SZYBOWCOWY ZAKŁAD DOŚWIADCZALNY
Bielsko-Biała, POLSKA

ZAKŁAD SZYBOWCOWY »JEŻÓW« - Henryk Mynarski - 58-521 Jeżów Sudecki, ul. Długa 93
Dokument bez nadruku w kolorze czerwonym jest nielegalną kopią.
A document without overprint in red is an illegal copy.

SZD-30 „Pirat" Sailplane

FLIGHT MANUAL

Approved by Ministrg of Transport – CIVIL AIRCRAFT INSPECTION BOARD

1967

AMENDMENT SHEET

The place where the text has been changed is marked by a vertical line on the left of the text together with amendment number

O. No	Page	Amendment details	Date	Signature
	2.1 / 2.2	Change of op. conditions i.a.w. BE-035/30/2010	25/6/11	I/C924

TABLE OF CONTENTS

1. S A I L P L A N E D E S C R I P T I O N

1.1. GENERAL DESCRIPTION
/Fig. 1/

The SZD-30 "PIRAT" is a single-seat "Standard" class sailplane of good performance, designed as a general purpose sailplane for training and performance flights, including aerobatics.

It is of wooden construction. A high-wing monoplane with a "T"-configuration tail unit. The wing is in three parts with a characteristic dihedral of outer parts. The wing centre section, of rectangular shape, constant laminar aerofoil section,without dihedral has a multilongeron structure /no spars/. The wing stressed skin is made of double layers of plywood and is formed in concrete negative moulds. The wing centre section locates extendable, double plate type, aerodynamic brakes. The wing outer parts are of trapezoidal shape, of single-spar structure, plywood covered.

The wooden fuselage is covered with plywood. The cockpit canopy is suspended on side hinges and can be jettisoned in emergency. The wheel brake drive is connected

with air brake drive. The wheel band brake operates directly on the tyre. There are two launching hooks for both aerotow and winch launching. Moreover, a hook is provided for bungee launch. The fuselage rear part has permanently built-in grips for lifting up the tail.

The instrument panel contains: air speed indicator, altimeter, total energy variometer 5 m/sec., rate of climb indicator 30 m/sec., electric turn- and bank indicator and a compass. Owing to permissible all-up weight margin, installation of oxygen and radio systems could have been foreseen. 2 very spacious luggage compartments behind pilot's rest are provided.

The sailplane distinguishes itself by simple servicing, easy assembling and transportation. With wing outer parts dismounted, the sailplane has its span reduced to half size which considerably helps the handling and storage in hangars.

1.2. MAIN TECHNICAL DATA

Span	15.00 m
Length	6.86 m
Height	1.67 m
Wing area	13.80 sq.m
Aspect ratio	16.3
Wing centre section /rectangular/ chord	103.0 cm
Mean aerodynamic chord	94.5 cm

Rectangular wing aerofoil section	Fx 61-168
Outer wing aerofoil section	Fx 60-1261

1.3. FLIGHT INSTRUMENT INSTALLATION /Fig. 2/

All instruments are located on a panel suspended on shock-absorbers. Conduits and joints are accessible after removal of detachable top cover, made of laminate. The variometer compensating bottles are fastened to fuselage structure in front of the panel, Total energy and static pressure adapters are located in the fuselage nose. The static pressure tube has a dehydrator. The electric turn-and bank indicator is fed by one of the two available piles with possibility of switching over. The piles are located beneath the flight instruments.

1.4. OXYGEN INSTALLATION
/Fig. 8/

The sailplane is adapted to receive an oxygen breathing apparatus of the type SAT-5 located as follows:

- A column with SAT-5 apparatus on the cockpit floor ahead of the control stick. The column contains the pressure gauge with oxygen flow indicator, the inhaler /regulator/ and the mask hose end-piece.

- Oxygen cylinder 4 litres 150 kg/sq.cm with cut-off valve and charging valve with non-return valve in the bottom luggage compartment.

2. O P E R A T I N G L I M I T A T I O N S

1/ Maximum permissible empty sailplane weight with equipment indispensable to flight		255 kgs
2/ Permissible useful weight /pilot+parachute+disposable load/	min.	65 kgs
	max.	115 kgs
3/ Maximum all-up weight		370 kgs
4/ Empty sailplane /with equipment indispensable to flight/ centre of gravity distance from wing leading edge, measured on sailplane so set up that the fuselage rear leveling point is by 250 mm higher than the front one		63.5 ±2 cm
5/ Permissible limits of centre of gravity position in flight		
- with respect to M.A.C.		27 - 44% M.A.C.
- with respect to the leading edge		28.5 - 46.6 cm
6/ Proof load factor		+4.0/-1.5 ~~±6.0/-3.0~~
7/ Ultimate load factor		+10.3/-5.2
8/ Wing natural vibrations frequency		approx. 164/min
9/ The operating range extends to:		
Mac. flight speed IAS km/h		

	Still air	Rough air	Turbulent air
	G u s t s		
	up to ±4 m/sec.	up to ±10 m/sec.	up to ±30 m/sec.
a/ Winch launching, surface wind up to 12 m/sec.	120	120	-
b/ Aerotow take-off, surface wind up to 18 m/sec.	~~160~~ 140	~~140~~ 135	~~120~~
c/ Dive	~~250~~ 195	~~165~~ 135	~~140~~
d/ Flight with extended brakes	~~250~~ 195	~~165~~ 135	~~140~~

e/ Bungee launch with surface wind up to ~~15~~ m/sec.

f/ Opening of air brakes at speeds up to ~~250~~ 150 km/h

g/ Flight in clouds ~~without electric dischanges at speed under 140 km/h~~ FORBIDDEN

h/ Altitude flight upon condition of installing and efficient oxygen apparatus

i/ Aerobatics: ~~loop, stall turn, spiral, flick half roll and dive out, half roll and dive out, spin.~~ FORBIDDEN

j/ Training flights after dual control training

10/ Limitations

a/ Not admitted to night flying

b/ Flights in icing conditions are not recommended

c/ Air brakes shall be closed at speed below ~~150~~ km/h

11/ Supplementary conditions

a/ When using steel cables for launching, apply safety link of 690 kg tens. str.

b/ Before taking-off for a flight to accustom himself to the sailplane, the pilot shall get acquainted with the flight manual and, in particular, possess the knowledge of how to act in case of emergency in order to jettison the canopy and, eventually, bale-out.

c/ In view of insignificant value of the aerodynamic error, in flight limitations /chapter 2/ the value of EAS is taken as equal to IAS.

3. P E R F O R M A N C E D A T A
/Fig. 3/

At 340 kg flying weight /wing loading 24.6 kg/sq.m/,
the sailplane shows following performance /measured in flight/:

Minimum air speed	60 km/h
Minimum sinking speed	0.70 m/sec.
at an airspeed of	75 km/h
Maximum gliding ratio	31.2
at an airspeed of	83 km/h

Points of gliding polar and gliding ratio curve are given in the table beneath:

V km/h	65	70	80	90	100	120	150	200
W m/sec.	0.78	0.71	0.72	0.82	0.98	1.45	2.46	5.55
d	23.2	27.5	31.0	30.5	28.4	23.0	16.9	10.0

4. S E R V I C I N G T H E S A I L P L A N E

4.1. INSPECTIONS

4.1.1. Before flight

Before flight on a given day carry out the following pre-flight inspection and check the:

- validity of certificate of airworthiness in the sailplane log book,
- integrity of structure and covering,
- securing of assembly parts and control drive joints,
- control system operation,
- closing and release of launching hooks,
- closing and opening of canopy,
- wheel tyre pressure 1.8 kg/sq.cm /flattening of the tyre under the weight of the empty sailplane, on concrete surface, shall not exceed 3-4 cm/,
- pilot's safety belts,
- functioning of the airspeed indicator /when closing by hand the air intake to

total pressure adapter - the pointer should react to air impact; the same applies to static pressure heads, when air is blown into each of them/,
- condition of holes for static pressure /if necessary, pierce with a pin/,
- functioning of turn-and bank indicator,
- oxygen system acc. to 4.10.3.

4.1.2. Immediately before take-off

Immediately before take-off inspect the following items:
- luggage fastening,
- turn-and bank indicator operation,
- control system operation,
- closing /retraction/ of air brakes and canopy locking,
- closing of launching hook.

4.1.3. After flights

After flights proceed as follows:
- carry out the inspection as before flights,
- remove eventual faults and clean the sailplane,
- enter flight data into the log book,
- if the sailplane got drenched - remove the leaks, drain the static pressure tube dehydrator and let the sailplane dry.

4.2. ASSEMBLING AND DISMANTLING

4.2.1. Description of wing-fuselage joint and wing section interlinkage /Fig. 4/

Wing centre section joins the fuselage by means of two pairs of coaxial main fittings /1, 2 and 3, 4/.

Each pair is linked by a long pin /5/ which has two working cylindrical sections /fore and aft plus the handle/. The security of the end pin is achieved through immobilizing the handle by a safety catch /6/.

The outer wing part has a load carrying fitting /7/ and two stop-fittings /9 and 10/ collaborating with corresponding elements of wing centre section. The wing outer part is connected with the centre section by means of a vertical cylindrical load carrying bolt /13/ with a safety-pin /14/.

Installing and drawing-out the bolt is made with the help of the structural wrench /15/ which is beforehand screwed together with the bolt /13/. The same wrench serves to assemble the tail unit. The drive end-pieces become accessible after removal of the back cover /16/ and through inspection openings /19/ on wing internal surface.

4.2.2. Description of elevator unit - fuselage connexion /Fig. 5/

At positioning the tail plane on the tail fin the "T" - shaped duraluminium

fitting /1/ enters into its seat /1a/ and the front spigot /2/ gets in the corresponding socket /3/. The connexion is ensured by the fastening bolt /4/ screwed into the hole /4a/. The bolt is actuated by means of the structural wrench which shall be beforehand screwed together with the bolt. After closing the lid /5/, the bolt /4/ is automatically secured by the finger /6/.

While mounting the tail plane, the trimming tab drive is automatically linked through the lever /8/ getting in mesh with the forked piece /7/. The elevator drive joint is accessible from outside /9, 10/.

When assembling and dismantling the tail unit, it is allowed to use the bars protruding from fuselage rear, serving to lift the tail. Using them as footrest gives easy access to the fastening bolt.

4.2.3. Control system connectors

/Fig. 4 and 5/

The central connector of aileron drive situated on push-rod in the wing /Fig. 4-17/ is put upon the drive lever fixing pin in fuselage and is secured with safety pin.

The trimming tab has a fork connector /Fig. 5 - 7, 8/ which gets connected automatically at mounting the tail unit.

All remaining dismountable push rod end-pieces of ailerons, air brakes and elevator have quick-release connectors /Fig. 4 - 18, 20 and Fig. 5 - 9/ which require

no tools for servicing and have no loose parts. When the connector is correctly coupled, the forked arm of bush /22/ locks the end-piece of connector fixing pin /21/.

The bush is locked automatically by means of the spring catch with push-button /23/.

Note

ON A SECURED CONNECTOR THE PUSH-BUTTON /23/ MUST PROTRUDE FROM THE HOLE IN THE BUSH.

4.2.4. Assembling tools

/Fig. 4 and 5/

The only tool necessary for assembling is the structural wrench /15/. It serves to tighten the wing pins /bolts/ and the tail plane cylindrical bolt. One of wrench arms carries a screwdriver.

4.2.5. Assembly team

With some skill the assembling can be performed by a team of 3 persons. When mounting the wing centre section, the help by 2 other persons is desirable.

4.2.6. Assembly time

Amounts to 5 - 10 minutes depending on the team ability.

4.2.7. Order of assembling operations

1/ Open the canopy and take out the main pins. Remove the back cover. Take out the load carrying bolts.

2/ Clean and grease with petroleum jelly the working surfaces of fittings, bolts, sockets and control system connectors.

3/ Hold down the fuselage and put correctly the wing centre section. Insert the main pins and secure the handles with wedges. Connect aileron control /drive/ and secure with safety pin. Connect and secure air brake control elements acc. to 4.2.3.

4/ Screw together the structural wrench and one of the load carrying bolts. Set correctly the wing outer section till the fittings overlap, then insert the load carrying bolt. Set the bolt hole in flight plane and secure it with the safety pin /from the front to the back/.
Release the structural wrench. Using the inspection opening in wing lower surface connect and secure the aileron drive acc. to 4.2.3.

Remark

THE LOAD CARRYING BOLT MAY BE INSTALLED BY MEANS OF THE WRENCH ONLY BY PRESSING THE BOLT IN WITH SIMULTANEOUS OSCILLATING-ROTARY MOTION.
IT IS NOT ALLOWED TO DRIVE IT IN WITH HAMMER.
Proceed in the same manner when mounting the other wing outer part.

5/ Set the trimming tab and its slide in the cockpit near its neutral position. Screw together the structural wrench and the vertical bolt fastening the tail

plane, put the tail plane onto the fitting /1/ and socket /3/. The drive of trimming tab shall be thus connected automatically. Screw-in the fastening bolt /4/ and screw it home using the strength of one hand only, slightly moving the tail plane. The tightening of the screw shall remove any clearance. After tightening the wrench arm must be aligned in the sailplane symmetry plane or be perpendicular to the latter.

6/ Remove the wrench and close the lid. Use the screwdriver for screwing down the securing screw.

7/ Connect and secure the elevator drive acc. to 4.2.3.

8/ Check all connexions and move several times the drives of control surfaces, air brakes and trimming tab. Close the inspection openings and install the back cover.

4.2.8. Disassembly order

1/ Disconnect following control systems:
- control drives /connectors of aileron and air brake control drives are accessible after removal of the back cover/,
- aileron outer drives /accessible through wing lower inspection openings/,
- elevator drives /connector at the elevator/.

2/ Open the lid on the tail plane, install the structural wrench, undo the screw and take away the tail plane.

3/ Release the load carrying bolt safety pin of one of wing trapezoidal parts and install the structural wrench. Hold down /discharge/ the wing part under disassembly and tips of both trapezoidal parts and remove the load carrying bolt. Take off the wing outer part. Put back the bolt into fittings of the wing centre section and secure with the safety pin. Dismount in the same way the other wing outer part.

4/ Release the safetying of main pins and draw them out. Take off the wing centre section. Put the pins back into fuselage fittings and secure with safety wedges.

4.3. SERVICING ON GROUND

4.3.1. Sailplane ground handling

Hauling with speed not exceeding 10 km/h is recommended. Fasten the towing cable to the front towing hook. When hauling on concrete or on uneven ground, hold up the tail using the carrying handles.

4.3.2. Closing and opening the canopy

In order to close the canopy pull inside the supporting tie, then introduce the lock and the set claw into their sockets in the port side, press the lock to the port and pull the lock small lever to the rear. The lever is accessible from outside through the inspection opening.

The release of the lock takes place after shifting the lever forward.

4.3.3. Closing the canopy by means of a key

The canopy lock may be blocked in closed position by inserting from outside /through the hole in glazing/ a typical inset lock "MEFAZA". This lock must be put in together with its key. When the key is withdrawn the lock is secured and the canopy cannot be opened without the key.

4.3.4. Shifting pilot's rest

When adjusting the backrest take care to position symmetrically the right and the left pins and to correct setting of those into holders.

4.3.5. Adjusting the pedals

is carried out from pilot's seat, feet put on pedals. For this purpose:
- pull and retain the grip on the starboard,
- set the pedals in desired position,
- release the blocking grip.

4.3.6. Closing the towing hooks

Control cables projecting outside serve the purpose of closing the hooks. Each hook is closed separately.

4.3.7. Picketing

Prior to picketing the sailplane shall be placed against the wind at 45°. The wing tip directed upwind must be supported at approx. 1 m height. Anchor the sailplane by:

- front launch hook /forward/,
- tail skid or tail carrying handles /rearward/,
- passes in wing tips /at 45° outside, forward and rearward/.

The control stick shall be immobilized by means of belts and the rudder secured from outside. Close the canopy and the inspection window.
Put on the canopy cover.

4.3.8. Protection against atmospheric effect

The sailplane shall be protected against rain, insolation and dust. If drenching is unavoidable the sailplane shall be thouroughly wiped and leakages removed. When at rest /especially on an accidental field/ the canopy must be protected by a cover.

4.3.9. Inflating the tyre

The valve for inflating the tyre is situated on the wheel right side and is directly accessible through the recess in the side plate. Use the pump with a hose without the end-piece - the hose end is being put directly onto the valve.

Pumping shall reach the pressure of 1.8 kg/sq.cm /the flattening of the tyre must be equal to 3 - 4 cm under the weight of the empty sailplane/.

4.4. PILOT IN THE COCKPIT

The cockpit lodges comfortably the pilot of up to 2.00 m stature with a back-type parachute. Prior to take the seat in the cockpit it is necessary to adjust the parachute position depending on pilot's stature and weight. Pilots weighing less than 70 kgs should take advantage of the extreme front backrest position.

Pedals shall be adjusted after the seat has been occupied. This adjustment can also be carried out during the flight.

The pilot girded with safety belts must have freedom to perform full deflections of control stick and pedals and be able to reach by hand the instrument panel.

Access of fresh air is ensured by ventilation flap adjustable by means of a push rod at the right side of instrument panel, and otherwise through canopy small window.

Four side-pockets make easy the use of maps, charts etc. When preparing for a prolonged flight remove the funnel from its receptacle under the seat, because it is not easily accessible during flight.

R e m a r k

SMOKING IN THE COCKPIT IS FORBIDDEN!

4.5. INTRODUCTORY FLIGHT

The introductory flight may be performed with application of any launching methods. Prior to undertake the flight, the pilot must get acquainted with arrangements inside the cockpit and be aware of procedure to adapt for jettisoning the canopy and bailing-out in emergency.

4.6. FLYING QUALITIES

4.6.1. General characteristic

Flying qualities of the sailplane allow to use it safely for training flights /after dual control training/ and performance flights as well. The characteristic features are:

- stalling speid ranging from 58 km/h /light pilot/ up to approx. 62 km/h / heavy pilot/,
- very good controllability, especially the lateral onc,
- time required for reversing the direction of circling at 45° bank is approx. 3.5 sec.,
- low elevator control force,
- mean aileron · and rudder control forces,
- efficient trimming tab,
- very good circling qualities with flight controls set near their neutral position,

- correct side-slips at bank up to 20°,
- never exceed speed with air brakes extended and max. permitted flying weight of 370 kgs is 240 km/h.

4.6.2. Aero-tow

The take-off may be performed on grass-covered ground or on concrete. The admissible thickness of snow covering for take-off on the wheel is 15 cm. Beyond that value it is necessary to mount the skis.

Before taking-off the trimming tab must be set in neutral position. The admissible cross wind velocity is 5 m/sec.

Dusing the ground run the elevator shall be kept close to its neutral position. After unsticking the sailplane must be held down in level flight by easing the stick slightly forward. When sufficient speed is reached, correct the trimming tab setting. The aero tow speed shall be not less than 95 km/h.

4.6.3. Winch launching

It is advisable to take-off using the bottom hook since it is a correct and agreeable manoeuvre permitting to reach greater height. The trimming tab must be set in neutral position.

With cross-wind the taking-off must be performed by banking. The sailplane upwind. The admissible crosswind velocity is 5 m/sec.

The ground run is short enough and proceeds smoothly without longitudinal oscillations. After unsticking the sailplane should be held down applying a slight force upon the stick and next, pass over to a steep climb, slightly pulling the stick back. The best airspeed at winch launching is 90 - 100 km/h.

In the final stage of climbing the stick may be still pulled back a little.

Prior to cable release it should by loosened by easing the stick by a short motion forward. After release, the trimming tab setting shall be adjusted.

With a cable appr. 800 m long and headwind of 2 m/sec., the height reached is about 250 m.

Using the front hook for launching, the trimming tab must be set in neutral position. After unsticking the elevator shall be gradually pulled back till the desired angle of climb is reached. Should longitudinal oscillations appear,they must be suppressed by slightly easing the stick forward. The height attained with this method of launching is about 60% of the height reached when launching is made with the use of bottom hook.

4.6.4. Bungee launch

For bungee launch a single rubber cord with the assistong team of 2x5 persons is sufficient. With cross wind it is advised to use a double cord with 4x4 team.The admissible cross wind velocity in those circumstances is 5 m/sec.

For the take-off the elevator and the trimming tab must be set in neutral position. After the launch, the trimming tab position shall be adjusted /corrected/.

4.6.5. Flight with air brakes extended

The sailplane design allows to extend the air brakes within the whole range of permissible flight airspeeds.
At opening the airbrakes in flight with over 150 km/h speed, a strong jerk in the drive can be felt, which necessitates a strong withholding of the slider handle.The retraction of airbrakes shall not be operated at speed exceeding 200 km/h.

Extension and retraction of airbrakes does not cause perceptible changes in sailplane aerodynamic balance.

The limit speed in drive with airbrakes extended /never exceed speed/ and the maximum permitted flying weight of 370 kgs is 240 km/h.

4.6.6. Landing

The approach to land is to be performed at approx. 85 - 90 km/h airspeed and at 100 km/h with a strong headwing.

The angle of glide path is to be regulated using the airbrakes and eventually, applying side-slipping with bank up to 20° /at height over 10 m/. Durong side-slip with extended brakes a slight fuselage vibration can be felt.

Dependent on the extent of air brake opening, the touch down speed is approx. 60 - 65 km/h. The wheel·brake begin to operate as the air brakes are extended nearly to the half of their full travel. During the landing run the braking effect can

be increased to the point of full braking of the wheel. The efficiency of the brake is lessened on a wet ground or in case of inadequate pressure in the tyre.

4.6.7. Stalling

The stalling speed is appr. 58 km/h /for a light pilot/ and up to 62 km/h /for a heavy pilot/.

The sailplane stalled in a level flight maintains its "nose above horizon" attitude for quite a long time, then drops smoothly, without loss of its controllability. Further pulling back of the elevator when the sailplane loses height, causes loss of controllability and makes the sailplane sharply drop one wing.

At full pulling back the stick, the sailplane tends to get into spin. Bringing the elevator back to neutral position restores the controllability.

In circling, when stalled, the sailplane keeps the "nose above horizon" attitude for a long time with the tendency to increase the bank. Only when the stick is further pulled back, the sailplane begins to drop and tends to start a spin. The recovery occurs as soon as the elevator is bronght back to neutral position.

4.6.8. Spin

The character and behaviour in a spin depend on pilot's weight and on aileron deflection.

When the ailerons are deflected "against spin", the sailplane cannot be spun regardless to centre of gravity position.

With not deflected ailerons the spin may be started with pilots whose weight is below 90 kgs.

With ailerons deflected "with spin" a steady spin can be started at any pilot's weight.

Deflection of ailerons "with spin" facilitates introduction and maintaining of a steady spin.

The recommended method of initiating the spin is:

1/ To stall the sailplane statically.

2/ Just before the sailplane drops, to deflect the rudder and ailerons in the sense of autorotation.

3/ If longitudinal oscillations appear /with a light pilot/, to restore the ailerons neutral position.

The character of the spin is established during first two turns. A slight jerking of the stick caused by the elevator takes place. The inclination of sailplane longitudinal axis to the spinning axis and the speed depend on pilot's weight and are respectively:

- for a heavy pilot: approx. 80° at 120 - 130 km/h,
- for a light pilot: approx. 40° at approx. 50 km/h.

Release of controls or withdrawal of at least one of controls from position in which the steady spin has begun - causes recovery from the spin, almost without delay /for a heavy pilot/ or with a delay up to two turns /for a light pilot/. The recommended method of recovery:

1/ Deflect simultaneously the rudder and ailerons in direction opposite to that of spin autorotation.
2/ Bring the elevator back to neutral position.
3/ Recover the sailplane from the dive.

The delay in recovery when applying this method does not exceed 1/2 of a turn even at the most unfavourable position of the center of gravity.

4.6.9. Aerobatics

Prior to performing aerobatics, the pilot shall tighten the safety belts and make sure that parachute backrest is properly blocked.

The sailplane performs correctly the basic aerobatic manoeuvres and besides, the flick half roll and the controlled half roll. The initial air speeds for particular manoeuvres are:

- for loop . . . . . 140 - 160 km/h
- for stall turn . . . . . 160 km/h
- for spiral . . . . . 100 km/h
- for flick half roll and dive out . . . . . 90 km/h
- for half roll and dive out . . . . . 140 km/h

When performing aerobatics, it is necessary to take into account that the sailplane accelerates quickly in vertical elements of the manoeuvre /e.g. in half roll and dive out/. In stall turn, in upward elements of aerobatic figures, the efficiency of the rudder decreases rapidly thus necessitating a quick counteraction.

4.7. INSTRUCTIONS FOR FLIGHT CALCULATION
/Fig. 7/

The calculating disc of rate-of-climb indicator WRs-5 of the sailplane "Pirat" has a scale of crossing speeds, worked out diagramatically on the base of the gliding polar curve according to Mc Cready method. When the disc is set with its initial mark "75" to the value "0" of the rate-of-climb indicator as shown in Fig.7b, the scales form the following table:

Disc km/h	75	90	100	110	120	130	140	150	160
Rate-of-climb indicator m/sec.	0	1.25	1.8	2.6	3.3	4.2	5.0	6.0	7.4

Use of the disc is illustrated by the two following examples:

a/ Flight with maximum permissible cruising speed
/in relation to ambient air/

After leaving a thermal, set the initial mark "75" on the value of mean rate of climb, which is determined approximately according to rate-of-climb readings during circling /Fig. 7a/.

While crossing to the next thermal, the speed indicated by instrument pointer on the calculating disc, is to be maintained /crossing speed/. The crossing

speed and the cruising speed /in relation to ambient air/ depend on vertical current speed between thermals. Assuming for simplication the absence of descending currents, the following table is obtained for the sailplane "Pirat":

Mean rate of climb m/sec.	0	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0
Speed between thermals km/h	83	92	102	113	122	132	144	155	165
Cruising speed km/h	0	34.5	50.5	62	70	77	83	93	102

The true value of cruising speed /in relation to ground/ varies depending on wind velocity. It is determined by addition of both vectors.

b/ <u>Flight with maximum possible range</u> /in relation to ambient air/

Proceed as in example a/ but set the initial mark "75" on "0" of the rate-of-climb indicator /as in Fig. 7b/.

In flight up the wind, in order to get the maximum range in relation to ground, the air speed is to be increased and in flight with tail wind decreased respectively in relation to the value indicated by the calculating disc,

4.8. FLIGHT IN THE RAINFALL

The raindrops make worse the performance and the forward visibility. High air humidity in the rainfall zone favours deposition of vapour on canopy inner surface.

The static pressure tubes may accumulate water and that involves the decrease and even total decline of A.S.I. readings.

For these reasons flying in the rainfall must be limited to a minimum. In unavoidable cases the canopy window shall be opened and the front ventilation flap slightly deflected.

After the flight in rainfall the transmitters of static pressure shall be disconnected from the instruments and blown through. The dehydrator shall be drained.

4.9. FLIGHT IN ICING CONDITIONS

Flights in icing conditions shall be limited to unavoidable cases as they may cause deterioration of performance, clogging of the air speed indicator tubes, lack of visibility and jamming by ice of flying controls.

If icing effect has been ascertained, the window shall be opened and aerodynamic brake drives set in motion from time to time.

After flying in icing conditions, the total energy and static pressure tubes shall be disconnected and blown through.

4.10. SERVICING AND USE OF THE OXYGEN SYSTEM /Fig. 8/

4.10.1. Functioning

The SAT-5 is a high pressure oxygen apparatus /150 kg/sq.cm/, with constant oxygen flow and regulation by leaps of oxygene percentage contents in the mixture. The apparatus may be used up to 12 km altitude.

In sailplane "Pirat" the main group of SAT-5 apparatus, consisting of pressure gauge /7/ with oxygen flow indicator /8/, inhaler /9/ and mask hose connector /10/, is located in column /1/ in front of control stick, within pilot's reach. The oxygen cylinder with cut-off valve /2/, nonreturn valve /4/ and charging valve /3/ are placed in the bottom luggage compartment.

The inhaler /regulator/ consists of a reducing valve and dosing nozzles. By means of inhaler knob the mechanism can be cut off or set on one of four altitude ranges /4–6, 6–8, 8–10, 10–12 km/, or, finally, put into emergency position.

When the system is operating the oxygen, reduced to the pressure of approx. 1.5 kg/sq.cm, flows in a continuous stream from inhaler /9/ to flow indicator /8/ and further to mask /12/ and rubber bag /16/. The quantity of oxygen supplied is adjusted by the pilot /stepped regulation/.

The bag ensures a thrifty operation of the oxygen breathing apparatus in spite of the steady oxygen flow.

At altitudes below 8 km the pilot, when inhaling, absorbs additionally the ambient air through the adjustable respiratory valve /14/ in the mask. Above 8 km this valve must be closed.

At expiration the used air enters the bag and mixes there with fresh oxygen; partially, it escapes into the atmosphere through expiratory valve /15/.

The rubber drain plug /17/ serves to evacuate the condensed water. The apparatus works within pressure range 150 to 10 kg/sq.cm. With initial pressure in the 4 litre cap. cylinder equal to 150 kg/sq.cm, the pilot has at his disposal

$$4 \times /150-10/ = 560 \text{ litres}$$

4.10.2. Filling the cylinder

1/ Open the luggage compartment and inspection opening /3a/, unscrew the charging valve cap and connect the filling set.

2/ Set the inhaler knob in position "closed".

3/ Open the cut-off valve /on the cylinder/ and put into operation the filling set checking the charging process after board pressure gauge.

4/ When the the pressure of 150 kg/sq.cm is reached, close the cut-off valve, disconnect the filling tube and plug the valve.

C a u t i o n

PRESERVE ABSOLUTE CLEANNESS WHEN SERVICING FITTINGS AND CONNECTIONS THAT MAY BE AFFECTED BY OXYGEN UNDER PRESSURE. EVEN TRACES OF GREASE FROM HANDS MAY CAUSE EXPLOSION OR FIRE!

4.10.3. Inspection of the oxygen system before beginning the flights

1/ Carry out inspection of accessible parts of the oxygen system, check if there are missing elements, defects or dirt.

2/ Close the inhaler. Open the cut-off valve /on the cylinder/ and check oxygen pressure. The minimum recommended is 45 kg/sq.cm. Close the cut-off valve and 2 min. later read the oxygen pressure again, tapping the pressure gauge. Pressure drop should be almost imperceptible. If a leakage is detected, all connections shall be checked in succession by covering them with soap foam. Tighten the connections till they become leakproof. Clean the soap traces.

3/ Disconnect the mask hose /bayonet joint/. Check oxygen flow by setting the inhaler successively on all working ranges. At each knob position, close for a while the hose end with finger: the pointer shall react immediately.

C a u t i o n

SHUT THE END-PIECE FOR AS SHORT A WHILE AS POSSIBLE, IN ORDER TO PROTECT THE FLOW INDICATOR DIAPHRAGM AGAINST OVERLOADING.

4/ Apply the disconnected mask to the face, close the respiratory valve and shut the hose inlet with finger. Try to respire. If this is impossible, the set mask+bag may be considered tight enough.

4.10.4. Pre-flight inspection of the oxygen system

1/ Open the cut-off valve and read oxygen pressure which should amount to min. 45 kg/sq.cm.

2/ Close the inhaler and the respiratory valve. Put on the mask and adjust correctly the fastening strips. Check the proper mask adherence to the face by trying to breathe.

3/ Switch in turn all working ranges and check the oxygen flow to the bag. Observe the reaction of oxygen indicator when changing the ranges.

4/ Close the inhaler. Put aside the mask. Open the mask respiratory valve.

4.10.5. Making use of the oxygen system in flight

1/ After 30 min of flight at 3000 m altitude above sea level or having reached the altitude of 4000 m - carry out following operations:
- set the inhaler on "4-6" range,
- check the opening of mask expiratory valve visually,
- put on the mask and breathe. The mask bag shall hang freely and not be pressed.

Observe the indicator work and bag throbbing, check the oxygen pressure. Before it drops to 10 kg/sq.cm descend below 3000 m altitude.

C a u t i o n

OBSERVE ACCURATE SETTING OF THE INHALER ON THE DESIRED RANGE /SNAP TO!/. IN THE KNOB INTERMEDIATE POSITION THE OXYGEN OUTPUT IS EQUAL TO THE TOTAL OUTPUT OF BOTH ADJACENT RANGES AND A QUICK EXHAUSTION OF OXYGEN RESERVE TAKES PLACE.

- IN CASE OF INDISPOSITION SWITCH THE INHALER IMMEDIATELY ON THE EMERGENCY RANGE AND RETURN AS FAST AS POSSIBLE TO THE AIRFIELD!
- NEVER ALLOW THE CYLINDER TO DISCHARGE BELOW 10 kg/sq.cm PRESSURE.

2/ Use of the installation during climb

Altitude in km above sea level	Set the inhaler on range	Respiratory valve shall be
4 /3/	4 - 6	Opened
6	6 - 8	Opened
8	8 - 10	Close!
10	10 - 12	Closed

3/ Use of the installation during descent

Altitude in km a.S.L.	Set the inhaler on range	Respiratory valve shall be
10	8 - 10	Closed
8	6 - 8	Open!
6	4 - 6	Opened
3	Close!	Put the mask away

4/ Mean oxygen consumption

Altitude range km a.S.L.	Oxygen output litres/min	Time of oxygen reserve consumption under pressure kg/sq.cm				
		150	120	80	50	30
4 - 6	2.5	$3^h44'$	$2^h36'$	$1^h52'$	$1^h04'$	32'
6 - 8	3.5	$2^h40'$	$2^h06'$	$1^h20'$	46'	22'
8 - 10	5.0	$1^h52'$	$1^h28'$	56'	32'	16'
10 - 12	8.5	$1^h06'$	52'	34'	18'	10'
Emergency	14.0	40'	32'	20'	12'	6'

At mean oxygen consumption after the abovementioned time has clapsed, the pressure in the system shall be 10 kg/sq.cm.

5/ Oxygen reserve indispensable for a quick descent to altitude of 3000 m a.S.L.

Down from altitude km	Time of descent x/ min	Indispensable reserve of oxygen xx/	
		Normal operation	Emergency operation
12	approx. 7	18 kg/sq.cm	34 kg/sq.cm
10	approx. 6	15 kg/sq.cm	30 kg/sq.cm
8	approx. 4	13 kg/sq.cm	25 kg/sq.cm
6	approx. 3	12 kg/sq.cm	20 kg/sq.cm
4	approx. 1	11 kg/sq.cm	15 kg/sq.cm

x/ Time of descent is given in round numbers approx. to 1 min, assuming the equivalent sinking speed equal to 15 m/sec and taking into account variation of air density.

xx/ The oxygen reserve includes the required ultimate reserve of 10 kg/sq.cm pressure, that must remain in the system after the descent.

4.10.6. Oxygen system post-flight inspection

1/ Close the cut-off valve. Set the inhaler on any working range and wait till the pressure gauge indicates "0" pressure.
2/ Unscrew the plug from the mask and drain water.
3/ Wash the mask with rectified alcohol and let dry.
4/ Eventually fill up the oxygen cylinder.

4.11. ROAD TRANSPORT

The sailplane may be conveyed on a special trailer or on an universal cart adapted for road transport. The wing sections may be placed in appropriate holding clamps or fastened using the wing load carrying fittings and bushings at wing tips. The fuselage resting on clamps can be immobilized by fixing the wheel axle /tapered holes drilled on axle ends/, tail protruding bars and, eventually, tail skid. The tail plane shall be fastened in clamps.

In order tc prepare the sailplane, disassembled into main components,for transportation, carry on the following operations:

- check the full strength and safetying of all pins, bolts, assembly details and equipment,
- immobilize connectors of aileron, air brake and elevator controls /binding them by means of wire or cord or wrapping up with rags/,
- fix the control stick by means of pilot's safety belts,
- fix the contents of the cockpit and luggage compartments,
- close the canopy, ventilation flap, window and all inspection openings; put on the canopy cover,
- if an uncovered cart is to be used for transportation,without sailplane covers, protect all fittings against dust and rain.

After removal from the cart, the sailplane shall be cleaned, securing items pushed aside and protective grease on fittings replaced.

5. SPECIAL FLIGHT CONDITIONS AND EMERGENCY INFORMATION

5.1. RUPTURE OF THE TOWING CABLE DURING WINCH LAUNCHING

a/ When the towing cable breaks at an altitude below 50 m, proceed as follows:
- pass immediately to glide,
- release the towing cable,
- extend the air brakes and land straight forward on the airfield.

b/ If rupture of the towing cable occurs at altitude of 50 to 100 m, then:
- pass to glide,
- release the cable,
- without changing the flight direction, fly away to a distance necessary to land in opposite direction /with tail wind/,
- turn through 180° and land /with tail wind/.

c/ If the towing cable breaks at an altitude above 100 m:
- pass to glide,

- release the cable,
- carry out a shortened circuit or approach to land in other safe way.

5.2. FLIGHT WITH DEFECTIVE INSTRUMENTS

If faulty functioning of the A.S.I. has been ascertained, do not perform aerobatics or a flight without visibility.

If during the flight in clouds, the A.S.I. ceases to work normally, estimate the airspeed after sailplane acoustical qualities, avoiding considerable changes of the airspeed. If difficulties appear, extend the air brakes and leave the cloud in a straight flight.

If, when flying in clouds, the turn-and bank indicator becomes defective, extend the airbrakes and get out of the cloud in a straight flight, making advantage of compass and clinometer indicatores.

5.3. DEFECTIVE ELEVATOR, RUDDER OR AILERONS

When the drive of one of these control surfaces becomes defective, still leaving the saiplane under partial control, the pilot shall try to substitute the defective control system by:
- ailerons in place of rudder,
- rudder in place of ailerons,
- trimming tab in place of elevator.

The control by the trimming tab gives the reverse effect /if the elevator is blocked/ or the normal one /if the elevator drive rupture has taken place/.

If the abovementioned endeavours do not enable the pilot to bring the sailplane to land under control, the bailing out with parachute becomes necessary.

5.4. JETTISONING OF THE CANOPY AND PARACHUTE JUMP

5.4.1. Obligatory abandonment of the sailplane

When there is no possibility to bring the sailplane to the ground in controlled flight, leaving the sailplane becomes necessary in order to save the pilot's life. The pilot is obliged to bail out in following cases:

- failure of technical nature, unabling the piloting,
- complete lack of possibility to land, caused by clouds sticking right to the ground,
- fire on board during the flight,
- capital indisposition of the pilot /e.g. loss of sight/.

5.4.2. Sequence of operations to carry out

1/ Let loose the control stick.

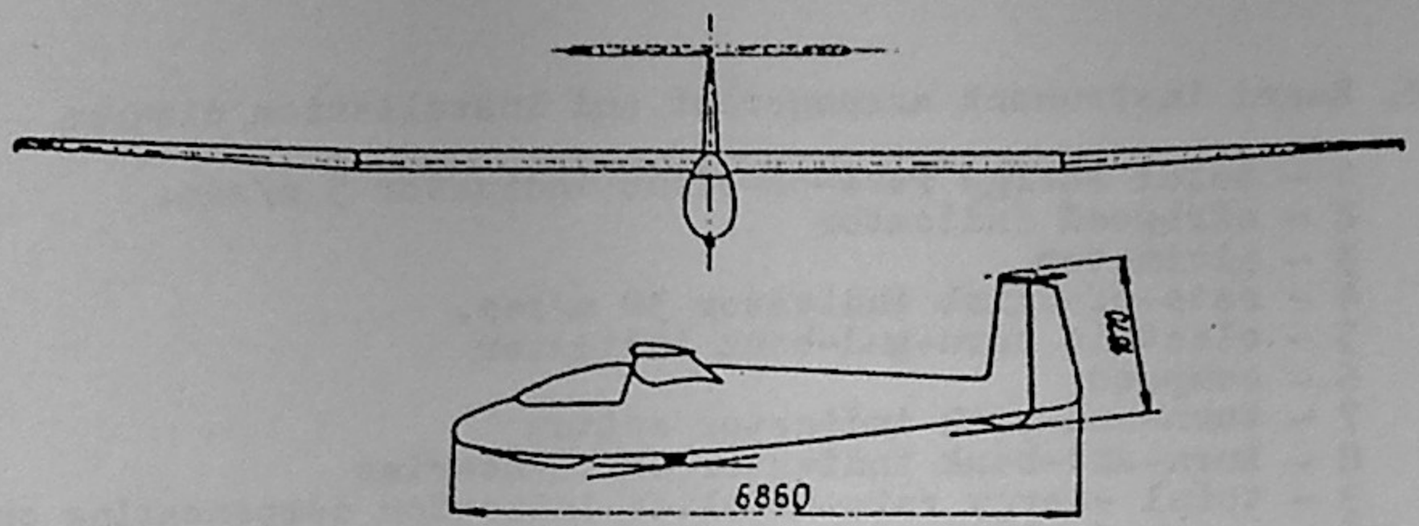
2/ Grip with both hands and push forward the two canopy handles, then repel the released canopy and throw it overboard.

3/ Undo and throw away the safety belts.
4/ Bring the feet close to the saddle and rest the hand on sailplane boards.
5/ Jump in the direction of sailplane eventual turn.
6/ Wait for about 3 sec. to get away from the sailplane and open the parachute.

5.4.3. Procedure in particular cases

- When the canopy cannot be jettisoned, try to destroy the glazing, beginning with the window.
- If the jump takes place at altitude below 200 m, open the parachute immediately after bailing out, taking care however, not to be caught by the structure, especially by the elevator.
- When the flight altitude is above 5000 m a. S.L. or when there is a strong ascendant current which may lift up the pilot with the parachute well above 5000 m - it is advisable to stay if possible in the sailplane cockpit and wait till the sailplane sinks to the safe altitude /observe the altimeter/. However, it is not advisable to bail out under such conditions with big delay of opening, as damage may occur to the parachute and because of body frostbite to the pilot.

6. DRAWINGS AND DIAGRAMS


6860
1770
3100
14950

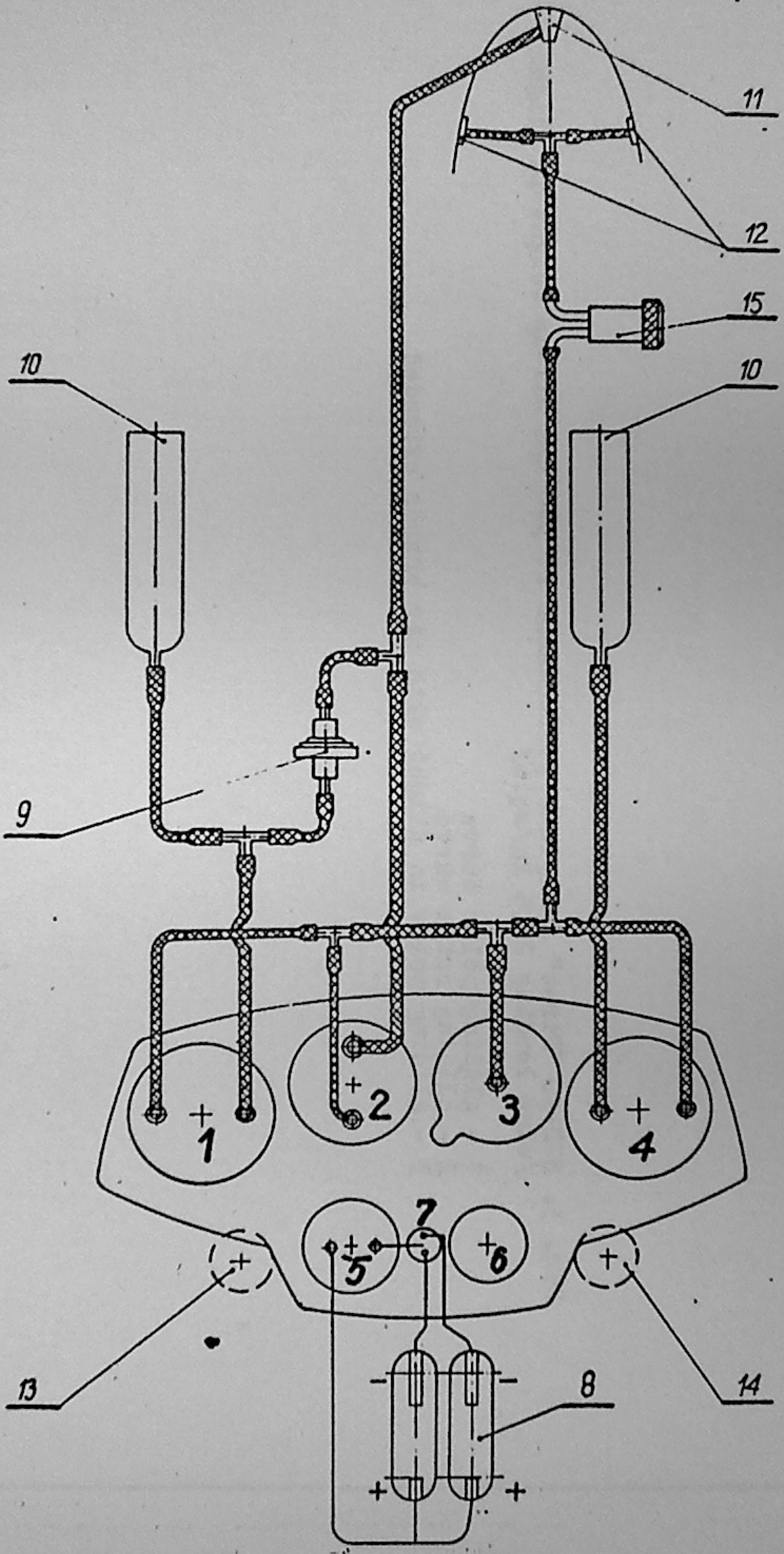

11
12
15
10
10
9
1
2
3
4
7
5
6
13
8
14

Fig. 3. SZD-30 "Pirat" sailplane performance at 340 kgs all-up weight in flight /wing loading 24.6 kg/sq.m/

1 - gliding polar curve
2 - gliding ratio curve
3 - gliding polar in flight with air brakes extended

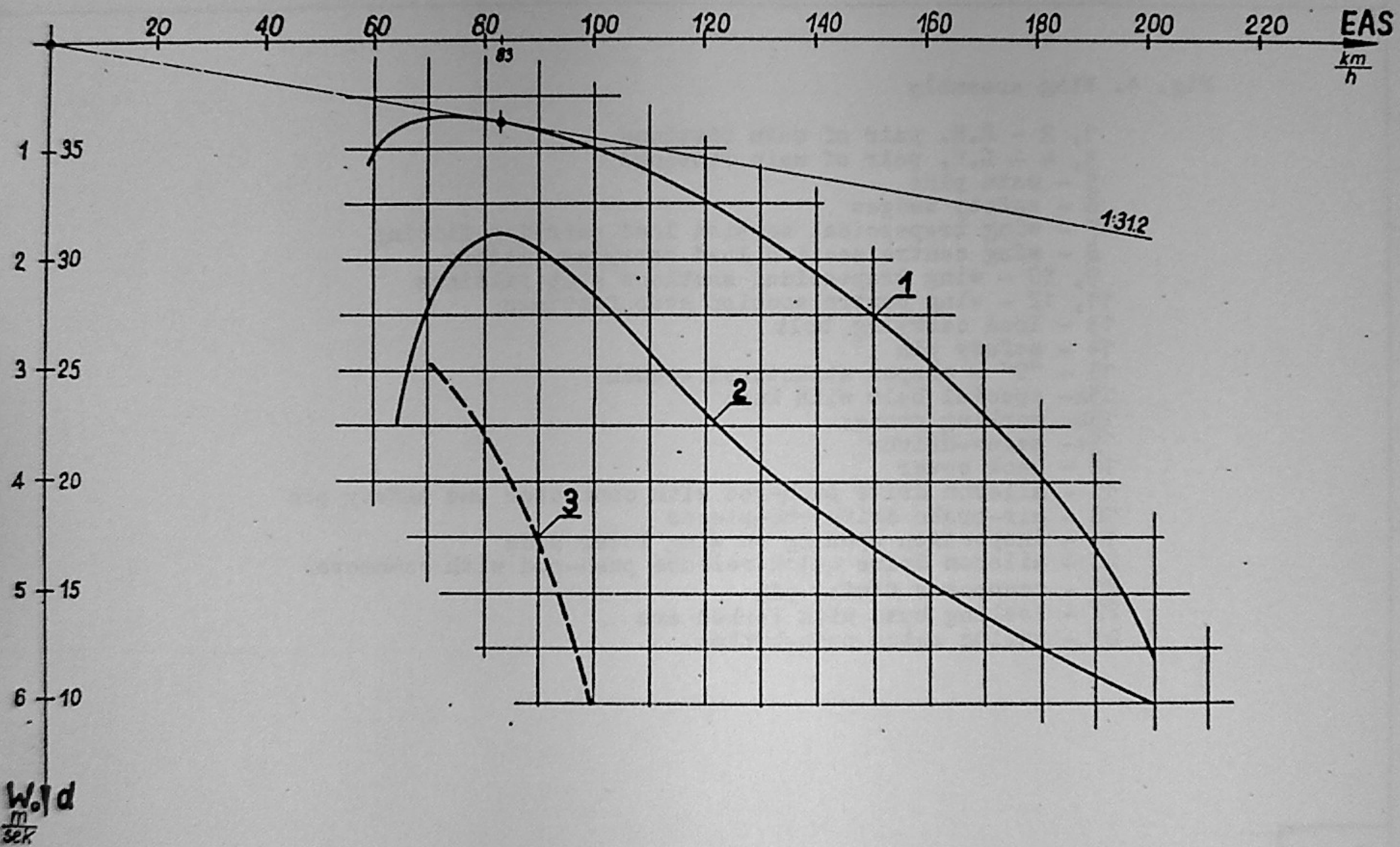

20
40
60
80
100
120
140
160
180
200
220
EAS
km/h
83
1
35
2
30
3
25
4
20
5
15
6
10
W.
d
m/sek
1:312
1
2
3

Fig. 4. Wing assembly

1, 2 - R.H. pair of main fittings
3, 4 - L.H. pair of main fittings
5 - main pins
6 - safety wedges
7 - wing trapezoidal section load carrying fitting
8 - wing centre section load carrying fitting
9, 10 - wing trapezoidal sections stop fittings
11, 12 - wing centre section stop fittings
13 - load carrying bolt
14 - safety pin
15 - "T" - shaped structural wrench
15a- special bolt with knob
15b- working prongs
15c- screw-driver
16 - back cover
17 - aileron drive push-rod with connector and safety pin
18 - air-brake drive end-pieces
19 - inspection opening on wing lower side
20 - aileron drive quick-release push-rod with connector
21 - connector fixing pin
22 - locking bush with forked arm
23 - spring catch push-button

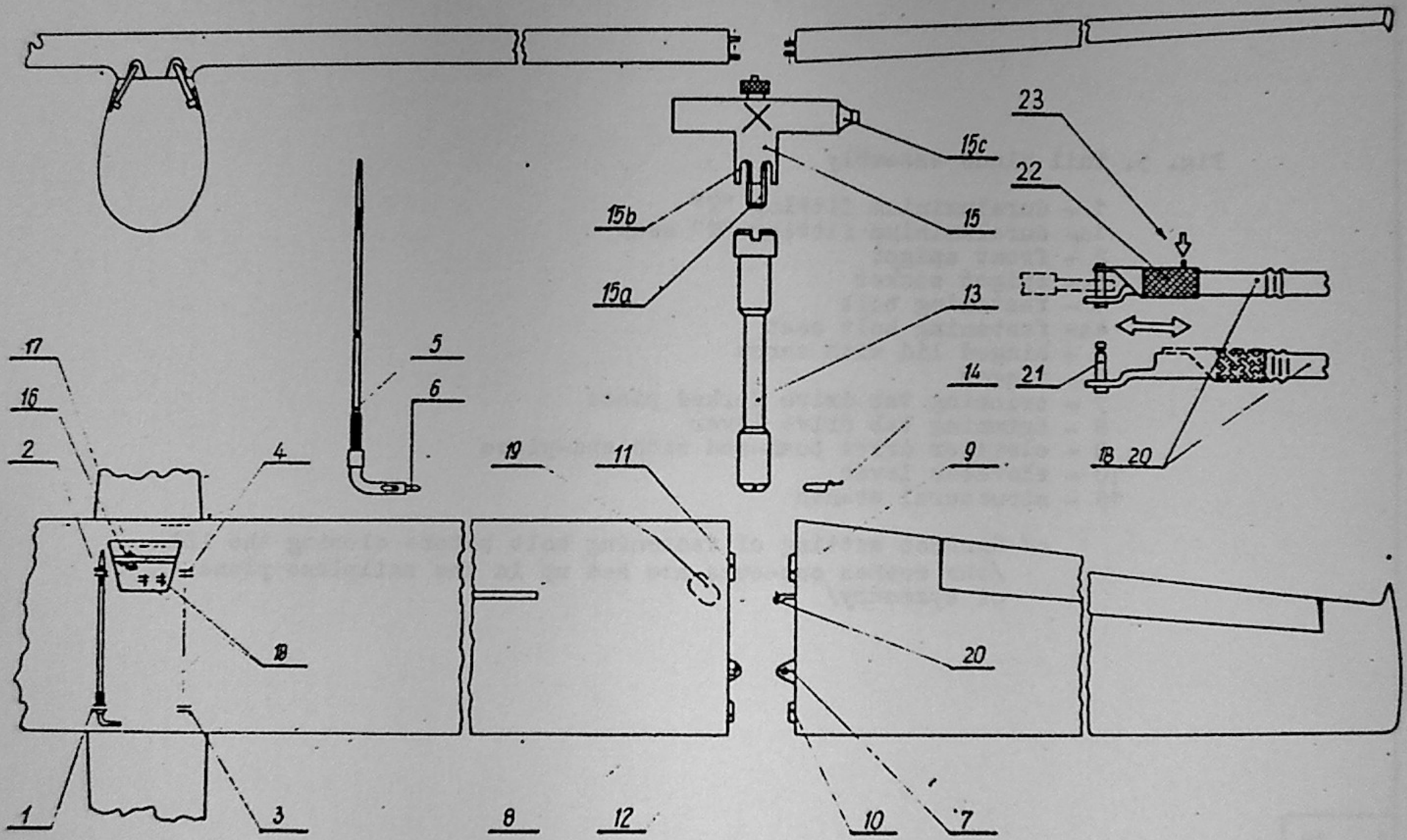
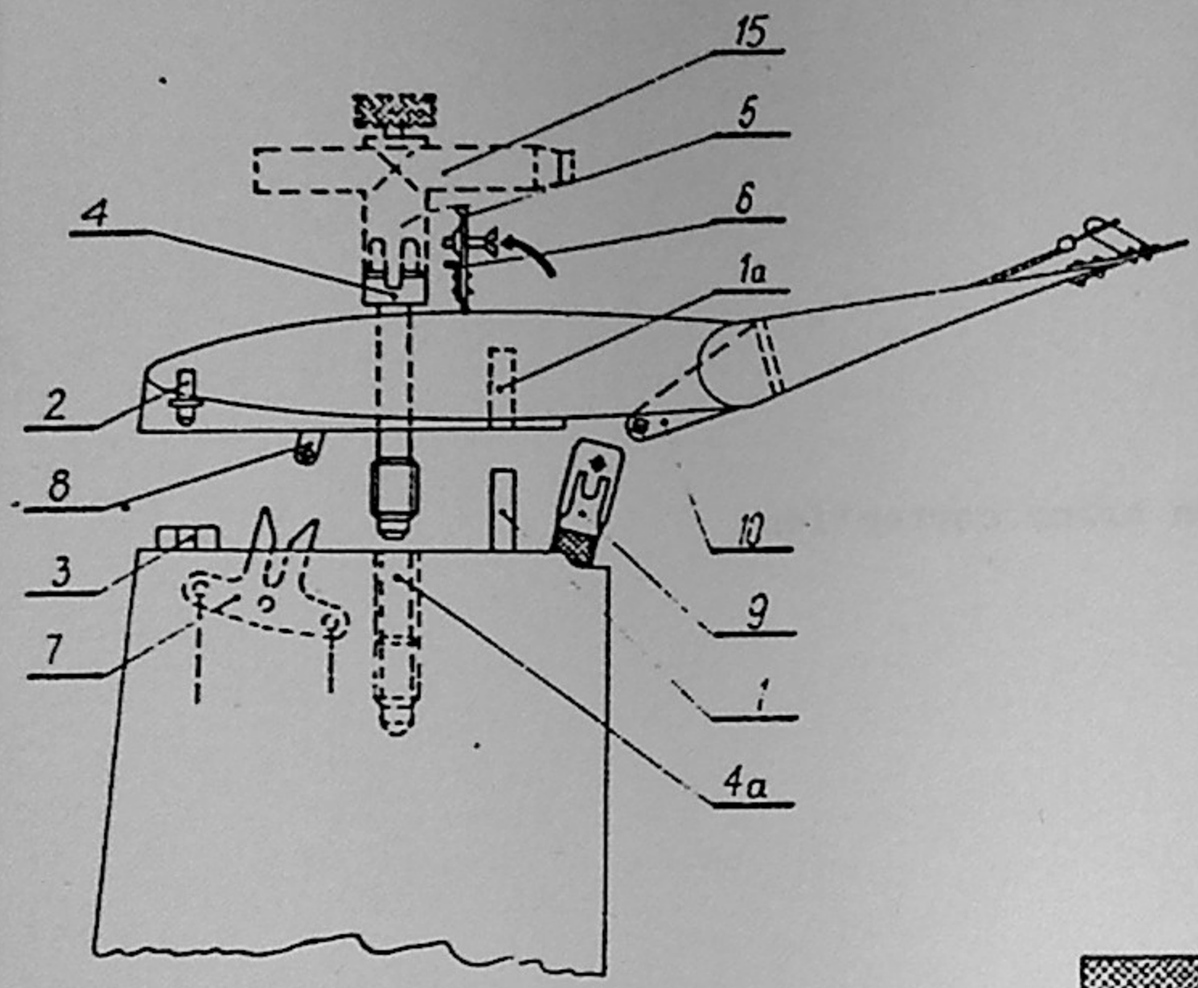
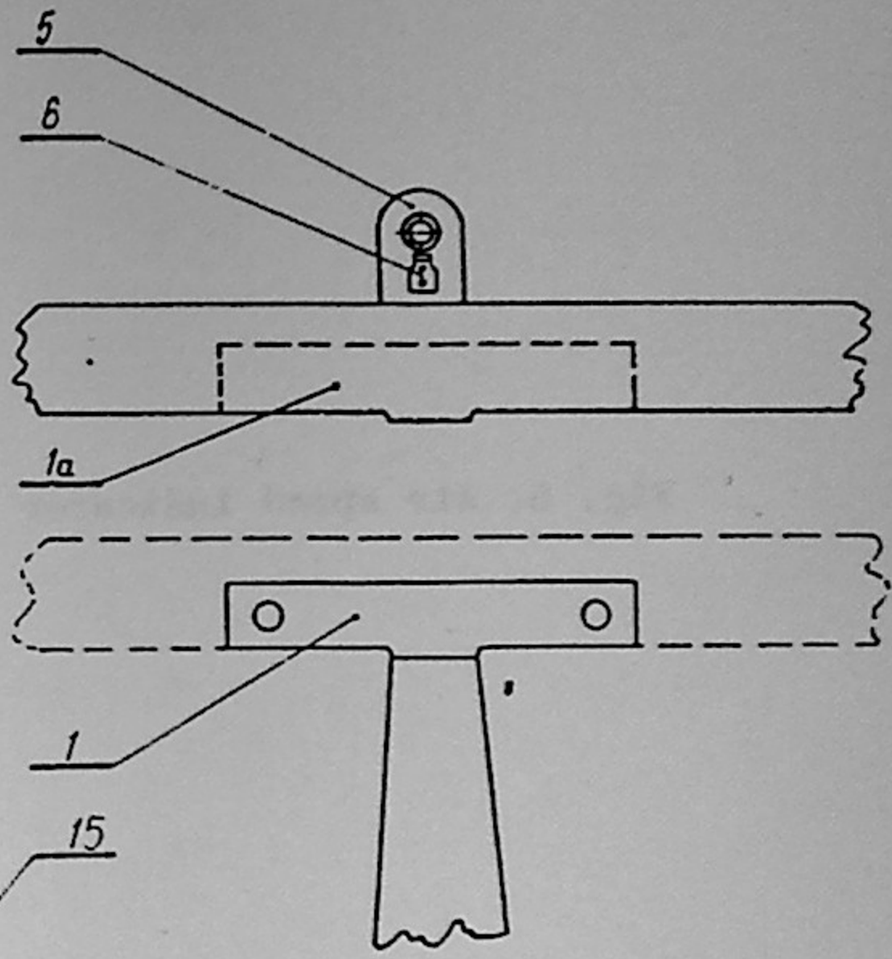

17
16
2
4
5
6
19
11
15c
15b
15
15a
13
14
23
22
21
9
18
20
18
20
1
3
8
12
10
7

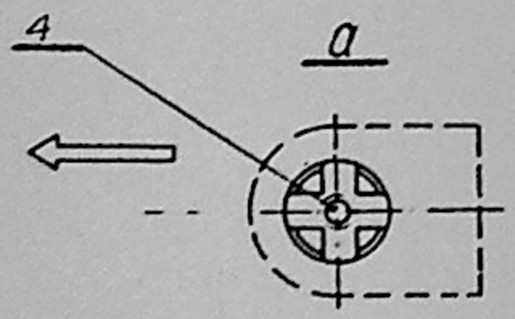
Fig. 5. Tail plane assembly

1 - duraluminium fitting "T"
1a- duraluminium fitting "T" seat
2 - front spigot
3 - spigot socket
4 - fastening bolt
4a- fastening bolt seat
5 - hinged lid with screw
6 - finger
7 - trimming tab drive forked piece
8 - trimming tab drive lever
9 - elevator drive push-rod with end-piece
10 - elevator lever
15 - structural wrench

a/ Correct setting of fastening bolt before closing the lid /the wrench cut-outs are set up in the sailplane plane of symmetry/


15
5
6
4
1a
2
8
10
3
9
7
1
4a


5
6
1a
1


4
a

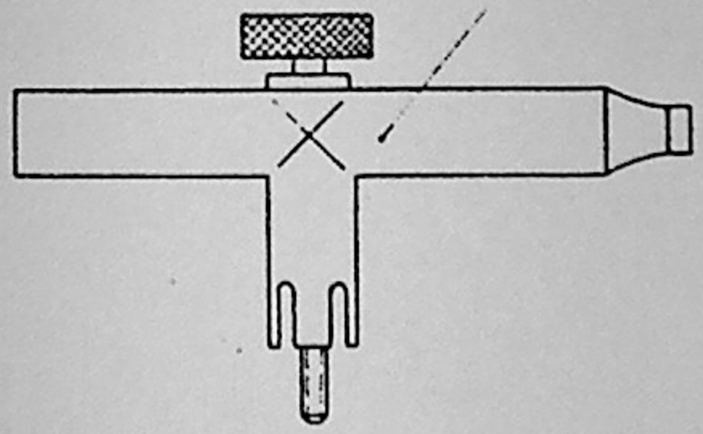

15

Fig. 6. Air speed indicator position error correction

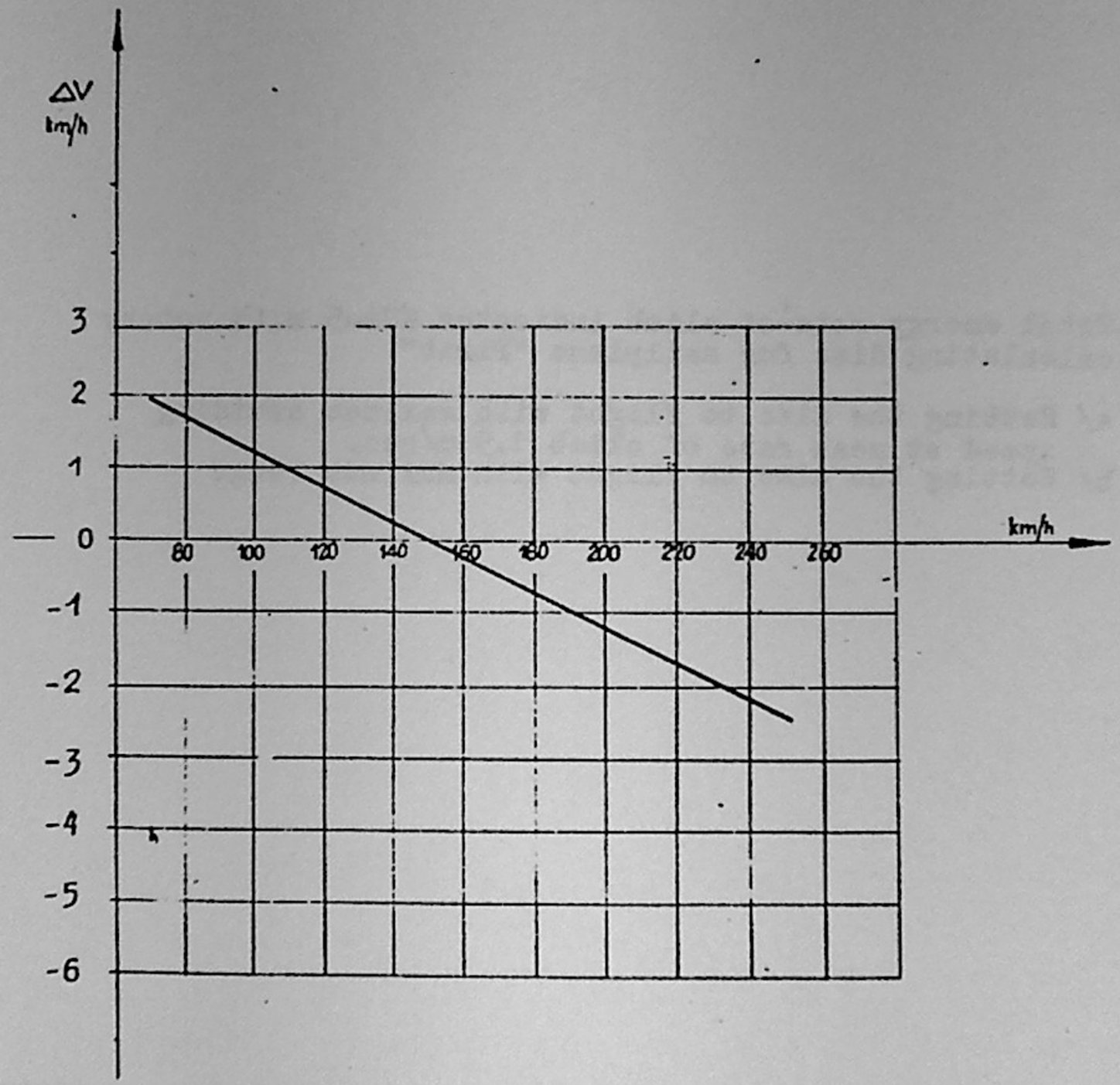
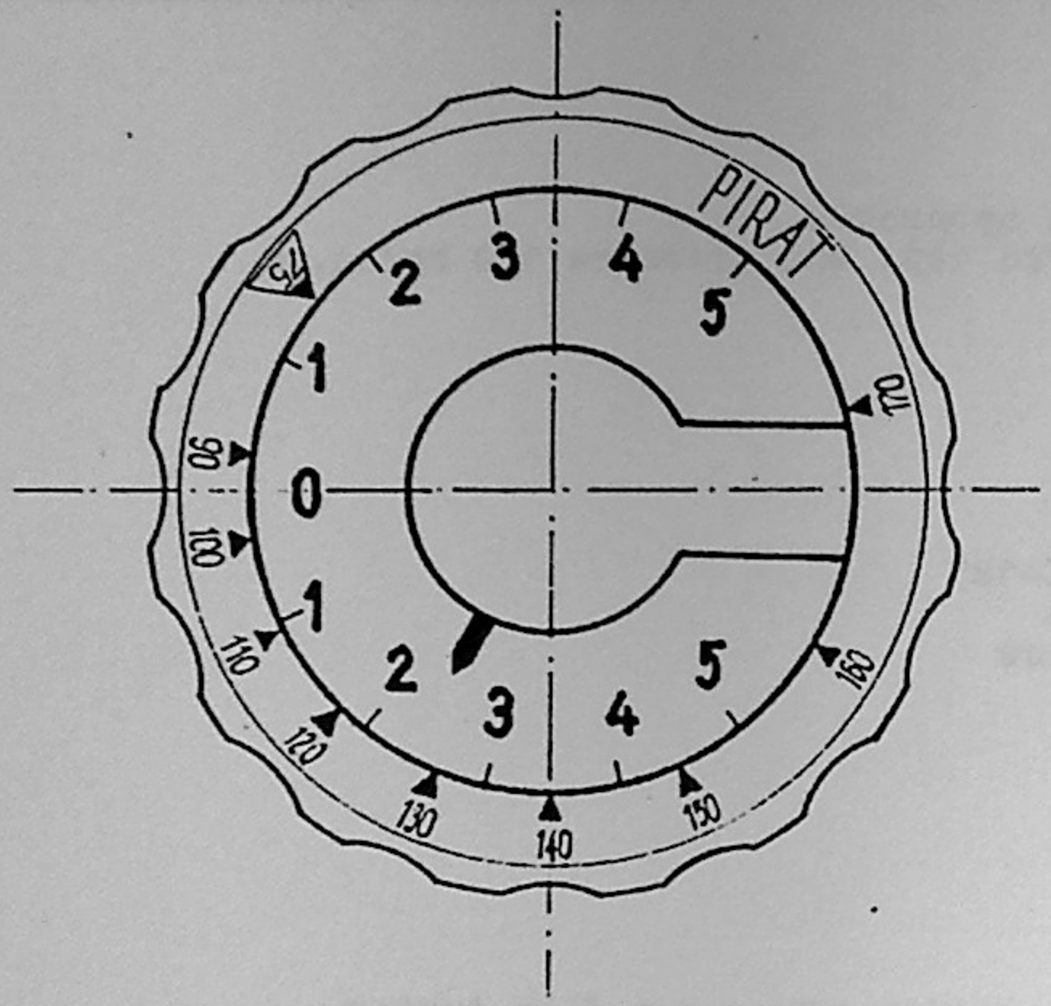

ΔV
km/h
3
2
1
0
-1
-2
-3
-4
-5
-6
km/h
80
100
120
140
160
180
200
220
240
260

Fig. 7. Total energy rate-of-climb indicator WRs-5 with rotary calculating disc for sailplane "Pirat"

a/ Setting the disc to flight with maximum cruising speed at mean rate of climb 1.5 m/sec.
b/ Setting the disc to flight with maximum range

a


PIRAT
0
1
2
3
4
5
75
90
100
110
120
130
140
150
160
170

b

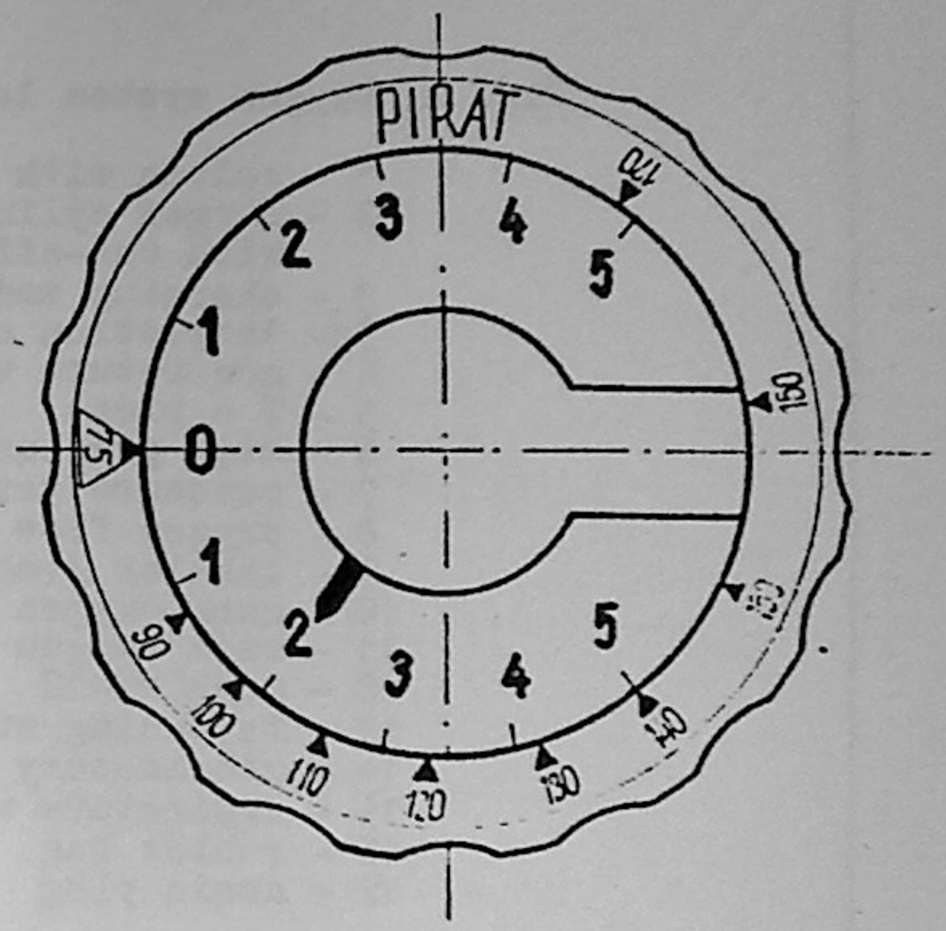

PIRAT
0
1
2
3
4
5
75
90
100
110
120
130
150
170

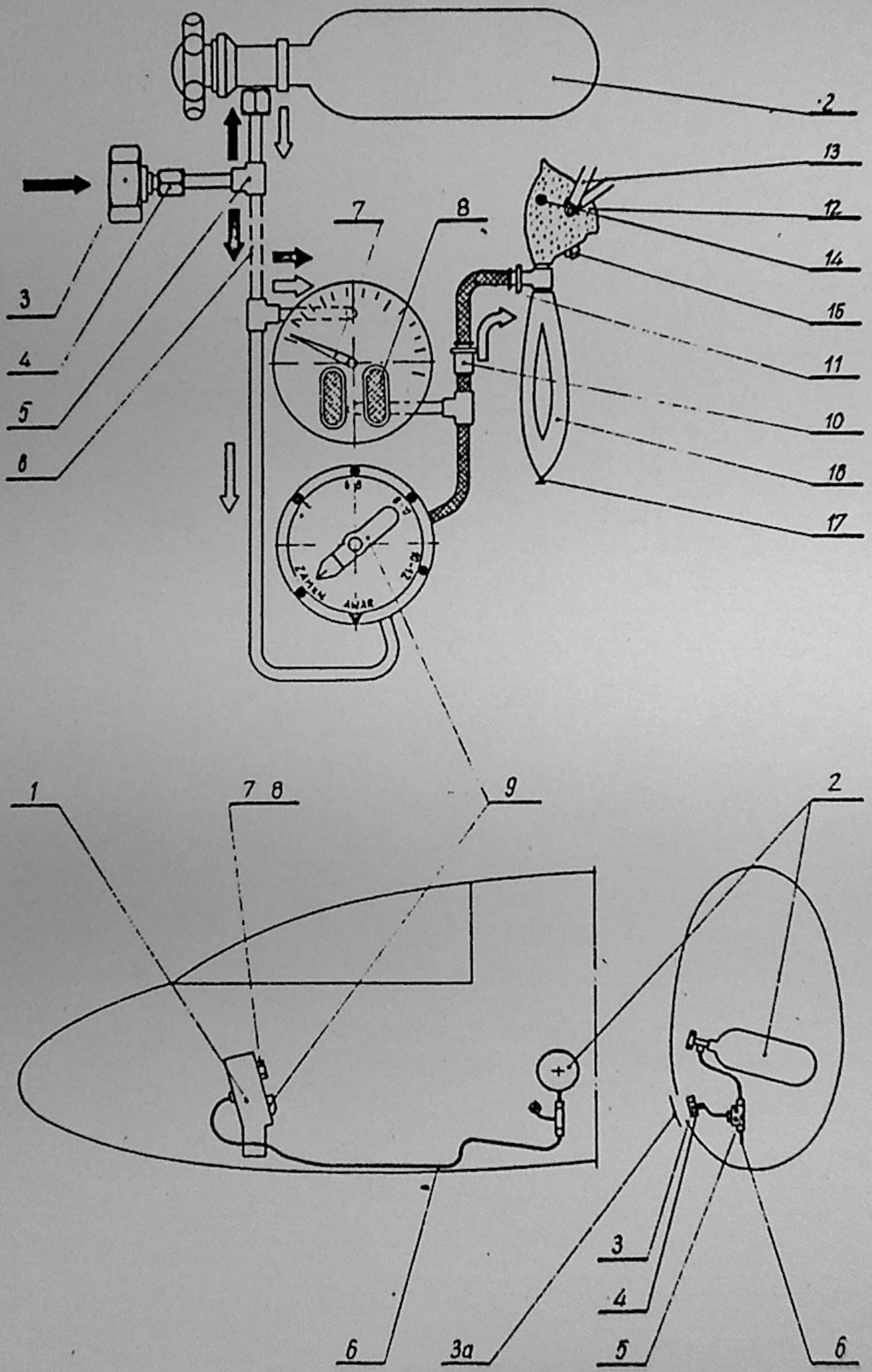
Fig. 8. Oxygen system layout

1 - column with SAT-5 oxygen apparatus
2 - oxygen cylinder of 4 litre cap. and pressure 150 kg/sq.cm with cut-off valve
3 - charging end-piece
3a- inspection opening
4 - non-return valve
5 - T - piece
6 - high pressure conduit
7 - pressure gauge
8 - oxygen flow indicator IK-185
9 - inhaler /regulator/ RT-1
10 - mask oxygen hose end-piece
11 - mask oxygen hose
12 - mask MT-12
13 - fastening strips
14 - respiratory valve
15 - expiratory valve
16 - rubber bag
17 - drain plug

Black arrows indicate direction of oxygen flow during charging the oxygen cylinder; white arrows indicate oxygen flow during operation of the system

ZAMKN. - Closed

AWAR. - Emergency


2
13
12
14
15
11
10
18
17
7
8
3
4
5
6
ZAPREN
ANAR

1
7 8
9
2
6
3a
3
4
5
6