# INSTALLATION MANUAL

**M 332A, M 137A, M 137AZ, M 337A, M 337AK**

**AIRCRAFT ENGINES**

Manufacturer: AVIA k.p., Praha 9 - Letňany, ČSFR (do 31.12.1992).

LOM PRAHA s.p. Praha 10 - Malešice, ČR.

Dedication: This INSTALLATION MANUAL is intended mainly for airfcraft manufacturer, but it contains helpful information valuable for owners, pilots and maintenance personnel, too. This manual deals with all model engines as they are described in the section "GENERAL". The observing of recommendations and principles stated in this manual will result in a successful installation, and reliable operation.

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TABLE of CONTENTS

Section 1. INTRODUCTION ..... 1-1

Section 2. PROPULSION UNIT ..... 2-1

Section 3. EXHAUST SYSTEM ..... 3-1

Section 4. FUEL SYSTEM..... 4-1

Section 5. OIL SYSTEM..... 5-1

Section 6. ELECTRICAL SYSTEM..... 6-1

Section 7. MAINTENANCE INSTRUCTIONS

OF ENGINE AND PROPELLER..... 7-1

# SECTION 1

# INTRODUCTION

1/ General.....1-2

2/ Revisions.....1-3

3/ List of Revisions.....1-4

4/ Typical Engine Configuration.....1-5

## 1. GENERAL

1/ This installation manual is suitable for all below mentioned engines, which are manufactured and repaired in LOM PRAHA s.p.

| | | |
|---|---|---|
| Types: | 4-cylinder: | M332, M332A, M332AK, M332B, M332C |
| | | M132A, M132AK, M132C |
| | 6-cylinder: | M337, M337A, M337AK, M337AK.1, M337B, M337C<br>M137A, M137AZ, M137C |

Instructions in this manual contain necessary information about installation of the engine in the airframe, which is the key for safe and reliable engine operation.

2/ This manual does not contain information about engine operation. This information is contained in the Operator´s Manuals for each engine type.

3/ This manual does not contain procedures for engine disassembly or reassembly, periodical inspections or overhaul. This procedures are given in the Operator´s Manuals for each engine type and LOM Engine Overhaul Manual.

4/ Instructions and recommendations in this manual were verified by practice and it is in operator´s benefit to know them and observe them.

## 2. REVISIONS

All changes or revisions in this manual are performed in the following way:

1/ The manufacturer of the engine sends a bulletin to each registered possessor of the manual new - revised pages.

2/ The manual´s possessor is obliged:

a/ to record the number od revision in the List of revisions. page 1-4.

b/ to replace the old pages with the revised ones, which are provided with new date of edition.

***Note:***

*The revised parts of the text will be indicated by a vertical line along the edge of the page.*

## 3. LIST OF REVISIONS

| Revi-sion number | Bulletin number | No. of the affected pages | Edition datum of the new pages | Datum of revision and sign. |
|---|---|---|---|---|
| 1 | | 0-1, 1-2, 1-3, 1-4, 1-5, 1-6, 2-8, 2-9, 2-10, 2-16, 7-15 | 21.8.2014 | |
| | | | | |

***Note:*** *The possessor of the Manual fills in the list according to the paragraph 2. REVISIONS.*

## 4. LIST OF VALID PAGES

| Section | Page | Date |
|---|---|---|
| | 0-1 | 21. 8. 2014 |
| | 0-2 | 31. 3. 1991 |
| Introduction | 1-1 | 31. 3. 1991 |
| | 1-2 | 21. 8. 2014 |
| | 1-3 | 21. 8. 2014 |
| | 1-4 | 21. 8. 2014 |
| | 1-5 | 21. 8. 2014 |
| | 1-6 | 21. 8. 2014 |
| | 1-7 | 31. 3. 1991 |
| | 1-8 | 31. 3. 1991 |
| Propulsion unit | 2-1 | 31. 3. 1991 |
| | 2-2 | 31. 3. 1991 |
| | 2-3 | 31. 3. 1991 |
| | 2-4 | 31. 3. 1991 |
| | 2-5 | 31. 3. 1991 |
| | 2-6 | 31. 3. 1991 |
| | 2-7 | 31. 3. 1991 |
| | 2-8 | 21. 8. 2014 |
| | 2-9 | 21. 8. 2014 |
| | 2-10 | 21. 8. 2014 |
| | 2-11 | 31. 3. 1991 |
| | 2-12 | 31. 3. 1991 |
| | 2-13 | 31. 3. 1991 |
| | 2-14 | 31. 3. 1991 |
| | 2-15 | 31. 3. 1991 |
| | 2-16 | 31. 3. 1991 |
| Exhaust system | 3-1 | 31. 3. 1991 |
| | 3-2 | 31. 3. 1991 |
| | 3-3 | 31. 3. 1991 |
| | 3-4 | 31. 3. 1991 |
| | 3-5 | 31. 3. 1991 |
| | 3-6 | 31. 3. 1991 |
| | 3-7 | 31. 3. 1991 |
| | 3-8 | 31. 3. 1991 |
| Fuel system | 4-1 | 31. 3. 1991 |
| | 4-2 | 31. 3. 1991 |
| | 4-3 | 31. 3. 1991 |
| | 4-4 | 31. 3. 1991 |

| Section | Page | Date |
|---|---|---|
| | 5-1 | 31. 3. 1991 |
| Oil system | 5-2 | 31. 3. 1991 |
| | 5-3 | 31. 3. 1991 |
| | 5-4 | 31. 3. 1991 |
| | 5-5 | 31. 3. 1991 |
| | 5-6 | 31. 3. 1991 |
| Electrical system | 6-1 | 31. 3. 1991 |
| | 6-2 | 31. 3. 1991 |
| | 6-3 | 31. 3. 1991 |
| | 6-4 | 31. 3. 1991 |
| | 6-5 | 31. 3. 1991 |
| | 6-6 | 31. 3. 1991 |
| | 6-7 | 31. 3. 1991 |
| | 6-8 | 31. 3. 1991 |
| Maintenance instructions of engine and propeller | 7-1 | 31. 3. 1991 |
| | 7-2 | 31. 3. 1991 |
| | 7-3 | 31. 3. 1991 |
| | 7-4 | 31. 3. 1991 |
| | 7-5 | 31. 3. 1991 |
| | 7-6 | 31. 3. 1991 |
| | 7-7 | 31. 3. 1991 |
| | 7-8 | 31. 3. 1991 |
| Operating substances | 7-9 | 31. 3. 1991 |
| | 7-10 | 31. 3. 1991 |
| | 7-11 | 31. 3. 1991 |
| | 7-12 | 31. 3. 1991 |
| | 7-13 | 21. 8. 2014 |
| | 7-15 | 21.8.2014 |
| | 7-16 | 31.3.1991 |

## 5. TYPICAL ENGINE CONFIGURATION

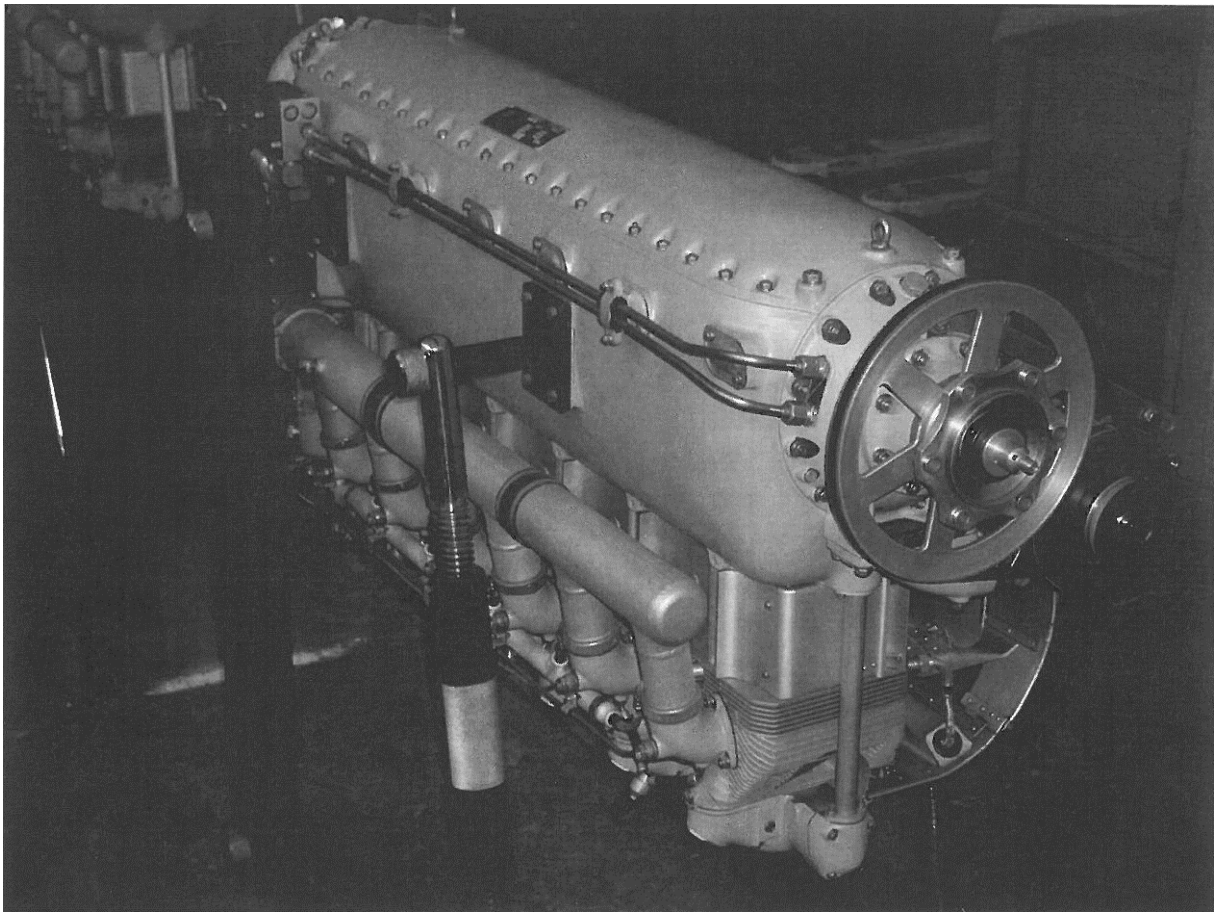


Fig. 1-1 Model M337C series engine

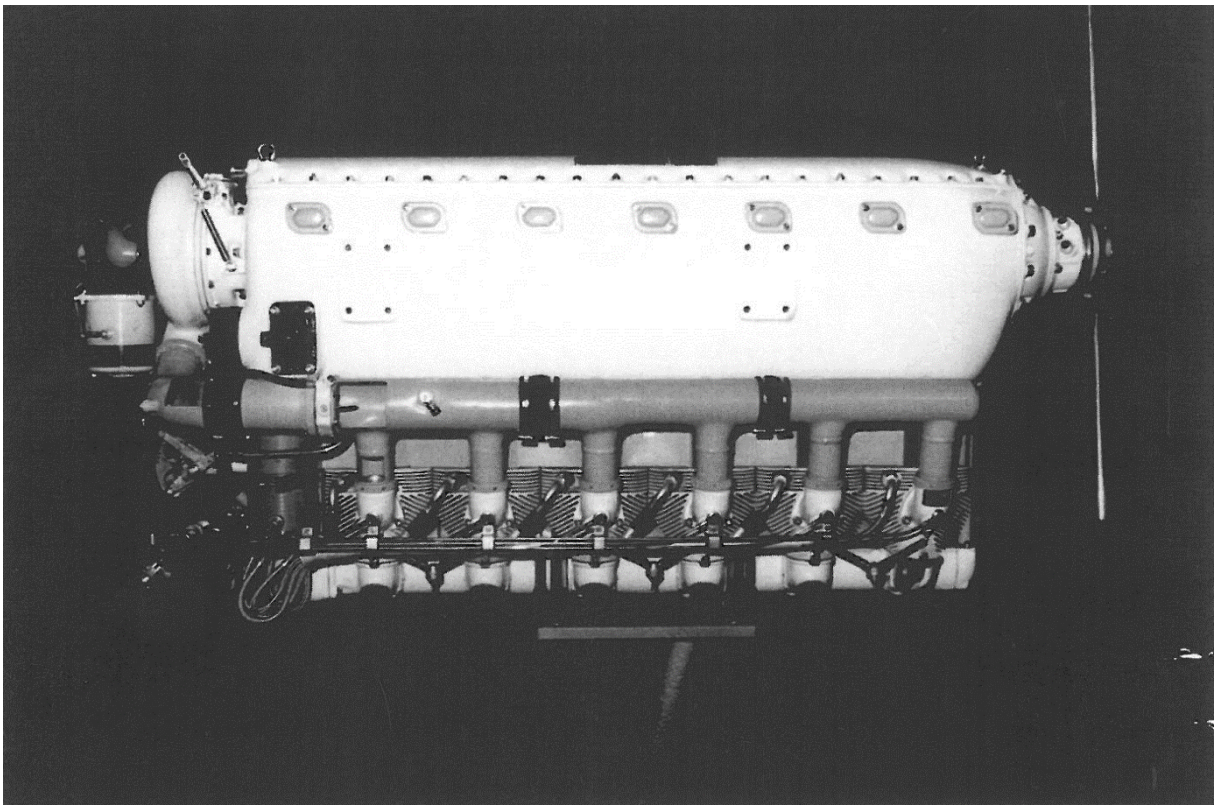
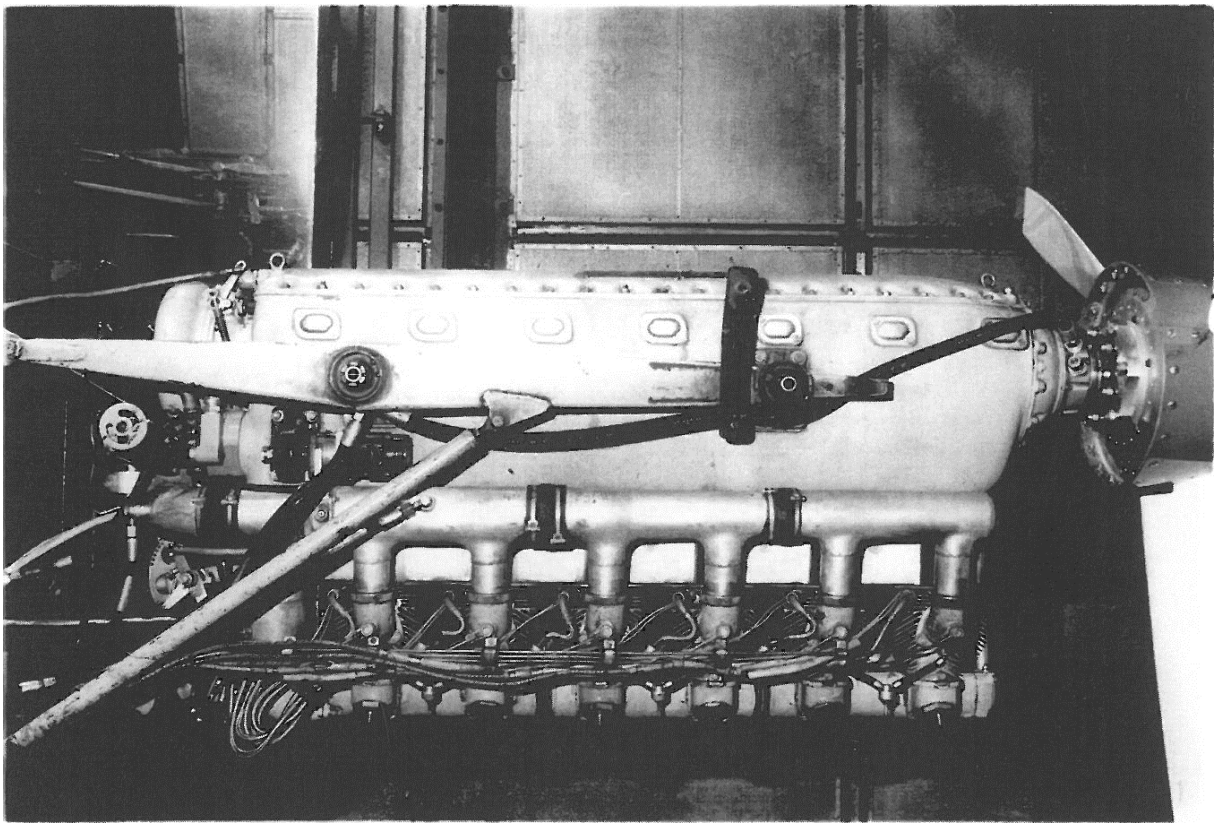


Fig. 1-2 Model M 337 series engine



Obr. 1-3 Model M 337 series engine with hydraulically actuated variable pitch propeller.

# SECTION 2

# PROPULSION UNIT

1/ Engine ..... 2-2
Engine Installation ..... 2-4
Engine Installation Dimensions ..... 2-8
2/ Propeller ..... 2-11
Typical propeller V 410 ..... 2-13
Typical propeller V 503 ..... 2-15
Typical propeller V 506 ..... 2-16

LOM engine is a piston, four-stroke, air-cooled, one row inverted, four or six-cylinder engine with counter-clockwisely rotating crankshaft. The engine valve gear with inclined valves and the camshaft are located on the cylinder heads. The fuel is injected before the port of the inlet valve at low pressure. The engine is supercharged, with direct drive to propeller and is adapted for high aerobatic and inverted flights.

For engine installation in aircraft see fig. 2-1A,B.

The engine is controlled by means of the throttle, by adjusting fuel/air mixture and by supercharging. The throttle control rods (left and right) control the throttle adjustment. Actuating the mixture handle, the fuel to air ratio is controlled. The compressor is engaged or disengaged by means of its control rod. The propeller RPM is controlled by rod, too.

## 1. ENGINE

The engine inspections are described in the "Operator´s Manual".

**Outline of inspections**

a/ First 10-hour inspection
b/ 50-hour inspection
c/ Partial inspection
d/ Complete overhaul

***Notes:***

*The interval to the partial inspection and TBO are set forth in the engine operator´s manual. These are dependent upon the used oil and upon the manner of operating the engine. In the engine operator´s manual there is also set forth further information about engine maintenance. The time spent by the engine in aerobatic operation is multiplied by 1.3.*

***Attention:***

*For good access to the engine during inspection, it is necessary to:*

*a/ Disconnect the grounding of the engine top and bottom cowling to the engine frame.*

*b/ Remove the top engine cowling together with the side cowlings and then the bottom ones.*

*c/ Disconnect the front engine cowling from its frame and remove it from the dampers of the engine mount.*

## Assembly

The parts are assembled following the opposite order from disassembly after completion of the works on the engine. When assembling the engine cowlings, the following order is recommended:

a/ Attach the bottom part of the front cowling to the damper of the engine mount without tightening the fastening bolts.

b/ Mount the top and the bottom cowling to the engine.

c/ Mount the top part of the front cowling to the engine.

d/ Tighten the fastening bolts from bottom part of the front cowling.

During assembling the engine cowlings and before tightening the bolts check the uniformity of scoop duct:

a/ between the front cowling and the propeller spinner

b/ between the exhaust tubes and bottom cowling

c/ between the cooler and the bottom cowling

d/ between the engine and the front cowling.

The scoop entrance in the front cowl must be continuously followed by the engine airduct.

***Attention:***

*In the case of replacing the engine, it is necessary to tighten bolts (1) from the engine attachments (3) – see fig. 2-2, applying a torque of 15.7 +2 Nm. Fit the bolt head position to the lock washer within the range of the tightening torque.*

## ENGINE INSTALLATION

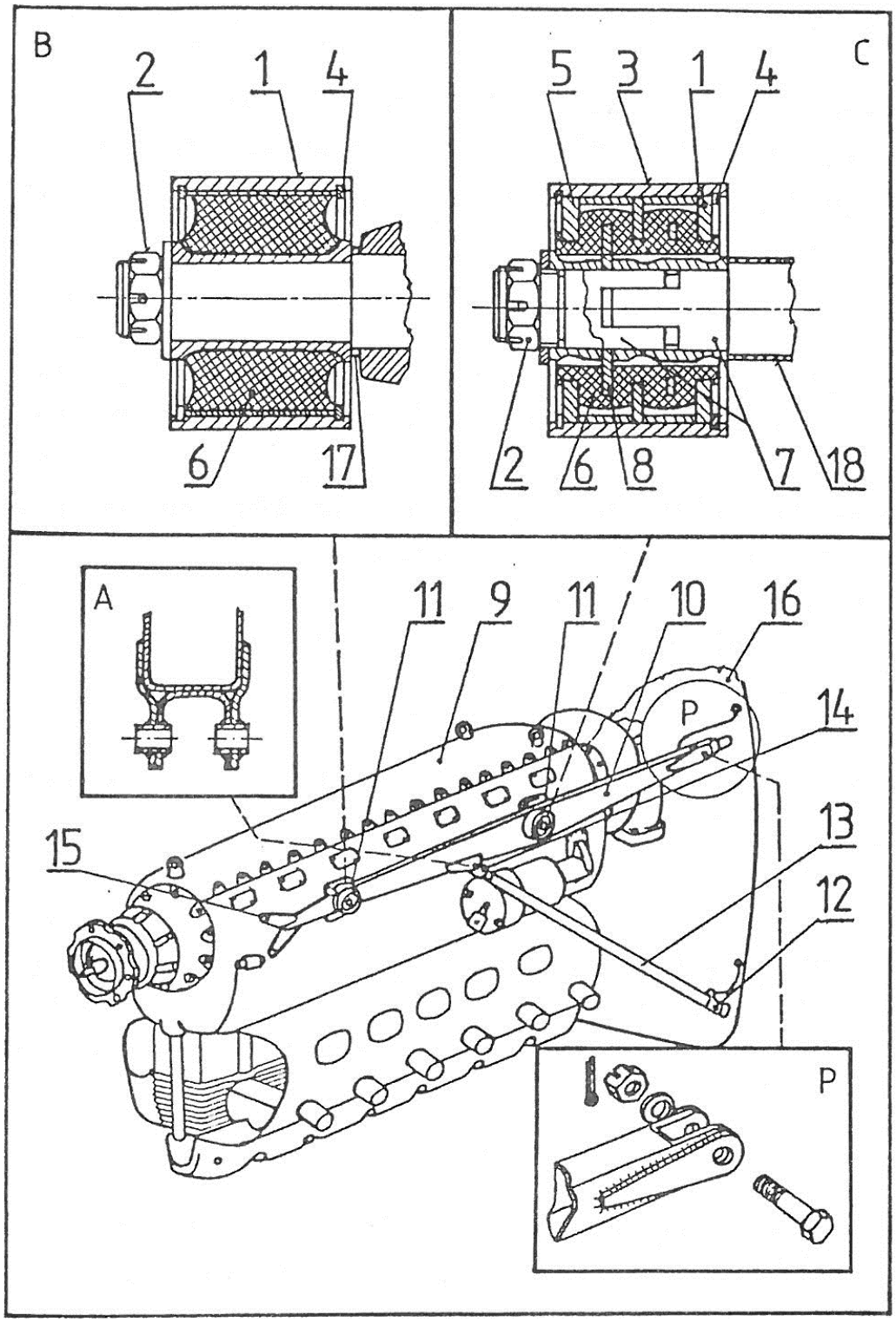



Fig. 2-1A Engine installation.

Fig. 2-1A Engine Installation

A - section through the attachment of the upper end of the strut

B - section through the front damper

C - section through the rear damper

D - attachment of the engine mount to the fuselage

1 - damper body

2 - nut

3 - distance rings

4 - securing rings

5 - damper outside ring

6 - damper rubber

7 - metallic insertion piece with frontal claws

8 - inside rings

9 - engine

10 - engine mount main beam

11 - engine hinged pins

12 - hinged pin of the strut to fuselage

13 - engine mount strut

14 - adjustable strut endpiece

15 - engine front cowl clip

16 - fire-proof wall

17 - insertion piece

18 - insertion piece

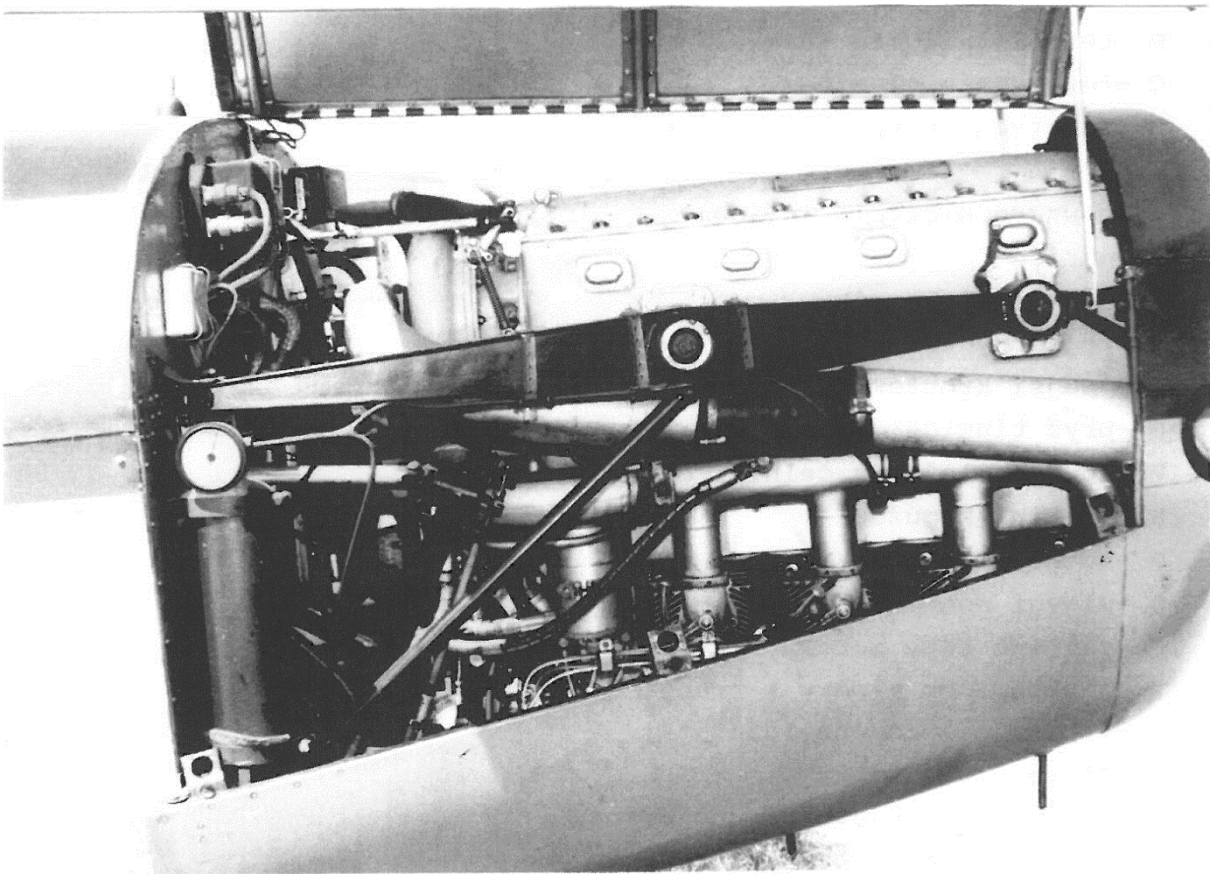
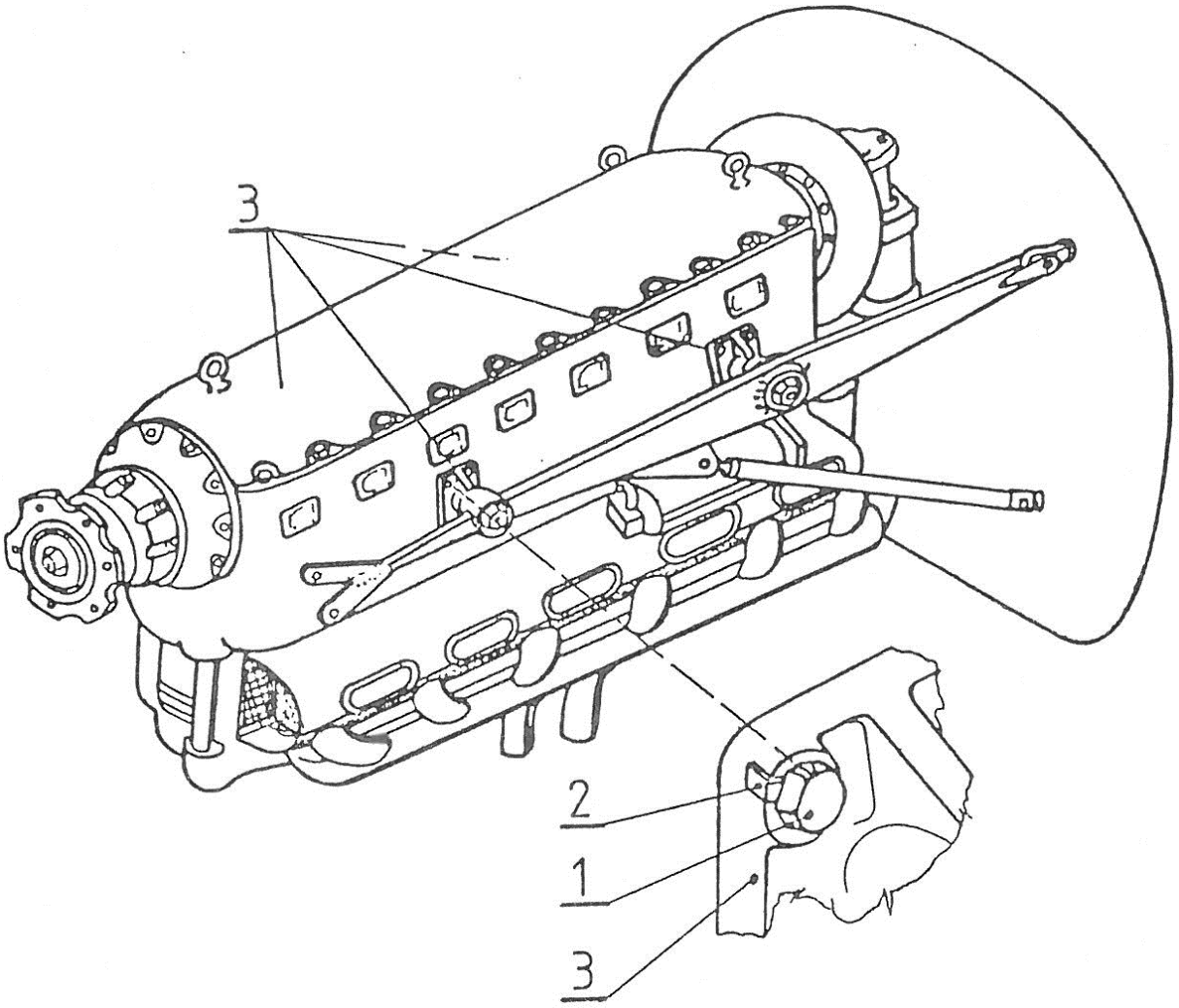


Fig. 2-1B Sample M 332 engine installation onto the L 40 Metasokol aircraft




1 -bolt
2 -lock washer
3 -engine attachment

Fig. 2-2 Tightening of engine attachment bolts

## ENGINE INSTALLATION DIMENSIONS

Engine installation dimensions are marked on Installation drawing of engine. It has to be ordered in scale 1:5 on paper format A0, or in electronic version in TIFF format.

## LIST OF ENGINE INSTALLATION DRAWINGS

| No. of drawing | Engine | Note |
|---|---|---|
| Sc 0005 A | M332.A | - |
| Sc 0005 AK | M332 AK | - |
| Sc 0005 C | M332B, M332C | - |
| Sc 0007 A | M132A | - |
| Sc 0007 AK | M132AK | - |
| Sc 0008 C | M132C | - |
| Sh 0006 A | M337.A | - |
| Sh 0006 AK | M337AK | - |
| Sh 0006 B | M337B, M337C | - |
| Sh 0008 | M137AZ | - |
| Sh 0008 C | M137C | - |
| Sh 0009 | M337AK.1 | - |

Format (A4) of this installation manual does not allow detailed resolution of drawings so we used pictures 2-4 and 2-5 as miniatures.

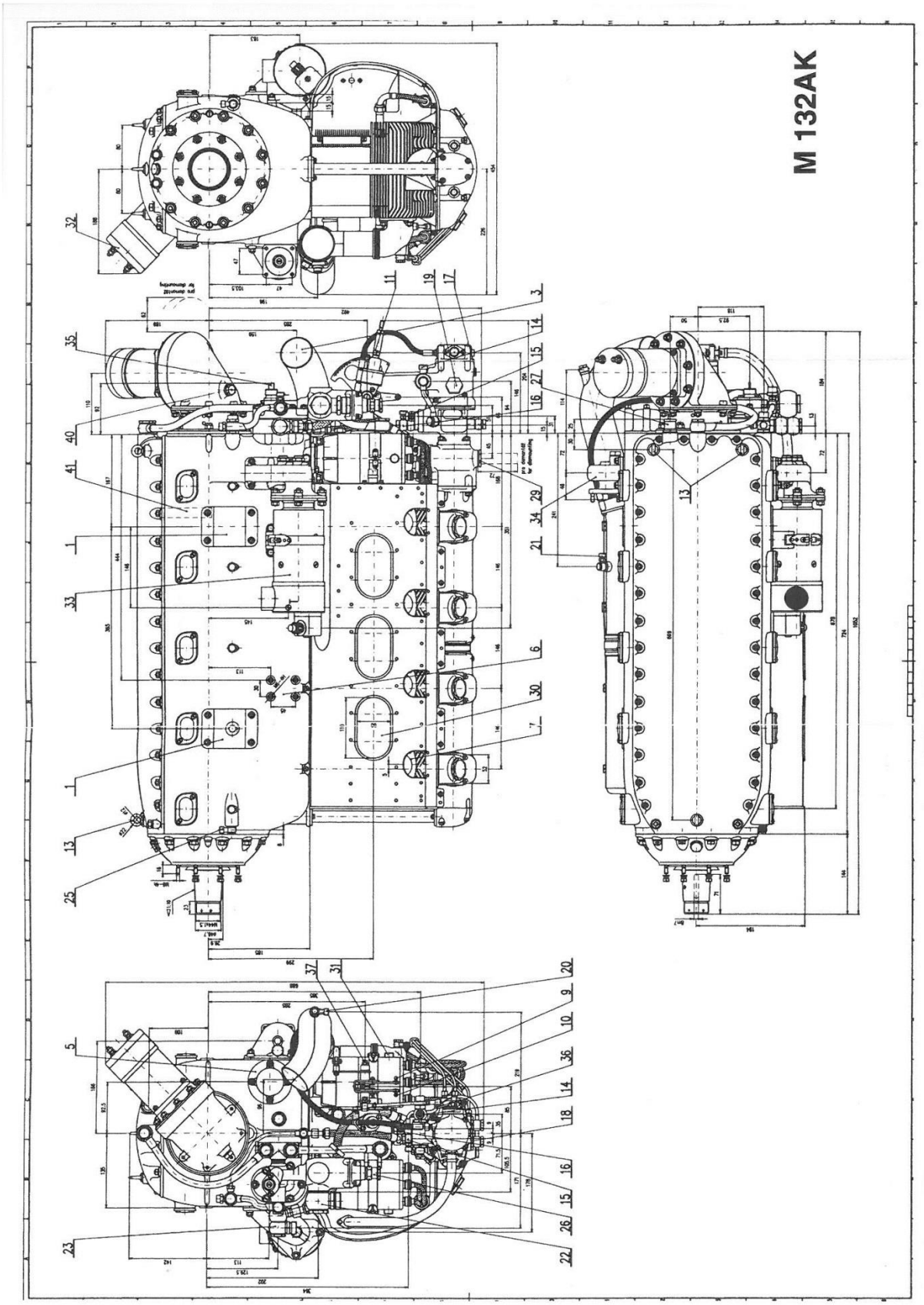



Fig. 2-4 Miniature of Installation drawing of engine M132AK

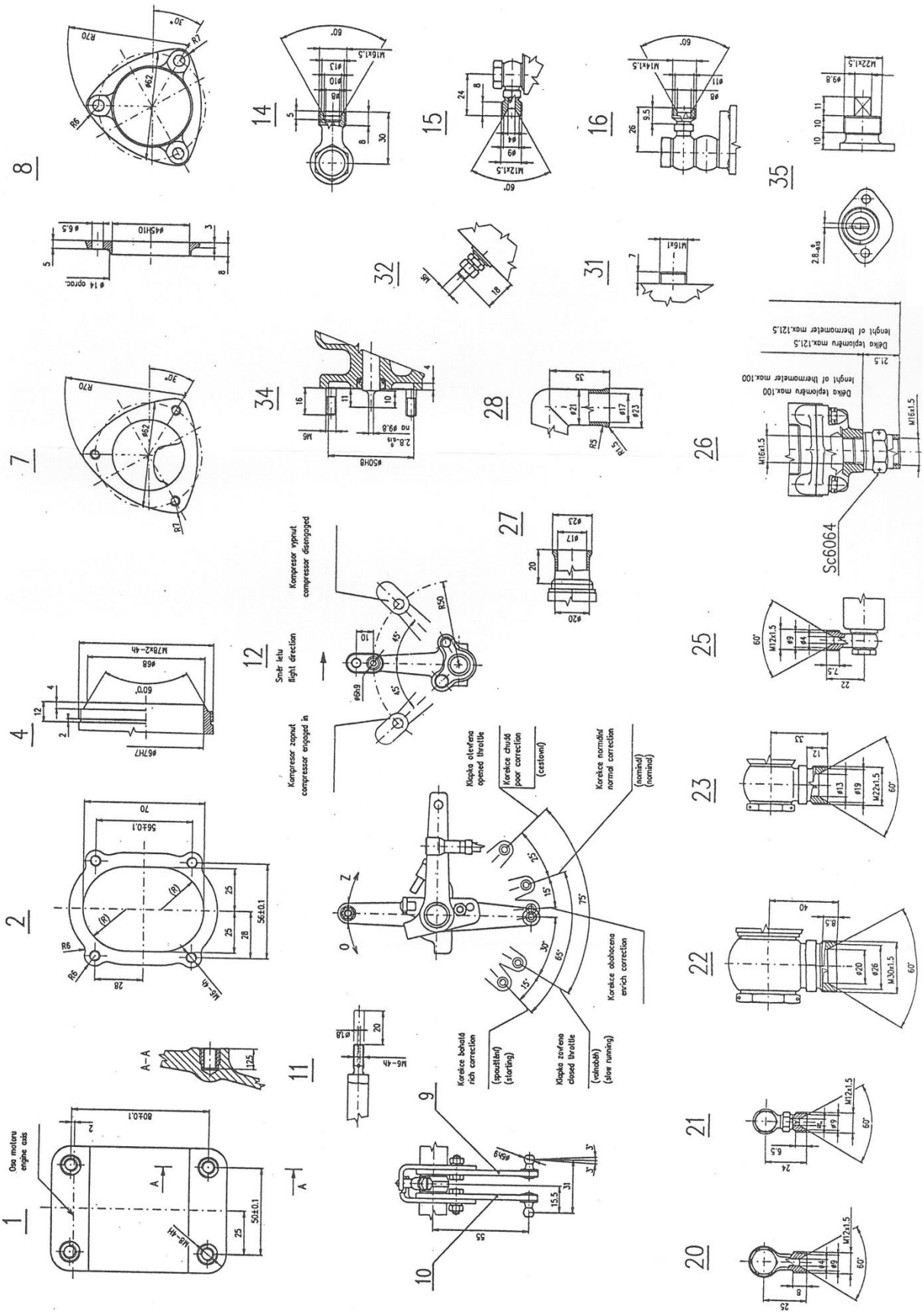


Fig. 2-5 Miniature of Installation drawing of engine M132AK; engine attachments

## 2. PROPELLER

With light, sport, aerobatic, touristic and training, LOM engines up to 157 kW powered airplanes, it is possible to use two-blade, fixed pitch propellers or both incremental variable pitch, mechanically or electromechanically governed propellers or automatically/RPM governor controlled, continuously variable pitch propellers. At the same time, it can be used a 3-blade, hydraulically governed propeller.

Mechanically control can be used with one engine powered airplanes. It is performed by the means of a crank equipped with an indicator of the current blade pitch. The crank is located in the cockpit and it actuates the propeller mechanism by means of joint shaft.

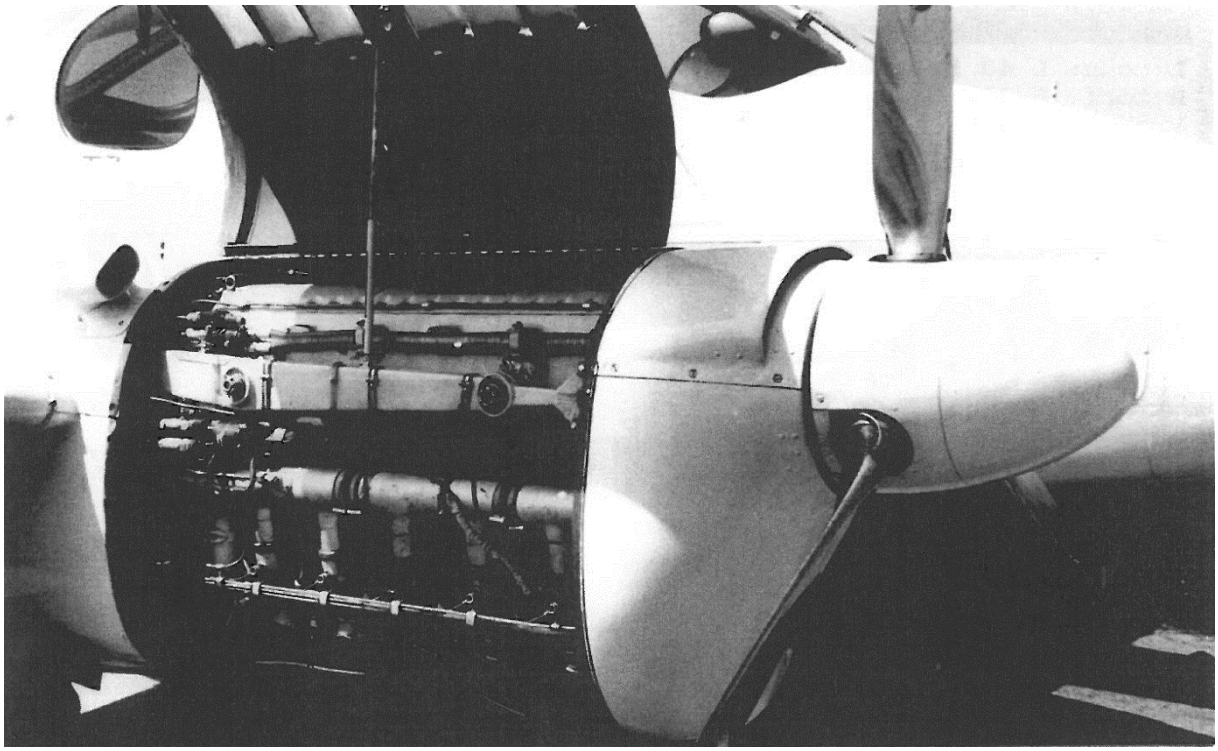
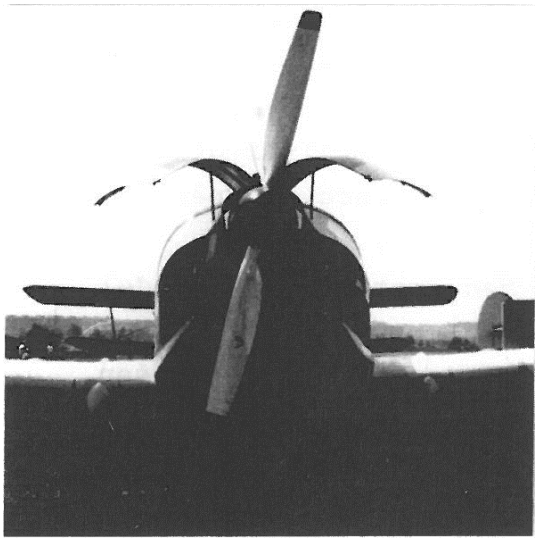
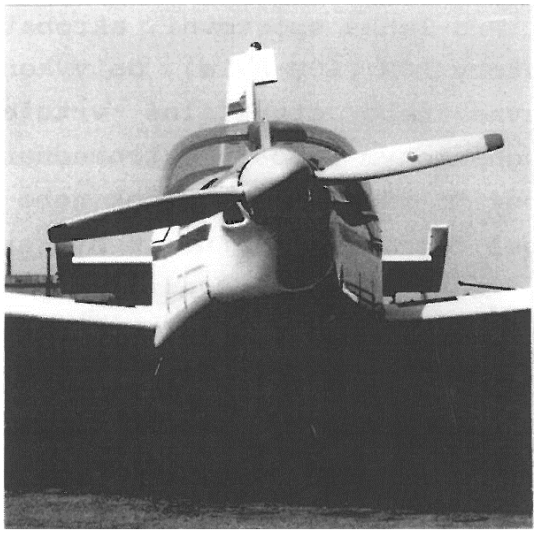


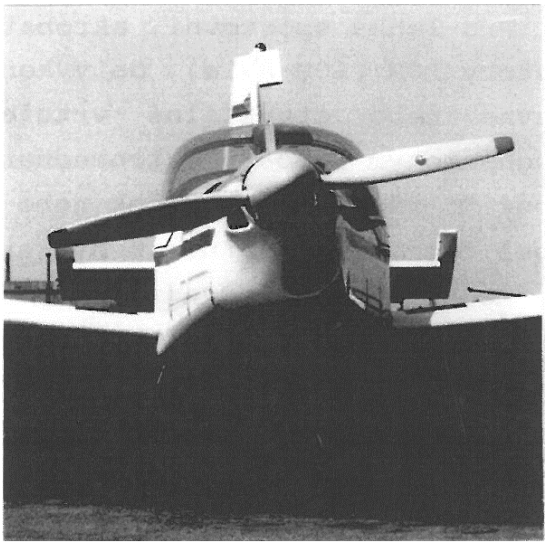
Fig. 2-5A Sample M337 engine installation onto the two-engine L 200 D Morava aircraft.



Aircraft: L 40 *Metaskol*
Engine: M 332
Propeller: V 410



Aircraft: ZLIN Z 142
Engine: M 337 AK
Propeller: V 500



Aircraft: ZLIN Z 42
Engine: M 137 A
Propeller: V 503

Aircraft: L 200 *Morava*
Engine: 2 x M 377
Propeller: 2 x V 506

Fig. 2-5B Sample propulsion unit application.

TYPICAL PROPELLER V 410

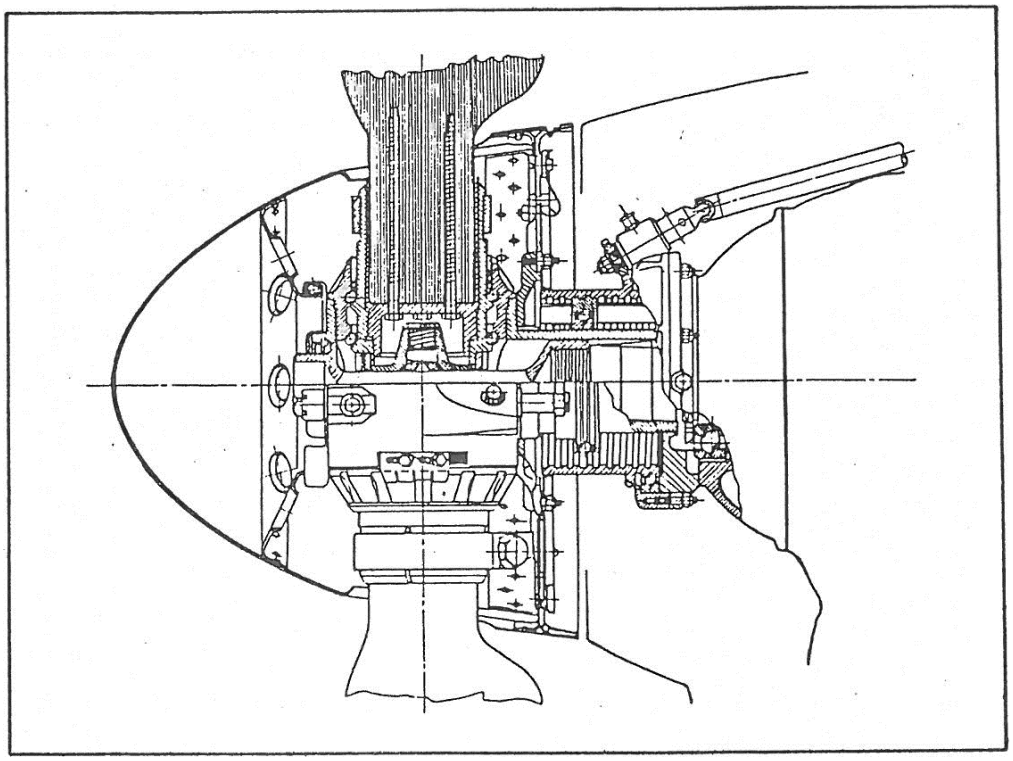


Fig. 2-6 Longitudial section through the V 410 propeller

Technical specifications

Type ..... variable pitch propeller
Way of varying the blade pitch ..... mechanically or electromechanically
Way of action ..... tractive propeller
Sense of rotation ..... counter-clokwise
Max. output ..... 157 kW (220 h.p.)
Max. RPM ..... 2800 $min^{-1}$
Max. diameter ..... 2000 mm
Number of blades ..... 2
Material of blades ..... wood
Max. blade angel range ..... 85°
Moment of inertia ..... 0,075 $kgm.sec^{-2}$
Max. weight ..... 27,5 kg
Application on engines ..... M 332, M 337

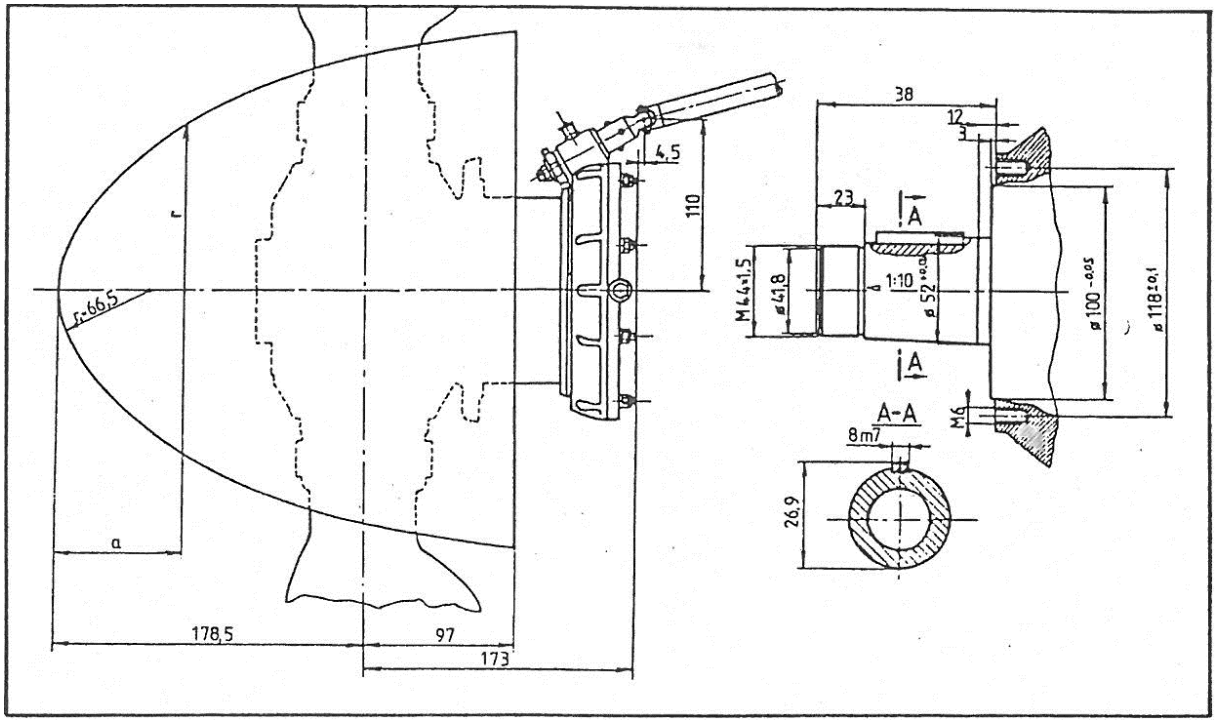



Fig. 2-7 Dimension sketch of propeller shaft.

| Outside dimensions of propeller spinner (dimensions in mm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| a | 7,5 | 30,5 | 58,5 | 88,5 | 118,5 | 148,5 | 178,5 | 208,5 | 238,5 | 275,5 |
| r | 49 | 65,3 | 89 | 06,5 | 120 | 129,5 | 136 | 141 | 144,5 | 147,5 |

The electrical control of the blades is performed by means of a governor, located in the front part of the engine. The rotational motion of this governor is transmitted to propeller by means of a joint shaft. Actuating of the governor by pressing buttons assures simplicity and easy survey.

The blade angle range also enables to set the propeller in the emergency (feathering) position and due to this fact it can be used for multi-engine airplanes.

TYPICAL PROPELLER V 503

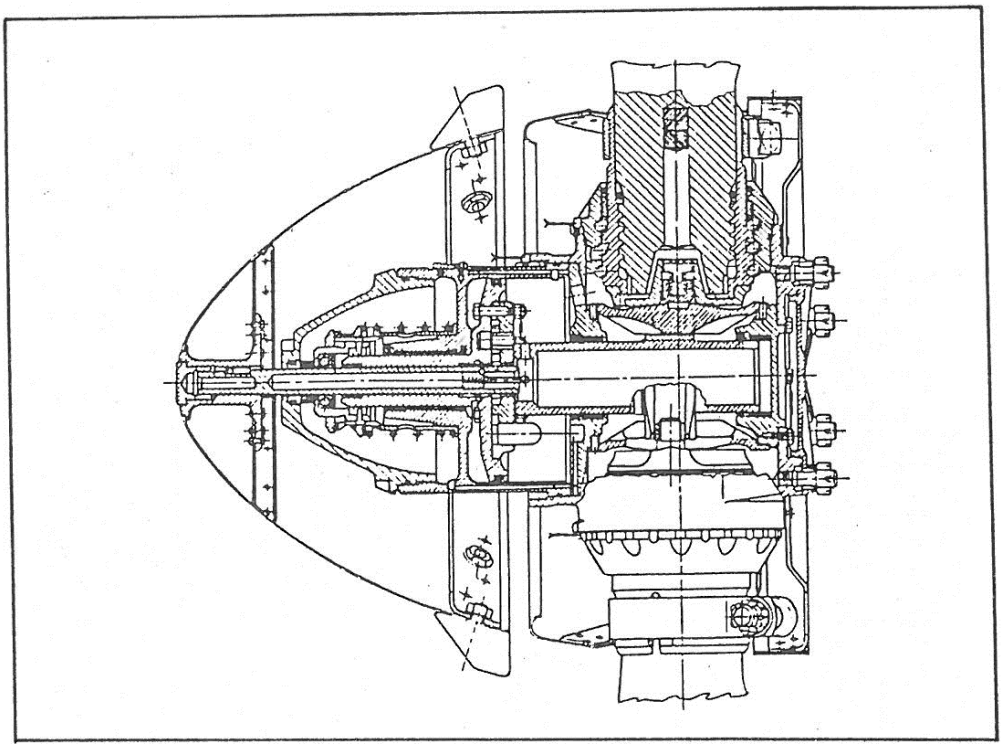


Fig. 2-8 Longitudial section through the V 503 propeller.

Technical specifications

| | |
|---|---|
| Type | autonomy, variable pitch propeller |
| Way of varying the blade pitch | hydraulically |
| Way of action | tractive propeller |
| Sense of rotation | counter-clokwise |
| Max. output | 184 kW (250 h.p.) |
| Max. RPM | 2750 $min^{-1}$ |
| Max. diameter | 2000 mm |
| Number of blades | 2 |
| Material of blades | duralumin |
| Max. blade angle setting | 15° |
| Servomechanism | single action |
| Self-adjustment velocity range | 110-120 $km.h^{-1}$ |
| Moment of inertia | 0,095-0,1125 $kgm.sec^{-2}$ |
| Propeller wet weight | 26,7 kg |
| Propeller mounting accessories weight | 1,4 kg |

TYPICAL PROPELLER V 506

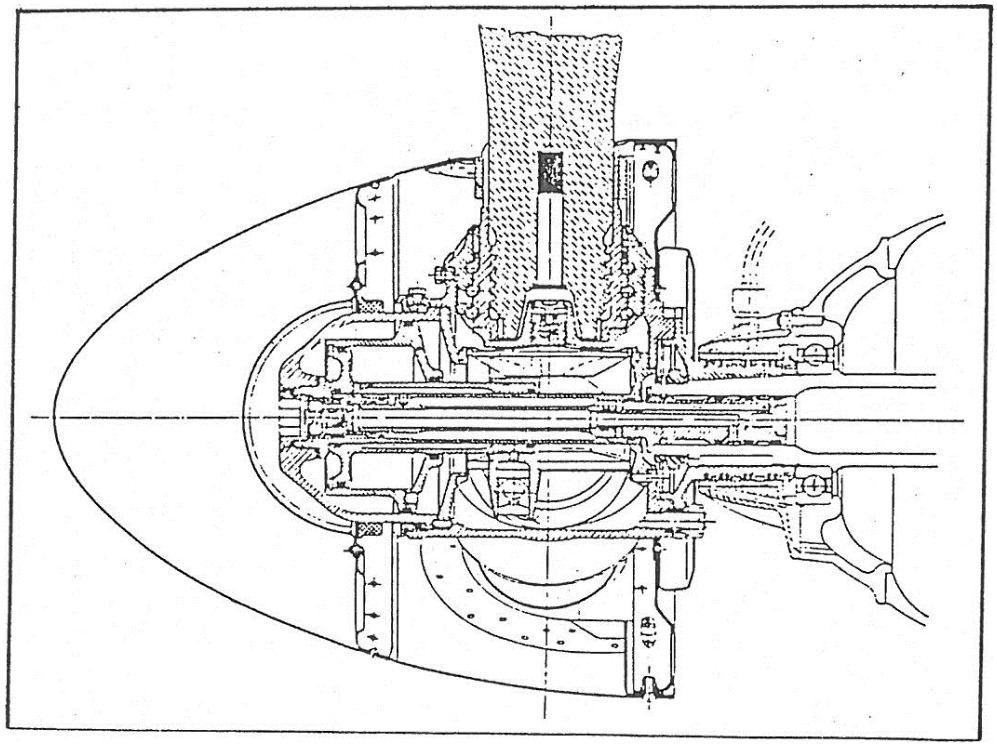


Fig. 2-9 Longitudial section through the V 506 propeller.

Technical specifications

| | |
|---|---|
| Type | variable pitch propeller |
| Way of varying the blade pitch | hydraulically |
| Way of action | tractive propeller |
| Sense of rotation | counter-clockwise |
| Max. output | 184 kW (250 h.p.) |
| Max. RPM | 2750 $min^{-1}$ |
| Max. diameter | 1900 mm |
| Number of blades | 3 |
| Material of blades | duralumin |
| Max. blade angle range | 75° |
| Type of servomotor | single action |
| Max. pressure | 0,8 MPa (8 atm) |
| Moment of inertia | 0,1615 $kgm.sec^{-2}$ |
| Max. weight | 32 kg |
| Min. pressure in the control system | 0,5 MPa (5 atm) |
| Type of servomotor | single action |

# SECTION 3

# EXHAUST SYSTEM

1/ Cabin heating ..... 3-3
Model M 337 engine exhaust system ..... 3-6
Model M 332 engine exhaust system ..... 3-7

The exhaust parts in the cylinder heads are obturated during transport by means of the pads P/N Sc 7815, see fig. 3-1A, which are sustained by the exhaust flanges P/N Sc 7804, see fig. 3-1B. These flanges are made from corrosion resistant POLDI L-AKVS steel. When fastening the exhaust tubes on the engine, the gaskets P/N Sc 7808 are placed between the flange and the cylinder head see fig. 3-1C.

Exhaust gases of each cylinder are led through the exhaust tubes directly outside the engine cowling, or can be collected in the exhaust collector, in the exhaust ejector or in the noise damper.

The exhaust system is subjected to approval for flight operation accordingly to pertinent prescriptions.

In a suitable place of the exhaust system there can be located the cabin heater, see fig. 3-2. It must be also approved for flight operation accordingly to pertinent prescription.

Fig. 3-3 shows the installation of model M 337 engine exhaust system in configuration with noise damper and cabin heater.

Figures 3-4 and 3-5 show recommended examples of noise damper configuration for model M 332 engines.

## 1. CABIN HEATING

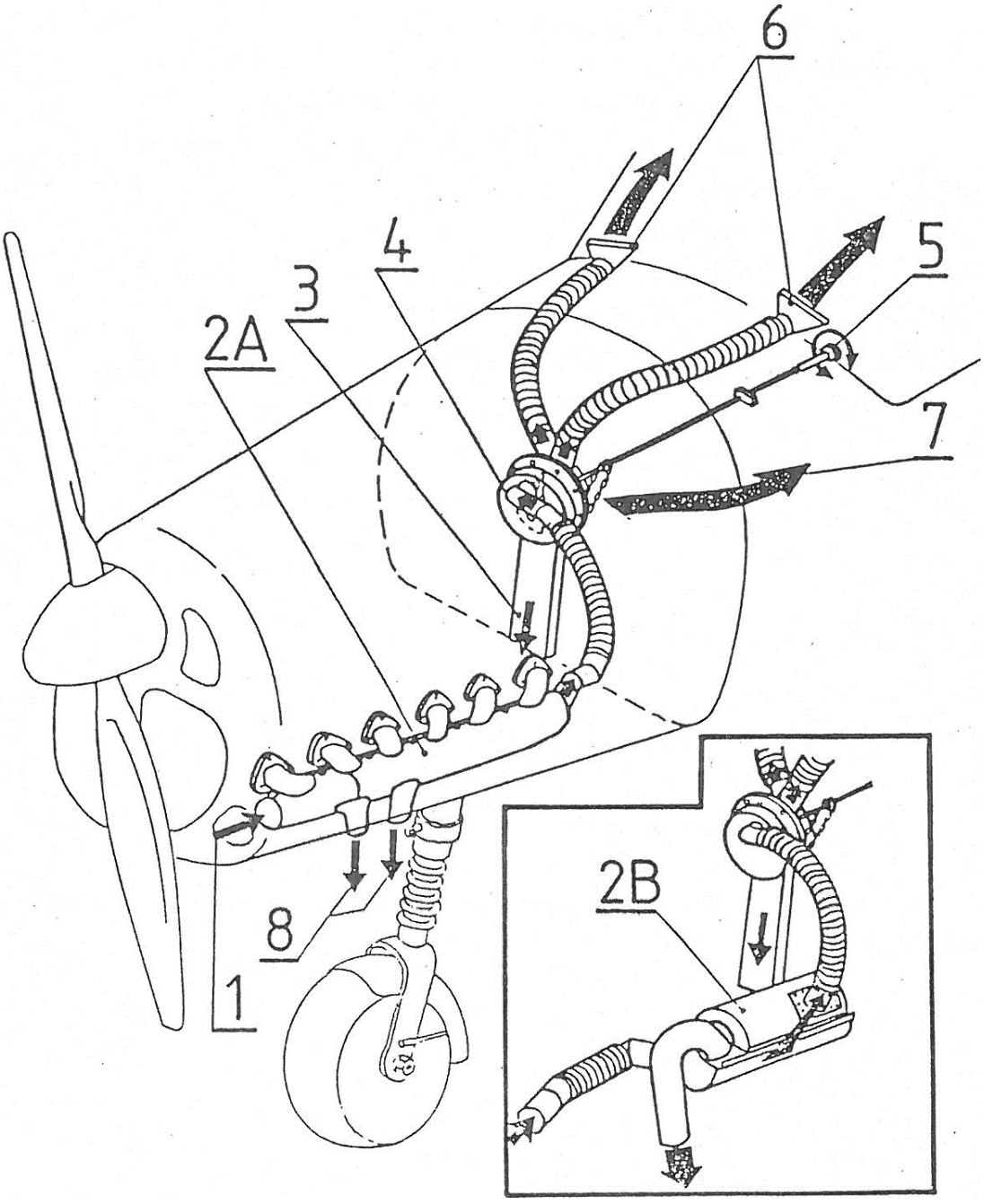



Fig 3-1 Cabin heater.

Fig 3-1 Cabin heater

1 - atmospheric air inlet into the heater

2A - exhaust system with heater (standard configuration)

2B - exhaust system with heater and noise damper (it is delivered on customer´s request)

3 - hot air duct outside the airplane (heating off – the heat controller position 0)

4 - regulation chamber (distributor)

5 - cabin heater and venting control

6 - output of hot air on the cabin front glass

7 - output of hot air on the crew legs

8 - exhaust of engine gassses

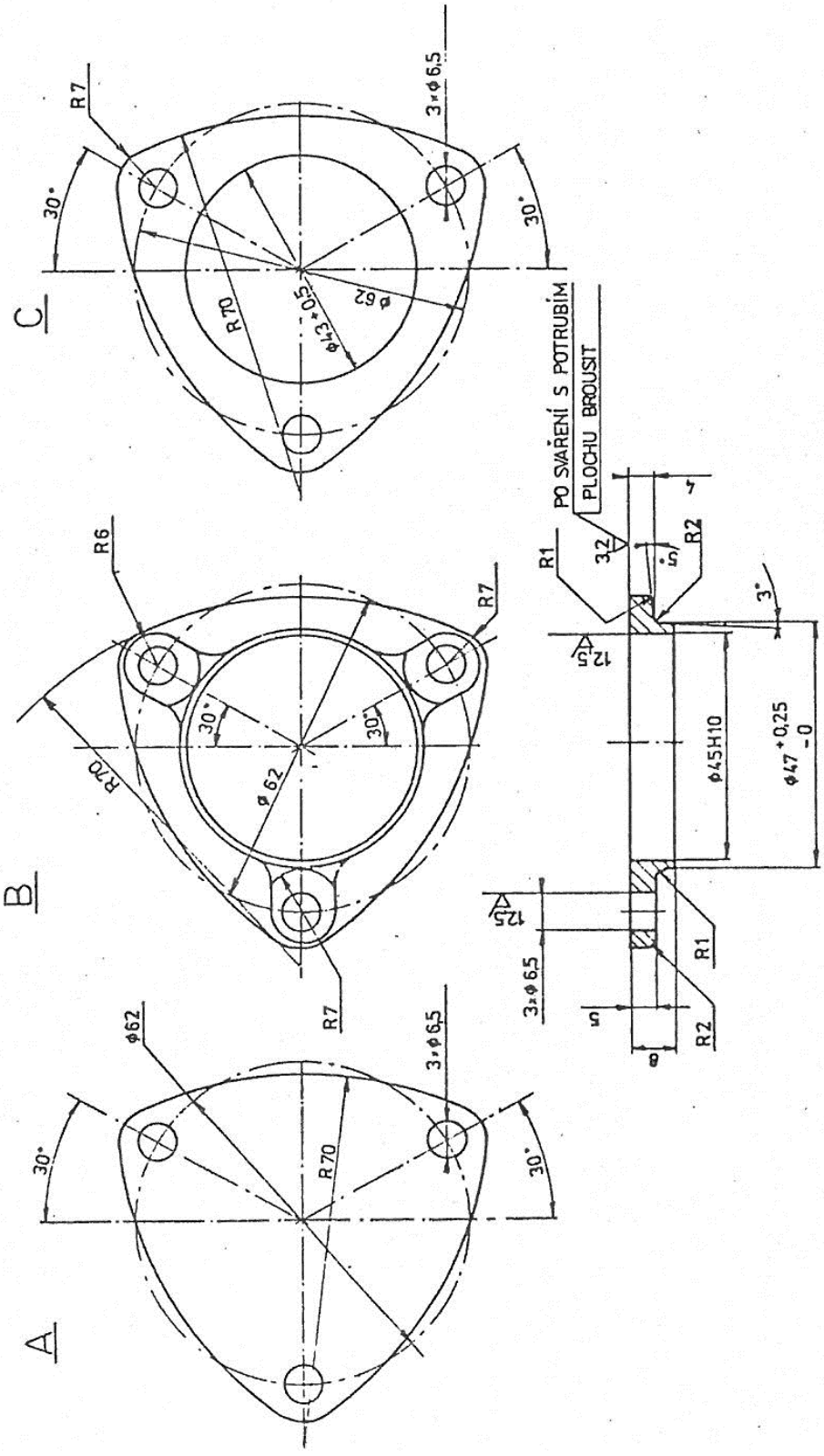



Fig. 3-2 Pad, flange and gasket.

MODEL M 337 ENGINE EXHAUST SYSTEM

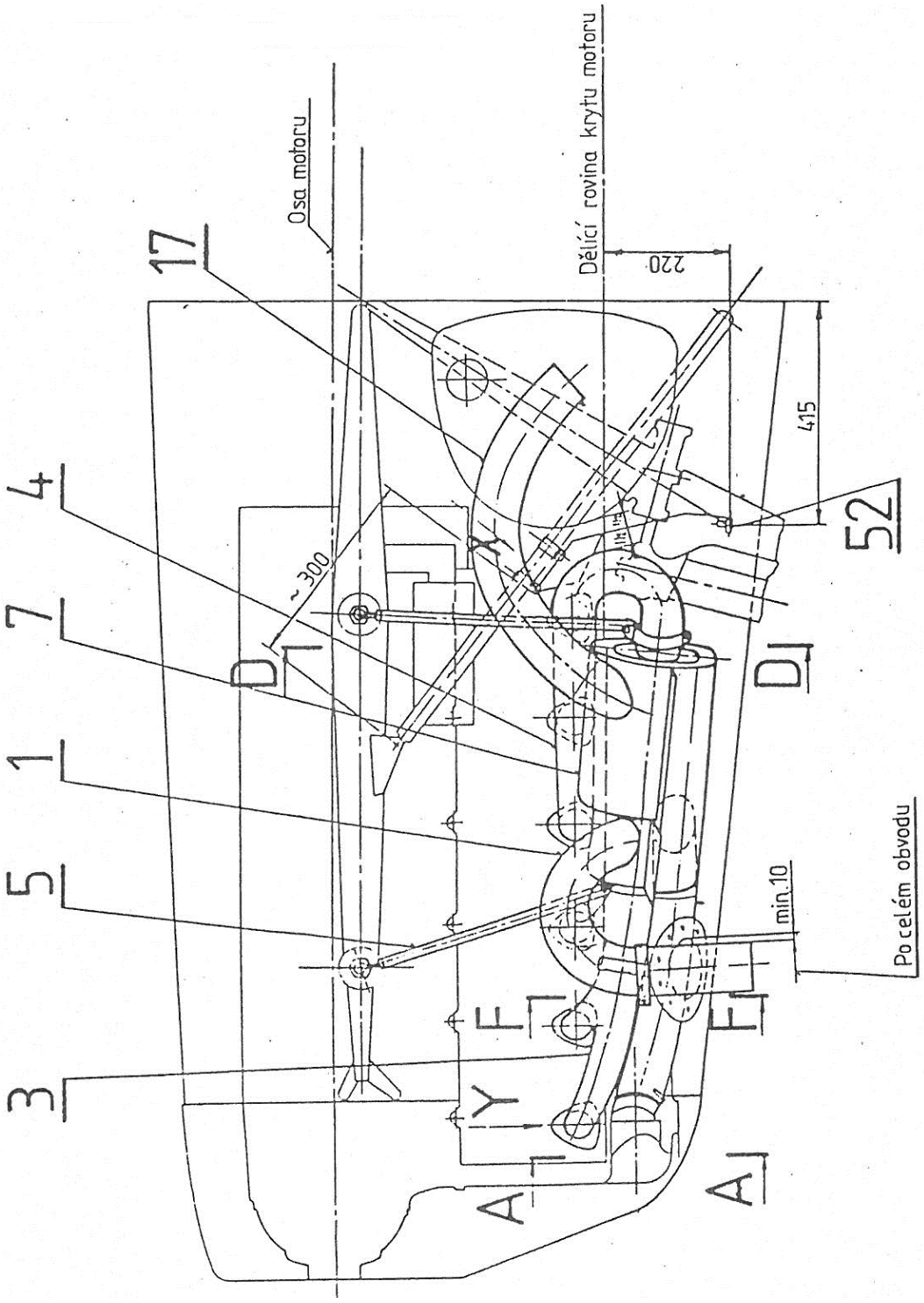



Fig. 3-3 Model M 337 engine exhaust system

MODEL M 332 ENGINE EXHAUST SYSTEM

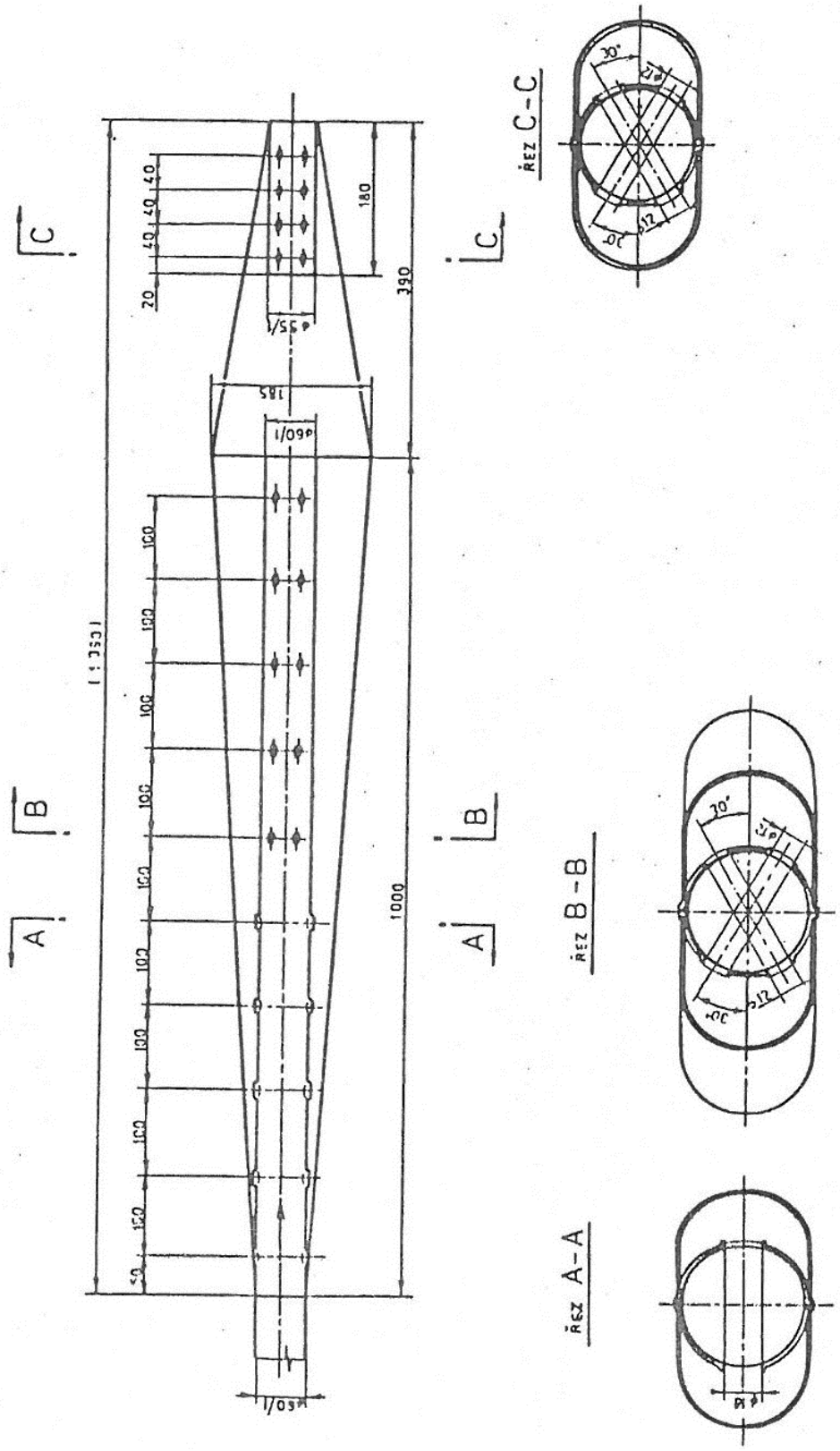



Fig. 3-4 Recommended example of noise damper installation for model M 332 engine.

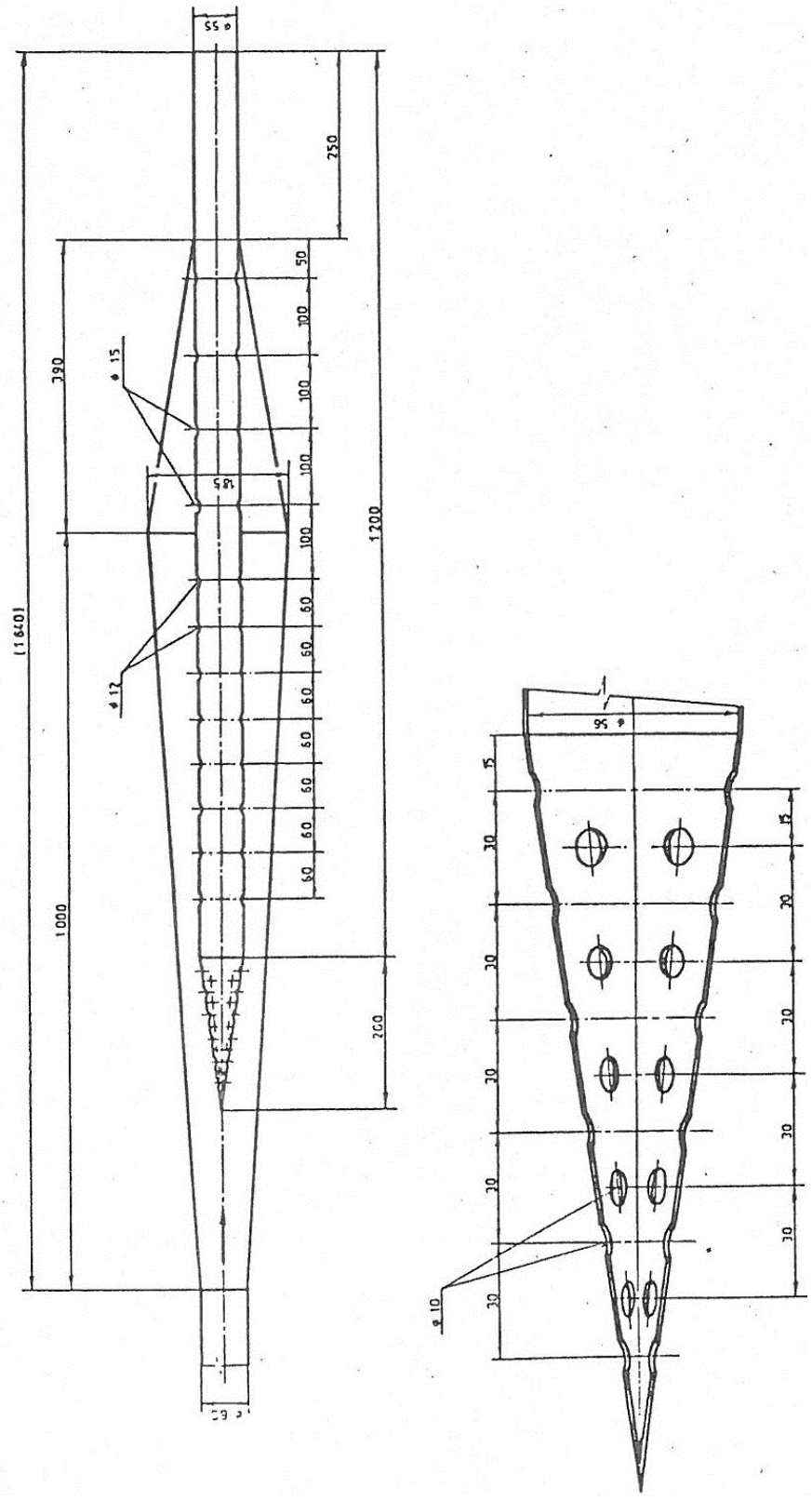



Fig. 3-5 Recommended example of noise damper installation for model M 332 engine.

# SECTION 4

# FUEL SYSTEM

1/ Fuel system - Diagram.....4-3

The fuel is delivered to the engine by a pump which is an engine component. The main fuel tanks are located in the wings, the additional tanks are on the wing tips, and the aerobatic operation tank is located under the cockpit floor. The fuel is led from the tanks to the fuel selector cock and from here through the strainer to the engine injection pump. From the left wing tank the fuel is transferred to the aerobatic operation tank and from here it is led to the fuel selector cock and through the strainer to the injection pump. From the fuel selector cock it is selected the fuel to be delivered according to customer´s need from either the left or right tanks, or from all tanks, and the fuel system can be also completely cut off. The fuel selector cock is actuated by a handle on the panel between the pilots' seats. During invert flights the fuel is delivered from the aerobatics operation tank. The consumed fuel will be completed when returned in the normal flight, and due to this fact, the fuel selector cock should be switched to the left tank during aerobatic operation. The quantity of fuel in the fuel tanks is measured by a quadruple indicator, which is located on the instrument panel. The minimum amount of fuel is signalized by light, which is located on the panel about the instrument panel. The signals warn the pilot on the necessity to switch the fuel selector cock to another tank.

The hand operated pump enables to fill the fuel installation before engine starting. It is located, together with the fuel strainer, on the front side of the fire-proof wall and it is controlled by a rod on the panel of the cockpit desk (inscription: "Hand operated pump")

The priming pump, which is located on the left side of the cockpit under the instrument panel (inscription : "Fuel priming") is used for fuel injection in the air-intake manifold before engine starting

***Attention:***

*The additional tanks should be empty during aerobatic operation.*

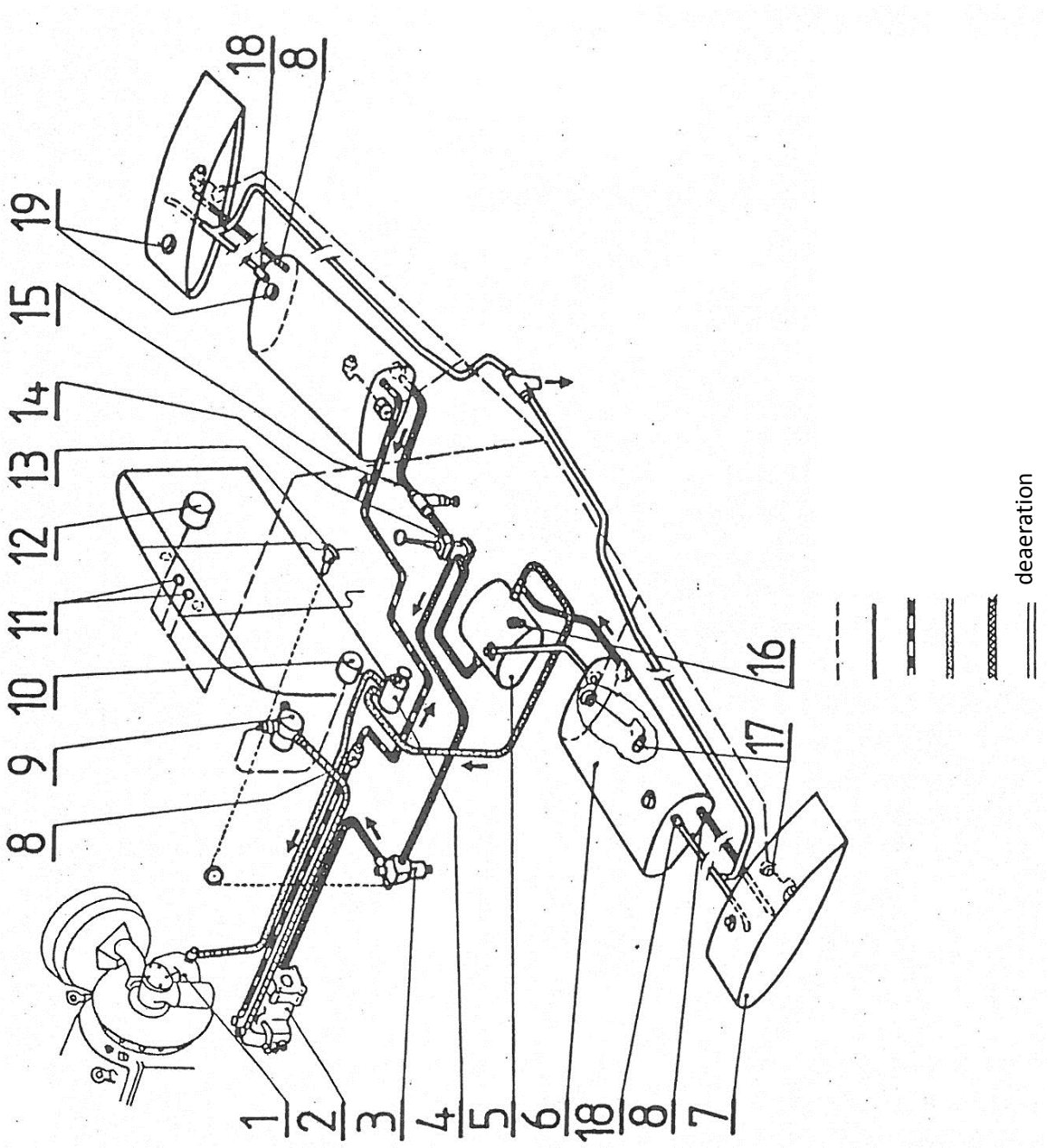



Fig. 4-1 Fuel system - Diagram

Fig. 4-1 Fuel system -Diagram

1 - engine air intake manifold
2 - injection pump
3 - fuel strainer with filling pump
4 - hand operated priming pump
5 - aerobatic operation tank
6 - fuel tank in the wing
7 - additional tank
8 - non-return valve
9 - fuel pressure transmitter
10 - triple indicator
11 - minimum fuel quantity warning
12 - quadruple indicator
13 - filling pump control
14 - fuel selector cock with control
15 - sump with drain cock
16 - drain valve
17 - fuel indicator transmitter
18 - deaeration valve
19 - main tank caps

# SECTION 5

# OIL SYSTEM

1/ Oil system - diagram ..... 5-3

Oil system

The oil is sucked-in from the oil tank through the oil tank screen and through the engine intake filter to the pressure pump and from here it is pumped into the engine. After lubricating the bearings, the oil drains to the oil sump, where it is removed by the scavenge pump through the ball valve and returned through the thermostat and safety valve chamber through the cooler back to the tank. Both pumps are engine components. The oil tank is located on the front side of the fire-proof wall, and it is accessible after lifting the left engine side cowl.

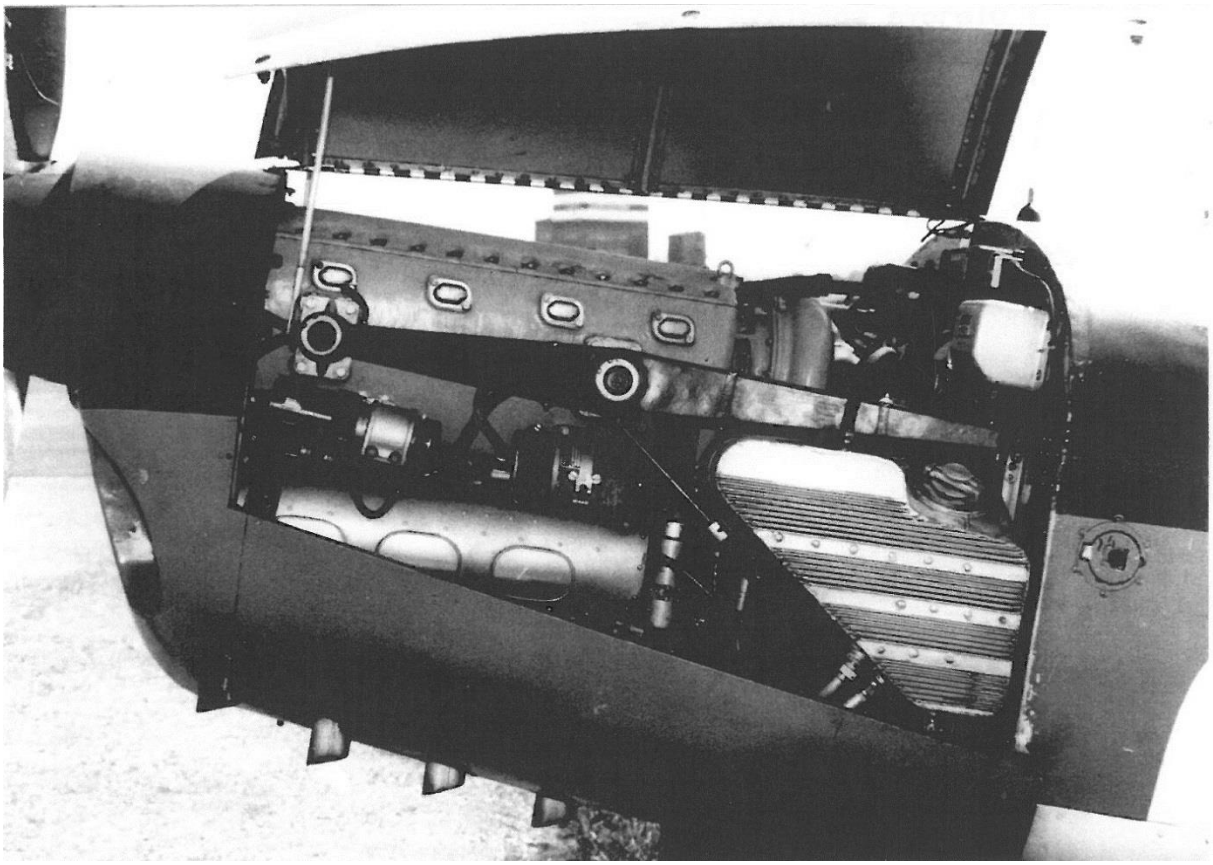


Fig. 5-1A Oil system.

## 1. OIL SYSTEM - DIAGRAM

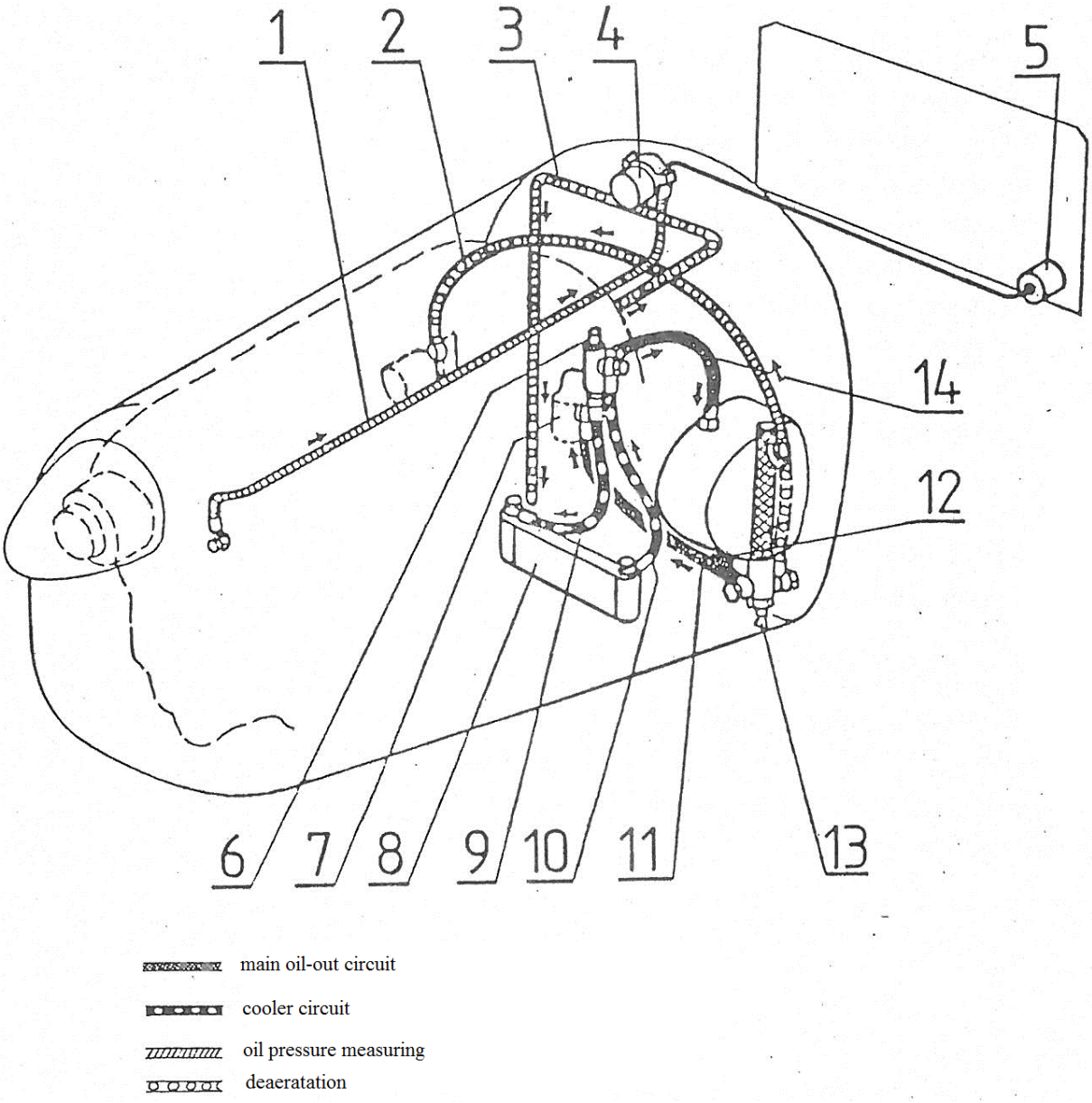



Fig. 5-1B Oil system - Layout

Fig. 5-1 Oil System - layout

Fig. 5-2 Oil System - diagram

1 - hose to oil pressure transmitter
2 - oil tank deaeration
3 - crankcase vent line
4 - oil pressure transmitter
5 - triple pressure indicator
6 - thermostat safety valve
7 - engine oil-in filter chamber
8 - oil cooler
9 - hose to the oil cooler inlet
10 - hose from the oil cooler outlet
11 - tank oil-out hose
12 - drain valve
13 - gravity valve with sump valve
14 - oil hose engine to tank
15 - engine
16 - oil tank
17 - gravity ball valve
18 - inlet (pressure) oil pump
19 - outlet (scavenge) oil pump
20 - thermometer transmitter

***Note:***

*Outlet scavenge pump delivers the scavenged oil from the engine to the tank through the thermostat valve, which closes the bypass circuit when temp. of 85°C has been reached. The oil is then forced to flow through the cooler.*

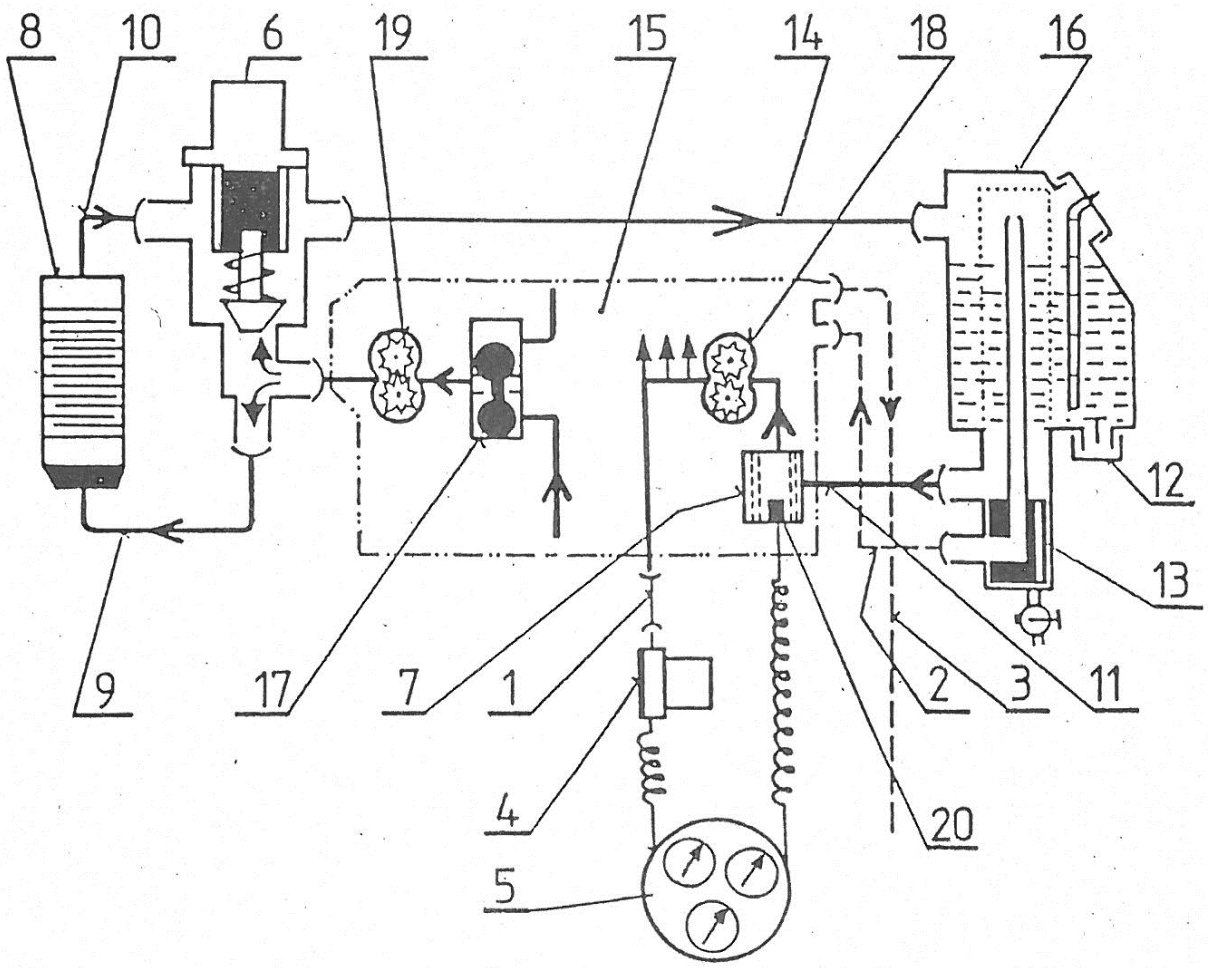



Fig. 5-2 Oil System - diagram

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# SECTION 6

# ELECTRICAL SYSTEM

1/ General ..... 6-2

2/ Electrical System – “A” Wiring Diagram ..... 6-4

3/ Electrical System – “B”, “C” Wiring Diagram ..... 6-6

## 1. GENERAL

The electrical system is of single-lead type (+ pole), the ground conductor being formed by the metal aircraft frame (- pole). The direct-current electrical system is fed by the generator, which is located on the engine. As auxiliary electrical energy source there is used a battery, which is accessible after opening the cover under the baggage compartment.

For engine starting it is recommended to use an external direct-current source (28V/150A), which can be connected to the aircraft electrical system through the outside source socket on the fuselage left side. The connection is performed automatically and it is secured against damage due to the polarity reversing. The electrical system is composed from electrical circuits, which are secured by fuses and checked.

The main switch operates all the circuits without the ignition system (the magnetos are controlled by the magneto selector) and the cabin illumination.

Electrical system protection

a/ The generator control light, the volt-ammeter and the cockpit illumination are protected by fuses, which are located on the right side of the panel between seats.

b/ The external source connection is automatically protected against damage due to polarity reversing by a contactor and a diode.

c/ The batter and other electrical circuits, which are not mentioned under the points a), b) are protected by automatic circuit breakers AZS.

Electrical system check

a/ Charging check: when the engine is running (the main switch is on), the red warning lamp on the instrument stops illuminating at a crankshaft speed about 1800 RPM, if the battery charging is normally performed. If it does not stop illuminating, this signalizes a damage of the generator of the electrical system.

b/ The stalling warning circuit, impact pressure gauge heating circuit and Pitot tube heating circuit check: turn on the main breaker, the FLIGHT INSTRUMENTS switch, PITOT HEATING switch and press the PITOT SYSTEM CHECK button, if the heating white warning lamp illuminated and the stall warning bell rings after pressing the button ( the button and the warning lamp are on the instrument panel, the warning bell is on the firewall), the corresponding electrical circuit is free of faults or defects. Immediately after warning circuit check, switch off PITTOT HEATING.

c/ VA-meter monitors the battery charging current, generator or battery output and battery voltage.

## 2. ELECTRICAL SYSTEM – "A" WIRING DIAGRAM

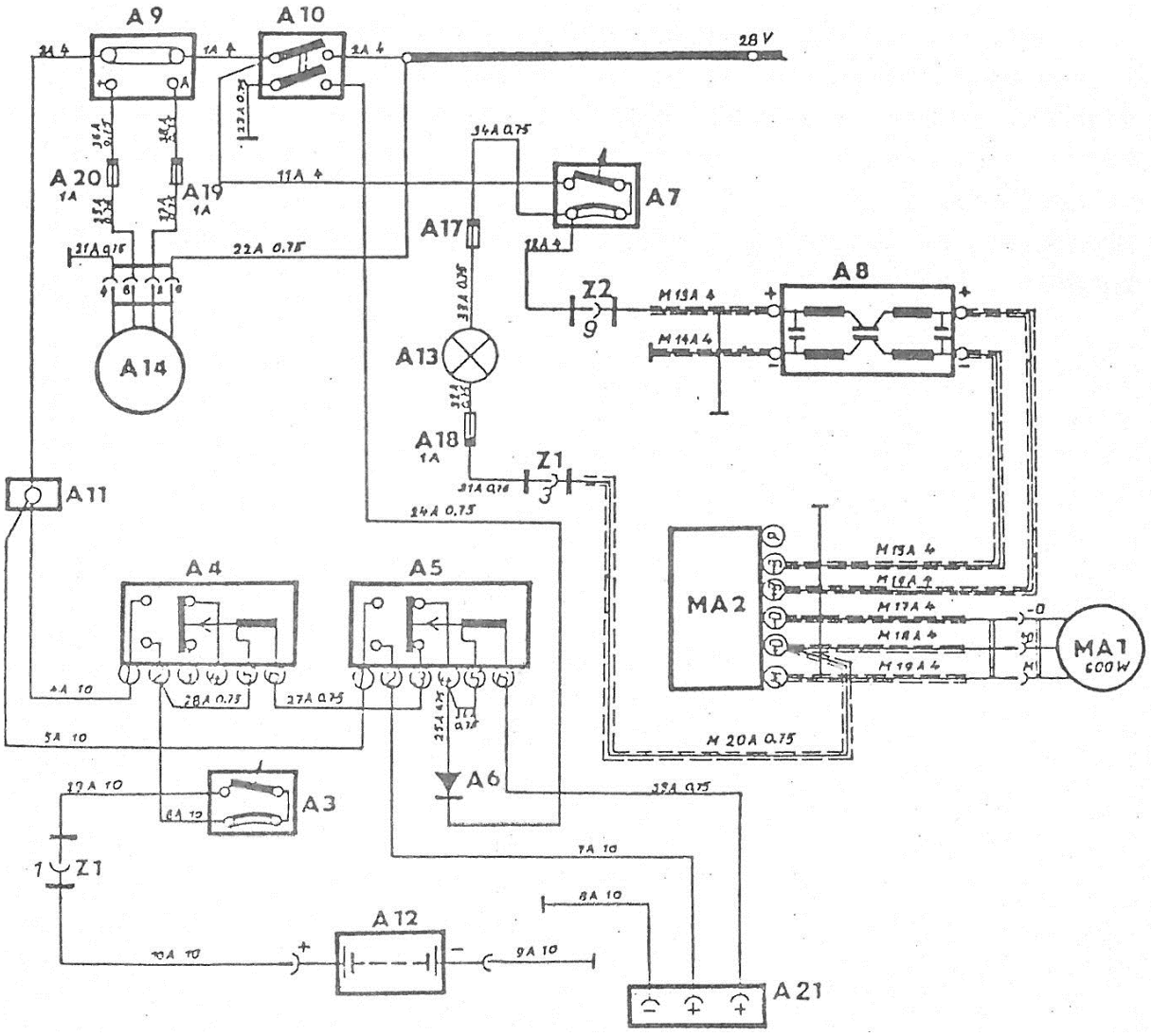



Fig. 6-1 Electrical System – "A" Wiring Diagram

Fig. 6-1 Electrical system – "A" Wiring Diagram

| | | | |
|---|---|---|---|
| MA1 | generator | LUN 2111 | 600W |
| MA2 | regulator | LUN 2141 | |
| A3 | circuit breaker – battery and cockpit illumination switch | AZS 50 | |
| A4 | battery contactor | LUN 2285 | |
| A5 | external source contactor | LUN 2285 | |
| A6 | diode | KY 132/150 | |
| A7 | circuit breaker – "A" circuit switch | AZS 30 | |
| A8 | filter | LUN 2171 | |
| A9 | shunt | ŠA 240 | |
| A10 | main switch | 2V 45 | |
| A11 | terminal board | 990-266 | |
| A12 | battery | PS 12-24 | |
| A13 | circuit warning lamp (red) | SLC 51 incandescent lamp SM 30 | |
| A14 | VA-ammeter | LUN 2715 | |
| A17, A18 | circuit warning lamp fuses | REMOS I | 1A |
| A19, A20 | volt-ammeter fuses | REMOS I | 1A |
| A21 | external source socket | L 200.8522-00 | |
| Z1 | connection plug | ŠR 3S | |
| Z2 | connection plug | ŠR 13S | |

Conductor code: shielded conductor

not shielded conductor

The last number of the conductor designation, in fig. 6-1 and 6-2, indicates the cross sectional area in $mm^4$.

## 3. ELECTRICAL SYSTEM – "B" AND "C" WIRING DIAGRAM

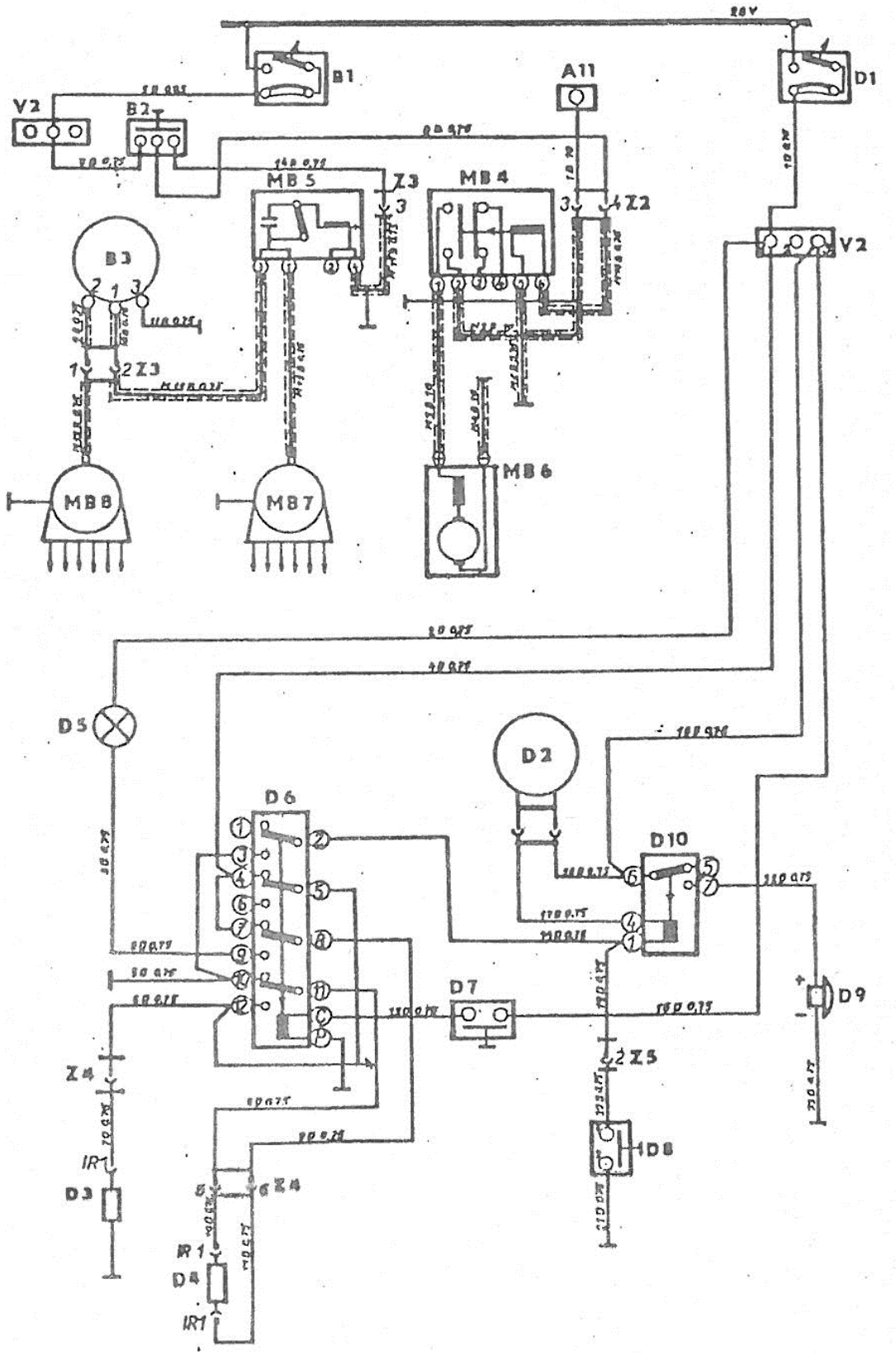



Fig. 6-2 Electrical system – "B" and "C" Wiring Diagram

Fig. 6-2 Electrical System – "B" and "C" Wiring Diagram

*1/ "B" wiring diagram (engine starting)*

| | | |
|---|---|---|
| A1 | terminal board | 990-266 |
| B1 | circuit breaker – "B" circuit switch | AZS 5 |
| B2 | starter push button | 205 K |
| B3 | magneto selector | PM – 1 |
| MB4 | starter contactor | LUN 2285 |
| MB5 | starter buzzer | LUN 2231 |
| MB6 | starter | MV 1500 W |
| MB7 | R-H magneto | LUN 2221 |
| MB8 | L-H magneto | LUN 2221 |
| V2 | terminal board | 74 K |
| Z2 | connection plug | ŠR 13S |
| Z3 | connection plug | ŠR 4S |

*2/ "C" wiring diagram (air speed indicator system check and heating).*

| | | |
|---|---|---|
| D1 | circuit breaker – "C" circuit switch | AZS 5 |
| D2 | air speed indicator | LUN 1107 |
| D3 | Pitot tube | PDV-6M |
| D4 | impact pressure transmitter | LUN 1155 |
| D5 | warning lamp of the Pitot and | SLC 51; incandescent |
| | impact pressure transmitter heating | lamp SM 30 SLC 51 |
| D6 | relay | RP 6 |
| D7 | push button of the air-speed | |
| | Indicator system check | A 09-9430-60 |

| | | |
|---|---|---|
| D8 | micro switch | KV – 9A |
| D9 | stall warning bell | ZMR – 48P |
| D10 | relay | LUN 2621.42 |
| Z4 | connection plug | ŠR 13S |
| Z5 | connection plug | ŠR 9S |
| V2 | terminal board coupling | IR 1 |

The conductor designation is explained after the fig. 6-1.

# SECTION 7

# MAINTENANCE INSTRUCTIONS OF ENGINE AND PROPELLER

1/ Fuel and Oil Filling and Draining ..... 7-2

2/ The Engine Air Intake Filter..... 7-4

3/ Necessary Operations During Engine Starting..... 7-4

4/ Engine Test..... 7-7

5/ Engine operation..... 7-9

6/ Lubrication Schedule..... 7-12

The maintenance instructions of engine and propeller are to be performed in accordance with the prescriptions in the "LOM AIRCRAFT ENGINE OPERATOR´S MANUAL" and in the aircraft PROPELLER OPERATOR´S MANUAL".

## 1. FUEL AND OIL FILLING AND DRAINING

Fuel filling

For engine operation there is prescribed a not TEL-added aircraft gasoline with min. 78 octane number. If TEL added aircraft gasoline is used, then the volume of tetraethyl lead should not be greater than 0.06% of volume. The recommended sorts of fuel are given in the table "Operation substances – substitutes". It is necessary to transport and to store the fuel in such a manner, in which it cannot be depreciated by impurities or water.

Before each fuel filling from new cistern or barrel, it is necessary to check the content of water in the fuel by hyper manganese. We pour some crystals of hyper manganese in glass containing a fuel probe. After the agitation of the glass, the hyper manganese indicates the presence of water and the fuel must not be used for refueling.

Oil filling

For engine operation it is necessary to use mineral oils with kinematic viscosity min. 20 cSt at 100°C and with carbon residue less than 0.4%. The recommended sorts of oils are given in the table "Operations substances – substitutes".

During oil filling it is necessary to use a funnel with screen.

The recommended oil levels: max. 12 liters

min. 7 liters

For aerobatic engine operation it is recommended to fill 9 liters oil, because greater quantity can cause oil loss through the crankcase breather during aerobatic maneuvers.

The quantity of the oil is checked by a level gauge on the oil tank plug, the best after the engine test (see paragraph 5.10. –Engine stop).

***Warning:***

*When using ashless dispersant oil, it is necessary to observe the following principles:*

*1/ During engine break-in use exclusively mineral oils (the first oil change after 10 engine run hours).*

*2/ It is possible to switch to ashless dispersant oil after the oil consumption should have leveled off, generally after about 50 engine hours.*

*3/ After the first 10 engine run hours with ashless dispersant, change the oil with fresh ashless dispersant oil.*

*4/ Further oil change perform according to the maintenance prescriptions.*

***Remarks:***

*1/ If switching to another oil sort, always clean the oil filter.*

***2/ ATTENTION! Mineral and ashless dispersant oils should not be mixed!***

Fuel and oil draining

For the fuel and oil draining, it is used the draining hose, which is delivered with the airplane tools. For draining, unscrew the drain valve plug and screw the drain hose. After tightening the drain hose, the drain valve opens automatically.

*Oil drain:* 1 valve on the lower part of the oil tank.

## 2. THE ENGINE AIR INTAKE FILTER

Cleaning procedure

1/ Take out the paper insertion piece from the filter body and by nocking it on a wood desk eliminate dirt and other particles.

2/ Clean the filter body with a gasoline impregnated swab.

3/ After the mounting of the insertion piece in the filter body fully tighten and secure the nut of the filter cover to avoid unfiltered air sucking.

***Warning:***

*1/ Do not use liquid means or blow the filter paper insert piece with compressed air, when cleaning it.*

*2/ Replace the paper insertion piece, if its lamellas are damaged.*

*3/ Cleaning intervals depend upon service conditions. In normal conditions, it is recommended to clean the filter every 100 hours, and to change the insertion piece after 600 hours.*

## 3. NECESSARY OPERATIONS DURING ENGINE STARTING

Starting the engine:

1/ Connect external power source.

2/ Switch the fuel selector cock in the 2P (right) position.

3/ Throttle and mixture control – according to pertinent instructions.

4/ Hand pump – establish the necessary pressure.

5/ Priming pump – prime fuel before inlet ports.

6/ Rotate the engine by hand from propeller (only when cold engine).

7/ Select "Max. pressure" (min. angle.) position for the propeller governor.

8/ Engage compressor.

9/ Evacuate space around propeller.

10/ Switch on magnetos (1+2).

11/ Press the starter push button.

12/ Adjust the engine idle up at 1000 RPM (actuating the throttle control).

13/ Check oil pressure – min. 120 kPa after 10 sec.

14/ Lean mixture.

15/ Disconnect external power source.

***Warning:***

*1/ If the air temperature is less than -15°C, pre heat the oil in the oil tank and engine.*

*2/ The starter engage the engines through the compressor drive. The engine starting is possible only when the compressor is engaged.*

*3/ Engine starting:*

*a/ During engine starting switch off radio station.*

*b/ Maximally start attempting time is 10 sec.*

*c/ The start attempt: repeat max 3-times with 30 sec intervals.*

*d/ The next start attempt is allowed after starter temperature decreases (after min. 10 min).*

*e/ Immediately release starter button after engine started.*

*f/ After engine started, follow oil pressure, if not min. 120 kPa (1.2 kp/cm$^2$) after 10 sec., then stop the engine and immediately remove the defect.*

***Recommendation:***

*1/ When starting the engine, it is recommended to use external electrical source (in order to elongate the board battery life, the external source must be of approved type).*

*2/ When using the external electrical source do not switch on the aircraft radio station.*

*3/ At ambient air temperature less than +5°C, it is recommended to preheat the oil and the engine in order to facilitate the starting.*

Table for the engine starting:

| Ambient air temperature and starting conditions | Throttle | Mixture | Fuel injection | Remark |
|---|---|---|---|---|
| more than +5°C | ¼ to ½ of the working stroke | lean | 2 to 4 injection pump working strokes | Rotate prop. 2-4 turns by hand, magneto switched off |
| less than +5°C | | lean or a little enriched | | |
| hot engine after the flight | ½ of the working stroke | lean | do not inject | do not rotate prop. |

Engine heating

1/ Speed:

a/ 1000 RPM -2 to 5 min. (according to ambient air temperature)

b/ 1500 RPM – as long as necessary to heat the engine for the engine test

2/ Check during heating:

a/ smooth engine run while switching the fuel selection cock to different positions: Left, Right, Left and Right. After the check, select the right tank position.

b/ the function of generator and battery charging:

at max. 1800 RPM the red warning lamp GENERATOR must extinct and the volt-ammeter must show

-voltage: 26 – 28 V

- current: charging or 0

c/ the other equipment function (artificial horizon, radio station, etc.)

3/ Values for engine test:

| | |
|---|---|
| Cylinder head temperature | - min. 120°C |
| Oil temperature | - min. 25°C |
| Oil pressure | - min. 350 kPa (3.5 kp/cm$^2$) |

***Warning:***

*1/ At low ambient air temperature it is necessary to heat the engine a longer time till specified operation oil pressure 350-400 kPa (3.5 – 4 kp/cm$^2$ ) and the oil temperature 40 – 50°C are reached.*

*2/ While heating the engine, do not apply ratings at which the engine runs rough.*

## 4. ENGINE TEST

1/ Control stick – elevator in neutral position

2/ Mixture control - lean

3/ Check of the speed governor function:

a/ manifold pressure 90 kPa (0.92 at)

b/ propeller control – actuate 2 or 3 times between the extreme positions (i.e. min. and max. propeller blade pitch)

4/ Check the engine speed and output range according to table.

***Attention:***

*1/ Perform engine test against the wind.*

*2/ Do not perform engine test on a dusty ground (the propeller can aspirate sand and small mechanical particles, which may damage the propeller blade leading edges).*

*3/ During engine test, secure the undercarriage wheels with chock blocks.*

*4/ Perform ignition check with unengaged supercharger.*

*5/ The oil and cylinder head temperature should not exceed the operation range.*

***Remark:***

*The manifold pressure values are given for ISA conditions.*

Engine speed and output range check:

| Operation values, limitation | | Engine rating | | | |
|---|---|---|---|---|---|
| | | max. continuous | max. take-off | | idle run |
| time limitation | | 20 s | 10 s | | unlimited |
| throttle opening | | maximum | maximum | | idle run |
| supercharger | | unengaged | engaged | | unengaged |
| propeller speed governor | | max. speed (min. angle) | max. speed min. (min. angle max.) | | max speed (min. angle) |
| speed RPM | | 2530 +50 -50 | 2700 +0 -100 | max. 2250 | 550 +50 -50 |
| manifold pressure | kPa | 98 +2 -2 | 118 | +1 -2 | - |
| | at | 1,00 +0,02 -0,02 | 1,20 | +0,01 -0,02 | - |
| oil pressure | kPa | 350-400 | 350-400 | | min. 120 |
| | $kp/cm^2$ | 3,5-4,0 | 3,5-4,0 | | min. 1,2 |
| fuel pressure | kPa | 30-40 | 30-40 | | min. 10 |
| | $kp/cm^2$ | 0,3-0,4 | 0,3-0,4 | | min. 0,1 |
| ignition check | | 30-50 RPM drop | - | | - |

Engine stop

1/ Disengage supercharger.

2/ Cool engine at 1000 to 1200 RPM for about 2 min.

3/ After cooling the cylinder heads to a temperature less than 140°C, decrease the engine speed to min. value and then switch off radio station and magnetos.

4/ Shut off the fuel selection cock.

5/ Cut off main switch and separate the different circuit breakers.

***Attention:***

*1/ If back firing occurs after magnetos switched off, then switch on magnetos and keep on cooling the engine.*

*2/ If you intend to check the oil level, run the engine for 2 or 3 min at 1500 RPM before decreasing RPM to 1000.*
*This fact aids the oil in the camcase to be evacuated to the tank.*

*3/ At high ambient temperature it is possible to accelerate the engine cooling if enriching mixture.*

Aircraft leaving and parking

1/ Shut off the fuel selector cock, cut off main switch and the circuit switches.

## 5. ENGINE OPERATION

1/ Prestart inspection works:

- Before each flight check the fuel tank vents and crankcase breather to be clean.

- During pre-start inspection, drain sediments from the fuel strainer sump in an appropriate vessel and verify, if fuel is free of ice crystals. If ice crystals are noticed, refuel with clean fuel.
- Before refueling check if fuel is free of water, taking a sample of fuel and verifying it for water presence.
- Clean both fuel sumps under the fuselage and the oil tank sump (drain a small quantity of both fuel and oil).

2/ Oil and engine pre-heating:

If the aircraft is hangared in that way, that the ambient air temperature is not less than +5°C, there is possible to start the engine without pre-heating. If the ambient air temperature is below +5°C, it is suitable to heat the engine and the oil before starting. At ambient air temperature below -15°C, the engine and the oil should be preheated. Before engine pre-heating, cover the front part of fuselage with the winter blanket.

The hot air is streamed concomitantly during pre-heating:

- through the front scoop (intake for cylinder cooling), while the sight side airduct outlet should be kept free to permit air evacuation.
- through the hole in the bottom engine cover (air outlet behind the nose wheel), for this case being necessary to remove the front cowl around propeller to permit evacuation of the hot heating air.

The hot air temperature must not be greater than 100°C measure at the heater exit. During the heating, leave the oil in the tank and pre-heat it at the same time with the engine till the cylinder head temperature and the inlet oil temperature are about +30°C.

3/ Starting the engine

- Rotate the cold engine crankschaft 6 turns by hand from the propeller (magnetos switched off).
- Connect the electrical source to the aircraft.

***Warning:***

*For starting in winter conditions always use external electrical source.*

- To check if the main switch and the breakers "Battery, Generator, Starter, Accessories" are switched on.
- Open the fuel cock and fill the fuel installation with fuel from the pump (label "Hand pump"), pressure: 20 – 30 kPa (0.2 – 0.3 kp/$cm^2$).
- Adjust the mixture control in the position "partially enriched".
- Prime fuel in the inlet manifold from the priming pump on the left side, prime 3 to 4 times.
- Further procedure during engine starting, heating and engine test are the same as in summer conditions.
- Avoid oil and cylinder head temperature decrease during breaks between flight missions, starting the engine at necessary intervals and heating it again.

  When starting a warm engine, do not prime fuel!

## WINTER OPERATION

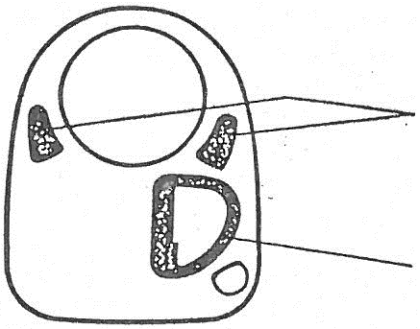
1/ General

The aircraft operation is considered as winter operation, if the ambient temperature is less the n +5°C.

2/ Aircraft preparation for winter operation

If the ambient temperature decreases it is necessary to:

- obturate the air flow inlets to the engine crankcase by means of lugs
- obturase the air duct scoop to the cylinders by means of the obturator



Use plugs to obturate if ambient air temperature
decrease below -10°C

Use the obturator if ambient air temperature is less than -5°C

Fig. 7-1 Plugs and obturator used for winter operation.

## 6. LUBRICATION SCHEDULE

| Lubrication place | Lubricant | Interval |
|---|---|---|
| The engine: change oil in the engine and in the oil tank | MS 20 oil | Change after the first 10 hours further changes during the 50-hours inspections |
| Joint of the engine and propeller control push/pull rods engine compartment. The mixture, supercharger and propeller control push/pull rods (lubricator) Throttle control in the cockpit (two joints of the left rod) | Lubricating grease SP 2 | 100 hours |
| Covers and access doors hinges | | 600 hours |

***Attention:***

*1/ In addition to the lubricants, which are set forth in "Lubrication schedule", it is possible to use lubricants, which are set forth in the "Operation substances" or other sorts with the same quality.*

*2/ During the 600-hour inspection, it is necessary to change the oil in the tank to lubricate the aircraft in the extent, which is prescribed after 100 and 600 hours operation.*

Operation substance - substitutes

Operation substances are described in OPERATOR´S MANUAL.

Information about new approved operation substances are described in service bulletins on internet sites of LOM PRAHA s.p.

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