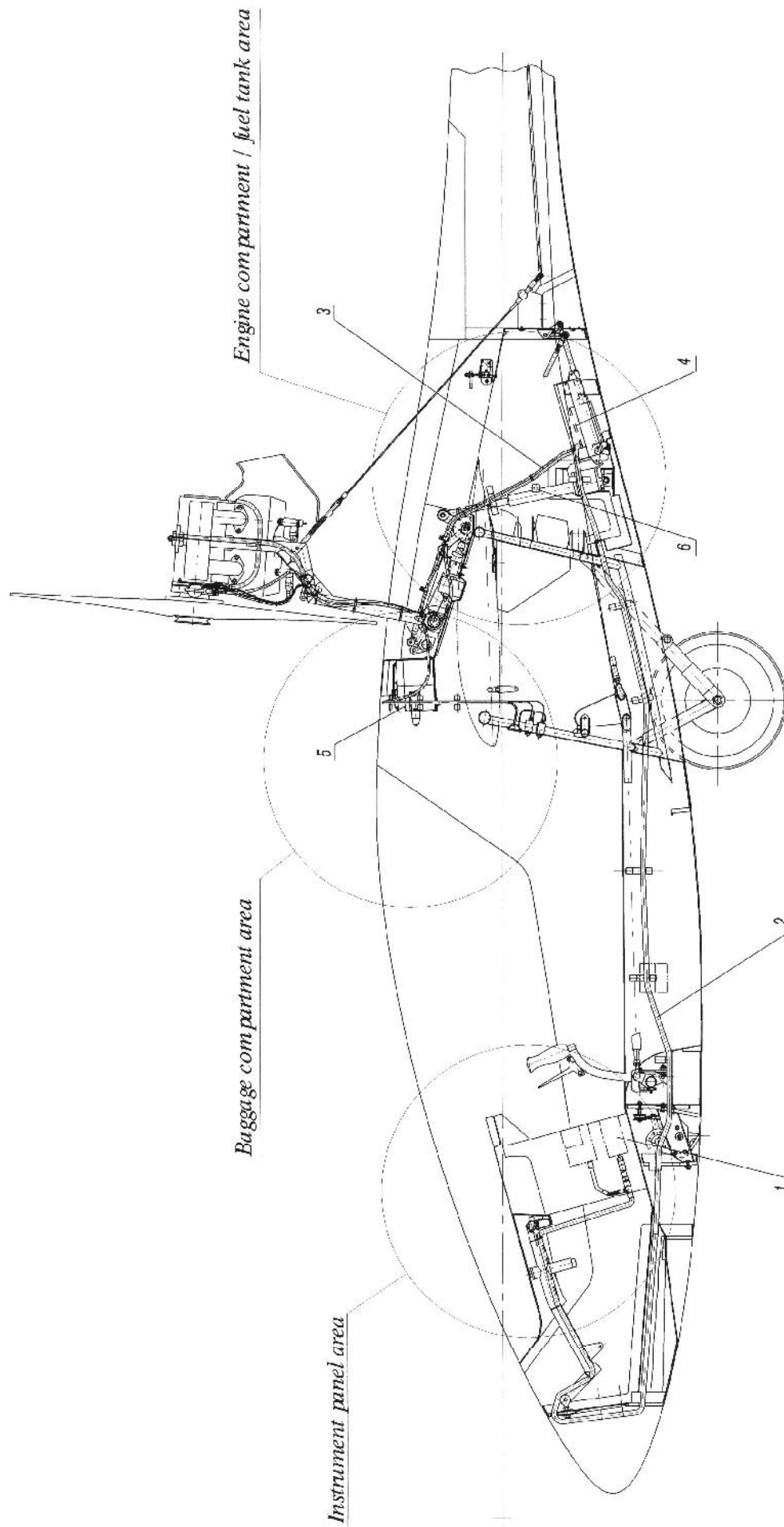
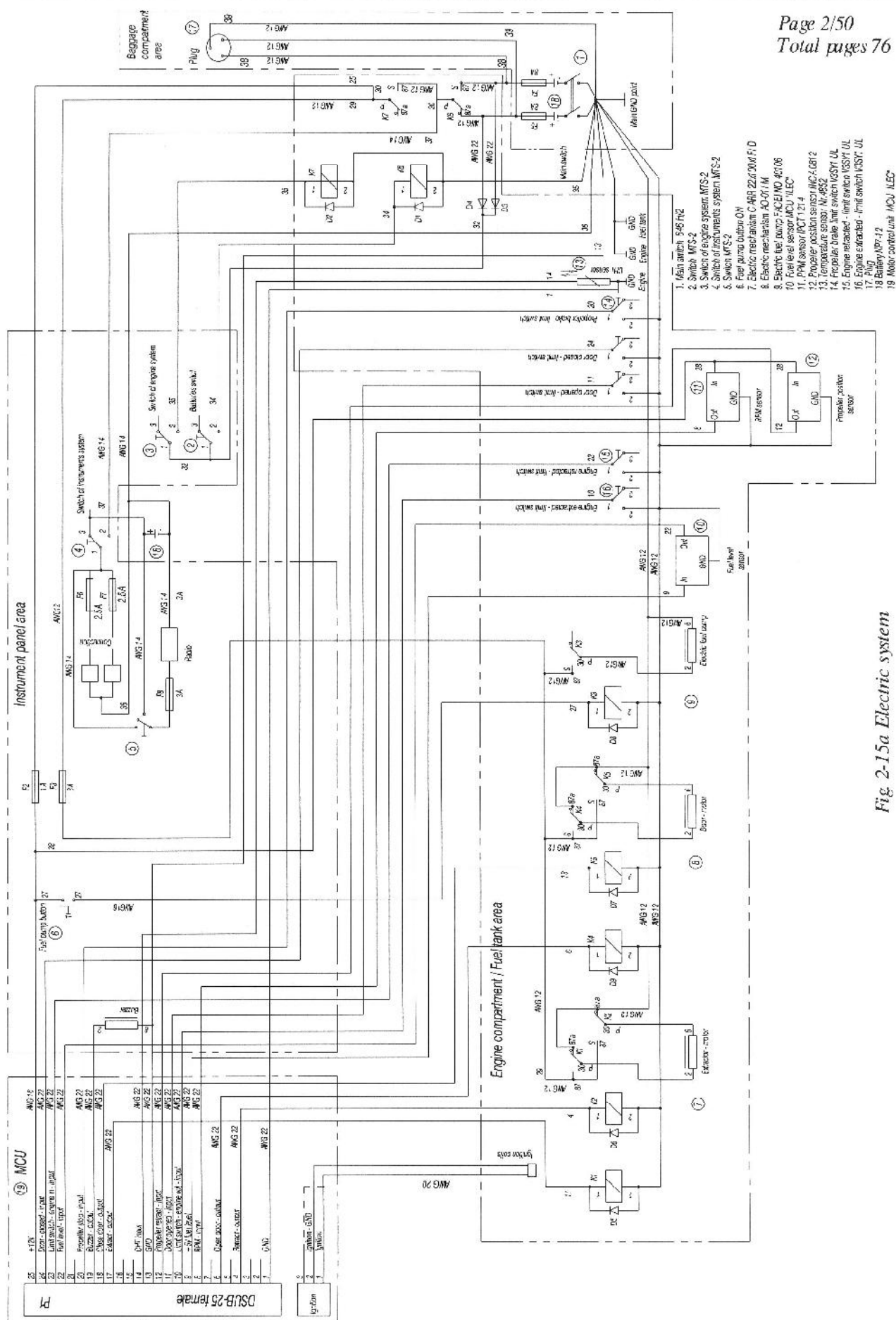


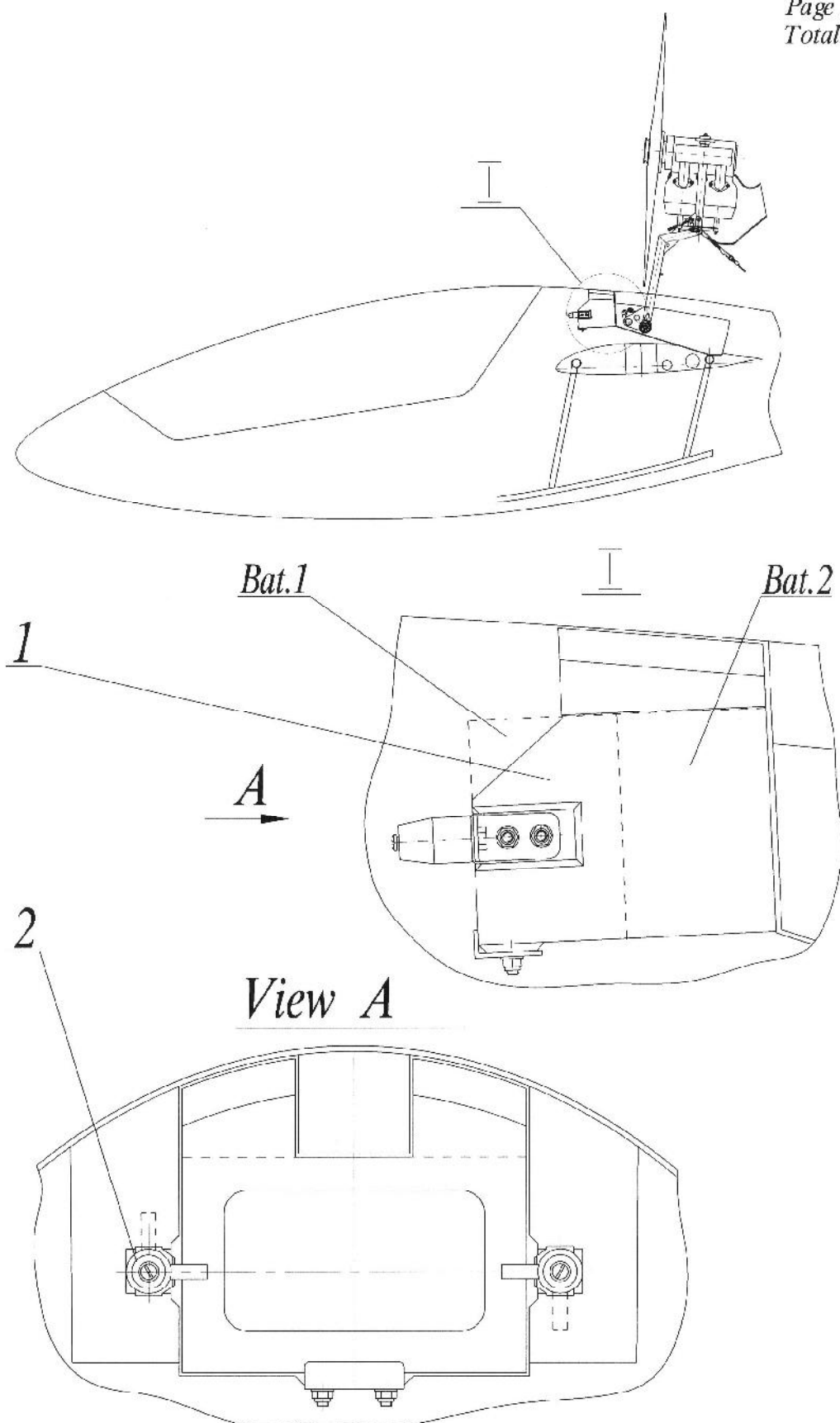
Fig 2-14. Options of flight control and navigation instruments



1. Motor control unit MCU LAK-17 AT
2. Cable LAK-17 AT79010000SB
3. Cable LAK-17 AT79020000SB
4. Relay block LAK-17 AT79030000SB
5. Battery NP7-12
6. Main ground point LAK-17 AT79060000SB

Fig 2-15 General lay-out of electric system





1.Box LAK-17 AT 72 10 01 00
2.Lock

Fig 2-15b Electric system

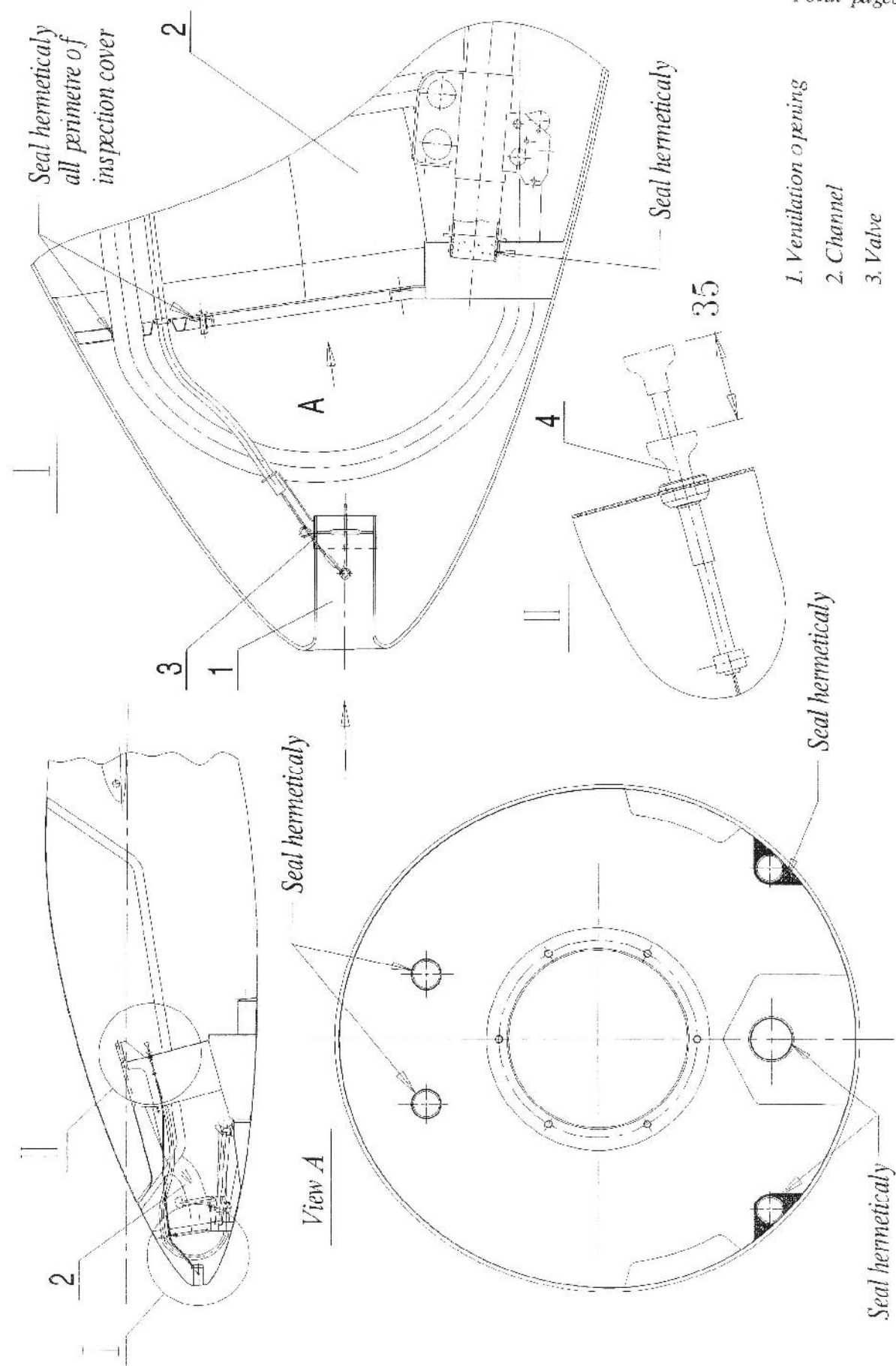


Fig.2-16 Ventilation system

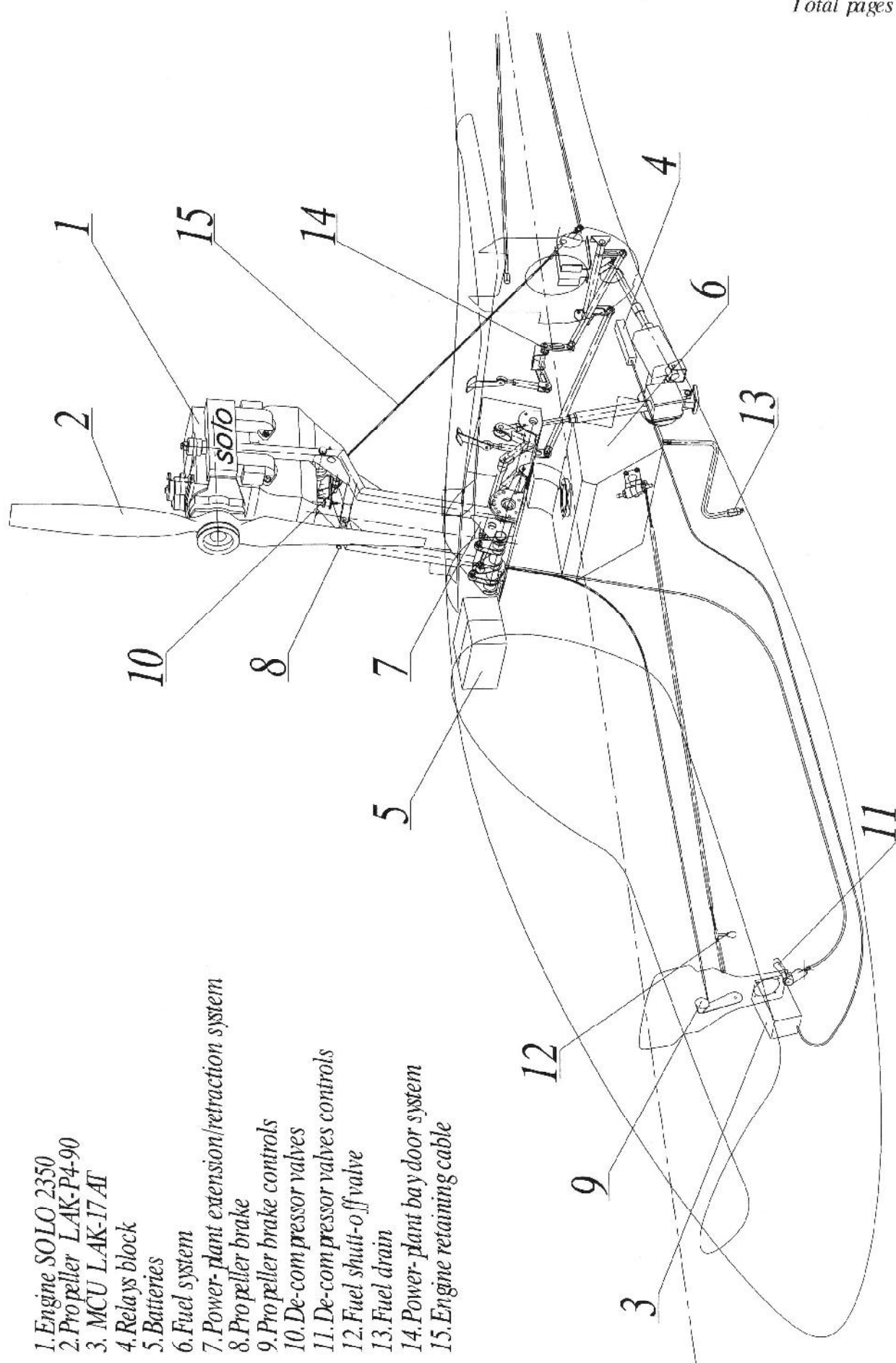


Fig 2-17 General layout

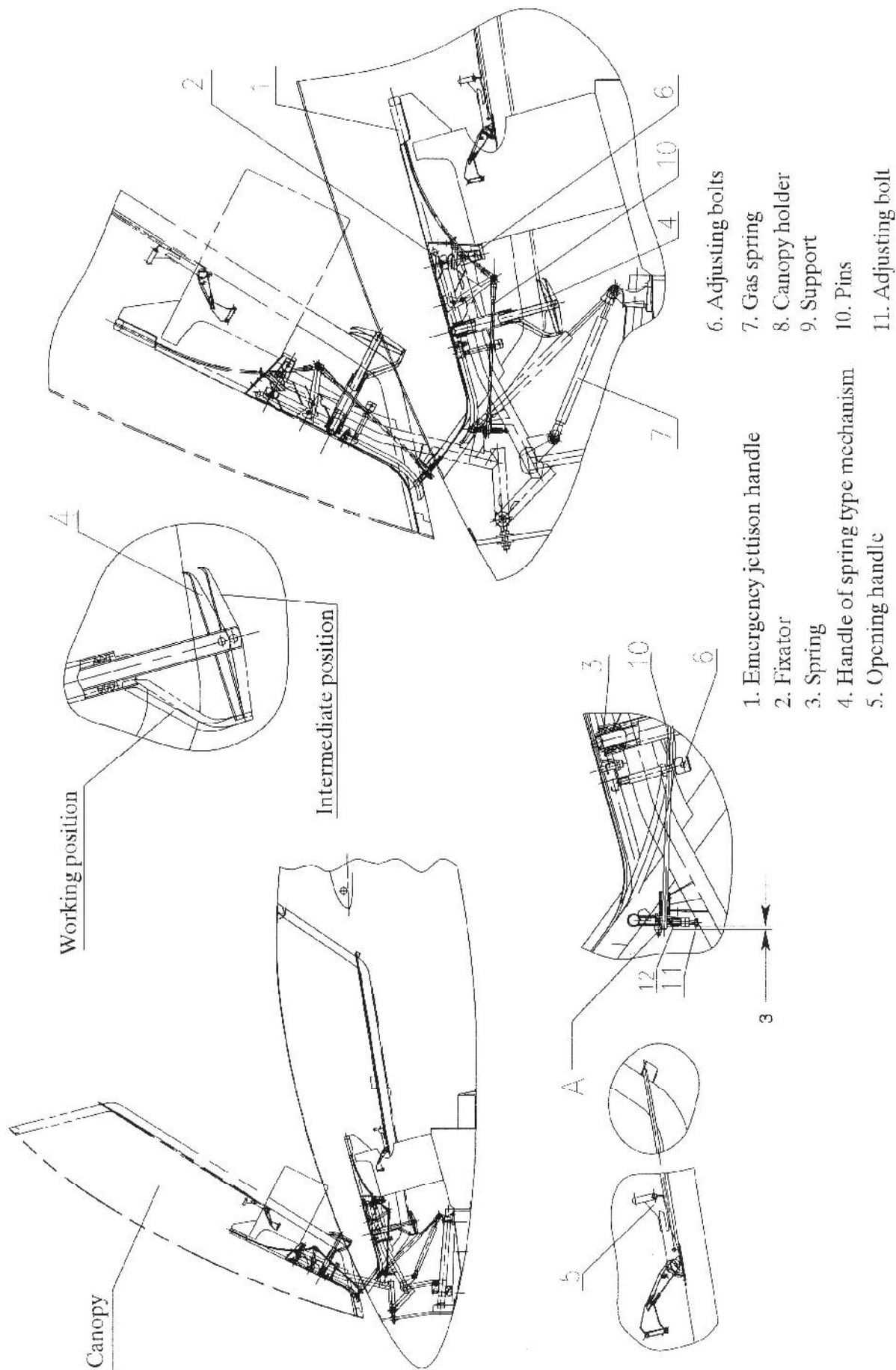


Fig.2 - 18a. Cockpit canopy

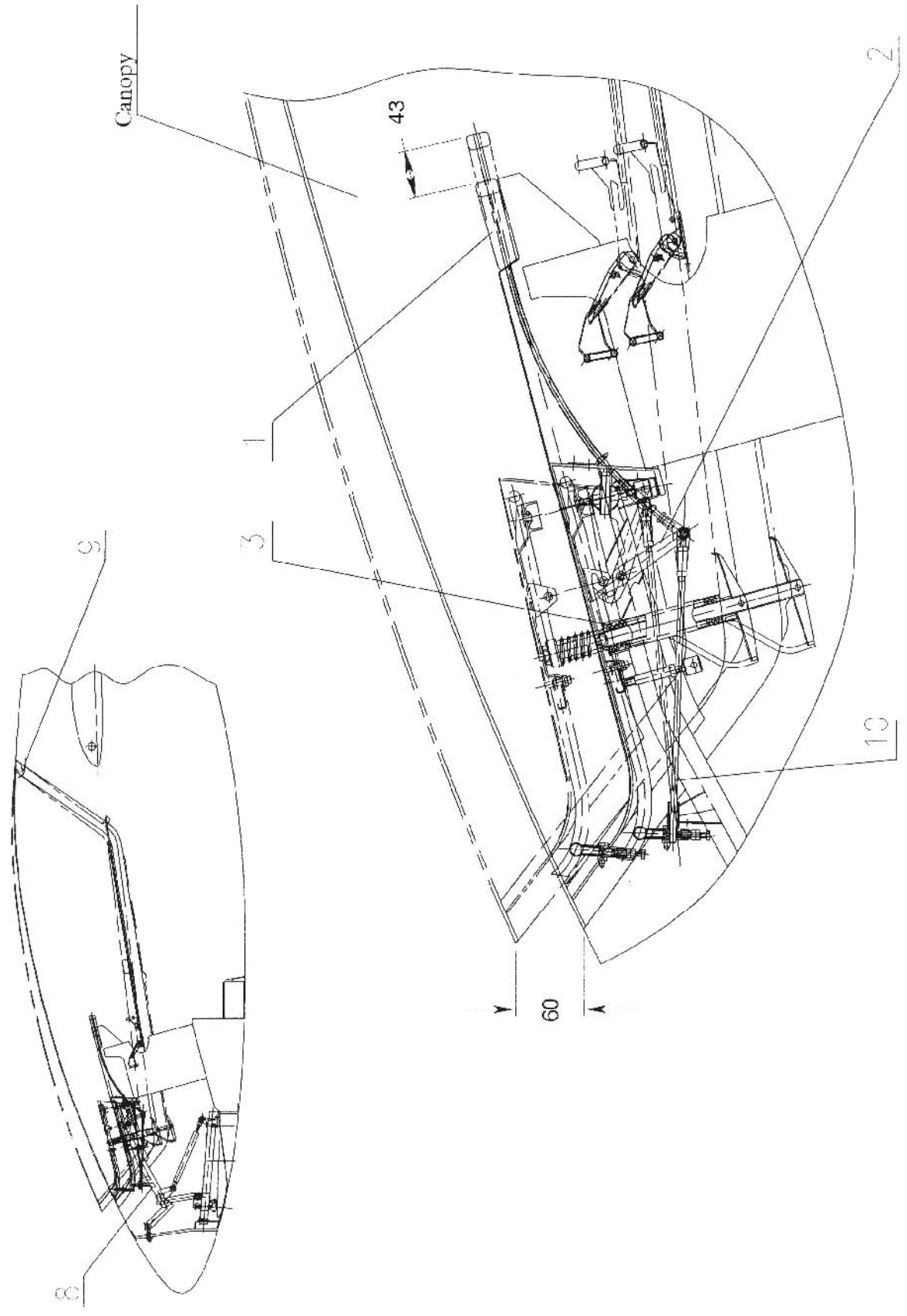


Fig.2 - 18b. Cockpit canopy

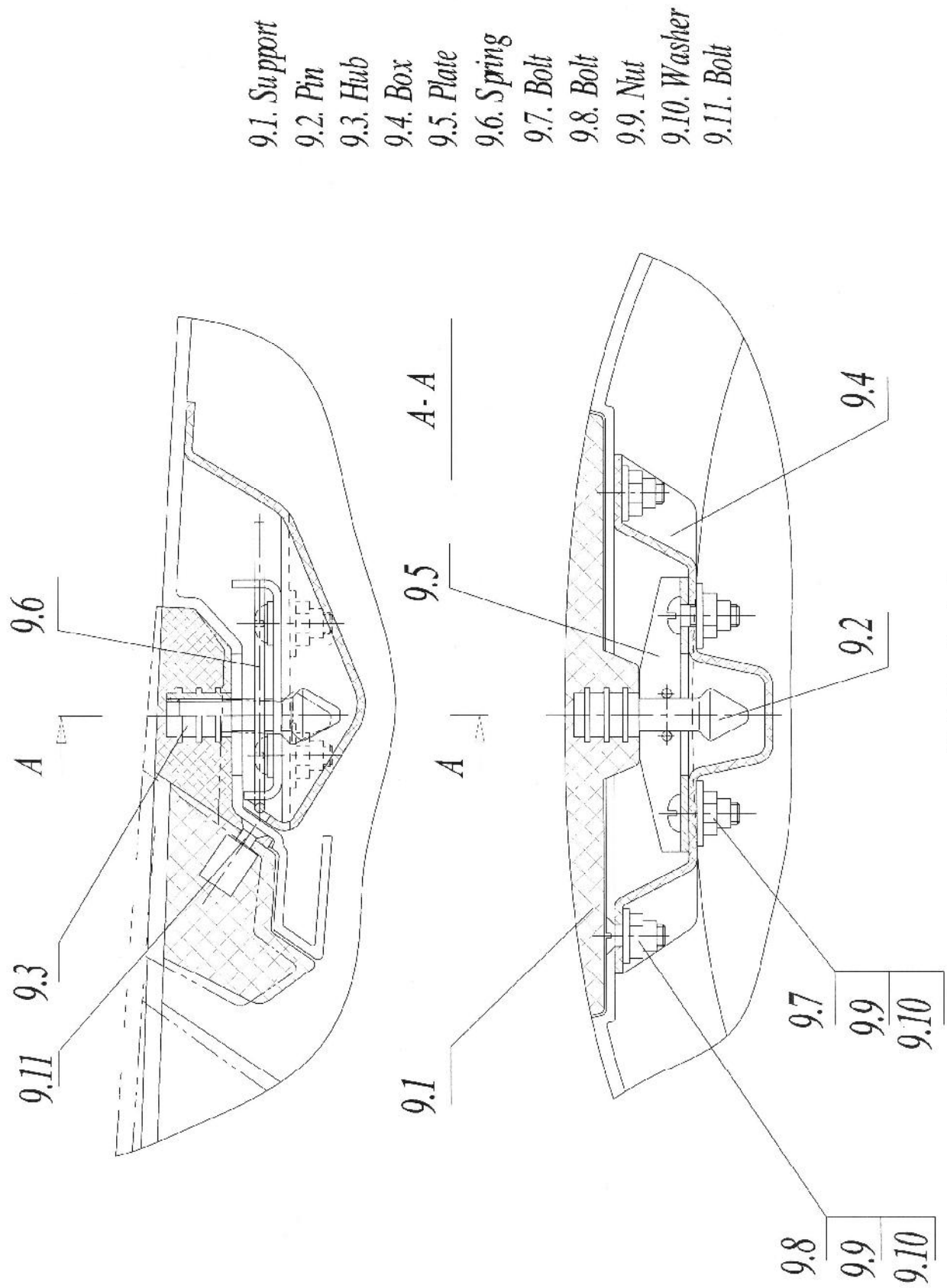


Fig 2-18c. Cockpit canopy

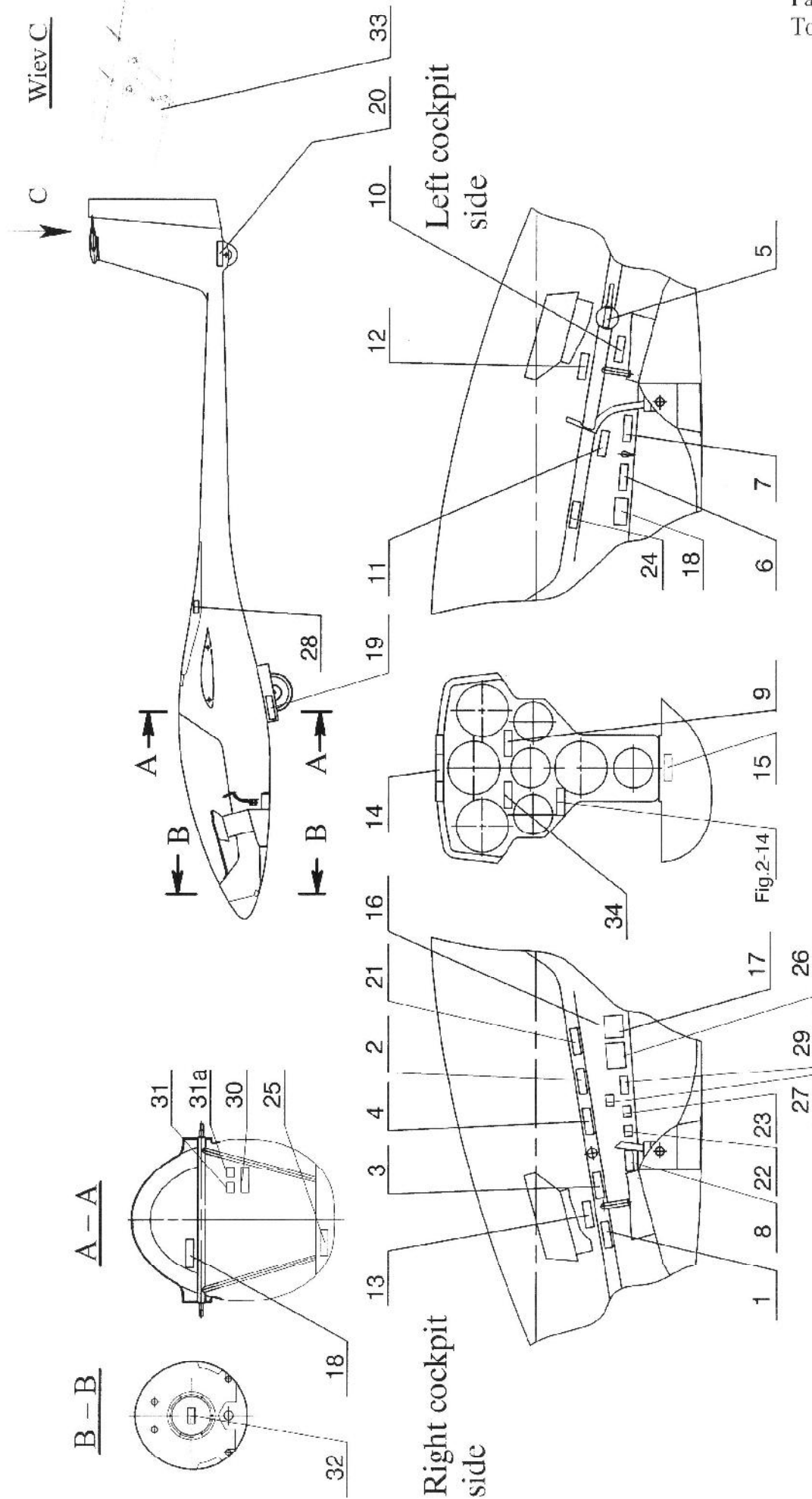


Fig.2 - 19a. Placards marking of controls

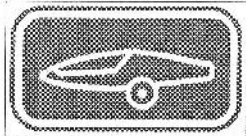
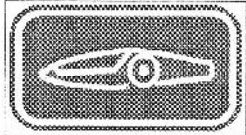



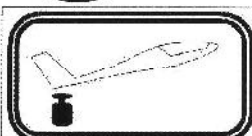

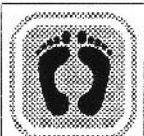

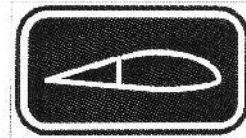
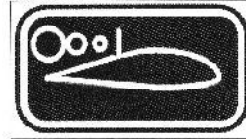
1.Landing gear extended	
2.Landing gear retracted	
3.Water ballast closed	
4.Water ballast opened	
5.Tow release	
6.Trimmer in pitching position	
7.Trimmer in diving position	
8.Pedals adjustment	
9. Cockpit ventilation	

Fig.2 - 19b. Placards and marking of controls

10. Air brakes retracted



11. Air brakes extended



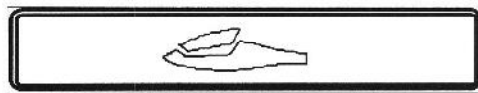
12. Canopy opening handle



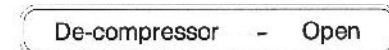
13. Canopy opening handle



14. Canopy emergency jettison



15. De-compressor valve



16. 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	
• Fuel Valve Closed	
• Canopy closed and latched	
• Wind direction	
Check list for powered flight	
• Fuel quantity checked	
• Engine installation checked	

17. Table of operational limitations

LAK-19T 15/18m - AIR SPEED DATA & LOADING PLACARD						
Speed IAS:		km/h	kts	Masses and loads	kg	lbs
Never exceed	V _{NE}	275	148	Max. mass with water ballast	480/500	1058/1102
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	650 daN	1461 lbs
Landing gear oper.	V _L	205	110	Engine operation is allowed only with empty water ballast tanks !		
Power-plant oper.	V _{PE}	160	86			
Max. engine ext/ret	V _{POmax}	110	60	Aerobatic manoeuvres are not permitted !		
Min. engine ext/ret	V _{POmin}	90	49			

Fig.2 - 19c. Placards and marking of controls

18. Baggage limitation table

Max baggage weight
7 kg (15,4 lbs)

19. Table of main wheel tyre pressure

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

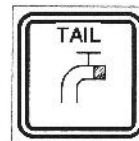
20. Table of tail wheel tyre pressure

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

21. The airspeed limitation placard

m - Altitude - ft	km/h - V_{NE} IAS - kts
4000 13100	275 148
5000 16400	260 140
6000 19680	245 132
8000 26250	220 119
10000 32800	195 105

22. Fin water ballast closed
(optional)



23. Fin water ballast open
(optional)



24. Seat back adjustment



25. Manufacture data plate

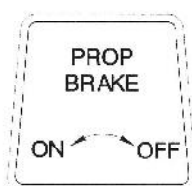
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Pociūnai, LT-59327 Prienai, Lithuanian Republic					
Modelis Model	LAK	<input type="text"/>	Serijinis Nr. Serial No.	<input type="text"/>	
Pagamin. data Date of mfg.		<input type="text"/>			

Fig.2 – 19d. Tables and marking of controls

26. Engine extract / /start

Engine extract / start
<ul style="list-style-type: none"> • Engine electr. switch ON • Extract the engine switch ON <ul style="list-style-type: none"> • Fuel Valve OPEN • Check if engine is extracted • Remove Propeller Brake OFF <ul style="list-style-type: none"> • Switch the Ignition ON • Press Fuel Pump for few sec. • De-compressor valve OPEN <ul style="list-style-type: none"> • Increase the speed.
Stop / retract the engine
<ul style="list-style-type: none"> • Ignition OFF • De-compressor OPEN and release. Repeat if needed. <ul style="list-style-type: none"> • Propeller Brake ON <ul style="list-style-type: none"> • Close Fuel Valve • Check prop is in right position • Retract the engine switch ON • Engine electr. switch OFF

27. Propeller brake



28. Fuel type

Fuel - two stroke mixture: Min. 95 RON; AVGAS 100LL / two stroke oil Castrol Super TT 30:1
Fuel tank capacity = 7.5 ltr. (2 US gal.) Usable amount of fuel = 7.2 ltr. (1.9 US gal.)

29. Fuel valve

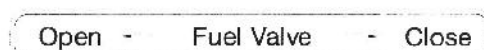


Fig.2 – 19e. Placards and marking of controls

30. Batteries charge

Charge
Batt 1; Batt 2

31. Battery fuse

Fuse-Batt 1


31a. Battery fuses

Fuse-Batt 2

32. Nose ballast (optional)

Nose ballast max. permitted 5,25 kg (11,6 lbs)	
Reduction of the min. cockpit load by:	Lead weight required
5 kg (11 lbs)	1,75 kg (3,9 lbs)
10 kg (22 lbs)	3,5 kg (7,7 lbs)
15 kg (33 lbs)	5,25 kg (11,6 lbs)

33. Stabilizer bolt

Pull-out bolt locking
pin  **first!**

34. RPM indication (LED) meanings

located as close as possible to MCU:

RPM indications	
Green	4500...5800
Yellow	5800...6500
Red	> 6500

Fig.2 – 19f. Placards and marking of controls

Possible places to mount acrials for GPS, transponders, ELT

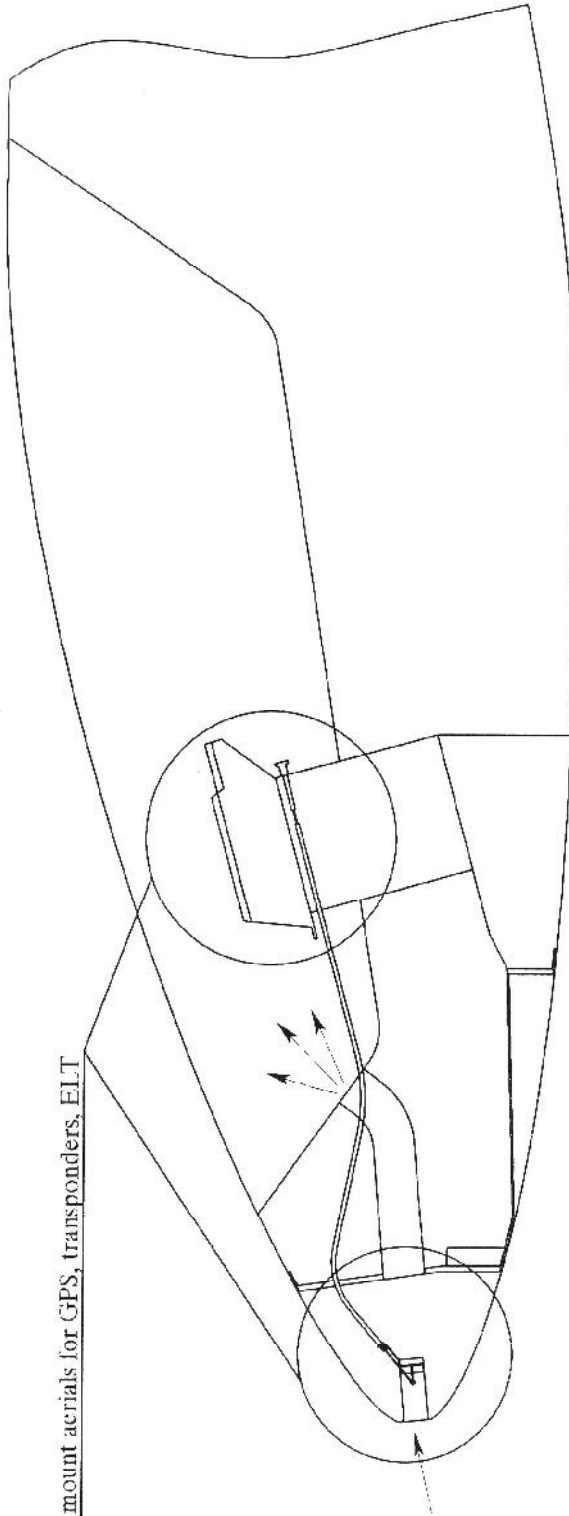
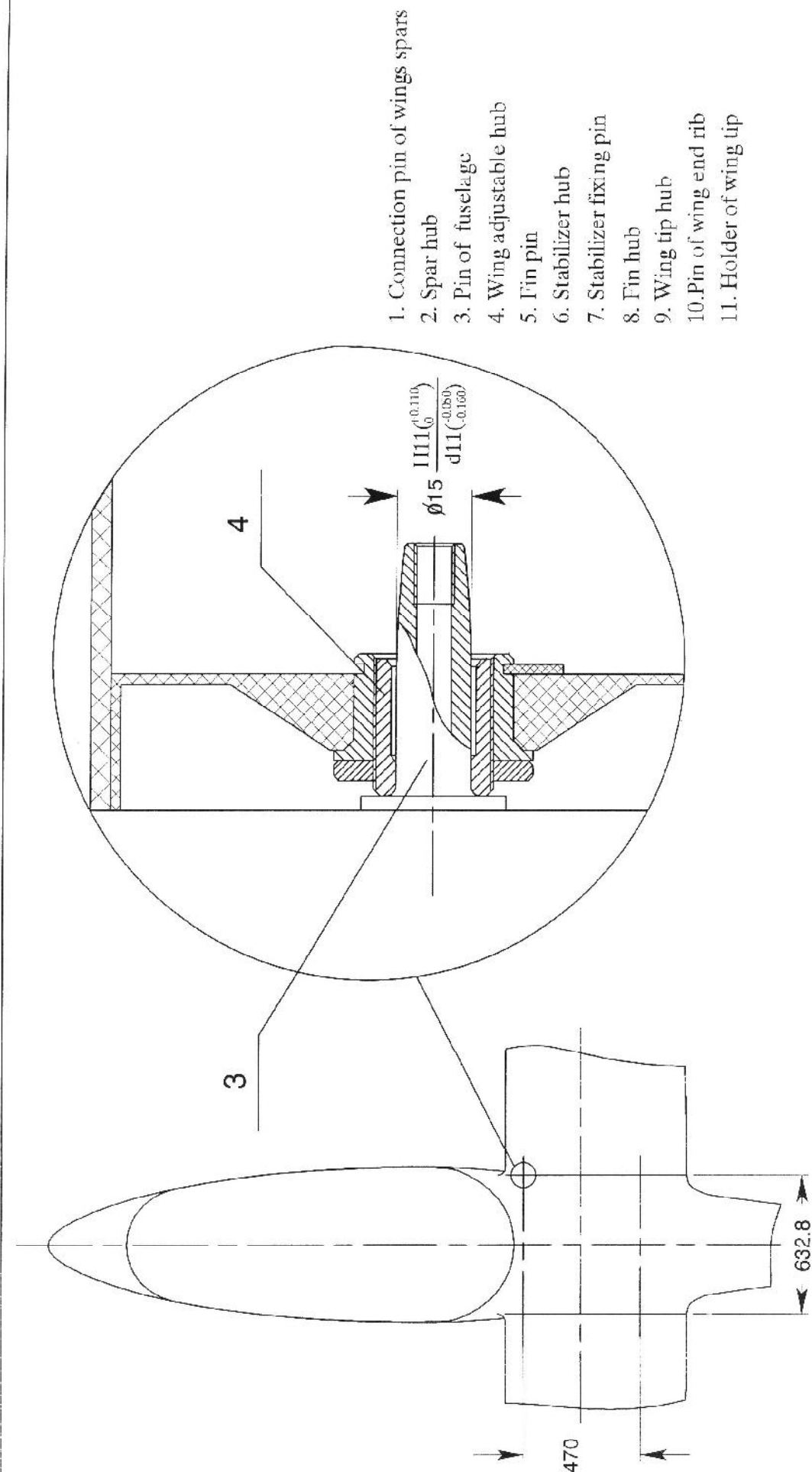


Fig.2 - 20. Possible places to mount acrials for GPS, transponders, ELT



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 pin
8. Fin hub
9. Wing tip hub
10. Pin of wing end rib
11. Holder of wing tip

Fig.2 - 20a. Allowed clearances of connection of sailplane aggregates

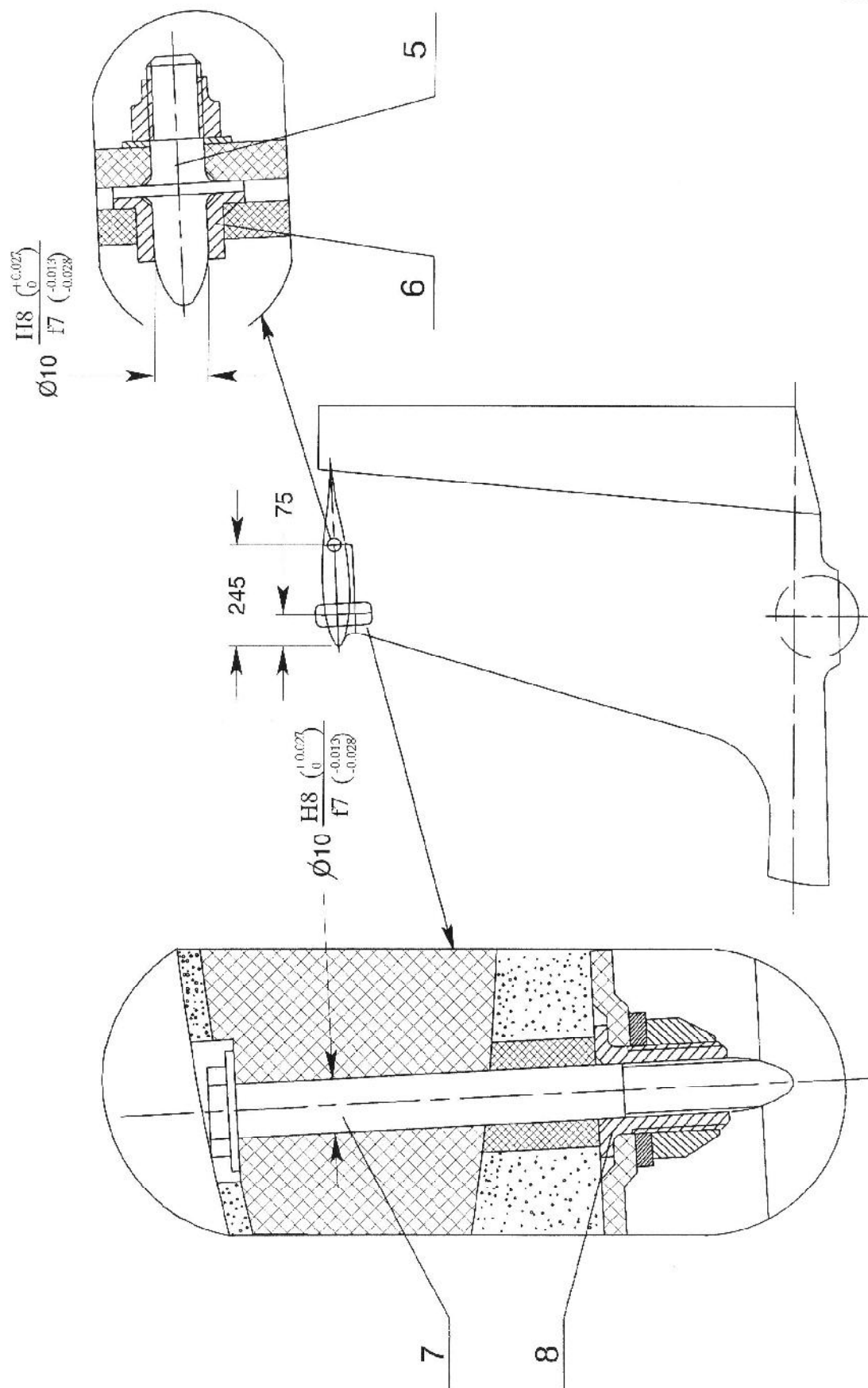


Fig.2 - 20b. Allowed clearances of connections of sailplane aggregates

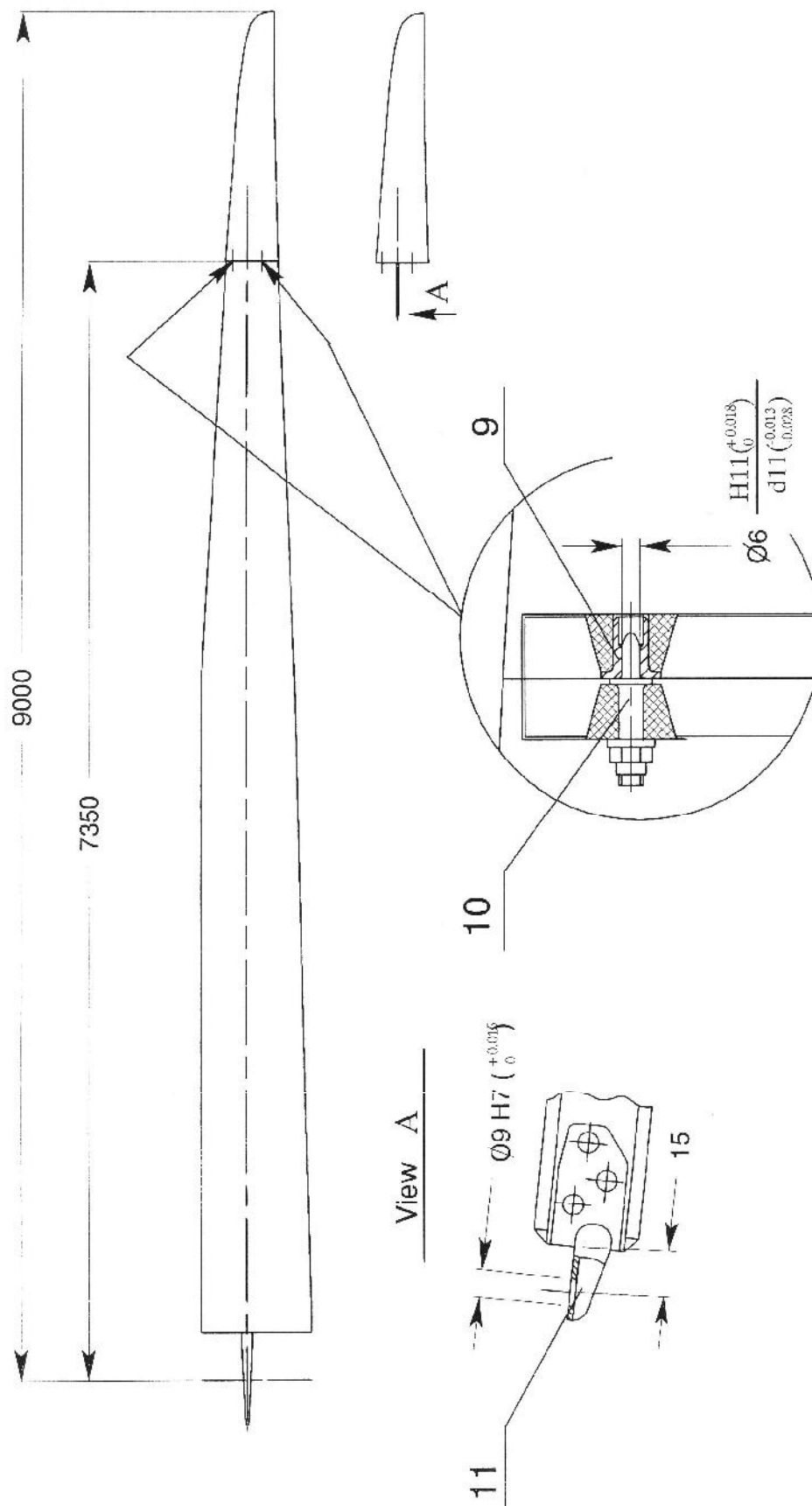
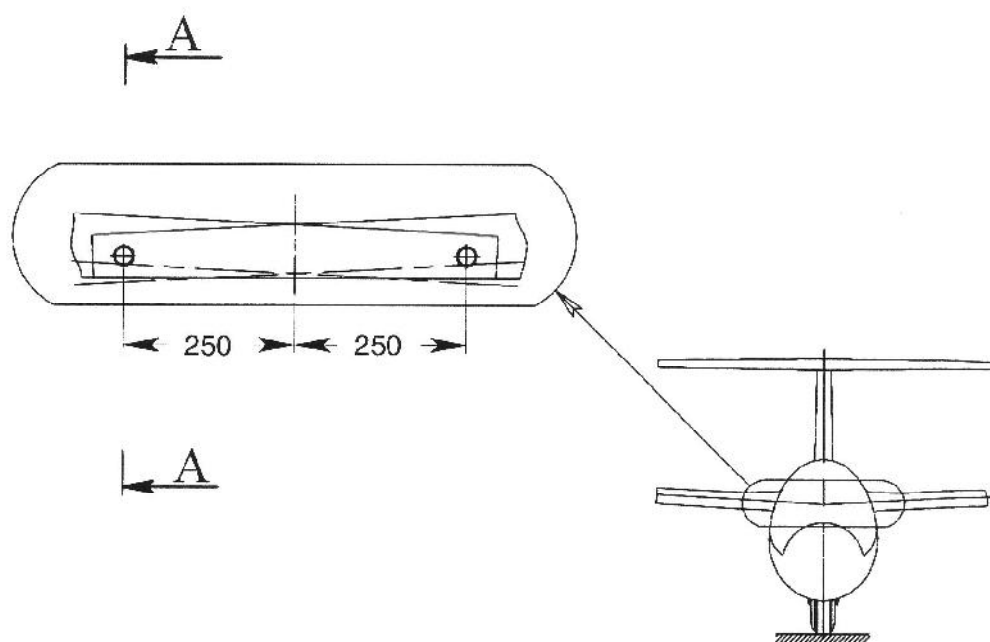


Fig.2 - 20c. Allowed clearances of connections of sailplane aggregates



A - A typical

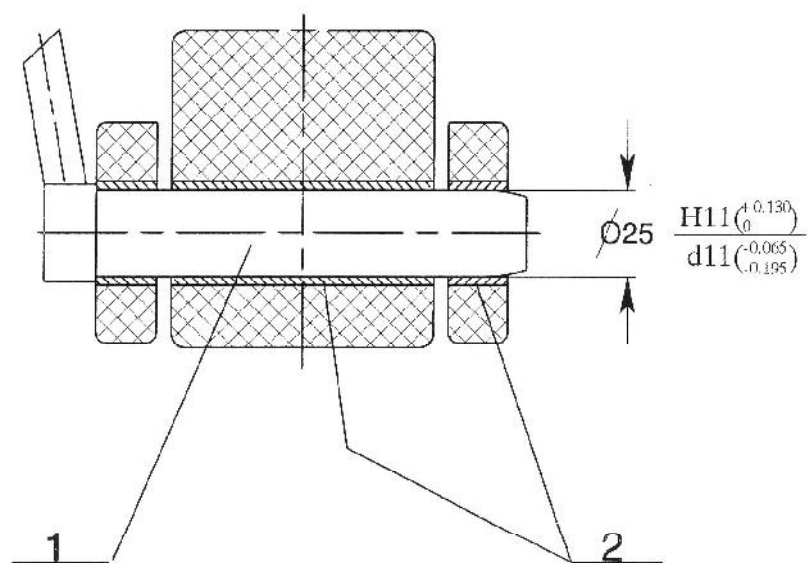
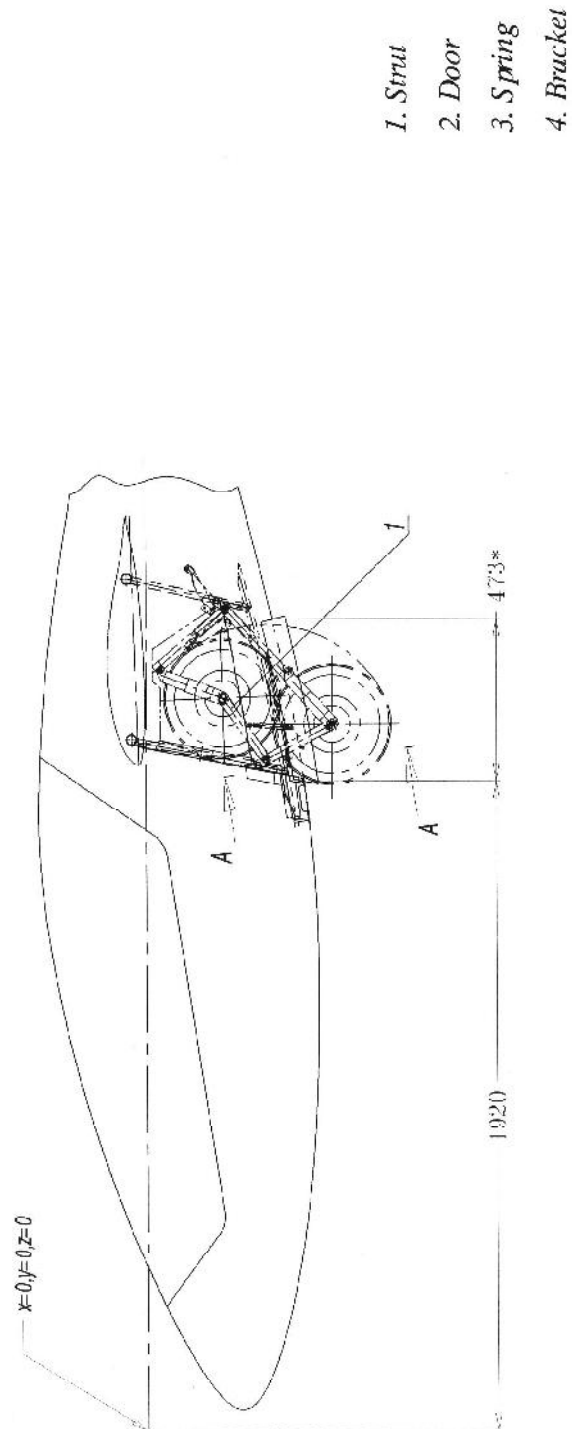


Fig.2 - 20d. Allowed clearances of connections of sailplane aggregates



A - A

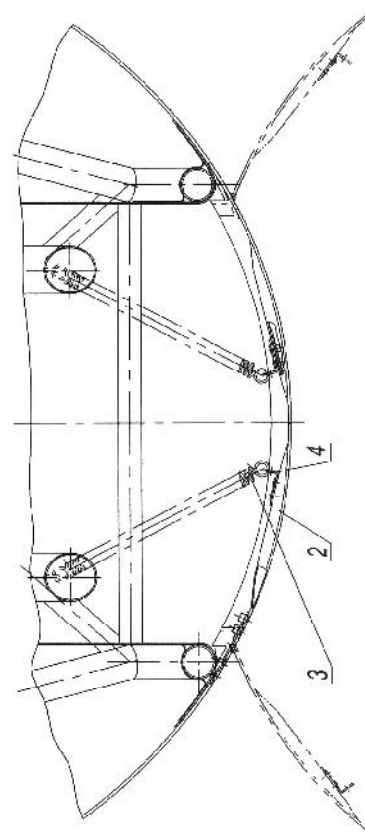


Fig 2-21 Landing gear door

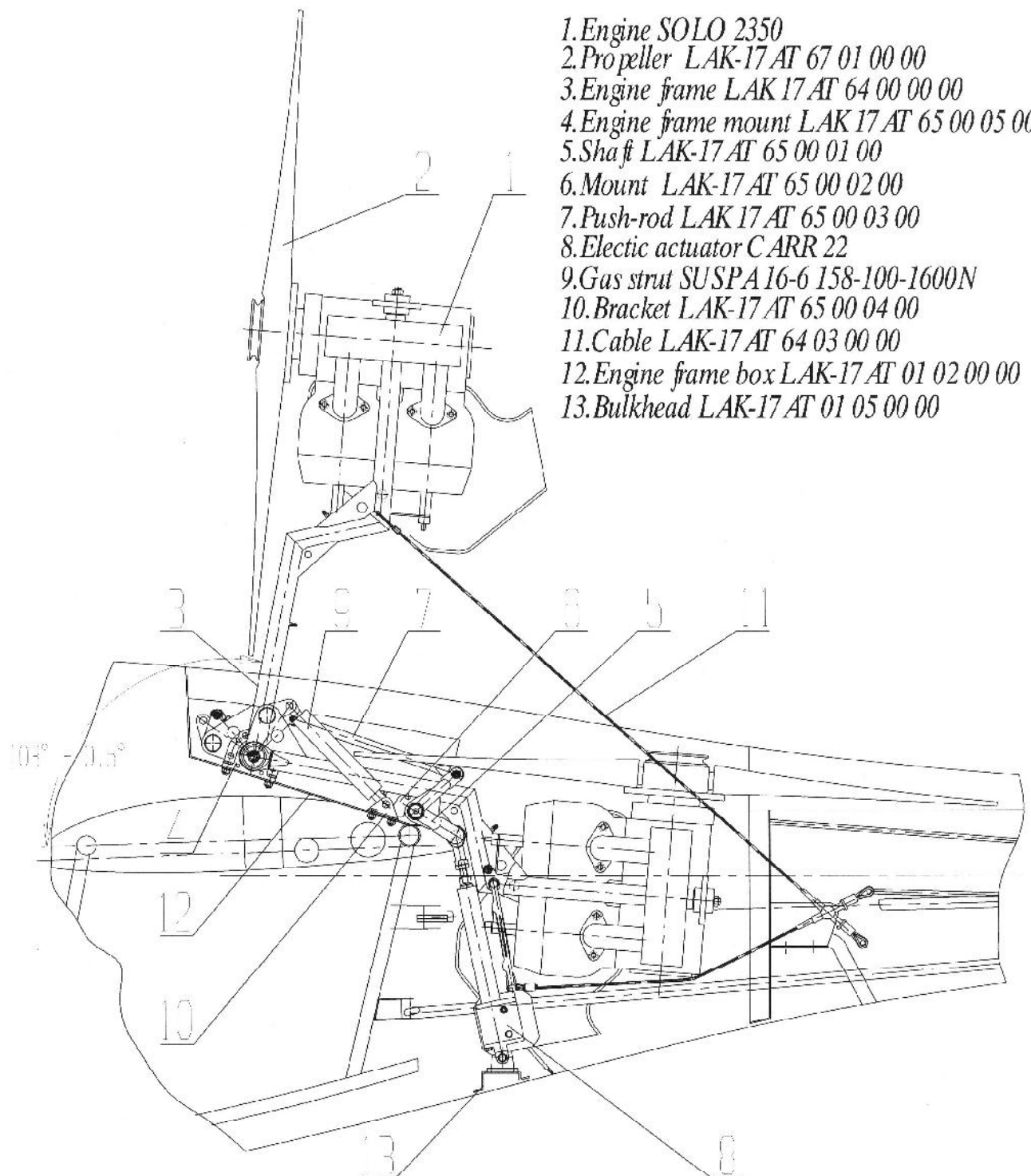
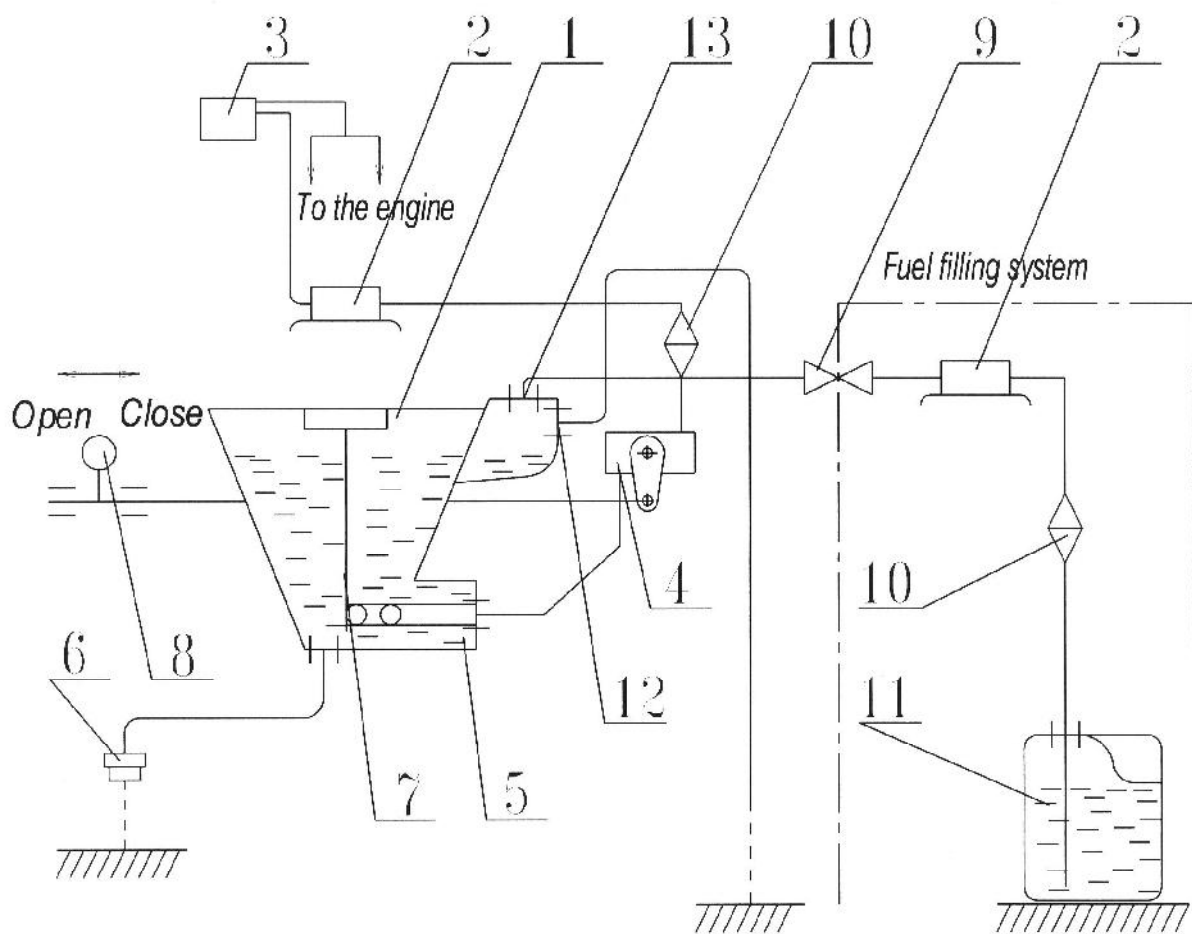
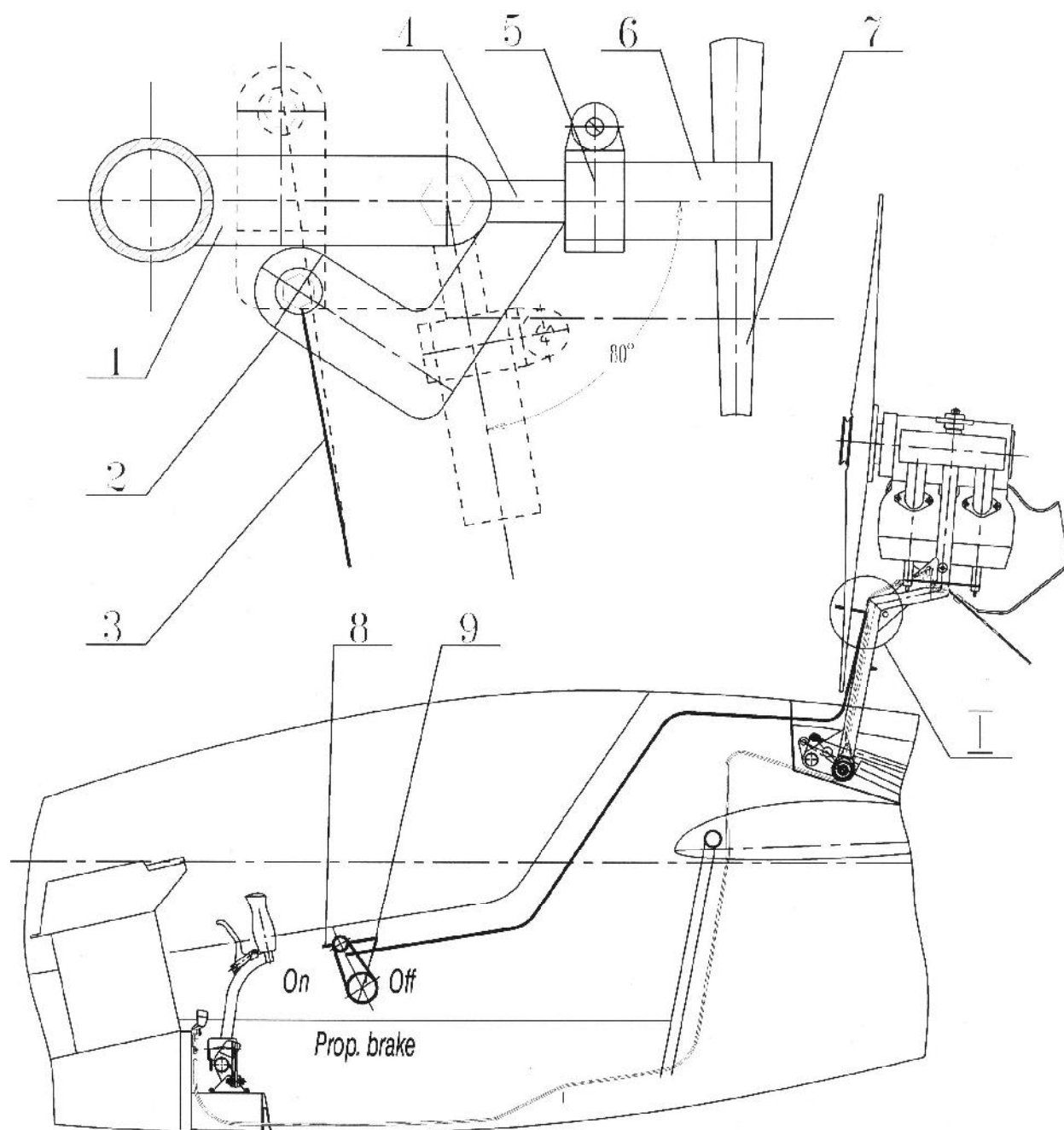


Fig. 2-22 Engine extraction/retraction system



1. Fuel tank LAK-17AT 61 00 01 00 SB
2. Electric fuel pump FACET NO 40106
3. Vacuum fuel pump Bing 80 - 203A
4. Fuel shut-off valve ASS&C P/N 05 - 23325
5. Fuel strainer LAK-17AT 61 00 02 01
6. Fuel drain ASS&C CAV - 110 P/N 05 - 17700
7. Fuel level sensor MCU "ILEC"
8. Fuel valve control handle LAK-17AT 61 00 02 02
9. Fast connection ASS&C P/N QD001
10. Fuel filter ASS&C P/N FUF01
11. Fuel can
12. Fuel breather nipple LAK-17AT 61 00 02 03
13. Fuel filling nipple LAK-17AT 61 00 02 03

Fig 2-23 Fuel system



1. Engine frame LAK-17AT 64 00 00 00 SB

2. Arm LAK-17AT 65 02 02 01

3. Cable LAK-17AT 65 02 03 00 SB

4. Brake rod LAK-17AT 65 02 02 02

5. Clamp

6. Rubber hose L=35 mm ERGON 20 BAR

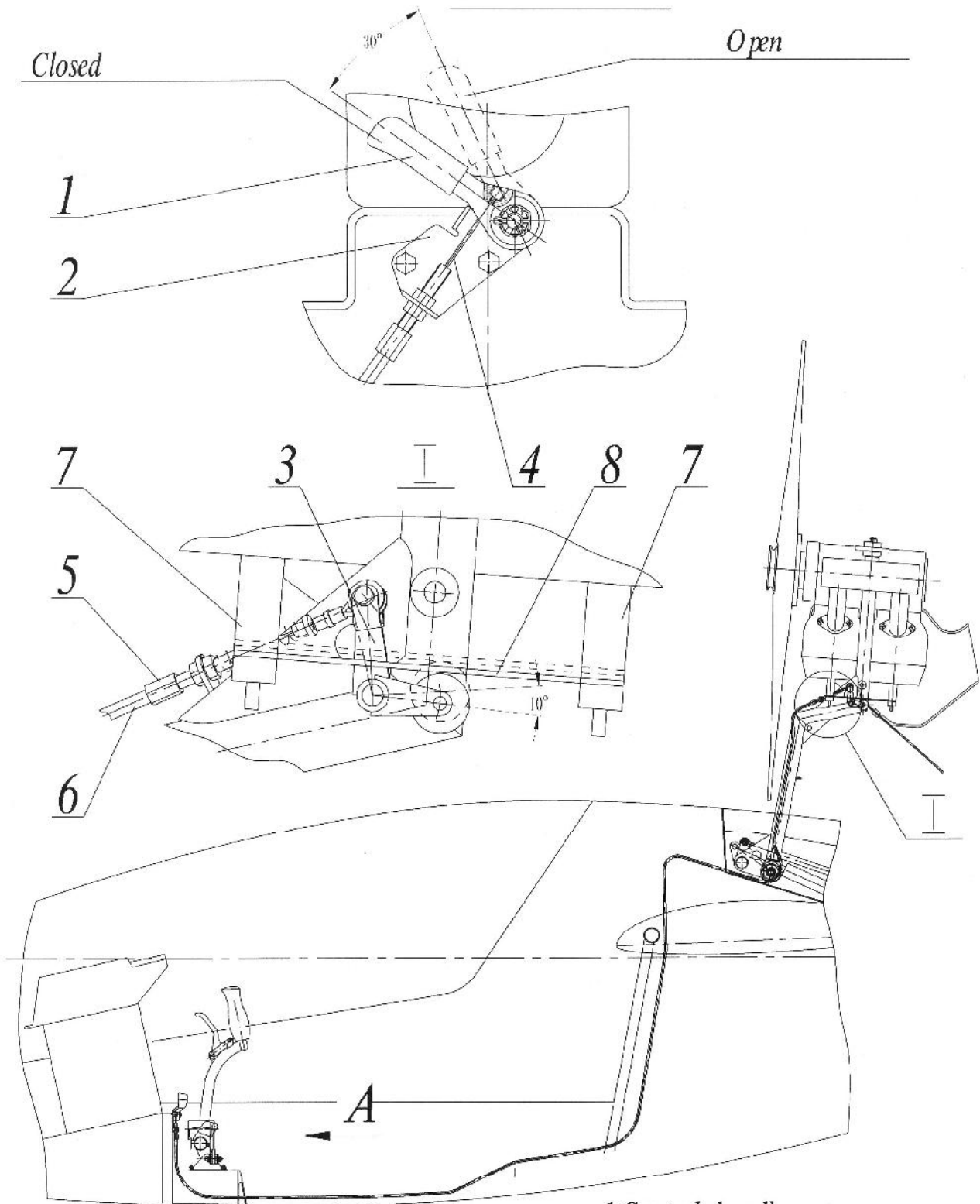
7. Propeller LAK-P4-90 LAK-17AT 67 01 00 00 SB

8. Propeller brake handle fixing plate LAK-17AT 65 02 01 01

9. Propeller brake handle LAK-17AT 65 02 01 00 SB

Fig 2-24 Propeller brake

View A



1. Controls handle
2. Bracket LAK-17 AT 65 01 01 00
3. Arm LAK-17 AT 65 01 02 00
4. Cable LAK-17 AT 65 01 03 00
5. Bowden end LAK 17 A 58 01 01 04
6. Bowden 3 OST 1 10173-71
7. De-compressor
8. De-compressor plate

Fig. 2-25 Controls of de-compressing valves

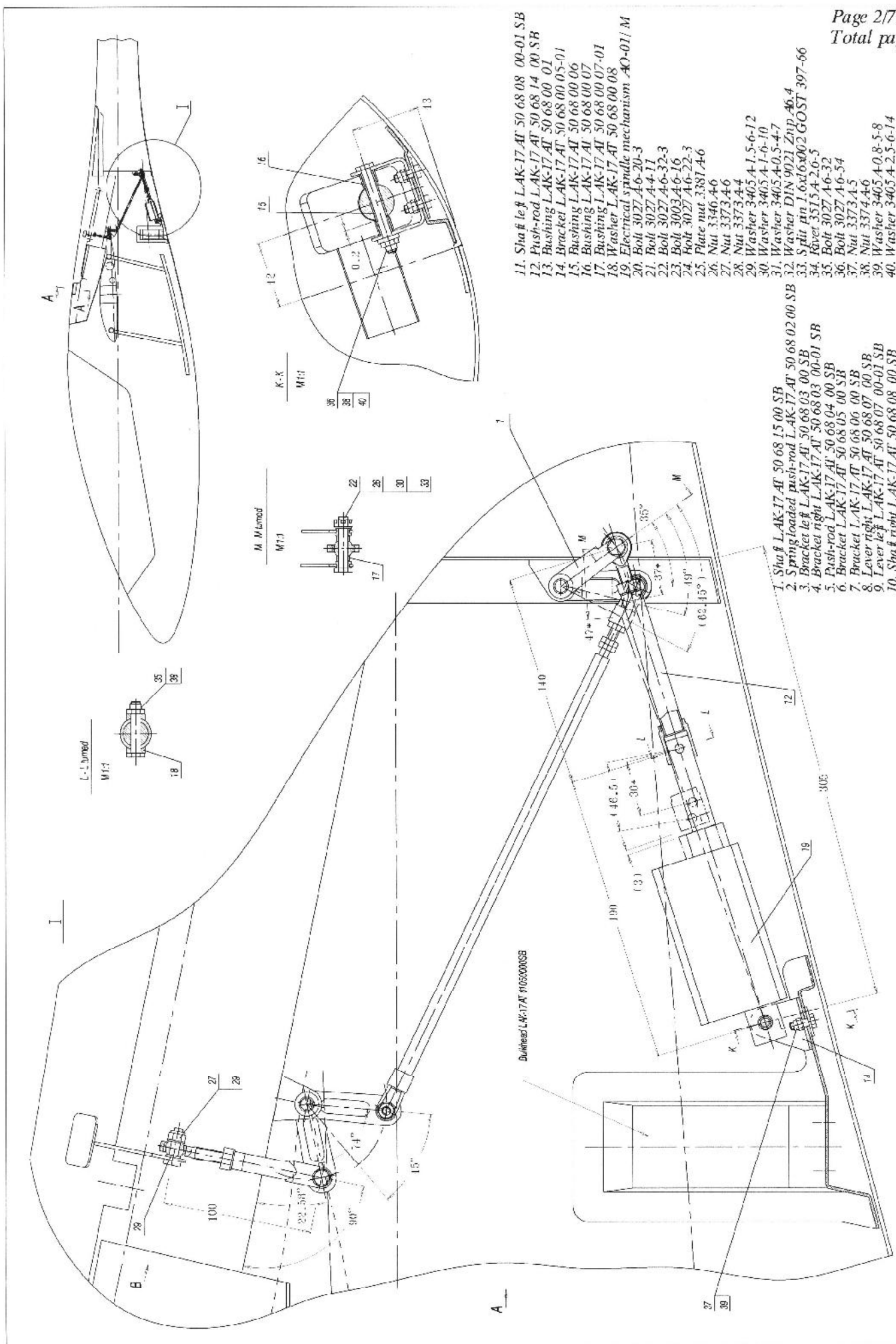


Fig. 2-26a Power-plant bay door

Left side door LAK-17 AT69030000SB

Right side door LAK-17 AT69030000-01SB

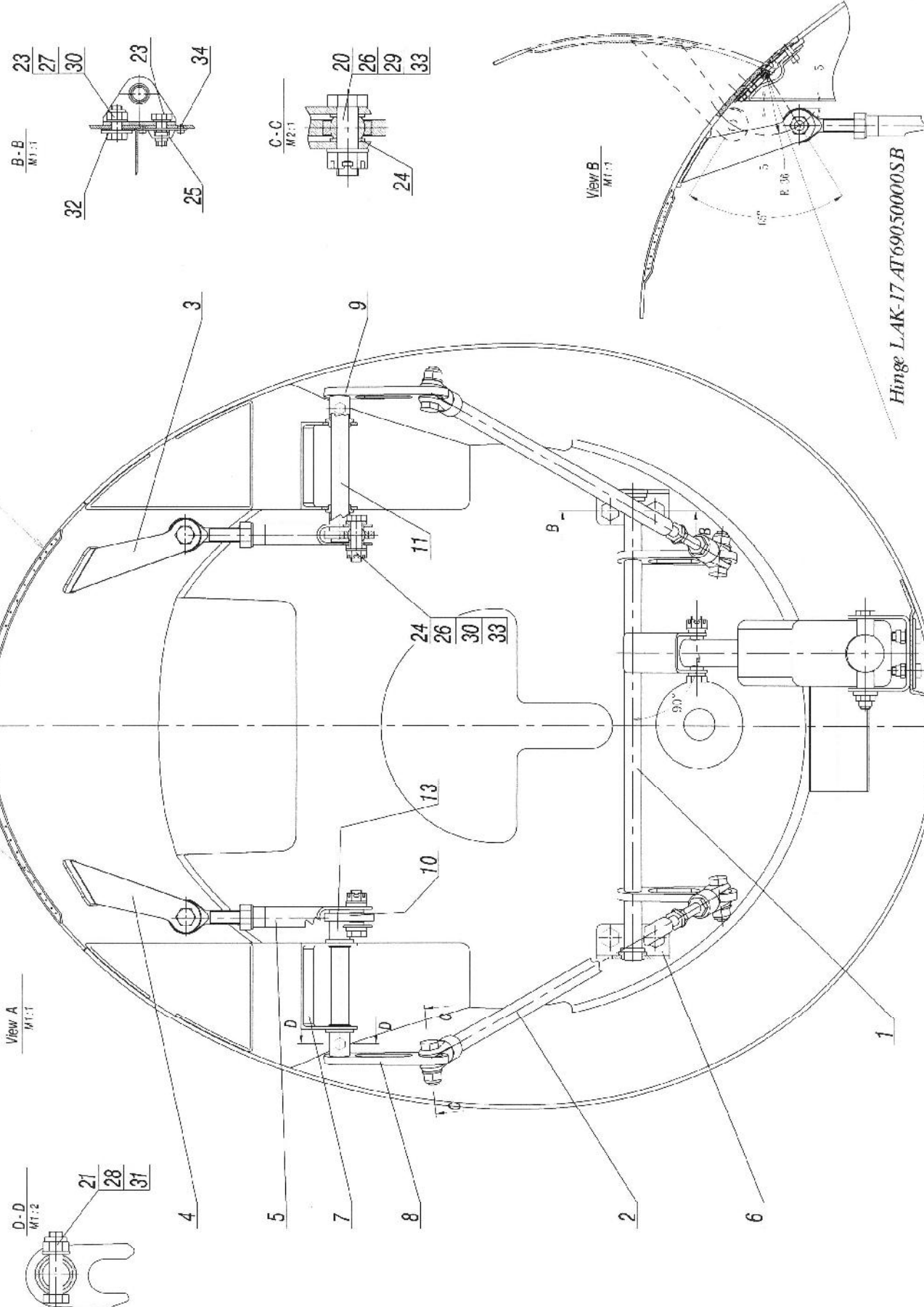


Fig 2-26b Power-plant bay door

A - A

Right side door LAK-17 AT69080000-01SB

Left side door LAK-17 AT69080000SB



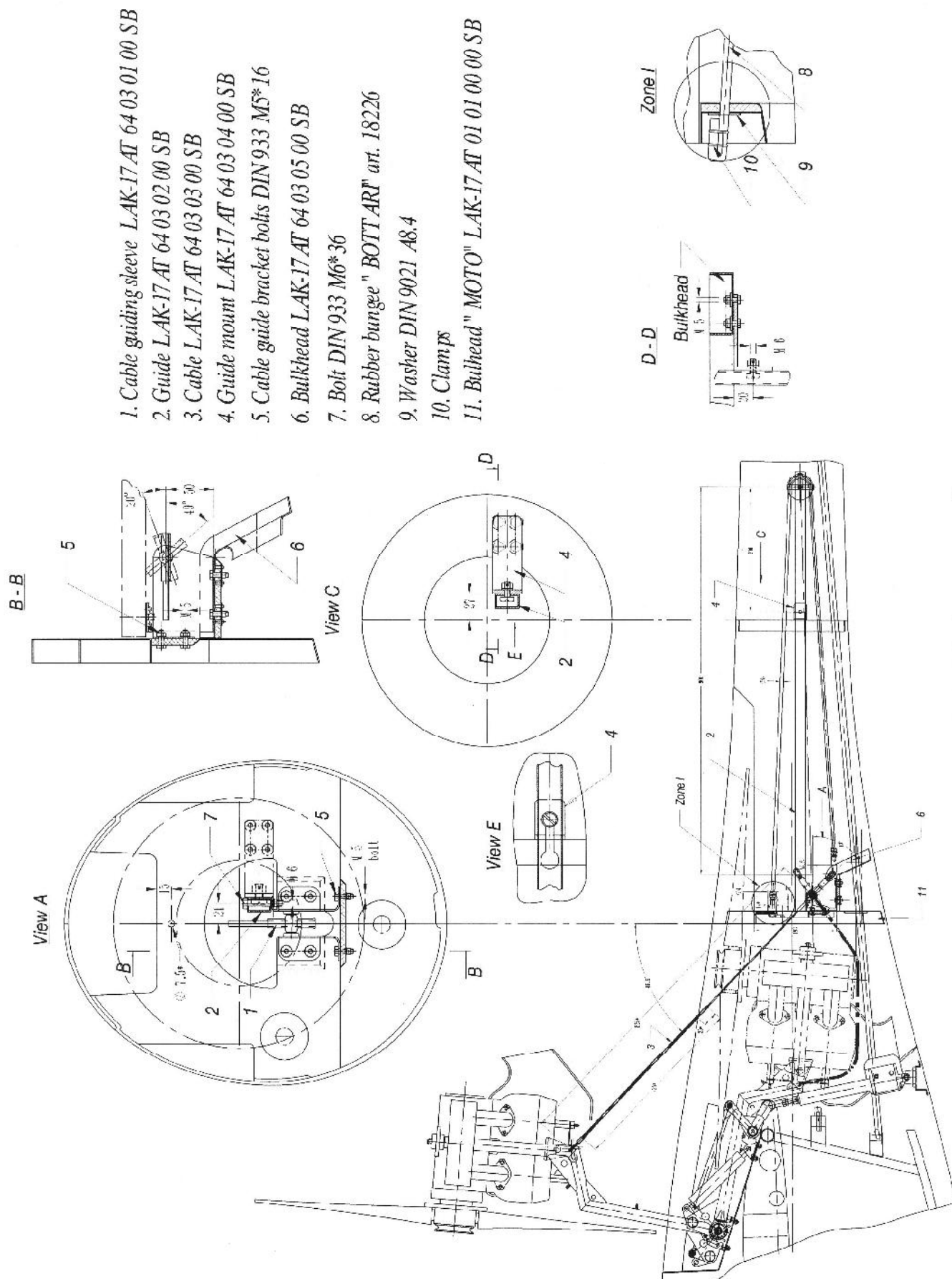


Fig 2-27 Engine support cable

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/1 Total pages 33
---------	--------------------	--------------	----------------------------

SECTION 3

Sailplane maintenance

	Page
3.1 Sailplane current maintenance	2
3.1.1 Daily inspection	2
3.1.2 Post flight inspection.....	3
3.1.3 Ground handling.....	3
3.1.4 Storing and transportation	4
3.1.5 Cleaning and clean keeping	4
3.1.6 Rigging and de-rigging of a sailplane	4
3.2 Lubrication system.....	6
3.3 Adjustment	6
3.3.1 Adjustment of airbrakes.....	6
3.3.2 Adjustment of main wheel brake control system	7
3.3.3 Adjustment of cockpit canopy emergency jettison system	7
3.3.4 Adjustment of rudder control system	7
3.3.5 Adjustment of power-plant extraction/retraction and retaining cable	7
3.4 De-rigging and rigging of sailplane parts	8
3.4.1 De-rigging and rigging of ailerons	8
3.4.2 De-rigging and rigging of a rudder	9
3.4.3 De-rigging and rigging of an elevator	9
3.4.4 De-rigging and rigging of a trimmer	9
3.4.5 De-rigging and rigging of a cockpit canopy	9
3.4.6 Removal and installation of main landing gear wheel	10
3.4.7 Removal and installation of tail wheel.....	12
3.4.8 Taking out and mounting of an instrument panel	12

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/2 Total pages 33
---------	--------------------	--------------	----------------------------

3.4.9	Taking out and mounting of pilot cockpit floor	12
3.4.10	Removing and installing the fuel tank	13
3.4.11	Removing and installing the engine retaining cable	13
3.4.12	Removing and installing the engine	13
3.4.13	Mounting and removal of the propeller	14
3.5	Illustrations	14

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. 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,
 - operation of the motor control unit MCU,
 - 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,
 - deflections of ailerons and their clearances,
 - airbrakes for proper function and locking,
 - fixing of ailerons attachment to the wing,
 - clearance in respect of the fuselage,
 - winglets or wing tips installed, locked and secured.
5. Check function of control systems (of an aileron, airbrakes), their connections to corresponding control systems in the fuselage.
6. Check the fuselage surface.
7. Check the stabilizer, elevator and rudder:
 - surfaces,

Date: 01 March 2006	Rev. No.0
---------------------	-----------

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/3 Total pages 33
---------	--------------------	--------------	----------------------------

- 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 power-plant installation:
- all bolted, screwed connections and their securing;
 - function of decompressor, fuel cock and propeller brake;
 - ignition system incl. wires and the spark plug connectors for tight fit;
 - engine retaining cable for wear and its connections to the engine and fuselage structure;
 - fuel lines, electrical wires, bowden cables and structural parts for wear and kinks;
 - exhaust muffler, propeller flange and accessories for tight fit and any cracking;
 - apply moderate pressure to the propeller in forward, backward and sideward direction to check if the bolted connection between the engine block and the propeller mount or anything else is loose or damaged. Check the rubber engine mounts;
 - visual check of the propeller;

Warning: make sure ignition is switched off before you turn propeller by hand.

- turn the propeller one revolution by hand listen for abnormal sounds which may indicate engine damage;
 - check the fuel level;
 - drain condensed water from the fuel tank. The drainer is located in the main wheel box on the rear wall;
 - check the fuel tank vent line outlet for cleanliness, the outlet is located directly behind the landing gear box;
 - check the fuel filter for dirt or sludge, the filter is located in the power-plant bay on a right side.
10. Check the extension-retraction mechanism by operating it in both directions. Extension and retraction time must not exceed 12 seconds.

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 canopy cover.

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/4 Total pages 33
---------	--------------------	--------------	----------------------------

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 airfield is 6 km/h,
- during ground-towing the stick shall be fastened with safety belts, power-plant retracted and a sailplane cockpit canopy shall be closed;
- for ground towing the engine has to be retracted.

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, engine must be specially preserved for such a storage (see SOLO 2350 engine manual).

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

3.1.5 Cleaning and clean keeping

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 the penetrability of the hole.

The sailplane shall be washed with clean water using a soft cloth. After washing check drainage openings are clear of.

3.1.6 Rigging and de-rigging of a sailplane

Caution: It's not allowed to rig or de-rig wings with 18m wingtips or winglets installed. These must first be removed from the wing.

1. Use a sailplane rigging team of 2 persons (or 3 - if special rigging equipment isn't used).
2. Rigging equipment: fuselage supporter (holder), wing tip supporter (holder 1,2 m of height).
3. Rigging procedures (fig. 3-2a, fig. 3-2b, fig. 3-2c, fig. 3-2d):
 - 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,

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/5 Total pages 33
---------	--------------------	--------------	----------------------------

-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, airbrakes and water ballast shall be in such position that pins in control shafts of ailerons 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, 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, 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 wing tips: for this screw bolt M5 into the wing tip or winglet fixator (pos.12) and pull it out until it reaches stop. While holding fixator in lifted position, pull the wingtip or winglet out so it disengages the locking device. Release fixator, remove the bolt. Remove the wingtip or winglet.

- fit spar ends of wing tips (pos. 13) into recesses correspondingly in end ribs of left and right wings and push them to the end until hubs in ribs of wing tips (pos. 14) push onto the corresponding them connection pins in end ribs of wings (pos. 15) and coverings of wings tips and wings ends come together without any slots. When connecting of wing tips of 18 m variant it is necessary to hold the ailerons of wing tips and wings in such position that tongues on ailerons ends of wing tips (pos. 17) coincide with corresponding sockets (pos. 16) on the ends of wing ailerons, then aileron controls of wing tip from the main wing ailerons connect automatically. In order to improve an aerodynamic cleanness of surface the connection slot between wing tips and wings later is covered with sticky tape.

- loosen fixators (wing tips thus fix automatically), unscrew bolts from fixators and cover openings for bolts with sticky tape.

Caution: check the reliability of the wing tip connections to the wing by trying to pull them out by their ends applying force of 10-20 kg. With fixators down they have to hold the wings tips reliably not allowing any movement. If the wing tips move or the slot between tip and wing in their coverings connection place has increased separate the ends, find out the reason and eliminate it.

- when the stabilizer is being connected (fig. 3-3a, fig. 3-3b) 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

Date: 01 March 2006	Rev. No.0
---------------------	-----------

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/6 Total pages 33
---------	--------------------	--------------	----------------------------

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, 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. 3-2a, pos. 3) shall be adjusted.

4. 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. 3-3b, pos.7).

3.2 Lubrication system

Lubricants:

- (a) 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.

- (b) 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. 3-4 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 and airbrakes and hinges of rods.
5. Levers and hinges of airbrakes.
6. The wing water ballast tank valve and sealing.
7. Hinges of ailerons and connection joint of lever.
8. Hinges of ailerons of wing tips.
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. De-compressor, propeller brake mechanisms.
15. Hinged connections of the power-plant extension/retraction system.
16. Power-plant door hinges and actuating system hinged connections.

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

3.3 Adjustment

3.3.1 Adjustment of airbrakes

If airbrakes (fig. 3-5, 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.

Date: 30 01 2008	Rev. No.1
------------------	-----------

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/7 Total pages 33
---------	--------------------	--------------	----------------------------

3.3.2 Adjustment of main wheel brake control system

Adjustment of control system of landing gear brake (fig. 2-12a) is performed doing these operations:

- disconnect the plate pos. 10 from the lever pos. 5,
- loosen the nut pos. 11,
- turn up the plate pos. 10 into required position,
- fix the plate pos. 10 by screwing the nut pos. 11,
- connect the lever pos. 5.

3.3.3 Adjustment of cockpit canopy emergency jettison system

The cockpit canopy emergency jettison system (fig. 2-18a, fig. 2-18b) 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. 2-8a, fig. 2-8b). 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 $\phi 1.0$ mm (pos. 10). Refer to fig. 2-8b (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 $2,5 \pm 0,2$ daN. Motion of pedals shall be smooth and even.

3.3.5 Adjustment of power-plant extraction/retraction and retaining cable

The following power-plant items has to be checked and adjusted if out of allowable range:

Date: 01 March 2006		Rcv. No.0
---------------------	--	-----------

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/8 Total pages 33
---------	--------------------	--------------	----------------------------

1. The angle of power-plant extraction at the extended position.
2. Power-plant at the retracted position.
3. Power-plant retaining cable.

Adjustment of extension/retraction angles. End switches (p/n V3SY1 manufacture Saia Burgess) are located: for retracted position on a right side power-plant bay beam and is switched by the screw on the engine at the retracted position; for extracted position - switch is located on the engine mount box and is switch by the retraction system shaft. Moment of switching on end switches can be adjusted by adjustment screws. At extended position angle has to be $103^{\circ} \pm 0.5^{\circ}$ (see Fig 2-22). To measure this angle place the straight edge on the fuselage lift pins. Using protractor measure the angle of the pins to the horizon. Than measure angle of engine frame tube, as shown at the drawing, to the horizon. Subtract the angles. At retracted position engine has to bottom down on a cushions at a bottom of the engine bay.

Retaining cable together with the rubber bungee cord has to be checked for wear and adjusted so, that the tension on a cable when engine is in extended position is not more as if 3 daN (6,7lbs.), but sufficient enough to keep cable on a tension. At the same time cable has to be adjusted so that when engine is at extended position (engine stopped), the clearance between the sleeve at the aft end of the cable and the metal bushing p.1 (Fig.2-27) has to be minimum 1 mm, but not more as if 3 mm.

3.4 De-rigging and rigging of sailplane parts

3.4.1 De-rigging and rigging of ailerons

The aileron of wing tip L = 1650 mm is de-rigged and rigged doing these operations (fig. 3-6):

1. Removal of the aileron:
 - remove split pins (pos. 3),
 - take off washers (pos. 2),
 - take away hinge pins (pos. 1).
2. Installation of an aileron:
 - fit the aileron to the hinge brackets,
 - insert pins(pos. 1),
 - put on washers(pos. 2),
 - lock the hinge pins with split pins (pos. 3).

The wing aileron is de-rigged and rigged doing these operations (fig. 3-7):

1. De-rigging of control rod:
 - remove the rivet (pos. 1) and discard,
 - remove the intermediate hubs (pos. 2).
2. Removal of an aileron:
 - remove wire split pins (pos. 5),
 - take off washers(pos. 4),
 - take away hinge pins (pos. 3).

Wing aileron is installed doing these operations:

1. Setting of an aileron:
 - fit the aileron to the hinge brackets,
 - push through pins (pos. 3),
 - put on washers(pos. 4),
 - lock the hinge pins with wire split pins (pos. 5).

Date: 01 March 2006		Rev. No.0
---------------------	--	-----------

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/9 Total pages 33
---------	--------------------	--------------	----------------------------

2. Connect 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 the manufacture.

3.4.2 De-rigging and rigging of a rudder (fig. 3-9a, fig. 3-9b)

Note: Full disconnection of rudder from fin 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 hinge pins 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.

3.4.3 De-rigging and rigging of an elevator

1. Operations used for de-rigging of an elevator (fig. 3-10):

- 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).

3.4.4 De-rigging and rigging of a trimmer

It is possible to de-rig and rig a trimmer (Fig.2-7) through the inspection hatches (pos 8, 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.

3.4.5 De-rigging and rigging of a cockpit canopy

1. De-rigging of the cockpit canopy (fig. 2-18a, fig. 2-18b):

Date: 30 01 2008	Rev. No.1
------------------	-----------

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/10 Total pages 33
---------	--------------------	--------------	-----------------------------

- 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.

3.4.6 Removal and installation of main landing gear wheel

De-rigging of main gear wheel (fig. 3-11) is performed by theses operations:

- unbend edge of the supporting plate (pos. 1) of gear door from head of the bolt (pos. 2),
- unscrew the bolt (pos. 2),
- unscrew bolts (pos. 13) of the hydraulic cylinder (pos. 12) and remove the plate (pos. 14),
- remove an axle of gear wheel (pos. 4) removing together hubs (pos. 5, pos. 6) and support plate (pos. 7) of the main gear door,
- remove the wheel,
- leave the torque plate (pos. 3) with the hydraulic cylinder (pos. 12) in connected position together with the support (pos. 15),
- unscrew bolts (pos. 8) of the rim (pos. 10), remove the disk (pos. 9), disconnect sides of rim body and remove tyre (pos. 11) together with inner tube.

Rigging of wheel and fastening of it is performed in opposite order.

Remarks:

1. Before screwing up the bolts (pos. 8) which connect the sides of the rim body (pos. 10) and the disk (pos. 9), it is necessary to move the tyre slightly side-ways and superpose marks A on the tyre and the rim.
2. After mounting a wheel check up the gap B between hubs (pos. 5 and pos. 6). The gap B shall be equal to $0,25 \div 0,3$ mm.

• **Wheel Brake**

The main wheel brake is a Parker / Hannifin, Cleveland hydraulic disc brake.

Brake assembly #30-9A.

Disc #164-01700.

Lining #66-106.

Master cylinder #10-55A.

Refer to the Technicians Service Guide. Cleveland Wheels and Brakes from Parker Aerospace for more information.

Removal and Installation

Remove the wheel brake by cutting the safety wire and unscrewing the two 1/4 dia. AN bolts that hold the brake shoe backing plate. Remove the backing plate and slide the brake

Date: 30 01 2008	Rev. No.1
------------------	-----------

assembly out of the torque plate. Unless you intend to remove the brake unit completely do not unscrew the hydraulic hose.

Note: When the backing plate is removed do not actuate the wheel brake. Doing so will force the brake piston out and hydraulic fluid will be lost.

Adjusting of wheel brake actuation point

The wheel brake actuation point is adjusted by the threaded rod located on the hydraulic master cylinder. Loosen the jam nut and rotate the threaded rod to lengthen or shorten the linkage as necessary. With proper adjustment the wheel brake should engage with full deployment of the air brakes.

Wear Limits

The minimum replacement thickness for the brake linings is 0.100 in. (2.54 mm).

Part number 66-106.

The minimum thickness for the disc is 0.171 in. (4.241 mm).

Disc part number is 164-01700.

The torque of the 1/4 dia. bolts for the brake shoe backing plate is 60 in. lb. (6.8 Nm) Dry torque.

See the Technician's Service Guide, Cleveland Wheels and Brakes as referenced in Section 11 for further details.

Servicing the Hydraulic Fluid Reservoir

If hydraulic fluid is visible in the hose going from the reservoir to the master cylinder then fluid can be added through the top of the reservoir. Be careful not to block the vent hole in the reservoir cap when reassembling.

If the hydraulic fluid is not visible in the reservoir or in the hose going to the master cylinder it is likely that air has entered the system. The system should then be serviced from the bottom to the top using the following method.

A simple filling device is a funnel with a length of plastic tubing attached that has an inside diameter of 1/4 in. (6 mm). Fill the funnel about 3/4 full with clean brake fluid. Let the fluid push the air out of the hose. Remove the dust cap from the servicing nipple on the brake assembly and slip the hose over it. Unscrew the servicing nipple about 3/4 of a turn. Be very careful that no air enters the line during these steps. Insure there is enough fluid in the funnel. By holding the funnel above the level of the fluid reservoir, hydraulic fluid will flow into the brake lines. Continue filling until the reservoir is about 2/3 full. Tighten the nipple and remove the filling device. Install the dust cap on the nipple.

If there is fluid in the reservoir the following method can be used to bleed air out. Connect a hose from the bleeder nipple on the brake assembly to a clear container with brake fluid in it. Apply pressure to the system via the air brake handle and open the bleeder nipple. Repeat the process of opening and closing the bleed nipple as you apply pressure to the system. If the hose stays submerged in the fluid air should not enter the system. Be sure not to run out of fluid in the reservoir.

An aid to bleeding air from the system is to remove the master cylinder from its mounts but keep the hoses connected. Turn it so the chrome rod is pointing up at about a 45 deg. angle.

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/12 Total pages 33
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Compress the chrome rod several times and watch to see if air bubbles come out of the cylinder and travel through the hose toward the reservoir. Continue compressing the rod till no further air is seen.

The system is considered bled when the chrome rod of the master cylinder moves about 3/16 in. (5 mm) before meeting with very high resistance. It may take several bleeding cycles to rid the system of air. If you are not able to meet the 3/16 in. (5 mm) dimension the master Cylinder may be defective.

If the wheel brake becomes "soft" or weak it may be that air has entered the fluid line.

Warning: Use only brake fluid of a mineral oil base. Mil-H-5606 fluid, ESSO UNIVIS J-13 or Aeroshell fluid 4.

It is recommended to change hydraulic fluid every 10 years.

When changing the hydraulic fluid check if the expiry date of the fluid you intend to use is good for the next ten years.

To change the fluid, open the bleeding valve on a brake caliper and let all fluid to go out. Help by actuating brake handle in a cockpit several times.

Fill system with a new hydraulic fluid as it is described above.

Automobile brake fluids of ester base will quickly destroy the seals. Do not use them.

3.4.7 Removal and installation of tail wheel

To remove the tail wheel (fig. 3-12) 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.

3.4.8 Taking out and mounting of an instrument panel

Do the following operations to take out the instrument panel (fig. 3-13):

- 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.

3.4.9 Taking out and mounting of pilot cockpit floor

The cockpit floor (fig. 3-14) 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.

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/13 Total pages 33
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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.

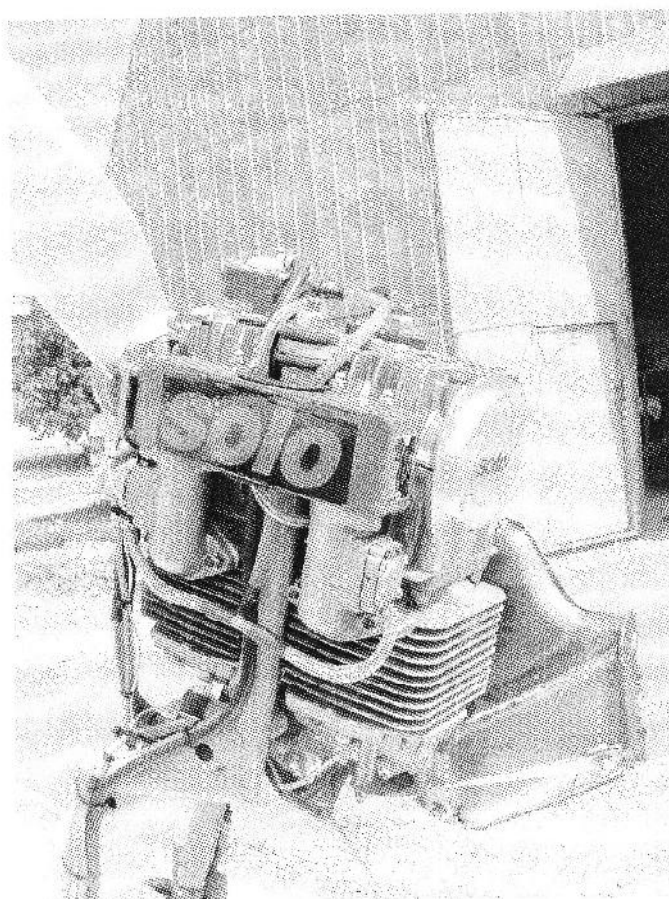
3.4.10 Removing and installing the fuel tank

To remove fuel tank from the glider, drain all fuel from the tank first. Disconnect all fuel lines and fuel level sensor wires at the wires connection. Remove main wheel cover. When main wheel cover is removed, fuel tank can be removed through the cockpit side. To install it, follow the reverse order.

3.4.11 Removing and installing the engine retaining cable

To remove the engine retaining cable, cut retaining cable near the engine mount. Unscrew and remove guide p.2 (Fig. 2-27) fixing bolt p.7. Push guide toward the tail to disengage it from the guide mount p.4. Once you feel guide is disengaged, pull it out from the fuselage. To install it, follow the reverse order.

3.4.12 Removing and installing the engine



General view of the engine installation

To remove the engine from the engine frame, first clearly identify for yourself and make a record which wire, hose or sensor is connected were.

Remove the retaining cable from the engine mount.

LAK-19T	MAINTENANCE MANUAL	Section 3	Page 3/14 Total pages 33
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Unscrew and remove decompression valves from the engine.

Unscrew nut and remove decompression valves arm.

Disconnect all wires, lines and hoses from the engine which would be preventing for the engine to be removed.

Unscrew three mounting bolts which attach engine to the frame - two at the top of the engine and one at the bottom. Lift engine up to remove it from the frame.

To assemble engine back on glider, follow the reverse order.

After engine is reinstalled, check the following:

- all lines and wiring connected correctly and secured;
- no leakage in fuel lines connections;
- all bolted connections assembled correctly and secured;
- propeller brake function correctly;
- decompression valves function correctly;
- check engine extraction/retraction cycle (extension/retraction time should not exceed 12 sec.);
- check engine extracted and retracted position, adjust if needed;
- Start the engine on a ground and run for few minutes to check:
 - ignition is okay;
 - ILEC MCU is functioning properly;
 - on-ground RPM within limits. On the ground RPM should be 4850 ± 100 .

Warning: after the ground run do not retract engine immediately, let it to cool down.

Rubber parts such as fuel lines, shock mounts are lifetime restricted parts and have to be replaced periodically. Refer to the Section 6 of this manual.

3.4.13 Mounting and removal of the propeller

For mounting and removal of the propeller refer to the propeller manual.

Mounting of a propeller must be checked by a licensed inspector.

3.5 Illustrations

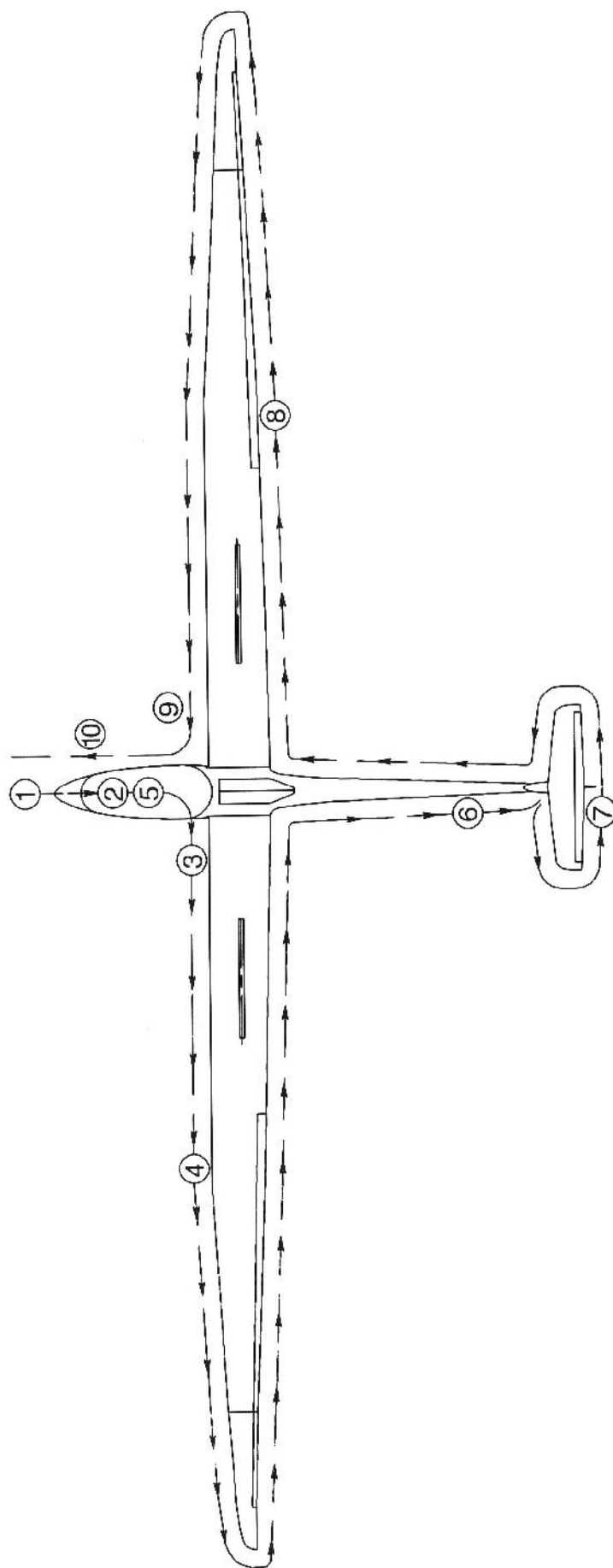


Fig.3 - 1. Scheme of preflight inspection

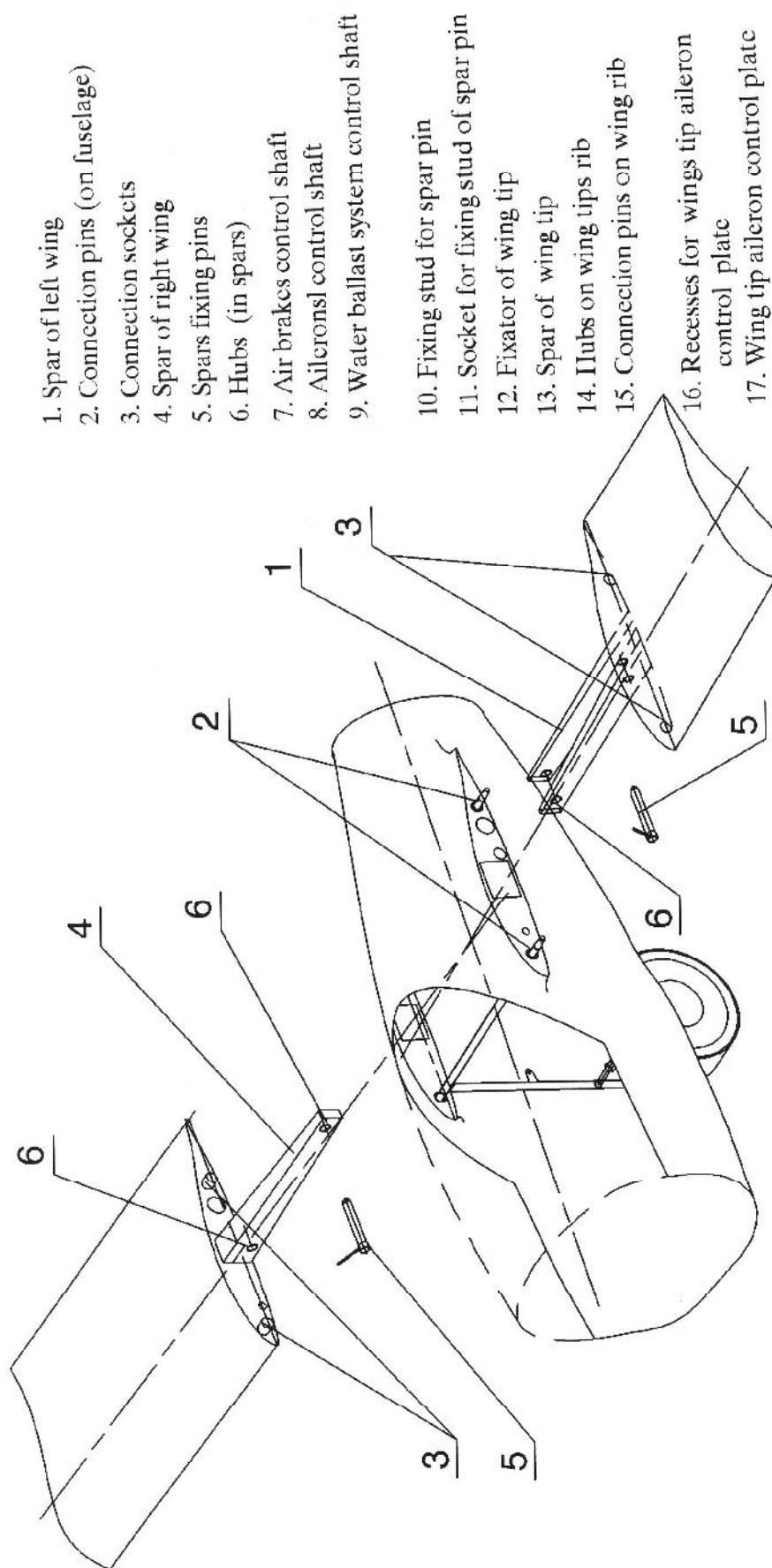


Fig.3 - 2a. Rigging of wing

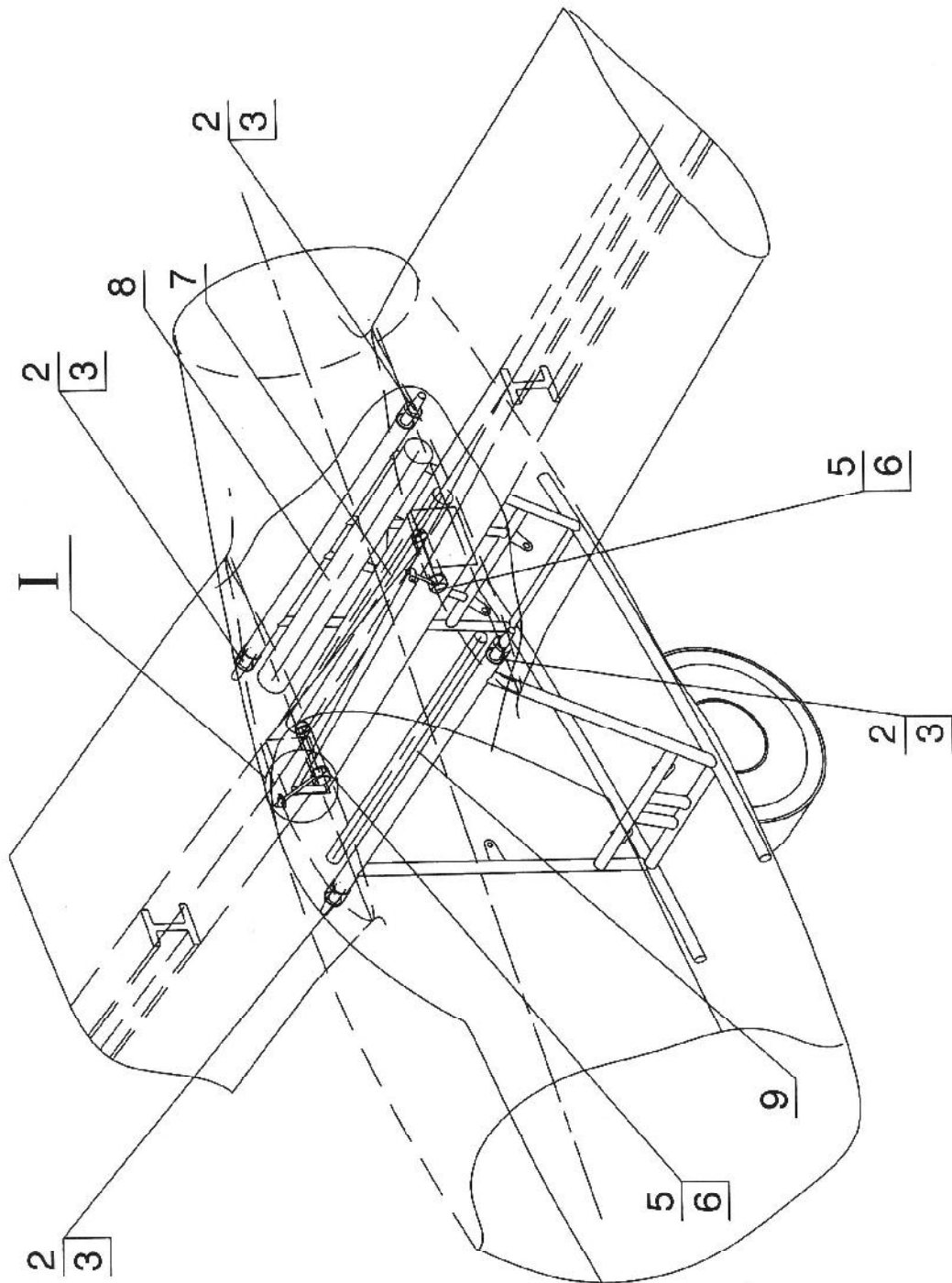


Fig.3 - 2b. Rigging of wing

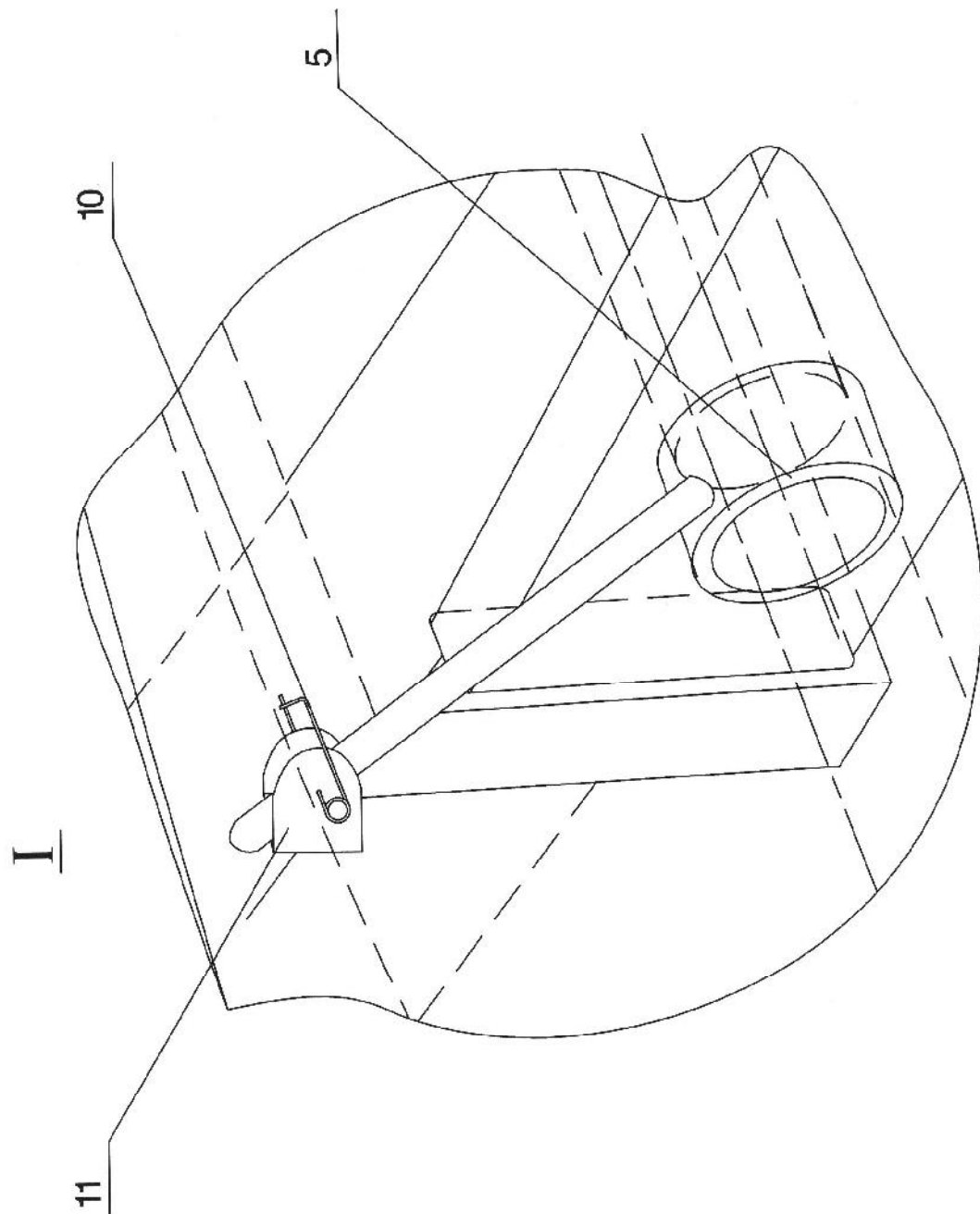


Fig.3 - 2c. Rigging of wing

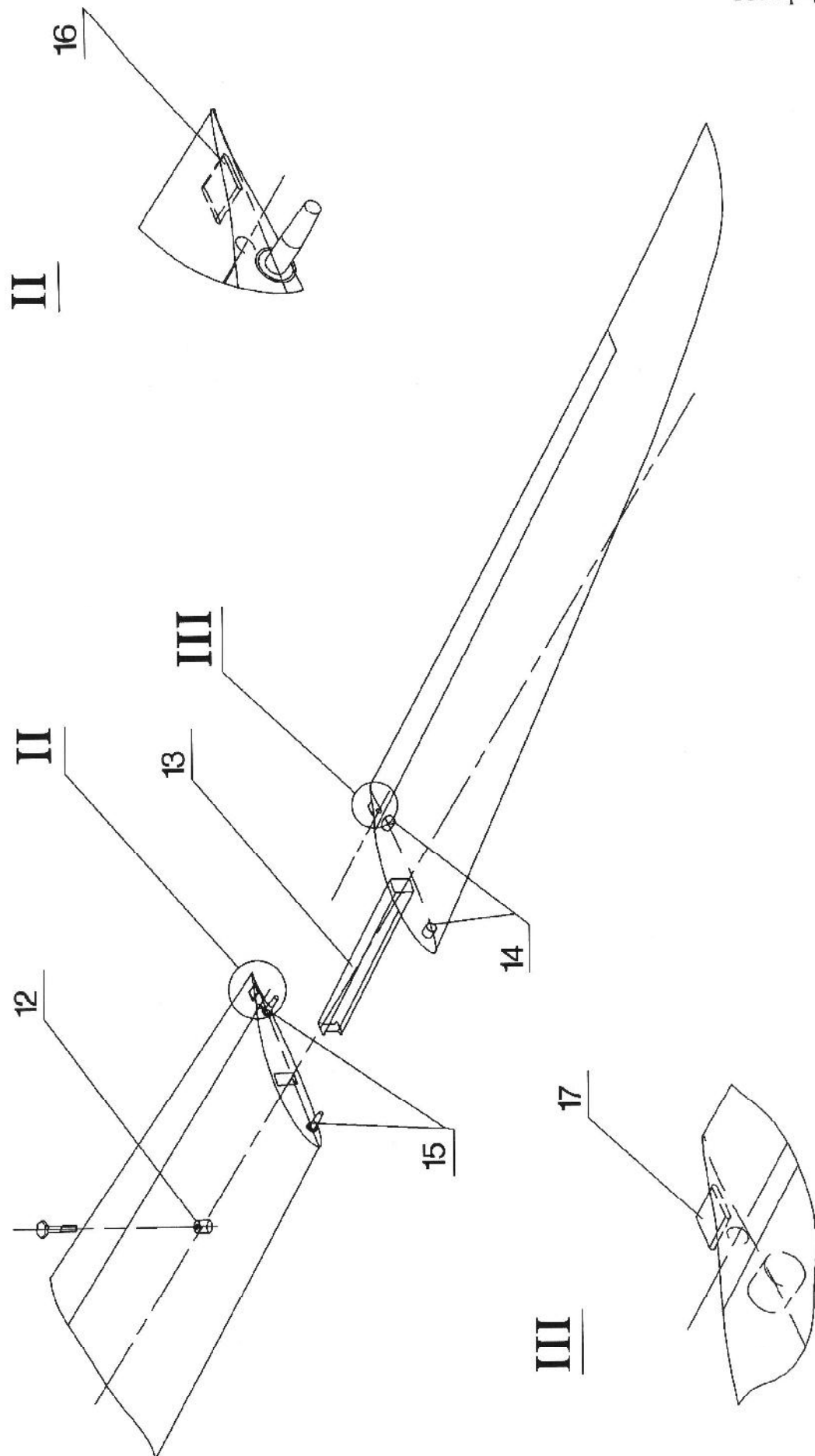


Fig.3 - 2d. Rigging of wing

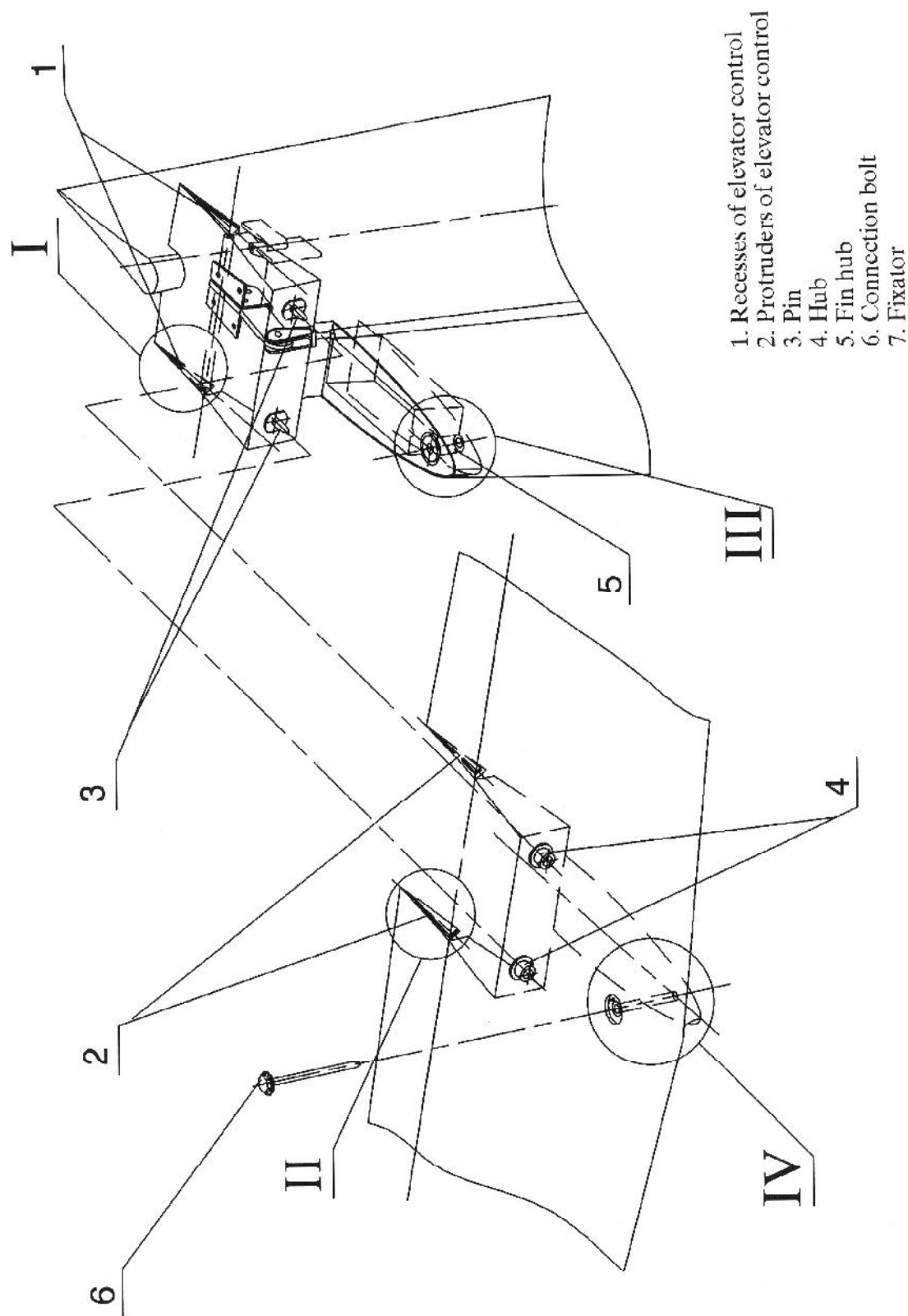
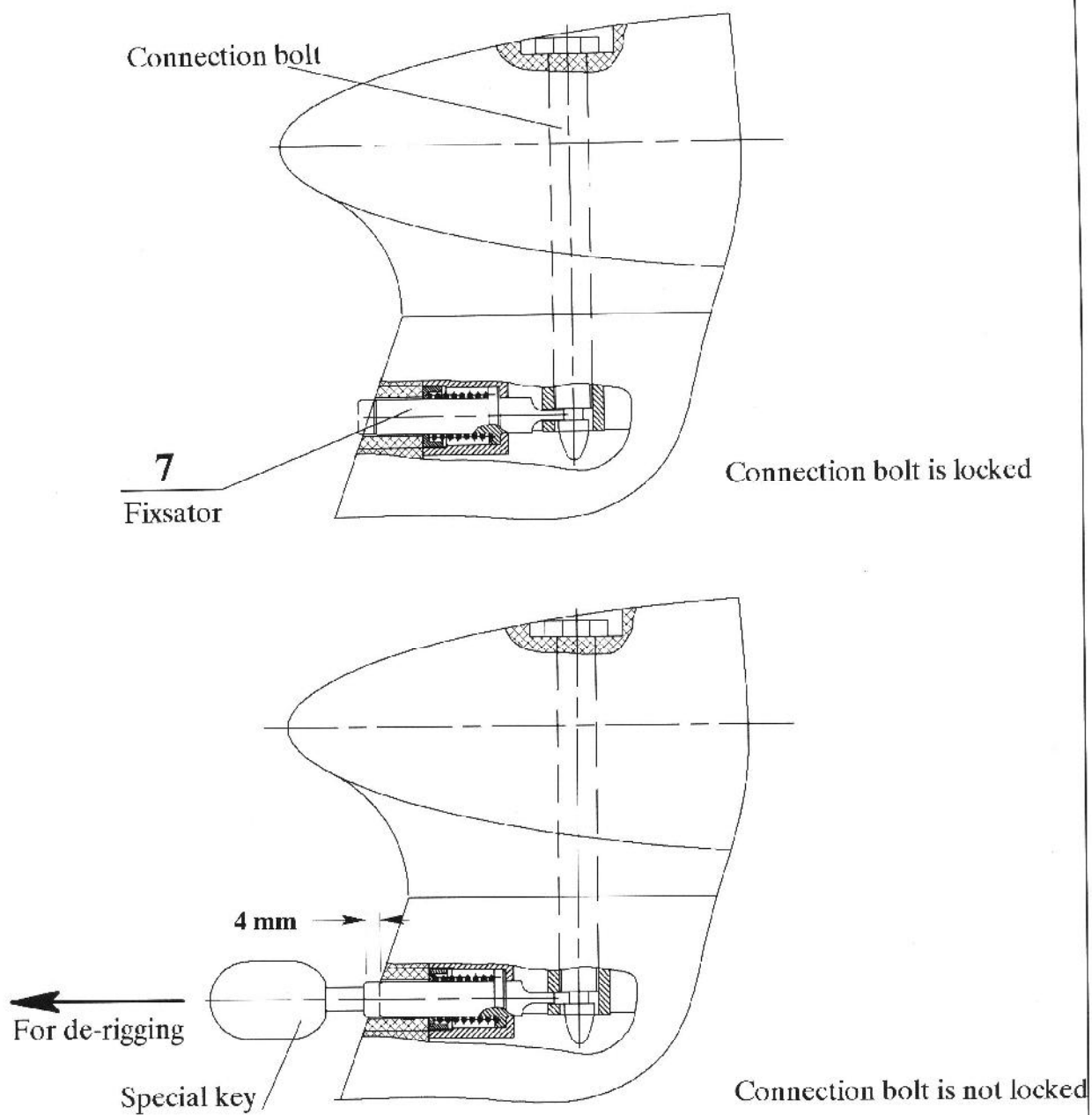


Fig.3 - 3a. Mounting of stabilizer on fin

III, IV



I,II

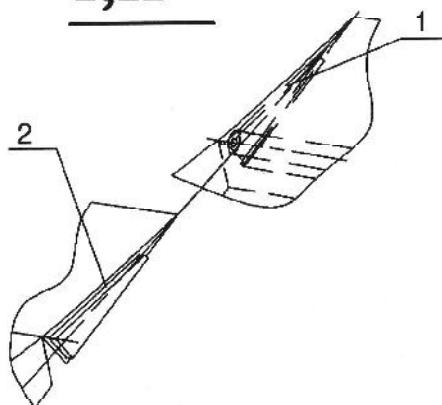


Fig.3 - 3b. Mounting of stabilizer on fin

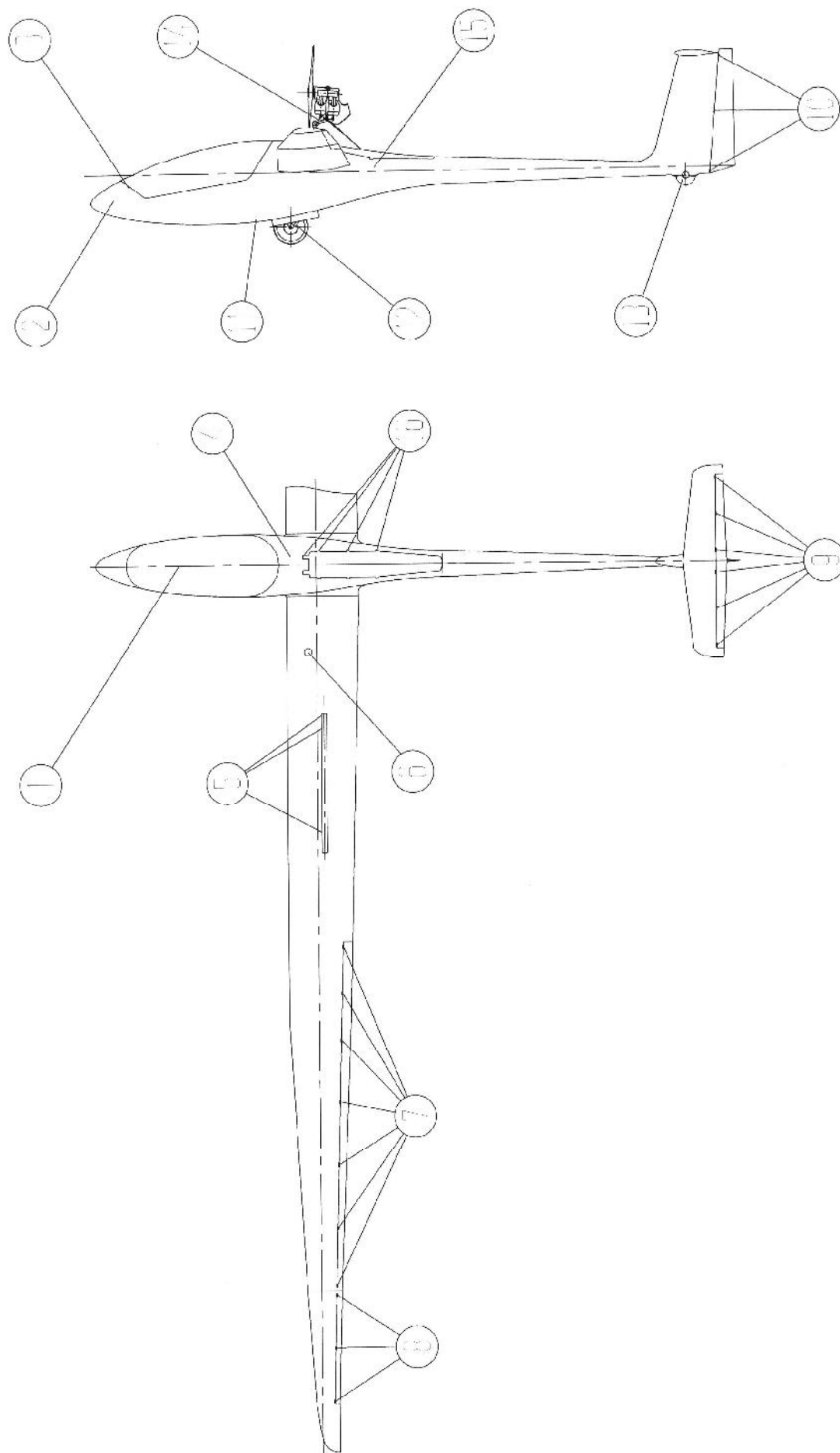


Fig.3 - 4 Lubrication scheme

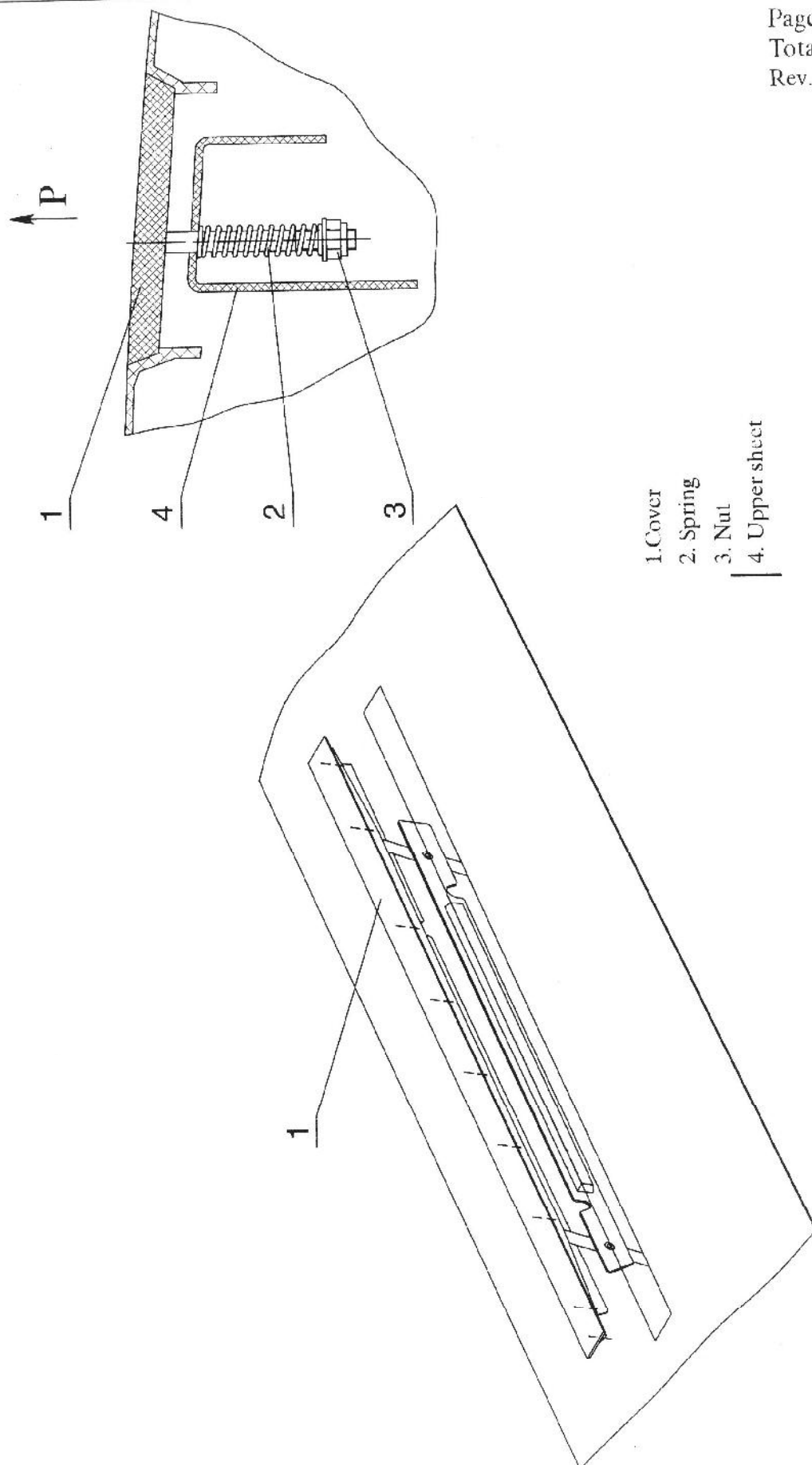


Fig.3 - 5. Adjustment of air brakes covers

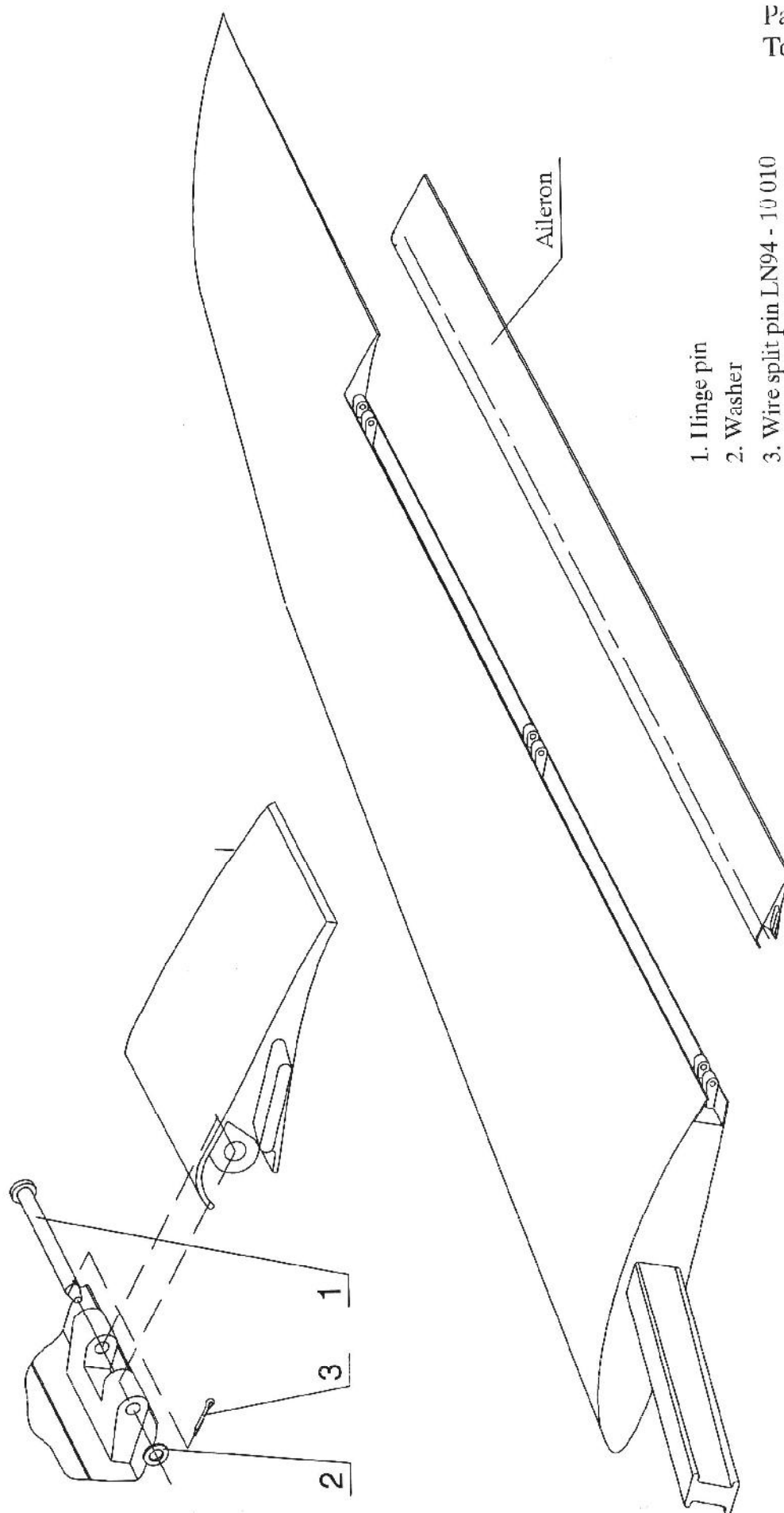


Fig. 3 - 6. Mounting of aileron of wing tip $L = 1650$ mm

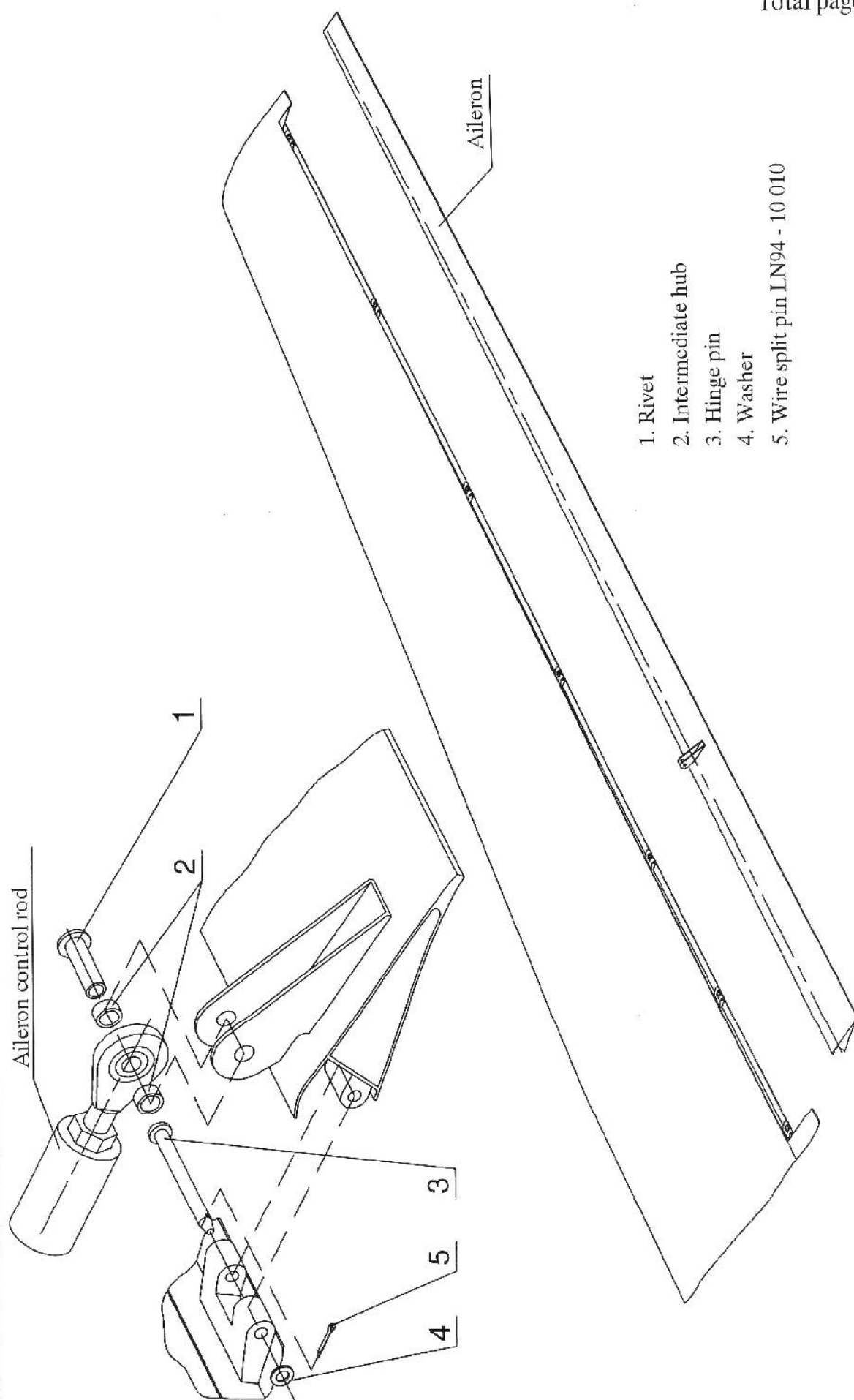


Fig. 3 - 7. Mounting of ailerons

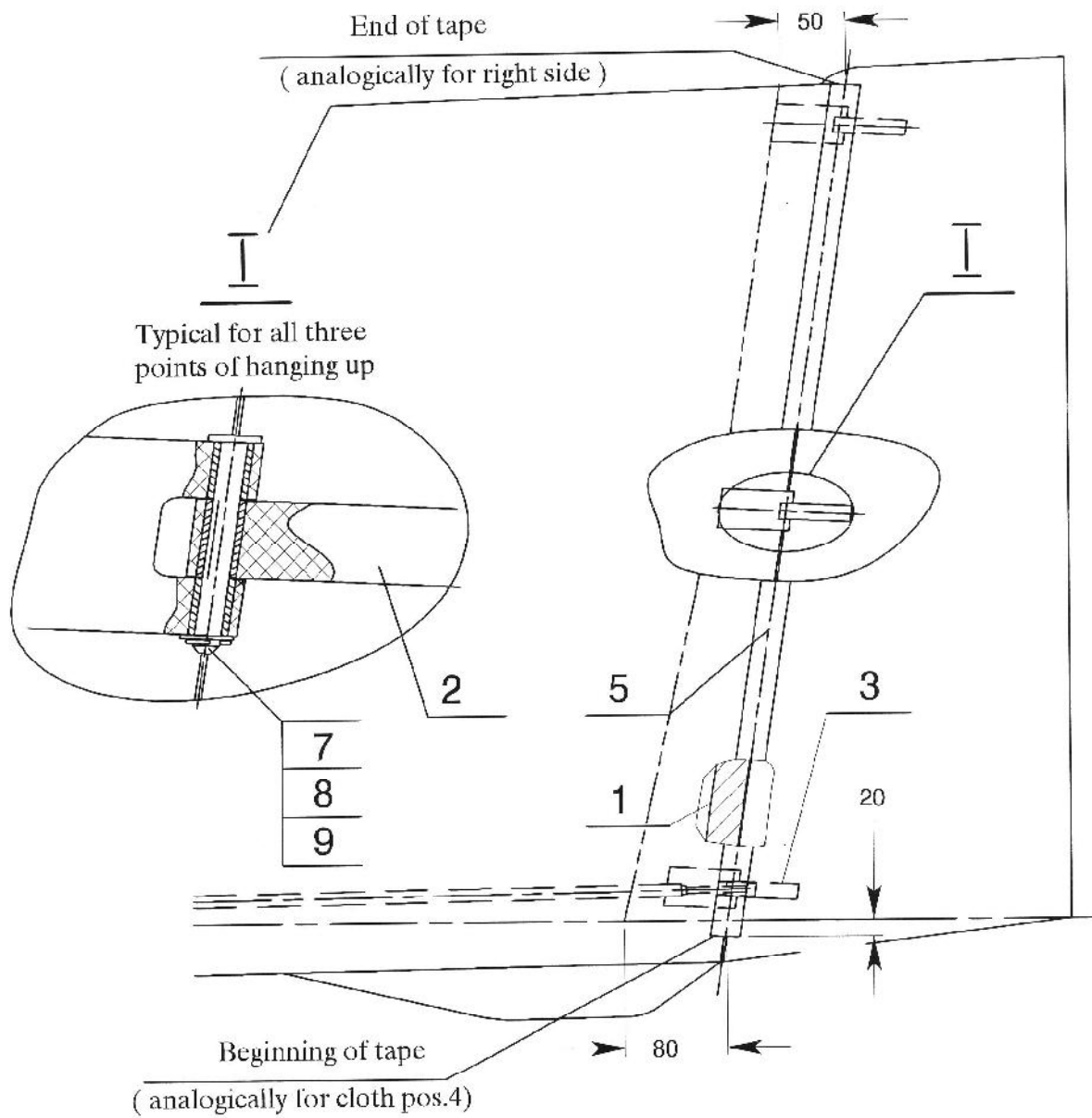


Fig.3 - 9a. Hanging of rudder

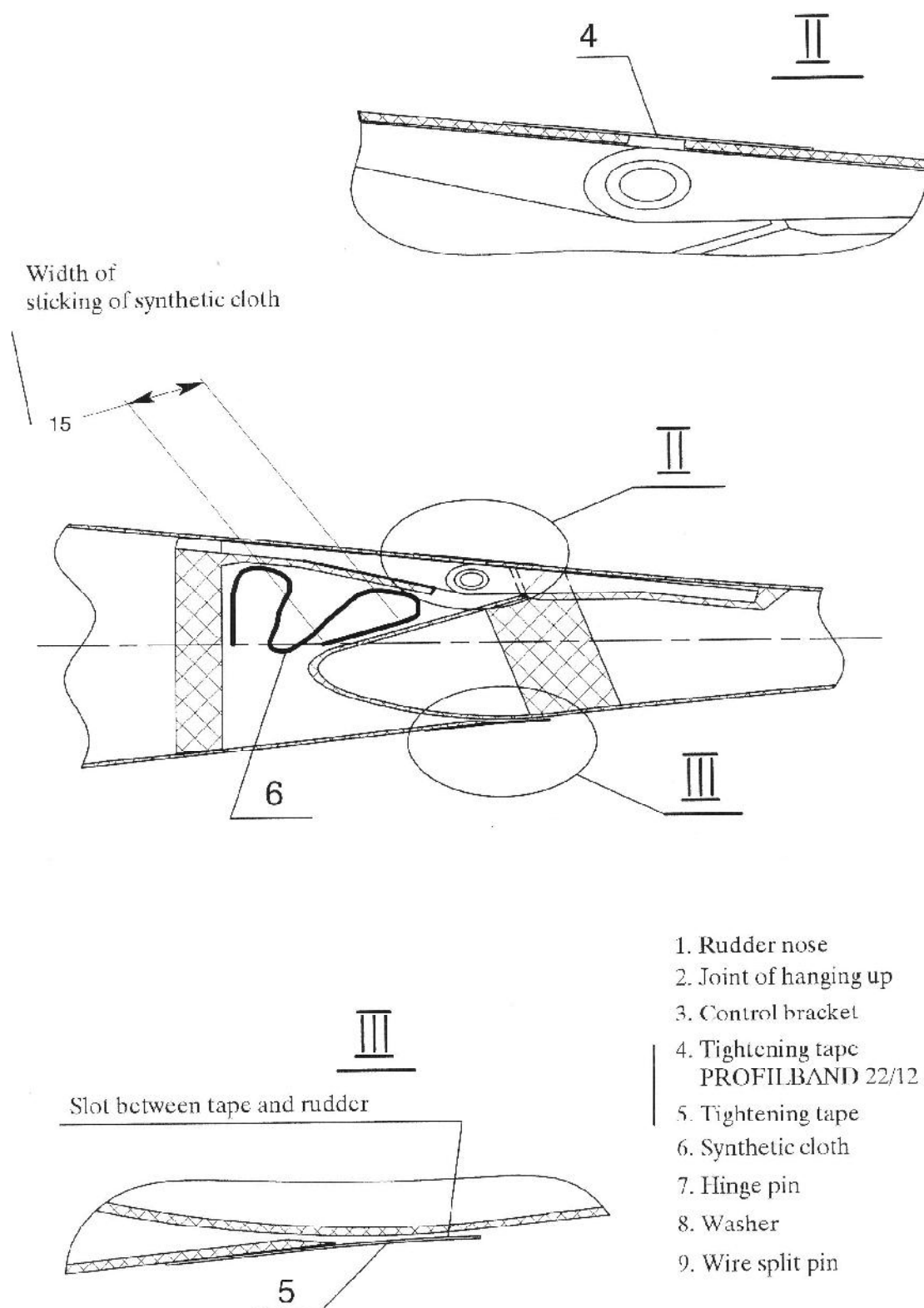
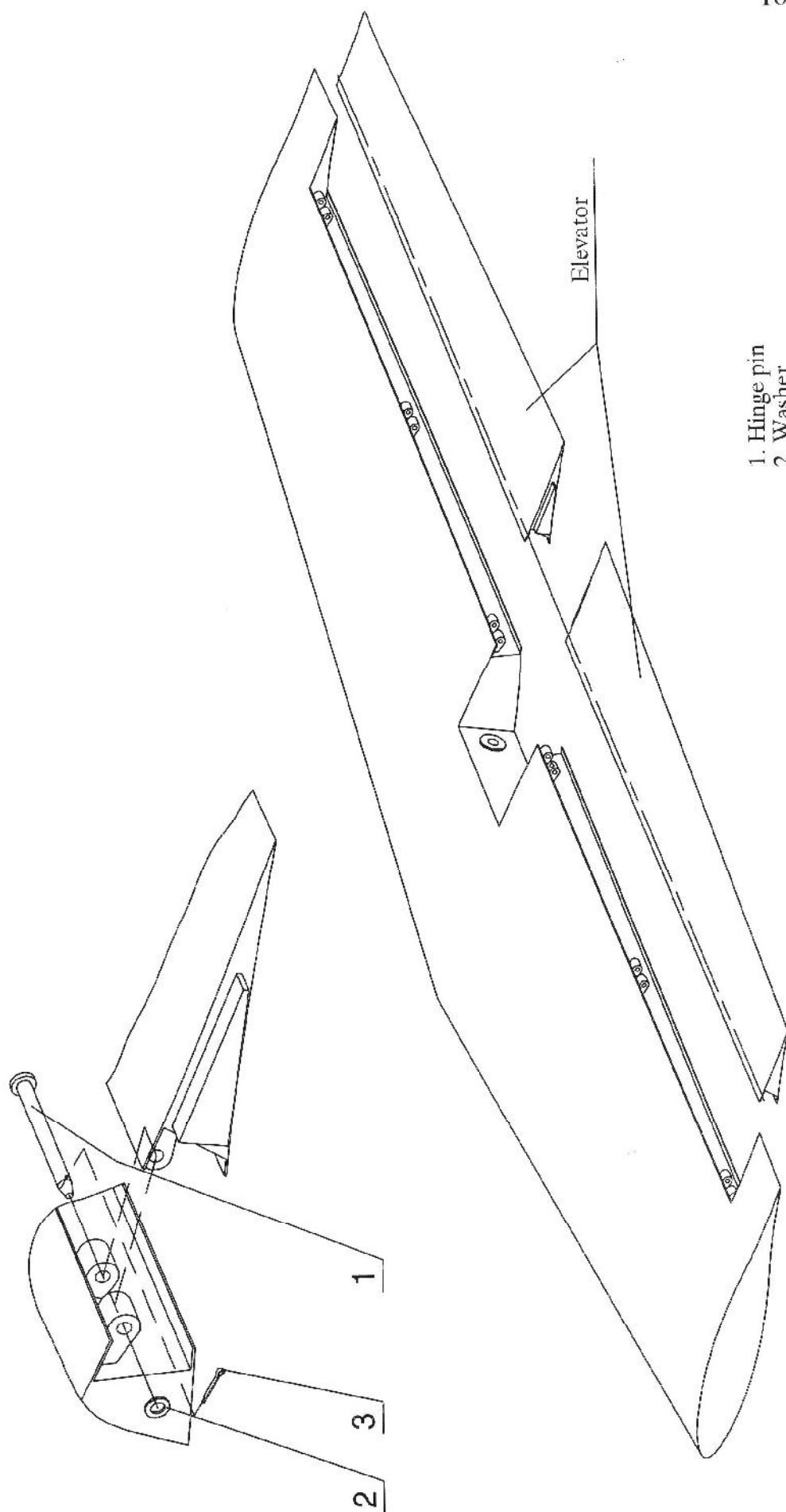


Fig.3 - 9b. Hanging up of rudder



1. Hinge pin
2. Washer
3. Wire split pin LN94-10 010

Fig.3 - 10. Mounting of elevator

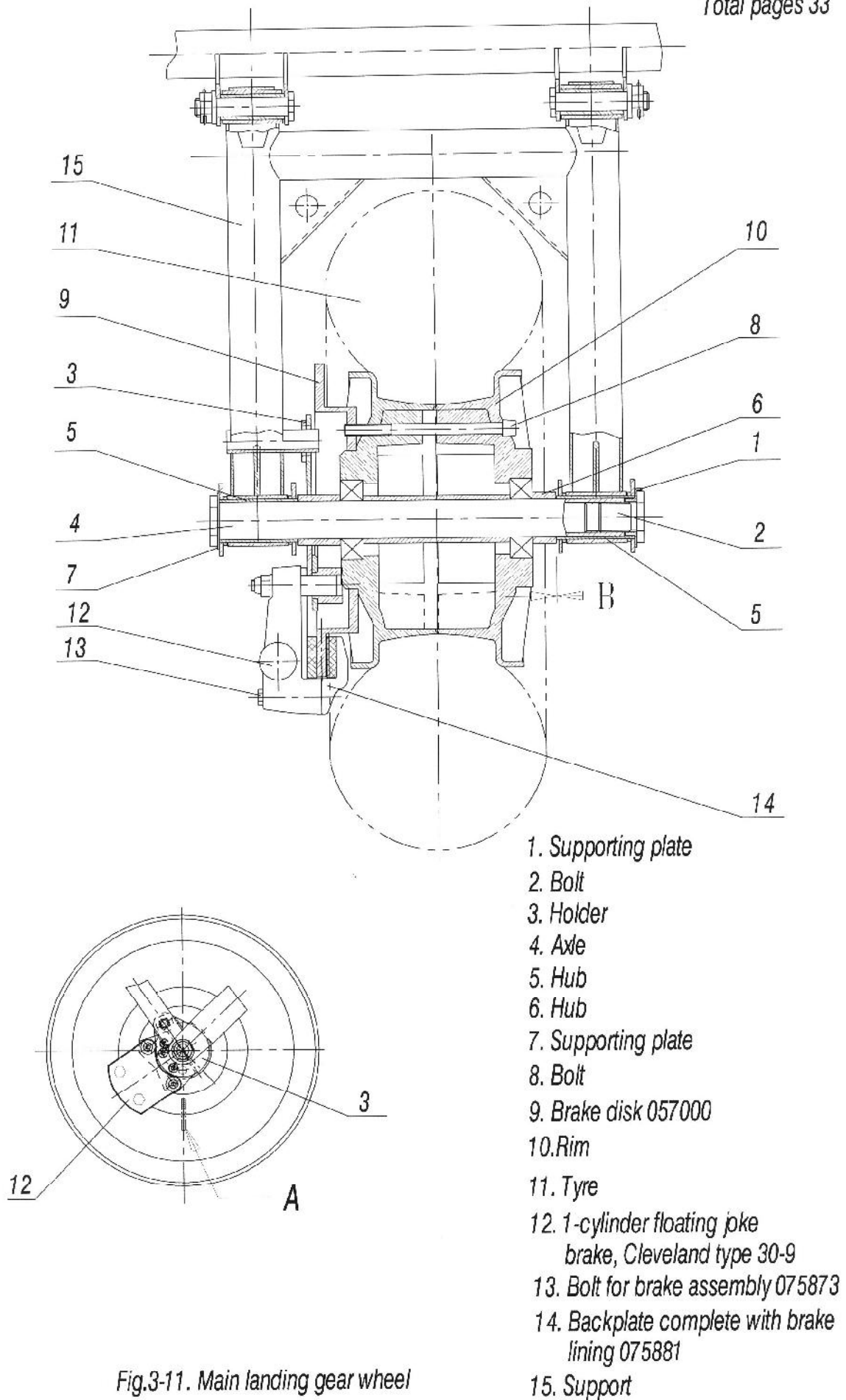
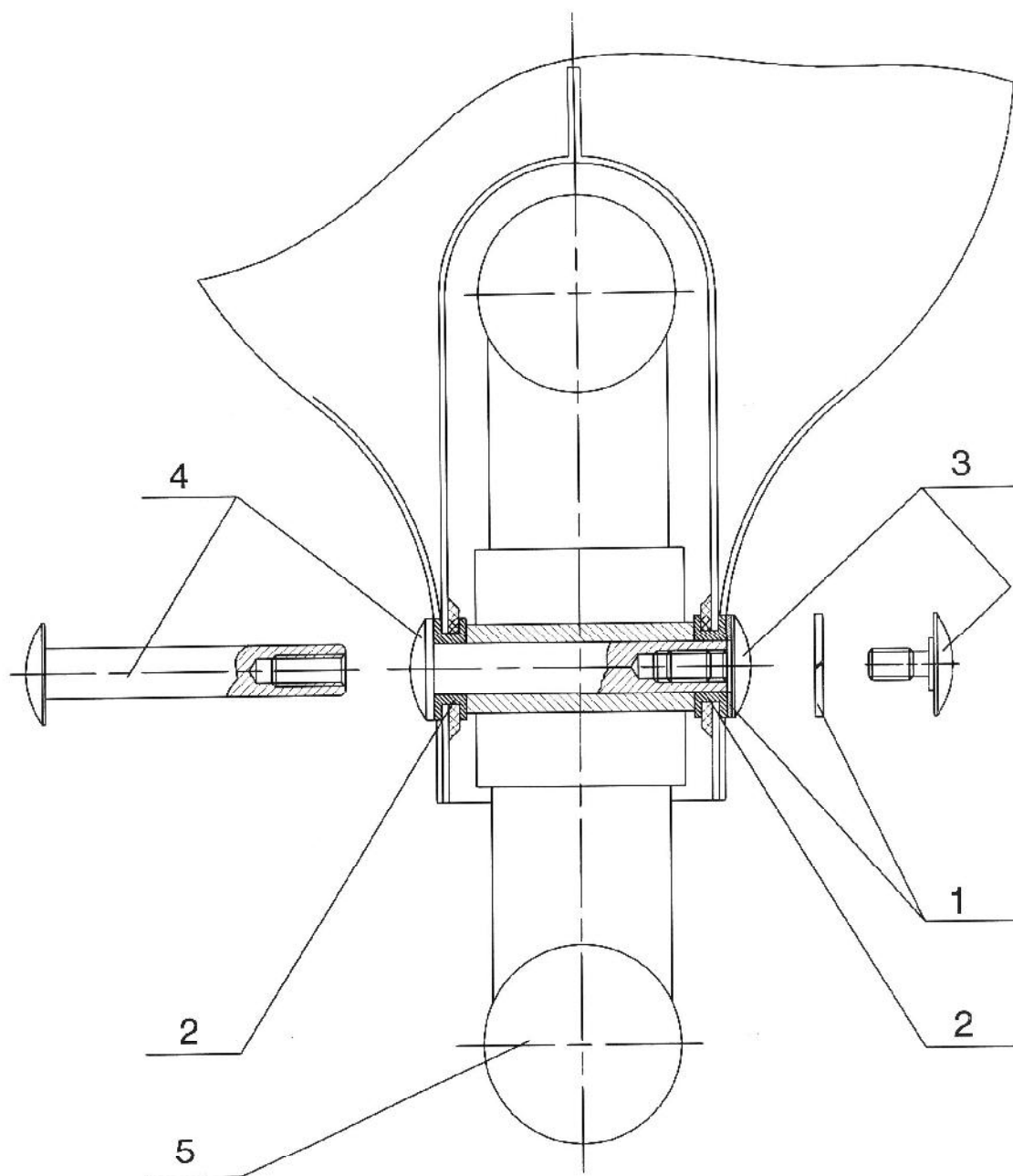


Fig.3-11. Main landing gear wheel



- 1. Washer
- 2. Supporting hub
- 3. Bolt
- 4. Wheel axle
- 5. Wheel

Fig.3 - 12. Rigging and de-rigging tail wheel

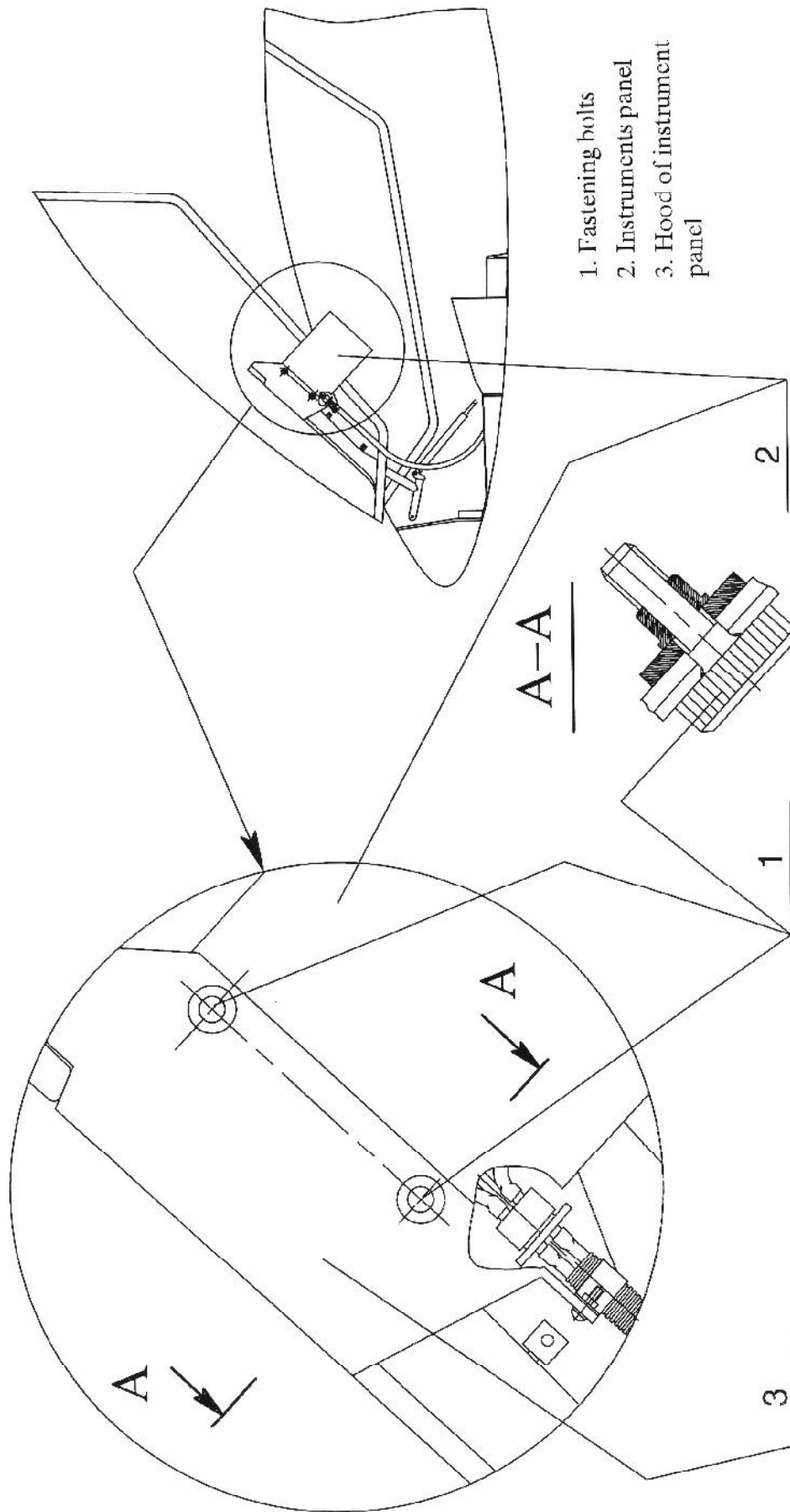
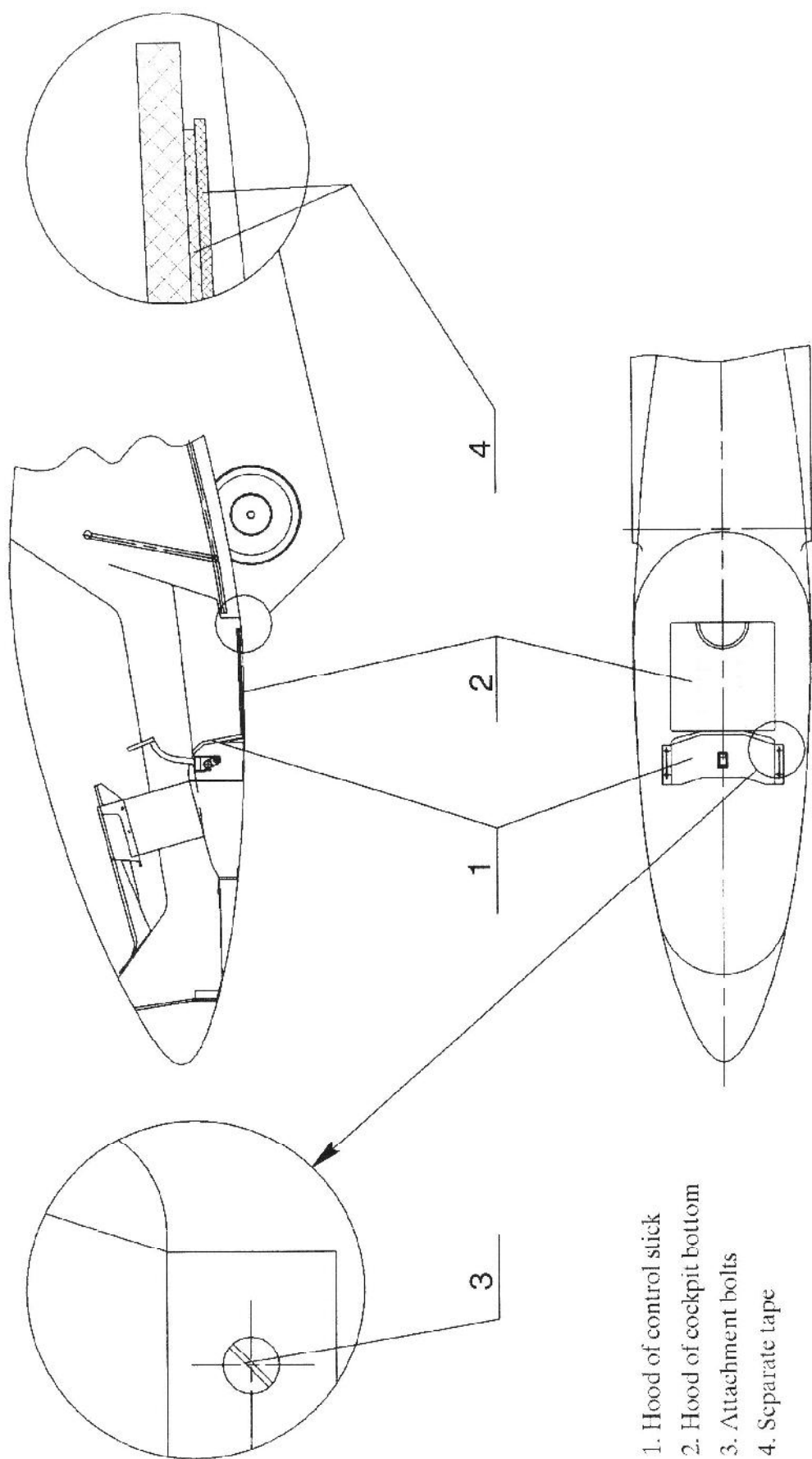


Fig.3 - 13. Removal and mounting of instrument panel



1. Hood of control stick
2. Hood of cockpit bottom
3. Attachment bolts
4. Separate tape

Fig3 - 14. Taking out and putting in of pilot cockpit floor

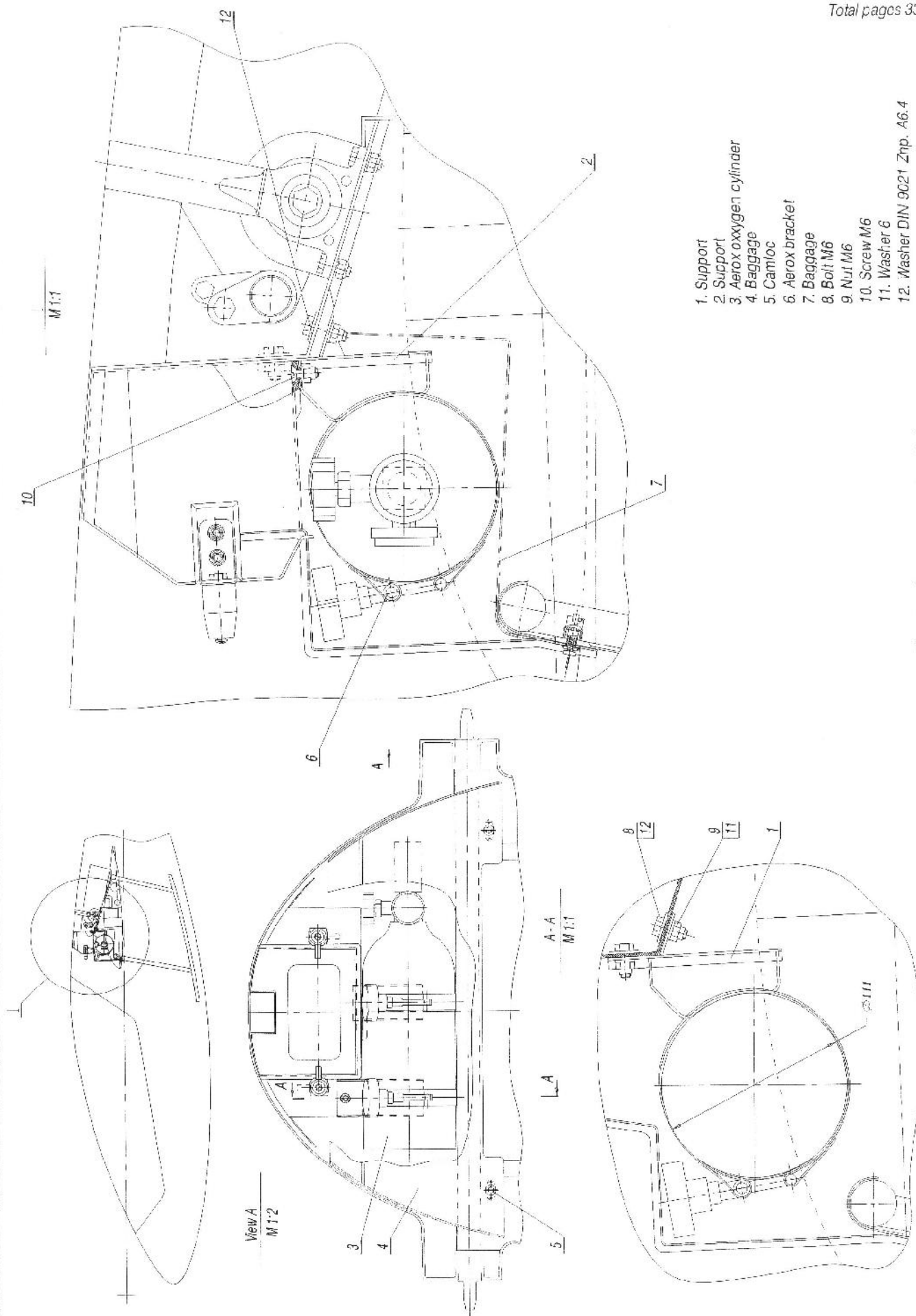


Fig. 3-15. Oxygen system installation

LAK-19T	MAINTENANCE MANUAL	Section 4	Page 4/1 Total pages 1
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SECTION 4

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

4.1	Introduction	Page 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 FMS 421	Instrument passport
2	Altimeter	WINTER 4 FGH 10; 4 HM 6 WD-10-C	Instrument passport
3	Mechanical variometer	LUN-1141, WINTER 5 STV-5	Instrument passport
4	Electronic variometer	FILSER LX5000, LX7000; LX 160	MM
5	Fly computer display	FILSER LX5000, LX7000 ILEC SN10	MM
6	Radio	Becker AR 4201, Dittel FSG-2T	MM
7	Compass	KI-13A	Instrument passport
8	Side - slip indicator	LUN-1216	Instrument passport
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	TOST 045100 / Aero Trainer, 6 ply	Wheel passport / Tyre pasport
12	Tail wheel	Barum Rubena T3 / V12 or TOST 200x50	Wheel passport
13	Engine	SOLO 2350	Manual for engine SOLO type 2350
14	Propeller	LAK-P4-90	Operation and installation manual for propeller LAK-P4-90
15	Transponder	Filser TRT 600; TRT 800; Microair T2000; Becker ATC 4401	Instrument operator and installation instructions. Antennas types and installation as per manufacture recommendations.

LAK-19T	MAINTENANCE MANUAL	Section 5	Page 5/1 Pages 10																		
<div>SECTION 5</div> <div>Periodical inspections</div> <table><tr><td></td><td>Page</td></tr><tr><td>5.1 Introduction.....</td><td>1</td></tr><tr><td>5.2 Sailplane inspection periods.....</td><td>1</td></tr><tr><td>5.3 Inspection after every 100 flight hours.....</td><td>1</td></tr><tr><td>5.4 Annual inspection.....</td><td>5</td></tr><tr><td>5.5 Inspection after rough landings, after ground loop.....</td><td>5</td></tr><tr><td>5.6 Inspection at the end of flight season.....</td><td>5</td></tr><tr><td>5.7 Inspection of the sailplane after every 1000 flight hours.....</td><td>6</td></tr><tr><td>5.8 Inspection of the sailplane after every 3000 flight hours.....</td><td>10</td></tr></table>					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 landings, after ground loop.....	5	5.6 Inspection at the end of flight season.....	5	5.7 Inspection of the sailplane after every 1000 flight hours.....	6	5.8 Inspection of the sailplane after every 3000 flight hours.....	10
	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 landings, after ground loop.....	5																				
5.6 Inspection at the end of flight season.....	5																				
5.7 Inspection of the sailplane after every 1000 flight hours.....	6																				
5.8 Inspection of the sailplane after every 3000 flight hours.....	10																				
<div>5.1 Introduction</div> <p>In section 5 there is defined a list of inspections ensuring safe the sailplane operation and lifetime.</p> <p>The periodical inspections shall be performed by qualified staff having permission to execution of those works.</p> <p>All inspections are general visual inspections unless specified otherwise.</p> <p>Clean the sailplane prior conducting any inspections. Also, the sailplane wings and horizontal stabilizer has to be removed.</p>																					
<div>5.2 Sailplane inspection periods</div> <p>The sailplane inspections shall be performed:</p> <div><div>1)</div>after every 100 flight hours;</div> <div><div>2)</div>annual inspection;</div> <div><div>3)</div>after rough landings, after ground loops;</div> <div><div>4)</div>at the end of flight season or before long storing in a hangar or in a trailer;</div> <div><div>5)</div>after every 1000 flight hours;</div> <div><div>6)</div>after every 3000 flight hours;</div>																					
<div>5.3 Inspection after every 100 flight hours</div> <p>It is necessary to check throughly the sailplane after every 100 flight hours. A sailplane shall be checked by qualified staff having a license for those works.</p>																					
Date: 15 January, 2018	Rev. 5																				

LAK-19T	MAINTENANCE MANUAL	Section 5	Page 5/2 Total pages 10
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Inspection after every 100 flight hours

Date.....

No	Checking	Conformity Yes/No	Signature
101	Flight Manual and Maintenance Manual revision		
102	Sailplane airworthiness certificates revision		
103	Sailplane log-book revision		
104	Sailplane airworthiness bulletins revision		
105	Sailplane technical bulletins revision		
106	Sailplane weight, instruments in the instrument panel list and its' weights revision		
107	Sailplane instruments and equipment which are serviced according to their own maintenance documents revision		
200	Wing, winglets, wing tips 15m and 18m		
201	Surfaces of wings (paint cracks, peeling paint) condition		
202	Defects of skins (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, their hinges, pins, clearances of the ailerons, control connections, tip ailerons control plates		
209	Airbrakes, clearances of airbrakes, state of metal parts		
210	Water ballast tanks, ballast control system in the wings		
211	Wing tips fixators (connections)		
212	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		

LAK-19T	MAINTENANCE MANUAL	Section 5	Page 5/3 Total pages 10
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Inspection after every 100 flight hours

Date.....

No	Checking	Conformity Yes/No	Signature
314	Elevator automatic connection 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.		
318			
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		
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 skins (cracks, holes, etc)		
503	Bonded areas		
504	Rudder, its hinges, pins, clearances of the rudder, control connections		
505			
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	Airbrakes control system (movement, friction, clearances, fixings)		
704	Rudder control system (movement, friction, clearances, fixings)		
705	Pedals adjust system		
706	Trimmer control system operation		
707	Tow release control system (movement, friction, clearances, attachments)		
708	Attachment of cockpit canopy and its emergency jettison system operation		
709	Canopy ventilation control system		
710	Water ballast control system operation		

LAK-19T	MAINTENANCE MANUAL	Section 5	Page 5/4 Total pages 10
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Inspection after every 100 flight hours

Date.....

No	Checking	Conformity Yes/No	Signature
711			
712			
713			
800	Instruments		
801	Instrument panel mounting		
802	Air speed indicator static system vacuum test, pipes color markings		
803	Altimeter system functioning		
804	Accumulators batteries , electric wiring installation		
805	Radio station, navigation instruments mounting, operation		
806	Radio aerial, cable installation		
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	MCU, type LAK-17AT instrument wiring and functioning		
814			
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			
910			
911			
1000	Power-plant installation		
1001	Inspect propeller as per propeller manual		
1002	Inspect engine as per engine manual		
1003	Check functioning of the decompressing valves		
1004	Check functioning of the propeller brake		
1005	Check mounting of the engine on a engine frame		
1006	Check fuel lines for leaks or wear		
1007	Check engine accessories such as fuel pump, sensor and etc.		
1008	Check all bolted connections		
1009	Check engine frame for possible cracks		
1010	Check power-plant bay doors and their system		

Date: 01 March 2006	Rev. No.0
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LAK-19T		MAINTENANCE MANUAL	Section 5	Page 5/5 Total pages 10
1011	Check retaining cable for wear			
1012	Check fuel valve operation			
1013	Perform ground test run of the engine			
1014	Engine extraction\ retraction system Fig.2-22, special attention for inspection shaft pos.5, bracket 580-22 of electric actuator CARR 22 pos.8 and bulkhead pos. 13			
1015				
1016				
1017				
1018				
1100	Conclusion checking			
1101	Checking records revision			
1102	Maintenance manual changes revision			
1103	Jobs according airworthiness and technical bulletins revision			
1104	Sailplane log-book records revision			
1105				
1106				
1107				

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 fuel tank for leaks and clean the tank.

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 the power-plant extension/retraction, especially if power-plant was extracted during rough landing.

LAK-19T	MAINTENANCE MANUAL	Section 5	Page 5/6 Total pages 10
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5.6 Inspection at the end of flight season

At the end of flight season or before long storing in a hangar or in a trailer:

- 1) check sailplane airworthiness certificate, log-book airworthiness and technical bulletins;
- 2) check condition of external surfaces of accessible metal parts. Pay special attention to surfaces places damaged by corrosion;
- 3) clean up and lubricate with oil bearings and sailplane systems connection places according to requirements of chapter 3.3;
- 4) check water ballast tanks for sealing. Drain the tanks.
- 5) drain the fuel from a tank;
- 6) if needed, do conservation of the engine according to the engine manual Section 5.

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:

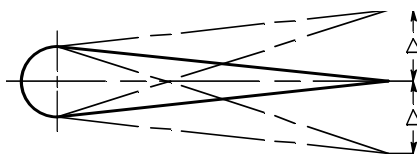
- a) between the wings connection pins and openings in spars consoles $\Delta = 0.32$ mm (fig.2-20d);
- b) between the fuselage pins and wing hubs $\Delta = 0.27$ mm (fig.2-20a);
- c) between the hubs of wing tips and lateral pins of wings $\Delta = 0.046$ mm (fig. 2-20c);
- d) tolerance of opening of fixation plate of wing tip spar $\Delta = 0.015$ mm (fig. 2-20c);

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

Allowed clearances:

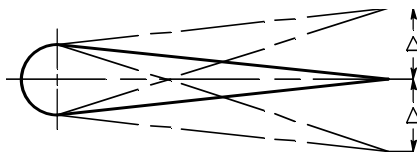
- a) between the fin pins and hubs of the stabilizer $\Delta = 0.055$ mm (fig. 2-20b);
- b) between the stabilizer fixation pin and an opening of stabilizer $\Delta = 0.32$ mm (fig. 2-20b);

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



LAK-19T	MAINTENANCE MANUAL	Section 5	Page 5/7 Total pages 10
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5. To measure clearances of the ailerons 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 and ailerons. Allowed radial clearance between the hole diameter and axis is $\Delta = 0.1$ 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 2.6.2).

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,
- k) landing gear control:
 - when extracting – 20 daN,
 - when retracting – 14 daN,
- l) towing hook control:
 - without loading on towing hook – 10 daN,
 - with loading on towing hook – 12 daN,
- m) emergency opening of a canopy – 13 daN,
- n) 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, elevator and rudder according to the scheme shown in Fig.7-2. if repaire 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,
- wingtip fixators and fixator hubs in the upper skin of the wing (fig. 3-2d, pos. 12),
- control and hinge joints of ailerons, 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. 1), 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.

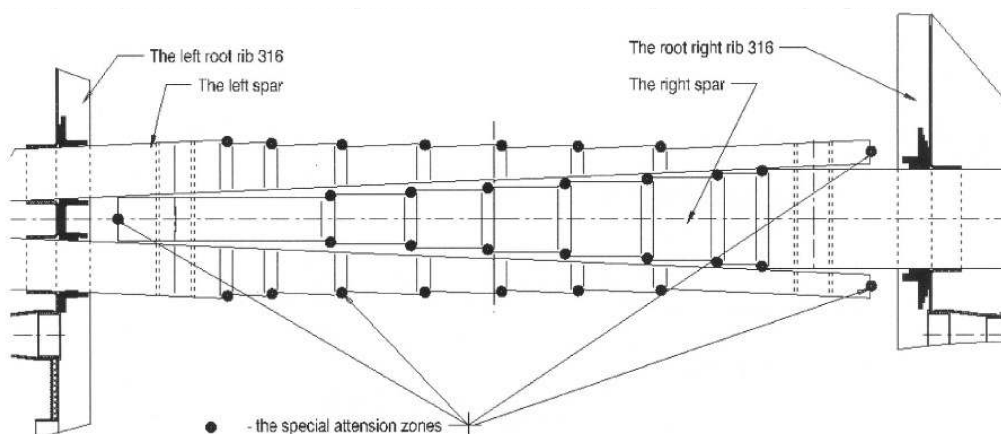
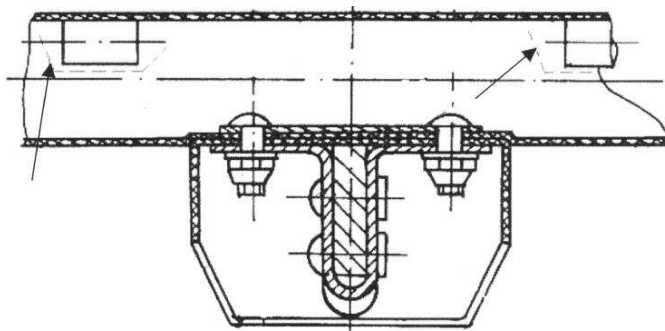


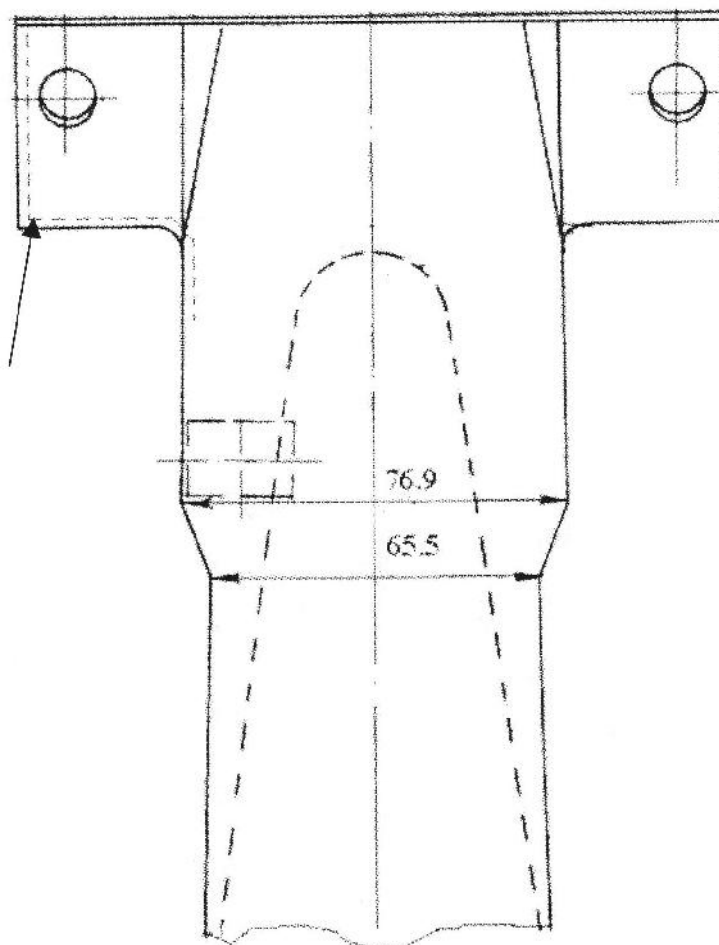
Fig. 1. The wing spar.

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

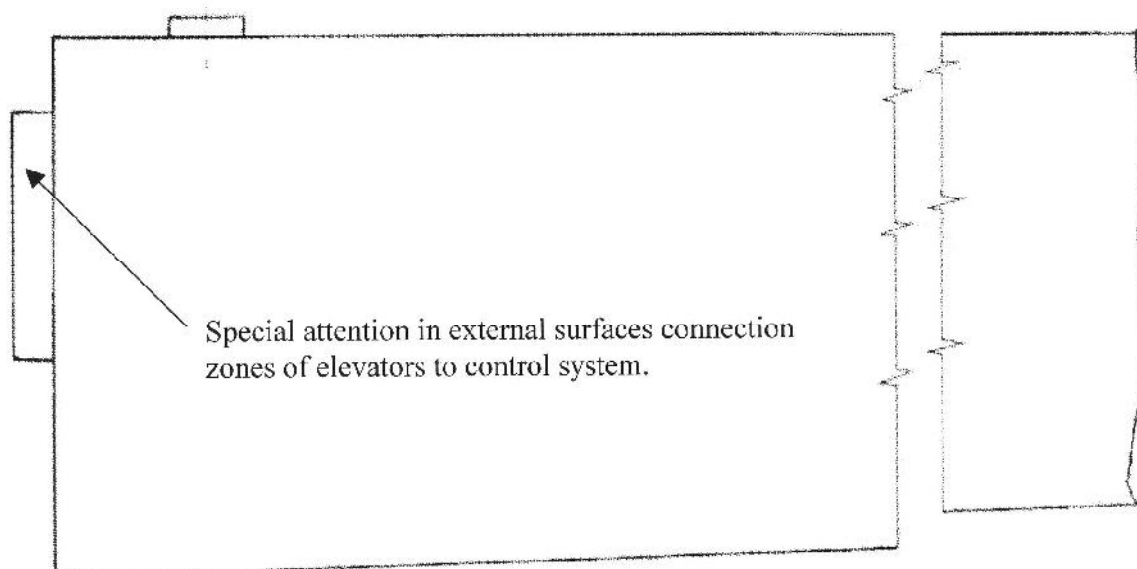
- (a) the surfaces around hinge joints of control unit of elevators on the horizontal tail.



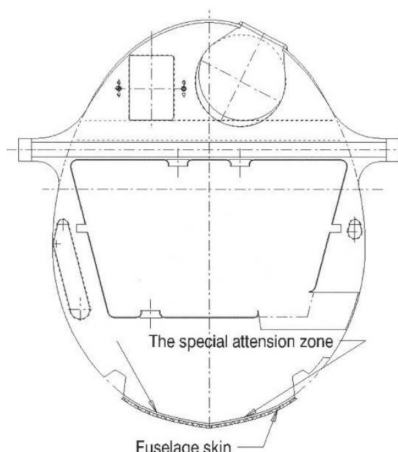
b) the glued zones of the vertical tail spar onto the upper fin part



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 its defatting protective prime 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 damage 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. Check the power-plant extracted/retracted position as indicated in Section 3.3.5 of this manual.
23. Check the completeness of the fire resistant paint. Repair damaged parts of the paint with the right material (see page 8/4 material list).
24. Check the power plant rubber parts and their service life (see Section 6).
25. Check the fastening torque of the engine (refer to the engine manual).
26. After doing all the works the sailplane shall be weighed and C.G. shall be defined.

5.7 Inspections of the sailplane after every 3000 flight hours

It is necessary to check thoroughly the sailplane after every 3000 hours. The sailplane shall be checked by qualified staff having a license for those works.

Inspections must be performed according to "LAK-19T Inspection Program To Extend the Service Life", Doc. No. IP/19T-3000. Inspection program should be ordered from the manufacturer of the sailplane.

LAK-19T	MAINTENANCE MANUAL	Section 6	Page 6/1 Total pages 1
<p style="text-align: center;">SECTION 6</p> <p style="text-align: center;">Sailplane life limits</p> <p>The approved lifetime limit of the sailplane LAK-19T is 6000 flight hours. The following power-plant rubber parts have 5 years limited service life:</p> <ul style="list-style-type: none"> – engine rubber shock mounts; – all fuel lines; – engine frame mount rubber shocks (see Fig. 2-22, p. 4); – engine retaining cable bungee cord (see Fig. 2-27, p. 8). <p>The continued airworthiness of the sailplane is ensured by prescribed inspections and technical maintenance works done during its use:</p> <ol style="list-style-type: none"> 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, axceeding of allowed loadings and etc. according to requirements of section 5 of "Maintenance Manual"; 4) inspection and works according to requirement 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, engine, propeller and others); 6) inspection after every 1000 flight hours according to requirements of Section 5 of "Maintenance manual" 7) inspection after every 3000 flight hours according to requirements of Section 5 of "Maintenance Manual"; <p>Checking of a sailplane, maintenance and neccessary repair works shall only be done by qualified staff having permission to do the work.</p> <p>In the case of damage of the sailplane structure not included in the "Maintenance Manual" the repair shall be agreed to by manufacturer of the sailplane.</p>			
Date: 15 January, 2018		Rev. No. 5	

SECTION 7

Weights and center of gravity

	Page
7.1 Introduction	1
7.2 Definition of the sailplane weight and C.G	3
7.3 Weights of non-lifting parts of the sailplane	4
7.4 Checking of control weights and balancing	5
7.5 Calculation of loading limits.....	6

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.

Approved positions of C.G.:

Pos. No	Parameter	Approved boundaries, mm
1	Foremost C.G. limit - engine extracted	182
2	Rearmost C.G. limit - engine retracted	305

Warning: it is important to do weighing or calculation of c.g. for forward limit with **engine extracted** and for rear limit with **engine retracted** as engine position makes big influence for c.g. position.

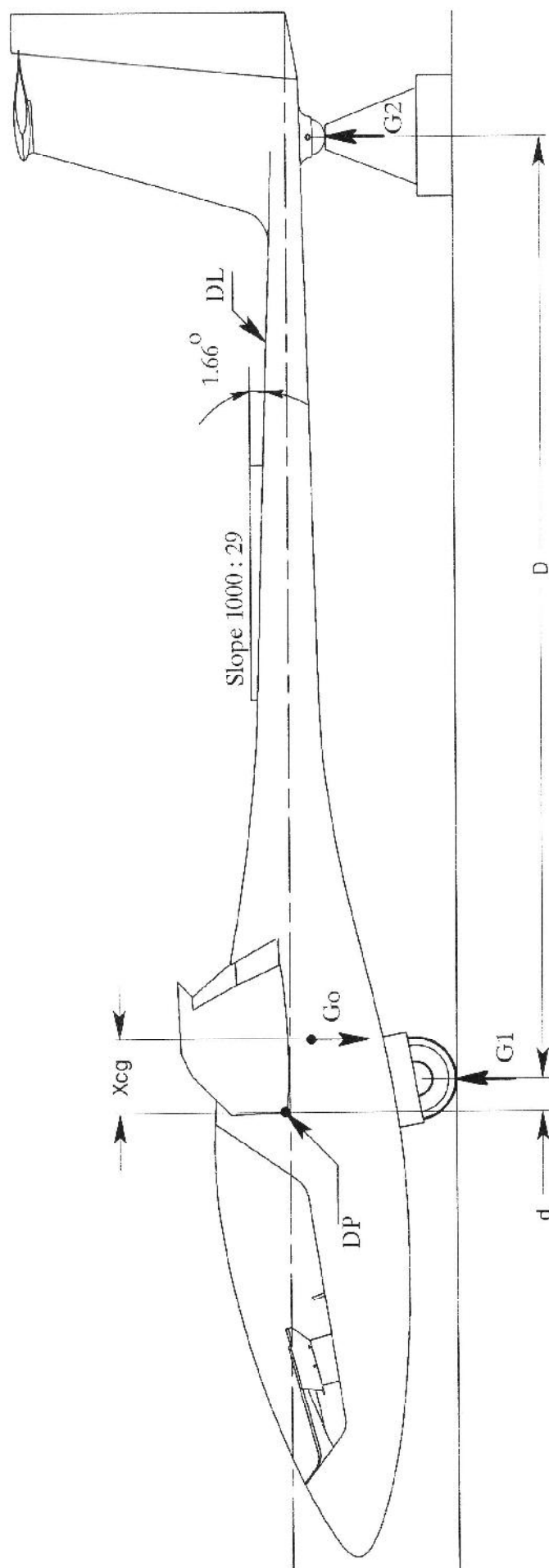
Empty weight center of gravity of the LAK-19T with the power-plant installed is defined for the 15m wing configuration, fuel tank empty, glider ready to fly, excluding weight of pilot and parachute.

Warning: for the glider with power-plant installed, fin battery has to be removed. Only the baggage compartment batteries can be installed.

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

Note: if pilot weight is 100...110 kg (220,5...242 lbs), it is possible to remove one baggage compartment battery and replace it by installing battery in the fin. This moves c.g. of the glider back by 32...34 mm. Re-weighing or re-calculation of the c.g. position is mandatory in this case.

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



Center of gravity of sailplane:

$$X_{cg} = \frac{G_2 * D}{G_0} + d$$

G_0 - weight of sailplane. Weight is defined as summary value of sailplane parts. Using two balances - $G_0 = G_1 + G_2$.

Theoretical data of D and d : $D = 4007.2$ mm; $d = 116.1$ mm.

Fig.7-1. Sailplane weighing and Center of Gravity definition scheme

Max weight of the sailplane shall not be exceeded:

- for 15m wing 480 kg;
- for 18m wing 500 kg.

Min pilot weight - see cockpit 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 wing with controls	Gwr	
2	Left wing with controls	Gwl	
3	Fuselage with rudder	Gfz	
4	Stabilizer with elevator	Gst	
5	Wing tip /15 m right	Gt15r	
6	Wing tip /15 m left	Gt15l	
7	Wing tip /18 m right	Gt18r	
8	Wing tip /18 m left	Gt18l	

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

$$G_{emp} = G_{emp15m} = G_{wr} + G_{wl} + G_{fz} + G_{st} + G_{t15r} + G_{t15l},$$

- b) wing of 18 m

$$G_{emp} = G_{emp18m} = G_{wr} + G_{wl} + G_{fz} + G_{st} + G_{t18r} + G_{t18l}.$$

Weight of sailplane including a pilot Go:

- a) wing of 15 m

$$G_o = G_{15m} = G_{emp15m} + G_{pil},$$

- b) wing of 18 m

$$G_o = G_{18m} = G_{emp18m} + G_{pil}.$$

2. To assemble the sailplane.

3. To put up sailplane tail on weighing-machine. To position the sailplane with help of an auxiliary equipment according to requirements of fig. 7-1.

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.

LAK-19T	MAINTENANCE MANUAL	Section 7	Page 7/4 Total pages 20
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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

$$X_{cgemp} = \frac{G2 * D}{G_{emp}} + d, \text{ mm}$$

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

$$X_{cg} = \frac{G2 * D}{G_o} + d, \text{ mm}$$

Note: 1) weights G2, Gemp, Go are assumed for corresponding weighing variant.

Warning: it is important to do weighing or calculation of c.g. for forward limit with **engine extracted** and for rear limit with **engine retracted** as engine position makes big influence for c.g. position.

9. To check if position of C.G. is within an allowed range **for both engine extracted and retracted**.

If C.G. is outside the allowed boundaries position the sailplane C.G. shall be corrected by the help of lead ballast (Fig.7-3, Fig.7-4, Fig.7-5):

- 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",
- 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.

Warning: Flying with removed engine is not allowed.

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.

Date: 30 01 2008	Rev. No.1
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Maximum weight of non-lifting parts of the LAK-19T is 263 kg.

Max sailplane flight weight shall not be exceeded:

- for 15m wing 480 kg;
- for 18m wing 500 kg.

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. 7-2) 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 small weighing machine. Shoulder r, mm, - the distance between rotation axis of the control and weighing point is to be measured by a ruler.

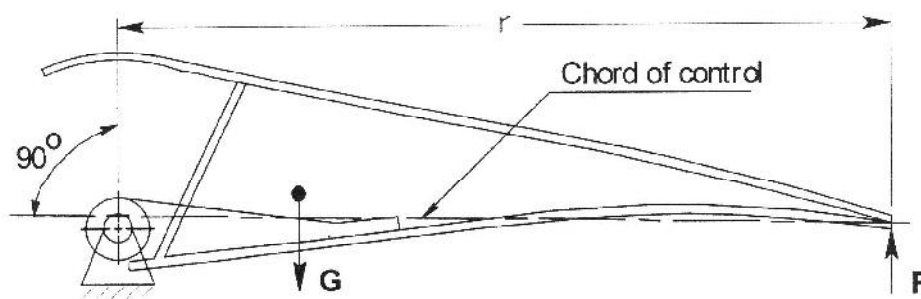


Fig. 7 - 2. Scheme of control positioning and weighing

Static moment of a control $M = P \times r$, kg * mm

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

Approved boundaries for control weights and static moments:

Control	Approved boundaries of control weight, kg	Approved static moment of control, kg * mm
Aileron main	1.65	≤ 67
	2.2	≤ 77.4
Wing tip aileron	0.32	≤ 8.9
	0.42	≤ 10.25
Elevator	0.36	≤ 15.8
	0.43	≤ 17.4
Rudder	2.5	≥ 50
	3.2	≤ 85

If weight of a control and static moment are not within the approved tolerances, contact the company "Sportinč 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 gliders component mass *, kg;

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

• distance “-“, if mass C.G. is before datum point;

• distance “+” if mass C.G. is after datum point;

n = number of glider component mass;

ΣG_n = sum of glider all components mass;

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

The C.G. calculation table

No	Component	Weight G_n ; kg	Distance from DP X_n ; mm	Moment =Weight *Distant $G_n * X_n$ kg * mm
1.	Empty glider. Engine - extracted - retracted			
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	(1 ... 5)	-1785	
n	Baggage weight			
$\Sigma G_n =$			$\Sigma G_n * X_n =$	

* - 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.

Warning: empty weight and center of gravity of the empty glider has to be determined for forward limit with **engine extracted** and for rear limit with **engine retracted** as engine position makes big influence for c.g. position.

Warning: for the glider with power-plant installed, fin battery has to be removed. Only the baggage compartment batteries can be installed.

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

LAK-19T	MAINTENANCE MANUAL	Section 7	Page 7/7 Total pages 20
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- Pilot: real pilot weight with parachute,
distance from DP = -520, when pilot seat in rearmost position;
distance from DP = -670, when pilot seat in foremost position .
- Water ballast in wings: really filled water ballast weight.
- Water ballast in fin: really filled water ballast in fin tank weight.
- Baggage weight: baggage in baggage compartment weight .

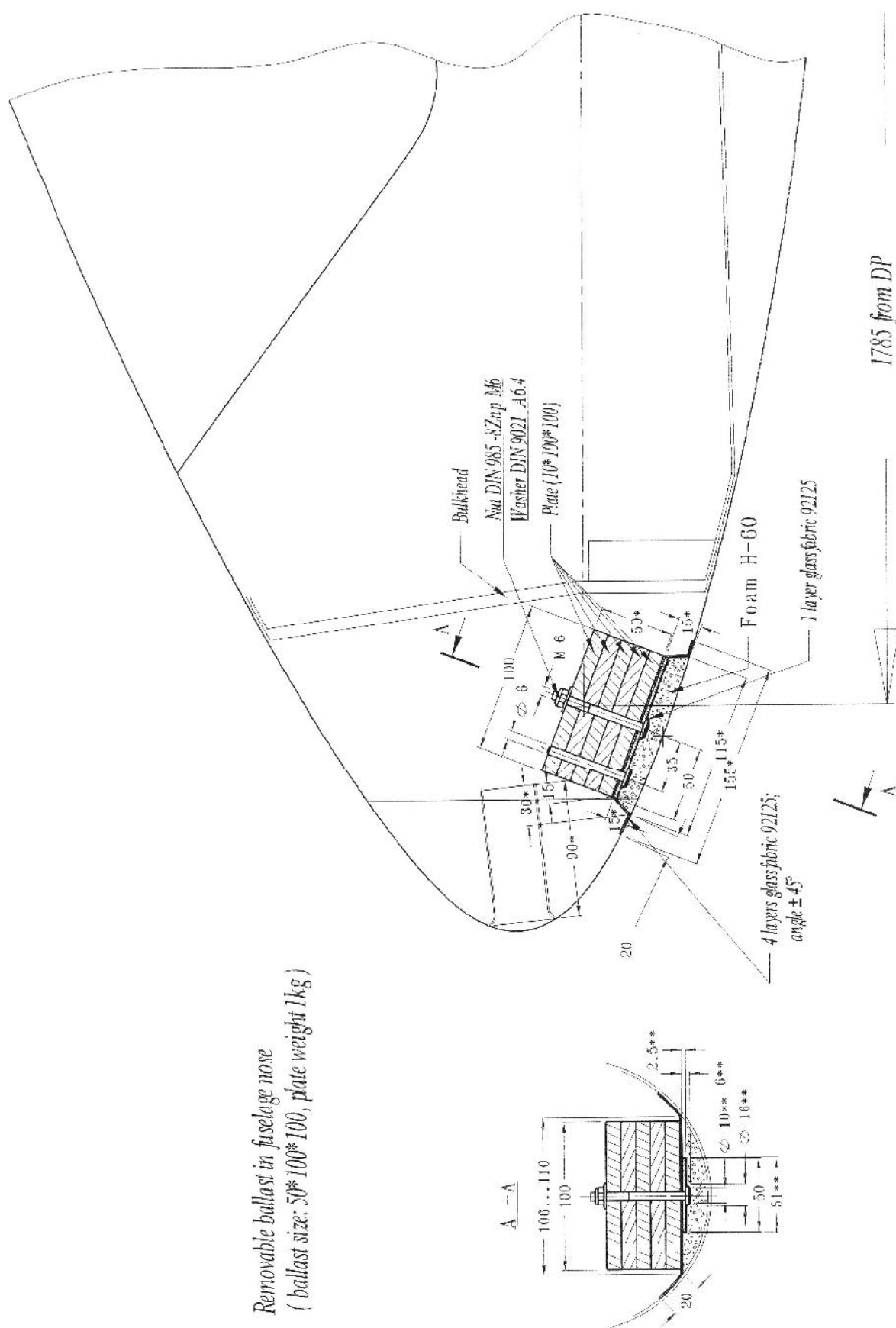


Fig. 7-3. Removable ballast in fuselage nose

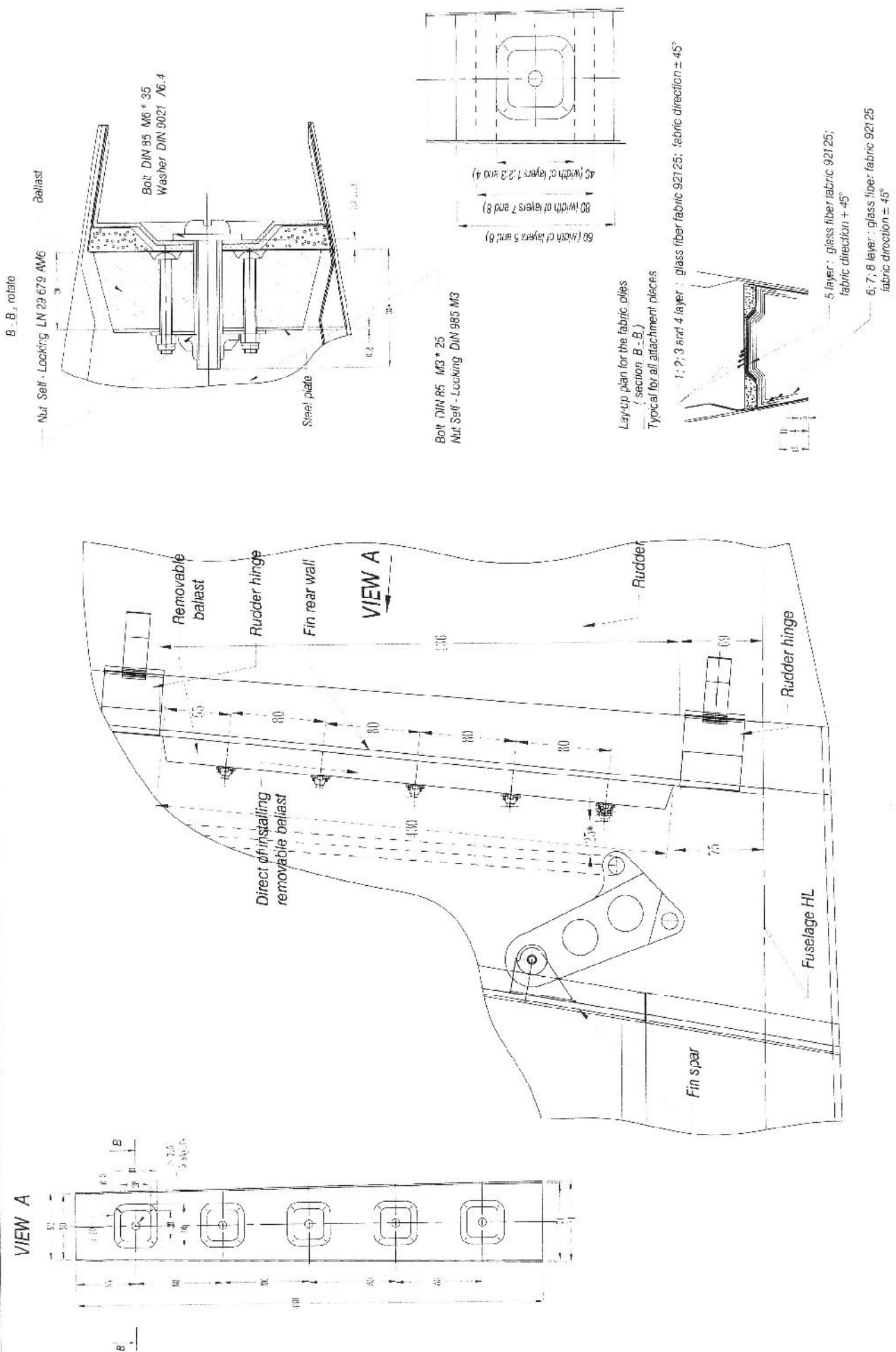


Fig. 7-4. Removable ballast weight fixing in the fin

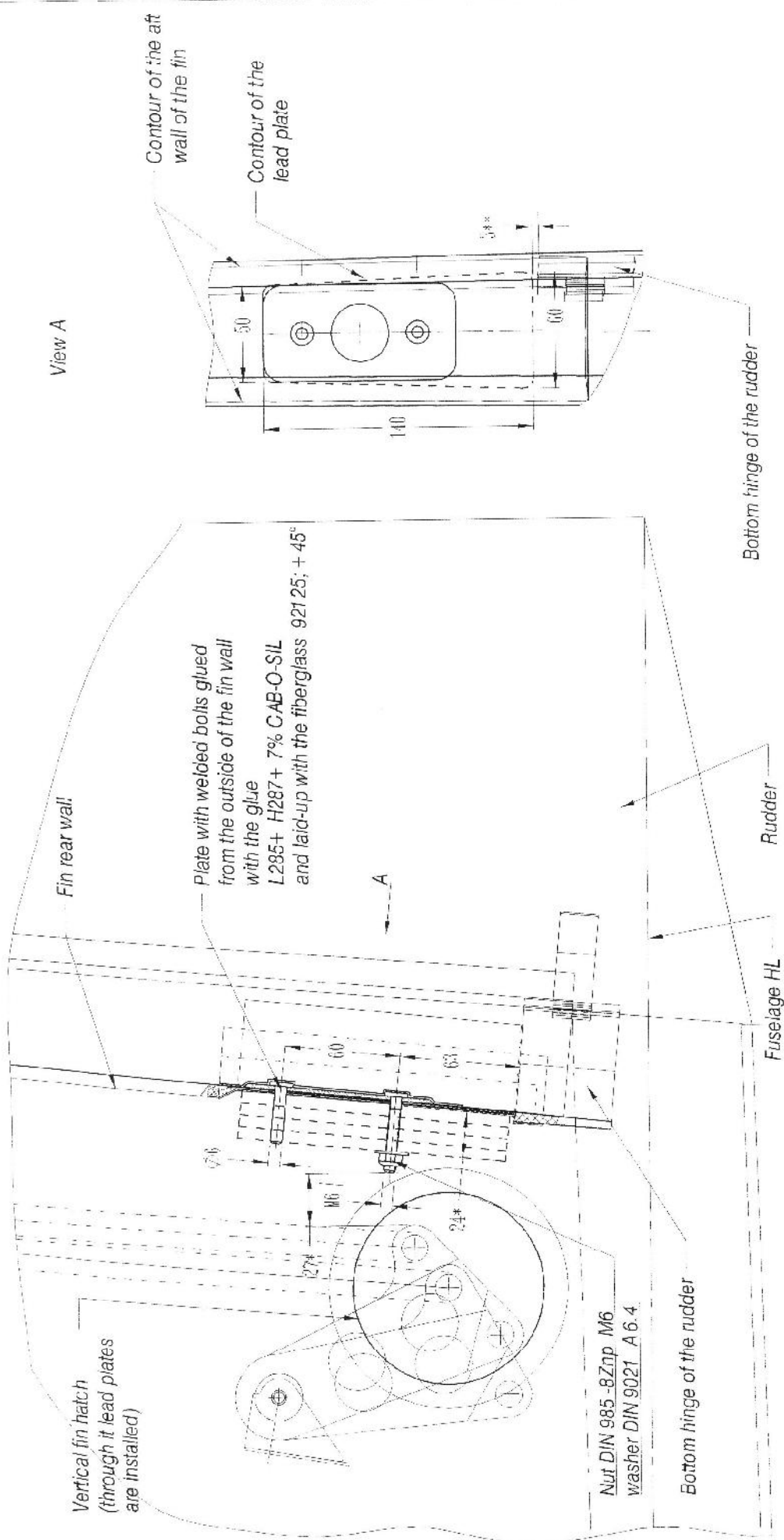
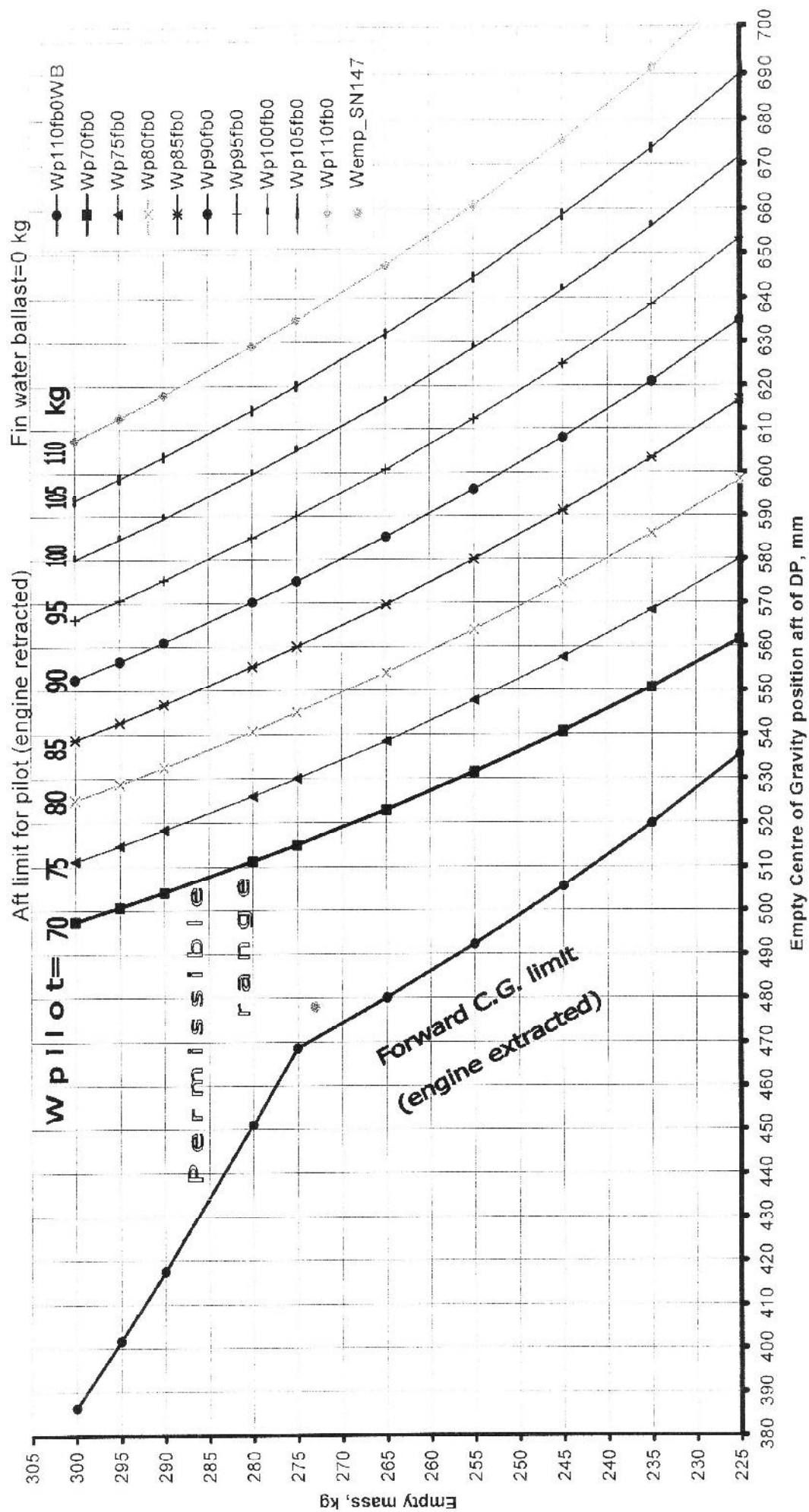
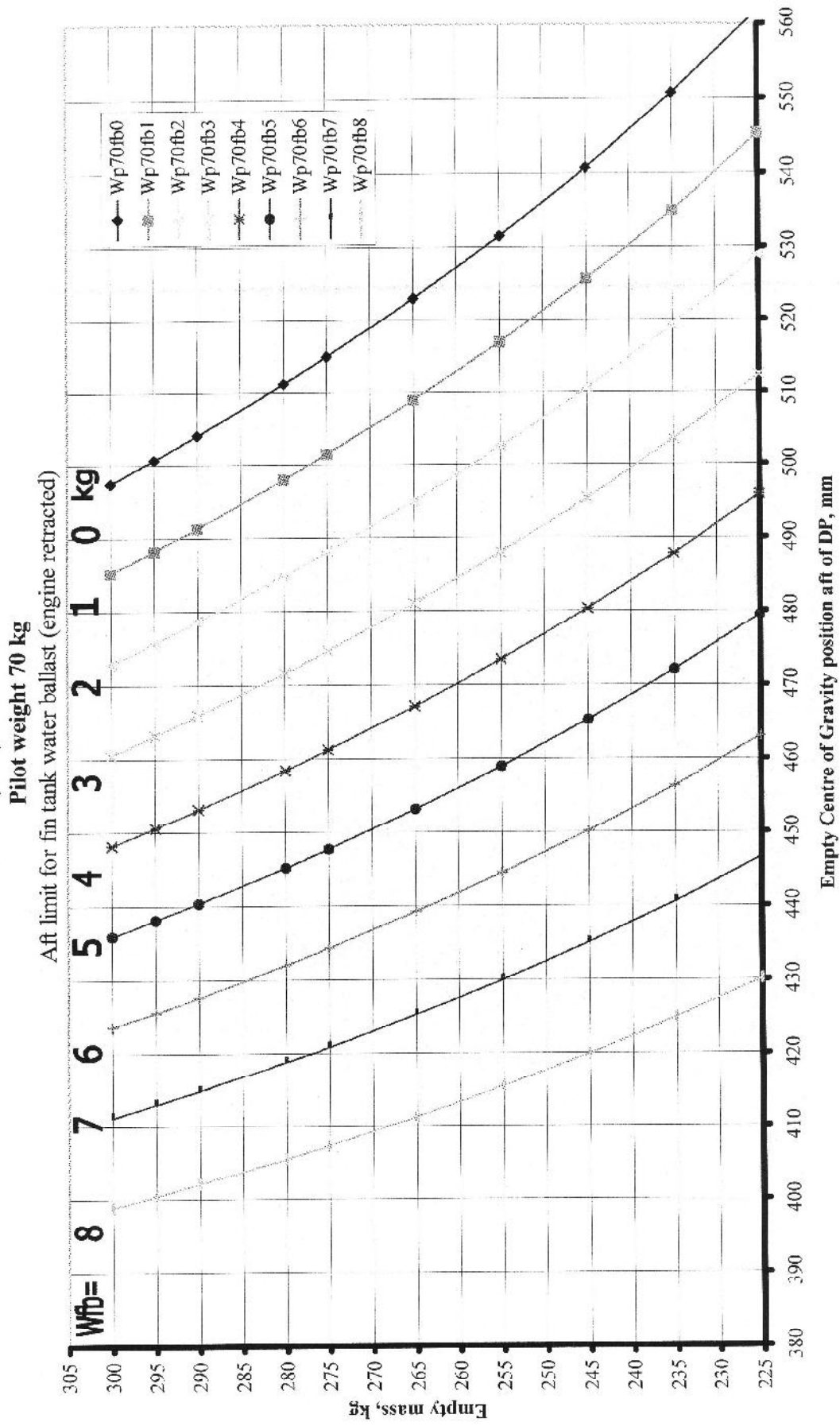


Fig.7-5. Removable ballast in the fin

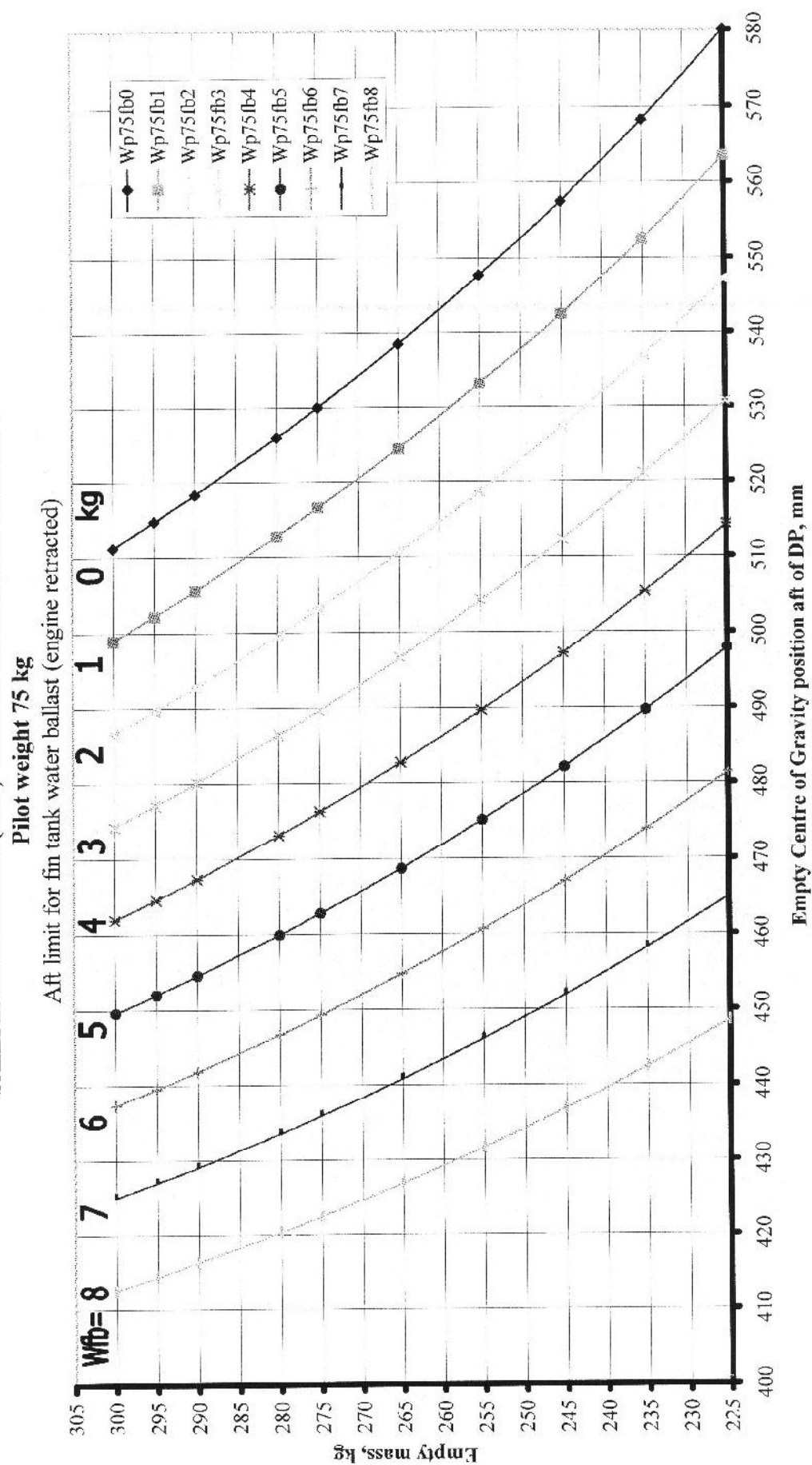
SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY



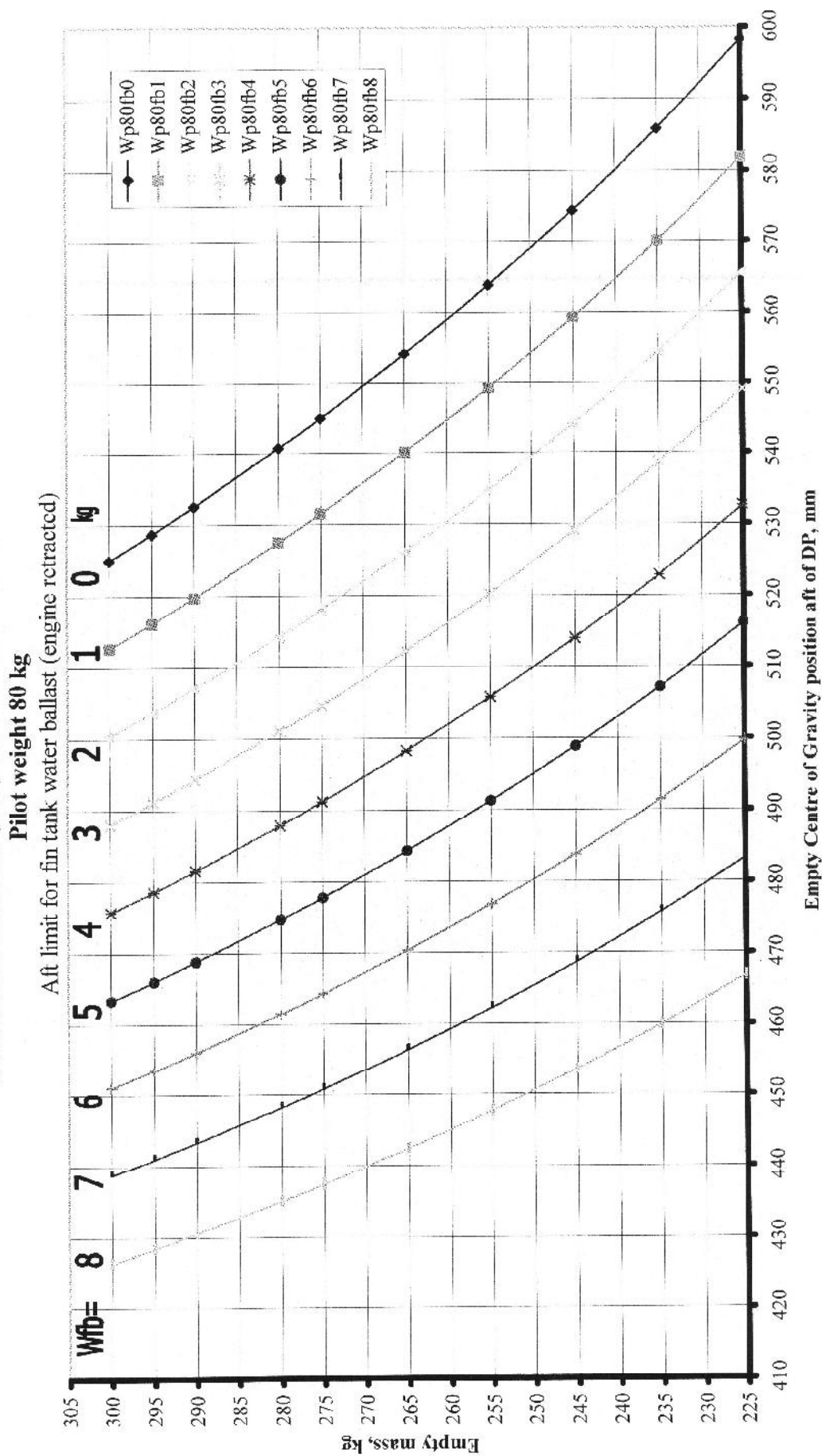
SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY



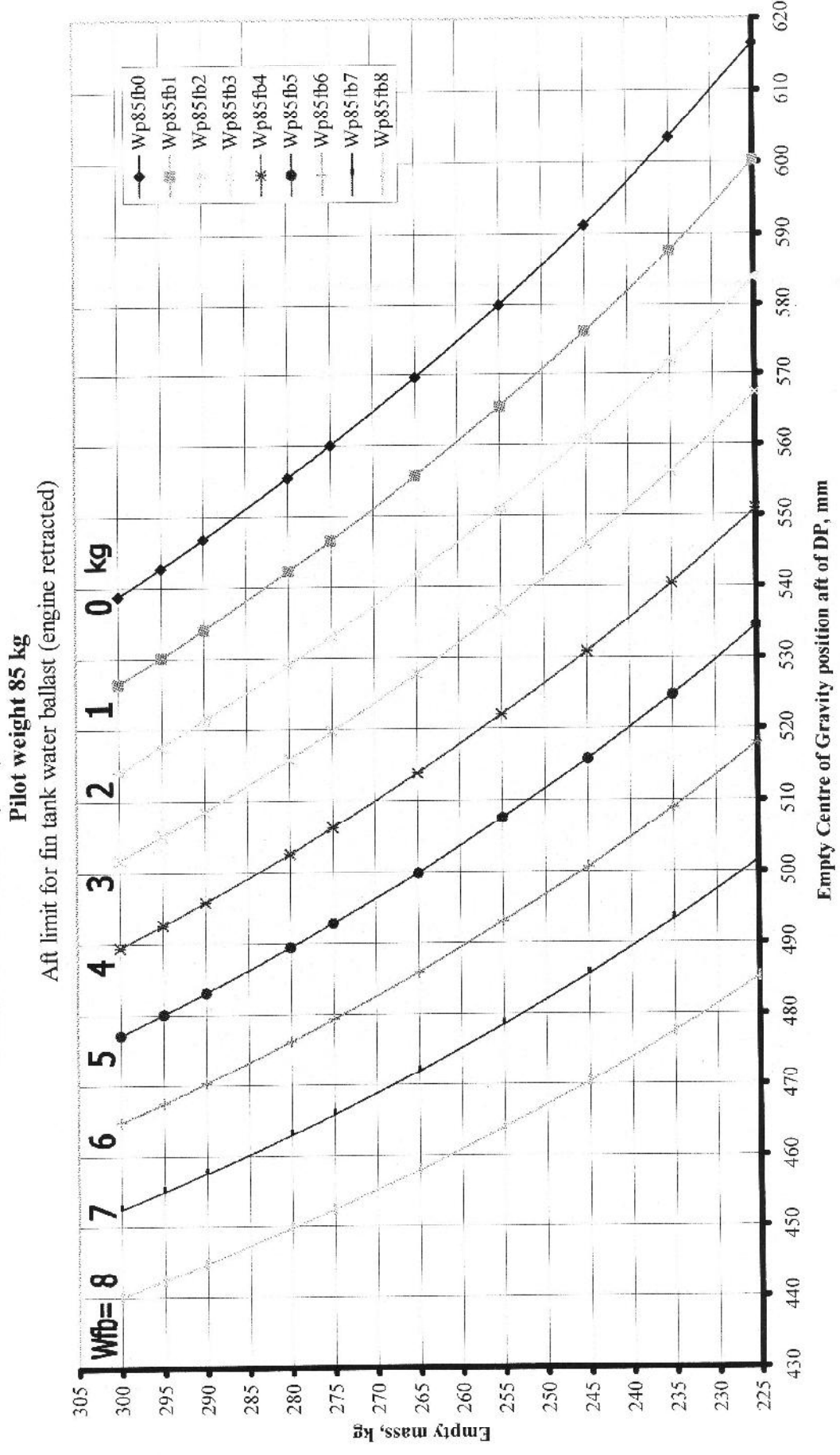
SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY



SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY



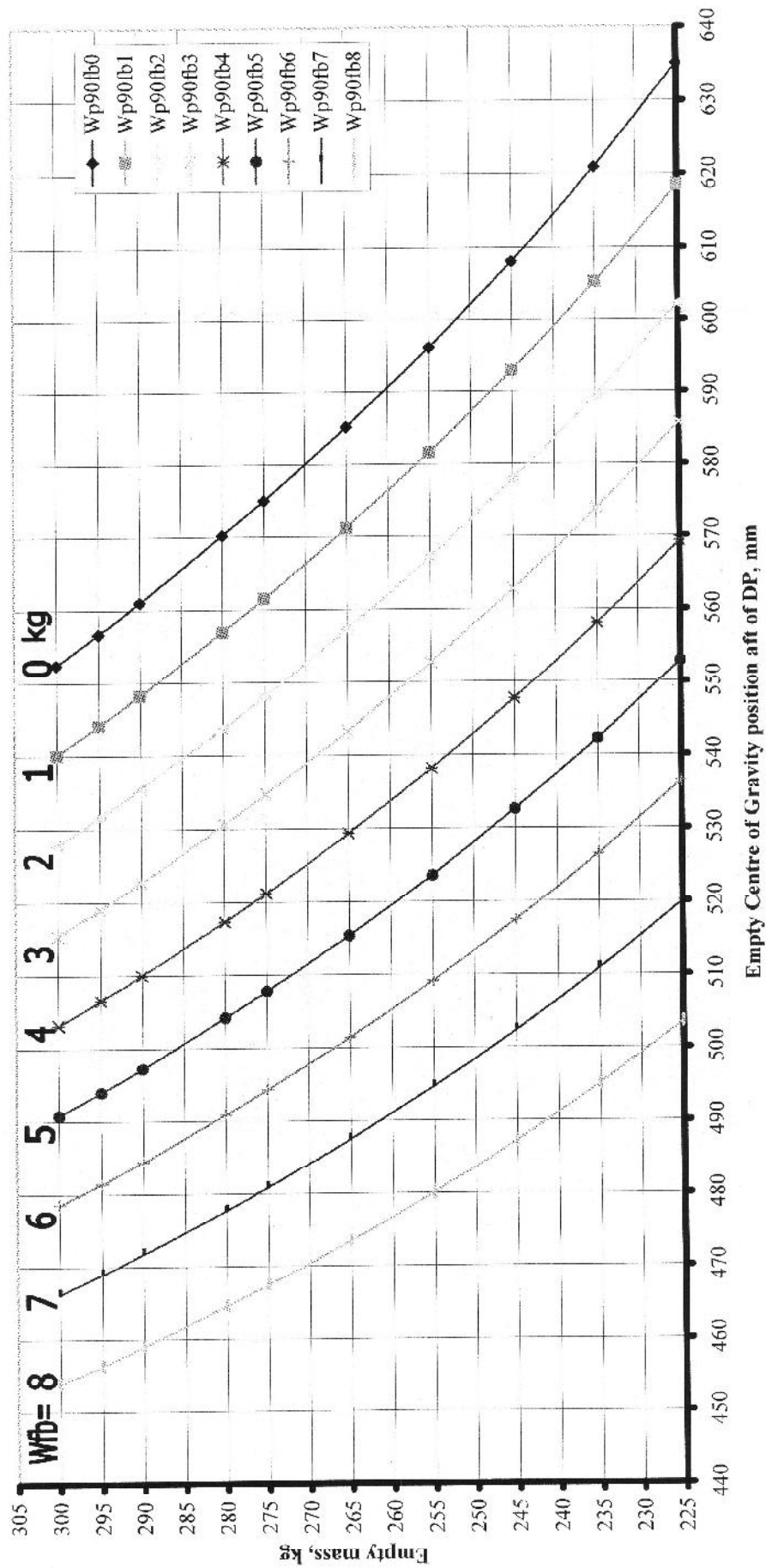
SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY



SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY

Pilot weight 90 kg

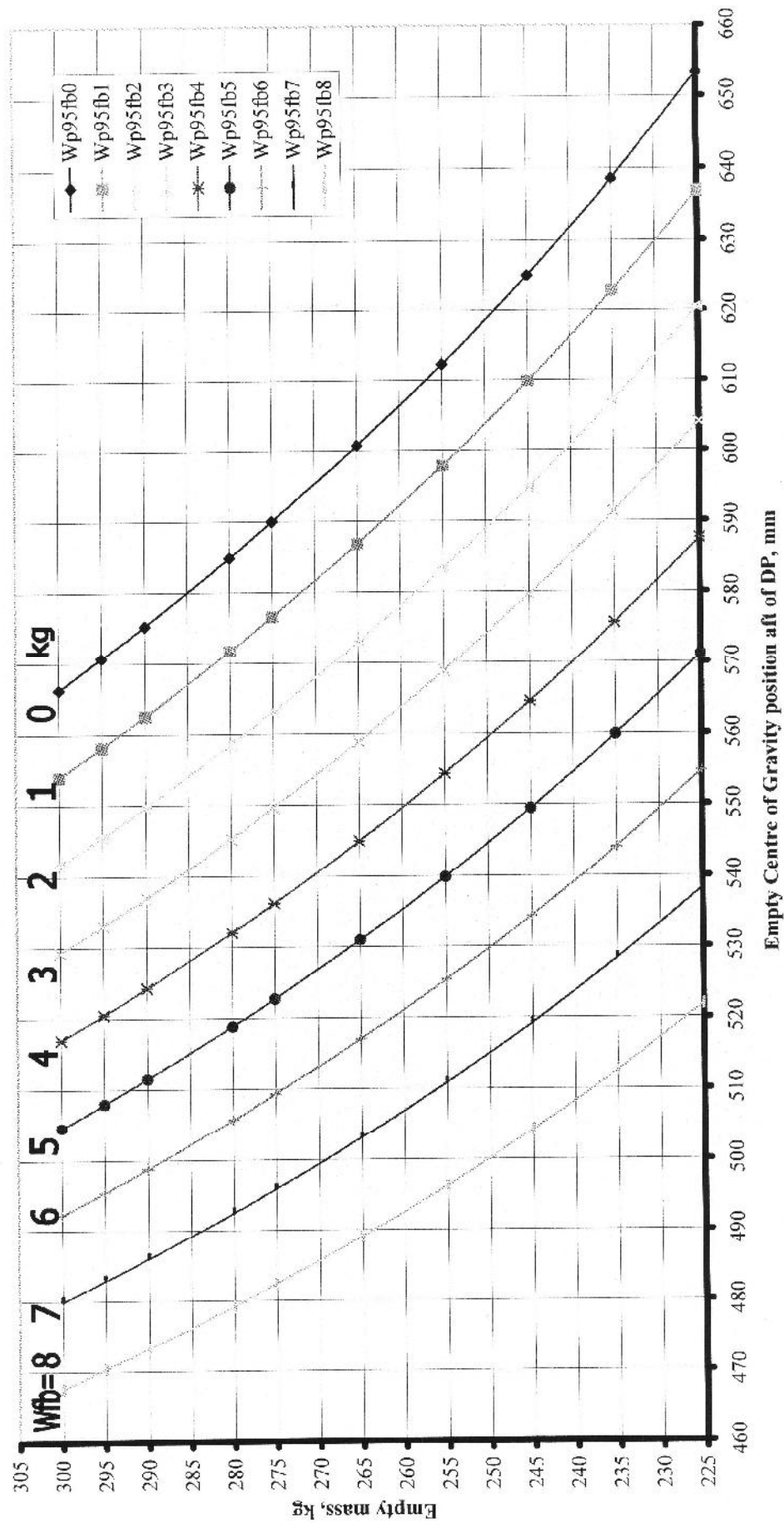
Aft limit for fin tank water ballast (engine retracted)



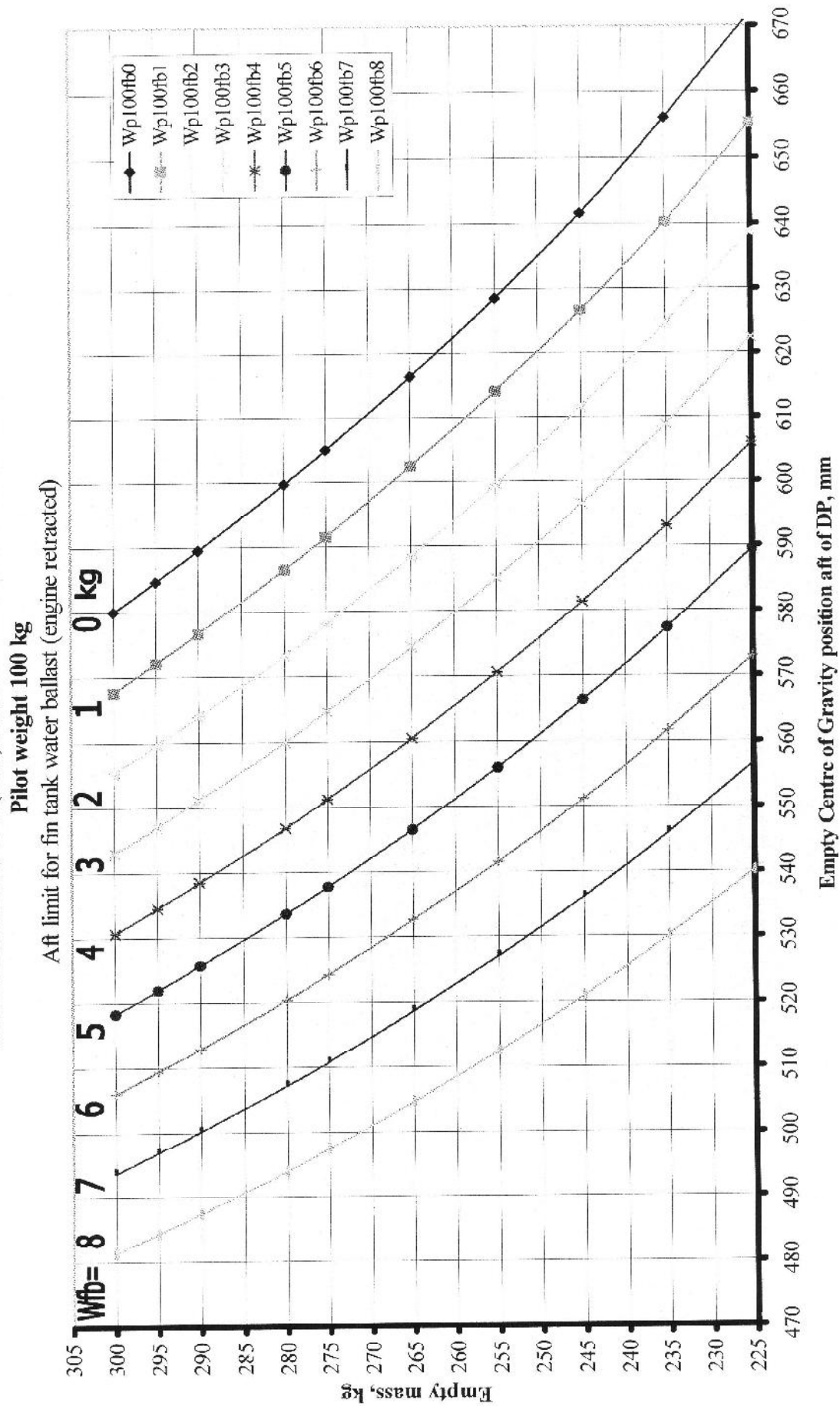
SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY

Pilot weight 95 kg

Aft limit for fin tank water ballast (engine retracted)



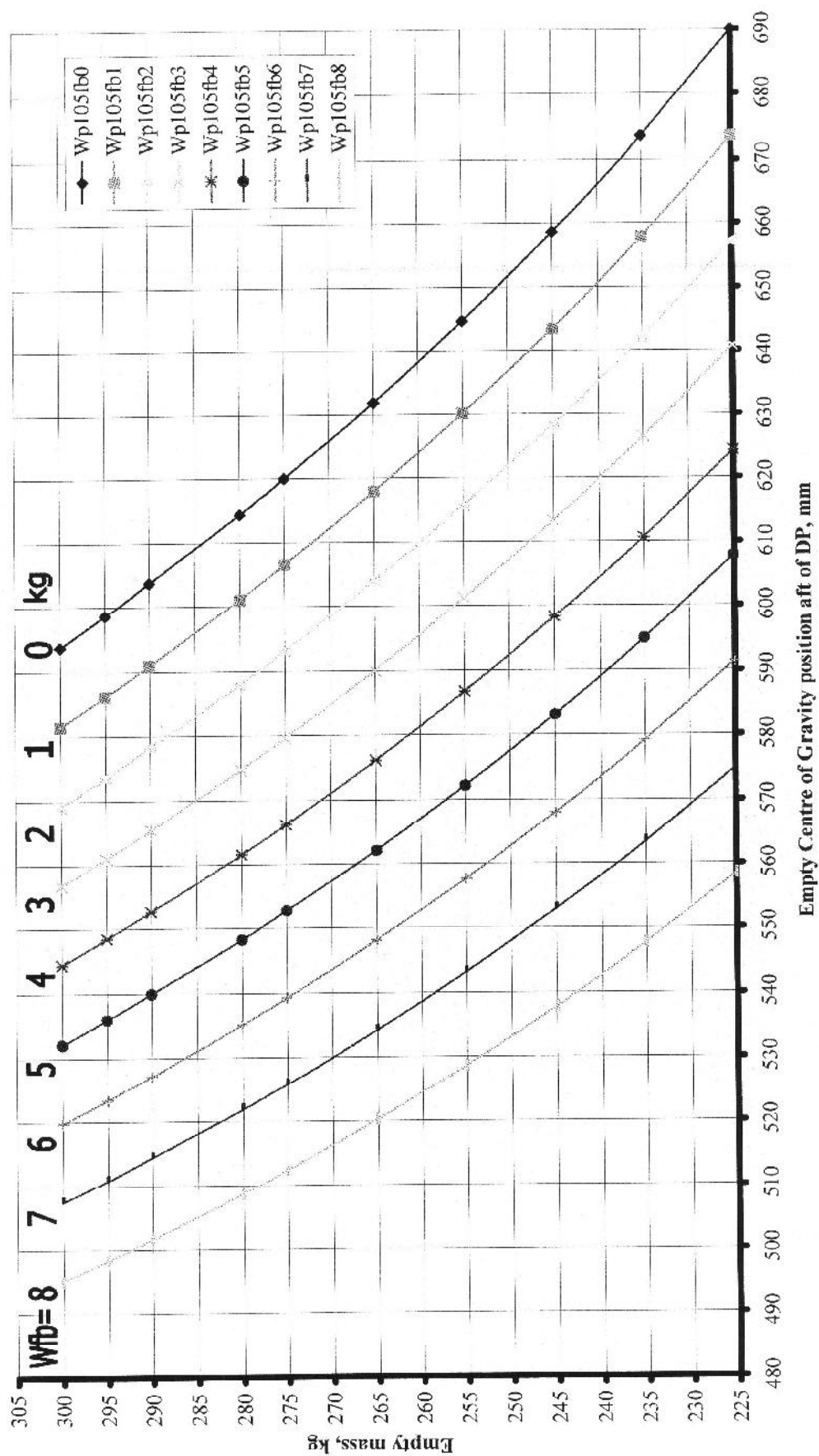
SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY



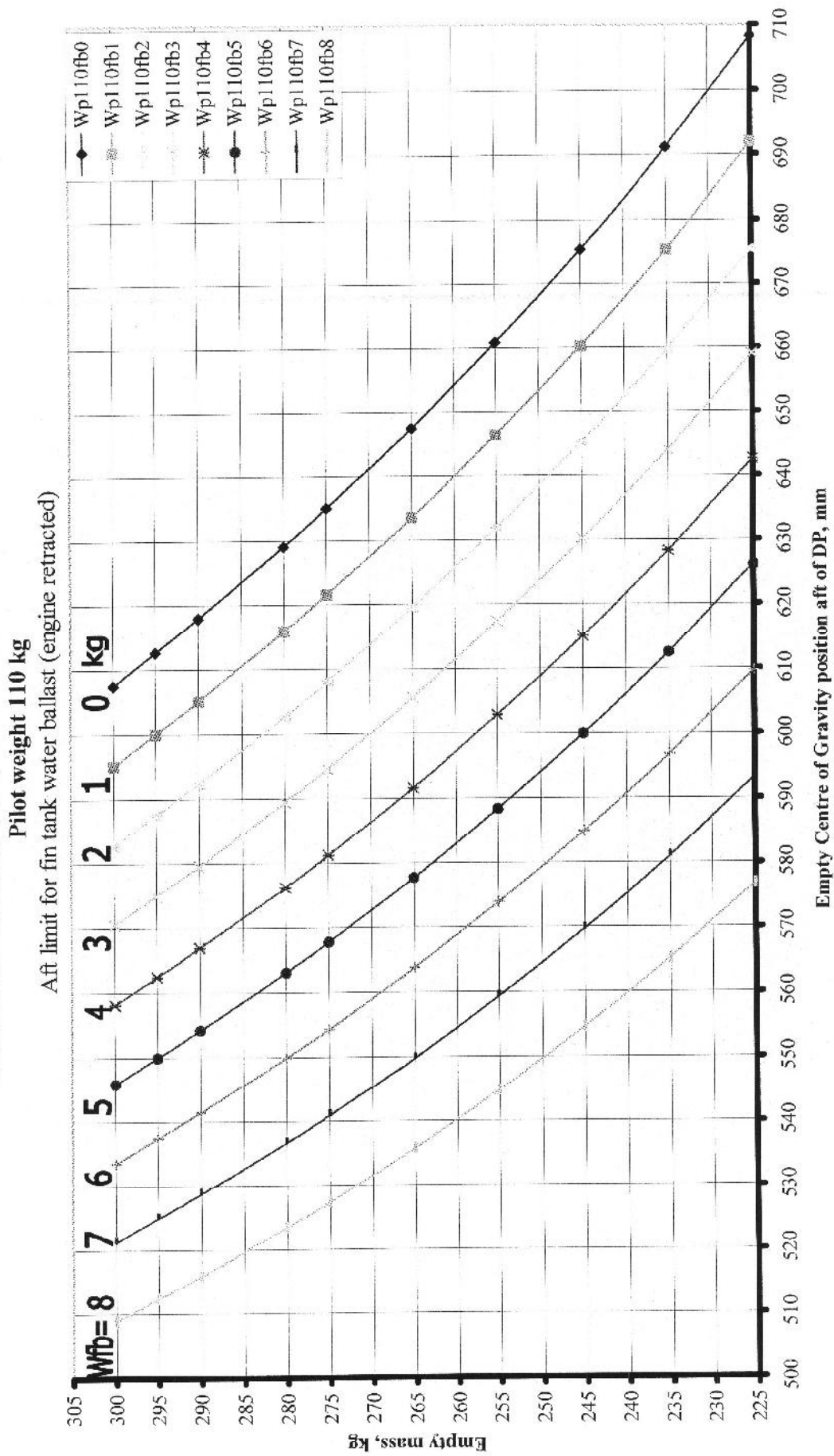
SAILPLANE LAK-19T (15m) EMPTY CENTER OF GRAVITY

Pilot weight 105 kg

Aft limit for fin tank water ballast (engine retracted)



SAILPLANE LAK-19T (15m) EMPTY CENTRE OF GRAVITY



SECTION 8

Repair

	Page
8.1 Introduction	1
8.2 Main requirements for repair work.....	1
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	2
8.3.4 Materials used for repair	3
8.4 Repair of metal parts	4
8.5 Illustrations	4

8.1 Introduction

General requirements for repair of minor sailplane damage are given in this section.

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. 8-1a, fig. 8-1b) 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 $\geq + 20^{\circ}\text{C}$ and humidity $\leq 65\%$.

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 $50\text{-}60^{\circ}\text{C}$ 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. 8-1a, fig. 8-1b, table 8-1).

Table 8-1

Pos. No	Repair damage	Zone 1	Zone 2
1	An opening	ϕ 100 mm	ϕ 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, 40 mm – for wings
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. 8-2.

If a part of advanced composites is damaged partially not through (fig. 8-2,a) its repair must be performed as follows:

- make round edges of a damaged zone,
- take out foam of opening (fig. 8-2,b) and check the internal layer for damage,
- if an internal layer is not damaged, prepare an upper coating for repair (fig. 8-2,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. 8-1a, fig. 8-1b, fig. 8-2,c).

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. 8-2,d) repair must be performed as follows:

- make round edges of a damaged zone,
- take out foam around the opening (fig. 8-2,c),
- prepare an upper coating for repair (fig. 8-2,c),
- glue in a plate on prepared internal layers according to requirements of fig. 8-2,c (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. 8-1a, fig. 8-1b, fig.8-2,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 8-2

Type (Interglass No)	Weaving type	Mass g/m ²	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				
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:

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

LAK-19T	MAINTENANCE MANUAL	Section 8	Page 8/4 Total pages 7
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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.

The engine compartment is painted with special fire protection paint of system Pyroplast-Primer L/ Pyroplast-Stahl L/ Pyroplast-Top L. The manufacture of the paint is Rutgers Organics GmbH (www.ruetgers-organics.de). Use this material if the paint was damaged and needs fixing.

8.5 Illustrations

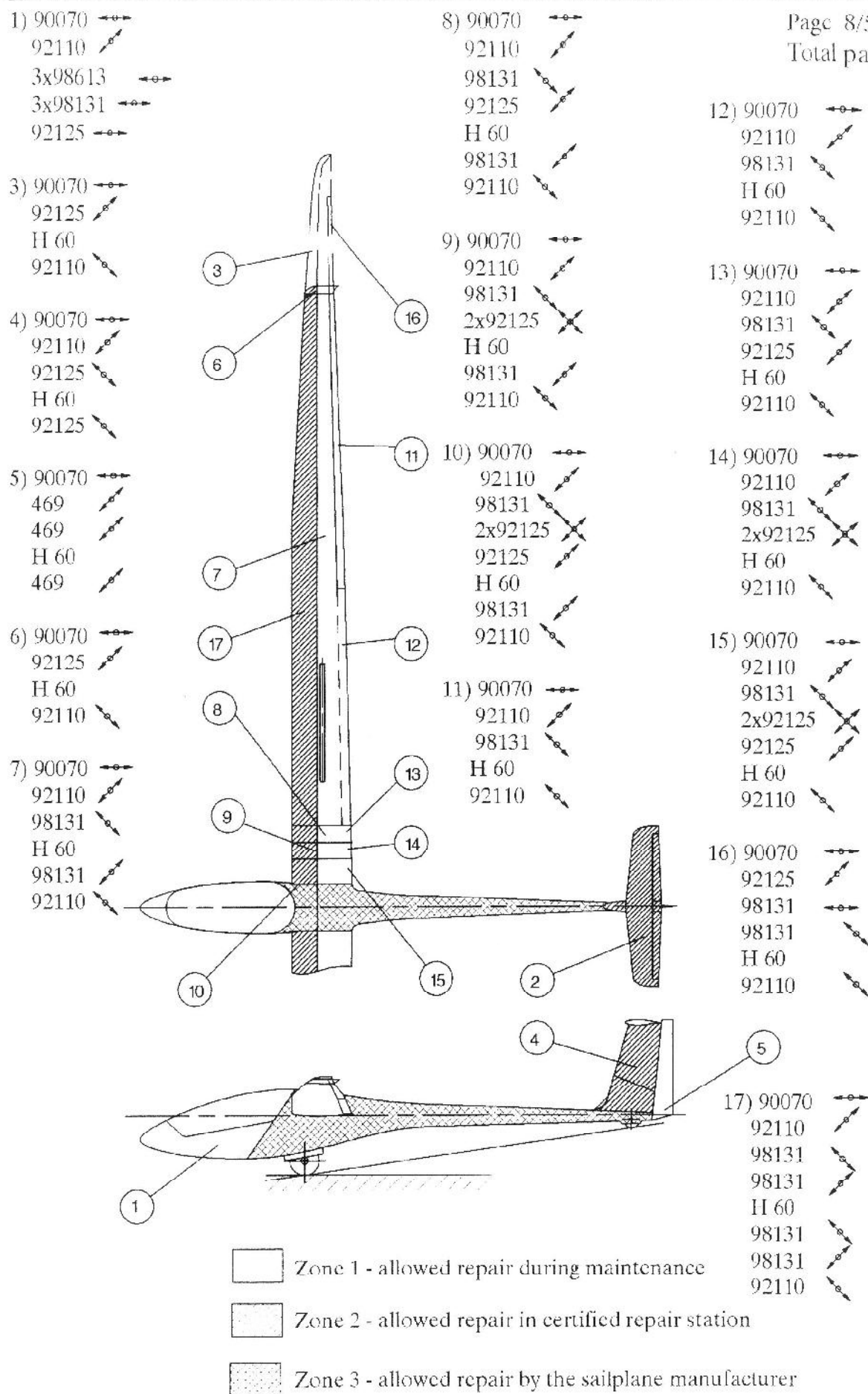
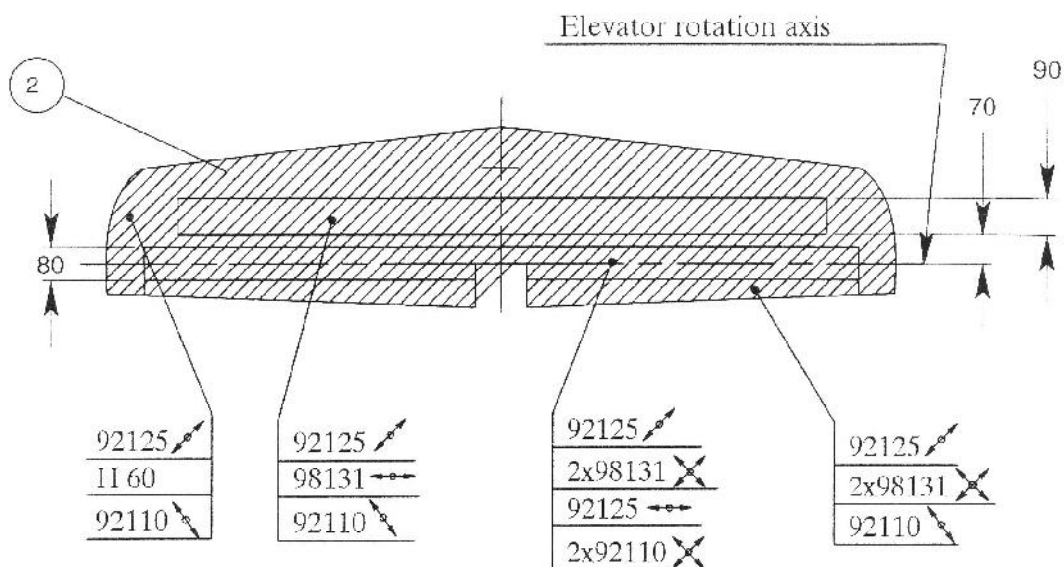


Fig8 - 1a. Repair zones of sailplane

An upper surface of stabilizer and elevator



A lower surface of stabilizer and elevator

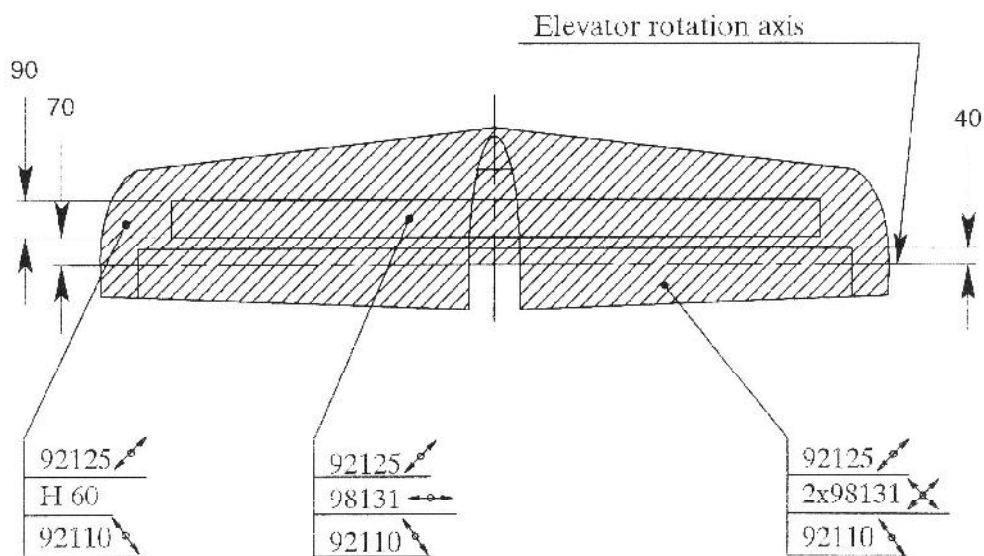
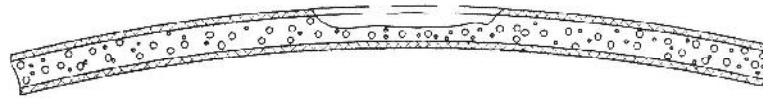


Fig.8 - 1b. Repair zones of sailplane

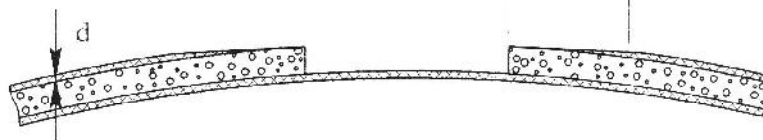
Repair of partially damaged skin

a) partial damage

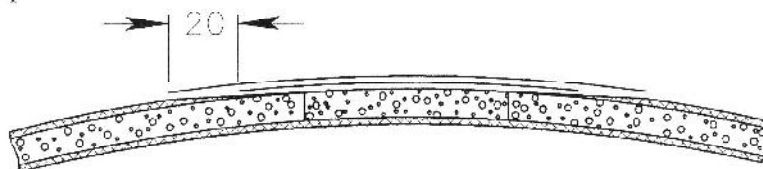


b) preparation for repair

$$l/d = 50$$



c) repair



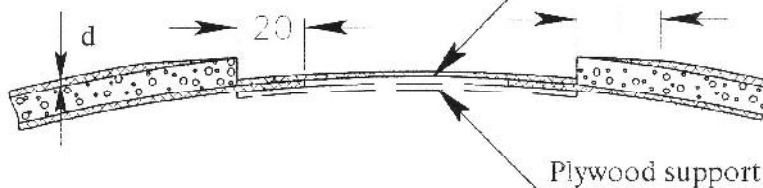
Repair of skin damaged through

d) through damage



e) preparation for repair

$$l/d = 50$$



f) repair

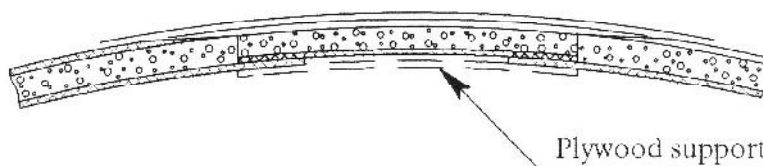


Fig.8 - 2 Typical repair of skin of composite skin sandwich

LAK-19T	MAINTENANCE MANUAL	Section 9	Page 9/1 Total pages 1
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SECTION 9

Appendixes