CHAPTER 7

DESCRIPTION OF THE AIRCRAFT AND ITS SYSTEMS

CONTENTS

7. DESCRIPTION OF THE AIRCRAFT AND ITS SYSTEMS

7.1. GENERAL

The Z 143 LSi aircraft is a four-seat, low-wing, single-engine cantilever monoplane of all-metal structure, with "2+2" arranged seats and with a fixed tricycle landing gear.

It is powered by a piston-type TEXTRON Lycoming IO-540-C4D5 aircraft engine provided with a three-blade, hydraulic pitch control MTV-9-B/195-45a propeller.

7.1.1. Fuselage

The fuselage is of mixed structure. The central supporting part is a latticework, being welded of steel tubes and covered by a body made of hard light alloy sheets and of glassfibre composite. The rear part is a semimonocoque construction made of aluminum-clad duralumin plate. The front and the rear part of the fuselage are connected by means of four bolts.

There are four seats in the cockpit. Front pilot´s seats are adjustable in the longitudinal direction into five positions. A main pilot´s seat for solo flights is the left one. Above and behind the rear seats the upper baggage space is located. The canopy is opened by sliding forward and it is provided with an emergency jettisoning mechanism.

7.1.2. Wing

The wing is of all-metal structure provided with a main and an auxiliary spar. Two wing halves are attached to the fuselage. The main spar of the wing is connected with the centre-Chapter in the fuselage by means of two expandable bolts/bushings provided with conical pins. The upper bolt is oriented vertically, the lower one horizontally. The rear auxiliary spar isconnected with the fuselage by means of a horizontally oriented cylindrical bolt. The wing skin is made of hard light-alloy aluminium clad sheets. The wing flaps and ailerons are slotted, all-metal and identical in construction and dimensions. The ailerons are provided with fixed balance tabs. The wing ends are terminated with composite wing tips to reduce the induced drag.

7.1.3. Empennage

All parts are of a all-metal cantilever structure - covered with hard aluminium sheet. Both the rudder and the elevator are partially mass-balanced. The elevator is provided with two balance tabs, the one being controllable for longitudinal trim. The rudder is provided with a fixed balance tab.

7.2. AIRCRAFT CONTROL

The aircraft is provided with a dual control for training purposes. The manual control is of a stick-type, the rudder/nose wheel control is of a pedal-type.

7.2.1. Longitudinal Control

The elevator is controlled by means of the control stick via levers, rocker levers and control rods (see Fig. 7-1).

7.2.2. Lateral Control

The ailerons are controlled by means of the control stick via levers and control rods. The ailerondeflections are differentiated (see Fig. 7-1).

7.2.3. Directional Control

The rudder is controlled by means of pedals of the directional control via control rods, a gate and cable system. The control of the rudder is combined with the steering of the nose landing gear (see Fig. 7-1).

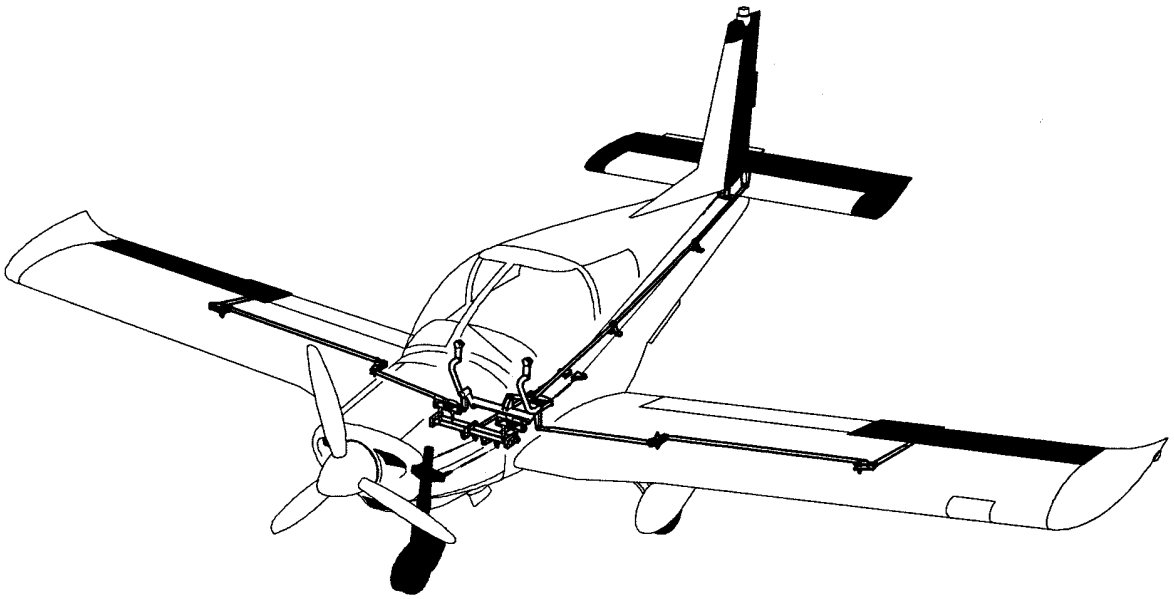

Fig. 7-1 Aircraft Primary Control

7.2.4. Trim

1) Longitudinal Trim (Fig. 7-2) is of mechanical type and consists of the control wheel of longitudinal trim located on the central panel between the front seats. The forces playing the role during elevator control are balanced aerodynamically, by means of the trim tab.

Sense of control:

Turning the control wheel forwards - makes the aircraft nose heavy

Turning the control wheel backwards - makes the aircraft tail heavy.

NOTE

The trim tab is in neutral position, when the mark on the longitudinal trim indicator is set to **TAKE-OFF**.

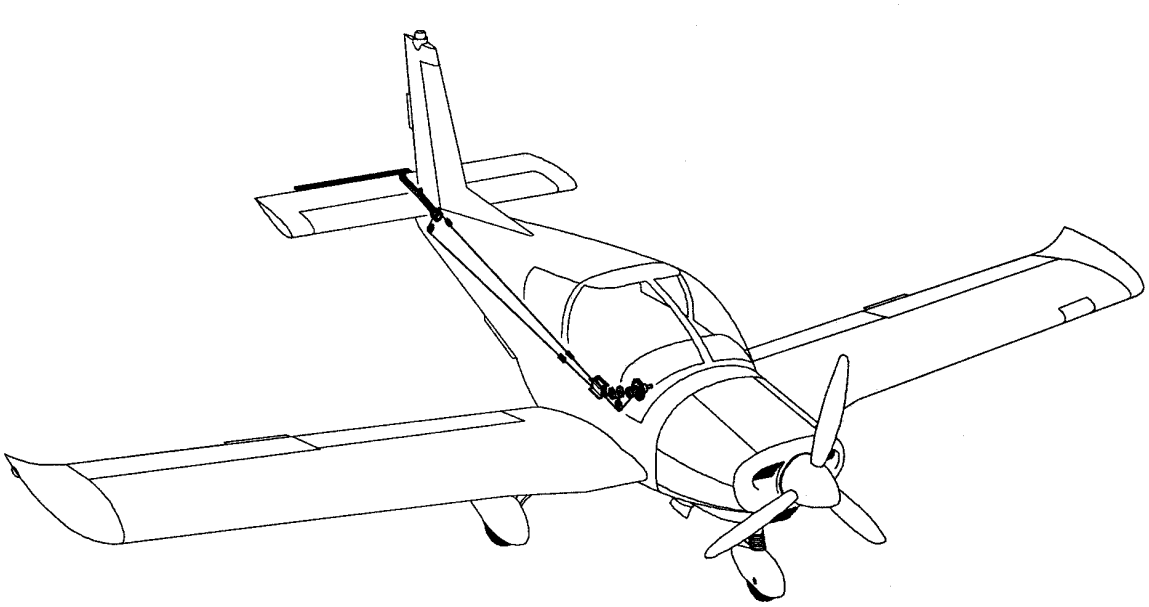

Fig. 7-2 Longitudinal Trim

2) Directional Trim is of mechanical type and controlled by means of a small wheel for directional trim located on the central panel between the front seats. The forces playing the role during foot control are balanced by the spring.

7.3. COCKPIT

7.3.1. Pilot´s Compartment

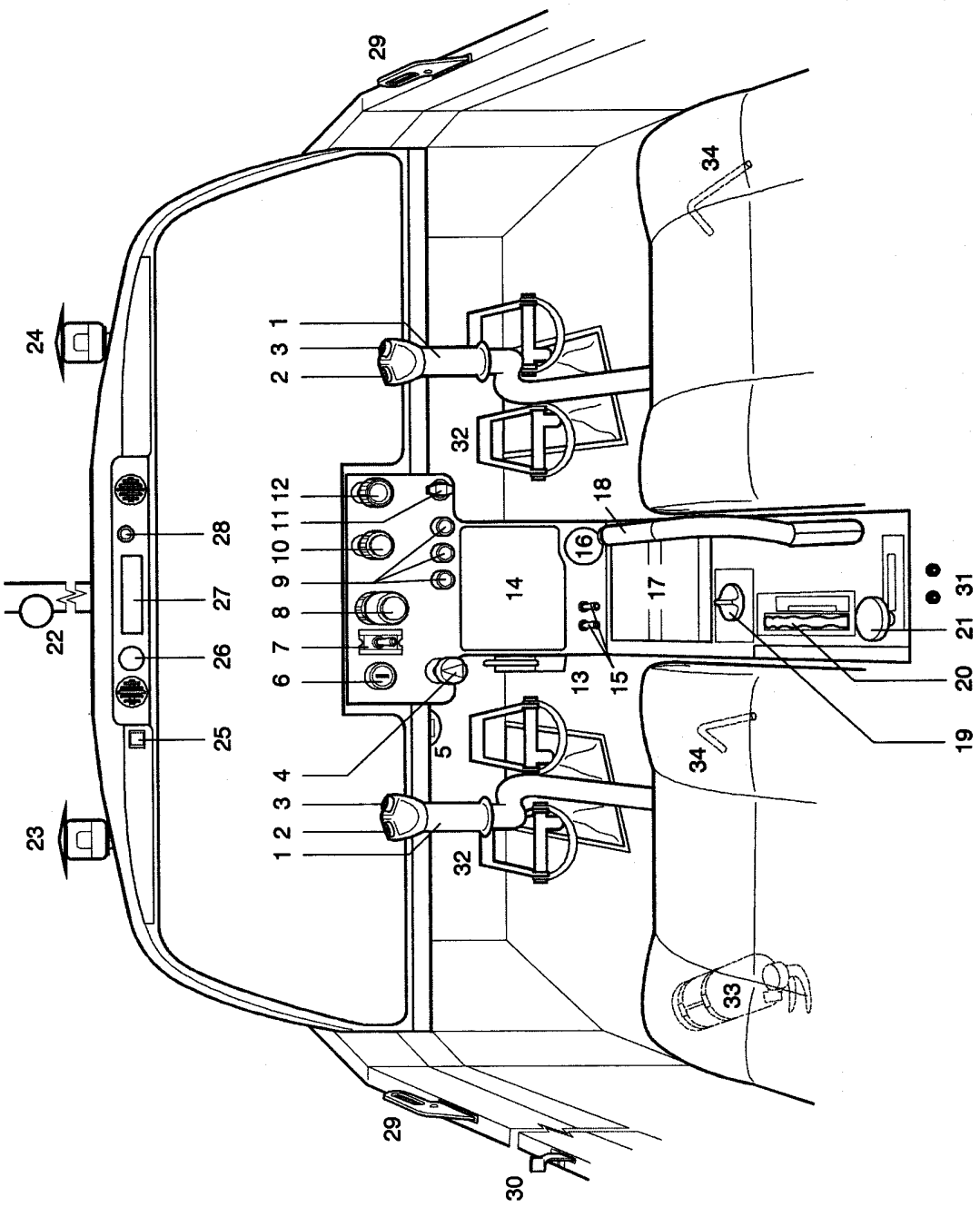

Fig. 7-3 Pilot´s Compartment up to S/N 0045 incl.

1 - Control Stick
2 - Transmitter Pushbutton (VHF)
3 - Intercom Pushbutton (IC)
4 - Ventilation and Heating Control
5 - Control Stick Lock
6 - Ignition Switch
7 - **MASTER SWITCH**
8 - Throttle Control
9 - Instrument Lighting Dimmers
10 - Propeller Control
11 - Parking Brake Control
12 - Fuel Mixture Control
13 - *Towing Gear Control*
14 - Fuses
15 - **COMM/NAV 1** and **2** Switches
16 - Main Spar Flange Nitrogen Pressure Indicator
17 - Switches
18 - Wing Flap Lever
19 - Fuel Valve Control
20 - Longitudinal Trim Control
21 - Directional Trim Control
22 - *Outside Air Thermometer*
23 - Magnetic Compass I
24 - *Magnetic Compass II*
25 - *Control ELT*
26 - *Vacuum Indicator (of vacuum gyro instruments)*
27 - Annunciator Lights
28 - Signalisation Check Pushbutton
29 - Canopy Emergency Jettisoning Lever
30 - Canopy Arrestment
31 - Headphone Connection Socket
32 - Brake Pedal
33 - Portable Fire Extinguisher
34 - Seat Position Adjustment Lever

NOTE

Items written by *italics* are delivered only as optional equipment.

If the voice activated intercom is installed, the control stick is delivered only with the VHF pushbutton.

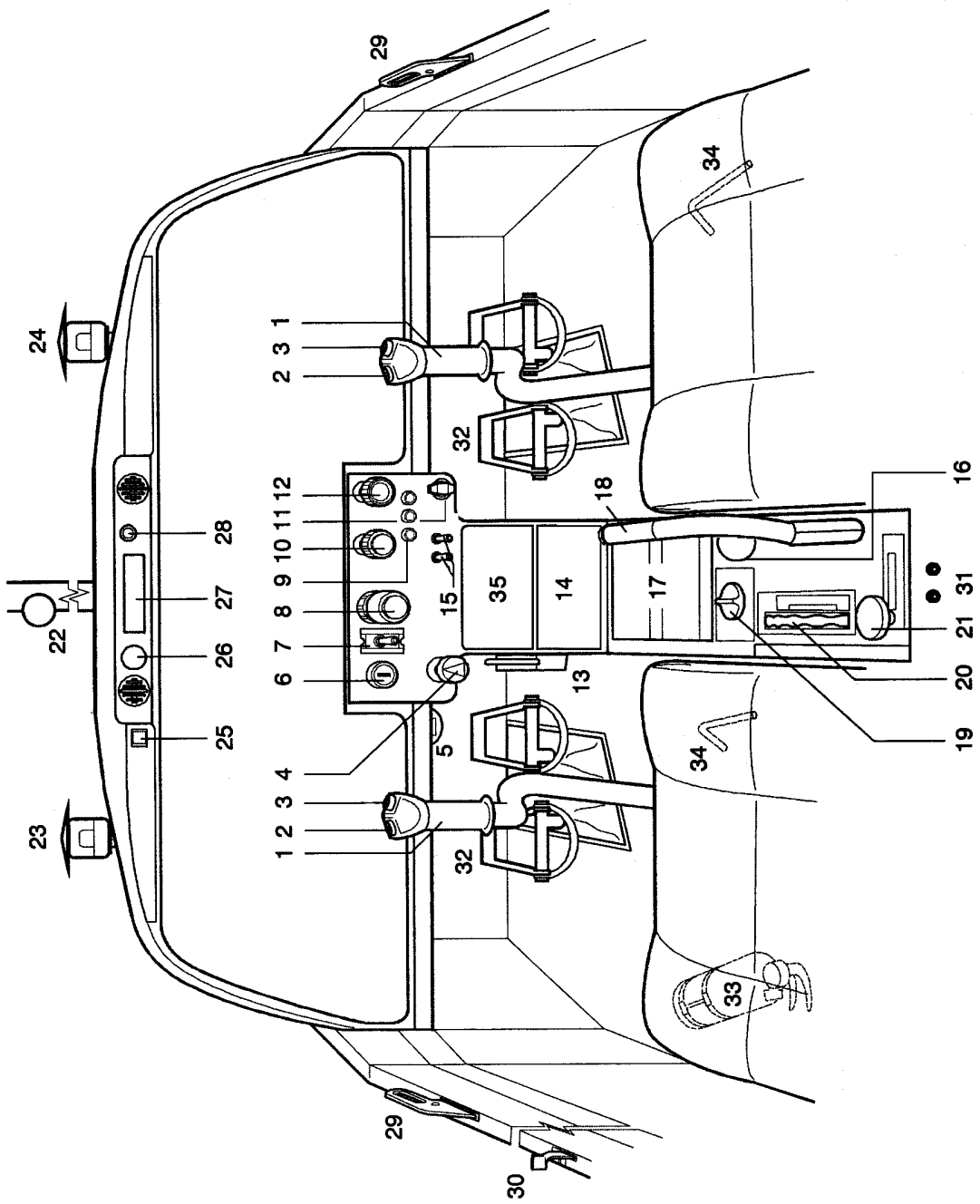

Fig. 7-4 Pilot´s Compartment from S/N 0046 incl.

1 - Control Stick
2 - Transmitter Pushbutton (VHF)
3 - Intercom Pushbutton (IC)
4 - Ventilation and Heating Control
5 - Control Stick Lock
6 - Ignition Switch
7 - **MASTER SWITCH**
8 - Throttle Control
9 - Instrument Lighting Dimmers
10 - Propeller Control
11 - Parking Brake Control
12 - Fuel Mixture Control
13 - *Towing Gear Control*
14 - Circuit breakers
15 - **COMM/NAV 1** and **2** Switches
16 - Main Spar Flange Nitrogen Pressure Indicator
17 - Switches
18 - Wing Flap Lever
19 - Fuel Valve Control
20 - Longitudinal Trim Control
21 - Directional Trim Control
22 - *Outside Air Thermometer*
23 - Magnetic Compass I
24 - *Magnetic Compass II*
25 - *Control ELT*
26 - *Vacuum Indicator (of vacuum gyro instruments)*
27 - Annunciator Lights
28 - Signalisation Check Pushbutton
29 - Canopy Emergency Jettisoning Lever
30 - Canopy Arrestment
31 - Headphone Connection Socket
32 - Brake Pedal
33 - Portable Fire Extinguisher
34 - Seat Position Adjustment Lever
35 - Additional Avionics Block

NOTE

Items written by *italics* are delivered only as optional equipment.

If the voice activated intercom is installed, the control stick is delivered only with the VHF pushbutton.

7.3.2. Instrument Panel

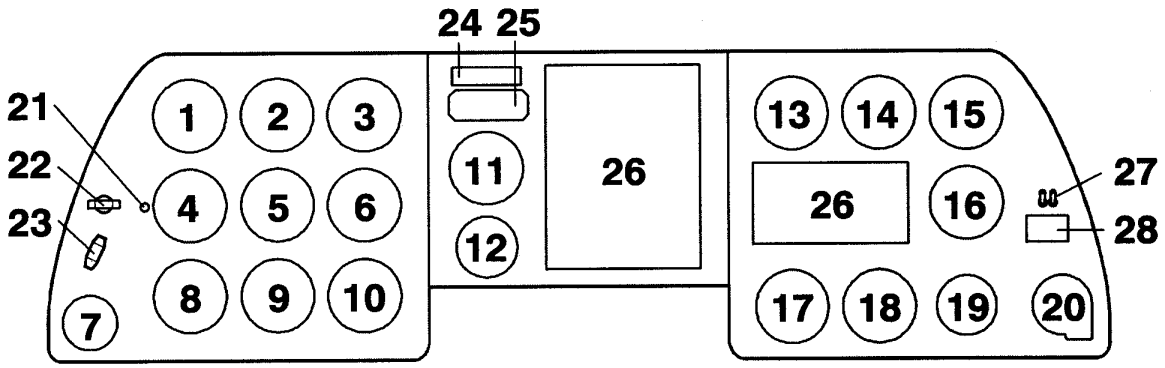

Fig. 7-5 Instrument Panel up to S/N 0045 incl.

1 - Airspeed Indicator I
2 - Attitude Gyro I
3 - Altimeter I
4 – Turn-and-Bank Indicator I
5 - Directional Gyro
6 - Vertical Speed Indicator I
7 - Clock
8 - *ADF Indicator*
9 - CHT/EGT Indicator
10 - *VOR/ILS Indicator*
11 - RPM Indicator
12 - Manifold Pressure Gauge
13 - *Airspeed Indicator II*
14 – *Turn-and-Bank Indicator I*
15 - *Altimeter II*
16 - *Vertical Speed Indicator II*
17 - Four-pointer Engine Indicator
18 - Four-pointer Fuel Indicator
19 – V-A Meter
20 - Accelerometer
21 - Annunciation of Turn-and-Bank Indicator I operating at emergency power supply
22 - Regulating Screw for Alternate Static Pressure Source Adjustment
23 - Alternate Static Pressure Source Switch
24 - *Marker*
25 - *Intercom*
26 - *Avionics Block*
27 - *Emergency Switches for COMM/NAV System*
28 - *Engine Hours Counter*

NOTE

Items written by *italics* are delivered only as optional equipment.

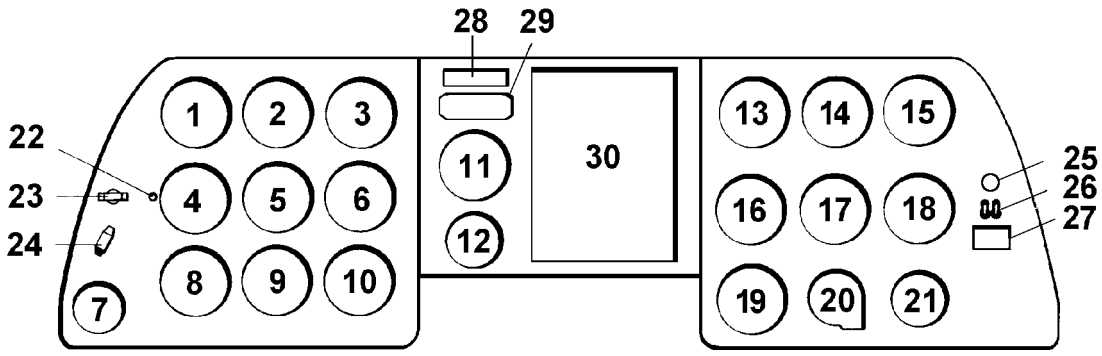

Fig. 7-6 Instrument Panel from S/N 0046 incl.

1 - Airspeed Indicator I
2 - Attitude Gyro I
3 - Altimeter I
4 – Turn-and-Bank Indicator I
5 - Directional Gyro
6 - Vertical Speed Indicator I
7 - Clock
8 - *ADF Indicator*
9 - CHT/EGT Indicator
10 - *VOR/ILS I Indicator*
11 - RPM Indicator
12 - Manifold Pressure Gauge
13 - *Airspeed Indicator II*
14 - *Turn-and-Bank Indicator I*
15 - *Altimeter II*
16 - *Vertical Speed Indicator II*
17 - Four-pointer Engine Indicator
18 - Four-pointer Fuel Indicator
19 - *VOR/ILS II Indicator*
20 - Accelerometer
21 - V-A Meter
22 - Annunciation of Turn-and-Bank Indicator I operating at emergency power supply
23 - Regulating Screw for Alternate Static Pressure Source Adjustment
24 - Alternate Static Pressure Source Switch
25 - *External GPS power socket*
26 - *Emergency Switches for COMM/NAV System*
27 - *Engine Hours Counter*
28 - *Marker*
29 - *Intercom*
30 - *Avionics Block*

NOTE

Items written by *italics* are delivered only as optional equipment.

7.3.3. Annunciator Lights

The Annunciators lights panel is located in the upper part of the instrument panel. The inclinable lampshade located above the panel enables to decrease the intensity of panel lights at night operation.

L FUEL LOW LEVEL	R FUEL LOW LEVEL	GENERATOR	EXT. POW. SOURCE
OIL PRESS LOSS	STALL. WARN. INACTIVE	PITOT HEATING	STATIC HEATING

Fig. 7-7 Annunciator Lights

Signification of individual annunciator lights:

L FUEL LOW LEVEL (yellow) - Fuel rest in the left tank

R FUEL LOW LEVEL (yellow) - Fuel rest in the right tank

GENERATOR (yellow) - Voltage drop below 26,2 V in the electric network

EXT. POW. SOURCE (yellow) - External source of electric power connected

OIL PRESS LOSS (red) - Oil pressure drop under 170 kPa (25 p.s.i.)

STALL. WARN. INACTIVE (white) - Stall warning circuit is opened with the microswitch controlled by depresion of the rear landing gear leg

PITOT HEATING (green) - Pitot tube and stall speed probe heating

STATIC HEATING (green) - Static pressure probes heating

7.3.4. Description of the Switches

1) Left to the throttle control there is the **MASTER SWITCH**, which turns off all circuits including the emergency source of electrical power except of the cockpit "ceiling" light and engine ignition.
2) In front of the fuel valve is circuit switches:

   LANDING LIGHT - turns on and off the landing light

   TAXI LIGHT - turns on and off the taxiing light

   BEACON - turns on and off the anti-collision beacon and the auxiliary “map” lamp

   POSITION LIGHTS - turns on and off the position lights

   LIGHTING - turns on and off the lighting of instruments and placards

   STROBE LIGHTS - turns on and off strobe lights (if installed)

   EXT. POW. SOURCE - connects or disconnects the electrical system to the external source

   BATTERY - connects or disconnects the battery to or from the network

   GENERATOR - connects or disconnects the alternator to or from the network

   FUEL PUMP - turns on and off the electrical fuel pump

   ENGINE INSTR. - turns on and off the fuel meters, the four-pointer engine indicator (fuel and oil pressure, oil temperature and fuel consumption) and engine hours counter (if installed)

   FLIGHT INSTR. - turns on and off the attitude gyro(s), turn-and-bank indicator(s), directional gyro, annunciator check, stall warning, annunciator check of the stall warning circuit opening, fuel low lever signalling, and minimum oil pressure signalling

   PITOT HEATING - turns on and off the heating of the probe of total pressure and of the stall speed warning probe

   STATIC HEATING - turns on and off the heating of static pressure probes
3) To the left of the nitrogen pressure indicator, there are the switches **COMM/NAV 1** and **COMM/NAV 2**, which turn on and off the radiocommunication and navigation equipment.
4) To the right on the right instrument panel, there are the switches **EMERGENCY SWITCH COMM 1** and **EMERGENCY SWITCH NAV/ADF**, which enable to turn on the transmitter 1 and the signal monitoring for NAV 1 and ADF in case of Audio Control Console failure.

CAUTION

DO NOT OPERATE ANY SWITCH UNLESS YOU ARE EXACTLY FAMILIAR WITH IT'S FUNCTION.

NOTE

The sense of the switches function:

TURNED **ON** - forward or upward position of the lever

TURNED **OFF** - backward or downward position of the lever.

7.4. WING FLAPS

The all-metal wing flaps (Fig. 7-8) are of slot type, controlled by means of a mechanical lever, which is located between the seats. Three arrested positions: **RETRACTED** (0°), **TAKE-OFF** (14°) and **LANDING** (37°) are provided. The arrestment is controlled by a pushbutton located on a lever. The wing flaps are extended by mowing the lever upward.

CAUTION

NEVER STEP ON THE WING FLAPS - THESE MIGHT BE SERIOUSLY DAMAGED. EXTEND THE FLAPS INTO THE POSITION **TAKE-OFF** DURING EMBARKING OF THE OCCUPANTS - THE RISK OF DAMAGE BY UNINTENTIONAL STEPPING IS REDUCED WITH FLAPS IN THIS POSITION (flaps are arrested only "upwards" in both extended positions).

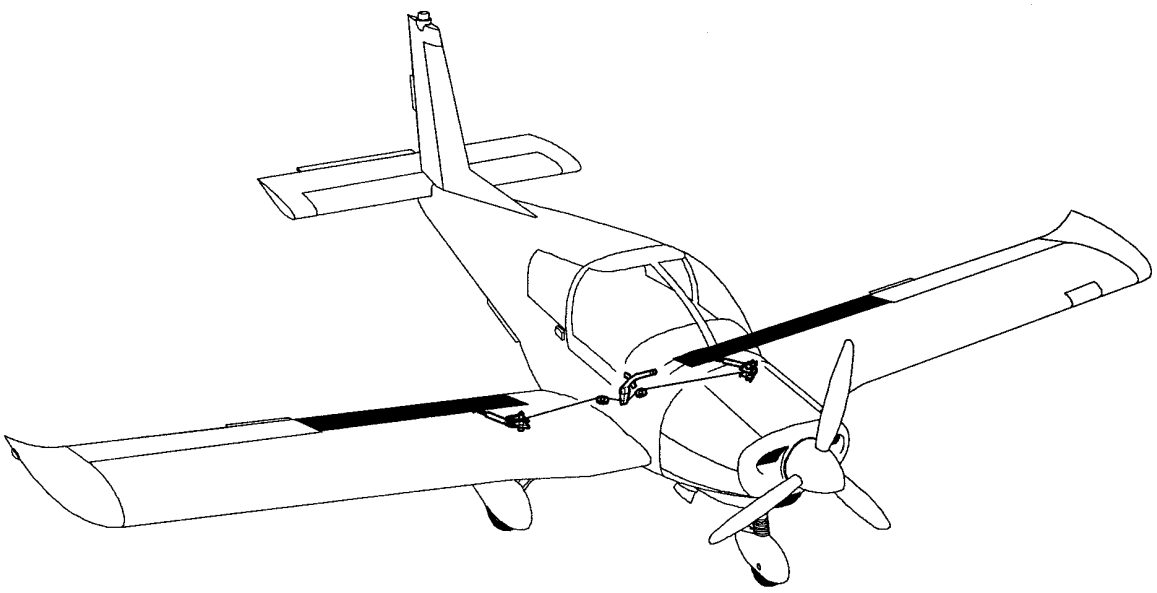

Fig. 7-8 Wing Flaps

7.5. LANDING GEAR, WHEELS AND BRAKES

The tricycle landing gear consists of the main landing gear and the nose landing gear.

The main landing gear is comprised of flat-steel springs, which are attached to the fuselage main spar. The wheels of the main landing gear are fitted with hydraulic disc brakes provided with metalceramic lining; they are fitted with automatic clearance adjustment. The brakes are controlled individually left and right brake. For short-period parking may be braked by means of the parking brake, which controls both brakes simultaneously.

NOTE

The parking brake can be engaged only from the left pilot seat.

The nose landing gear is attached by means of struts to the first bulkhead of fuselage airframe.The nose landing gear is provided with a hydropneumatic shock absorber and with a shimmy damper. The nose wheel is controlled by means of rudder control pedals and is not braked. The diagram of the brake system is in Fig. 7-9.

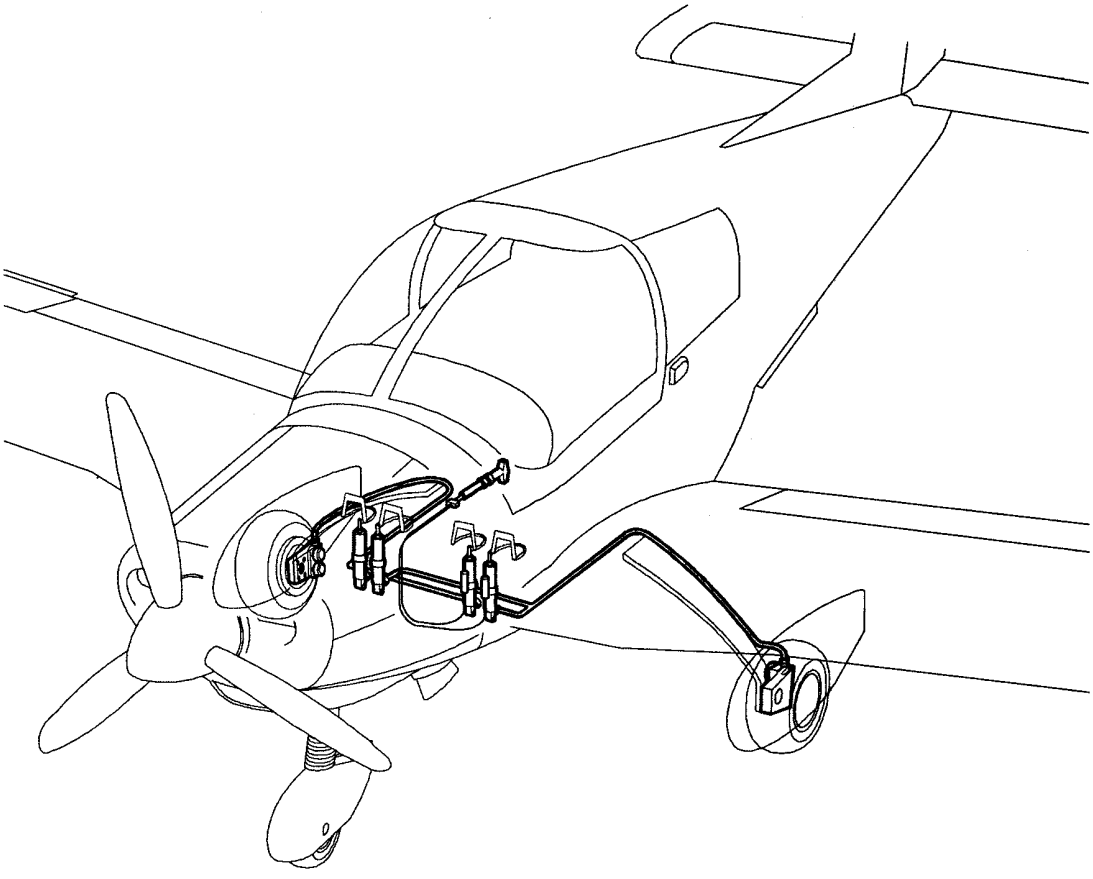

Fig. 7-9 Diagram of Brake System

7.5.1. Nose Landing Gear Control

The aircraft is controlled during taxiing by means of the rudder control pedals. The rudder control pedals movement steers the nose landing gear via a cable system; the maximum controlled wheel deflection is 15°. For turns of a small diameter, the directional control is used in combination with braking the inner wheel. In this case, the springs incorporated into the cable system between the pedals and the nose landinng gear, enable the maximum wheel deflection be increased to 38°.

7.6. BAGGAGE COMPARTMENTS

There are upper and lower baggage compartmets in the aircraft. The upper baggage space (the lay-off shelf) is situated behind the headrests of the passenger seats; it is accessible from the cockpit. The lower baggage compartment is situated behind rear seats. The lower baggage space is accessible through the lockable door on the left side of the aircraft. The floors of the baggage compartments are provided with fastening straps with elastic networks.

CAUTION

THE BAGGAGE MUST ALWAYS BE PROTECTED AGAINST MOVEMENT BY MEANS OF STRAPS.

7.7. SEATS, SAFETY BELTS

7.7.1. Seats

The front seats are adjustable in the longitudinal direction into five automatically arrested positions. The position adjustment lever is located to the bottom right of the seat front part. After moving the lever upwards, the seat is released for readjustment. To enable embarkment of passengers into the rear compartment, the front seats are provided with hinged backrests. The folding control lever is located in the upper part of the backrest hind side. Moving the leverupwards, the backrest can be folded forwards (Fig. 7-10).

The rear seats are of a fixed type.

7.7.2. Safety Belts

All seats are provided with three-point safety belts, which consists of ventral belts, two shoulder straps and the lock (Fig. 7-10).

The safety belts lock is controlled by turning the lock-knob in three positions:

- **LOCKED** - green point - the pawls of the fastening straps are locked.
- **DON** - yellow point - position for inserting the pawls into the lock.
- **RELEASE** - position for releasing the pawls.

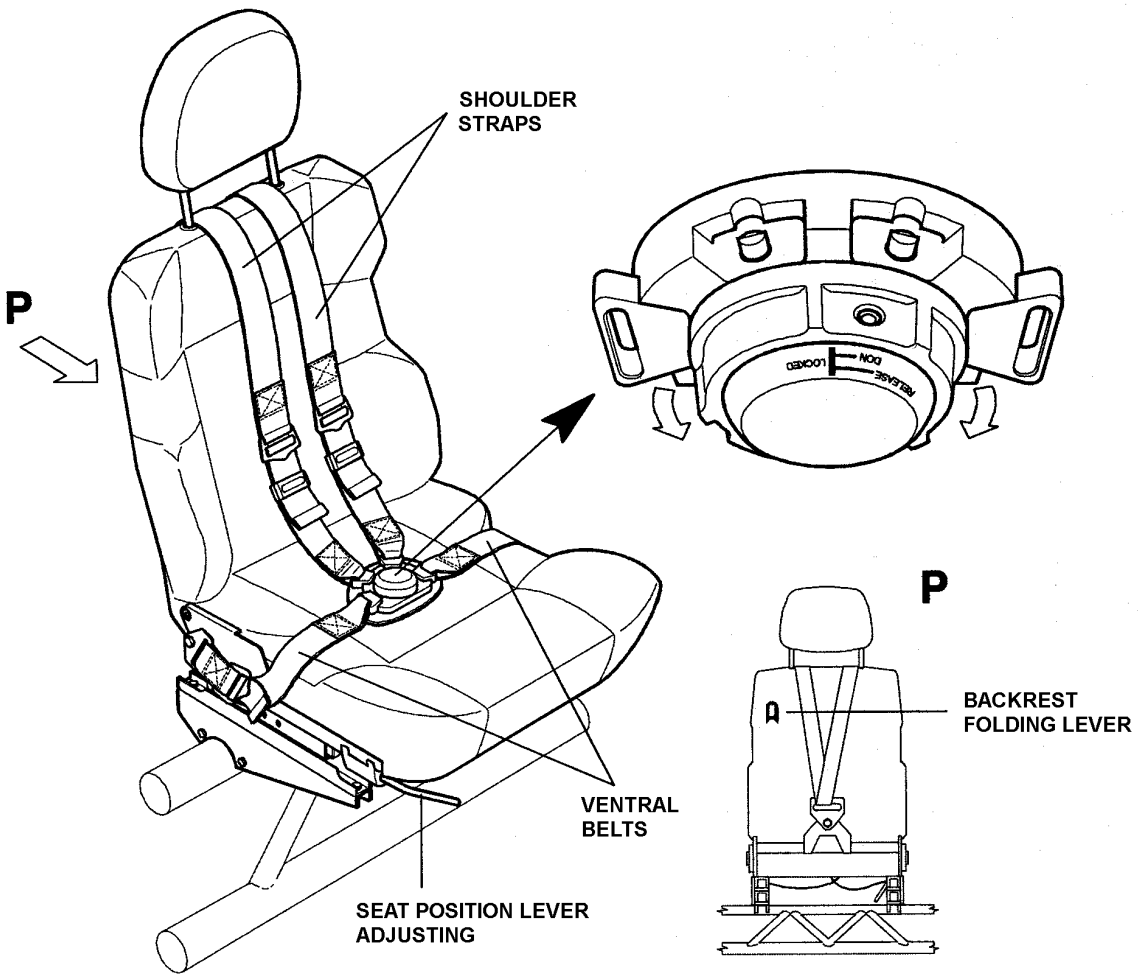

Fig. 7-10 Seat and the Safety Belts

Procedure for using the safety belts:

1) Sit down comfortably on the seat, arrange the fastening belts to prevent their twisting.
2) Turn the lock-knob into the position **DON** (inserting the pawls).
3) Slide the pawls of the straps free ends into the lock body.
4) Turn the lock - knob gate into the position **LOCKED**.
5) To shorten the straps length, pull the free ends of the straps.
6) To release the harness, turn the knob into the position **RELEASE** - in this position all threepawls are released. After being released, the knob turns to the position **DON** automatically.

7.7.3. Headrests

All seats are outfitted with headrests, vertically adjustable into five positions. They are arrested by springs. To readjust the headrest position, push or pull in the desired direction of rest adjustment.

7.8. CANOPY

The canopy is opened by sliding forward. It is provided with an emergency jettisoning mechanism. Securing the cockpit canopy in its open position on ground enables thearrestment lever, located on the canopy frame left side. Canopy lock is controlled by a door handle located on the top of the canopy frame. In closed position the handle points backwards. To open the canopy, rotate the lever through 180° forward and slide the canopy forward. The canopy can be locked from outside by key during parking.

The lever for emergency release is located both on the left and on the right sides of the cockpit; it is painted red and provided with a seal. The lever controls a cable mechanism, which releases the pins connecting the canopy frame with sliding mechanism to the airframe. The emergency jettisoning handles intentionally do not control canopy lock opening, which is not desirable at emergency jettisoning.

7.10. LOCKING THE CONTROL STICK

During the aircraft parking, the control stick can be locked by means of a latch, which is located beneath the left instrument panel, on the right. Tilt the latch up, push the left control stick against the latch and lock it by tilting the latch down (Fig. 7-11).

The pilot gets the information about the manual control being locked by means of the warning placard **WARNING - CONTROL LOCKED!**

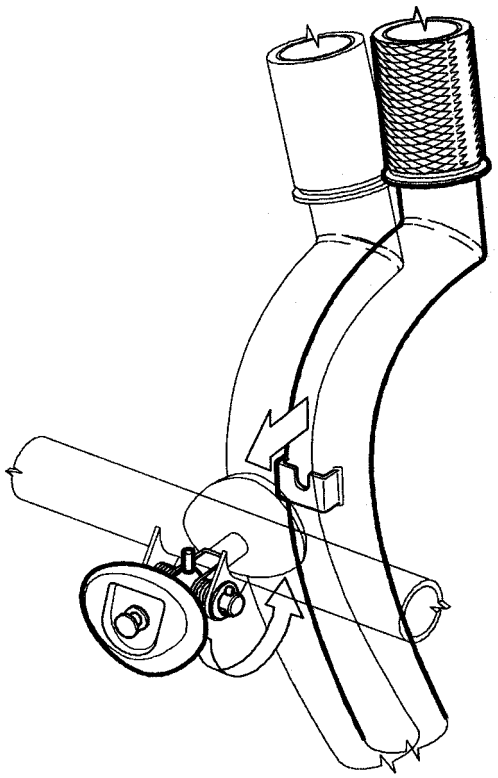

Fig. 7-11 Locking the Control Stick

7.10. ENGINE

7.10.1. General

The aircraft is powered by the TEXTRON LYCOMING IO-540-C4D5, injector piston-type, four-stroke, aircooled, flat, six-cylinder engine of maximum continuous power 175 kW (235 HP) at 2400 RPM. The engine has no speed reducer and is not supercharched (it has no compressor).

7.10.2. Engine and Propeller Control (Fig. 7-12)

1) **Engine power** (black handle) - controlled by means of the throttle control - the engine power is increased by pushing the controller and decreased by pulling the controller. The friction arrestment of the throttle control can be adjusted by tightening or releasing the nut, located on the rod sleeve.

2) **Propeller Speed** (blue handle) is controlled by means of propeller control - pushing the controller increases the speed; pulling the controller decreases the speed (press and hold the button when handling the controller).

   Fine-tuning of propeller speed is done by rotating the controller (do not press the button) rotating the controller clockwise increases the speed, rotating the controller anticlockwise decreases the speed.

3**)** **Fuel mixture** (red handle) is controlled by means of mixture control - by pushing the controller the mixture is enriched, by pulling the controller themixture is weak (press and hold the button when handling with the controller).

   Mixture fine-tuning is done by rotating the controller (do not press the button) - by rotating the controller clockwise the mixture is enriched, by rotating the controller anticlockwise the mixture is weaked.

   In the last phase of “weaking“ motion, the fuel supply into the engine is cutt-off.

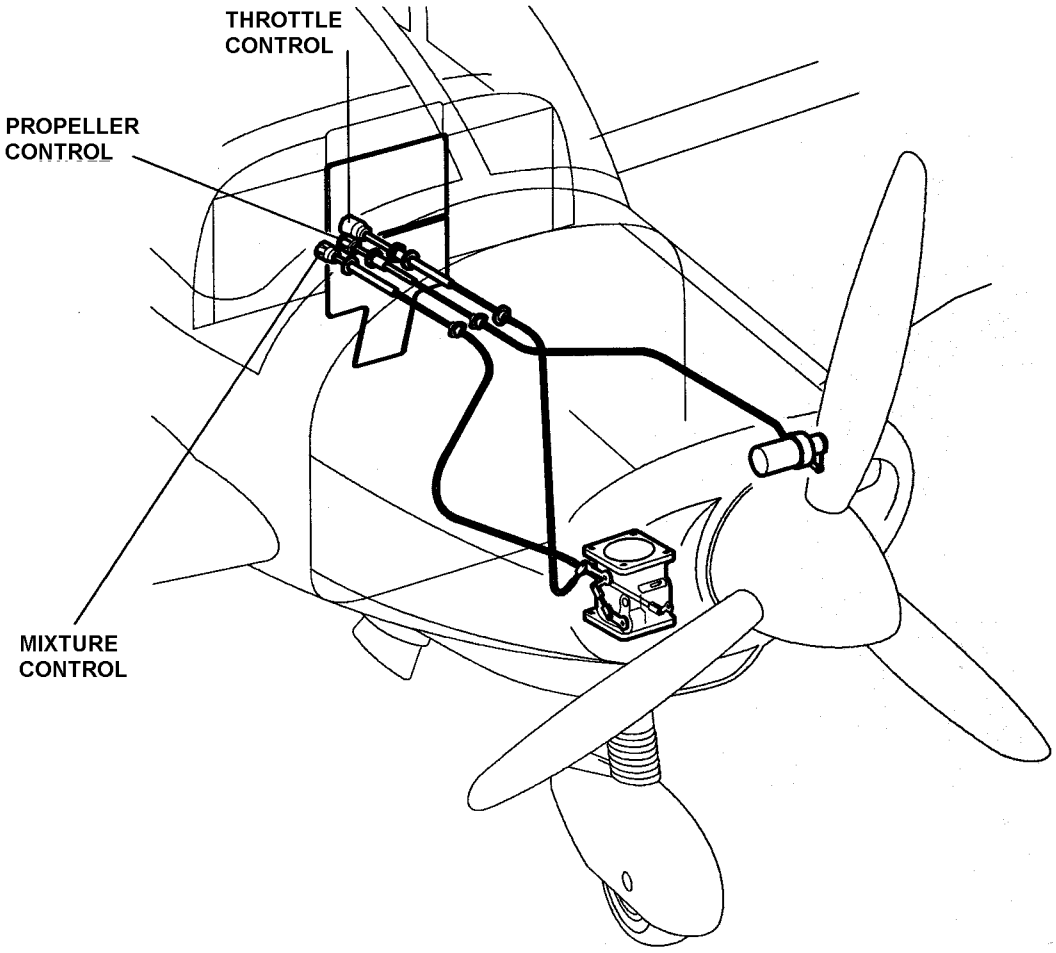

Fig 7-12 Engine and Propeller Control

7.10.3. Engine Instruments

The engine run is monitored by the following indicators: oil temperature and pressure, fuel pressure and fuel consumption indicator these four are combined into a quadruple indicator), cylinder heads temperature, exhaust gases thermometer, engine speed indicator and manifold pressure gauge.

The oil pressure is picked-up on engine back wall (above the right magneto) and is divided in two branches; the first one is terminated with an oil pressure transducer, in which the pressure is converted into an electrical signal. The second branch is terminated with the minimum oil pressure switch, when the oil pressure drops uder the minimum value, the "**OIL PRESS LOSS**" light on the annunciator panel is ON.

The oil temperature is measured by means of a resistance gauge, inserted into the oil filter adaptor.

The fuel pressure is taken from the injector body; the pressure transducer converts the pressure on the calibrated electrical signal.

Fuel consumption is measured by fuel consumption indicator, which is connected to the fuel distributor located on the engine.

The thermoelectric sensor of the cylinder heads temperature (CHT) is inserted in the head of the right rear cylinder.

The thermoelectric sensor of the exhaust gas temperature (EGT) is located in the exhaust manifold of the right rear cylinder.

The engine speed indicator is of the mechanical type, driven by a flexible shaft connected to the drive on engine back-wall.

The manifold pressure is picked-up from the first right cylinder manifold.

7.10.4. Operating a New Engine

Whenever the aircraft is fitted with a new engine, with an engine after a general overhaul or with an engine in which one or more cylinders were replaced, it should be operated in flight at the cruising power in the range of 65 % to 75 %, for the period of 50 operation hours or until the oil consumption is stabilized.

In the case of all-new or newly repaired engines, the 50 hours inspection including the oil drainage and charge replacement must be carried out after the first 25 hours of operation.

For the first 50 hours of operation, only mineral oil of appropriate aviation grade must be used.

NOTE

More detailed information is contained in the "LYCOMING Operator's Manual“.

7.10.5. Engine Oil System

The oil charge is contained in the engine crankcase (Fig. 7-13).The oil quantity in the engine crankcase-tub is checked by means of an oil stick gauge (3) - the maximum filling is 11,4 litres (12 quarts). Oil is transported by the pump (5) to the lubricated parts of the engine via double flow oil filter (7). When the oil temperature reaches approximately 85°C, the thermo-static valve (17) closes the direct oil flow through the filter, whereupon oil starts to flow through the oil cooler (8) and is returned back into the tub through the filter. The oil pressure is controlled by means of a pressure reduction valve (4). The crankcase is vented into the atmosphere via an oil separator (9), from the separator oil is returned into the engine through the hose.

The oil pressure measured by means of the oil pressure transmitter (14), signalling the oil minimum pressure “**OIL PRESS LOSS**“ by means of minimum pressure switch (15) and oil temperature by means of the oil temperature transmitter (6). Oil is drained by the drain valve (19).

CAUTION

THE OIL SYSTEM IS NOT ADAPTED FOR INVERTED FLIGHT.

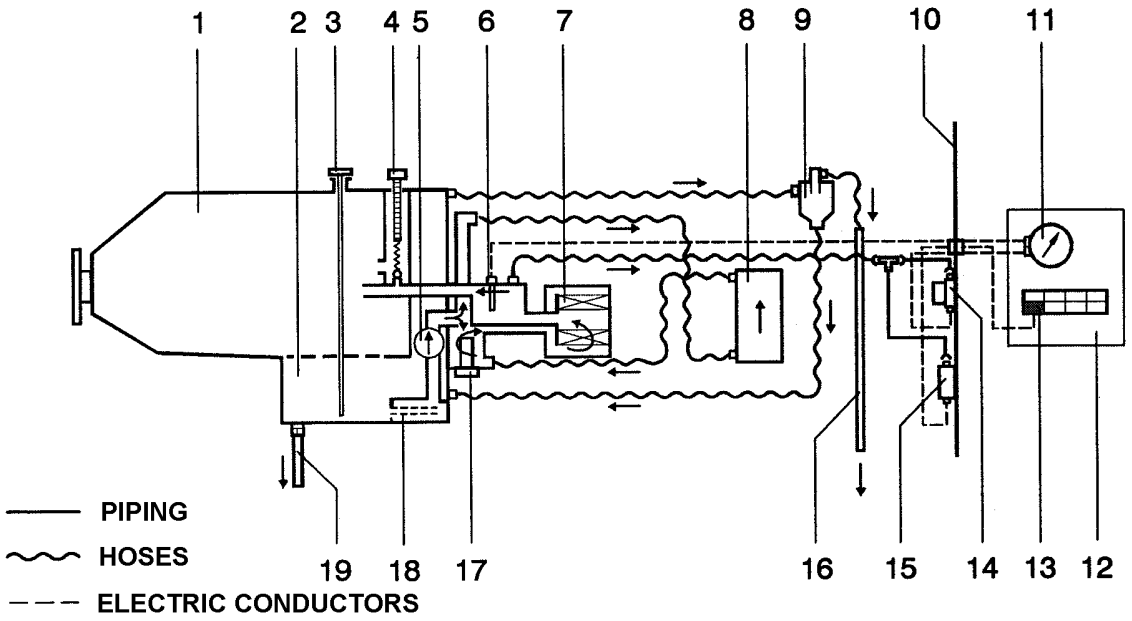

Fig. 7-13 Functional Diagram of Oil System

1 - Engine
2 - Oil tub
3 - Oil stick gauge
4 - Reduction valve
5 - Oil pump
6 - Oil temperature transmitter
7 - Through-flow oil filter
8 - Oil cooler
9 - Oil separator
10 - Firewall
11 - Four-pointer engine indicator
12 - Instrument panel
13 - Annunciator light panel **OIL PRESS LOSS**
14 - Oil pressure transmitter
15 - Minimum oil pressure switch
16 - Venting piping
17 - Thermostatic valve
18 - Filter mesh
19 - Drain-valve with piping

7.10.6. Engine Starting and Ignition System

The ignition system comprises two magnetos, bunched hi-voltage cables and sparking plugs. The magnetos are attached on the engine back wall. The ignition sequence follows the pattern 1 - 4 - 5 - 2 - 3 - 6. To facilitate engine starting, the left magneto is provided with an impulse coupling.

The engine is fitted with an electric starter.

Use of the ignition switch:

"**OFF**" both magnetos switched OFF

"**L**" only left magneto switched ON

"**R**" only right magneto switched ON

"**BOTH**" both magnetos switched ON

"**START**" both magnetos switched ON, the starter is activated; after releasing the spring returns the switch into the position **BOTH**.

7.10.7. Engine Cooling and Intake

Engine cooling air (1) enters on either side of the propeller through openings in the front cowling and is carried through engine cowling around the cylinders and through the oil cooler (3), located on the left rear part of the engine baffling. The cooling-air for the engine fuel pump (4), voltage regulator (5) and the battery box (2) is supplied from the rear cowling. Fig. 7-14 shows the engine intake system.

At low external air temperatures, oil or cylinder heads temperature can be increased by inserting the winterization plates into front cooling air-intakes of engine cowling.

There is a hole in the lower part of the cowling which feeds the air through the filter into engine intake system. If the filter is foul, the intake of air is significantly reduced. Low amount of incoming air cannot provide a sufficient underpressure in the suction piping. Therefore the alternative air intake flap is opend (6). The air from the filter area cools down the alternator (9).

7.10.8. Fuel injection system

Bendix RSA fuel injection system is based on the air flow measurements, which are used by the transducer converting air pressure to fuel pressure. The fuel pressure data obtained by the fuel measuring unit determine the proper amount of injected fuel in relation to the amount of air. The fuel evaporates in the engine cylinder´s suction drain.

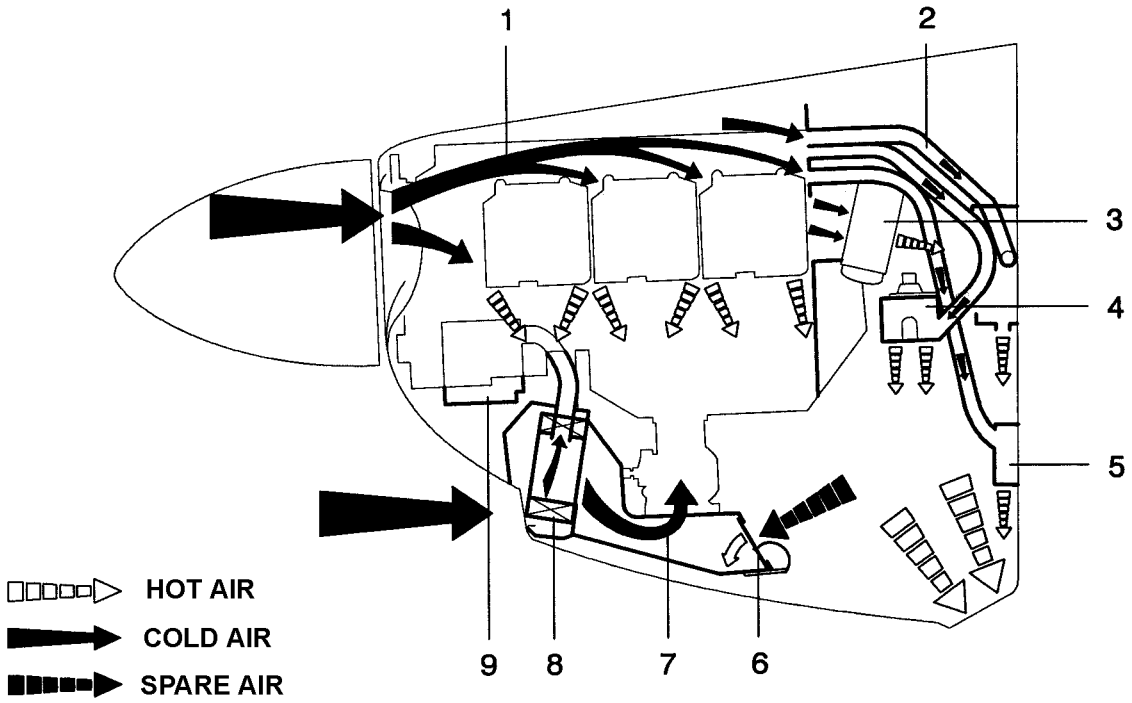

Fig. 7-14 Engine Cooling and Intake System

1 - Air for cooling the engine cylinders
2 - Air to battery cooling
3 - Oil cooler
4 - Fuel pump on the engine
5 - Voltage regulator
6 - Spare air flap
7 - Air into the engine intake
8 - Air filter
9 - Alternator

7.10.9. Exhaust System

The exhaust gases are ducted from the cylinders by fire resistant piping into the muffler /noise silencer/ outer shroud of which forms the heat-exchanger. Here the air is heated for the cockpit heating. The exhaust gases from the muffler flow out beneath the aircraft into the free atmosphere.

7.11. PROPELLER

The propeller MTV-9-B/195-45a is a three-blade, constant-speed hydraulically controlled variable-pitch propeller.

Changing the pitch of the propeller blades is carried out by a speed-governor, which maintains the propeller speed independently on the aircraft speed and the engine power. The range of the pitch change is limited by mechanicals stops of high/low pitch respectively. In case of oilpressure loss, the propeller blades are set on low pitch automatically. The oil pressure in the regulator is single-acting in sense of high pitch; the low pitch is changed by means of aerodynamic forces, which act upon the blade. The propeller has no counterbalance weight.

The propeller blades are made of resin-bonded wood with composite skin; leading edges of the propeller blades are protected with stainless steel tipping.

7.12. FUEL SYSTEM

The main tanks containing 2 x 58 litres (2 x 15,3 US gal.) of usable fuel are attached to the main spar in the central nose part of each wing; the auxiliary integral tanks of 2 x 50 litres (2 x 13,2 US gal.) usable fuel at the wing ends are extended by composite wing tips.

Each tank is provided with the sump and draining valve to enable separate fuel draining. The master fuel drain valve (11) on the bottom of the fuselage is used for central fuel draining and regular check of the fuel on water and sediments (Fig. 7-15).

There are ball air-bleeder valves in the highest points of the main fuel tanks. These ball valves are connected to auxiliary fuel tanks via piping. Air-bleeding system of both wings is interconnected by the piping (9). The two outlets (10) of this piping are located at the bottom of the airframe.

The fuel pump (16) sucks the fuel from tanks and distributes it through the fuel valve with filter (11) to the injector (17). The injector ensures an appropriate fuel supply to fuel distributor (19). The fuel distributor conveys an equal amount of fuel into each fuel nozzle (18). Through these nozzles, the fuel is injected into the ports of individual engine cylinders.

Whenever the auxiliary electric pump (5) is engaged, the by-pass valve (14) behind the strainer closes the direct flow from the strainer to the engine pump (16) and opens the way via the electric pump (5). The electric auxiliary pump (5) is attached to the central fuselage beneath the floor. The pump is turned ON by the **FUEL PUMP** switch and is used for flooding the fuel system at the engine start-up. If the engine fuel pump is failure, emergency possible use the electric fuel pump for finish the flight.

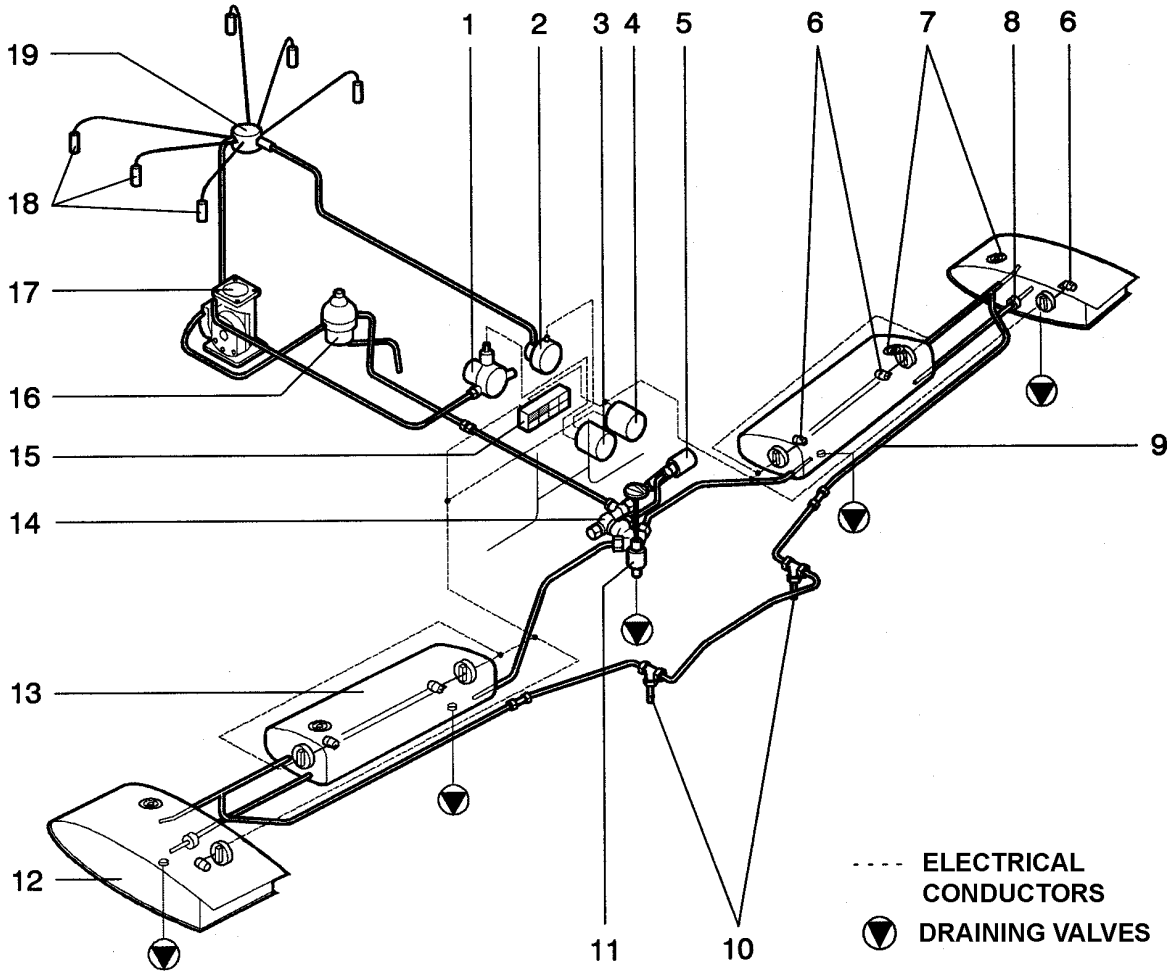

Fig. 7-13 The Fuel Installation

1 - Fuel pressure transmitter
2 - Fuel consumption
3 - Four-pointer engine indicator
4 - Four-pointer fuel indicator
5 - Electric fuel pump
6 - Fuel quantity float-gauge
7 - Filling cap
8 - One-way flap valve
9 - Venting tube
10 - Venting outlet
11 - Fuel valve with filter
12 - Auxiliary fuel tank
13 - Main fuel tank
14 - By-pass valve
15 - Annunciator light panel
16 - Fuel pump on the engine
17 - Injector
18 - Fuel nozzle
19 - Fuel distributor

The fuel supply from left and right tank is started by the fuel valve (11). The control of the fuel valve is located on the panel between front seats.

Fuel valve function:

L fuel supply from left fuel tanks

R fuel supply from right fuel tanks

L+R fuel supply from both fuel tanks

OFF fuel supply closed

NOTE

The valve can be switched into the **"OFF"** position only after pulling the knob slightly up before turning.

The four-pointer fuel indicator (4) on the instrument panel is interconnected with float-guages (6) in each fuel tank. The fuel rest in the left and right main tanks is signalled **L FUEL LOW LEVEL** and **R FUEL LOW LEVEL** on the annunciator light panel (15).

CAUTION

THE FUEL SYSTEM IS NOT ADAPTED FOR INVERTET FLIGHTS.

7.13. ELECTRICAL SYSTEM

7.13.1. General

Single-wire ("+" pole) electric system with "-" pole connected to the aircraft provides the rated voltage 28 V DC. The primary electric power source is an alternator driven by the engine. It supplies the current of 60 A.

An auxiliary power source is the battery attached to the front side of firewall on the left side of engine compartment. The battery is accessible after opening the left door of the cowling.

The emergency power supply to the turn-and-bank indicator and the auxiliary lighting lamp is ensured from the emergency electric power source - two batteries SONNENSCHEIN connected in parallel - in case of either the both main and auxiliary source failure or the intentional switching-off the **FLIGHT INSTR.** circuit. In these cases the emergency source turns ON automatically, thus the turn-and-bank indicator(s) and auxiliary lighting lamp remain in service. The emergency source activation is signalled by getting ON the green signal light **EMERGENCY SOURCE** close to the turn-and-bank indicator on the instrument panel, which signalling correct function of emergency source and correct function of the turn-and-bank indicator. The emergency source batteries are recharged during normal operation.

The electrical system consists of circuits, connected to the main bus-bar through Chapteral switches AZS, which simultaneously functions as the circuit breakers. The **MAIN SWITCH** opens all circuits except of the ignition and the cockpit lighting. The separate ignition circuit (magnetos) is controlled by the magneto switch.

The simplified diagram of the electrical system is on Fig. 7-16 or Fig. 7-17.

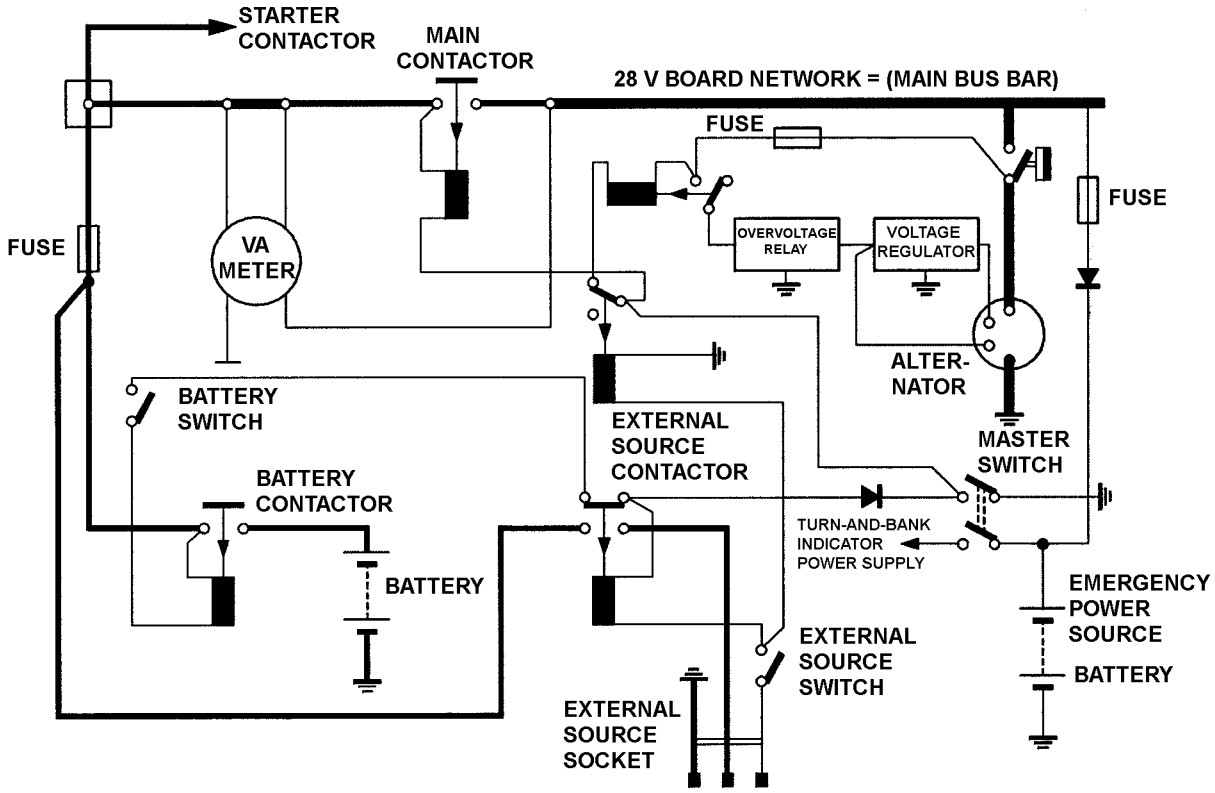

Fig. 7-16 Electrical System up to S/N 0045 incl.

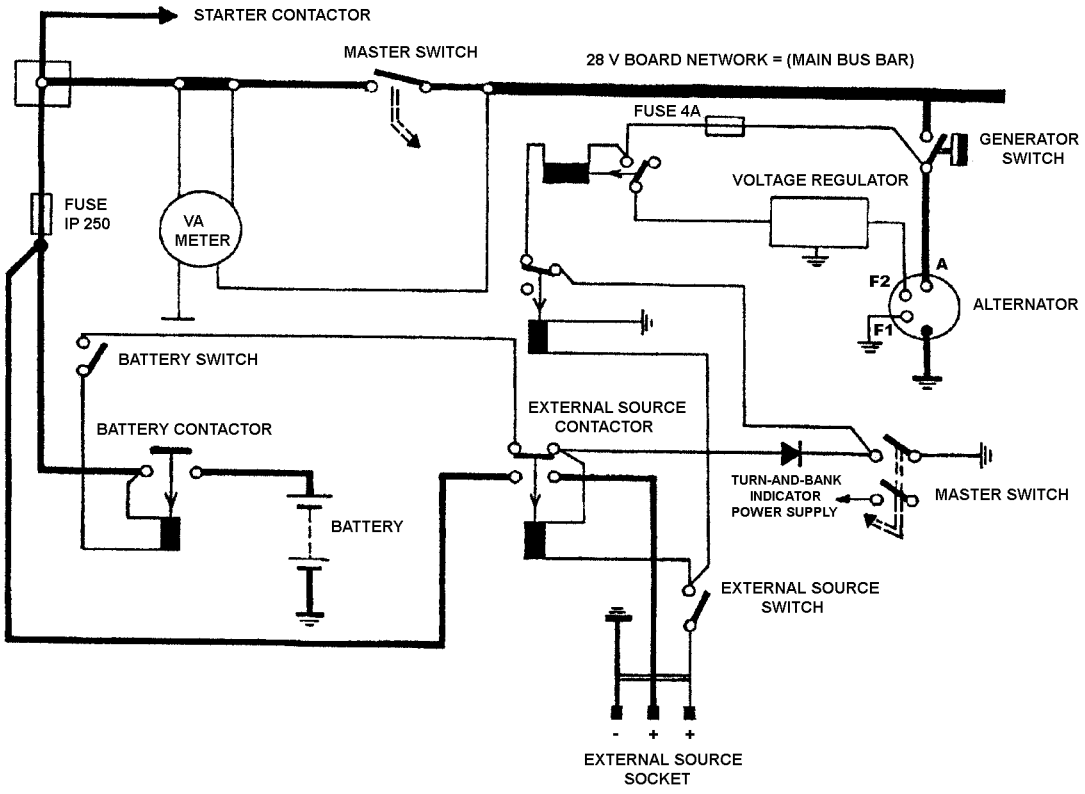

Fig. 7-17 Electrical System from S/N 0046 incl.

7.13.2. V-A Meter

The V-A meter is a combined instrument, which indicates the voltage and the current in the main bus-bar.

1) The left indicator indicates the voltage (range 0 to 40 V)
2) The right indicator indicates the current
   a) (+) battery charging - range 0 to 20 A (indicating clockwise from 0)
   b) (-) battery bleeding - range 0 to 60 A (indicating anticlockwise from zero)

7.13.3. Circuit Protection

The circuit switches on the panel between the front seats, and the switches **COMM/NAV 1** and **COMM/NAV 2**, function as automatic circuit breakers. In case of the circuit overload this switch turns **OFF** automatically - turning off is indicated by the switch lever position. Each switch is designated with a placard identifying the circuit.

For aircrafts up to S/N 0045 incl.

Cut-out fuses located on the panel beneath the instrument panel are designated by a placard with the fuse value and name of the circuit protected therewith.

Fuse replacement:

Press on the fuse cap and turn slightly counterclockwise, remove the cap. Provided the fuse is blown, replace it by the new fuse of the same rating. Insert the cap containing the new fuse into the fuse holder body, then press and turning slightly clockwise, fix the cap.

CAUTION

BE SURE TO USE THE CORRECT RATING OF THE FUSE AT FUSE REPLACEMENT. CURRENT NOMINAL VALUE IS STAMPED ON THE METAL CAP OF EACH FUSE.

NOTE

Spare cut-out fuses are stored in a ribbon strap with rating designation in the left-side pocket of the cockpit.

For aircrafts from S/N 0046 incl.

The circuit breakers switches are located on the panel beneath the instrument panel. Each circuit breaker is designated by a placard with the name of the circuit protected therewith. In case of the circuit overload, this circuit breaker switches off automatically. Switch off is indicated by the OFF position of the circuit breaker push button and the visible tint strip on the push button body.

Circuit breaker switch on procedure:

After push button pressing is circuit beraker switch on. The tint stripe on the push button body is after switching on cover up.

NOTE

The current value on the circuit brakers placards is not mentioned.

Signification of designation of the cut-out fuses (circuit breakers)

COMM 1, COMM 2	(6,3 A)	- Transceivers 1, 2
NAV	(3,15 A)	- Navigation equipment
ADF	(1 A)	- Radio-Compass
XPDR	(3,15 A)	- Transponder
MKR	(1 A)	- Marker
DME	(3,15 A)	- Distance Measuring Equipment
GPS	(3,15 A)	- Global Positioning System
FUEL L	(1 A)	- Fuel indicator L.H.
FUEL R	(1 A)	- Fuel indicator R.H.
GIC	(4 A)	- Gyroinduction Compas
ELT	(1 A)	- Emergency Locator Transmitter
AUDIO	(2 A)	- Audio Control Console
STARTER	(2 A)	- Starter
ANN. PAN.	(2 A)	- Annunciator Light Panel
VA METER	(2x1 A)	- V-A Meter
CHECK	(1 A)	- Annunciator check
TURN C.	(1 A)	- Turn-and-bank indicator
ATT. GYR.	(1 A)	- Attitude gyro
DIR. GYR.	(1 A)	- Directional gyro
INT. LIGHT.	(1 A)	- Interior lighting
ENG. INSTR.	(2 A)	- Engine instruments
STALL W.	(2 A)	- Stall warning inactive
INST. LGT.	(3,15 A)	- Instrument lighting
PLACARDS	(1 A)	- Placards lighting
BATTERY	(3,15 A)	- Battery recharging
EXCIT	(4 A)	- Generator excitation
C. U. LIGHT	(1 A)	- Cockpit ligh
EXT. GPS	(3,15A)	- External GPS power socket

7.13.4. Use of the External Electric Power Source

The standard socket for connecting the external source of electric power is located on the fuselage left side in front of the door of the baggage compartment. The socket construction prevents reversing of polarity.

CAUTION

USE EXTERNAL SOURCE WITH MAXIMUM RATING 28 VOLTS/ 150 A DC ONLY.

7.13.5. Radiocommunication and Navigation Equipment

The COMM and the NAV equipment have their respective panels fitted with independent **OFF-ON** switches. However, the complete radiocommunication and navigation equipment can be turned OFF simultaneously by two switches **COMM/NAV 1** and **COMM/NAV 2**, if necessary.

CAUTION

PRIOR TO ENGINE STARTING, STOPPING AND DURING THE CONNECTION OF THE AIRCRAFT ELECTRIC SYSTEM TO THE EXTERNAL SOURCE, THE **COMM/NAV 1**, **COMM/NAV 2** AND **FLIGHT INSTR.** SWITCHES SHOULD BE TURNED OFF - THERE IS A RISK OF DAMAGE OF THE AVIONICS AND INSTRUMENTS RESULTING FROM VOLTAGE TRANSIENT PEAKS.

7.14. LIGHTING

7.14.1. External Lighting

1) Position Lights

The green position light on the right wing tip, red light on the left wing tip, and white tail light on the elevator.

To turn the position lights ON, use the switch **POSITION LIGHTS**.

2) Landing and Taxiing Lights

The landing and taxiing lights are located in the leading edge of the left wing, near the external fuel tank.

To turn the landing light ON, use the switch **LANDING LIGHT**.

To turn the taxi-light ON, use the switch **TAXI LIGHT**.

3) Anticollision Beacon

The anticollision beacon is located on the rudder top.

To turn the anticollision beacon ON, use the switch **BEACON**.

4) Strobe Lights (optional)

The stobe lights are delivered optionally. These are located on the wing tips.

To turn the strobe lights ON, use the switch **FLASH LIGHTS**.

CAUTION

THE STROBE LIGHTS SHOULD NOT BE OPERATING, WHEN FLYING THROUGH CLOUD, FOG OR HAZE. THE REFLECTED LIGHT CAN PRODUCE SPATIAL DISORIENTATION. THEY ALSO SHOULD NOT BE USED IN CLOSE PROXIMITY TO THE GROUND, SUCH AS DURING TAXIING, TAKE-OFF AND LANDING.

7.14.2. Internal Lighting

1) Cockpit Lighting

Lighting of the cockpit is provided by ceiling lamp, which is attached on the fixed frame of canopy.To turn the lamp ON, use the switch on the lamp body. The ceiling lamp is connected directly to the battery. **MASTER** and **BATTERY** switch need not be ON when using the ceiling lamp.

2) Illumination of the placards and the instruments

To illuminate the placards and the instruments, turn ON the switch **LIGHTING**.The luminous intensity of the three instrument Chapters/groups may be controlled individually by means of three dimmers located on the central panel.

3) Auxiliary lamp ("Map" lamp)

The auxiliary lamp is located on the sliding canopy frame. To turn the lamp ON and to regulate its luminous intensity, use the switch - dimmer on the lamp body; adjacent this lamp switch a pushbutton is located, pressing of which causes the lamp to light at maximum luminous intensity. Prior turning the auxiliary lighting lamp ON, the circuit switch **BEACON** must be turned ON. In case of electric power supply failure the auxiliary lamp is supplied from the emergency power source.

NOTE

The lamp can be turned ON only, when the cockpit canopy is closed.

7.15. VENTILATION AND HEATING

The aircraft cockpit is provided with an adjustable ventilation and heating. The common ventilation and heating controller is located at the console under the instrument panel.

7.15.1. Ventilation

1) Ventilation of the cockpit front space

Fresh air enters the regulating chamber through the air-intake in front of the sliding canopy frame. The flap-valve (6) in the regulation chamber controls and distributes the airflow; the valve is controlled by the string mechanism connected to the push/pull handle on the cockpit central panel (5). The airflow is closed by pushing the handle fully forward. Pulling the handle backwards opens the airflow to the venting ducts from which it is directed to the windshield and two adjustable ventilators for front seats occupants (3).

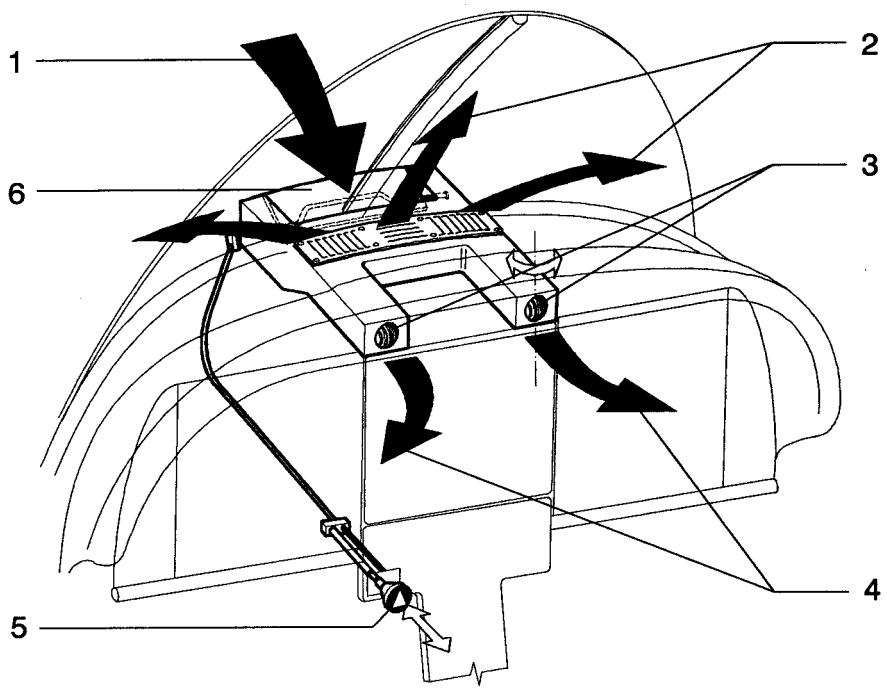

Fig. 7-18 Ventilation of the Cockpit Front Space

1 - Air-inlet into the regulating chamber
2 - Cool air outlet to the windshield
3 - Air-showers
4 - Fresh-air flow to the front seats occupants
5 - Ventilation and heating control handle
6 - Flap valve

2) Passenger compartment ventilation (Fig. 7-19)

Two air traps on both sides of the airframe supply the fresh air to the passengers compartment. The air quantity is possible regulated or closed an adjustable cooling flaps, which are located on both sides of the cockpit.

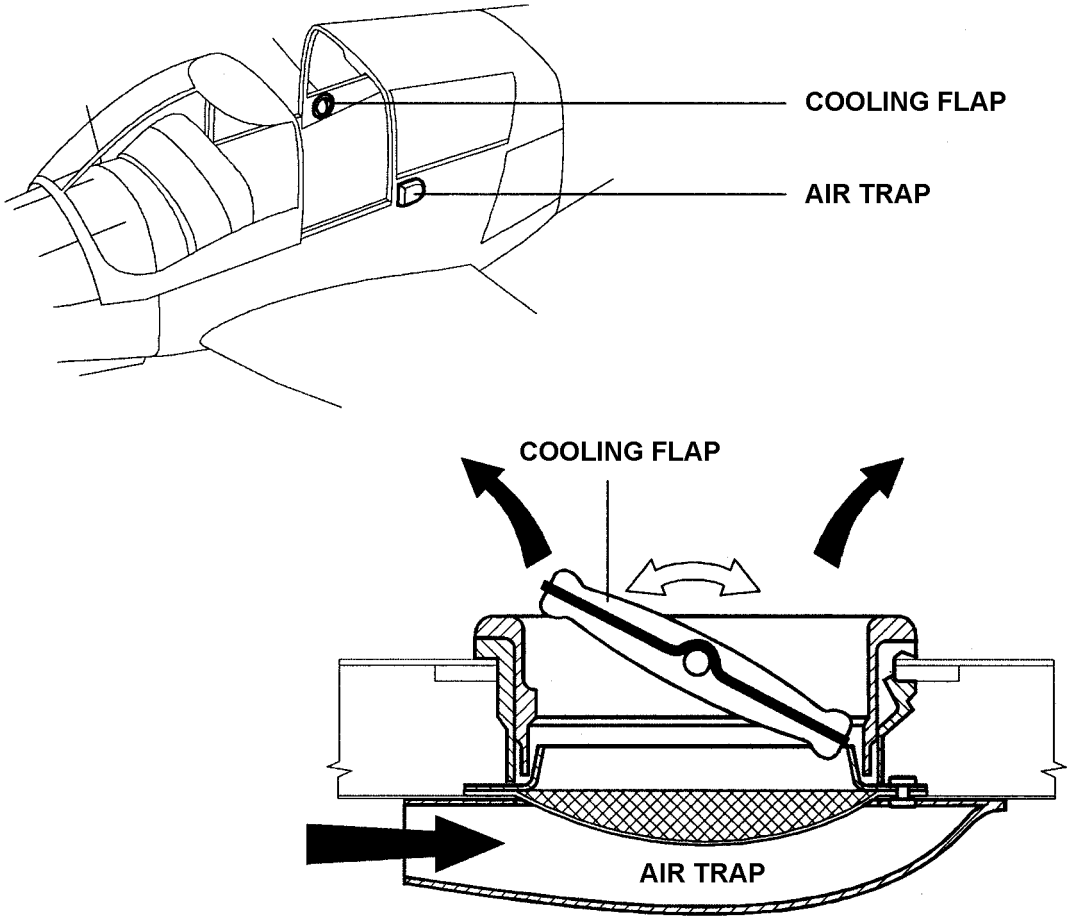

Fig. 7-19 Passenger Compartment Ventilation

3) Ventilation windows

Two side ventilation windows on the canopy is possible installed on the customer wish.

7.15.2. Heating

Ram air passes (7) the inlet in the front part of the engine bottom cowling in two heat exchangers (1), mounted on the exhaust manifold (Fig. 7-20). Here the air is heated and depending on adjustment of the rotary slide valve in the regulation chamber (4), the air flows into the cockpit or is bleeded through a channel (6) on the firewall beneath the aircraft. The rotary slide valve is controlled by means of a chain from the heating regulator handle (3), controlled by turning the same handle which the ventilation is controlled with located under instrument panel.

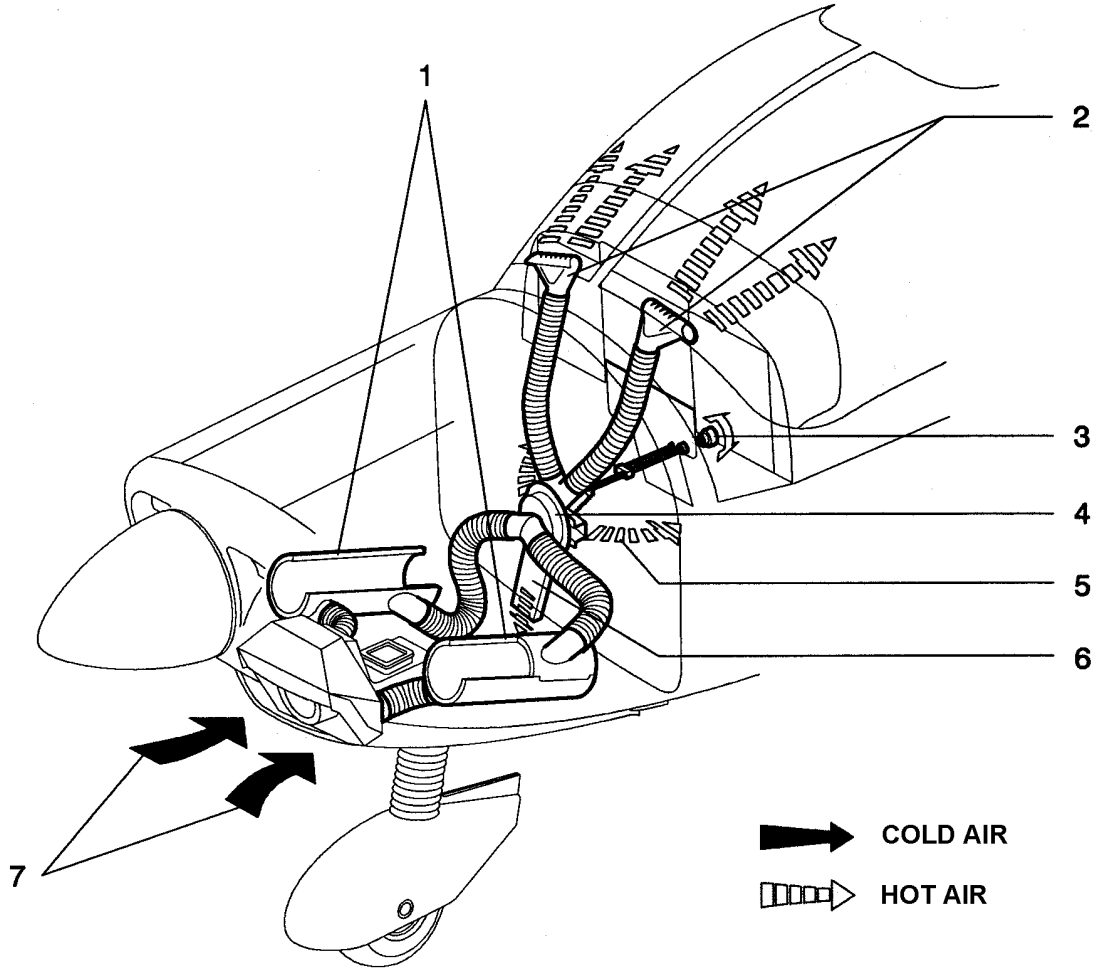

Fig. 7-20 Cockpit Heating

1 - Heat exchanger
2 - Hot air outlet onto the windshield
3 - Ventilation and heating control handle
4 - Regulation chamber
5 - Hot air outlet for the crew feet
6 - Hot air bleeding (heating closed)
7 - Ram outside air

The heating functions according to the heating control handle adjustment:

1) Adjusting the heating control arrow pointing to the left (0), the hot air inlet into the cockpit front space is closed. Hot air flows out beneath the aircraft fuselage.
2) Turning the heating handle arrow upwards(▲), the outlet of warm air into the outer atmosphere is closed and the hot air flows on the windshield.
3) Turning the heating handle arrow pointing to the right(◆), the stream of hot air is distributed partially to the windshield and to the space under the feet of the front occupants.
4) Adjusting the heating control handle arrow downwards, the stream of hot air flows to the space of the crew feet only.

The heating control handle (3) can be rotated as necessary throughout 360^{o} without any stops. In turning and partially pulling the handle, any desirable combination of heating and ventilation intensity can be selected.

7.16. PITOT-STATIC SYSTEM AND STALL WARNING

7.16.1. Pitot-Static System

Total (pitot) pressure for the airspeed indicator is supplied from the pitot-tube (13) installed on the bottom of the left wing (Fig. 7-21). Static pressure for the airspeed indicator, altimeter and vertical speed indicator is picked-up by the static pressure probes (8) on both sides of the rear fuselage in front of the tail.

The static-pressure line is provided with two-way pneumatic valve (17), which enables to select the alternate static pressure source in case of primary source failure. The static pressure is picked-up by two branches from the engine compartment (firewall) and the cockpit. Switching from the primary static-pressure system to alternate static-pressure source does not cause any significant variance of altimeter and airspeed indicator readings.

Both pitot and static lines are provided in the lowest part by transparent drainage sumps (16) accessible through the lid on the fuselage bottom cover.

7.16.2. Stall-Speed Signalling Unit

The installed airspeed indicator is provided with stall-speed signalling unit. The unit functions as the switch operated by differential manometer, comparing the total pressure from the pitot-tube with the pressure from the stall-warning probe (12) located on the left wing semispan, slightly below the leading edge. The piping is provided with the same draining sump as pitot-static ones, located in the same area. At the required speed interval by 5÷10 knots (9 ÷ 18 km/h) above the stall-speed, the pressure difference switches on the warning horn.

To prevent this warning signal being activated on ground, the microswitch controlled by the right main landing gear spring is turned off after the displacement of the loaded spring occurs. At this condition the warning light **STALL. WARN. INACTIVE** on the annunciators becomes ON. **STALL. WARN. INACTIVE** light gets OFF after the spring is released when the aircraft is airborn and the stall-warning circuit is armed again.

CAUTION

THE STALL WARNING CIRCUIT IS OUT OF OPERATION WHENEVER THE **STALL. WARN. INACTIVE** LIGHT IS ON DURING FLIGHT.

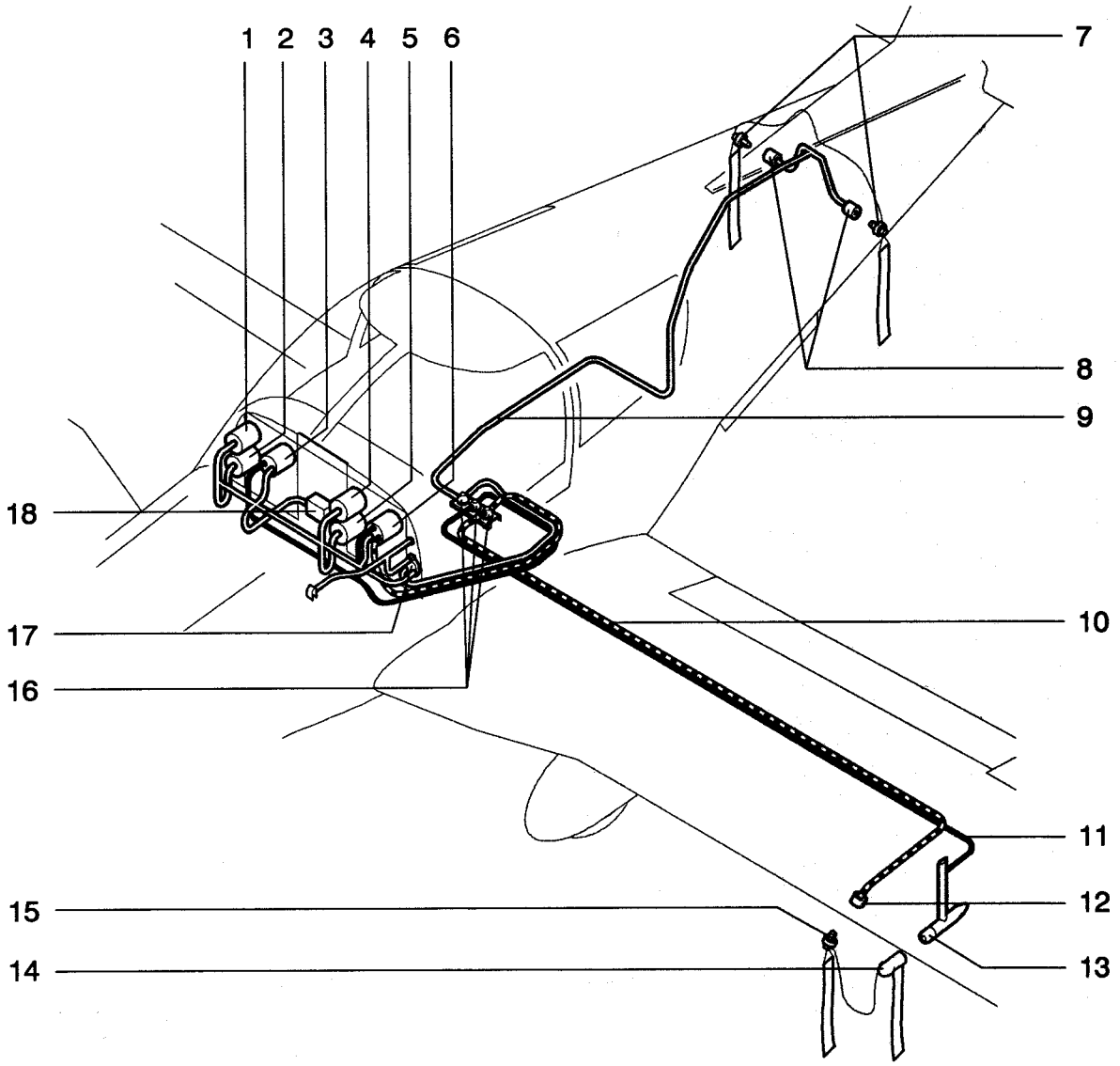

Fig. 7-21 Pitot-Static and Stall Warning Systém

1 - Altimeter
2 - Vertical Speed indicator
3 - Airspeed indicator
4 - Encoding Altimeter
5 - Vertical Speed indicator
6 - Airspeed Indicator with stall speed signalling
7 - Blinding plugs for static pressure probes
8 - Static pressure probes
9 - Static pressure line
10 - Stall-warning line
11 - Total pressure line
12 - Stall-warning probe
13 - Pitot-tube
14 - Pitot-tube cover
15 - Blinding plugs for stall-warning probe
16 - Draining sumps¨
17 - ASPS switch valve
18 - Encoding Altimeter

7.17.3. Pressure Probes Icing Protection

All probes of pitot-static / warning system are provided with electrical heating elements, that prevent the probes against icing.

The static pressure probes heating are activated by the circuit switch **STATIC HEATING**, the pitot-head and stall warning probe heating is controlled by the switch **PITOT HEATING**.

After the appropriate circuit switch is ON, the green signalling light on the annunciator panel **STATIC HEATING** and **PITOT HEATING** must be ON respectively.

CAUTION

THE FAILURE OF THE PARTICULAR PROBE HEATING IS SIGNALLED WHEN THE SIGNAL LIGHT **STATIC HEATING** OR **PITOT HEATING** REMAINS OFF AFTER SWITCHING THE PARTICULAR CIRCUIT SWITCH ON.

INTENTIONALLY LEFT BLANK