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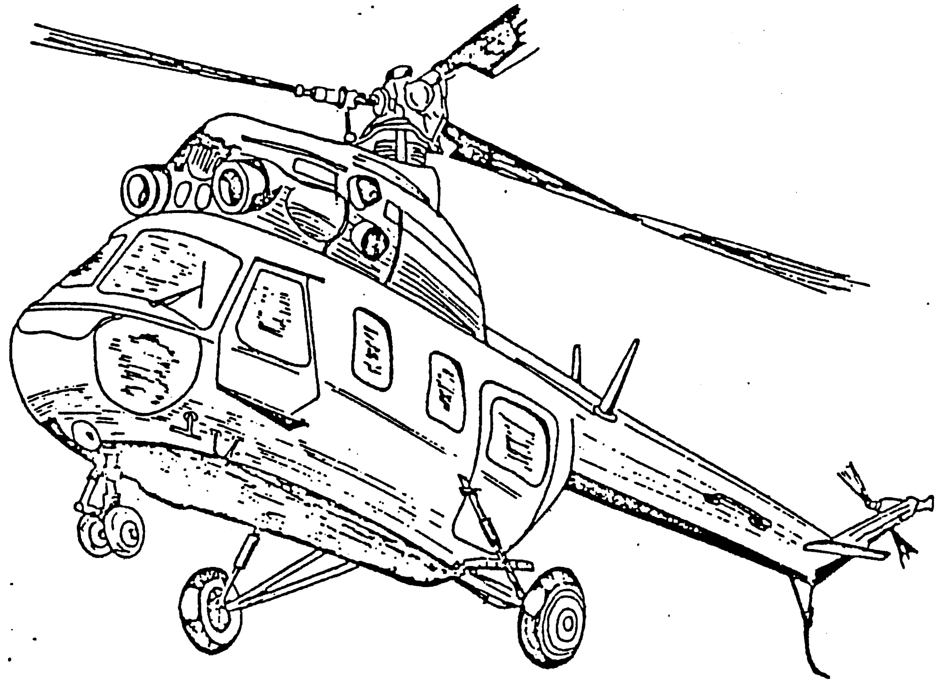


HELICOPTER

Mi-2

SERIAL No........

FLIGHT MANUAL

Polish version of this manual approved by CACA in February, 1981.
Foreign language version approved by manufacturer under delegated authority by CACA.

Signed by ....

Janusz Karnkowski
Authorized manufacturer
representative

ŚWIDNIK

1981

LOG OF REVISIONS

A vertical line on the margin indicates the revised portion of the text.

Revision No	Page	Remarks	Date	Signature
1	2-8	page has been replaced on the basis of Bulletin No.6/Mi-2/84	5th December 1984	
2	1-39/40	-the page has been replaced with a No 1-39 one; - an extra page No 1-40/1 has been added	the revision has been incorporated on the basis of Bulletin No 3/Mi-2/86 July 1986	
3	1-4;1-13; 1-14;1-17; 1-19;2-8; 2-14;3-17; 3-18;3-29; 3-30.	page has been replaced on the basis of Revision No.2D-3956 Bulletin No.3/Mi-2/90	August 1990	
4	2-1,2-2, 2-14	-the page has been replaced, -and extra page No 2-14a and 2-14b has been added, -the revision has been incorporated on the basis of Bulletin No 1/Mi-2/91	June 1991	

LIST OF EFFECTIVE PAGES

NOTE: The list comprises all effective pages.
It shall be replaced if a ravision is made.
Every revision shall be entered in the LOG OF REVISIONS
A vertical line on the outer margin indicates the latest revised portion of the text or drawing.

CHAPTER I - GENERAL DATA

The purpose of this chapter is to familiarize the pilot and other crew members with the content of this Flight Manual, as well as the helicopter it refers to.
Helicopter description is limited to the information essential for in-flight operation only. This description cannot be used for servicing purposes. Full description of the helicopter is contained in other volumes of accompanying documentation.

CHAPTER II - LIMITATIONS

This chapter lists various limiting values which restrict the renge of helicopter operation. These limitations are related to weight, balance, performance, floor loading, powerplant and others. Limitations pertaining to types of fuels and lubricants used in the helicopter are also listed.

CHAPTER III - NORMAL PROCEDURES

This chapter contains descriptions of proper procedures used for all operations performed by the crew during various flight phases, as well as those operations which directly procede the flight or are performed at the end of it.

CHAPTER IV - EMERGENCY PROCEDURES

This chapter describes the procedures to be followed by helicopter crews in the case of typical defects and failures occuring on the helicopter during flight.

CHAPTER V - PERFORMANCE

Performance charts and tables included in this chapter will facilitate planning of the flight and accomplishing it in the best manner possible. It is also explained how to use these charts and tables.

APPENDICES

- They contain additional data necessary to calculate helicopter weight and center of gravity location, as well as to make conversion into British units. Maximum allowable gas producer turbine inlet temperatures for the GTD-350 series II engines are also given in here.

CHAPTER I

GENERAL DATA

CHAPTER I - TABLE OF CONTENTS

CHAPTER I

GENERAL DATA

1.1. INTRODUCTION

All the performance data contained in this Manual are based on the results of flight tests. The recommendations regarding the operation of the helicopter resulted from the experience gained by pilots and servicing staff. Familiarizaton with the material contained in this Manual and permanent use of this knowledge while flying will facilitate helicopter operation and contribute to high efficiency and safety of flights.

This Manual is prepared for licenced pilots and therefore contains no school-book information, especially regarding flight techniques. It includes general information on the Mi-2 helicopter, its performance and flying characteristics, as well as normal and emergency procedures particular for this type of helicopter.

Individual pages are not to be detached from the Manual unless it is absolutely necessary. Any page of this Manual should not be destroyed, even when it loses its validity, but has not been replaced by an up-dated one delivered by the manufacturer together with a corresponding bulletin. In a similar way supplementary pages will be delivered, and they should be inserted into the Manual in places indicated by the applicable bulletin

1.2. CONTENTS OF MANUAL

This Manual is divided into 5 chapters, each of which has its own important function.

1.3. BASIC TECHNICAL DATA

Main dimensions:

Overall length (including rotors)	17,42 m
Fuselage length	11,94 m
Helicopter height (excluding tail rotor)	3,75 m
Main rotor diameter	14,56 m
Tail rotor diameter	2,70 m

Surface areas:

Tail rotor disc	5,7 m^2
Main rotor disc	166,5 m^2

Weights:

Maximum take-off weight of the helicopter 3550 kg

Invariable empty weight is recorded in Helicopter Weighing Record Abstract included in Log Book pocket or contained in Section I of the Log Book.

Capacities:

Main fuel tank	600^{+20}_{-10} l
Auxiliary fuel tanks	476^{+10}_{-5} l
Maximum fuel quantity to be filled	1076 l
Engine oil contained in 2 tanks	30 $\pm$ 1 l
Fluid contained in blade dampers	1,7 l
Hydraulic system (hydraulic block)	4,5 l
Brake air system (landing gear framework)	6,5 l
Oil contained in main gearbox	10,0 l
Oil contained in intermediate gearbox	0,4 l
Oil contained in TR gearbox	0,65 l

Powers:

Take-off power (2 x 400 KM) 529 HP	800 kM
Maximum one-hour power (2 x 320 KM) 423 HP	640 KM
Maximum continuous power (2 x 285 KM) 377 HP	570 KM
Starter-generator output (2 x 3 KW)	6 KW
AC generator output	16000VA

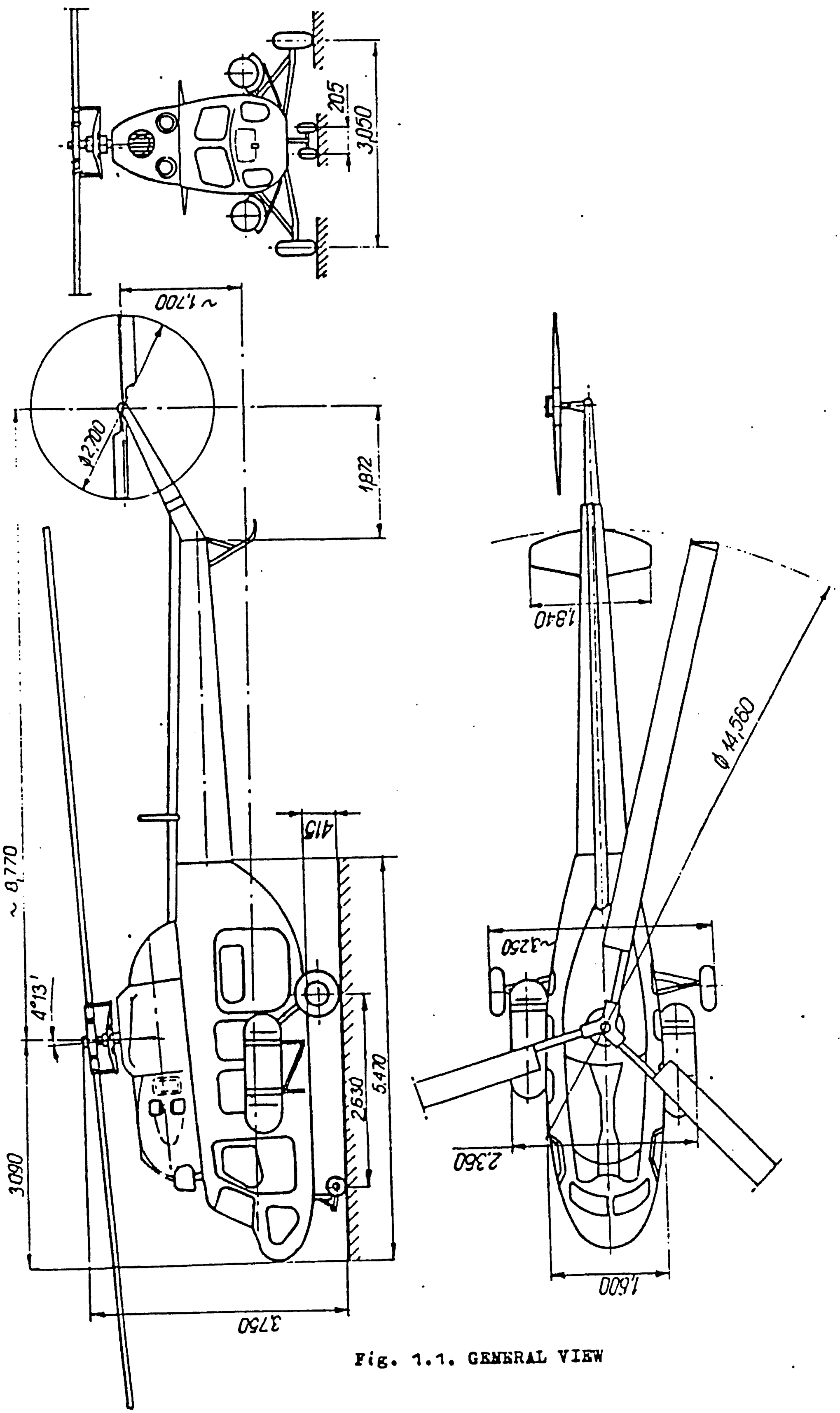


Fig. 1.1. GENERAL VIEW

1.4. SHORT DESCRIPTION OF HELICOPTER

1.4.1. Helicopter

The Mi-2 helicopter is designed for VFR operations in daylight and at night under various atmospheric conditions except for flights in clouds. It is a multipurpose helicopter and can be used in the following versions: passenor, cargo transport ani ambulance.
In each version the control system can be doubled for pilot training /dual-control versions/. One pilot is the minimum flight crew. If required, the crew may be increased with persons having special duties during flight /e.g. flight engineer, physician, special equipment operator, trainee or co-pilot, etc./.
This helicopter is approved essentially for above-land flights only. The operator, however, can decide to make above-sea flights with the crew aboard /no passengers allowed/, if he finds it necessary, provided that the applicable requirements and regulations are obeyed and the risk of helicopter sinking into the sea, in the case of emergency ditching, is taken into account.
Apart from interior finishing suitable for a given version, the helicopter can be fitted with the following equipment:

Passenger version: a table, two single seats and a hard or upholstered bench type seat for 6 passengers.

Cargo transport version: two single seats, cargo fixing equipment, and additinally an electrically-operated hoist /LPG-4/ and external cargo hook /under the fuselage/.

Ambulance version: a table, two single seats, two stretchers and one seat or two seats if no stretchers are used, other medical equipment, and additionally an electrically-operated hoist /LPG-4/ with rescue seat.
In addition, the following may be fitted: opening windows, tool box, optional battery guides, snap-in ventilators in the windows, rope ladder, and auxiliary tanks,

The helicopter has three doors: - front door /slideable/ on the left of the fusolage,
- front door /hinged/ on the right of the fusolage,
- rear door /hinged/ on the left of the fuselage.

Both front doors are provided with emergency jettison mechanism.

NOTE: With the left auxiliary fuel tank mounted on the helicopter, the front left door will not fully slide back as the auxiliary tank stops it partially open.

The fuselage consists of two main parts: fuselage proper, comprising the cockpit, cabin, all equipment and fuel tanks, and its rear part /tail-boom/. The fuselage has a semi - monocoque structure.

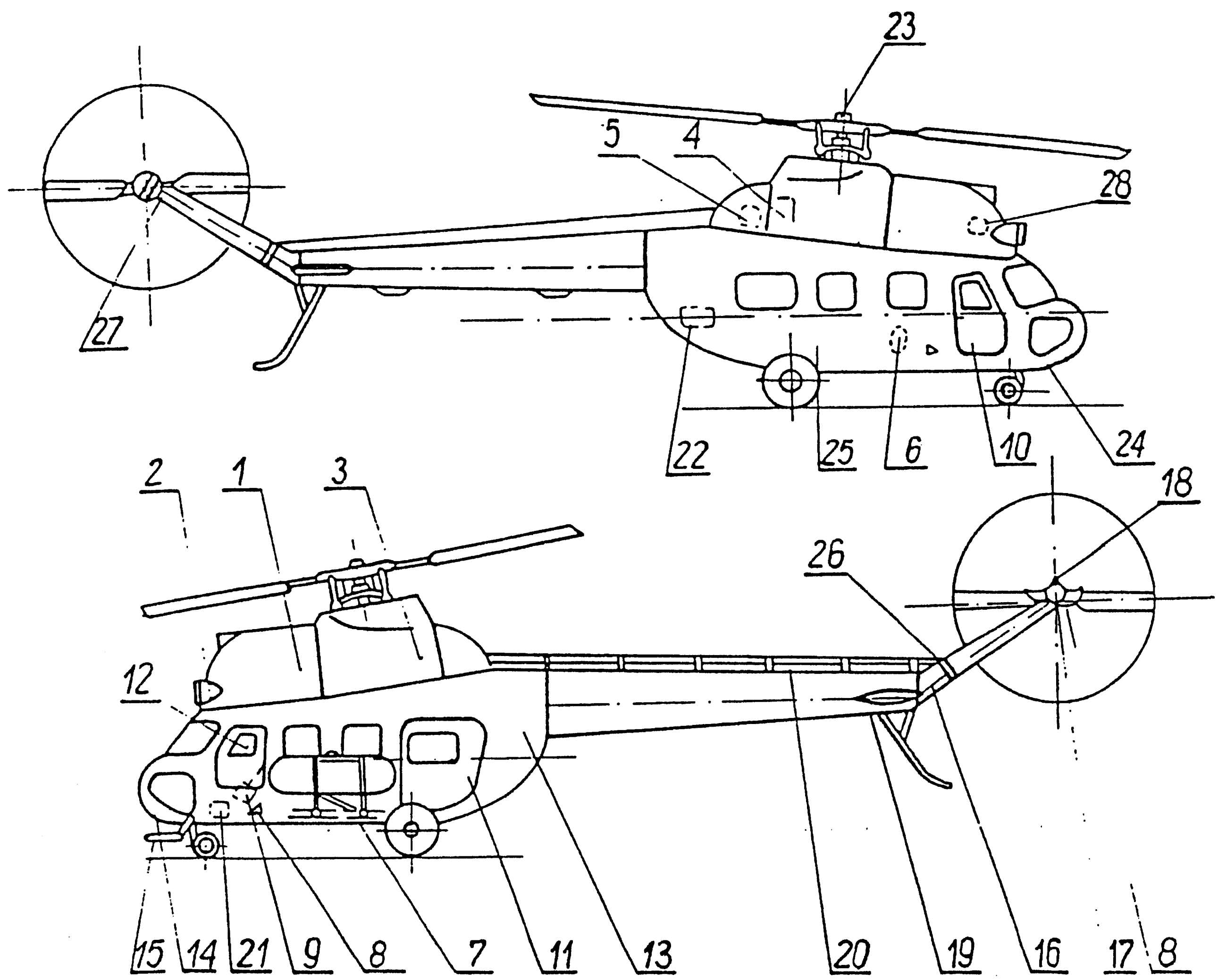


Fig. 1.2. LOCATION OF MAJOR ASSEMBLIES

1 - engine compartment; 2 - oil tank; 3 - main gearbox compartment; 4 - hydrailic block; 5 - fire extinguishing bottles; 6 - main fuel filler; 7 - fillers for auxiliary fuel tanks; 8 - position lights; 9 - pilot seat; 10 - front RH door; 11 - rear door; 12 - front LH door; 13 - electric and avionic - boxes compartment; 14 - battery compartment; 15 - pitot tube; 16 - intermediate gearbox; 17 - tail rotor gearbox; 18 - anti-collision light; 19 - horizontal stabilizer; 20 - tail rotor drive shaft; 21 - external power receptacle; 22 - charging valves /air and hydraulic supply systems/; 23 - hydraulic fluid reservoir; 23 - hydraulic fluid reservoir for blade dampers; 24 - landing light; 25 - passenger cabin; 26 - intermediate gearbox oil filler; 27 - tail gearbox oil filler; 28 - engine oil filler.

It is provided with mounting points for the engines, main gearbox, landing gear, special equipment, auxiliary fuel tanks and the tail-boom.
At its end, the tail-boom is fitted with an intermediate gearbox, tail rotor pylon, tail rotor gearbox, stabilizer and tail skid.
Over the tail-boom, the tail rotor drive shaft is situated under removable fairings.
The landing gear consists of a twin-wheel castoring nose unit and two main wheels with pneumatically controlled brakes.
The main landing gear wheels are mounted to two struts and one oleo-pneumatic shock absorber on both sides of the fuselage.
The main rotor consists of three all-metal blades attached to a fully articulated rotor head. The spars are filled with compressed air, whose pressure drop is detected and indicated by a detector located at each blade root, indicating thus any spar cracks and ot..er reasons for air leakage. All the blades have an electrical anti-icing system powered from a collector mounted on the rotor hub. The hunting of the rotor blades is minimized by hydraulic dampers.
The two-bladed all-metal see-saw tail rotor has also an electrical anti-icing system which is powered from a collector mounted on the rotor shaft.
Helicopter empty weight depends on its version, and the control system installed /single or dual/. The empty weight with a pilot is assumed to be 2,500 kg. For the procedure of calculating the maximum takeoff weight refer to APPENDIX NO 1 "HELICOPTER WEIGHT AND CENTER OF GRACITY CALCULATION". Location of major assemblies is shown in Fig. 1-2.

1.4.2. ENGINES

The GTD-350 is a turboshaft engine with a free power turbine.
Its compressor has 7 axial stages and 1 centrifugal stage. Compressor discharge air is delivered through two air transfer tubes into a single can-type combustion chamber.

The hot gases expand through the single-stage compressor turbine, two-stage free turbine, and are then discharged through the exhaust duct furnished with two exhaust pipes.

The power turbine, via reduction gear with a ratio of 1:4, drives the engine drive shaft, which is connected to the main gearbox.

The power turbine speed is governed automatically and maintained within the range of 23,100 - 24,900 rpm, which corresponds to the indicated main rotor rpm of 78 - 84 %.
The engine is started automatically by pressing the starting push-button on the central panel.
As power sources for engine starting the following may be used:

a/ helicopter batteries

b/ ground power units

c/ generator of a running engine.

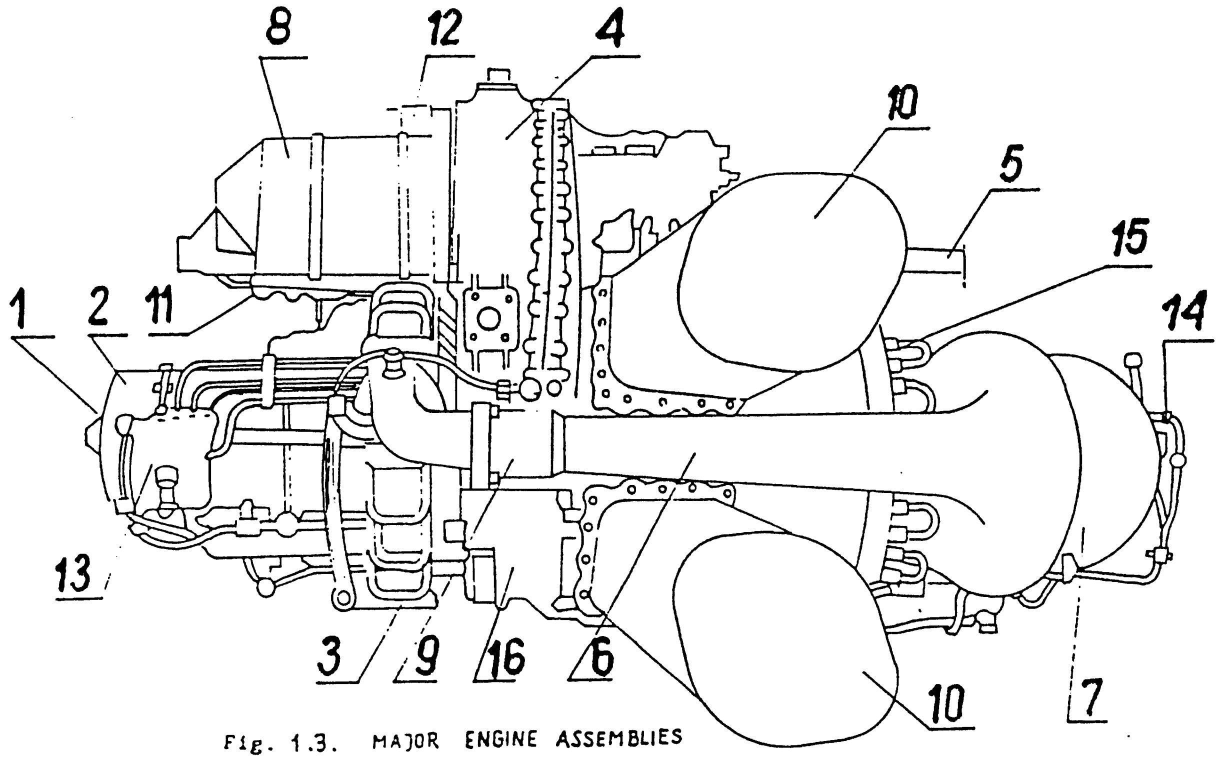


Fig. 1.3. MAJOR ENGINE ASSEMBLIES

1 - compressor inlet; 2 - axial compressor; 3 - centrifugal compresor; 4 - accessory gearbox; 5 - drive shaft; 6 - compressor discharge air tube; 7 - combustion case; 8 - starter generator; 9 - compensation joint; 10 - exhaust pipes; 11 - gas producer fuel control; 12 gas producer tachometer generator; 13 - engine anti-ice and bleed air valve; 14 - fuel nozzle; 15 - thermocouple; 16 - oil filter.

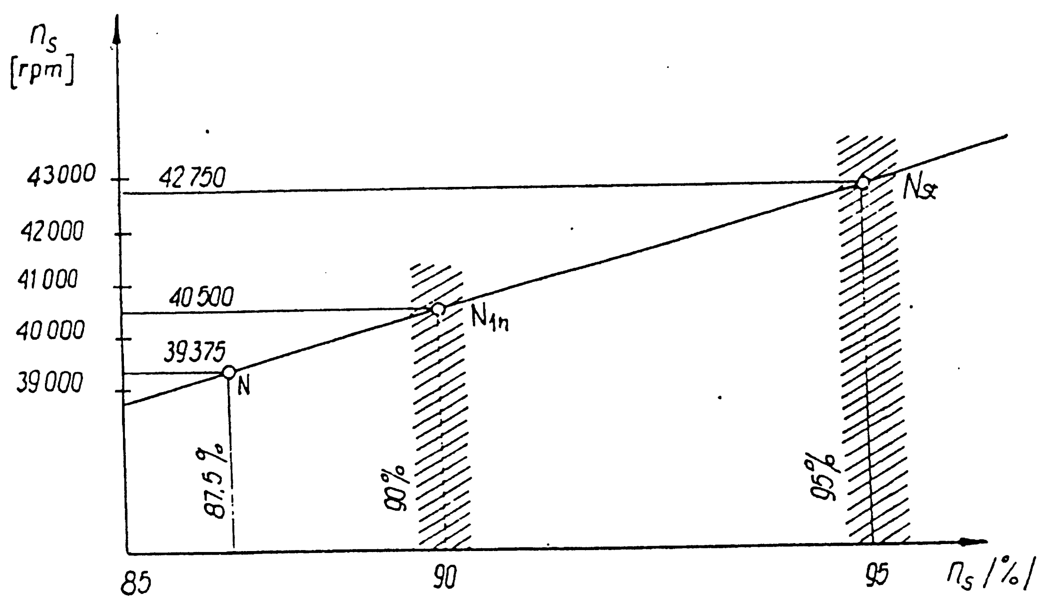


Fig. 1.4. INDICATED PERCENTAGE AND GAS PRODUCER RPM

Gas producer speed can be controlled with each of the three controls:

a/ collective pitch lever - power control is coupled with the main rotor blade pitch control,

b/ twist grip - power adjustment independent of the main rotor blade pitch control,

c/ single engine control lever.

During normal dual-engine flights, the pilot uses only the collective pitch lever to control the engine power, while the twist grip is turned fully right.

Single engine control levers are designed for use during single-engine flights and ground checks of each engine operation.

The actual engine power is monitored by the pilot on the engine tachometer, located on the instrument panel and indicating the gas producer speed by two pointers marked as follows:

1 - LH engine

2 - RH engine

as well as on the turbine inlet temperature indicator.

The relationship between the indicated gas producer speed /in percentage/ and the actual speed /rpm/ for various powers is shown in Fig 1-4.

1.4.3. HELICOPTER CONTROLS

The following are used as controls in flight and on the ground:

- cyclic stick
- tail rotor pedals
- collective pitch lever
- single engine control levers
- main rotor brake lever

The helicopter can be provided with either single or dual-control system.

Cyclic stick. It is located in front of the pilot's seat and connected to the swashplate by a system of two push rods and two hydraulic boosters. On its handle /Fig. 1-5/ there are: a trim system switch for longitudinal and lateral control system, radio communication push-button, external cargo release push-button /under a protective cap/ and a wheel brake lever.

When the hydraulic system is on, the forces felt while moving the cyclic stick are mostly caused by compression of trim system springs, and they can be eliminated by pressing the trim system switch.

When the hydraulic system is off, the forces are considerably high, especially while hovering.

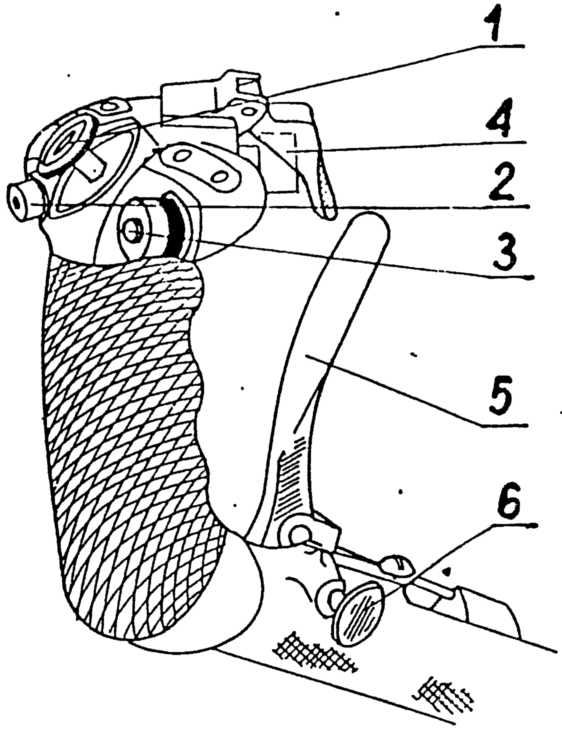


Fig. 1.5. CYCLIC STICK HANDLE

1 - trim system switch /beep switch/,
2 - radio communication push-button,
3 - intercom ON push-button,
4 - emergency cargo hook release,
5 - wheel brake lever, 6 - wheel brake lever lock-pin.

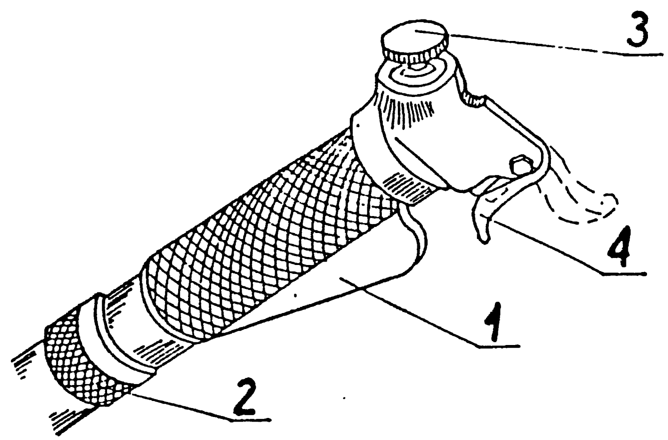


Fig. 1.6. COLLECTIVE PITCH LEVER HANDLE

1 - lever locking, 2 - twist grip friction ring, 3 - landing light positioning switch, 4 - cargo hook release.

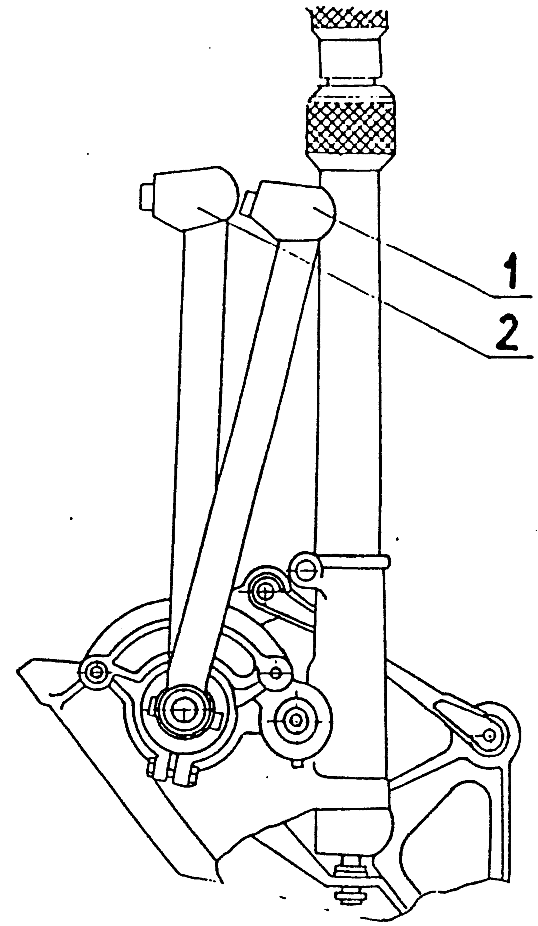


Fig. 1.7. SINGLE ENGINE CONTROL HANDLES

1 - neutral position release push-button - LH engine

2 - neutral position release push-button - RH engine.

Tail rotor pedals. They are located under the pilot's feet and coupled with the tail rotor by a system of push rods and cables. The pedals can be adjusted on the ground and set in any of three positions according to the length of the pilot's legs.

Collective pitch lever. It is located on the left of the pilot and connected to the swashplate sliding sleeve by a system of push rods and one hydraulic booster.
The twist grip of this lover /Fig. 1-6/ has two positions as follows:

- fully right - nominal main rotor rpm
- fully left - ground idle rpm

The fully left position is used only in power-on autorotation and on the ground. In any other flight regime the fully right position is used.
The collective pitch lever has a locking mechanism, which is released with a trigger on its handle, and it may be locked in any of thirty positions according to the toothed sector design.

Any pitch setting is displayed on the indicator located on the instrument panel.
The fully down position of the collective pitch lever corresponds to main rotor blade pitch decrease and simultaneous engine power decrease.
The fully up position corresponds to main rotor blade pitch increase and simultaneous engine power increase.
When the hydraulic system is not operative, considerable effort is required to move the collective pitch lever.
On its handle there are: cargo hook release push-button, twist grip friction adjusting ring and landing light positioning switch.
In the dual-control version, the co-pilot's collective pitch lever is not fitted with a cargo hook release push-button.

Single engine control levers /Fig. 1-7/. They are located on the left of the pilot's seat and used for ground run checks of each engine and engine power control in single-engine flights.
The levers are locked in their normal /neutral/ positions by means of a spring ratchet, which may be released by depressing the push-button on the handle. Upward /backward movement corresponds to power increase, while downward/ forward movement corresponds to power decrease.

Rotor brake lever. It is located on the right of the pilot's seat. The fully down /level/ position corresponds to full disengagement of the rotor brake, while the upper position - to full engagement of the brake. The lever is coupled with a switch in the starting system so that engine starting is possible only with lever fully down /brake disengaged/. With the brake lever in any other position, the switch will open the engine starting circuit and make engine starting impossible.

1.4.4. BOARD INSTRUMENTS

All board instruments /except for the magnetic compass/, i.e. those necessary for flying and monitoring the engine and main gearbox operation, are located on the instrument panel in front of the pilot. There are also 6 warning lights on the instrument panel. The compass is mounted separately on a bracket located to the left of the instrument panel.
The instrument panel lay-out is shown in Fig. 1-8.

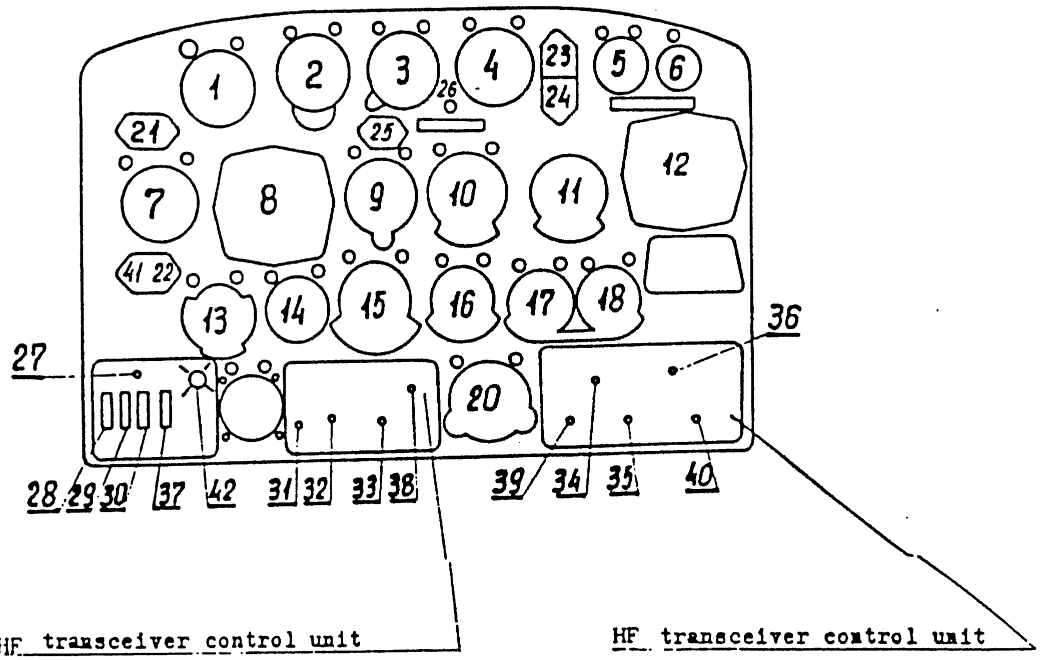


FIG.1 - 8. INSTRUMENTS PANEL

Instruments.

1. Radar altimeter
2. Altimeter
3. ADF and gyrocompass indicator
4. Fuel quantity indicator
5. Main gearbox oil temperature indicator
6. Main gearbox oil pressure indicator
7. Air speed indicator
8. Attitude indicator
9. Vertical speed indicator
10. Main rotor RPM indicator
11. Gas producer RPM indicator
12. Copilot's attitude indicator
13. Trimmers position indicator
14. Collective pitch indicator
15. Engine oil temperature indicator
16. Engine oil pressure indicator
17. LH engineTIT temperature indicator
18. RH engine TIT temperature indicator
19. Magnetic compass
20. Clock

Signalling lights

21. RW-3 indications invalid
22. External cargo check light
23. "FILTER CONTAMINATION" signalling
24. Fuel low level
25. Fire signalling
41. "CARGO HOOK LOWERED" signalling

Push-buttons

26. Gyrocompass slaving
27. Position lights signalling

Switches

28. pressure gauges transformers selector MAIN)STANDBY
29. Landing/taxiing light selector
30. Bright)dim position light selector
31. Radio)ADF selector
32. Frequency selector
33. Squelch
34. Channel selector
35. Modulation limiter activating switch
36. Operation mode selector
42. Windscreen wiper selector

Knobs and switches

37. RW-3 radar altimeter switch
38. Volume control knob
39. Side -tone
40. Volume control knob

Characteristics of the instruments:

RW-3 Radar Altimeter

Indication range $0 \div 300$ m

Measurement accuracy:

- for altitude up to 10 m $\pm$ 1 m
- for altitude over 10 m $\pm$ 10 %

This radar altimeter is supplied with 28.5 V DC. No control or adjustment is required except switching it on. The RW-3 radar altimeter indicates the distance between the helicopter wheels and the ground.

Altimeter

It is a two-pointer pressure-operated altimeter with the range up to 10,000 m. The small pointer indicates altitude in kilometers and the bigger one indicates altitude in hundreds of meters. Below the instrument is a knob for "0" setting on the ground or for standard pressure /760 mm Hg/ setting in flight.

ADF and gyro-compass indicator. It is a dual instrument containing both the GIK-1 slaved gyro-compass indicator /a double-bar pointer /and the ARK-9 ADF indicator /a single-bar pointer/.
Both parts of the instrument become operative upon turning on an appropriate switch on the upper LH control panel and setting the selector switch on the ADF control panel in COMP position. On the instrument panel, next to the indicator, there is a slave push-button.

Indication error of the GIK-1 gyro-compass while determining the magnetic heading:

- at +20°C not more than $\pm$ 1.5 degrees
- at +50°C not more than $\pm$ 2 degrees

ARK-9 ADF - accuracy of selecting the required frequency on the control panel is 2.5 %.

KSB-2097A Fuel Quantity Indicator. Indication range 0-600 litres. It indicates fuel quantity in the main tank. In flight, with auxiliary fuel tanks installed, the indicator reads 600 litres until the auxiliary fuel is used up. Beside the indicator there is a red warning light, which illuminates when fuel quantity in the main tank decreases to 100 l. It keeps the light either flashing or constant, depending on the FLASHING SYSTEM being on or off on the circuit breaker panel.

Main Gearbox Oil Temperature Indicator. Indication range from - 70°C to +150°C.

Main Gearbox Oil Pressure Indicator. Range $0 \div 8$ kG/cm^2. This induction type pressure indicator is supplied with 36 V/400 Hz. In its power supply circuit there are two transformers, main and standby, and their selector switch is located on the instrument panel.

Airspeed Indicator. Range from 0 to 250 km/h. It indicates forward speed only. It is supplied with dynamic and static pressure from the pitot tube mounted on a bracket in the lower left part of the helicopter nose.

AGK-47W Attitude Indicator.

pitch indication	$90^\circ - 0^\circ - 90^\circ$
roll indication	$45^\circ - 0^\circ - 45^\circ$

Misalignment of the aircraft silhouette with the horizon line is not more than $\pm 1^\circ$.

It is a combined instrument consisting of an artificial horizon and a bank and turn indicator. It has a locking mechanism for the gyroscopes which is operated by pulling out the right knob.
When the indicator is inoperative, a red flag will appear on the face of the instrument.
The left knob is used for aligning the aircraft silhouette with the horizon line. While hovering or flying at low speed the ball of the bank indicator is moved a little to the right.

In helicopters with dual-controls the second LH attitude indicator is turned on and off by means of a switch located on the co-pilot's instrument panel.

Vertical Speed Indicator. Range $\pm$ 10 m/s.

Main Rotor RPM Indicator. Its scale is graduated in percentage and the range is from 0 to 110 %. 246 RPM of the main rotor corresponds to 81.3 % on the dial.

Gas Producer RPM Indicator. It is a dual instrument with the indication range from 0 to 110 %.

The pointers are marked:

1 - LH engine
2 - RH engine

100 % on the dial corresponds to 45,000 RPM of the gas producer.

Clock. This is a combined instrument incorporating a normal clock with seconds hand /main dial/ stop-watch /lower inner dial/ and an elapsed time counter /upper inner dial/.
The clock knobs have the following functions:
LH knob /red/ - setting the pointers, winding up the clock, starting the elapsed time counter,
RH knob /silvery/ - starting the stop-watch and locking the clock.
To set the clock pointers pull out the LH knob and turn it clockwise or anti-clockwise.
To wind up the clock keep turning the LH knob anti-clockwise until some resistance is felt. To start the elapsed time counter press in the LH knob. It is operated in 3 successive stages:

1st push - counter ON: red or green colour displayed
2nd push - counter OFF: red and white or green colour displayed.
3rd push - erasure: white colour displayed.

The elapsed time counter has a clock dial with two pointers: the hour and the minute pointers. To start the stop-watch press in the RH knob and operate it in the same way as the elapsed time counter. The stop-watch has no display system. To lock it turn the RH knob clockwise. The stop-watch scale is divided into 60 sections, and it has two pointers: long for seconds and short for minutes.

External Cargo Check Light. This yellow light will remain on until the cargo hook is released.

Cyclic Stick Trim System Position Indicator. This instrument has two scales, each with the range of $\pm 30^{\circ}$. The LH scale indicates lateral displacement, and the RH scale is used for longitudinal displacement of the cyclic stick.
The upper parts of both scales indicate left and forward positions respectively.

Collective Pitch Indicator. Indication range from 1° to 15°.

Engine Oil Temperature Indicator. This is a double-scale instrument, which indicates the LH engine oil temperature on the LH scale, and the RH engine oil temperature on the RH scale. Indication range from $-50^{\circ}C$ to $+150^{\circ}C$. The indicated temperatures represent engine outlet oil temperatures.

Engine Oil Pressure Indicator. This is a double-scale instrument with indication range on both scales /the LH and RH scales for LH and RH engines respectively/ from 0 to 8 kG/cm^2. It operates in the same way as the main gearbox pressure indicator.

Turbine Inlet Temperature Indicators. They are two instruments operated on thermo-electric principle and connected to thermocouples at each engine. The indication range is from 200 to $1{,}050^{\circ}C$. The indicator on the left is for the LH engine, and the one on the right is for the RH engine.

Magnetic Compass. It is located on the left of the instrument panel. Deviation tables for the gyrocompass, ADF, magnetic compass, airspeed indicator and the altimeter are provided in the cockpit. They are placed under a transparent shield on the central divider of the windsceen.

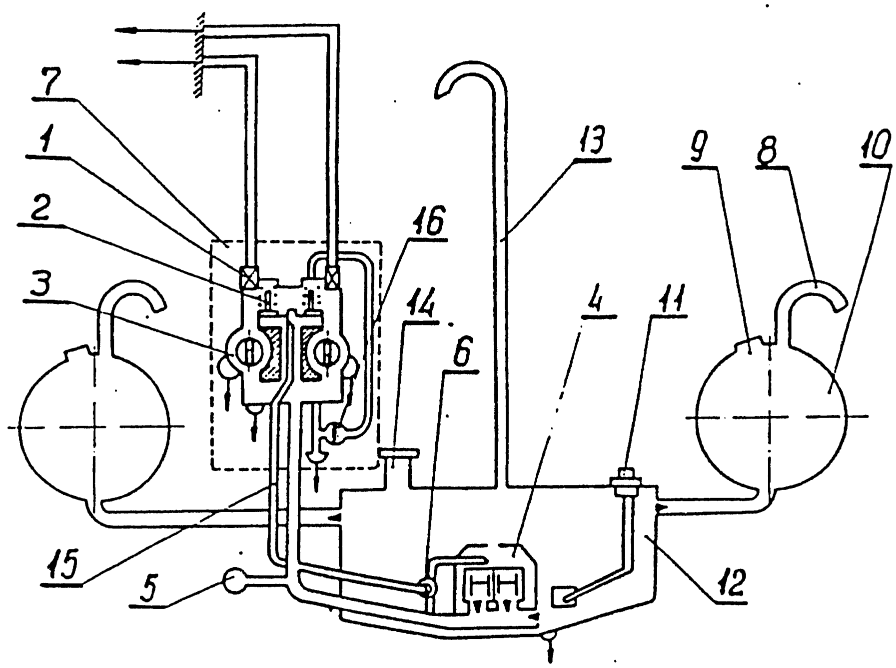


FIG. 1 - 9. FUEL SYSTEM DIAGRAM

1 - Cut - off valve
2 - Straight -run valve
3 - Fine fuel filter
4 - Boost pump reservoir
5 - Differential pressure transmitter
6 - Ejector
7 - Filter block
8 - Venting
9 - Filler
10 -Auxiliary fuel tank
11 - Fuel quantity indicator
12 - Main fuel valve
13 - Venting
14 - Filler
15 - Fuel supply lines from the filter block to the ejector
16 - Filters contamined condition indicator

1.4.5. FUEL SYSTEM

The fuel system /Fig. 1.9/ consists of one rubber tank with a pump assembly located in the fuselage under the passenger seats, two auxiliary fuel tanks made of metal, a filter assembly, cut-off valves, tubes, instruments and gauges to control the system. Capacities of all tanks are given in section 1.3. "Basic Technical Data", whereas fuel grades to be used are specified in Chapter II "Limitations".

Fuelling the main tank is monitored on a fuel quanitity indicator on the instrument panel and a light at the filler throat. Fuel level in the auxiliary fuel tanks is measured with a dipstick. During flight the pilot is kept informed of the fuel quantity in the system by means of the fuel quantity indicator located on the instrument panel /Fig. 1-8/.
It is graduated in litres. As soon as fuel quantity is reduced to 100 l, warning light will be illuminated on the instrument panel to indicate fuel low level.
Fuel is drawn from the main tank by a pump assembly installed at the bottom of the tank. Normally it is pump No. 1 that is operating all the time.

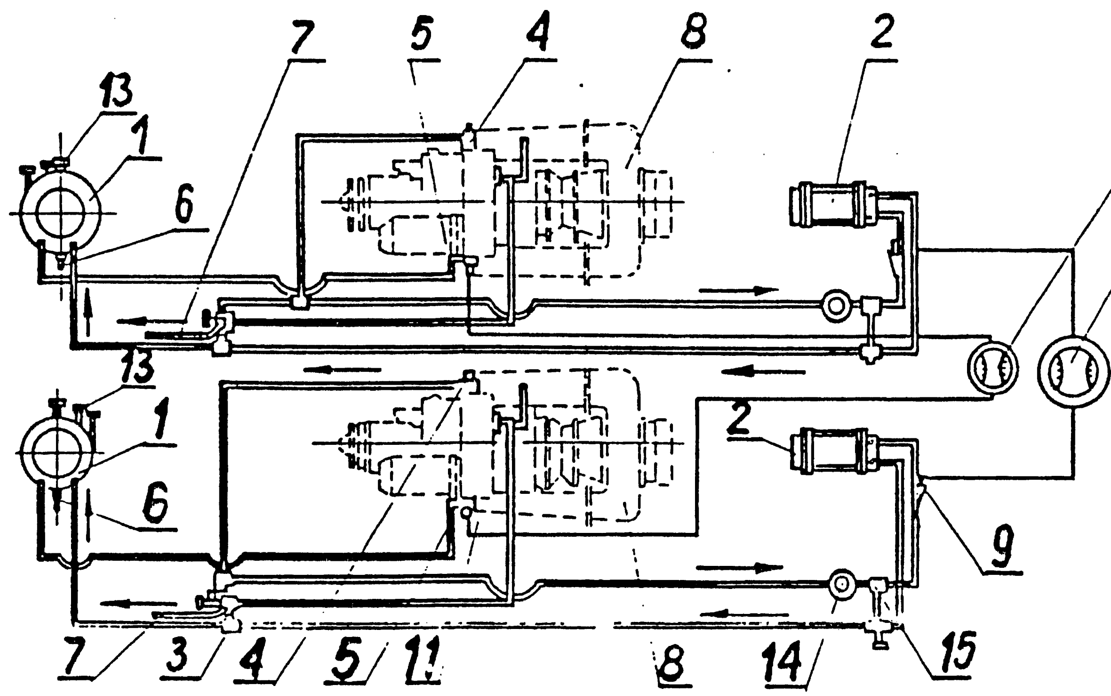


Fig. 1.10. ENGINE LUBRICATION SYSTEM

1 - oil tank, 2 - cooler, 3 - valve assembly, 4 - oil scavenge pump, 5 - oil pressure pump, 6 - tank oil drain, 7 - system oil drain, 8 - engine, 9 - outlet oil temperature sensor, 10 - outlet oil temperature indicator, 11 - oil pressure sensor, 12 - oil pressure indicator, 13 - oil filler, 14 - magnetic plug, 15 - by-pass valve.

N O T E

When auxiliary fuel tanks are installed,the fuel quantity indicator readings are constant and equal to 600 l(i.e. main fuel tank capacity) until auxiliary fuel tanks are empty.

Pump No.2 is actuated automatically in case of pump No.1 failure. To inform pilot,which pump is operating ,green lights are installed on the upper panel(starting section).
Fuel is supplied to the engines via the filters block including two fine filters and two shut-off valves actuated by means of red levers installed on RH side of the pilot's seat.

The fuel filters block is equipped with SF-0,4 E pressure drop signallizer causing "FILTER CONTAMINATION" lamp lighting on the instrument panel in case of filters contamination and pressure dropping up to $0{,}4 \pm 0{,}1$ kG/cm^2.
A tank and ejector installed in the main fuel tank provide proper supplying of the fuel pumps in case of low fuel quantity.

1.4.6. ENGINE OIL SYSTEM
Each engine has an independent oil system with separate oil tanks and coolers,tubes, filters and valves. The oil tanks are installed at the engine inlets. Oil flow for each engine is provided by means of two pumps installed in every engine:pressure and suction pump. Turbine shaft bearings,compressor bearings and gears train of the power turbine are lubricated.
Hot oil drained from lubrication points is delivered to the oil cooler. The oil cooler is cooled with air stream supplied by a fan installed between the engines.
The operation of each lubrication system is monitored by continuous measuring engine outlet temperature,as well as system pressure. Two dual indicators on the instrument panel provide pilot's information. Engine oil system is shown in FIG. 1.10.

1.4.7. MAIN GEARBOX OIL SYSTEM

The main gearbox has independent oil system (see FIG. 1-11) including an oil cooler, oil filter and a filler installed on the gearbox.

Hot oil is delivered by pump from the gearbox oil sump to the cooler,and then to the "cold" section of the sump. Oil is sup-lied from the "cold" sump to the gears,bearings and splines by means of pressure pump. Drained oil flows back to the"hot" section of the sump. Oil drained from the system flows through a magnetic plug located in the bottom of the gearbox. Actual values of inlet oil pressure and temperature are transmitted via transducers installed in the main gearbox to the indicators located on the instrument panel.

1.4.8. PNEUMATIC SYSTEM
The pneumatic system is provided for main landing gear wheels braking (see FIG. 1.12). Maximum pressure in the system amounts 50^{+4} KG/cm2.
Pneumatic system charging is performed by means of air compressor driven by main gearbox or with theground charging equipment adopted for quick disconnection and located in RH rear part of the fuselage. The wheel brake is controlled with a lever on the cyclic stick. When controlling,pressure reduction valve provides air pressure drop up to $24^{\mp}_{1,5}$ KG/cm2. Air pressure to be monitored on two pressure indicators located in the cockpit under the sliding door. Pneumatic system tubing is marked with black paint,

1.4.9. AIR COOLING SYSTEM

This system /Fig. 1.13/ provides necessary cooling for both starter generators, drive shaft articulated joints, AC generator mounted on the main gearbox and the air compressor.
The fan, mounted on the upper front section of the fuselage, with its inlet between the engine air inlets, is driven by the main gearbox output shaft. Operation of this system is not controlled by the pilot.

1.4.10. CABIN HEATING AND VENTILATION SYSTEM

The system /Fig. 1.14/ provides forced air heating and ventilation. The cabin is heated by heat exchangers supplied with compressor bleed air through the valves 9. The valves are opened with the knobs on the side distribution ducts.
A cooling air blower 4 for the heat exchanger is energized trough a circuit breaker marked CABIN HEATING AND VENTIL located on the circuit breaker panel.
The system provides ventilation when the blower is on and the bleed air valves are closed. The outside air intake is controlled with a lever 11. The shutters in the heat exchangers provide for outlet air distribution and thus cabin temperature regulating.
An additional fan is installed on the left of the instrument panel. It is energized through a circuit breaker marked DW - 3 FAN.

1.4.11. FIRE DETECTION AND EXTINGUISHING SYSTEM

The fire detection and extinguishing system installed in the helicopter /Fig. 1.15/ is used for extinguishing fire in any of three sections separated by fire-walls, i.e. two engine compartments and one main gearbox compartment. In each compartment fire detectors and spray nozzles are installed, which actuate the system automatically under specific conditions: temperature of 150°C, temp. rate of growth greater than 2°C/sec and an airflow.
Automatic actuation of the system will release the fire extinguishing agent from one botle only /bottle No 1/. If necessary, the second and third bottles may be actuated manually by the pressing in the push-button of bottle No. 2, and if required, bottle No 3.
A special control panel is provided in the cockpit to operate the fire extinguishing system and monitor its operation. On the panel there are [illegible] and SIGNAL LAMPS, push-buttons for manual opening of electromagnetic valves and manual actuation of bottle No 2 and No 3, as well as the master swithh /Fig. 1.16/.

1.4.12. HYDRAULIC SYSTEM

Hydraulic system is applied to reduce flight control forces. Hydraulic power is generated by a pump driven by the main gearbox, thus it depends on rotor turning.

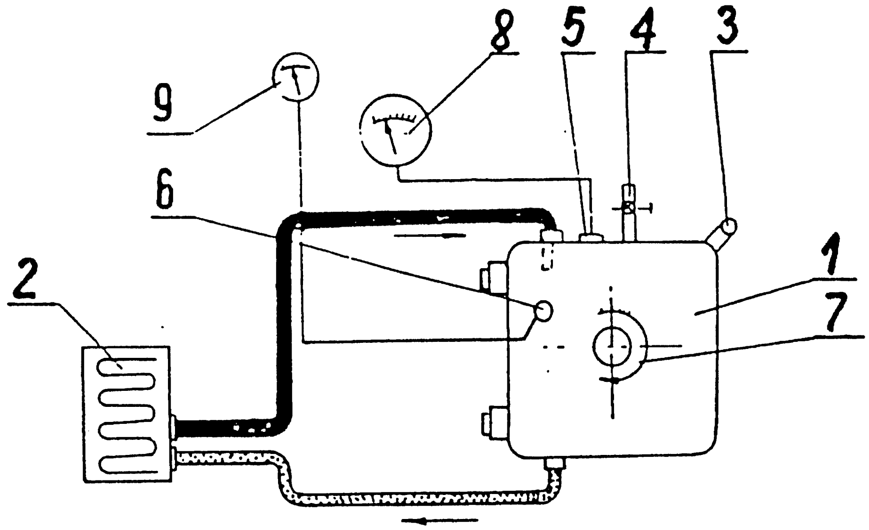


Fig. 1.11. MAIN GEARBOX LUBRICATION SYSTEM

1 - main gearbox, 2 - cooler, 3 - gearbox oil filler, 4 - magnetic plug 5 - oil temperature sensor, 6 - oil pressure sensor, 7 - main shaft, 8 - gearbox oil temperature indicator, 9 - gearbox oil pressure indicator.

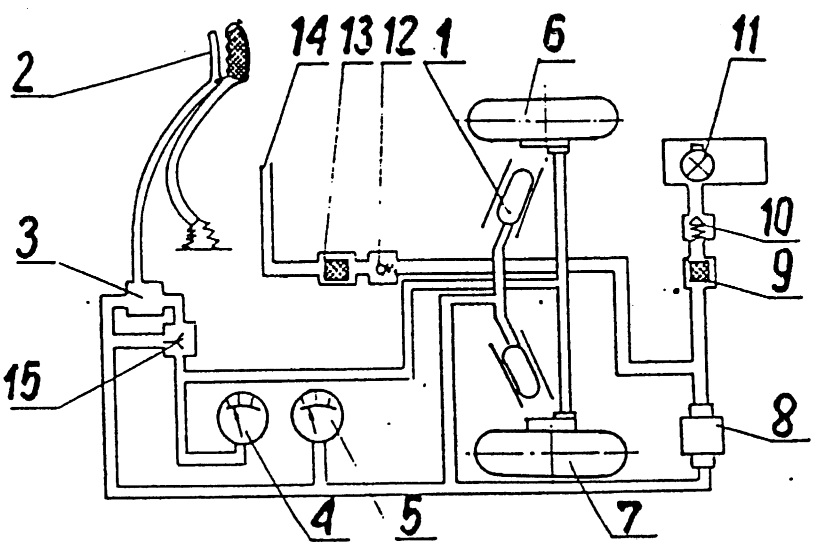
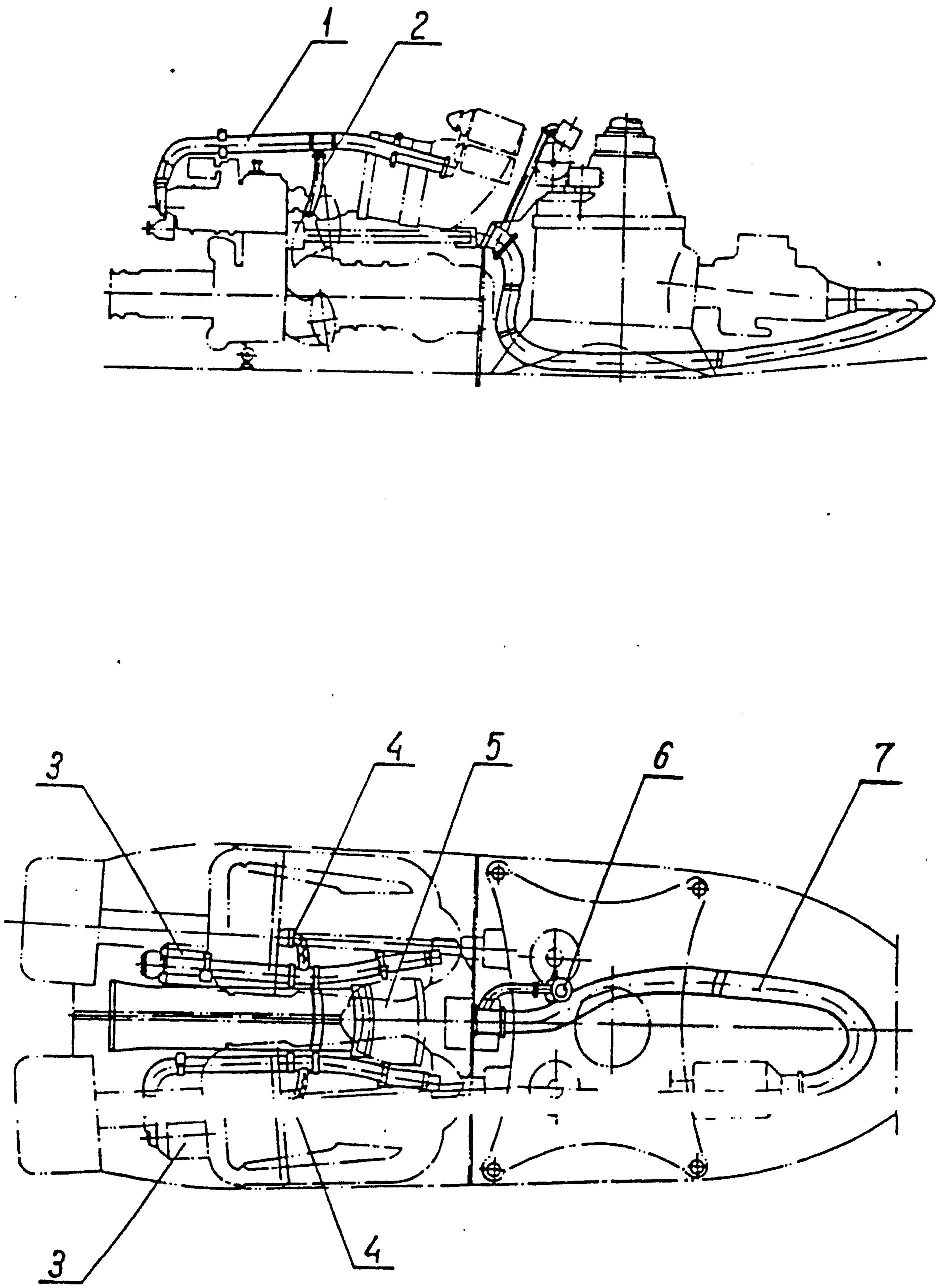


Fig. 1.12. PNEUMATIC SYSTEM

1 - compressed air reservoirs /undercarriage struts/, 2 - brake lever on cyclic stick handle, 3 - control valve, 4 - working pressure indicator, 5 - air reservoir pressure indicator, 6 - RH wheel brake, 7 - LH wheel brake, 8 - pressure regulator 9 - air filter, 10 - check valve, [illegible]-ground charging valve, 12 - check valve, [illegible] - air pressure reducing valve /UP-24/2/.



1 - air duct, 2 - air hose, 3 - starter-generator, 4 - drive shaft articulated joints, 5 - fan, 6 - AK-50P-10 compressor, 7 - air duct.

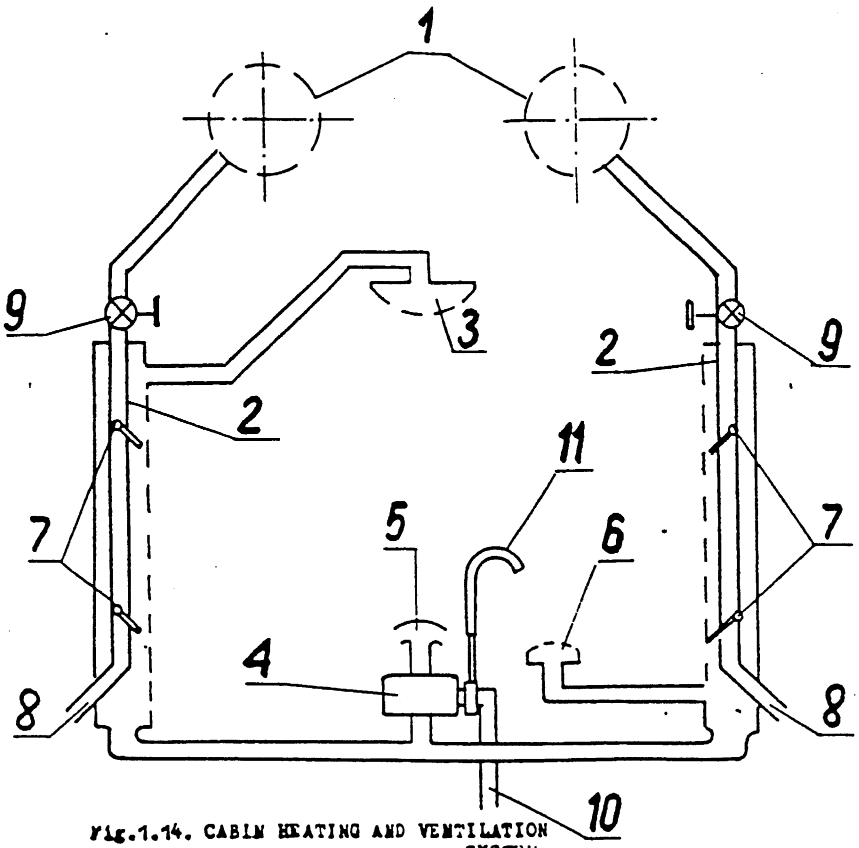


Fig.1.14. CABIN HEATING AND VENTILATION SYSTEM.

1 - engine compressor , 2 - compressor bleed air duct, 3 - ceiling distribution duct, 4 - blower, 5 - blower air inlet, 6 - outside air inlet, 7 - shutters, 8 - heater outlet, 9 - bleed air valves, 10 - outside air inlet, 11 - shutter lever

Operation of the system is monitored by the pilot on a pressure indicator located on the central panel /Fig. 1.19/. Beside the pressure indicator there is a master switch and a caution light. After turning the system off, or in case of failure, the red light will go on, and considerable forces will have to be reacted with the collective pitch lever as well as during longitudinal and lateral movement of the cyclic stick.

Major hydraulic system components are shown in Fig. 1.17. The hydraulic block is mounted at the rear of main gearbox while the booster assembly is mounted on the top. Ground test connections are mounted in the rear of the right side of the fuselage.

1.4.13. ANTI-ICING SYSTEM

The helicopter is provided with an anti-icing system of main rotor and tail rotor blades, engine air inlets, pitot tube and pilot's windscreen.

Rotor blades and windscreen protection is provided by means of resistance heater elements supplied by 208 VAC/400 H_z generator which is mounted on and driven by the main gearbox.

The generator is excited with 27 VDC through a circuit breaker marked EXCIT.
Electrical de-ice can be activated either automatically or manually.
Engine air inlets anti-ice is provided through the use of energy supplied by engine bleed air.
Icing rate information is obtained by the ice detector. The detector actuates blades electrothermal heating as well as engine inlet anti-icing, if the switch on the upper central panel is placed in AUTO postion.
Icing conditions are indicated by the lighting of ICING warning light.
The ice detector is mounted on the cooler fan air inlet.
The anti-icing system actuating, regardless to the ice detector signal, is possible by placing the switch on the upper central panel in MANUAL position. This is also a way of system checking for proper operation before entering icing zone.
The pilot's windscreen heating is controlled by WINDSCREEN HEATING switch located on the upper central panel.
The heating of engine air inlets can be controlled independently of rotor blades de-icing by ENGINES WARMING switch located on the upper central panel.

NOTE: The anti-icing system remains switched on even after leaving icing zone. To switch it off, place the AUTO/MANUAL switch to MANUAL and then to central position.

The electrothermal heaters operation is monitored on the ammeter located on the upper central panel. A selector switch is provided to enable checking heaters condition and a control for sequencing power to the blade heating zones:
These zones are as follows:

I upper sections of main rotor blade heaters

II intermediate sections of main rotor blade heaters

III lower sections of main rotor blade heaters

IV rotor blade heaters

Electric power is applied to each zone for 38 sec and for 114 sec. a zone cools down.
The amperage in the particular zones is the following:

I and II	zone	- 56 - 66 A
III	zone	- 50 - 64 A
IV	zone	- 14 - 17 A

CAUTION

SWITCHING ON THE ELECTROTHERMAL HEATERS AT A ROTOR SPEED LESS THAN 78 %
IS NOT ALL
THE HEATER

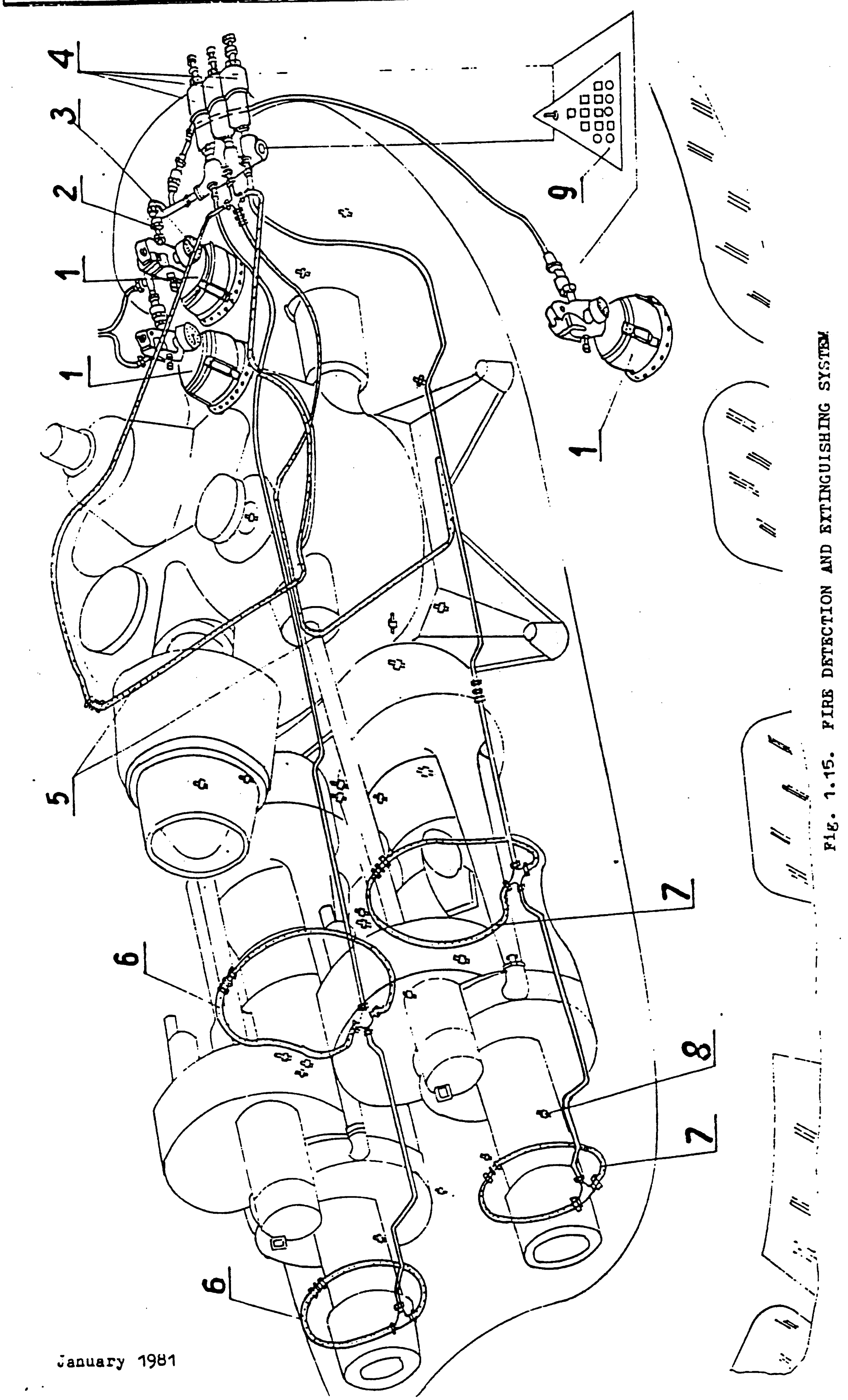


Fig. 1.15. FIRE DETECTION AND EXTINGUISHING SYSTEM

1 - fire extinguishing bottle, 2 - check valve, 3 - pressure gauge, 4 - solenoid valves,
5 - main gearbox spraying nozzles, 6 - RH engine spraying nozzles, 7 - LH engine spraying nozzles,
8 - engine fire detectors, 9 - fire extinguishing panel.

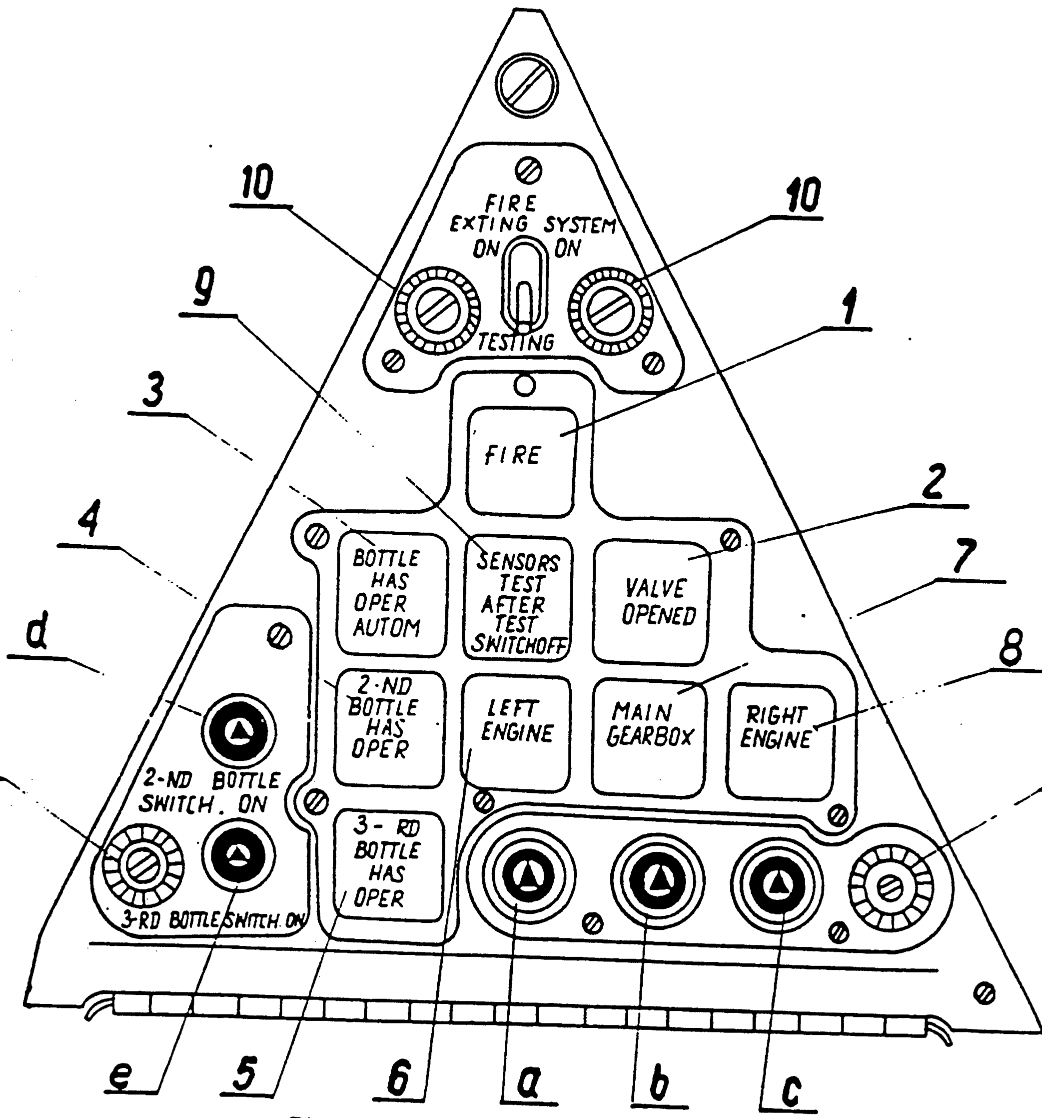


Fig. 1.16. FIRE EXTINGUISHING PANEL

Push-buttons:

a - manual opening of LH engine solenoid valve
b - manual opening of main gearbox solenoid valve
c - manual opening of RH engine solenoid valve
d - No. 2 bottle actuation
e - No. 3 bottle actuation

Indicator lights:

1 - fire light, 2 - solenoid valve open light, 3 - first bottle discharged light, 4 - second bottle emptied light, 5 - third bottle discharged light, 6 - LH engine compartment fire light, 7 - main gearbox compartment fire light, 8 RH engine compartment fire light, 9 - detectors check light, 10 - red illumination light

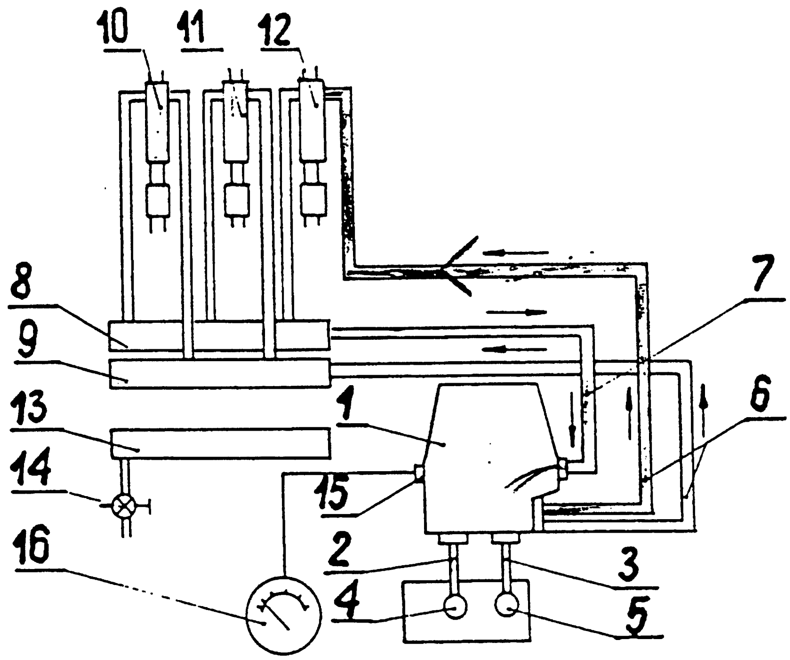


Fig. 1.17. HYDRAULIC SYSTEM

1 - hydraulic block, 2 - delivery tube, 3 - suction tube, 4 - delivery valve, 5 - suction valve, 6 - delivery tubing, 7 - return tube, 8 - return collector, 9 - delivery collector, 10 - longitudinal control booster, 11 - collective pitch control booster, 12 - lateral control booster, 13 - drain channel, 14 - channel drain valve, 15 - system pressure sensor, 16 - system pressure indicator.

Electrothermal anti-icing of the pitot tube is supplied with 27 VDC through the circuit breaker marked PITOT TUBE HEAT.

1.4.14. DC ELECTRICAL SYSTEM

The DC system is the basic electrical system of the helicopter.
The power sources for this system are:

- two batteries, 24 V and 28 Ah each /12 SAM-28 batteries/ located in the nose section.

- two compound starter-generators, 27.5 V and 3 kW each, mounted on the engines and functioning also as engine starters.

Fig. 1.18 CIRCUIT BREAKER PANEL

1. ЗАПУСКА ДВИГАТЕЛЕЙ
2. ОБЩИЙ
3. УПРАВЛ.
4. ТЕМПЕР. МАСЛА ДВИГАТЕЛ.
6. ЛЕВ.
7. ПРАВ.
8. ТЕМПЕР. ГЛАВН. РЕДУКТ.
9. ТОПЛИВОМЕР
10. УКАЗАТ. ШАГА ВИНТА
11. ГИДРОСИСТЕМА
12. ВКЛ.
13. ТРИММЕРЫ
14. УПРАВЛ.
15. ПРОДО
16. ПОПЕРВ.
17. ТОПЛИВНЫЕ НАСОСЫ
18. № I
19. № 2
20. ПРОТИВОПОЖАР. СИСТЕМА
21. ОЧЕР. I
22. ОЧЕР. 2
23. КОНТРОЛ. СИГНАЛ. ЛАМП
24. МИГАЛКА
25. ВЕНТИЛЯТОР ДВ-3
26. ОБОГРЕЗ ВЕНТИЛ. КАБИНЫ
27. СТЕКЛООЧИСТИТ.
28. ПВД
29. ЧАСОР
30. ОБОГРЕЗ
31. АККУМ.
32. ПРОТИВООБЛЕД.
33. ОБЩИЙ
34. СИГНАЛ.
35. ПЕРЕМЕННЫЙ ТОК
36. ГЕНЕРАТОР
37. УПРАВЛ.
38. ВОЗДУХ
39. АВТОМ. ПЕРЕКЛ. ИСТОЧН.
40. КРАСНЫЙ ПОДСВЕТ.
41. ОСНОВН.
42. ПОДСВ.ПЫЛИТЫ
43. ДОПОЛН. ДОСКА
44. ТАБЛО ЯРКО ТУСКЛО

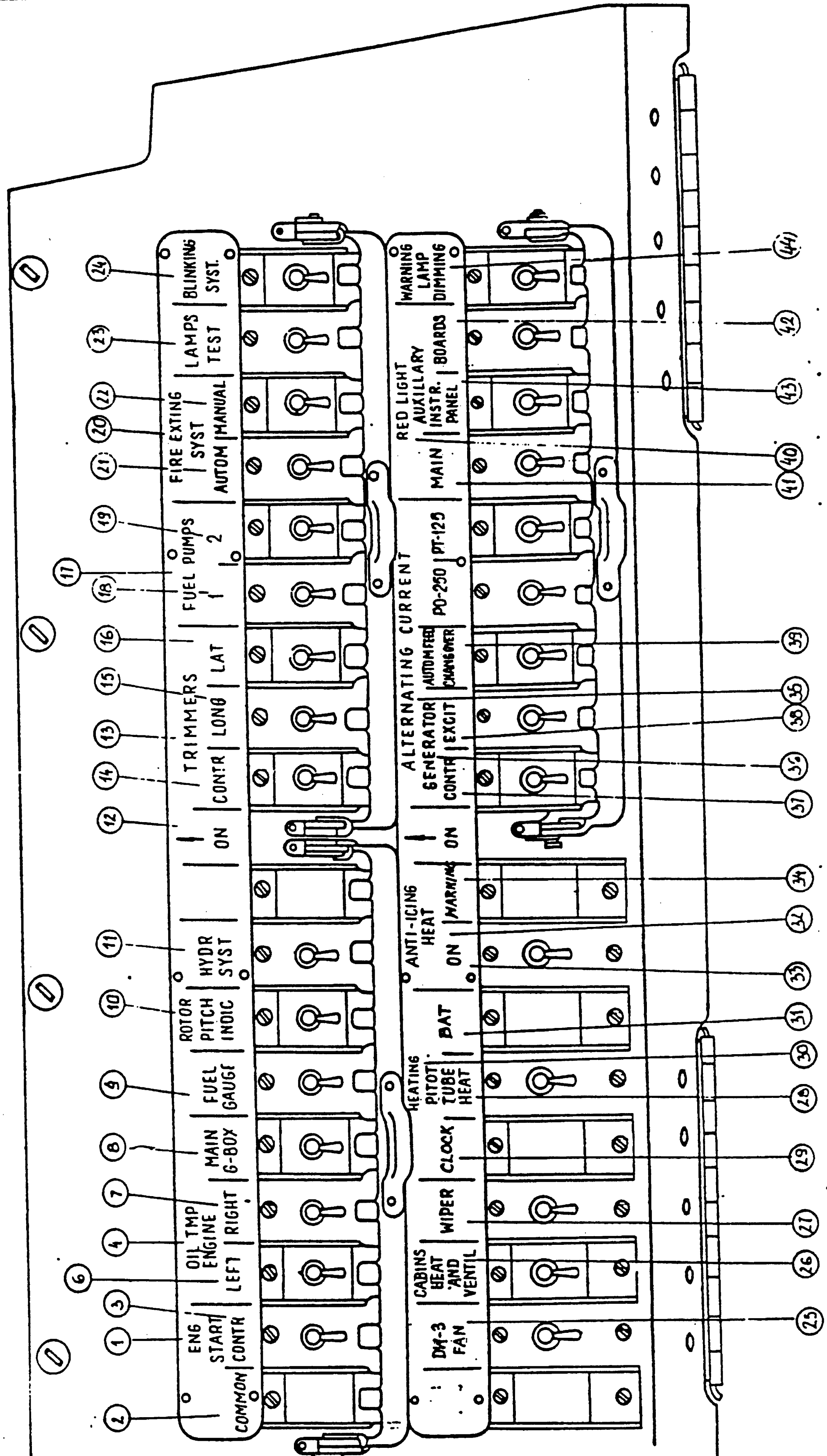

ENG START CONTR
COMMON
OIL TMP ENGINE
LEFT
RIGHT
MAIN G-BOX
FUEL GAUGE
ROTOR PITCH INDIC
HYDR SYST
ON
TRIMMERS
CONTR
LONG
LAT
FUEL PUMPS
1
2
FIRE EXTING SYST
AUTOM
MANUAL
LAMPS TEST
BLINKING SYST.
DM-3 FAN
CABINS HEAT AND VENTIL
WIPER
CLOCK
HEATING PITOT TUBE HEAT
BAT
ANTI-ICING HEAT
ON
WARNING
ON
ALTERNATOR GENERATOR
CONTR
EXCIT
AUTOM FEED CHANGEOVER
ALTERNATING CURRENT
PO-250
PT-125
MAIN
RED LIGHT AUXILARY
INSTR. PANEL
BOARDS
WARNING LAMP DIMMING

Fig 1.18.

Fig. 1.19. CENTRAL PANEL

Sections:

I - Direct Current, II - Hydraulic System, III - Anti-icing System, IV - Alternating Current, V - Engine Starting, VI - Lighting

Switches:

1 - LH generator switch, 2 - ammeter selector switch, 3 - battery switch, 4 - external power supply switch, 5 - RH generator switch, 6 - voltmeter selector switch, 7 - hydraulic system switch, 8 - windscreen heating switch, 9 - selector switch of the anti-ice manual/automatic control/, 10 - 115V AC inverter switch, 11 - 36VAC inverter switch, 12 - LEFT /RIGHT switch, 13 - engine inlet heating switch, 14 - fuel pump change over switch, 15 - cockpit lighting switch, 16 - cabin lighting switch, 17 - bright/dim light selector switch, 18 - starting/cranking selector switch, 19 - lights check switch, 20 - electrothermal heaters check selector.

Indicators:

a - LH engine ammeter, b - RH engine ammeter, c - voltmeter, d - hydraulic system pressure indicator, e - AC voltmeter, f - AC ammeter.

Warning caution and advisory lights:

A - external power supply on /green/, B - LH generator failure /red/, C - battery failure /red/, D - RH generator failure /red/, E - 115V AC generator failure /red/, F - 115V AC inverter /red/, G - 36V AC inverter failure /red/, H - hydraulic system failure /red/, I - icing goes on /red/ J - anti-icing system is on /green/, K - starting system on /yellow/, L - No 1 fuel pump on /green/, M - No 2 fuel pump on, N - rear door open /red/.

Push-buttons:

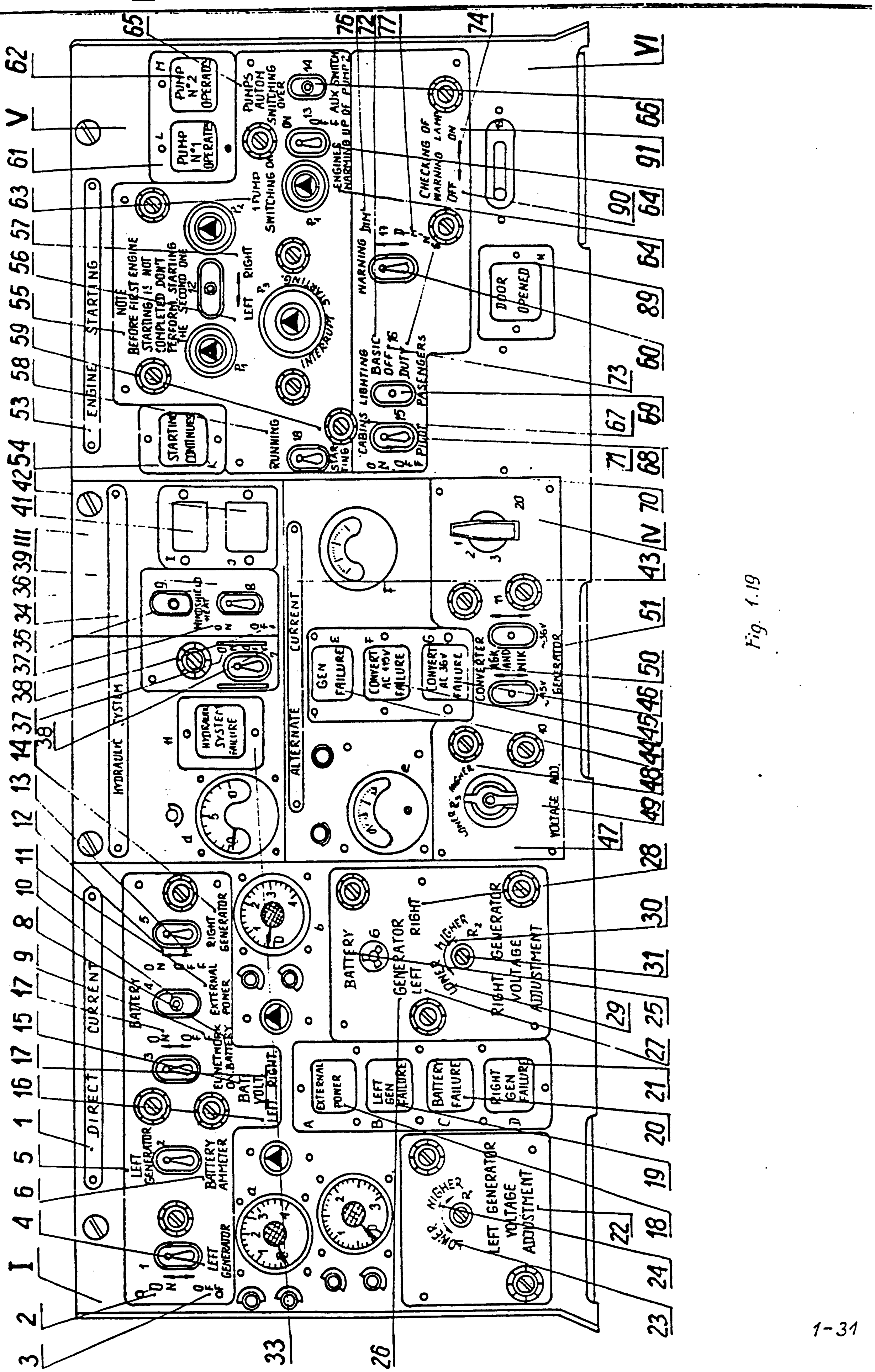
P_1 - LH engine starting, P_2 - RH engine starting, P_3 - engine starting cycle interruption, P_4 - fuel pumps change over.

Regulators:

R_1 R_2 - for synchronising operation of DC generators.
R_3 - for voltage adjustment of the AC generator.

1. ПОСТОЯННЫЙ ТОК
2. ВКЛ.
3. ВЫКЛ.
4. ЛЕВЫЙ ГЕНЕРАТ.
5. ЛЕВЫЙ ГЕНЕРАТ.
6. АККУМУЛ. АМПЕРМЕТ.
7. ВКЛ.
8. СЕТЬ НА АККУМУЛ.
9. ВЫК.
10. АККУМУЛ.
11. АЭРОДР. ПИТАНИЕ
12. ВКЛ.
13. ВЫК.
14. ПРАВ. ГЕНЕРАТ.
15. ЗАМЕР НАПР. АККУМУЛЯТ.
16. ЛЕВ.
17. ПРАВ.
18. АЭРОДР. ПИТАНИЕ
19. ОТКАЗ ЛЕВОГО ГЕНЕРАТ.
20. ОТКАЗ АККУМУЛЯТОРА
21. ОТКАЗ ПРАВОГО ГЕНЕРАТ.
22. РЕГУЛИРОВ. НАПРЯЖ. ЛЕВ.ГЕНЕРАТ.
23. МЕНЬШЕ
24. БОЛЬШЕ
25. АККУМУЛЯТ.
26. ГЕНЕРАТОРЫ
27. ЛЕВ.
28. ПРАВ.
29. МЕНЬШЕ
30. БОЛЬШЕ
31. РЕГУЛИР. НАПРЯЖ. ПРАВ.ГЕНЕРАТ.
32. ГИДРОСИСТЕМА
33. ОТКАЗ ГИДРОСИСТЕМЫ
34. ПРОТИВООБЛЕД.
35. РУЧНОЕ
36. АВТОМ. ОБОГРЕВ.
37. ВКЛ.
38. ВЫКЛ.
39. АВТОМ. ОБОГРЕВ.
40. ВКЛЮЧ.ПРОТИВОБЛ.СИСТЕМЫ
41. ПРОТИВОБЛ.СИСТЕМА РАБОТАЕТ
42. ПЕРЕМЕННЫЙ ТОК
43. ОТКАЗ ГЕНЕРАТОР.
44. ОТКАЗ ПРЕОБРАЗОВАТ. II5B
45. ОТКАЗ ПРЕОБРАЗОВАТ. 36В
46. МЕНЬШЕ
47. БОЛЬШЕ
48. РЕГ. НАПРЯЖ.
49. ПРЕОБРАЗОВАТЕЛИ
50. ГЕНЕРАТОР
51. СЕКЦИИ ЛОПАСТ.
52. ЗАПУСК ДВИГАТЕЛЕЙ
53. АВТОМАТИКА ВКЛЮЧЕНА
54. ВНИМАНИЕ НЕ ПРОИЗВОДИ. ЗАПУСК ДРУГОГО ДВИГАТЕЛЯ ДО ОТКЛЮЧЕНИЯ АВТОМАТИКИ
56. ЛЕВЫЙ
57. ПРАВЫЙ
58. ПРОКРУТ.
59. ЗАПУСК
60. ПРЕКРАЩ. ЗАПУСКА
61. НАСОС №I РАБОТАЕТ
62. НАСОС №2 РАБОТАЕТ
63. ВКЛЮЧЕНИЕ НАСОСА № I
64. ОБОГРЕВ ДВИГАТЕЛЕЙ
65. АВТОМАТ ПЕРЕКЛЮЧ. НАСОСОВ
66. ДУБЛИРУ.ВКЛЮЧ. НАСОСА № 2
67. ОСВЕЩ. КАБИН
68. ЛЕТЧИК
69. ГРУЗОВ.
70. ВКЛ.
71. ВЫКЛ.
72. ОСНОВНОЕ
73. ВЫКЛ.
74. ДЕЖУРНОЕ
75. ЯРКО
76. ТАБЛО
77. ПРЕКЛЮЧ.
78. ЯРКОСТЬ
89. ДВЕРТ ОТКРLTA
90. ВЫКЛ.
91. ВКЛ.

34



ENGINE STARTING
NOTE BEFORE FIRST ENGINE STARTING IS NOT COMPLETED DON'T PERFORM STARTING THE SECOND ONE
STARTING CONTINUES
PUMP N°1 OPERATES
PUMP N°2 OPERATES
PUMPS AUTOM SWITCHING OVER
1 PUMP SWITCHING ON
ENGINES WARNING
DOOR OPENED
CHECKING OF WARNING LAMP
CABINS LIGHTING
HYDRAULIC SYSTEM
HYDRAULIC SYSTEM FAILURE
ALTERNATE CURRENT
GEN FAILURE
CONVERTER AC 115V FAILURE
CONVERTER AC 36V FAILURE
VOLTAGE ADJ.
DIRECT CURRENT
LEFT GENERATOR
BATTERY AMMETER
BATTERY
EXTERNAL POWER
RIGHT GENERATOR
EXTERNAL POWER
LEFT GEN FAILURE
BATTERY FAILURE
RIGHT GEN FAILURE
RIGHT GENERATOR VOLTAGE ADJUSTMENT
LEFT GENERATOR VOLTAGE ADJUSTMENT

Fig. 1.19

In addition, the system may be provided with DC power from an external /ground/ power source.

Battery containers are electrothermally heated with 27 V DC through a circuit breaker marked BAT.COMP.HEAT. Battery heater shall be switched on whenever ambient temperature is below -5°C.

The DC system supplies the electrical power either directly - 24/27 V DC or indirectly /through inverters/ - 115 V or 36 V AC. The DC cables are whits.
The system operation is protected by voltage regulators, reverse current relays and overload circuit breakres. For monitoring the operation of voltage sources the following are used: two ammeters and one voltmeter on the central panel /Fig 1.19./, and theree red lights on the same panel, which will go in the event of:

- LH generator failure
- RH generator failure
- battery failure.

On the panel there are also two resistors for synchronizing the operation of both generators, as well as a green advisory light to indicate that external /ground/ power is used.

1.4.15. AC ELECTRICAL SYSTEM

The AC power system consists of two inverters, the first supplying 115 V AC/400 H_z and the second 36 V AC/400 H_z, as well as the 3 - phase 16 kVA generator mounted on and driven by the main gearbox.
The generator is a secondary power source for the AC electrical system except for supplying power to electrothermal heating. A generator control unit regulates generator output and protects against overvoltage and undervoltage.

C A U T I O N

SWITCHING ON THE AC GENERATOR AT A ROTOR SPEED LESS THAN 78 % IS NOT ALLOWED.
THE GENERATOR MUST BE SWITCHED OFF BEFORE ROTOR SPEED DECREASES BELOW 78 %.

In case of inverter mulfunction, the generator will automalically supply power to the respective bus through transformers.
The single - phase 115 V AC/400 H_z inverter supplies power to pressure indicators, automatic direction finder and a radar altimeter.
An attitude indicator and a gyrocompass are supplied by the 3 phase 36 V AC/400 Hz inverter.
For monitoring and control the operation of the AC system the following are used: a voltmeter and an ammeter, three caution lights, inverters and a generator, off-on switches, and the generator voltage control knob.
Alternating current power system fault protection is provided by 16 fuses, which are collected in the fuse box and located under the central distribution unit plate.
There are also 6 spare fuses in the fuse box.

1.4.18. RADIO-NAVIGATION EQUIPMENT

Radio-navigation equipment installed in the helicopter is the following:

- R-860 VHF Communication Transceiver
- R-842 HF Communication Transceiver
- SPU-7 Intercom System
- RV-3 Radar Altimeter
- ARK-9 Automatic Direction Finder

R-860 VHF Communication Transceiver is manufactured in two versions:

R-860 - I which operates at frequency increments of 83,3 kHz

R-860 - II which operates at frequency increments of 100 kHz

Major particulars of both transceivers are shown below:

Item No	Parameters	Unit	Values	
			Version I	Version II
1.	Frequency range	MHz	118 - 136,5	118 - 135,9
2.	Number of channels		220	180

The R-860 transceiver is connected to the headphone with a cord through the standard receptacle.
To begin a communication with the R-860 transceiver do the following:

- switch on a circuit breaker marked VHF
- select a VHF on the SPU intercom control unit
- place the operation mode selector to RADIO position, after that the R-860 will function as a reciever; transmitter operation will require to key the microphone with a push-button on the cyclic stick handle.

R-842 HF Communication Transceiver provides two way voice communication with the frequency range of 2 MHz to 8 MHz in 2 kHz increments /10 channels/.
The transceiver control unit is installed on the instrument panel /Fig. 1.8/.

Actuating procedure of R-842 HF Transceiver is the following:

- switch on a circuit breaker marked HF
- select a HF on the SPU intercom control unit
- place the operation mode selector to RADIO position

the remaining procedure is the same as for R-860 VHF transceiver.

SPU Intercom System provides communication in the helicopter between crew members as well as control of the two way VHF and HF communication.
There are two SPU intercom control units installed; the first one, assigned for a pilot and a co - pilot is on the push-rods column, the second one assigned for a crew member in the rear of the cabin and is installed on the No 9 frame.
To begin an intercommunication, switch on a circuit breaker marked SPU, place the operation mode selector to ICS and place the ICS 1/2 switch to 1 position.

RW-3 Radar Altimeter

Major particulars of the RW-3 were described in paragraph 1.4.4. - "Board Instruments". The RW-3 radar altimeter operating requires switching on a circuit breaker marked RW-3 as well as adjusting an appropriate decision height with a knob on the RW-3 indicator.

ARK-9 Automatic Direction Finder was described in paragraph 1.4.4. "Board Instruments".
The ARK-9 control unit is installed on the upper left circuit breaker panel. Below the control unit a preselected frequency change-over switch is installed.
To actuate the ARK-9, do the following:

- switch on a circuit breaker marked ARK-9
- set a selector on the ARK-9 control unit in AHT position
- set a selector on the SPU-7 control unit in AДF 1 position
- adjust required volume with the ГРОМК knob

Selecting required frequency is as follows:

- set a selector on the ARK-9 control unit in AHT position
- select frequency of the basic station; to do this, turn the knobs on the ОСНОВНОЙ control unit until the desired station frequency appears in the window,
- tune up by turning a knob marked ПОДСТР until an indicator reads max. value
- select frequency of the stand-by station; use РЕЗЕРВНЫЙ control unit.

1.4.17. LIGHTING SYSTEM

The helicopter lighting system consists of the following elements:

- instrument and control panels illumination with red light,
- cabin lighting,
- position lights,
- landing and taxiing light,
- anti-collision light,
- cargo floodlight,
- radio compartment light.

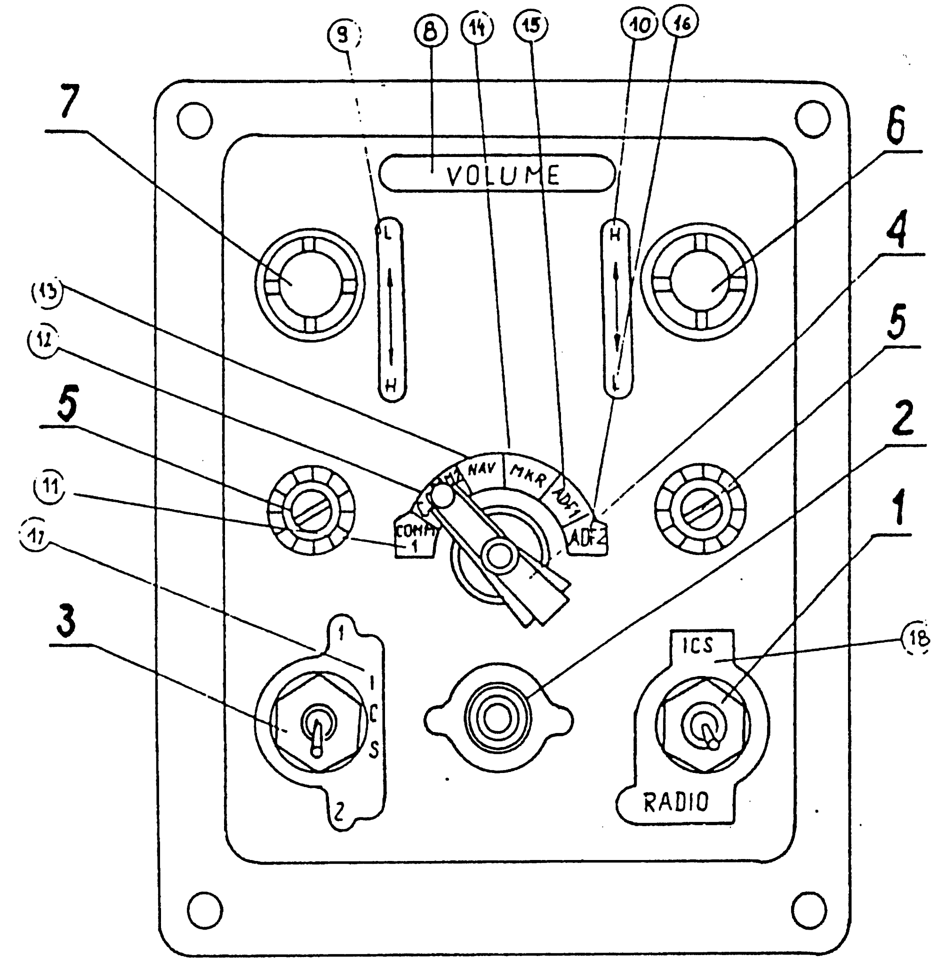


Fig. 1.20. SPU-7 INTERCOM CONTROL UNIT

1 - operation mode selector, 2 - general call push-button, 3 - intercom 1/2, 4 - selector switch, 5 - red illumination lights, 6 - "H - L" volume knob, 7 - side-tone "H - L" volume knob.

8	- ГРОМКОСТЬ	14	- ДР
9	- ПРОСЛ	15	- РК-1
10	- ОБЩАЯ	16	- РК-2
11	- УКР	17	- СЕТЬ
12	- СР	18	- СПУ
13	- КР		

Fig. 1.21. UPPER LEFT CIRCUIT BREAKER PANEL

A - ARK-9 automatic direction finder control unit

B - Basic/stand-by station selector switch

I. ЛЕБЕДКА

2. № I

3. № 2

4. ОСВЕЩЕНИЕ

5. ПЫЛЕСОС РОЗЕТКА

6. ДНО

7. МАЯК

I5. СПУ

I6. КВ

I7. УКВ

22. ФАРА

23. УПРАВЛ.

24. СВЕТ

25. ФАРА ОСВЕЩ. ГРУЗА

26. ВНЕШН. ПОДВ.

27. ТАКТИ

28. АВАРИЙН.

29. ПВД - КОНТ. ОБОГРЕВА - РИО-3

30. ОБОГРЕВ ПВД СПРАВЕН

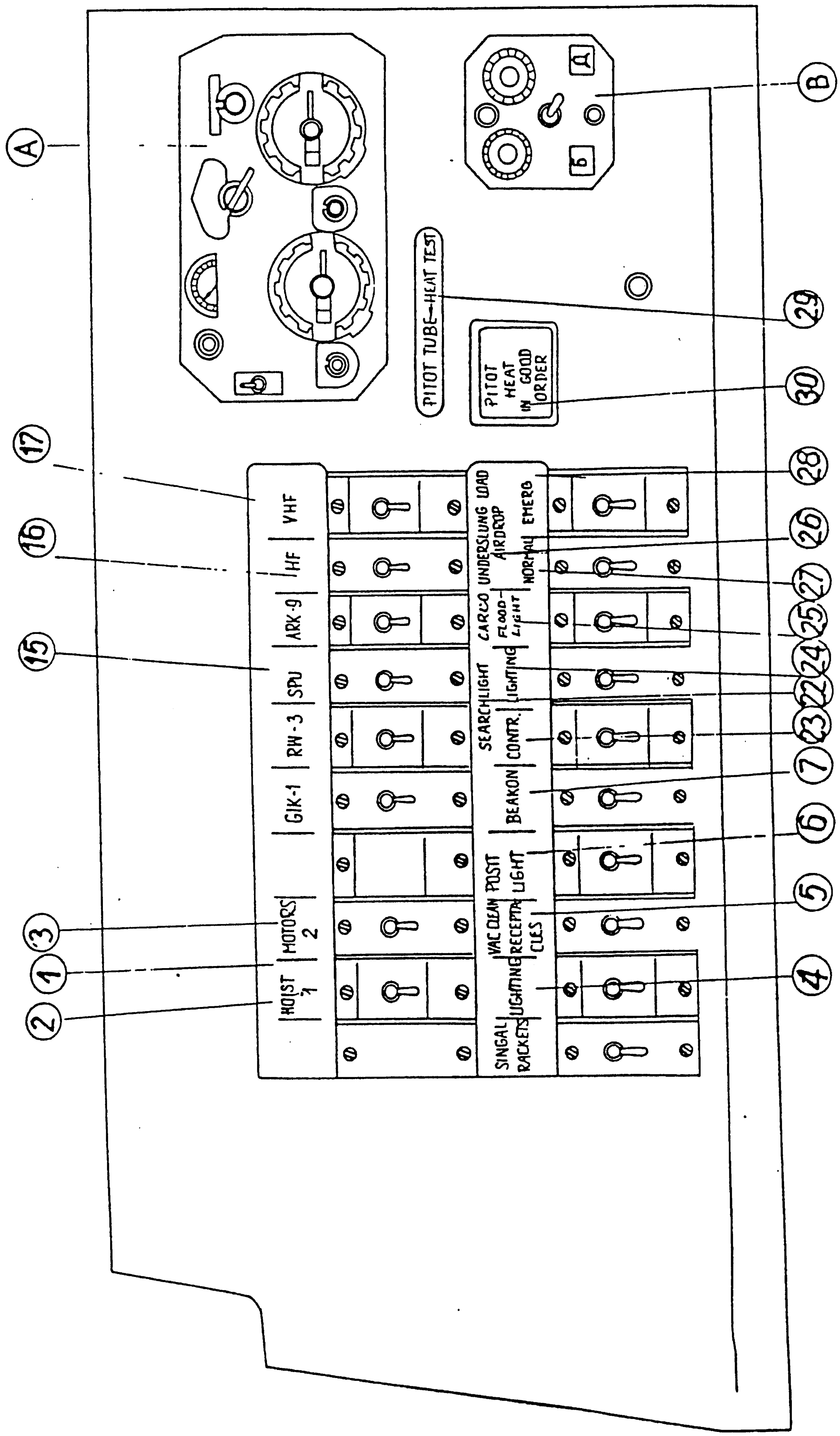

A
B
PITOT TUBE—HEAT TEST
PITOT HEAT IN GOOD ORDER
VHF
HF
ARK-9
SPU
RW-3
GIK-1
MOTORS 2
HOIST 1
UNDERSLUNG LOAD
AIRDROP
EMERG
NORMAL
CARGO FLOOD-LIGHT
SEARCHLIGHT LIGHTING
SEARCHLIGHT CONTR.
BEAKON
POSIT LIGHT
VAC CLEAN RECEPTACLES
LIGHTING
SINGAL RACKETS
17
16
15
3
1
2
28
26
27
25
24
22
23
7
6
5
4
29
30

Fig. 1.21.

The instrument and control panels are illuminated with red light by sheathed bulbs located at the instruments and illuminating their dials, as well as bulbs under the surface of the panel to make the lettering visible. The red illumination is switched on with 3 switches located on the circuit breaker panel /Fig. 1.18/. Light intensity is controlled by potentiometers on the illumination control panel. External lighting is arranged in two independent groups of lights which can be switched on together or separately /4 position switches/.

The interior lighting consists of a dome light above the pilot's head, the passenger compartment lights and a cockpit utility light of adjustable intensity, located on the left of the pilot, and used to facilitate map reading, etc.

The interior lighting is put on by a "LIGHTING" switch on the upper panel, and two switches on the central panel, which are used to switch on either the dome light only at the passenger compartment lights or all of them at once, Intensity of the cockpit utility light may be varied by turning the knob on its casing.

The position lights comprise a green light on the right side of the fuselage, a red light on the left and a white one at the end of the tail rotor pylon. The lights are turned on by a switch located on the upper left panel /Fig. 1.20/. together with a light intensity switch and a light signalling push-button.

NOTE: Signalling the position lights is performed with the light switch placed to "OFF" /central position/.

The light installed in the nose of the helicopter is used to facilitate landing and taxiing at night. It is fitted with a 450 W bulb.

Direction of the light beam can be changed within the range of 88^{0}. The landing light is switched on by two switches on the upper panel /Fig. 1.20/ and a 3 -position switch on the same panel. The latter is also used for selecting a desired light intensity.

NOTE: The bulb has two filaments of different wattage. Landing should be made with the 230 W filament on, while for taxiing the 150 W filament is to be used.

A thumbswitch on the collective pitch lever handle /Fig. 1.5/ is used to direct the light beam.
The anti-collision light, installed on top of the tail rotor pylon, has a 60 - 100 W bulb giving a light beam of 850 lumens.
Its turning rate is 40 rpm, and it is turned on with a swith on the upper left panel /Fig. 1.21/.
The radio compartment light, installed inside, is turned on with a switch on the inside of the compartment wall to the left of the entrance.
In addition to the above lighting system components, the helicopter is fitted with sockets for portable lamps, which are connected to the DC electrical system.

1.4.18. SERVICE POINTS

Service points used for refilling the fuel, oil, hydraulic fluid or compressed air, as well applying external power or hydraulic pressure. Location of these points in the helicopter is shown in Fig. 1.1.

1.4.19 OPTIONAL EQUIPMENT

a/ An external cargo hook for transportation of suspended loads up to 500 kg, the cargo is attached manually.
Cargo hook control: normal load release by push-button on collective pitch lever and emergency release by push-button on the cyclic pitch stick.

b/ An electrically operated hoist /LPG-4/ with capacity up to 120 kg mounted over thecabin door. It is designated to load and unload the cabin, as well as lift and lower poeple in a rescue seat.

c/ Stretchers for the ambulance version to transport casualities. They are brought into the cabin through the left rear door and fixed to special tiedown rings on the cabin walls and suspended on belts close to the fuselage axis.

d/ Auxiliary fuel tanks, 238 l each, are attached to removable supports beds being fixed to the fuselage by means of struts.

e/ A dual-control system to be used in the helicopter.

f/ A rescue seat /single/ lifted aboard by means of a hoist mounted by the cabin door. The seat is used for lifting aboard shipwrecked persons from water, life-boats or land, as well as lowering persons down onto floating vessels and land.

g/ A rope ladder fixed to the brackets in the passenger cabin and used for getting onboard and off board the helicopter during rescue operations.

h/ A tool-box for tools and plugs fixed in the passenger cabin under the rear seat.

i/ Guide-brackets for two auxiliary batteries fixed to the passenger cabin floor behind the fuel tank.

j/ Removable windows with snap-in ventilators or without them, as well as snap-in ventilators for unremovable windows.

k/ Metal skids No 50.44.000.00.00 mounted on the landing gear wheel to permit take-off and landing on snow or soft ground. For their description and operation instruction, see "Technical Description, In-flight Use and Maintenace and Routine Repair of Metal Skids No 50.44.000.00.00 Mounted on Mi-2 helicopters" /1978 issue/

l/ A RS 6102 and RS 6105 UHF transceivers of which one or two of the type can be installed on the helicopter. When two transceivers are installed, the first one is the basic unit and the second one is the stand-by unit.
Helicopters furnished with the mentioned transceivers are supplied with the following documentation:

- "RS 6102 Transceiver Technical Instruction"
- "RS 6105 Transceiver Technical Instruction"

Supplement to "Mi-2 Helicopter Flight Manual" concerning installed receivers.
The said receivers can be installed in place of R-860 UHF transceivers.

m/ A "Bakłan-5" tranceiver of which one or two units can be installed on the helicopter.
The a/m transceivers can be installed in place of the R-860 UHF transceivers.
Helicopters equipped with the said transceivers are supplied with the following documentation:

- "Bakłan-5 transceiver - Operating Instruction. Technical Maintenance"
- Supplement to "Mi-2 Helicopter Flight Manual" concerning installed transceivers.

n/ Thermo-fans installed in the cockpit to ventilate it.

o/ 3001-40 Radio-telephone coupled to the SPU-7 intercom control set..

NOTE: It is forbidden to open the windows in the passenger version with passengers aboard.

2.In all other versions, anybody leaving his seat must use a sefty belt /of a special kind/ when the windows are open.

3.It is forbidden to use a rope ladder in the passenger version with passemgers onboard.

C H A P T E R II

L I M I T A T I O N S

CHAPTER II TABLE OF CONTENTS

CHAPTER II

LIMITATIONS

2.1. WEIGHT LIMITATIONS

2.1.1. MAXIMUM GROSS WEIGHT

Maximum gross weight approved for all conditions, due to structural strength, is:

$$Q_{t\ max} = 3{,}550\ kg$$

For the method of helicopter weight calculation refer to Appendix No. 1 "Weight and Center of Gravity Calculation".

2.1.2. MAXIMUM TAKEOFF AND LANDING WEIGHT

Maximum takeoff and landing weight is affected by pressure altitude, ambient temperature and head-wind speed.
For applicable information see Figures 2-1 and 2-1a.
The weight shown in Fig. 2-1 enables a take-off and landing to be achieved in the normal way, i.e. with vertical lift-off and descent, as well as hovering above the landing - ground /in ground effect/ without power deficiency or rotor stall.
The weight shown in Fig. 2-1a enables a take-off, landing and hovering to be achieved as above, but out of ground effect.

Example . 1

The landing site is situated at 1,500 m above sea level and ambient temperature is +20°C.
In windless conditions both takeoff and landing IGE /Fig. 2.1/ are allowed with helicopter weight not exeeding 3,330 kg. With head-wind of 6 m/s the takeoff and landing weight will increase to 3,460 kg.

Example 2

The landing site is situated at 1,200 m above sea level and ambient temperature is +20°C.
In windless conditions both takeoff and landing OGE are allowed with the helicopter weight not exceeding 3,230 kg. With head-wind of 6 m/s the takeoff and landing weight will increase to 3,370 kg.

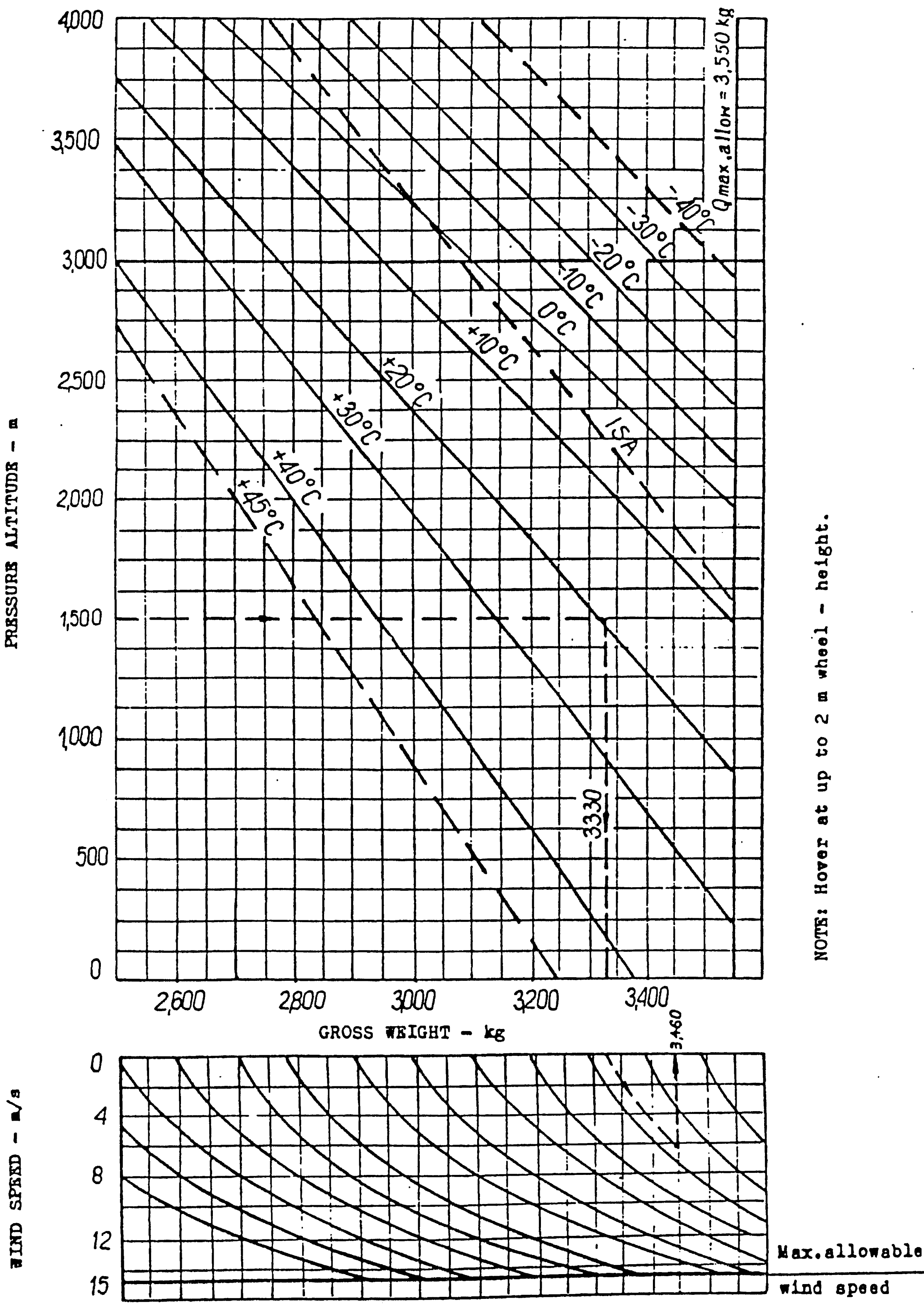


Fig.2.1. MAXIMUM ALLOWABLE HELICOPTER TAKEOFF AND LANDING WEIGHT IN GROUND EFFECT WITH HEAD - WIND

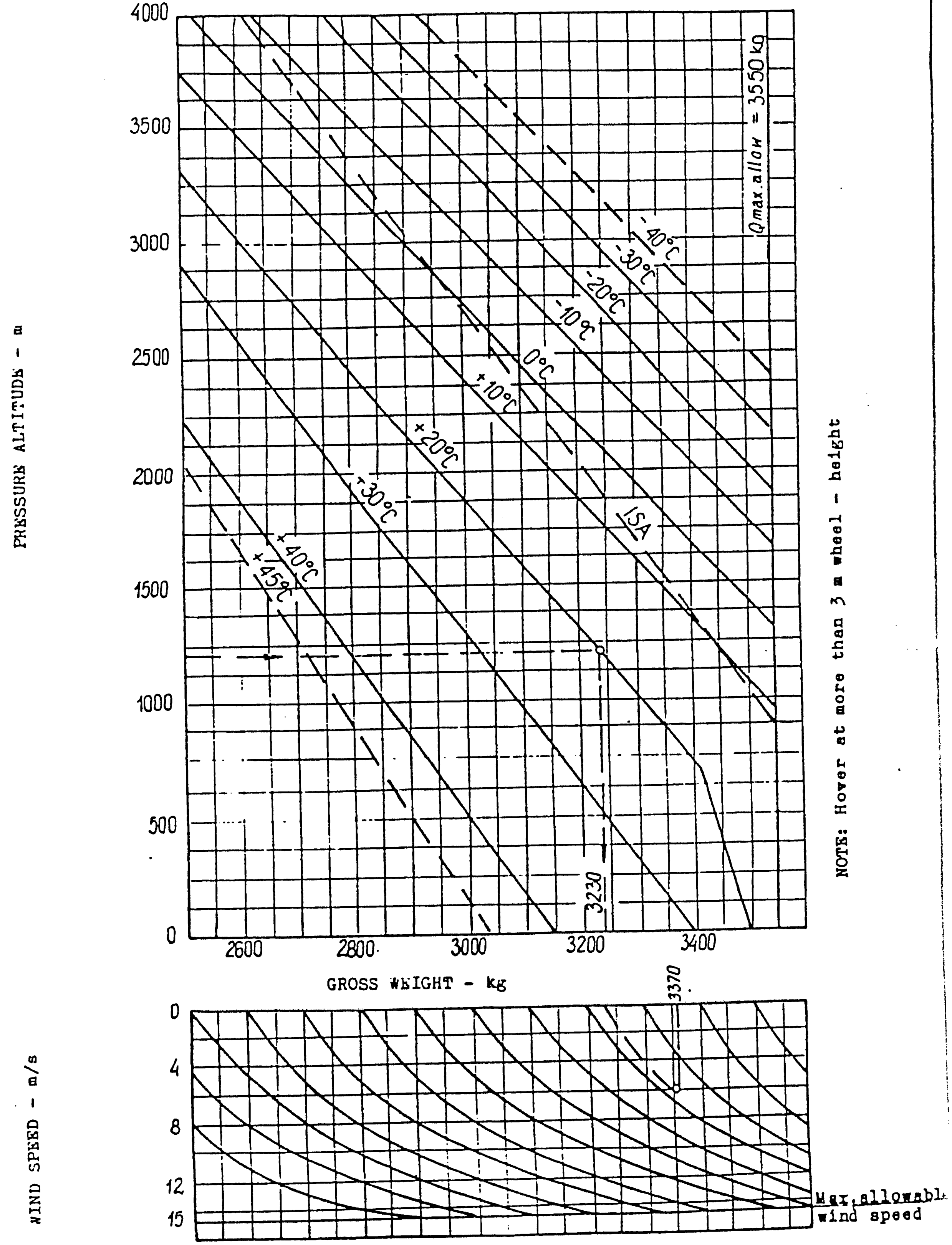


Fig.2.3a Maximum allowable helicopter takeoff and landing weight out of ground effect /with head - wind/

2.2. PERFORMANCE LIMITATIONS

2.2.1. AIRSPEED IN DRY AIR

The airspeed limits for operation in dry air /without precipitation/ are given in Table II-1.

Table II-1. MAXIMUM AND MINIMUM ALLOWABLE AIRSPEED /Fig. 2-3/.

Pressure altitude /m/	V_{NE} /km/h IAS/	
	V_{NE} Minimum	V_{NE} Maximum
0 - 5	0	60
10	25	70
20	40	90
50	40	210
500	40	210
1000	40	200
2000	40	160
3000	60	120
4000	70	90

C A U T I O N

AT AMBIENT AIR TEMPERATURES HIGHER THAN +25°C AND ALTITUDES OF 50 - 1000 M, MAXIMUM AND CRUISING SPEED MUST NOT EXCEED 180 km/h /IAS/.

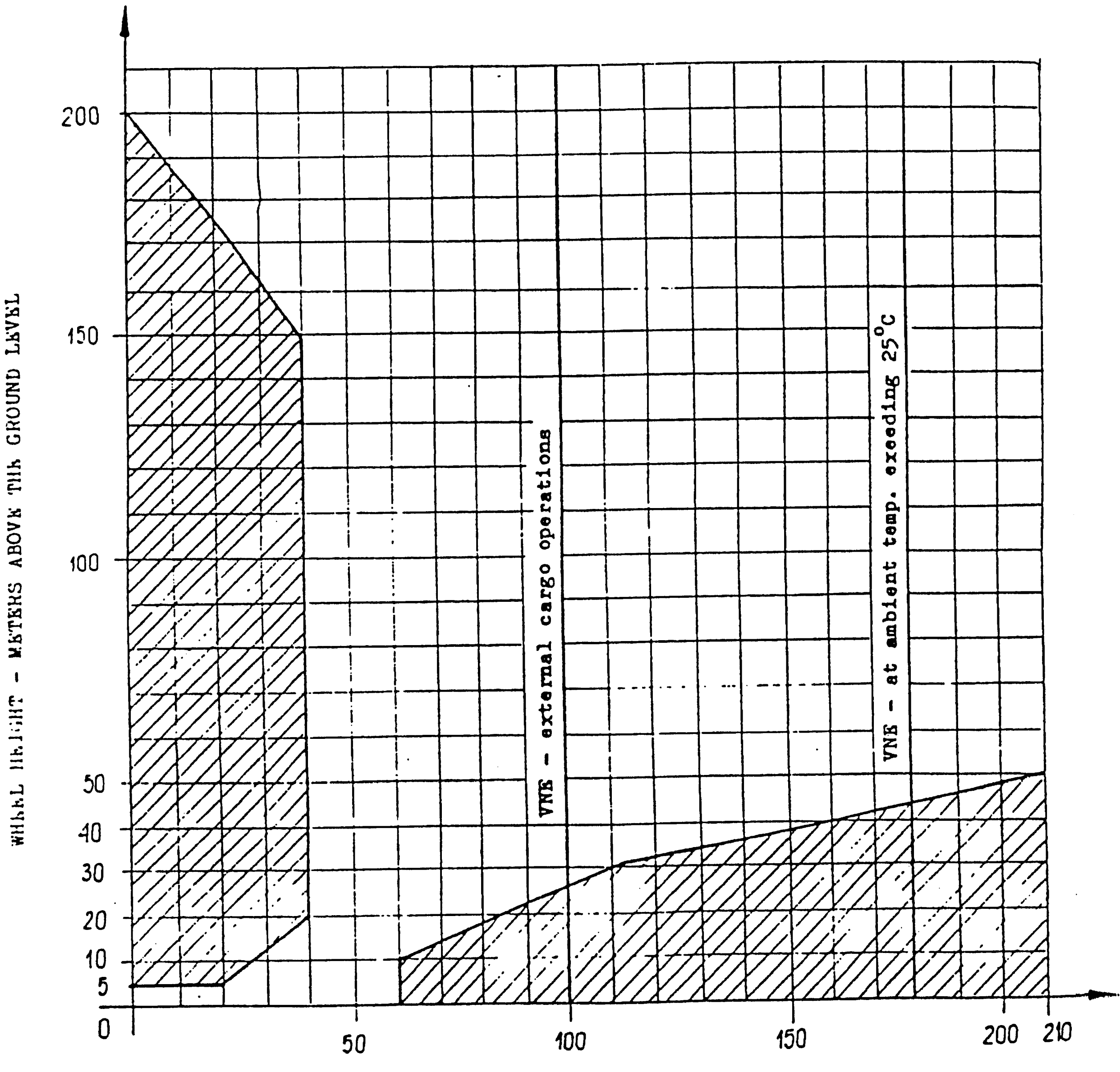


Fig. 2.2. HEIGHT - VELOCITY DIAGRAM

NOTES: 1/ The L.H. branch of the H-V diagram, up to a height of 50 m represents the distance between the helicopter wheels and the ground.

2/ The R.H. branch of the H-V diagram, up to a height of 50 m represents the distance between the helicopter wheels and obstacles.

2.2.2. RATE OF DESCENT

The rate descent is not limited. The rate of vertical descent is limited to maximum allowable value of 3 m/s due to probable vortex ring.

2.2.3. SIDEWARD AND BACKWARD FLIGHT AIRSPEED

Sideward and backward flight air speed at 10 m or less above ground is limited to maximum allowable value of 10 km/h, which corresponds to the speed of fast walk.

2.2.4. WIND VELOCITY

It is not allowed to operate the helicopter at head -wind velocity exceeding 15 m/s.
Cross and tail wind components at takeoff, landing, hovering and turns should not exceed 5 m/s.

It is allowed to use the helicopter for rescue operations at wind velocities up to 18 m/s.

2.2.5. ALTITUDE

Maximum allowable flight altitude of the helicopter is limited to 4000 m measured by the altimeter set to po = 760 mm Hg for H=0m.

2.2.6. MAIN ROTOR SPEED

Maximum and minimum speed of main rotor are included in table II 2.

Table II MAIN ROTOR SPEED

CONDITION	MAIN ROTOR RPM %	
	Minimum	Maximum
Transient	76 Y/	86x/
Continuous	78	84

x/ up to 30 seconds y/ up to 15 seconds

NOTE

Main rotor RPM should be equal to transient value for range 54 % to 75 % when operating the engines at "low power ". Maximum transient time - 20 seconds.

2.2.7. BANKING IN TURNS

Maximum allowable bank angle in turns is 30°.

2.2.8. RATE OF HOVERING TURNS

Maximum allowable rate of turn in a hover is 12° /sec. which corresponds to a 360° turn in 30 seconds.

2.2.9. DURATION OF FLIGHT WITH ONE ENGINE INOPERATIVE

Duration of helicopter flight with one-engine inoperative, is limited to the time absolutely necessary to reach the nearest suitable landing site.

2.3. CENTER OF GRAVITY LOCATION

The center of gravity limits are shown in Table II-3 below.

TABLE II-3. CENTER OF GRAVITY LIMITS

Center of gravity	Center of gravity location /m/	
	As measured about the main rotor axis /"+" forward "-" backward/	As measured in reference coordinates
Front	+0.185	2.905
Rear	-0.010	3.100
Rear in a hover x/	-0.055	3.145

For the method of determining the center of gravity location in reference coordinates see Appendix No. 1 "Helicopter Weight and Center of Gravity Calculation".

x/ For the LPG-4 hoist operation in a hover or slow movement above the ground.

2.4. POWERPLANT LIMITATIONS

2.4.1. GAS PRODUCER SPEED

The GTD-350 gas producer speed limits depend on the rating periods as follows:

TABLE II-4. TAKEOFF /6 MINUTES/

Ambient temperature in °C	Gas producer speed in % Series III and IV engines
-50	92.7
-40	93.4
-30	94.2
-20	94.8
-10	95.5
0	96.3
+10	97.0
+15	97.3
+20	97.6
+25	97.0
+30	96.4
+40	95.0
+50	93.6

Maximum allowable gas producer speed /at takeoff /6 minutes/ power/ must not exeed 101 % for any flight regime.

TABLE II-5. ONE-HOUR OPERATION

Ambient temperature in °C	Gas producer speed in % Series III and IV engines
from -50 to -40	84.0
from -40 to -15	87.2
from -15 to +60	90.0

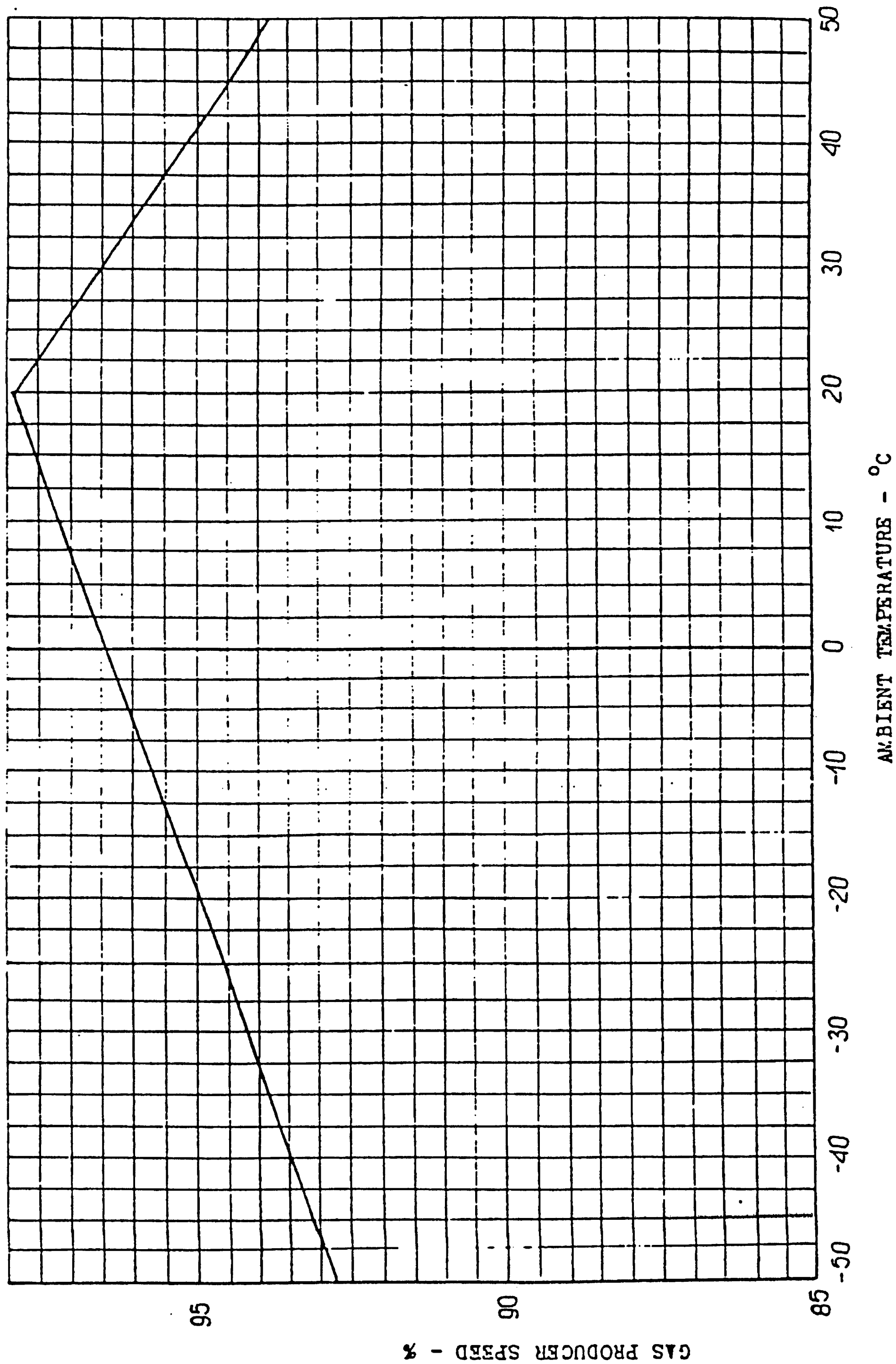


Fig. 2.3. MAXIMUM ALLOWABLE GAS PRODUCER SPEED AT TAKEOFF POWER /series III and IV engines/

TABLE II-6. CONTINUOUS OPERATION

Ambient temperature in °C	Gas producer speed in %
	Series III and IV engines
from -50 to -40	82.0
from -40 to -15	85.2
from -15 to +60	88.6

Maximum allowable gas producer speed limits for any flight regime.

Ambient temperature in °C	ONE-HOUR OPERATION	CONTINUOUS OPERATION
-50 - -40	89	85.5
-40 - -15	92	88.5
-15 - +60	95	91

2.4.2. GAS TEMPERATURE

TABLE II-7

Operating condition	Maximum Turbine Inlet Temperature in °C
	Series III and IV engines
Takeoff /6 min/	970
One-Hour	920
Normal Cruise	890
Ground Idle	790

2.4.3. ENGINE OIL TEMPERATURE

Minimum allowable temperature .... 30°C

Maximum allowable temperature .... 140°C

2.4.4. MAIN GEARBOX OIL TEMPERATURE

Maximum allowable temperature .... 90°C

2.4.5. ENGINE OIL PRESSURE

Minimum oil pressure at Ground Idle .... 1.5 kG/cm^2
Minimum oil pressure at any power above Ground Idle .... 2.5 kG/cm^2
Maximum oil pressure at any power above Ground Idle .... 3.5 kG/cm^2

2.4.6. MAIN GEARBOX OIL PRESSURE

Minimum allowable pressure .... 1.2 kG/cm^2
Maximum allowable pressure .... 8 kG/cm^2

2.4.7. ENGINE RATINGS TIME LIMITS

The GTD-350 engine is allowed to be operated continuously for the following periods of time depending on the power range:

at Takeoff power .... 6 min.
at One-Hour power .... 60 min.
at Maximum Continuous /cruising/ power .... unrestricted
at Ground Idle .... 20 min.

Total time of engine operation at each power range with relation to the TBO /Time Between Overhauls/ should not exceed the following percentage:

Takeoff power .... 5 %
One-Hour power 40%
Max Continuous and below unrestricted

2.4.8. WARMING UP AND COOLING DOWN TIME

Minimum time of engine warming up at Ground Idle before increasing power ... 1 min.

Minimum time of engine cooling down at Ground Idle before shutdown .... 1 min.

in winter .... 2 min.

Minimum time of starter cooling down after each start attempt

/up to 5 attempts/ .... 3 min.

Minimum time of starter cooling down after 5 successive start attempts .....30 min.

2.5. FUELS AND LUBRICANTS

The only fuels and lubricanta to be used in the Mi-2 helicopter are listed in Table II-8.

TABLE II-8. FUELS AND LUBRICANTS

Item	Assembly (system)	Grade (type), Standard No.	Remarks on operation
1	2	3	4
1	FUEL SYSTEM	1. T1 acc. to GOST 10227-86 2. T2 acc. to GOST 10227-86 with PMAM-2 additive. 3. TS-1 acc. to GOST 10227-86 4. TS-1G /T-7/ acc. to GOST 12308-80 with PMAM-2 additive 5. PSM-2 acc. to PN-86/C-96026 6. RT acc. to GOST 10227-86 7. PL-6 acc. to CSN 65 6518 8. JET A-1 acc. to DERD 2494	
2	ENGINE OIL SYSTEM	1. B-3W acc. to MRTU-38-1-157-65 or acc. to TU 38-101295-75 2. Aeroshell Turbine Oil 500 /Asto 500/ acc. to MIL-L-23699 3. Castrol 5000 acc. to MIL-L-23699C 4. Castrol 98 acc. to DERD 2487 5. Elf Turbo Jet II acc. to MIL-L-23699	Exxon 2380 Mobil Jet II
3	MAIN GEARBOX	1. Oil mixture: hypoid gear oil acc. to GOST 4003-53 and AMG-10 oil acc. to GOST 6794-75 / voluminal mixing ratio 2:1/	- for direct lubrication - oil temperature in main gear-box during starting not lower than minus 10°C.
		2. TS-gip acc. to OST 38-01260-82 incl. Supplement 1 and 2	- mixture component acc. to item 1 instead of hypoid gear oil
		3. Aeroshell Fluid 4 acc. to MIL-H-5606D	- mixture components acc. to item 1 to be used instead of AMG-10 oil.
		4. Aeroshell Fluid 41 acc. to MIL-H-5606D	
		5. Shell Aviation Oil S 8350 acc. to DTD 900/4981 or MIL-L-2105 / grade 90/	- for direct lubrication - oil temperature in main gear-box during starting not lower than plus 5°C.
		6. Hipol 10F acc. to TWT RNJe 10/L/75	- for direct lubrication - oil temperature in main gear-box during starting not lower than minus 5°C.

TABLE II-3, FUELS AND LUBRICANTS

Item	Assembly /system/	Grade /type/, standard No.	Remarks on operation
1	2	3	4
4	INTERMEDIATE AND TAIL ROTOR GEARBOX	1. Hypoid gear oil acc. to GOST 4003-53	- for direct lubrication - to be used for temperatures greater than 0°C and momentary temperature decrease to -5°C.
		2. Oil mixture: hypoid gear oil acc. to GOST 4003-53 and AMG-10 oil acc, to GOST 6794-75 / voluminal mixing ratio 2:1/	- for direct lubrication - below temperature of +5°C - heat up the gearbox when starting below temperature of minus 25°C
		3. TS- gip	- for direct lubrication - mixture component according to a/m Item 2 to be used instead of hypoid gear oil.
		4. AeroShell Fluid 4 5. AeroShell Fluid 41	- mixture components acc. to Item 2 to be used instead of AMG-10 oil
		6. Shell Aviation S8350 7, Hipol 10F	- for direct lubrication - heat up the gearbox when starting at temperatures below minus 10°C /for S 8350/ and below minus 15°C /for Hipol 10F/
5	HYDRAULIC SYSTEM	1. AMG-10 2. AeroShell Fluid 4 3, AeroShell Fluid 41	

NOTE:1. It is prohibited to mix S8350 oil with hypoid gear oil or TS-gip oil /or with any mixtures containing such oil grades/ as well as with Hipol 10F oil.

2. Oil grade change procedure included in the following Manuals:

- for engine oil system - according to "Operation and Maintenance Manual for GTD-350 Engine"
- for WR-2 Main Gearbox oil system - according to "Operation and Maintenance Manual for WR-2 Main Gearbox",

- for other systems installed on Mi-2 helicopter- according to " Maintenance Manual for Mi-2 Helicopter, Airframe" including complete list of lubricants to be used.

2.6. MISCELANEOUS LIMITATIONS

2.6.1. FLIGHT TIME IN ICING CONDITIONS

No limitations

2.6.2. FLIGHT DURATION IN PRECIPITATION

No limitations

2.6.3. AEROBATICS

No aerobatic maneuvers allowed.

2.6.4. NIGHT FLIGHTS

VFR flights at altitudes up to 1,000 m / Above Ground Level/ are allowed without any time limit.

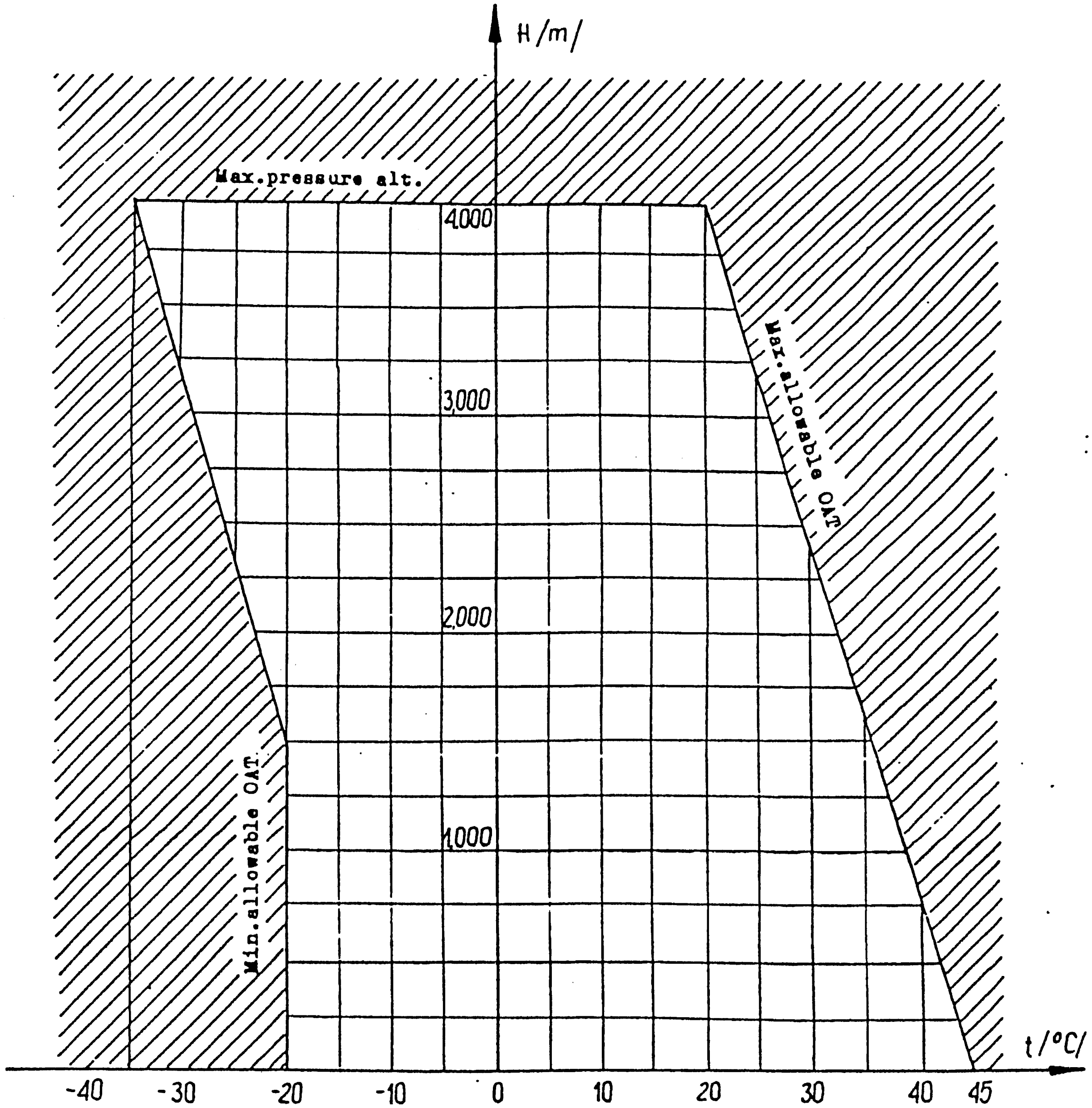


Fig. 2.4. AMBIENT AIR TEMPERATURE LIMIT CHART

2.6.5. CLIMATIC CONDITIONS

The Mi-2 helicopter is designed and approved for operation in temperate and dry tropical climatic zones /see Fig. 2-5/. It is forbidden to operate the Mi-2 helicopter beyond the ambient temperature limits as in Fig. 2-5.

2.6.6. OPERATION WITH CARGO ON THE HOOK

Maximum allowable external cargo weight is 800 kg
Maximum allowable airspeed for external cargo operation is 100 km/h.

2.6.7. LPG-4 HOIST OPERATION

Maximum load weight is 120 kg.

W A R N I N G

IT IS FORBIDDEN TO FLY WITH A LOAD ON THE HOIST EXCEPT HOVERING AND MOVING SLOWLY ABOVE THE GROUND.

2.6.8. MAXIMUM CARGO WEIGHT

Maximum internal cargo weight is 700 kg.

2.6.9. TRAINING FLIGHTS

While operating a dual - controls version a ballast on the tail skid is required.

N O T E

It is not recommended to use a dual controls version for other than training flights.

2.6.10. TAKEOFF DISTANCE

The takeoff distance to allow for a safe landing without changing the flight direction in case of one engine failure at height of 10 m or below, and speed of 70 km/h, is minimum 250 m.

2.6.11. UNUSABLE FUEL

The minimum quantity of fuel, up to which the flight may be continued, is 100 litres.

C H A P T E R III

NORMAL PROCEDURES

CHAPTER III - TABLE OF CONTENTS

CHAPTER III

NORMAL PROCEDURES

3.1. PRE-FLIGHT PROCEDURE

3.1.1. CHECKING FOR POSSIBLE LIMITATIONS

Taking into account expected flight conditions, check which limitations contained in Chapter II "LIMITATIONS" are applicable to this flight as regards gross weight, airfield altitude above sea level, weather, etc.

3.1.2. WEIGHT AND BALANCE

Calculate the actual helicopter takeoff weight and determine its center of gravity location. Compare the results with the weight and center of gravity limits contained in Chapter II "LIMITATIONS".

NOTES: 1/ When determining the takeoff weight with regard to wind /of variable speed/, the minimum wind speed should be considered.

2/ If the ambient temperature and wind speed in the place of anticipated landing are unknown, use the ambient temperature of takeoff airfield and the wind speed equal to zero to determine the takeoff weight.

3/ When the helicopter is provided with single controls the passengers take their seats acc. to the seat numbers.

In order to carry one passenger /crew member/ on the front seat, a ballast of min. 50 kg must be placed on the floor at frame No. 9F.

When the helicopter is provided with dual controls the passengers take the seats from 4 to 7 /in the case of four passengers/ in the order of increasing seat numbers.

3.2. CHECKING HELICOPTER READINESS FOR FLIGHT

By asking the technician in charge make sure that all pre-flight work on the helicopter has been completed in compliance with the Maintenance Manual and obtain information about fuel and oil quantities, as well as about oil levels in the blade damper oil reservoir and the main, intermediate and tail rotor gearboxes.

3.3. EXTERIOR PRE-FLIGHT INSPECTION

Make the exterior inspection in the following sequence /Fig. 3-1/ to check whether the requirements listed below are fulfilled.

1. Nose

Battery compartment lid	-	closed
Nose landing gear	-	no leakage, proper tire inflation
Engine air intakes	-	uncovered
Anti-radiant guard of RIO-3 icing detector	-	removed
Windscreen	-	clean, no cracks

2. Fuselage - right side

Cockpit door	-	proper operation of hinges and latches, glass clean, no cracks.
Windows	-	clean, no cracks
Fuel filler lid	-	closed
Charging valves lid	-	closed
Position light	-	no damage
Engine drain lid	-	closed
Main RH landing gear	-	no leakage, proper tire inflation
Rotor hub and swashplate	-	no damage, all protection in place
Main rotor blades	-	no damage, clean of dust, red crack indicators invisible
RH engine exhaust pipes	-	covers removed, surface clean, no damage, no fuel leakage
Engine and gearbox cowlings	-	all locks fastened
Engine mounting plate drain outlet	-	clean, unclogged

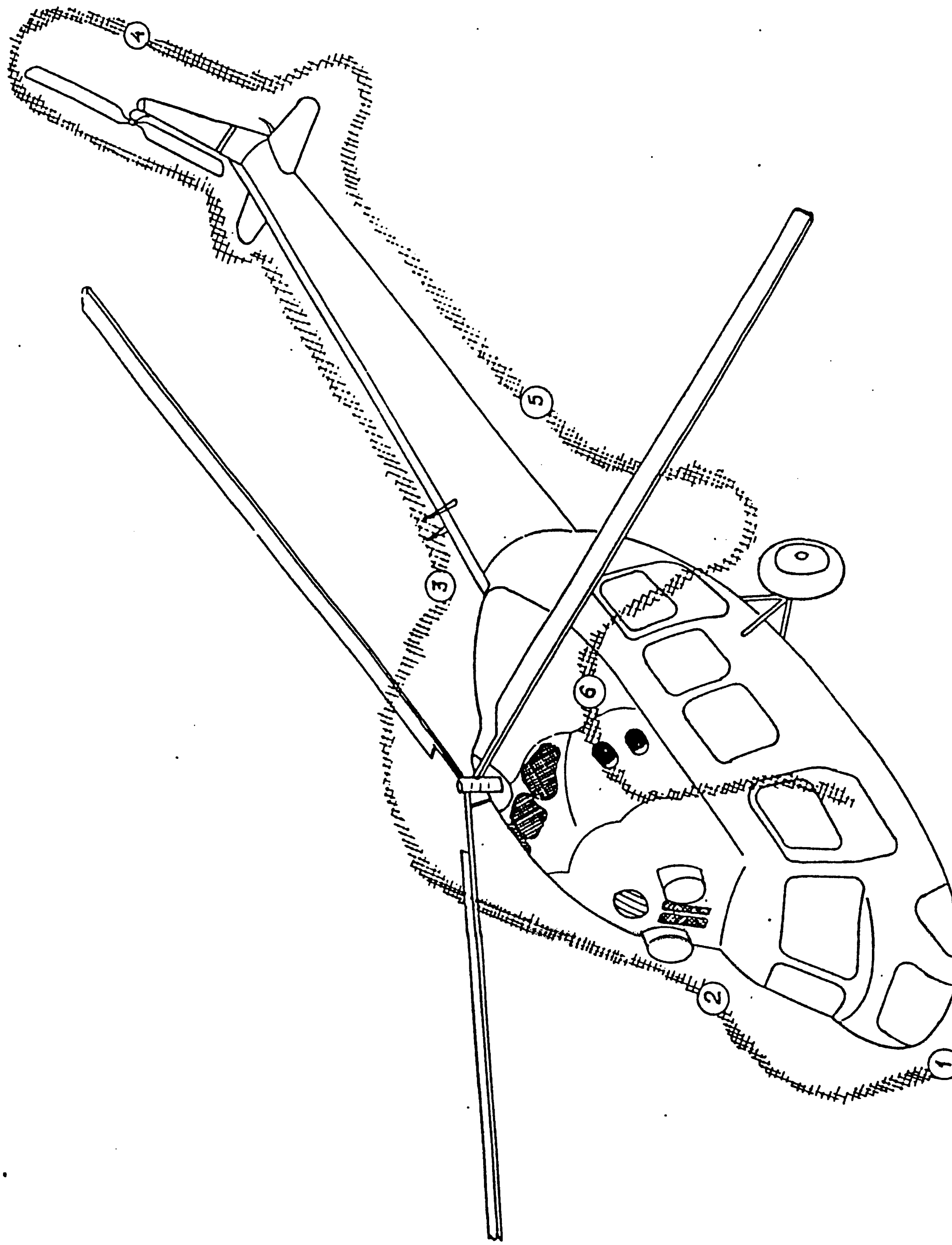


Fig. 3-1 PRE-FLIGHT INSPECTION SEQUENCE

Heater outlet - clean, unclogged

Vent - clean, unclogged

Compressor bleed-air outlet - clean, unclogged

Fuel filling light cover - closed

Engine oil drain outlet - clean, unclogged

3. Tail boom - right side

   Antennas - no damage

   Intermediate gearbox - no oil leakage

   Tail rotor drive shaft cover - secured

   Tail boom surface - no damage, clean

4. Tail boom - full aft

   Tail rotor - moves freely on its hinge, no damage to rotor blades.

   Tail skid - no damage

   Tail rotor gearbox - no oil leakage

   Anti-collision light - no damage

   Tail position light - no damage

5. Tail boom - left side

   Follow the same procedure as under 3 above

6. Fuselage - left side

   Rear cabin door - proper operation of hinges, latches and locking mechanism, glass clean, no cracks

   Windows - clean, no cracks

   Main LH landing gear - no leakage, proper tire inflation

   Front /pilot's/ door - proper operation of latch, glass clean, no cracks

   Position light - no damage

   Antennas guards under the fuselage - no damage

   Rotor hub and swashplate - no damage

   Main rotor blades - no damage, surface clear of dust, red crack indicators invisible

   LH engine exhaust pipes - covers removed

   Pitot tube - cover removed, free of obstruction, no damage

Fuselage skin - no damage, clean, no fuel leakage

Engine and gearbox cowlings - all locks fastened

Compressor bleed-air outlet - free of obstruction

Heater outlet - clean, unclogged

Engine mounting plate drain outlet - clean, free of obstruction

3.4. INTERIOR PRE-FLIGHT INSPECTION

Make the interior inspection in order to check whether the following requirements are fulfilled:

1. Front LH and RH doors - closed
2. Rear door - closed and safely locked /with a lever at the door and a knob on the left of the pilot's head/.
3. Pneumatic system - minimum pressure 50 kG/cm^2
4. Air-tightness of pneumatic system - no braking pressure drop when the brake is engaged
5. Pilot's seat - adjusted
6. Collapsible seat next to the pilot - safely locked
7. Flight controls - free movement, no jamming
8. Single engine control levers - locked in center position
9. Collective pith lever - lowered fully down, twist grip fully left /idle/
10. Fuel shut-off valves - closed, levers fully up
11. Engine shut-down levers - fully down
12. Attitude indicators - blocked
13. Safety belts - attached to all seats
14. Compressor bleed-air valves - closed
15. Rotor brake - engaged, lever lifted up.
16. All switches on the circuit-breaker panel /Fig.1-12/ - "off" /down/
17. ADF switch - in "OFF" position
18. Wheel brake - engaged, air pressure in pneumatic system 50^{+4} kG/cm^2 and in the wheel braking system $24^{-2.5}$ kG/cm^2
19. Fire extinguishing system switch - in lower position /CHECK/
20. Upper control panel switches /Fig. 1-19/

    LH generator switch - in off /down/

    RH generator switch - off /down/

    "BATTERY /EXTERNAL POWER" switch - in central position.

Anti-icing system switch - in central position

Windscreen heating switch - down position

Engine anti-ice off - "ENGINES WARMING UP" switch — down

3.5. PRE-START CHECK

In order to make the final pre - start check, the following should be done:

1. "BATTERY /EXTERNAL POWER" switch - place to "BATTERY" position /up/
2. Switch on battery supply - "EL. NETWORK ON BATTERY" switch in "ON"
3. Check battery voltage - 4-position switch in the left section of upper control panel place to upper position marked "BATTERY". Reading on adjacent voltmeter.
4. Switch on circuit - breaker of indicator lights - switch marked "WARNING LAMP DIMMING" in upper position.
5. Switch on two upper rows of circuit - breakers, all switches in up positions.
6. Switch on the 115 VAC inverter circuit breaker - "PO-250" switch up.
7. Switch on the circuit-breaker of automatic power supply change - switch marked "AUT. FEED CHANGE OVER".
8. Switch on the automatic pump change-over system - "PUMPS AUTOM.SWITCHING OVER" switch on the upper control panel in the upper position
9. Open fuel - shut off valves

Testing procedure:

10. Check the warning, caution and advisory lights for proper condition - collective switch on the upper control panel in "ON" position.

    After that, all lights should go on. After checking, place the switch back to "OFF".

11. Check the automatic pump change - over system:

    a. depress the push - button "1 PUMP SWITCHING ON" - the "PUMP Nr 2 OPERATES" advisory light should go off and the "PUMP NR 1 OPERATES" advisory light will go on,

    b. switch off the No 1 pump circuit-breaker - the "PUMP NR 1 OPERATES" advisory light will go off and the "PUMP NR 2 OPERATES" advisory light will go on,

    c. switch on the No 1 pump circuit breaker,

    d. depress the push - button "1 PUMP SWITCHING ON" - the No 1 pump will return to operation.

12. Check the 115V inverter for proper operation:
   - place the 115V inverter switch to upper position. A hum of operating inverter should be heard and the pointers of engine and gearbox oil pressure indicators should move from their dead position to "0".
   - after checking, place the 115V inverter switch back to central position

13. Check the trimming system operation :
   - while moving the push-button on the cyclic stick . grip check whether the cyclic stick moves in the correct direction, and whether the indicator on the instrument panel indicates this movement;
   - trim the cyclic stick to "zero" /as indicated/.

14. Check the fuel quantity - reading on the indicator on the instrument panel.

15. Check the radio communication system for proper operation :
   - turn on "VHF" and "HF" circuit - breakers for a while on the upper left panel.

16. Check the cockpit and cabin lighting :
   - switch on the "LIGHTING" circuit breaker on the upper left control panel;
   - switch on the "CABINS LIGHTING" circuit breaker, on the upper control panel, by placing them in upper position /"ON"/.

17. Check instrument illumination with red light :
   - switch on three "RED LIGHT" circuit - brakers on the circuit - braker panel;
   - by turning appropriate knobs check the light intensity.

18. With the assistance of a person outside the helicopter check the position lights:
   - switch on the "POSIT. LIGHTS" switch on the upper left panel;
   - the light dimming switch, on the instrument panel, place successively to both positions;
   - with the "WARNING LAMP DIMMING" in the central position, depress the "SIGN." push-button several times;
   - check whether this causes all position lights to go on.

19. Check the landing light :
- switch on 2 switches marked HEADLIGHT - CONTR. and LIGHT on the upper left control panel;
- using the push-button on the collective pitch grip check the landing light resetting mechanism for operation;
- using the switch on the instrument panel, check the light dimming for operation.

20. Check the anti-collision light /with the assistance of a person outside the helicopter/ :
- switch on for a while the "ANTI-COLL.LTS" switch on the upper left control panel;
- check the lights for lighting and rotation.

3.6. STARTING ENGINES

Helicopter engines can be started on battery power, external power or on the starter - generator power of the running engine. The starting procedure described below is carried out after the final pre - start check /p.3.5./

C A U T I O N

WHEN START ATTEMPTS ARE REPEATED FOR THE SAME ENGINE THE FOLLOWING INTERVALS MUST BE OBSERVED :

BETWEEN EACH OF 5 SUCCESSIVE START ATTEMPTS AT LEAST 3 MINUTES,

AFTER 5 SUCCESSIVE START ATTEMPTS - 30 MINUTES.

3.6.1. STARTING ON BATTERY POWER

1. Set the helicopter against the wind and apply the wheel brake by depressing and locking the braking lever on cyclic stick grip.

C A U T I O N

WHEN SEVERAL HELICOPTERS ARE TO BE STARTED, THE ORDER OF STARTING THEM SHOULD PREVENT ANY AIRSTREAM IMPINGEMENT FROM THE OPERATING ROTOR OF ONE HELICOPTER UPON THE HELICOPTER JUST BEING STARTED.

C A U T I O N

IT IS NOT ALLOWED TO START ENGINES AT WIND SPEED EXEEDING 15 m/s. AND WITH A RH SIDE OR TAIL WIND COMPONENT EXEEDING 3 m/s AND 5 m/s RESPECTIVELY.

NOTE: While starting the helicopter in dusty or sandy environment it is recommended to pour some water over the area from which the helicopter will take off.

2. Make sure that covers are removed from the air intakes of both engines and exhaust pipes.

3. Make sure that fire extinguishing equipment is available nearby /i.e. fire-engine, fire truck or fire extinguisher/.

4. Fasten the safety belts.

5. Release the main rotor brake - rotor brake lever down.

6. Turn on the fire extinguishing system - the switch on the triangular control panel of the fire extinguishing system "ON".

7. Make sure that generator switches of both engines on the upper control panel /section marked DIRECT CURRENT/ are placed to "ON" /up./.

8. Switch on the ammeters - the switch on the upper control panel /section marked DIRECT CURRENT/ in the upper position.

9. Make sure that the following controls are in starting positions :
   - collective pitch lever down
   - twist grip turned left
   - cyclic stick in neutral position /as indicated/
   - single engine control levers in neutral position
   - tail rotor pedals in neutral position

10. Turn on the 115 V inverter-the switch on the upper control panel in the upper position

11. Turn on the starting system of the engine to be started , the LEFT/RIGHT switch on the upper control panel /between the starting push - buttons/ in LH or RH position depending on which engine is to be started.

    - "RUNNING/STARTING" switch - place to "STARTING" position

WARNING

JUST BEFORE STARTING THE ENGINE MAKE SURE THAT NOBODY IS WITHIN THE REACH OF THE MAIN AND TAIL ROTORS, AND EXHAUST PIPES.

12. Press for 2 - 3 sec. the starting push - button.

13. Open the fuel supply line - engine shut-down lever /LH or RH correspondingly/ fully up.

N O T E

Depressing the starting push-buttons will turn the "STARTING CONTINUES" caution light on, which indicates that the starting cycle is in progress. The cycle lasts for about 30 seconds.

14. Start the stop-watch on the instrument panel by depressing the RH knob of the clock.

N O T E

Fuel supply opening, depressing the starting push-buttion and starting the stop-watch should be done at the same time, if possible.

15. Monitor the increase of gas producer speed, turbine inlet temperature, oil pressure and the starting cycle time.
At the end of the starting cycle oil pressure should be within 1.5 to 3 kG/cm^2.

C A U T I O N

THE STARTING CYCLE MUST BE ABORTED IF ANY OF THE FOLLOWING OCCURS: TURBINE INLET TEMPERATURE IS HIGHER THAN ALLOWABLE AS FROM DIAGRAM IN THE GTD-350 ENGINE MANUAL, HUNG STARTING, FAILURE TO REACH IDLE RPM IN 40 SECONDS, FUEL OR OLL LEAKAGE, OR OTHER MALFUNCTIONS. THE STARTING CYCLE CAN BE ABORTED BY DEPRESSING THE LARGE PUSH-BUTTON /INTERRUPT STARTING/ ON THE UPPER CONTROL PANEL AND SIMULATANEOUS CUTTING OFF FUEL SUPPLY TO THE ENGINE BY RESETTING THE ENGINE SHUT-DOWN LEVER TO FULLY DOWN.

16. If the engine starting has been completed properly, and the engine reached its idle RPM of 57 ± 3 %, reset the "LEFT/RIGHT" switch on the upper control panel into the position appropriate for the engine to be started /left or right/.

17. By pressing the right knob of the clock, stop the stop-watch, and press it again to set the stop-watch on "O".

C A U T I O N

MAXIMUM 3 START ATTEMPTS CAN BE MADE ON BATTERY POWER WITH INTERVALS OF AT LEAST 3 MINUTES BETWEEN EACH OF THEM.

18. Start the other engine by repeating the entire procedure from 12 do 15 above. During start of second engine utilizing battery electrical power the generator switch of the running engine should be off for the time of starting the engine.

19. If the engine starting has been completed properly and the engine has reached its idle RPM of 57 ± 3 %, reset the start "LEFT/RIGHT" swith on the upper control panel into central position.

20. Stop the stop-watch, by pressing the RH knob of the clock, and set it on "O" by pressing the knob again.

21. Place the "EL. NETWORK ON BATTERY" switch to "OFF".

3.6.2. STARTING ON EXTERNAL POWER

1. Set the helicopter against the wind and apply the wheel brake by depressing and locking the brake lever on the cyclic stick grip.

C A U T I O N

WHEN SEVERAL HELICOPTERS ARE TO BE STARTED, THE ORDER OF STARTING THEM SHOULD PREVENT ANY AIRSTREAM IMPINGEMENT FROM THE OPERATING ROTOR OF ONE HELICOPTER UPON THE HELICOPTER JUST BEING STARTED.

C A U T I O N

IT IS NOT ALLOWED TO START ENGINES AT WIND SPEED EXCEEDING 15 m/s AND WITH A RH SIDE OR TAIL WIND COMPONENT EXEEDING 3 m/s AND 5 m/s RESPECTIVELY.

N O T E

While starting the helicopter in dusty or sandy environment it is recommended to pour some water over the area from which the helicopter will take off.

2. Make sure that covers are removed from the air intakes of both engines and exhaust pipes.

3. Make sure that fire extinguishing equipment is available nearby /i.e. fire-engine, fire truck or fire extinguisher/.

4. Fasten the safety belts.

5. Release the main rotor brake - rotor brake lever down.

6. Switch off the battery power supply - the "BATTERY/EXTERNAL POWER" switch in the central position.
7. Connect the ground power unit to the external power receptacle.
8. Place the "BATTERY/EXTERNAL POWER" switch to "EXTERNAL POWER" positon /down./
9. Check the voltage - 3-position switch in the LH section of the upper control panel set in the upper position marked "BATTERY", reading on the voltmeter.
10. Turn on the fire extinguishing system - the switch on the triangular control panel of the extinguishing system, placed to "ON" /up/.
11. By depressing the push-button on the upper control panel turn on the No. 1 fuel pump- the "PUMP" NR 1 OPERATES" advisory light will go on.
12. Switch on both engine generators - the switches on the upper control panel /section marked "DIRECT CURRENT" place to "ON" /up./.
13. Switch on the ammeters - the switch on the upper control panel /section marked DIRECT CURRENT/ in the upper position.
14. Make sure that the following controls are in starting positions :
    - collective pitch lever down, twist grip turned left
    - cyclic stick in neutral position
    - single engine control levers in neutral position
    - tail rotor pedals in neutral position .
15. Turn on the 115V inverter-the switch on the upper control panel in the upper position.
16. Turn on the starting system of the engine to be started , the "LEFT/RIGHT" switch on the upper control panel, between the starting push-buttons in LH or RH position, depending on which engine is to be started.

WARNING

JUST BEFORE STARTING THE ENGINE MAKE SURE THAT NOBODY IS WITHIN THE REACH OF MAIN AND TAIL ROTORS, AND EXHAUST PIPES.

17. Press for 2 - 3 sec the starting push - button
18. Open the fuel supply line - the appropriate /LH or RH/ engine shut — down lever fully up.
19. Start the stop-watch on the instrument panel by depressing the RH knob of the clock.
20. Monitor the increase of gas producer RPM, turbine inlet temperature, oil pressure and the starting cycle time. At the end of the starting cycle oil pressure should be within 1.5. to 3 kG/cm^2.

21. If the engine starting has been completed properly, and the engine has reached its idle RPM of 57 ± 3 % reset the "LEFT/RIGHT" switch on the upper control panel into the position appropriate for the engine to be started /left or right/.
22. Start the other engine by repeating the entire procedure from 17 to 20 above.
23. If the engine starting has been completed properly, and the engine has reached its idle RPM of 57 ± 3 %, reset the LEFT/RIGHT switch on the upper control panel into the central position.
24. Stop the stop-watch, by pressing the RH knob of the clock, and set it on "0" by pressing the knob again.
25. Turn on the battery power supply - the "BATTERY/EXTERNAL POWER" switch on the upper control panel /section marked DIRECT CURRENT/ in the upper position.
26. Disconnect the ground power unit.

3.6.3. STARTING FROM RUNNING ENGINE GENERATOR

If it is required to use the generator of the already running engine to start the other one, follow the same procedure as under 1 to 16 in section 3.6.1., and after that proceed as follows :

1. Allow the already started engine to operate for 2 - 3 minutes at idle until the minimum oil temperature of 30°C is reached.
2. Using the appropriate single engine control lever increase the gas producer RPM of the running engine up to 83 - 85 %.
3. Press for 2 - 3 seconds the starting push-button.
4. Open the fuel supply line - the appropriate /LH or RH/ engine shut-down lever fully up.
5. Start the stop-watch on the instrument panel by depressing the RH knob of the clock.
6. Monitor the increase of gas producer RPM, turbine inlet temperature, oil pressure and the starting cycle time.
7. If the engine starting has been completed properly and the engine has reached its idle RPM of 57 ±3 %and the "STARTING CONTINUES" advisory light extinguishes, reset the LEFT/RIGHT switch on the upper control panel into the central position.
8. Reduce the speed of the engine whose generator was used to start the other engine by moving the single engine control lever into the central position.
9. Stop the stop-watch by pressing the RH knob of the clock and set it on "0" by pressing the knob again.
10. Set the "EL.NETWORK ON BATTERY" switch in "OFF" position.

3.6.4. CRANKING

1. Make sure that covers are removed from engine air intakes and exhaust pipes.
2. Release the main rotor brake - brake lever down.
3. Place the "RUNNING/STARTING" switch on the upper control panel to "RUNNING".
4. Turn on the fire extinguishing system - the switch on the triangular control panel of the fire extinguishing system to "ON".
5. Turn on the starting system of the engine to be cranked-the "LEFT/RIGHT" swith on the upper control panel /between the starting push-buttons/ in LH or RH position, depending on which engine is to be cranked.
6. Press for 2 to 3 seconds the starting push-button on the upper control panel.

NOTE

Depressing the starting push-button will turn the "STARTING CONTINUES" caution light on, which indicates that the cranking cycle is continued. The cycle lasts about 30 seconds.

7. Start the stop-watch by pressing the RH knob of the clock.

NOTE

The starting push-button and the stop-watch knob should be pressed simultaneously, if possible.

CAUTION

ENGINE CRANKING IS OBLIGATORY AFTER AN UNSUCCESSFUL START AND BEFORE STARTING THE ENGINE WHICH REMAINED INOPERATIVE FOR MORE THAN 2 HOURS.

8. After completing the cranking cycle/the "STARTING CONTINUES" light extinguishes/ reset the "LEFT/RIGHT" switch on the upper control panel to central position.
9. Stop the stop-watch by depressing the RH knob of the clock and set its pointer on "0" by depressing the knob again.

3.7. ENGINE WARM-UP AND RUN-UP

After completing the starting cycle and setting the engine to idling perform the following procedure:

1. Set the trimmers in the central position with both pointers of the trimmers on "0".
2. Maintain the engine idling until the engine oil temperature will reach 30°C.

   The engine idling time not shorter than 1 minute in summer and not shorter than 2 minutes in winter.

3. Turn on the hydraulic system - place appropriate switch on the upper control panel in "ON" /upper/ position. A red light described as "HYDRAULIC SYSTEM FAILURE" should go off.

4. Check the engine working parameters:

-Gas producer RPM/in %/	57 $\pm$3%
-Turbine inlet temperature	maximum 790°C
-Engine oil pressure	minimum 1,5 kG/cm2
-Main rotor RPM	50^{+4}_{-10} %

5. Move the cyclic stick in longitudinal and lateral direction. During this movement the pressure gauge of hydraulic system should indicate from 63$\pm$2 to 80 $\pm$ 4 kG/cm2.
6. Turn off the hydraulic system -the switch on the upper control panel in lower /OFF/ position. The red warning light described as HYDRAULIC SYSTEM FAILURE is on.
7. Move the cyclic stick in the longitudinal and lateral direction. Longitudinal and lateral movements of the cyclic stick are connected with considerable forces.
8. Actuate the hydraulic system again.

WARNING

THE ENGINE RUNUP IN CASE OF HELICOPTER WEIGHT NOT EXCEEDING 3200 KG CAN BE PERFORMED DURING TIED START ONLY.

9. Make sure that the collective pitch lever is in extreme lower position. Turn the twist grip to the extreme right position and reset the single engine control lever of the engine to be tested to the extreme upper position.

   Set the gas producer RPM range between 65 and 70% for the engine not to be tested by resetting the single control lever to the extreme lower position.

10. Check the engine rating for 1 cruising power.
    Set the gas producer RPM to 87,5% and maintain it for 10 to 15 seconds by moving of the collective pitch lever. When moving the collective pitch lever upwards maintain the gas producer RPM for the engine which is not tested , within 65 to 70% rotating the twist grip to the left ; or further , by moving of the single engine control lever for this lever.

    Check the engine instruments indications at cruising power:

Turbine inlet temperature	maximum 890°C
Engine oil pressure	3$\pm$0,5 kG/cm2

Engine oil temperature — 30 up to 140°C

Main rotor RPM — maximum 84%

NOTE

At ambient temperature from -20°C to -40°C set the gas producer RPM to 85%.

11. Check the engine rated power . Set the gas producer RPM to 90% by pulling up the collective pitch lever and maintain this value for 10 up 15 seconds. When pulling up the collective pitch lever maintain the gas producer RPM at 65 up to 70% acc. to procedure included in Item 10 for the engine which is not tested.

    Check the operating parameters:

Turbine inlet temperature	maximum 920 mm
Engine oil pressure	3+_ 0,5 kG/cm²
Main rotor RPM	82 ±1%
Engine oil temperature	30 up to 140°C

NOTE

At ambient temperature from -20°C to 40°C set the gas producer RPM to 87%.

12. Check the engine at akeoff power. Pull the collective pitch lever to obtain RPM acc. to Table II-4 and FIG. 2 - 3 /Section II page 8 and 9/ . After setting the gas producer RPM maintain it for 10 up to 15 seconds. When pulling up the collective pitch lever . maintain the gas producer RPM from 65 to 70% for the engine which is not tested proceeding acc. to Item 10. Check the working parameters.

Turbine inlet temperature	maximum 970°C
Engine oil pressure	3+ 0,5 kG/cm²
Engine oil temperature	30 -140°C
Main rotor RPM	79 ± 1%

NOTE

At ambient temperature below -30°C the engine may not reach RPM acc. to FIG. 2-3. As it is quite normal , do not perform any adjustments of the engine fuel pump.

13. Move the collective pitch lever to the extreme lower position. Turn the twist grip to the extreme left position.
14. Set the single engine control lever of the engine which is tested to the central /neutral/ position.
15. Repeat the procedure included in Items from 9 to 13 for another engine.
16. Set both single engine control levers to central position ,turn the twist grip o to the extreme left position and make it sure if the both engine are on idling.

17. Turn the twist grip fully to the right and pull up the collective pitch lever to obtain the gas producer RPM for both engines of 80 %.

18. Check each of two generators for proper operation by switching them off individually. Note the voltage reading on the voltmeter on the upper control panel. The voltmeter should read 28.5 V for each generator.

19. Check the synchronized operation of both generators. To this end switch on both generators /after 15 minutes of engine operation/ by moving the switches on the upper control panel to "ON". Then switch on any electrically powered equipment /e.g. fan, lights and the like/. Compare the readings of both ammeters. The readings should be identical.

20. Increase the main rotor speed up to at least 70 %.

21. On the circuit breaker panel switch on two switches of AC generator marked CONT. and EXCIT. /on the left in the RH lower row of switches/.
In order to warm up the RJO-3 icing detector, the switch marked "ANTI-ICING - SIGN." on the circuit braker panel should be switched on. During the warming up period the light marked "ANTI-ICING SYSTEM - ON" may go on and off only twice. With the STG-3 generators supplying power to the electrical system, the above light must not be on for more than 3 seconds /when no icing occurs/, otherwise it becomes necessary to warm up the icing detector by either of the following actions :

   a/ Turn the detector and generators off, and then switch the detector on and allow it to warm up for 3 minutes. When the light marked "ANTI-ICING SYSTEM ON" is off turn on the generators again.

   b/ Depress the push-button marked "RJO-3 HEATING CHECK"/RJO-3 HEATING EFFICIENT" light on/ and hold it in until the "ANTI-ICING SYSTEM ON" goes off. Turn on the "ANTI-ICING ON" switch in the left lower row of switches on the circuit-breaker panel.

22. Switch on the windscreen heating - the switch in the ANTI-ICING SYSTEM section of the upper control panel in "ON" position. Then touch the windscreen with your hand and if the windscreen temperature rises, reset the switch back into "OFF" position.

23. Check the anti-icing system of the main and tail rotor blades. To this end place the switch of anti-icing system on the upper control panel to MANUAL and monitor the voltage and amperage on the indicators. In order to read the amperage, place the switch below the ammeter successively to SECTION 1, SECTION 2, SECTION 3 and TAIL ROTOR.

The readings should be within the following limits :

voltage	$208^{+4.5}_{-6.5}$ V
amperage - 1-st section	56-66 A
amperage - 2-nd section	55-66 A

amperage - 3-rd section	50-64 A
amperage - tail rotor	14-17 A

N O T E

After placing the ammeter switch into a given position it may prove necessary to wait about 2 minutes to see the reading. It is due to the fact that individual sections of the main and tail rotor blades are heated in sequence. Each section is heated for 38 seconds.

C A U T I O N

SHOULD THE AMPERAGE EXCEED THE ABOVE LIMITS- ADJUST THE GENERATOR VOLTAGE WITH THE REGULATOR BELOW THE VOLTMETER ON THE UPPER CONTROL PANEL. FOR TOO HIGH AMPERAGE DECREASE VOLTAGE, FOR TOO LOW - INCREASE VOLTAGE

24. Turn off the anti-icing system - place the switch on the upper control panel into the central position and two switches on the circuit breaker panel marked "ON" and "SIGN." into lower positions.

25. Lower the collective pitch lever fully down, and turn the twist grip fully to the left to set the engines at idle.

3.8. PRE-TAKEOFF PROCEDURE

1. Adjust the friction of the twist grip as desired.
2. Adjust the pilot's seat for most convenient height.
3. Fasten the safety belts.
4. Switch on the 36V inverter - the "PT-125" switch on the circuit-breaker panel and on the upper control panel in the upper position.
5. Turn on the radio communication equipment /as required/ and board instruments, and check them for proper operation.
6. Check front and rear doors for proper locking.

N O T E

At ambient temperatures lower than - 10°C turn on the cabin heating on the ground. It is not allowed to turn on the heating on the ground if the helicopter is to fly with maximum weight.

7. Move all flight controls through a small distance, checking for jamming.
8. Set the trimming system in the position corresponding to hovering, i.e. cause the trimming system indicator to read the following values :

   0.5 - 1.0 backward
   0.5 - 1.0 to the right

3.9. TAXIING

The Mi-2 taxiing is allowed at wind velocities not exceeding 12 m/s. At wind velocities between 12 and 15 m/s it is necessary to tow the helicopter on the ground with the engines shut down, or make a ferry flight at low altitude and speed. Normally the taxiing operation is performed as followa :

1. Set the collective pitch lever to 1° and turn the twist grip to the right to obtain the main rotor speed of 70 %.
2. Release the wheel brake by unlocking the brake lever at the cyclic stick grip.
3. Start taxiing by moving the cyclic stick forward.
   Maintain the taxiing speed :

   on concrete surface . . . . . . - about 10 km/h

   on field surface . . . . - a fast walk

   NOTE: If the ground is very rough, instead of taxiing fly at low speed near the ground. Taxiing speed is changed by appropriate movement of the cyclic stick.

4. If, during cross-wind taxiing, the helicopter tends to turn against the wind, apply the tail rotor pedals accordingly. The cyclic stick should be moved in the direction opposite to that of the wind.

C A U T I O N

IF, DURING TAXIING, THE HELICOPTER TENDS TO SKID, TURN THE TWIST GRIP IMMEDIATELY TO THE LEFT WHILE MOVING SIMULATANEOUSLY THE CYCLIC STICK IN THE DIRECTION OPPOSITE TO HELICOPTER BANKING.

IT IS FORBIDDEN TO USE THE TAIL ROTOR PEDALS TO COUNTERACT SKIDDING AND/OR BANKING.

5. Complete the taxiing by braking the main landing gear wheels.

10. TAKEOFF

10.1. NORMAL TAKEOFF

1. Set the helicopter against the wind.
2. Apply the "SLAVE IN" push button on instrument panel to obtain indications.
3. Unlock the attitude indicator.
4. By depressing the left knob of the clock, start the flight time counter. A red or green flag should appear on the dial.
5. Make sure that all persons aboard have fastened their safety belts.
6. Turn the twist grip to the right and increase smoothly /in 6 to 8 seconds/ the main rotor pitch until the helicopter lifts off. Counteract the helicopter turning by depressing the RH pedal.

   NOTE: Because of the landing gear characteristics and considerably high CG location, the helicopter lifts off with slight swinging, first to the left and then to the right. While hovering, the helicopter inclines to the right.

7. Hover the helicopter for a while to check instruments for normal indications. The helicopter should hover at no more than 5 m wheel height.
8. Move the cyclic stick forward to start accelerating while mainataining the altitude with the collective pitch lever, and the direction with the tail rotor pedals.
9. After accelerating to 90 - 100 km/h IAS, set the collective lever to obtain the gas producer RPM corresponding to one-hour power, i.e. 90 % at temperature above -20°C, and while maintaining the speed as in Table III-1, begin a steady climb.

WARNING

DURING ACCELERATION AND CLIMBING AFTER TAKEOFF AVOID FLYING IN THE DANGEROUS RANGE OF HEIGHT AND VELOCITY. /SEE FIG. 2-2/.

10. Turn on the cabin heating system /by opening the heat exchanger valves/ and the anti-icing system if required.
11. Use the trimming system to reduce the forces felt on the cyclic stick.

NOTES: 1. At temperature below -20°C the gas producer speed at one-hour power is equal to 87.0 %.

2. A pilot with a lot of experience may climb from a stabilised hovering height of 1 - 0.5 m without wheel to ground contact, but he should accelerate to 10 - 15 km/h by slight movement of the collective pitch lever so as to accelerate smoothly without height loss.

   Next, by moving the cyclic stick smoothly forward, while increasing the pitch, accelerate and climb simultaneously.

3. When climbing with maximum weight, the main rotor speed must not drop below 78%.

4. The helicopter should climb along such a path so as to obtain 20 km/h at 5 m, then 40 km/h at 10 m and 80 - 100 km/h at 25 m above the ground. This procedure allows for a safe landing in case of single engine failure with a short landing run or go-around.

5. A takeoff area should have a smooth surface and be clear of any obstacles /cables, trees, buildings, etc./.

When it is necessary to takeoff from a small airfield, a pilot with a lot of experience may perform the following procedure:

- keep the helicopter hovering a while at a height of 2 m to check instruments for normal indications;

- move the helicopter back by 3 - 5 m gaining simultaneously some height, and then start accelerating and climbing so that at a height of 10 m the airspeed is appr. 40 km/h.

- make a steady climb as in Table III-1.

NOTE: It is allowed to make turns at no less than 10 m wheel height.

3.10.2. RUNNING TAKEOFF

In the case when it is necessary to takeoff with the helicopter weight slightly exceeding the maximum allowable takeoff weight /see Ch. II "Limitations"/ a running takeoff can be made.

The necessary condition is a sufficiently long and smooth landing ground, clear of obstacles.

In order to make a running takeoff the following should be done :

1. Set the helicopter against the wind.
2. Apply the "SLAVE IN" push button on the instrument panel to obtain the indications.
3. Unlock the attitude indicator.
4. By depressing the left knob of the clock start the flight time counter. A red flag should apper on the dial.
5. Make sure that all persons aboard have fastened their safety belts.
6. Set the trimming system in the position corresponding to the indications on the instrument panel:

   0 - 0.5 backward
   0 - 0.5 to the right

7. Turn the twist grip to the right and increase smoothly /in 6 - 8 seconds/ the main rotor pitch until the takeoff power is obtained. Counteract the helicopter turning by depressing the RH pedal.

   NOTE: The takeoff power should be reached at the main rotor RPM of 78 - 80 %.

8. By moving the cyclic stick smoothly forward start the takeoff run. Maintain the direction with the tail rotor pedals. Lift off the ground should take place at speed of 20 - 40 km/h.
9. After lifting off and establishing 90 - 100 km/h, set the collective pitch lever to obtain the gas producer RPM corresponding to one-hour power, i.e. 90 % at temperature above -20°C.
   Begin a steady climb while maintaining the speed as in Table III-1.

   NOTE: At temperature from -20 to -40°C the gas producer RPM corresponding to one-hour power is 87.0 %, whereas at temperature below -40°C RPM is equal to 84.0 %.

WARNING

DURING ACCELERATION AND CLIMBING AFTER TAKEOFF AVOID FLYING IN THE DANGEROUS RANGE OF HEIGHT AND VELOCITY /FIG. 2.2/.

10. Use the trimming system to reduce the forces felt on the cyclic stick.
11. Turn on the cabin heating system /by opening the heat exchanger valves/ and the anti-icing system, if required.

3.10.3. CROSS-WIND TAKEOFF

In the case when it is necessary to make a cross-wind takeoff /allowable cross-wind speed is .5 m/s/ the same takeoff procedure is followed as described under 3.10.1. for a normal takeoff, and under 3.10.2. for a running takeoff.
The pilot, however, should be very careful, especially if the cross-wind is from the right side.

Just after lift-off the helicopter has a tendency to drift with the wind. This should be counteracted by moving the cyclic stick accordingly. It is recommended to set the helicopter against the wind immediately after lifting off and passing above any obstacles.

3.11. HOVERING AND MANOEUVRES NEAR GROUND

Hovering and manoeuvres near the ground are performed in order to check:

- the controls for proper operation,
- the power - plant for proper operation,
- all the equipment for proper operation,
- the takeoff weight and balance for accurate calculation, and to do some regular work.

Hovering should precede each flight.

NOTE: Maneouvres near the ground should be performed after periodical inspections and adjustments of the control system have been made.

Hovering and maneouvres near the ground are performed under the following conditions:

1. The trimming system is set in the position corresponding to the indications on the instrument panel:

   0.5 - 1.0 backward
   0.5 - 1.0 to the right.

2. The twist grip of the collective pitch lever is turned fully to the right and the locking push-button /Fig. 1-6/ depressed.

3. The helicopter movement /sideward and backward/ during maneouvres near the ground does not exceed 10 km/h.

4. Rate of hovering turns speed not higher than 20° /sec. Mean angular speed is 0.2 rd/s, which corresponds to a 360° turn in 30 seconds.

5. At wind velocities above 5 m/s, turns by no more than 90° off the head wind direction are allowed only.

6. All controls should be operated gently and smoothly while hovering and maneouvering.

NOTE: The helicopter engines are very sensitive to the exhaust gases blowing from the exhaust pipes. Therefore in cross-wind or tail-wind special attention should be paid to the temperature of exhaust gases, which should not exceed the maximum allowable value.

CAUTION

HOVERING HIGHER THAN 5 METRES ABOVE THE GROUND IS ALLOWED IN EMERGENCY ONLY; RESCUE OPERATIONS OR USE OF EXTERNAL CARGO HOOK.

NOTE: The hovering height is the distance between the wheels and the ground.

3.12. CLIMBING

Normal climbing takes place at one-hour power.
In case of need climbing can be performed at the takeoff power but without exceeding the time limit /maximum 6 min of engine operation at this power/.

For information about helicopter climbing speed refer to Chapter V - "Performance".

Climbing should be performed at indicated airspeeds as shown in Table III-1:

TABLE III-1. RECOMMENDED AIRSPEED WHILE CLIMBING

Altitude above sea level /m/	Indicated airspeed /km/h/
500	110
1000	105
2000	95
3000	90
4000	80

Under special circumstances the helicopter can climb vertically to pass above the obstacles making a normal takeoff difficult. As there are no hovering or low speed indicators on the instrument panel, the pilot who performs the above maneouvre must refer to the ground.

WARNING

VERTICAL CLIMBING TO MORE THAN 10 m ABOVE THE GROUND LEVEL IS DANGEROUS AS IN CASE OF DUAL - ENGINE FAILURE IT IS IMPOSSIBLE TO LAND WITHOUT HELICOPTER DAMAGE AND INJURIES TO THE CREW MEMBERS.

WARNING

IT IS FORBIDDEN TO CLIMB VERTICALLY TO OVER 10 m ABOVE THE GROUND LEVEL WITH PASSENGERS ABOARD.

3.13. LEVEL FLIGHT

The Mi-2 helicopter is allowed to perform level flights at altitudes up to 4,000 m above the sea level. For allowable range of airspeed at various altitudes in a level flight, refer to Chapter II "Limitations".

For maximum range flights the cruising speed of 190 km/s IAS is recommended. See Chapter V "Performance" for the data on helicopter range.

For endurance flights the economical speed of 100 km/h IAS is recommended.
Refer to chapter V "Performance" for the data on endurance flights.
During level flights the twist grip of the collective pitch lever remains turned fully to the right.

WARNING

IF THE LOW FUEL LEVEL LIGHT GOES ON, LAND AS SOON AS POSSIBLE.

Turns are made by a simultaneous application of the cyclic stick and tail rotor pedals in a suitable way. Banking while making a turn should not exceed 30°.

NOTES: 1. At airspeeds higher than 150 km/h, visibility from the pilot's seat upward and straight ahead is reduced.

3.14. DESCENDING

3.14.1. POWER-ON DESCENT

1. Establish the horizontal airspeed of 90 - 110 km/h.
2. While holding the twist grip turned to the right, reduce the collective pitch to establish required descending. The recommended rate of descent is 3-5 m/s.
3. Balance the helicopter by means of the trimming system at the indicated airspeed as shown in Table III-2 below.

TABLE III-2. RECOMMENDED AIRSPEED WHILE DESCENDING

Altitude above sea level	Recommended airspeed km/h IAS	Airspeed limits km/h IAS
4,000	80	70 - 90
3,000	90	70 - 90
2,000	95	60 - 140
1,000	105	60 - 175
below 500	110	60 - 150

3.14.2 . POWER-ON AUTOROTATIVE DESCENT

NOTE

Power-on autorotative descent is intended to fast altitude reduction. The main rotor in this flight condition is driven partially by surrounding air flow and partially by free turbines of the engines operated on idling.
Therefore such flight condition may be called "assisted autorotation".

1. Establish the level flight air speed at 90 to 110 km/h.
2. Smoothly reduce the collective pitch value to minimum-collective pitch power lever in extreme lower position.
3. Keep the twist grip in right position or rotate it gently to the extreme left position.

NOTE

When the twist grip is turned to the left , the engine power drops to idling and power turbine governor maintaing RPM at 82 to 84% becomes inoperative. Any further control of MR rpm is left to the pilot.

4. When main rotor RPM exceeds a/m limits, i.e. 82 up to 84%:
   Slightly increase the collective pitch ,if RPM is greater than 84%,
   Slighty rotate the twist grip to the right,when RPM is below 82%.
5. Using the trim switch ,balance the helicopter for air speed by instruments acc. to Table III-2.

WARNING

If the descent has been performed with the twist grip in left position it should be rotated to the extreme right position and increase collective pitch icreased by means of collective pitch lever prior to finishing the descent.

WARNING

IT IS FORBIDDEN TO PERFORM A POWER-ON AUTOROTATIVE DESCENT TO ALTITUDE LESS THAN 500 m ABOVE THE GROUND WITH THE PASSENGERS ABOARD.

3.15. PRIOR TO LANDING PROCEDURE

1. At the end of the landing approach shut hot air stream supplied from the compressors to the heat exchangers included in the cabin heating system -the valves over the heaters are closed.
2. Turn off the anti-icing system of MR blades and of the windscreen by setting the switches on the main control panel to the middle and lower positions respectively.
3. Turn off "CONTR". and "EXCIT". circuit breakers of the AC generator ,which are installed on the circuit-breaker panel /left extreme in the lower right row of the switches/ , as well as "ON" and "SIGN." switches of the anti-icing system / two extreme on the right in the lower row/.
4. Set the trimming system according to the anticipated type of landing:

normal landing	0,5 up to 1 backwards
	0,5 up to 1 to the right
running landing	0 up to 0,5 backwards
	0 up to 0,5 to the right

5. Taking into account the helicopter weight ,altitude of the landing ground and ambient temperature consider the possibility of normal landing according to Chapter II "Limitations" if a normal landing cannot be performed ,consider a running landing instead.

3.16. L A N D I N G

3.16.1. NORMAL LANDING

1. In case of unfavourable terrain conditions ,which make it difficult to approach against the wind ,perform a cross-wind approach. Just before or while hovering above the landing ground ,depending on the wind force ,turn the helicopter against the wind.
2. Make sure that the main landing gear wheel brake is released.
3. At about 50 m above the ground begin to decelarate.
   The air speed to be reduced to zero /helicopter hovering/ at the altitude of 2 up to 3m over the intended landing ground.

W A R N I N G

IT IS FORBIDDEN TO LAND WITH SUDDEN DECREASING OF HORIZONTAL SPEED BY MAIN ROTOR SPEED LOADING CAUSING RPM REDUCTION UNDER 76%.

4. Correct the approach angle by changing the collective pitch.
5. Descent at rate not greater than 0,5 m/s and cushion the touch-down. After landing reduce the collective pitch to minimum.
6. Brake the landing gear wheels by depresssing and locking the brake lever on the cyclic stick.
7. By turning the twist grip to the extreme left position reduce the engine power to idle.
8. Move the cyclic stick to neutral/middle' position-trimming system to "0".

3.16.2. RUNNING LANDING

If it is impossible to perform a normal landing due to excessive helicopter weight relative to actual altitude and ambient temperature , a running landing can be performed. In case of a running landing a sufficiently long and smooth landing ground without any obstacles to be provided.

The running landing procedure includes the following :

1. At the end of approach set the helicopter against the wind.
2. Make sure that the wheel brake is released.
3. At about 50m above the ground decelerate to 60 km/h and balance the helicopter at this speed.

4. Establish descent at a rate of 0.5 - 1 m/s. Control the approach angle by changing the collective pitch.

5. At the height of about 20 meters above the ground, reduce the airspeed to 40 km/h by pulling the cyclic stick gently, and just before the touch-down increase the colective pitch to reduce the rate of descent to almost zero.

   NOTE: The helicopter makes a touch-down with the main wheels first, and then with the nose twin-wheel.

6. After touch-down with all three wheels, reduce the collective pitch to minimum by lowering the collective pitch lever fully down and turn the twist grip fully to the left.

7. Apply the wheel brake to stop the helicopter.

3.16.3. SLOPE-AREA LANDING

Landing on slopes /up to 5^{o}/ is performed according to the same procedure as for a normal landing until a hover is established to complete the approach. While hovering, the helicopter should be set with the left side towards the foot of the slope /Fig. 3-3/. This is done as follows:

1. Descend slowly to make a touch-down with the up-the-slope wheel first.

2. By moving the cyclic stick in the up-the-slope direction, gently reduce the collective pitch until the other /down-the-slope/ wheel touches the surface of the landing ground.

3. While holding the cyclic stick in this position and the helicopter with the left side towards the foot of the slope, slowly reduce the collective pitch until the helicopter rests firmly on all three wheels.

4. If the helicopter stands firmly showing no tendency to slide down the slope, set the wheel brake by depressing and locking the brake lever on the cyclic stick, and turn the twist grip of the collective pitch lever fully to the left reducing the engine power to idle.

NOTE: If during landing inadequate control margins occur, stop this manoeuver and make landing on a less slopy terrain.

5. Before shutting down the engines use the trim push-button to set the cyclic stick at neutral which is indicated by "O" reading on the trimming system indicators.

3.16.4. CROSS-WIND LANDING

If it is necessary te make a cross-wind landing /allowable cross-wind velocity is 5 m/s/, the same landing procedure should be followed as that described under 3.16.1. for a normal landing, and 3.16.2. for a running landing.
The pilot, however, should be very careful, especially if the cross-wind is from the right side.
During approach and hovering before the touch-down, the helicopter has a tendency to drift with the wind.
This should be counteracted by moving the cyclic stick accordingly.

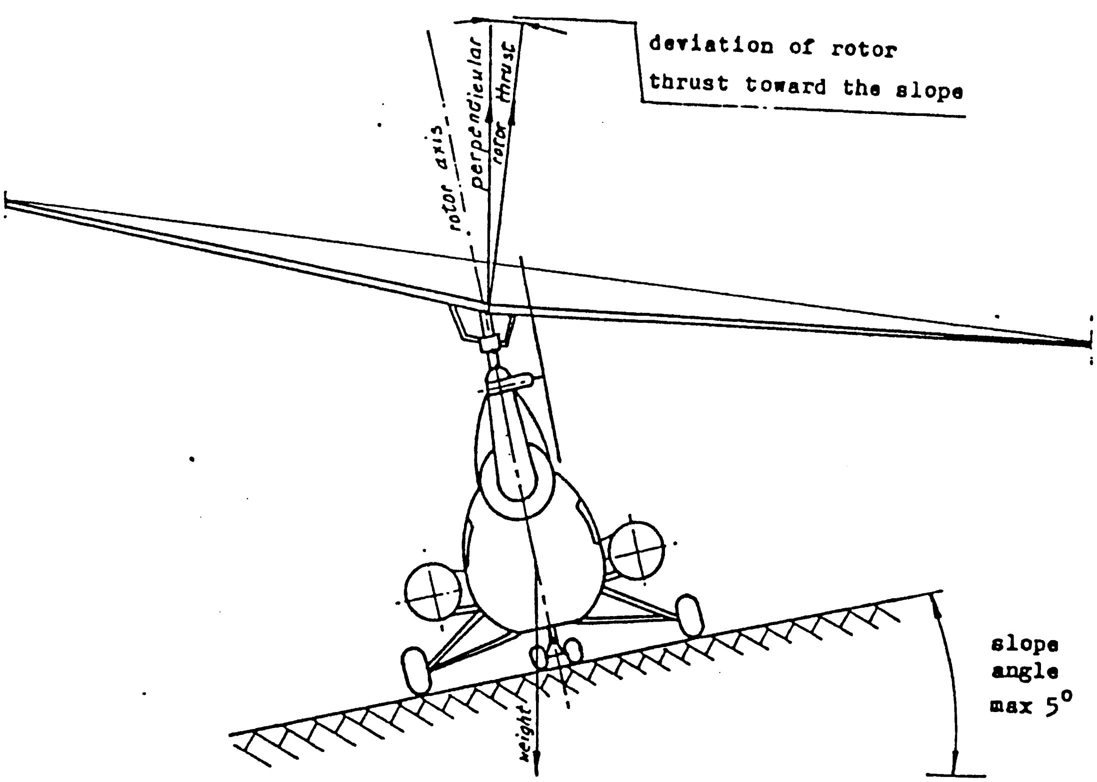


Fig. 3.3. SLOPE-AREA LANDING

3.17. AFTER-LANDING PROCEDURE

1. Set the wheel brake by depressing and locking the brake lever on the cyclic stick.
2. Block the attitude indicator.
3. Stop the flight time counter by depressing the LH knob of the clock - a white and red flag should apper on the dial.
4. Turn off the radio communication equipment and flight and navigation instruments by placing the corresponding switches on the upper left control panel to OFF.
5. Turn off the 36 V inverter - the switch on the upper control panel in the central position.
6. Turn off the radio altimeter by placing the two switches on the instrument panel to OFF.
7. Turn off the ADF by placing the corresponding switch on the radio equipment control panel to OFF.
8. Check the engine instruments for indications at idle:

gas producer speed	57 % ± 3 %
turbine inlet temperature	max 790°C
main rotor speed	below 56 %
engine oil pressure	1.5 kG/cm^2

9. By depressing the RH knob of the clock stop the stop-watch. If the flight took place at night the following should be done additionally:
10. Turn off the landing and anti-collision lights by placing the corresponding switches on the upper left control panel and the instrument panel to OFF /down/.
11. Turn on the internal /cockpit and cabin/ lighting by placing both the lower left switch, on the upper left control panel, and the LIGHTING switch, on the upper control panel, to "ON" /up/.
12. Turn off the red illumination of instruments and lettering by putting the switches on the circuit breaker panel into the lower positions.

3.18. ENGINE SHUT-DOWN

1. Maintain the engines at idle for 1 to 2 minutes prior to shut-down. In case of engine operation in dusty conditions reduce the time of engine cool-down to 1 minute.
2. Stop the stop-watch by depressing the clock knob amd bring its pointers to "0" by depressing the knob again.

3. Engine shut-down levers - fully down /"OFF"/.
4. Simultaneously start a time count using a stop-watch /by depressing the RH knob of the clock/.
5. Turn off the generators of both engines by placing the generator switches on the upper control panel to "OFF" /down/.
6. Note the gas producer deceleration to zero time, which should not be shorter than 25 seconds. Listen for any abnormal sounds during deceleration.
7. Apply the main rotor brake by pulling up the brake lever /between the front seats/ when the rotor has stopped turning.

   NOTE: It is not necessary to apply the rotor brake after each flight.

CAUTION

IT IS FORBIDDEN TO APPLY THE MAIN ROTOR BRAKE AT GUSTY WIND OR AT CROSS-WIND SPEED FROM THE RIGHT MORE THAN 3 m/s, AND FROM THE LEFT AND REAR MORE THAN 5 m/s.

8. Monitor the rotor braking time: if braking begins at rotor speed of 20 %, the braking time should not be shorter than 10 seconds.

   NOTE: After setting the rotor brake none of the rotor blades should be positioned directly above the tail boom.

9. After measuring the gas producer deceleration time and setting the rotor brake, stop the stop-watch and clear off its indications /by depressing twice the RH knob of the clock/.
10. Close the fuel line: red levers of the shut - off valves fully up.
11. Unfasten the safety belts.
12. Unlock the doors.
13. Put the 115 V inverter switch in the central position.
14. Place the automatic fuel pump change-over switch on the upper control panel to OFF /central/.
15. Turn off the hydraulic system by placing the switch on the upper control panel /section marked HYDRAULIC SYSTEM/ to OFF /down/.
16. Set the 4-position voltage selector switch on the upper control panel /section marked DIRECT CURRENT/ in the central position.

17. Set the AMMETER switch in the lower position.

18. Set the "BATTERY/EXTERNAL POWER" switch on the upper control panel /section marked DIRECT CURRENT/ in the central position.

19. Turn off all the switches on the circuit breaker panel by placing them to OFF /down/.

20. Leave the helicopter.

21. If the flight took place at night, before doing as in item 18 turn off the position lights and the cabin lighting by placing the appropriate switches on the instrument panel, upper control panel, and circuit-breaker panel to OFF.

3.19. PRE-FLIGHT CHECK FOR OPERATION OF EXTERNAL CARGO-HOOK

1. Check all the mounting points of the external cargo hook.

2. Turn on the circuit breaker switches marked "UNDERSLUNG LOAD AIRDROP - NORMAL - EMERG".

   If the lock is engaged a yellow light marked "HOOK ARMED" should light.

3. Detach the external lock from the strap secured to the fuselage /and attach the loose end of the strap to the fuselage by means a fastener being provided there/.

   Open the pneumatic system valve on the left side of the pilot's seat /the handle of the air valve at the sliding door marked EXT.SUSP., should be placed to "LIFT".

4. Relase the external cargo hook: the "HOOK ARMED" advisory light should go off.

CAUTION

WHILE FLYING WITH A LOAD SUSPENDED ON THE EXTERNAL CARGO HOOK, THE BAROMETRIC ALTIMETER /WD-10K/ SHOULD BE USED /BECAUSE OF POSSIBLE ERRONEOUS INDICATIONS OF THE RW-3 RADIO ALTIMETER WHEN A LOAD IS SUSPENDED/.

5. Check the routine load release system for proper operation. For that purpose press the ROUTINE RELEASE push-button on the collective pitch lever. Upon pressing the push-button, the external cargo hook will open and the light marked "HOOK ARMED" will go off.

6. Check the emergency load release system for proper operation. For that purpose press the EMERGENCY RELEASE push-button on the collective pitch lever.

   Upon pressing the push-button, the external cargo hook will open and the light marked HOOK ARMED will go off.

3.19.1. CARGO ATTACHMENT /RELEASE/ AND TRANSPORT

Flying with externally suspended loads requires well-established habits of the pilot. Therefore only those pilots are allowed to fly the helicopter with externally suspended loads who are fully proficient and experienced in flying the Mi-2 helicopter.

Quick attachment and release of the load /putting it in a predetermined place/ is in great measure the result of efficient cooperation between the pilot and controller or a specially appointed ground operator who by means a walkie-talkie set or gestures gives the pilot some commands to direct the helicopter to the place where the load is deposited.

Depending on conditions, loads can be attached to the helicopter hook in either of the following ways :

- one method is used in the case when the helicopter can land next to the load,
- the other one /attaching while hovering/ is used in the cases when it is impossible to land next to the load.

Attaching the load to the helicopter standing on the ground

1. Land near the load to be picked up and taxi the helicopter to a distance of 1 to 1.5 m from the main wheel. Set both engines at idle.

   In order to facilitate takeoff with suspended load, as well as moving the helicopter directly above the load, it is recommended to land and taxi so as to have the load on the left side of the helicopter.

2. Attach an intermediate rope to the cargo hook of the helicopter.

3. Extend the cargo hook to the working position by placing the valve handle marked EXT. SUSP at the sliding door to EXTEND. The light marked HOOK DOWN should light on the instrument panel /this should be performed while hovering/.

4. Takeoff and hover at such a height as to maintain the distance between the eye of the intermediate rope and the ground of no more than 1 - 1.5 m.

5. The ground staff is to attach the slings to the load by means of snap-locks provided at sling ends. Then connect the slings to the intermediate rope /being fastened to the external cargo hook/.

6. While climbing slowly, move the helicopter to be directly above the load. During this operation, the pilot's action is being corrected by the controller or ground operator using a walkie-takie or gestures.

7. By moving smoothly the collective pitch lever increase the hovering height until the intermediate rope and slings are tense. The increase of hovering should be performed exactly above the load in order to avoid any longitudinal and lateral displacement of the helicopter /while following the commands signalled by the ground controler/.

8. When the slings are tense, lift off the load from the ground by pulling smootaly the collective pitch lever up, and then increase the hovering height so as to hold the load at 2 - 3 m above the ground.

9. After making sure that the load is suspended properly and the hovering height is sufficient for safe acceleration, move the cyclic stick smoothly to gain forward speed.

10. When an indicated airspeed of 90 - 100 km/h is reached, begin to climb at one-hour power.

11. White carrying a suspended load perform all manoeuvres smoothly /airspeed increase or decrease and turns/ in order to prevent swinging of the load.

12. The degree of swinging depends mainly on how streamlined the load is, and therefore at the very beginning of the flight the airspeed should be changed to keep the load as steady as possible.

13. With a load suspended on the external cargo hook the helicopter should descend along a steeper flight path than while flying without suspended loads, and reduction of height and airspeed should be performed very smoothly.

14. The airspeed should be reduced gradually while smoothly increasing engine power so as to prevent considerable changes of the angle of load swinging in the longitudinal direction.

15. If it is impossible to reduce the airspeed smoothly before approaching the landing place, where the load is to be deposited, stop reducing the airspeed, perform a go-around, and then approach again the place where the load is to be left.

16. While hovering above the place of load deposition, reduce the hovering height by moving the collective pitch smoothly forward and deposit the load.

17. Release the load by depressing the push-button marked "REGULAR RELEASE", located in the collective pitch lever, or the one marked "EMERGENCY RELEASE".
Before releasing the load already deposited on the ground, the helicopter should slightly move sidewards while hovering in order to prevent possible load damage by ropes and/or slings on which it is suspended. Upon depressing the push-button, the light marked HOOK ARMED should go off.

18. After detaching the load retract the external cargo-hook by moving the valve handle marked from EXT.LOAD to RETR.

Attaching the load while hovering

1. Extend the cargo hook to the working position by placing the valve handle marked EXT.LOAD to EXTD. The light marked HOOK DOWN should light on the instrument panel.
2. The helicopter should hover above the load at no more than 1 - 1.5 m wheel height.
3. The ground staff:
   - attach snap-locks of the slings to the load
   - connect the ring of the intermediate rope to the cargo hook.
4. Further procedure to be followed by both the pilot and the controller is the same as in the case of attaching the load to the helicopter standing on the ground.

NOTE: In flights with a load suspended on the external cargo hook, condition of the ground surface should be taken into consideration /snow, dust, etc./.
Before attaching the load, hover above it to blow any dust or snow off the ground by the air-stream produced by the main rotor.

The landing ground should be properly prepared in the area where a load is to be alttached:
water should be poured in case of dust, or snow made compact in case of fresh snow fall.

Exceptional cases during flying

The load carried on the external cargo hook should be released in the following cases:
- when the load has caught on the ground during accelaration or deceleration,
- when the load is swinging or rotating, which affects the flight safety,

- when emergency landing is necessary,
- in case of single - engine failure in flight,
- in all cases when the pilot leaves the helicopter.

3.20. LPG-4 HOIST OPERATION WHILE HOVERING

Before lifting or lowering the load by means of the electically operated hoist while hovering, the operator should do the following :

- install a protective belt and attach it to the ring mounted on the right of the rear part of the main fuel tank;
- connect his head-phone to the intercom system and check if he can communicate with the pilot;
- on the pilot's command open the door of the cargo compartment and lock it safely in this position.

Set and secure the hoist in the operating position :

- take the hoist control handle out of its storage bag:
- place the circuit-breakers marked LH/RH ENGINE and located on the KUL-4 control box to "ON":
- report to the pilot readiness for operating the hoist on his command.

Load lowering procedure

Attach the load to the snap-lock of the LPG-4 hoist and bring it outside of the cargo compartment. Holding the hoist control handle in one hand depress the LOWERING push-button and hold it in, while watching the load until it is at about 1 - 1.5 m above the ground.

As soon as this height above the ground is reached relase the push-button and report to the pilot that the load lowering has been completed.
After that, the pilot should descend slowly so as to deposit the load on the ground.
In order to reduce the load lowering speed, the small lever on the hoist control handle should be depressed in addition to the push-button.

Load lifting procedure

After attaching the load to the snap-lock of the LPG-4 hoist, the operator should report to the pilot his readiness for lifting the load.
After that the pilot should increase the hovering height until the load is lifted off and then give the operator a command to start lifting the load. Holding the hoist control handle in his hand the operator should depress the LIFTING push-button and hold it in while watching the load until the hoist stops automatically when the load is fully up.

In order to reduce the lifting speed the small lever on the control handle should be depressed in addition to the push-button. When the load is fully up, put it into the cargo compartment. Set the hoist into its inoperative position, close the door of the cargo compartment and report to the pilot that the work has been completed.

3.21. RESCUE SEAT OPERATIONS WHILE HOVERING

1. Pre-flight inspection and check of the rescue seat for operation
   - Check the tapes, safety belt and floats for general condition,
   - Check the electrical system for operation,
   - Check the eye for hooking the seat on the lever hook for general condition.

2. Rescue seat operation.

   In order to hoist a person /castaway/ to the helicopter deck when hovering, the operator should :
   - prepare the LPG-4 electrical hoist as for lifting and lowering a load /see point 3.20/,
   - set the frame in the folded position /parallel to the seat/,
   - check the seat tapes for proper folding,
   - light the signal lights in case of poor visibility,
   - hook the seat on the lever hook and make sure that the lighting cable hangs down freely beside the seat,
   - lower the seat unitil the hoist cable is let out completely. When lowering it, the seat should not touch water /ground/ in the place where rescue is being performed,
   - report to the pilot that the lowering of the seat has been completed.

After receiving this report, the pilot should gradually decrease altitude so that the chair is placed on water /ground/.

The shipwrecked person pulls the seat under himself and after fastening the safety belt he waves his hand or switches on and off the signal light to let the operator know that he is ready to be lifted.

The operator reports to the pilot the readiness for lifting. Then the pilot increases the hovering height until the rescue seat with the shipwrecked person lifts off, and orders the operator at the hoist to start lifting the casualty aboard the helicopter. The operator depresses the "LIFTING" push-button on the hoist control handle, while watching the seat and keeping the push-button pressed in.

At the end of hoisting, when the seat with the casualty is near the wheels, further hoisting should be done in small steps /the seat should face the helicopter/.
While hosting, care must be taken not to catch the seat on helicopter construction parts.
One operator can hoist and receive fit people aboard the helicopter, while in case of shipwerecked /injured/ people, hoisting and receiving them on board must be done by two operators.
When the seat is already in the cabin unfasten the safety belt and let the casulaty get out of the seat.
Unhook the seat and, after setting the hoist into the inoperative position, lock the cabin door and report to the pilot that the operation has been completed.

3.22. SIGNAL FLARE OPERATION IN FLIGHT /EKSR-46/

The signal flare is switched on for operation by a circuit breaker marked SIGNAL ROCKETS on the upper left panel.
In order to fire a single flare:

- switch on a circuit breaker and press in the appropriate push-button on the flare control panel installed on the cockpit ceiling /when SIGNAL ROCKETS circuit breaker is on/.

In order to fire a volley:

- press in the appropriate push-button and SIGNAL ROCKETS circuit breaker /reverse order to firing a single flare/.

The push-buttons, after pressing them in, remain in this position to indicate that these flares have been fired.

NOTE: To fire a volley, press the push-buttons on the flare control panel and hold them in until the SIGNAL ROCKETS circuit breaker is on.

3.23. WINDSCREEN WIPER OPERATION /EPK-2T-75/

In order to start the windscreen wiper:

- switch on the WIPER circuit-breaker on the circuit breaker panel,
- set the switch on the left upper panel into the suitable position START, SLOW or FAST.

After switching it off, place the WIPER switch to RESET. Do not hold the switch in RESET for more than 2 - 3 s. after the wiper has been reset.

NOTES: 1. It is not permitted to operate the windscreen at the starting speed longer than 5 minutes, when the temperature in the helicopter cabin is within +30°C to -20°C, and longer than 30 minutes when the temperature is below -20°C.

2. At temperatures below -20°C it is necessary to place the windscreen to START first.

3. Do not place the WIPER switch to FAST at temperatures below $-20^{o}C$.

4. To read the KI-13 standby magnetic compass, place the wiper to RESET.

3.24. GENERAL REMARKS ON R-860 AND R-842 TRANSCEIVERS OPERATION.

If, during operation of the transceivers, the R-842 transmitter is found to interfere with the R-860 receiver, or the R-860 transmitter with the R-842 receiver, it is recommended not to transmit messages through one transceiver when the other is used for receiving.

C H A P T E R IV

EMERGENCY PROCEDURES

CHAPTER IV - TABLE OF CONTENTS

909.

CHAPTER IV

EMERGENCY PROCEDURES

4.1. DUAL-ENGINE FAILURE

4.1.1. DUAL-ENGINE FAILURE DURING TAKEOFF.

If during takeoff safe speeds and heights are observed as in Fig. 2-2, the kinetic energy accumulated in the main rotor is sufficient to prevent the helicopter from a hard and destructive contact with the ground.
The failure is not accompanied by change of forces on the controls as the hydraulic system is driven by the main rotor.
In case of failure while hovering after takeoff:

1. Increase the collective pitch to maximum while maintaining a level attitude and direction with the cyclic stick and tail rotor pedals until the helicopter settles to the ground.

2. After touch-down, reduce the collective pitch to minimum: the collective pitch lever fully down.

3. Cut off the fuel flow to the engines: the engine shut-down levers fully down, and the levers of the fuel shut-off valves fully up.

In case of failure during initial acceleration:

1. Move the cyclic stick backward to establish an attitude with slightly lowered tail. At the same time use the collective pitch lever to eliminate any climbing tendency which may occur after pulling the cyclic stick upon engine failure at high airspeed. To this end, push down the collective pitch lever and hold it in this position for a few seconds.

2. Increase smoothly the collective pitch so as to reach the maximum value just before touch-down. At the same time move the cyclic stick forward to establish a level attitude and to avoid striking the ground with the tail rotor.

3. After ground contact has been made, reduce the collective pitch to minimum - the collective pitch lever fully down.

4. Apply the wheel brakes to minimize the ground roll.

5. Out off the fuel flow to the engines: overhead engine shut-down levers fully down, and shut-off fuel valves by pulling levers between the seats fully up.

4.1.2. AUTOROTATIVE DESCENDING AND LANDING

If the failure of both engines takes place at higher altitude and beyond the dangerous zone, as in Fig. 2-2, the possibility of making a safe landing is assured by helicopter's capability to perform autorotative descent, and is also due to substantial quantity of kinetic energy accumulated in the main rotor.

1. Immediately after the failure of both engines has been determined, reduce the collective pitch to minimum by pushing the collective pitch lever fully down.

2. In case of rotor speed in autoration exceeding 84 %, increase slightly the collective pitch in order to maintain the main rotor speed within the range of 82 - 84 %.

3. Cut off the fuel flow to the engines: the engine shut-down levers fully down, and fuel shut-off levers between the seats fully up.

4. Establish the airspeed according to Table IV-1 below, and trim the helicopter at the selected speed.

TABLE IV-1. RECOMMENDED AIRSPEED RANGES FOR AUTOROTATIVE GLIDE

Altitude /m/above the sea level	Indicated speed /km/h/
4,000 - 2,000	70 - 90
2,000 - 1,000	60 - 140
1,000 - 0	60 - 175

NOTE: The minimum rate of descent airspeed is 100 km/h IAS, whereas maximum glide distance airspeed is 150 km/h IAS.

5. Choose a landing place and manoeuvre the helicopter so as to set it against the wind during the last phase of approaching.

6. In the last phase of approaching establish the airspeed of 60 km/h IAS and trim the helicopter at this speed.

7. At about 20 m above the ground begin to reduce the airspeed by pulling the cyclic stick gently.

8. At about 10 m above the ground begin to increase the collective pitch. It should reach the maximum value just before touch-down.

9. Before touch-down, at about 1 m above the ground, establish a level attitude in order to avoid striking the ground with the tail rotor.

10. Immediately after touch-down has been made, reduce the collective pitch to minimum and minimize the ground roll by applying the wheel brakes.

NOTE: Minimizing the ground roll should begin at less than 60 km/h but in case of absolute necessity it is allowed to begin it at 80 km/h.

4.1.3. AUTOROTATIVE DITCHING

In case of dual-engine failure while flying over water the helicopter will inevitably sink. Therefore the action to be taken is not aimed at saving the helicopter, but at providing the best possible conditions for the crew to leave the helicopter before it sinks.

1. As soon as an autorotative glide has been established, maintain the airspeed of 100 km/h IAS and trim the helicopter at this speed.
2. Set the helicopter against the wind.
3. Tighten the safety belts.
4. Close the sliding door.
5. At about 50 m above the water jettison the RH front door.
6. At about 20 m above the water begin to reduce the airspeed so as to make water contact at no forward speed with the helicopter tail lowered towards the water.
7. While reducing the airspeed, increase the collective pitch to reduce the rate of descent.
8. Immediately after tail to water contact, move the cyclic stick firmly to the left in order to roll the helicopter and make it fall on the left side.
9. Release the safety belts and leave the helicopter as soon as possible through the opening of the RH front door.

NOTE: Helicopter falling on the left side will cause instant stoppage of the main rotor and possible breaking of its blades. This manoeuvre, however, assures the longest time of helicopter floating, i.e. not shorter than 10 seconds. It should be remembered that the helicopter fuselage is not water-tight and will sink after some time.

WARNING

IF THE CREW MEMBERS ARE PROVIDED WITH INFLATABLE LIFE-JACKETS, DO NOT INFLATE THEM INSIDE THE HELICOPTER BUT ONLY AFTER LEAVING IT, I.E. IN THE WATER

WARNING

IT IS FORBIDDEN TO FLY ABOVE WATER WITH PASSENGERS ABOARD AT ALTITUDES NOT SUFFICIENT FOR REACHING THE SHORE /OR BANK/ IN AUTOROTATION.

4.2. SINGLE-ENGINE FAILURE

4.2.1. SINGLE-ENGINE FAILURE WHILE HOVERING AFTER TAKEOFF

1. Immediately after the engine faulure has been determined, increase the collective pitch to maximum in order to reduce the rate of descent.
2. After touch-down, reduce the collective pitch to minimum and turn the twist grip of the collective pitch lever fully to the left.
3. Cut off the fuel flow to the affected engine by pulling the corresponding engine shut-down lever fully down and the fuel shut-off lever between the seats fully up.
4. Shut-down the running engine according to the standard procedure/see Chapter III "Normal Procedures", point 3.18/.

WARNING

ENGINE FAILURE WHILE HOVERING AT MORE THAN 5 m ABOVE THE GROUND IS DANGEROUS AS IT IS IMPOSSIBLE TO LAND WITHOUT ANY DAMAGE TO THE HELICOPTER AND POSSIBLE INJURY TO THE CREW.

4.2.2. SINGLE-ENGINE FAILURE DURING ACCELERATION AFTER TAKEOFF

If the failure of one engine occurs during acceleration, the pilot can either:

a/ make a running landing if there are no obstacles, or

b/ find a suitable place for landing, while flying with one engine operative, and land there.

In the first case, i.e. when it is possible to make a running landing, proceed as follows:

1. By puling the cyclic stick, start reducing the airspeed.
2. While reducing the airspeed with cyclic stick, move the collective pitch lever down and then keep pulling it up in order to maintain gliding at a minimum rate of descent. Just before touch-down, the collective pitch should be increased to maximum.
3. Just before touch-down, obtain a level attitude by pushing the cyclic stick forward to avoid striking the ground with tail rotor.
4. As soon as the helicopter has touched the ground with all its wheels, reduce the collective pitch to minimum: the collective pitch lever fully down. Turn the twist grip of the collective pitch lever fully to the left.
5. Apply the wheel brakes to minimize the ground roll.
6. Cut off the fuel flow to the affected engine: the corresponding engine shut-down lever fully down, and the fuel shut-off lever between the seats fully up.

NOTE: In case of engine failure at less than 10 m above the ground, land straight ahead or with slight deviation to the side. Manoeuvrability is very limited: it increases with airspeed and power margin increase of the running engine.

7. Shut-down the running engine according to the standard procedure /see 3.18/.

In the second case, i.e. when the failure occured at the altitude above 20 m, or if there are obstacles which make it impossible to make a safe landing straight ahead, continue the flight with one engine operative.

1. Immediately after the engine failure has been determined, reduce the collective pitch to about 6^{o} in order to maintain the main rotor speed in the range of 78 - 84 %.

NOTE: The helicopter with the weight of 3,000 kg or more at the time of engine failure will not make a one - engine inoperative climb. It can only make a level flight at sea level, ISA.

2. Airspeed:
   - if it was higher than 100 km/h IAS, reduce to 100 km/h IAS,
   - if it was lower than 100 km/h IAS, maintain it.

3. Choose a suitable landing place and perform all the necessary manoeuvres to pass over any obstacles.

CAUTION

THE TIME FROM THE MOMENT OF ENGINE FAILURE TO LANDING SHOULD BE SHORTER THAN 6 MINUTES IF THE OPERATIVE ENGINE IS AT TAKEOFF POWER.

4. The airspeed should be reduced in such a way as to make a touch-down in the selected landing place at about 30 km/h.

5. While reducing the airspeed, change the collective pitch in such a way as to establish approx. 1 m/s rate of descent.

6. Just before touch-down, obtain a level attitude to avoid striking the ground with the tail rotor. At the same time increase the collective pitch so as to reach the maximum value at touch-down.

7. As soon as the helicopter has touched the ground with all its wheels, reduce the collective pitch to minimum and minimize the ground roll with the wheel brakes.

   NOTE: Minimizing the ground roll should normally begin at less than 60 km/h, but in case of absolute necessity it is allowed to begin it at 80 km/h.

8. Shut down the running engine according to the standard procedure /see 3.18/.

4.2.3. SINGLE-ENGINE FAILURE DURING CRUISE

If such a failure occurs during cruise, the helicopter capability of flying with one engine operative only will make it possible to choose a suitable landing place and perform all manoeuvres required for landing.

1. Immediately after a single-engine failure has been determined, reduce the collective pitch to about 6° so as to maintain the rotor speed within the range of 78 to 84 %.
2. Establish the airspeed of 100 km/h IAS.
3. After determining which engine has failed, cut off the fuel flow to the affected engine and close the shut-off valve of this engine.
4. Set the single engine power control lever of the operative engine into the upper position.
5. Use the collective pitch lever to obtain the following at one-hour power:

gas producer RPM	90 %
turbine inlet temperature	max 925°C /for engines of series III/
engine oil temperature	max 140°C
engine oil pressure	3 ± 0.5 kG/cm²

NOTES: 1/ The rate of descent of the helicopter in a single-engine flight at one-hour power is about 1 - 1.5 m/s. This corresponds to the distance /height ratio of about 18,5 to 28.

2/ If the engine fails when flying at 20 - 30 km/h and less than 10 m above the ground, land the helicopter straight ahead. The possibility of manoeuvering the helicopter to the side is very limited: it increases with airspeed and altitude increase.

6. If it is necessary to fly some distance before landing without height loss and relative range increase, set the collective pitch lever to establish takeoff power. The main rotor speed should not be lower than 78 %.

NOTE: The range with one engine inoperative is shown in Fig. 4-1. as a function of height loss at one-hour power. By operating the engine for 6 minutes at takeoff power, the range is increased by 10 km. The example of such range increase is illustrated by the diagram in Fig. 4-1.

CAUTION

THE TAKEOFF POWER OF THE OPERATING ENGINE CAN BE USED FOR NO LONGER THAN 6 MINUTES. AFTER THAT, THE ENGINE SHOULD BE OPERATED AT ONE-HOUR POWER OR BELOW THIS RATING FOR AT LEAST 5 MINUTES.

4.2.4. ONE-ENGINE-INOPERATIVE LANDING

1. The approach should be performed in such a way as to permit landing against the wind.
2. Make sure that the brake of main landing gear wheels is released.
3. At 50 meters above the ground reduce gently the airspeed to 60 km/h IAS and trim the helicopter at this speed. Adjust the approach angle by changing the collective pitch.

4. Touch-down should be performed at the airspeed of about 30 km/h. Just before touch-down increase the collective pitch so as to reduce the rate of descent to minimum.

5. Immediately after the helicopter has touched the ground with all its wheels, reduce the collective pitch to minimum and turn twist grip of the collective pitch lever fully to the left.

6. Minimize the ground roll with the wheel brakes.

4.3. SINGLE-ENGINE SHUT-DOWN AND RESTART IN FLIGHT

4.3.1. ENGINE SHUT-DOWN IN FLIGHT

In case of necessity to shut one engine down in flight, proceed as follows:

1. Reduce the collective pitch to about 6° and the airspeed to V = 100 km/h IAS and trim the helicopter at this speed.

2. Place the single engine control lever of the engine to be shut-down into the lower /idle/ position. Adjust the main rotor speed at the same time so as to maintain it within 78 - 84 %.

3. Continue the flight with one engine at idle for at least 5 minutes.

4. Cut off the fuel flow: the corresponding engine shut-down lever fully down.

4.3.2. ENGINE RESTART IN FLIGHT

If the engine, being previously shut-down in flight as described above under 4.3.1, is to be restarted, maintain the airspeed of 100 km/h IAS and attempt restart with the corresponding single engine power control lever in down position.

1. Check whether the generator of the engine to be restarted is off.

2. Check whether the "RUNNING/STARTING" switch on the upper control panel /section marked ENGINE STARTING/ is in STARTING position.

3. Check the ram effect of the gas producer of the engine to be restared.

NOTE: The engine can be restared at gas producer speed due to ram effect not exceeding 20 %. Above this limit the starting system will not operate due to automatic electrical interlock.

4. Place the LEFT/RIGHT switch on the upper control panel in the position corresponding to the engine to be started /LH or RH/.

5. Open the fuel shut-off valve of the engine to be started: the corresponding lever /between the front seats/ fully down /if it was closed/.

6. Set the operating engine at such power as to obtain the turbine inlet temperature not higher than 860°C.

CAUTION

THE TURBINE INLET TEMPERATURE OF THE OPERATING ENGINE INCREASES BY ABOUT 120°C WHILE ITS GENERATOR IS USED FOR ENERGIZING THE OTHER ENGINE.

7. Press in for 2 - 3 seconds the starting push-button on the upper control panel.

8. Open the fuel flow to the engine to be restarted: the corresponding engine shut-down lever in the upper position.

   NOTE: Pressing in the starting push-button will light a white light STARTING CONTINUES to indicate the beginning and continuation of the starting cycle. The cycle duration is about 30 s.

9. Start the stop watch on the instrument panel by depressing the RH knob of the clock.

   NOTE: The fuel flow opening, depressing the starting push-button and starting the seconds counter should be done simultaneously if possible.

10. Monitor the gas producer RPM acceleration, turbine inlet temperature, oil pressure and time. At the and of the starting cycle oil pressure should be within $1.5 \div 3$ kG/cm^2.

CAUTION

ABORT ENGINE STARTING IF: TURBINE INLET TEMPERATURE IS HIGHER THAN MAXIMUM ALLOWABLE AS FROM THE DIAGRAM IN THE GTD-350 ENGINE OPERATION MANUAL, GAS PRODUCER RPM STABILIZES BEFORE REACHING IDLE SPEED OR FAILS TO REACH IDLE SPEED WITHIN 40 SECONDS, OR IF FUEL OR OIL LEAKAGE OR ANY OTHER ABNORMALITIES HAVE BEEN DETECTED. ENGINE STARTING IS ABORTED BY DEPRESSING THE "INTERRUPT STARTING" PUSH-BUTTON ON THE UPPER CONTROL PANEL AND SIMULTANEOUS CUTTING OFF THE FUEL SUPPLY BY PLACING THE ENGINE SHUT-DOWN LEVER DOWN.

11. If the engine starting was completed properly and the engine has reached its idle speed of 57 ± 3 % reset the "LEFT/RIGHT" switch into the central position.

12. Switch on the generator of the engine just started.

13. Stop the stop-watch and clear off its indications by depressing the RH knob of the clock twice.

14. Start the stop-watch again.

15. Allow the engine just started to operate at idle for at least 1 minute, measuring the time by the stop-watch. After 1 minute, stop the stop-watch and clear off its indications.

16. Set the single engine power control lever of the engine just started in the central position.

17. Continue the flight with both engines operating.

4.4. MAIN ROTOR BLADES FLUTTER

Fluttering of the main rotor blades is manifested by strong vibrations of the helicopter and its controls, as well as by a blurred image of the main rotor disk.
When the above mentioned symptoms have been detected, the following should be done immediately:

1. Reduce the main rotor speed to 79 % by turning the twist grip to the left.
2. Reduce the airspeed by about 30 - 40 km/h.

NOTE: When main rotor blades flutter has occured, land as soon as possible at the nearest suitable area for servicing the helicopter.

4.5. UNINTENTIONAL AIRSPEED INCREASE

In case of unintentional airspeed increase beyond allowable limits /see Chapter II "Limitations"/ helicopter vibrations due to blade stall may occur, as well as helicopter swinging and descending. If the above symptoms are detected, do this:

1. Reduce the collective pitch gently.
2. Reduce the airspeed.

4.6. HYDRAULIC SYSTEM FAILURE

Any failure in the hydraulic system is indicated by the HYDRAULIC SYSTEM FAILURE warning /red/ light on the upper control panel and also by considerable forces felt while making longitudinal and lateral movements with the cyclic stick and changing the collective pitch.
Except for much greater forces required to operate the helicopter controls,no other changes in the control system will occur in case of the hydraulic system failure. The same movements of the cyclic stick and collective pitch lever are required as in flight with the hydraulic system being operative.

After the hydraulic system failure has been determined, do the following:

1. Place the hydraulic system switch in the upper control panel into OFF.
2. Using the trim switch reduce the airspeed to 100 - 140 km/h IAS.
3. Land as soon as possible /using the running landing technique, see 3.16. 2. above/ at the nearest suitable area.

4.7. MAIN GEARBOX FAILURE

Oil pressure drop, sudden increase of oil temperature and abnormal noise getting out of the gearbox are indicative of its failure.
After the failure has been determined, reduce immediately the engine power, descend and land.

4.8. TAIL ROTOR FAILURE

Loss of directional control and sudden yaw of the helicopter to the left are indicative of either the tail rotor failure or a failure of its drive system. In addition, considerble nose down pitch may occur if the tail rotor and its gearbox come off the tail boom.
In case of such failure proceed as follows:

1. IMMEDIATELY enter autorotation by pushing the collective pitch lever fully down and turning the twist grip fully to the left.
2. Reduce the airspeed to about 100 km/h IAS.
3. Cut off the fuel flow to the engines.
4. Make an autorotative running landing.

NOTE: While making an autorotative descending, turns should be made at a bank angle of 15°.

4. 9. TRIMMING SYSTEM FAILURE

4.9.1. TRIM SWITCH SHORT-CIRCUIT

When a short-circuit occurs in the control push-button of the trimming system, the trimming device will be set in the extreme position and considerable forces will be felt while moving the cyclic stick.

In such circumstances the trimming system should be turned off by placing the switches marked CONTR, LONG and LAT, into the lower position.
The switches are located in the first row of switches on the circuit breaker panel.

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4.9.2. TRIMMING DEVICE FAILURE OR SHORT-CIRCUIT WITHIN TRIMMING SYSTEM

The trimming system failure is manifested by no response /no change of forces/ to the trim switch on the cyclic stick. In such a case, do the following:

1. Turn off two switches of the trimming system on the circuit breaker panel /LONG. and LAT./.
2. Continue the flight to the nearest landing site without changing the flight regime.
3. Land in a normal manner.

4.10. FIRE IN FLIGHT

Fire symptoms are the following:

- lighting of the red FIRE warning light on the instrument panel, as well as lighting of a red light marked FIRE and a light indicating the affected compartment, i.e. LEFT ENGINE, MAIN GEARBOX or RIGHT ENGINE , on the detection and extinguishing panel;
- smoke, flames or burning odour in the cockpit and/or cabin;
- smoke, flames at the engine outlet;
- a rapid increase in turbine inlet temperature and exeeding the maximum allowable values.

4.10.1. ENGINE COMPARTMENT FIRE

In case of fire in the engine compartment, the red FIRE warning light on the instrument panel and red lights: FIRE and LEFT ENGINE/RIGHT ENGINE/ on the fire extinguishing panel are illuminated. At the same time a valve will automatically open in the affected compartment, a red VALVE OPENED light will go on and the fire extinguishing agent will be delivered to the affected compartment from the first discharged bottle.
Upon automatic discharge of the first bottle, the yellow BOTTLE HAS OPER.AUTOM. light will go on.
As soon as the red warning lights are on, the following should be done:

1. Shut down the affected engine.
2. Close the fuel shut-off valve of this engine.
3. Establish a single-engine flight by following the procedure described in this chapter under 4.2.3. "SINGLE-ENGINE FAILURE DURING CRUISE".

If, after automatic discharge of the first bottle, the fire is out, the red FIRE light in the center of the fire extinguishing panel will go off.
However, the FIRE warning light on the instrument panel and the indicator light LEFT ENGINE or RIGHT ENGINE on the fire extinguishing panel will remain on.

4.11. POWER TURBINE GOVERNOR FAILURE

This failure is manifested by an uncontrollable rotor speed increase to well above 84 %, and fluctuations in speed of the gas producers. When such indications have been noticed, turn the twist grip of the collective pitch lever to the left and establish the main rotor speed within the range of 78 - 79 %.
Continue the flight at the airspeed reduced by about 30 km/h.

4.12. ADF FAILURE

In case of ADF failure, the helicopter's heading can be read out from the magnetic compass located on the left side of the instrument panel.
As the electrical equipment highly interfers with the magnetic compass indications, it is necessary to turn off the following equipment before reading the heading:

a/ fans,
b/ pitot tube heating,
c/ battery compartment heating,
d/ windscrean wiper,
e/ anti-icing system and windscreen heating,
f/ AC generator.

NOTE: Even if all the above equipment is turned off, the magnetic compass indications will not be reliable unless after about 20 minutes from the moment of starting the engines on battery power.

4.13. EMERGENCY PARACHUTING

Helicopter's design features, its flying properties and capability to perform autorotative flights, do not make it necessary to use parachutes during normal flights. Under some circumstances, however, this is necessary /e.g. in test flights, parachute training, etc./.
If it is necessary to leave the helicopter by parachuting, do the following:

1. Warn all the persons aboard that it is necessary to leave the helicopter.
2. Reduce the airspeed to about 60 km/h IAS and trim the helicopter at this speed.
3. Jettison the RH front door.
4. Bail out through the opening of the RH front door by pushing off strongly with the right foot against the rear corner of the door opening. The pilot bails out last.

WARNING

AFTER LEAVING THE HELICOPTER, OPEN THE PARACHUTE NOT EARLIER THAN AFTER 3 SECONDS.

4.10.4. AUTOMATIC FIRE EXTINGUISHING SYSTEM FAILURE

In case of fire in any of the fire protected compartments and a failure of the automatic fire extinguishing system, proceed as follows:

1. Press in the manual control push-button of the first discharged bottle for the affected compartment. This will light the red VALVE OPENED light and the yellow BOTTLE HAS OPER. AUTOM. light. The manual control push-button is located on the fire extinguishing panel below the indicator lights of the corresponding compartment.
2. If the fire is not out after the first bottle has been discharged, press in the manual control push-button of the second bottle 2-ND BOTTLE SWITCH ON and then the 3-RD BOTTLE SWITCH ON. This should put on the yellow lights 2-ND BOTTLE HAS OPER. and 3-RD BOTTLE HAS OPER.

If the automatic fire extinguishing system fails after discharging the first bottle, and thus no warning lights are put on even if a repeated fire is determined, do the following:

1. Press in the manual control push-button of the first bottle below the indicator light of the affected compartment. This will open the valve releasing the agent to this compartment and put the VALVE OPEN light on.
2. Extinguish the fire using the second, and then the third bottle. To this end press in the manual control push-buttons: the 2-ND BOTTLE SWITCH ON first, and then the 3-RD BOTTLE SWITCH ON.

119

4.10.5. CABIN OR COCKPIT FIRE

In case of fire in the cabin or cockpit, proceed as follows:

1. Turn off all the electically powered equipment.
2. With a help from the cabin occupants try to extiguish the fire using a portable fire extinguisher.
3. Land immediately.
4. Make every effort to save the passengers and/or cargo and extinguish the fire.

4.10.6. ELECTRICAL SYSTEM FIRE

In case of the electrical system fire, turn the affected section off.
If it is impossible to localize the fire, the entire electrical system should be turned off. If both generators are affected, the pilot must turn off any unnecessary electrical equipment.
Land immediately at the nearest landing site.

When the fire in the engine compartment is out, do this:

1. Put the FIRE warning light and the LEFT ENGINE or RIGHT ENGINE light off. To this end place the operation mode detector switch on the fire extinguishing panel from FIRE EXTING. ON to TESTING and back to FIRE EXTING. ON.
2. Land as soon as possible.

When the switch is placed to ON again, the fire extinguishing system is ready for operation in case of fire located elsewhere.
If the fire persists after automatic discharge of the first bottle, and the red FIRE light on the fire extinguishing panel is still on, the pilot must:

1. Press in the push-button marked 2-ND BOTTLE SWITCH ON. This should put on the yellow light marked 2-ND BOTTLE HAS OPER.
2. If the second bottle discharge should not put the fire out, press in the 3-RD BOTTLE SWITCH ON, which will put the yellow 3-RD BOTTLE HAS OPER. light on.

CAUTION

IT IS FORBIDDEN TO RESTART THE ENGINE AFTER EXTINGUISHING THE FIRE IN ITS COMPARTMENT.

4.10.2. GEARBOX COMPARTMENT FIRE

The FIRE warning light on the instrument panel and FIRE and MAIN GEARBOX lights on the fire extinguishing panel will go on when fire is sensed by detectors in the main gearbox compartment.
The procedure to be followed by the pilot in this case is the same as in case of engine compartment fire. The only exception is that engine shut-down is not required.

4.10.3. REPEATED FIRE

In case of repeated fire in any of the fire protected compartments the following lights are on: a FIRE warning light, on the instrument panel, as well as a FIRE light and a fire location light, both on the fire detection and extinguishing panel.
The valve releasing the agent to the affected compartment will open automatically.
This will be indicated by lighting of a red light marked VALVE OPENED.
After that, the following should be done:

1. Press in the push-button marked 2-ND BOTTLE SWITCH ON.
2. Proceed as described under 4.10.1. "Engine Compartment Fire".

118

NOTE: If the pilot finds it more convenient to leave the helicopter through the LH door beside his seat, this door should be jettisoned just after the RH front door.

4.14. EMERGENCY ENTRANCE

In case of necessity to enter the helicopter on the ground /e.g. after a serious damage/ attempt to open the RH or LH front door first.
If the door does not open normally, break the window pane and pull the red lever to jettison the door.
Emergency entrance to the helicopter is also possible by breaking both panes of the windscreen.

4.15. DC SYSTEM FAILURE

In case of failure of one generator or both batteries, it is permitted to continue the flight. In case of failure of both generators or both batteries and one generator, it is necessary to find a landing site and land there.

4.15.1. SINGLE DC GENERATOR FAILURE

If the GEN.FAILURE /left or right/ light goes on, place the switch of the affected generator "OFF" and switch off the battery heating if it was on.
Then check the other generator for proper operation by voltage and amperage measurements.
The amperage must not exceed 100A. Adjust voltage to 28,5V if necessary.

4.15.2. DUAL DC GENERATOR FAILURE /BATTERY POWER ONLY/

If the LEFT GEN.FAILURE and RIGHT GEN.FAILURE lights go on, place the switches of both generators to OFF and choose a landing site.
Duration of flight is permitted for up to 0.5 hour with the following items being switched off:

- DW-1 kM and DW-3 fans /1 off/
- windscreen wiper
- landing, taxiing, etc. lights
- battery heating
- passenger cabin lighting

and with the following items being switched on:

- blade deicing system /in icing conditions/
- temperature gauges

- position lights and cockpit lighting
- anti-collision light and fuel pumps /ECN-75/
- lettering illumination /main or auxiliary/
- one transceiver.

It is permitted to switch on the MPRF-1A landing light for about 4 minutes during approach and landing.

4.15.3. DUAL-BATTERY FAILURE

In case of failure of both batteries, place the BATTERY/EXTERNAL POWER switch to OFF.

4.15.4. SINGLE DC GENERATOR AND DUAL-BATTERY FAILURE

If the LEFT GEN.FAILURE /or right/ and BATTERY FAILURE light should go on:
- place the switches of the failed power sources /batteries and one generator/ to OFF.

NOTE: When the STG-3 generator operaters properly it can provide power for all the basic electrical equipment.

4.16. SIDE BALANCE OF HELICOPTER ON GROUND

When the helicopter is starting to move, or during acceleration, taxiing or vertical takeoff, the helicopter may show a tendency to overturn about the axis passing through the nose wheel and one of the main gear wheels. The tendency, being caused by incorrect movements of the controls, results from the following forces /Fig. 4.2./:
- tail rotor thrust,
- main rotor lateral force due to cross-wind or if the swashplate is tilted sideways,
- main rotor longitudinal force directed forward /the cyclic stick moved forward/,
- decrease of the stabilizing moment due to the helicopter weight.

The force countering the overturn tendency of the helicopter is the resultant force of helicopter weight and the main rotor thrust.
All these forces, acting on an arm equal to a distance from their application points to the axis passing through the nose-wheel and oneof the main gear wheels, produce moments about this axis.
When the resultant overturning moment exeeds the counter-acting moment the helicopter will start to tilt.
Any increase of the main rotor thrust will decrease the counteracting moment, because the force acting against overturning of the helicopter will decrease.

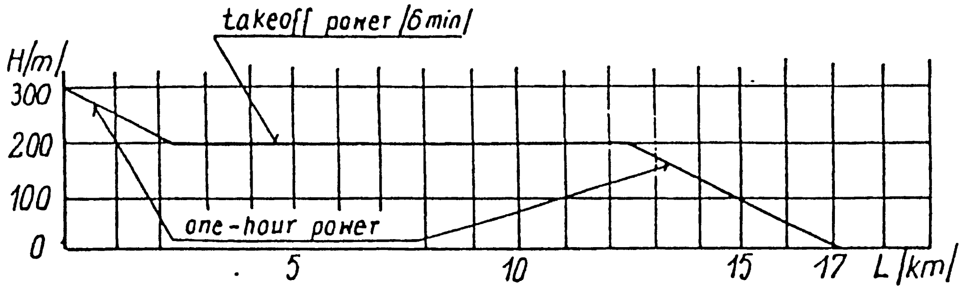
The following factors increase the tendency to overturn the helicopter:

- forward displacement of the helicopter center of gravity decreases the arm of a counteracting force, and therefore the counter-acting moment,
- unfavourable cross-wind direction,
- pushing the cyclie stick forward /then the main rotor lingitudinal force is produced/.

The worst case concerning the possibility of overturning the helicopter is when all the above factors occur simultaneously and the helicopter is in such a position that it cannot slide sideways /e.g. the wheel either rests against some uneveness of the ground or falls into a hole or muddy ground/ and is on inclined terrain /inclination of the runway, inclination of the helicopter on soft ground due to unequal loading of the wheels, etc./.

In order to allow the helicopter to overturn on the ground, the pilot should be guided by the following principles:

- in case of sudden increase of inclination /falling of one of the wheels into a ground hole, running over a knoll, inclination of the runway/ when the helicopter begins to tilt, it is necessary to decrease the main rotor pitch or lift-off /if conditions permit/,
- it should be rememberd that pushing tail rotor pedal in the direction opposite to tilting or sliding will increase the overturn tendency,
- when on a slope, set the helicopter so that the tail rotor thrust is directed in the direction opposite to tilting.



Extended single engine descent at one - hour/takeoff power.
Covered distance is 7 km at 300 m height loss and rate of descent of 1,25 m/s.

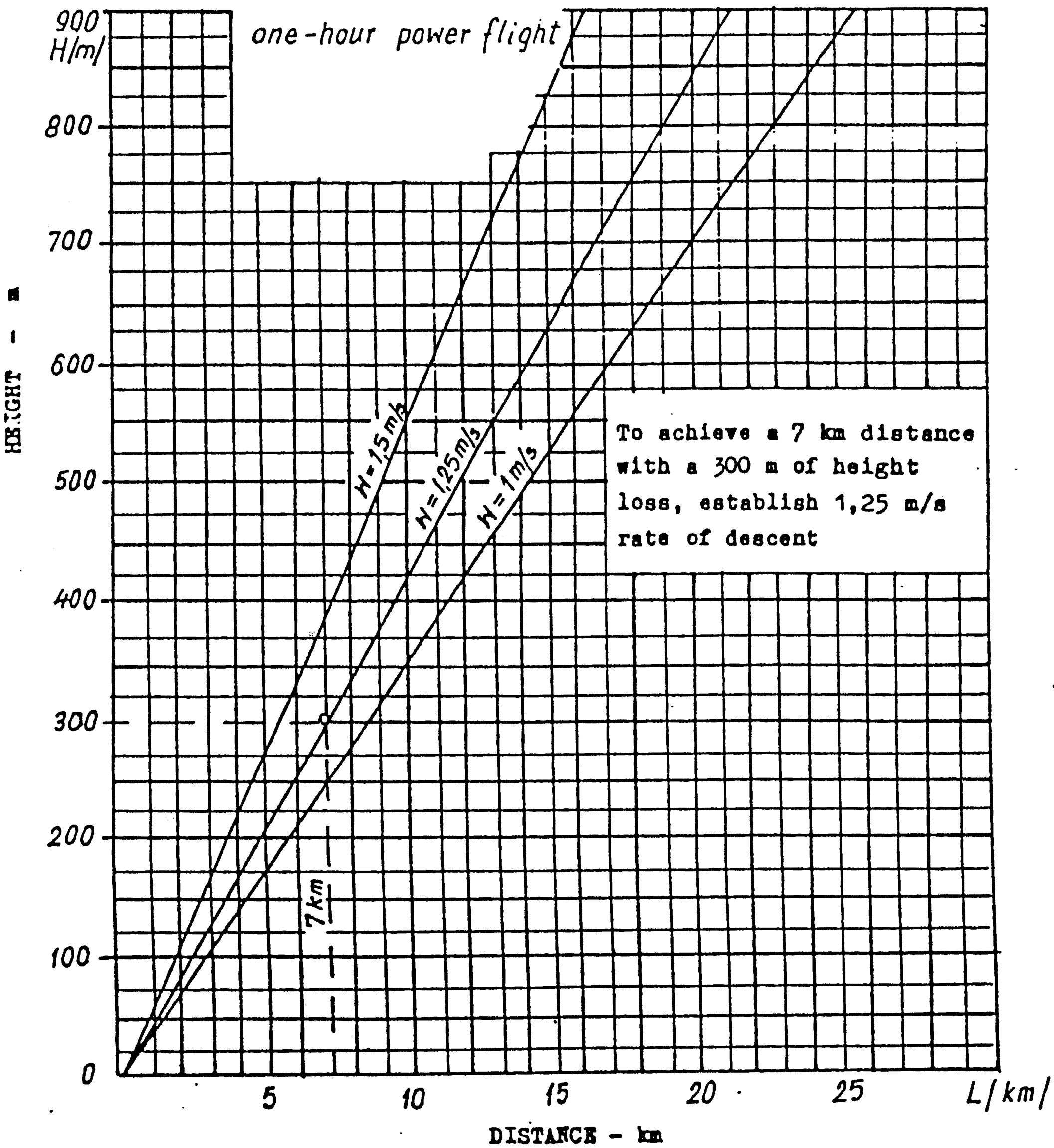


Fig. 4.1. SINGLE ENGINE DISTANCE OF FLIGHT AT ONE - HOUR POWER

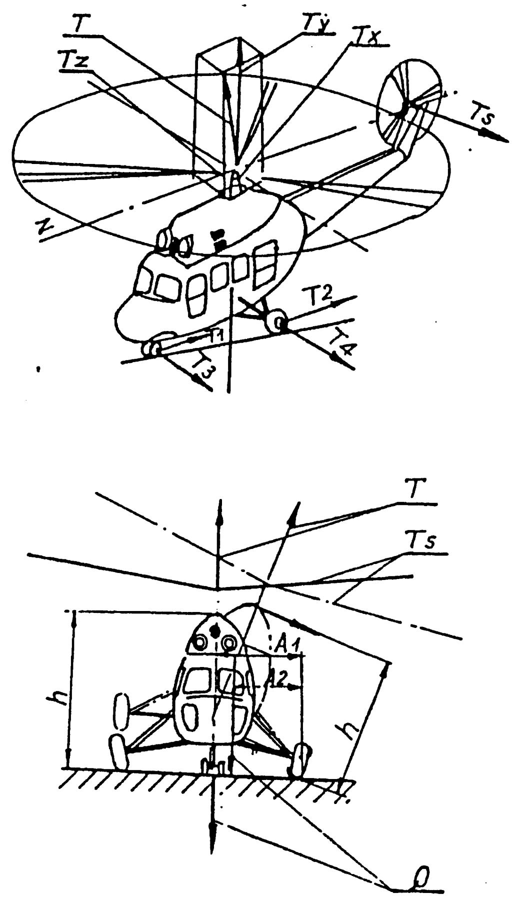


Fig. 4.2. SYSTEM OF FORCES ACTING ON HELICOPTER ON GROUND

T - main rotor thrust; T_z - longitudinal component of main rotor thrust; T_x - lateral component of main rotor thrust; Ty - vertical companent of main rotor thrust; T_s - tail rotor thrust; Q - helicopter weight T1; T2; T3; T4; - wheels resisting forces due to rough surface; A1 - weight arm; A_2 - tilted helicopter weight arm; h - arm of tail rotor thrust.

CHAPTER V

PERFORMANCE

CHAPTER V - TABLE OF CONTENTS

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CHAPTER V

PERFORMANCE

5.1. AIRSPEED CALIBRATION

The airspeed calibration table V-1 is intended for determining calibrated airspeed V_o/CAS/ from indicated airspeed V_{pp}/IAS/.
The corrections shown in this table account for error due to pitot tube position on the fuselage only /i.e.aerodynamic error/ Because of low airspeed, the errors due to air compressibility have been disregarded.

TABLE V-1. AIRSPEED INDICATOR CORRECTIONS

V_{IAS}	Corr. ΔV	V_{CAS}	V_{IAS}	Corr. ΔV	V_{CAS}
km/h	km/h	km/h	km/h	km/h	km/h
40	+5	45	130	-1	129
50	+5	55	140	-3	137
60	+3	63	150	-5	145
70	+1	71	160	-7	153
80	-1	79	170	-8	162
90	-1	89	180	-10	170
100	-2	98	190	-11	179
110	-2	108	200	-12	188
120	0	120	210	-10	200

5.2. INTERNATIONAL STANDARD ATMOSPHERE

TABLE V-2.

Standard sea level conditions:

Pressure	760 mm Hg - 1013.25 mb
Air temperature	288°K or 15°C
Density	1.2255 kg/m^3
Specific gravity of air	0.124966 kG.sec^2/m^4
Speed of sound	340.2 m/sec.

Altitude m	Pressure		Temperature		$\frac{1}{\sqrt{\sigma}}$
	mm Hg	mb	^{o}K	^{o}C	σ - density ratio
-200	778.20	1037.52	289.30	16.30	0.99049
0	760.00	1013.25	288.00	15.00	1.00000
200	742.14	989.44	286.70	13.70	1.00967
400	724.63	966.09	285.40	12.40	1.01948
600	707.45	943.19	284.10	11.10	1.02943
800	690.60	920.73	282.80	9.80	1.03953
1000	674.08	898.70	281.50	8.50	1.04976
1200	657.88	877.10	280.10	7.20	1.06015
1400	642.00	855.93	278.90	5,90	1.07069
1600	626.43	835.17	277.60	4.60	1.08139
1800	611.17	814.82	276.30	3.30	1.09223
2000	596.20	794.87	275.00	2.00	1.10326
2200	581.54	775.32	273.70	0.70	1.11444
2400	567.17	756.16	272.40	-0.60	1.12579
2600	553.09	737.39	271.10	-1.90	1.13732
2800	539.29	719.00	269.80	-3.20	1.14900
3000	525.77	700.98	268.50	-4.50	1.16087
3200	512.53	563.32	267.20	-5.80	1.17292
3400	499.56	666.03	265.90	-7.10	1.18515
3600	486.86	649.09	264.60	-8.40	1.19757
3800	474.42	632.51	263.30	-9.70	1.21019
4000	462.24	616.27	262.00	-11.00	1.22300

5.3. DENSITY ALTITUDE CHART

The density altitude chart in Fig. 5-1, is intended for determining density altidude on the basis of pressure altitude as indicated by the altimeter set for sea level conditions /0 m 760 mm Hg/ and outside air temperature.

NOTE: It is essential to know density altitude while using the performance data and limitations provided without taking into account the ambient outside air temperature changes.

DENSITY ALTITUDE CHART

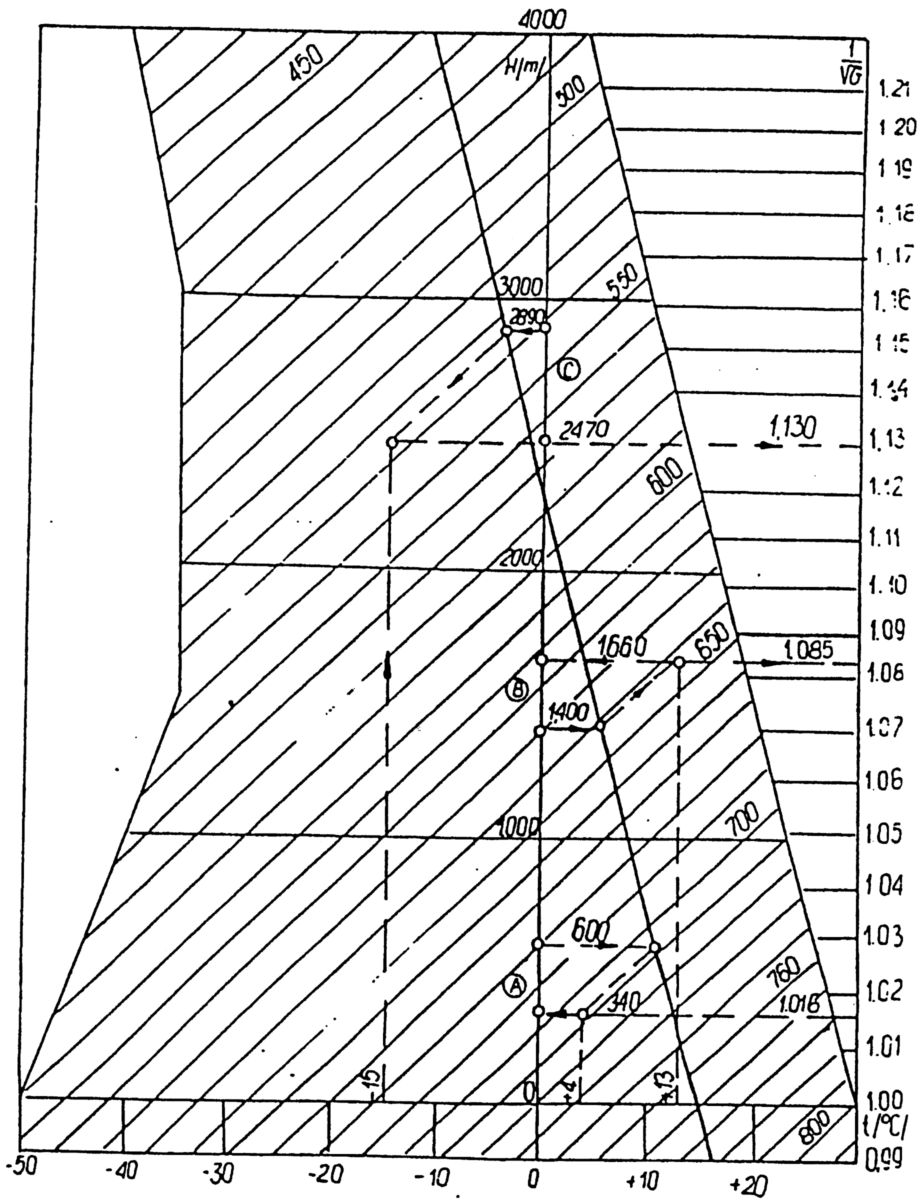


Fig. 5.1. DENSITY ALTITUDE CHART

Fig. 5-1 gives three examples of determining density altitude:

[illegible]	Pressure altitude m	Outside temperature °C	Density altitude m
A	600	+4	340
B	1400	+13	1.660
C	2880	-15	2.470

The $1/\sqrt{\sigma}$ scale in Fig. 5-1 is intended for determining the equivalent airspeed V_i/EAS/. It is not required to determine EAS during normal helicopter operation.

5.4. DUAL-ENGINE RATE OF CLIMB

The charts in Figs. 5-2 and 5-3 provide information on the rate of climb in dual-engine flight at one-hour power.
Fig. 5-2 refers to the helicopter weight of 3,000 kg, whereas Fig. 5-3 to that of 3,500 kg. Rates of climb for all weights between these two can be calculated approximately using the following formula:

$$W_Q = W_{3000}\ /7 - \frac{Q}{500}/ - W_{3500}\ /6 - \frac{Q}{500}/$$

where: Q - gross weight

W_Q - rate of climb for gross weight of Q

W_{3000} - rate of climb for gross weight of 3,000 kg

W_{3500} - rate of climb for gross weight of 3,500 kg

Example:

The helicopter weight is 3,200 kg, pressure altitude is 900 m, and ambient temperature +10°C. For gross weight of 3,000 kg under the above conditions the rate of climb is W_{3000} = 5.1 m/s and for 3,500 kg W_{3500} = 3.26 m/s.

Therefore the rate of climb for gross weight of 3,200 kg is

$$W_{3200} = 5.1\ /7 - \frac{3.200}{500}/ - 3.26\ /6 - \frac{3.200}{500}/ = 4.36 \text{ m/s}$$

DUAL - ENGINE RATE OF CLIMB

ENGINE RATING —— ONE-HOUR POWER
AIRSPEED —— 100 km/h IAS
HELICOPTER WEIGHT —— 3,000 kg
ISA CONDITIONS

Example:

At flight altitude of 900 m and outside air temperature of +10°, dual-engine rate of climb at one-hour power and airspeed of 100 km/h IAS is 5.1 m/s.

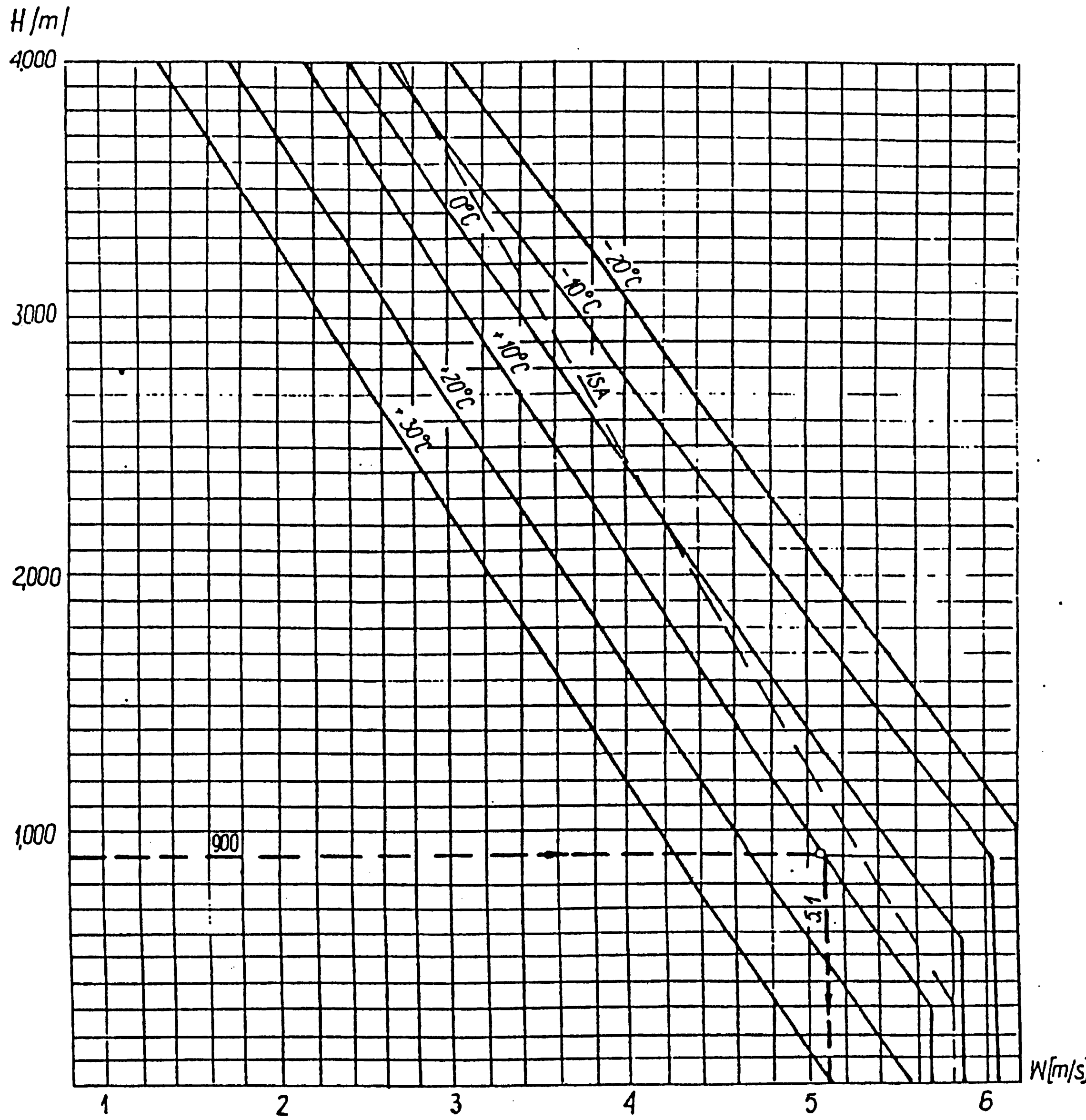


Fig. 5.2. DUAL-ENGINE RATE OF CLIMB

DUAL-ENGINE RATE OF CLIMB

ENGINE RATING — ONE HOUR POWER
AIRSPEED — 100 km/h IAS
HELICOPTER WEIGHT — 3,500 kg
ISA CONDITIONS

Example:

At flight altitude of 900 m and outside air temperature of +10°C, the rate of climb in a dual-engine flight at one-hour power and airspeed of 100 km/h IAS is 3.26 m/s.

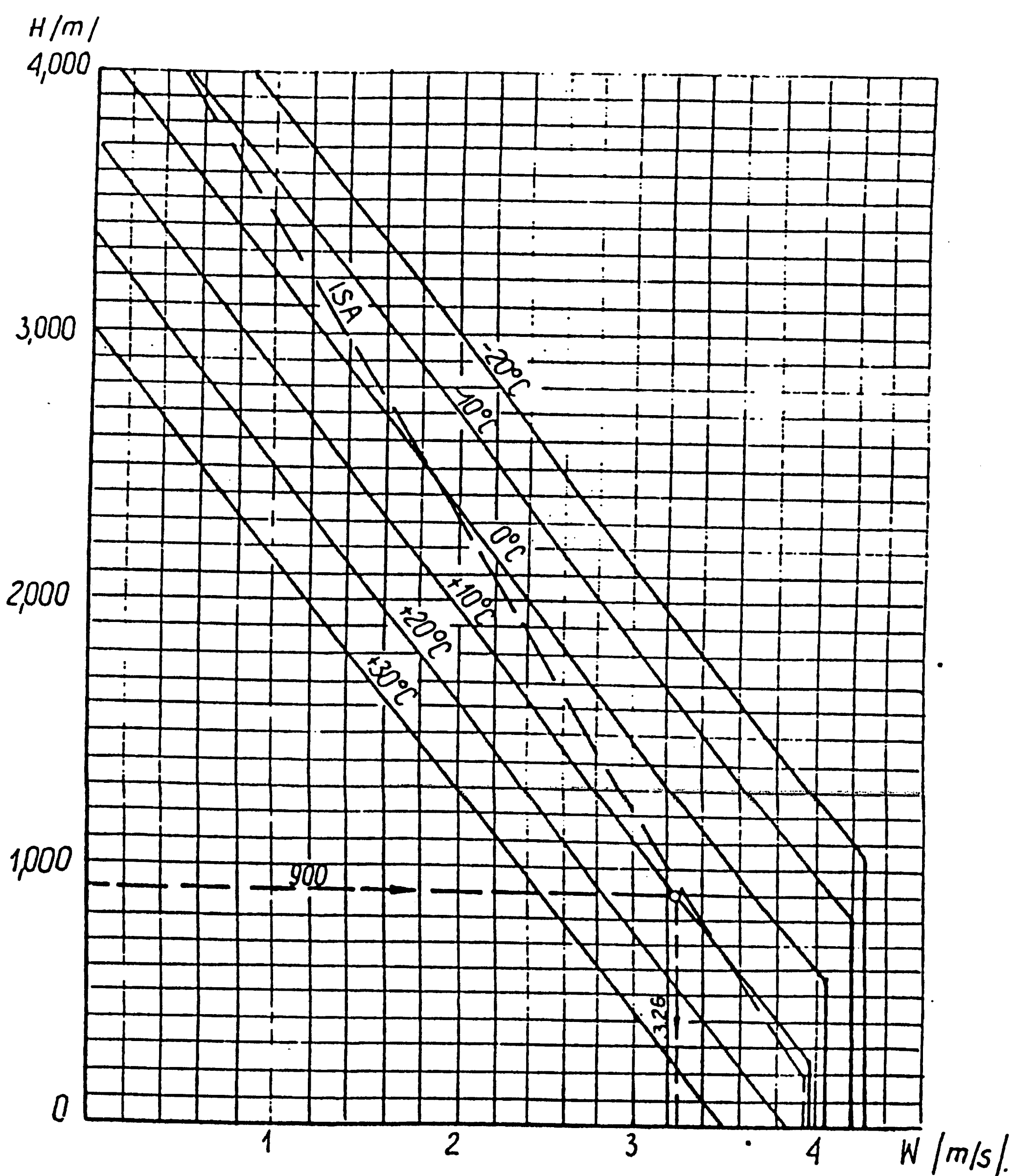


Fig. 5.3. DUAL-ENGINE RATE OF CLIMB

NOTE: 1. With the skis installed the rate of climb is reduced by 0.6 m/s.

5.5. SINGLE-ENGINE RATE OF CLIMB AND DESCENT

The charts in Figs. 5-4 and 5-5 provide information on the rate of descent /climb/ in single-engine flight at takeoff power of the operating engine.
The charts in Figs. 5-6 and 5-7 provide information on the rate of descent in single-engine flight at one-hour power of the operating engine.
The charts in Figs. 5-4 and 5-6 refer to the gross weight of 3,000 kg, whereas Figs. 5-5 and 5-7 to that of 3,500 kg.
Rates of climb /descent/ for any other gross weight can be calculated using the same formula as in Chapter V, item 5.5. for dual-engine flight.

5.6. RANGE

The flight range at a given gross weight depends on the quantity of fuel in the tanks and the flight regime determined by altitude and indicated airspeed.

While determining the weight of useful load, observe the maximum takeoff weight limit, i.e. 3,500 kg.
The weight and center of gravity location should be calculated as in Appendix No.1 "Helicopter Weight and Center of Gravity Calculation".

The selection of flight regime depends on the mission.
It should be remembered, however, that during cruise at altitude up to 1,000 m, the range will .increase with flight altitude.

SINGLE - ENGINE RATE OF CLIMB

ENGINE RATING — TAKEOFF POWER
AIRSPEED — 100 km/h IAS
HELICOPTER WEIGHT — 3,000 kg
ISA CONDITIONS

Example:

At flight altitude of 1,100 m and outside air temperature of +10°C, the rate of climb in a single-engine flight at take-off power and airspeed of 100 km/h IAS is 1,04 m/s.

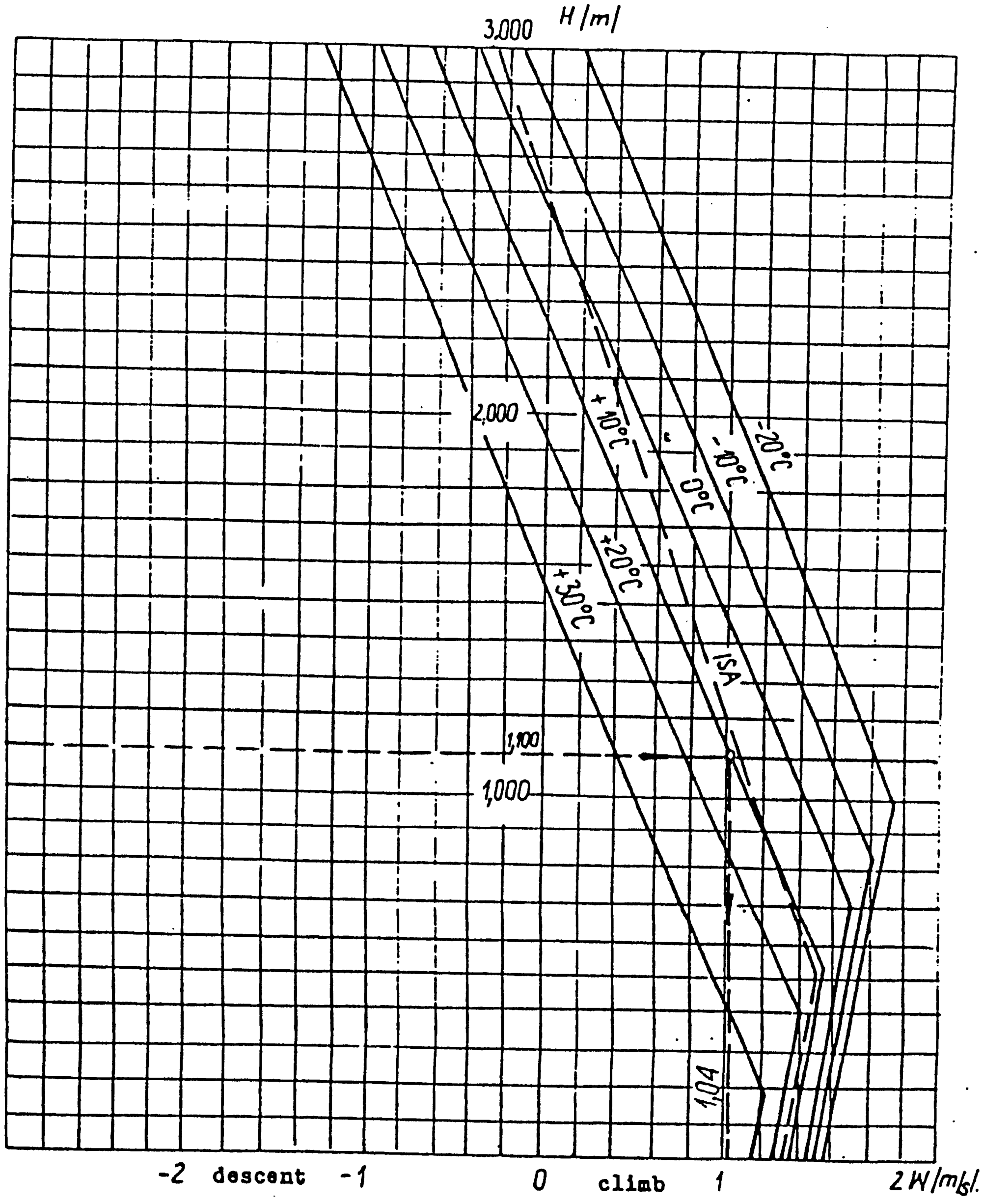


Fig. 5.4 SINGLE-ENGINE RATE OF CLIMB

SINGLE-ENGINE RATE OF CLIMB

ENGINE RATING — TAKEOFF POWER
AIRSPEED — 100 km/h IAS
HELICOPTER WEIGHT — 3,500 kg
ISA CONDITIONS

Example:

At flight altitude of 500 m and outside air temperature of +30°C, and in a single-engine flight at take-off power /6 min./ and airspeed of 100 km/h IAS, the helicopter descends at a rate of 0.4 m/sec.

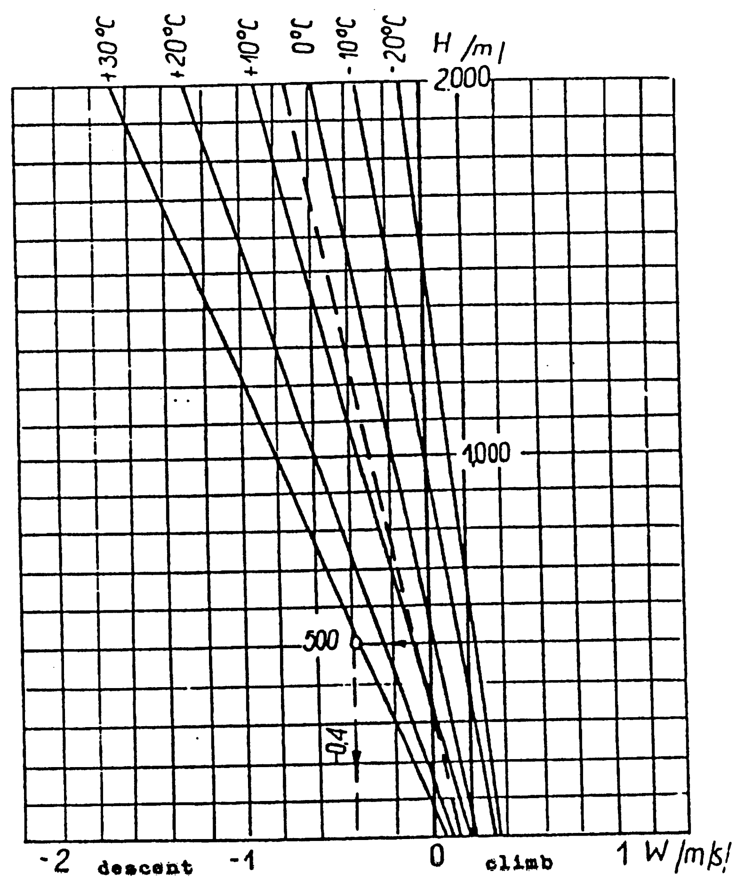


Fig. 5.5. SINGLE-ENGINE RATE OF CLIMB

SINGLE - ENGINE RATE OF CLIMB

ENGINE RATING —— ONE- HOUR POWER
AIRSPEED —— 100 km/h IAS
HELICOPTER WEIGHT —— 3,000 kg
ISA CONDITIONS

Example:

At flight altitude of 1,600 m and outside air temperature of +10°C, and in a single-engine flight at one-hour power and airspeed of 100 km/h IAS, the helicopter descends at a rate of 0.88 m/s.

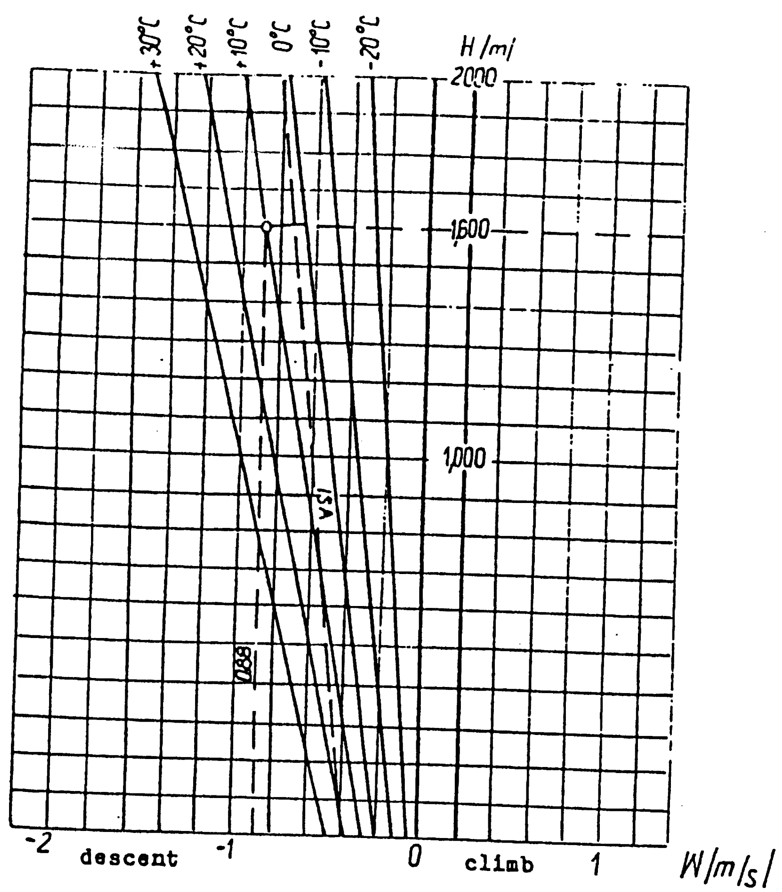


Fig. 5.6. SINGLE-ENGINE RATE OF CLIMB

SINGLE-ENGINE RATE OF CLIMB

ENGINE RATING — ONE-HOUR POWER
AIRSPEED — 100 km/h IAS
HELICOPTER WEIGHT — 3,500 kg
ISA CONDITIONS

Example:

At flight altitude of 700 m and outside air temperature of +20°C, and in a single-engine flight at one-hour power and airspeed of 100 km/h IAS, the helicopter descends at a rate of 1.8 m/s.

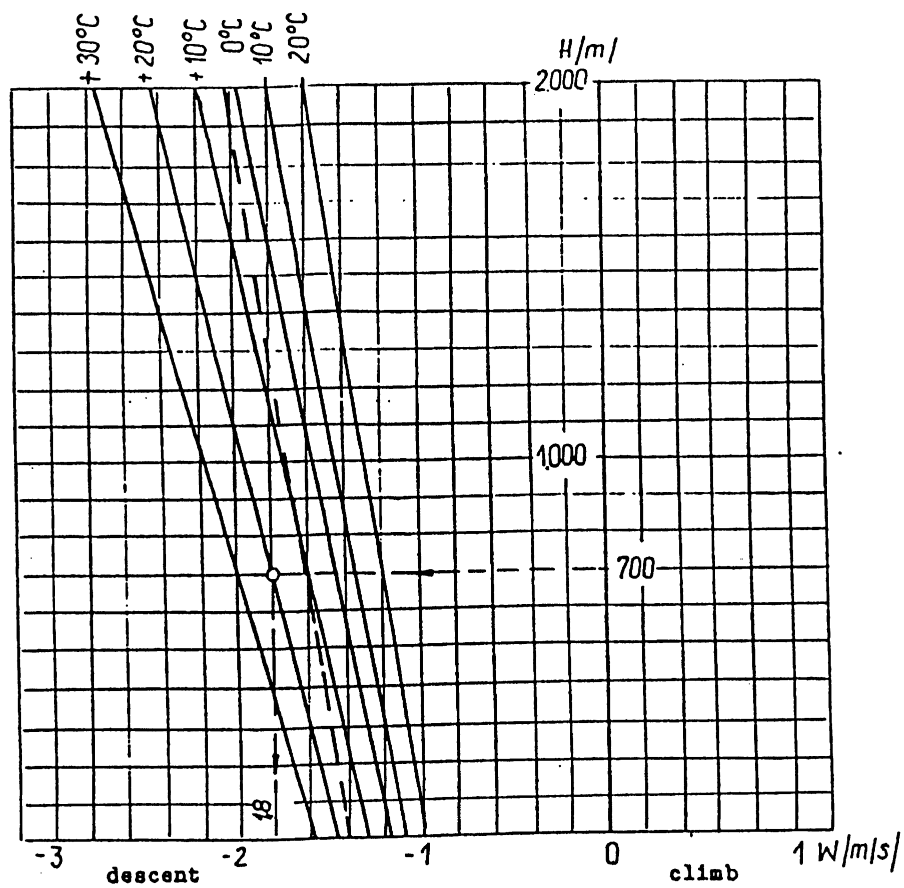


Fig. 5.7. SINGLE-ENGINE RATE OF CLIMB

NOTE: In order to achieve the range specified in this Chapter, maintain the cruising speed /IAS/ as in Table V-3.

TABLE V-3. CRUISING SPEED

Pressure altitude /m/	V_{IAS} /km/h/
100	190
500	190
1000	190
2000	160
3000	120

The charts in Figs. 5-9, 5-10, 5-11 and 5-12 provide a means of determining the range for given flight altitude and loading.

The values in the charts refer to windless conditions and flight with no altitude changes during cruise.

While preparing the range information, the following assumptions have been made:

a/ Ground run of the engines before takeoff /starting and warming up/ for 5 minutes,

b/ Climbing to the flight altitude at one-hour power and airspeed of 100 km/h, IAS,

c/ Rate of descent while approaching in compliance with the requirements specified in Table V-4.

TABLE V-4. RECOMMENDED APPROACH SPECIFICATIONS

Initial altitude	V_{IAS}	Rate of descent	Distance	Time
m	km/h	m/s	km	min
100	110	3	0.9	0.5
500	110	4	4	2
1,000	105	4	8	4
2,000	95	4	13	8
3,000	90	4	19	12

d/ A 10 % fuel reserve remains after landing.

In order to make allowances for the wind speed, refer to Table V-5 and charts in Figs. 5-13 and 5-14.

RANGE AT 100m PRESSURE ALTITUDE

ENGINE RATING — CRUISE POWER
AIRSPEED — 190 km/h IAS
ISA CONDITIONS

———— helicopter without auxiliary fuel tanks
— — — helicopter with two auxiliary fuel tanks

Example:

With payload of 750 kg, the range at 100 m pressure altitude is 205 km.

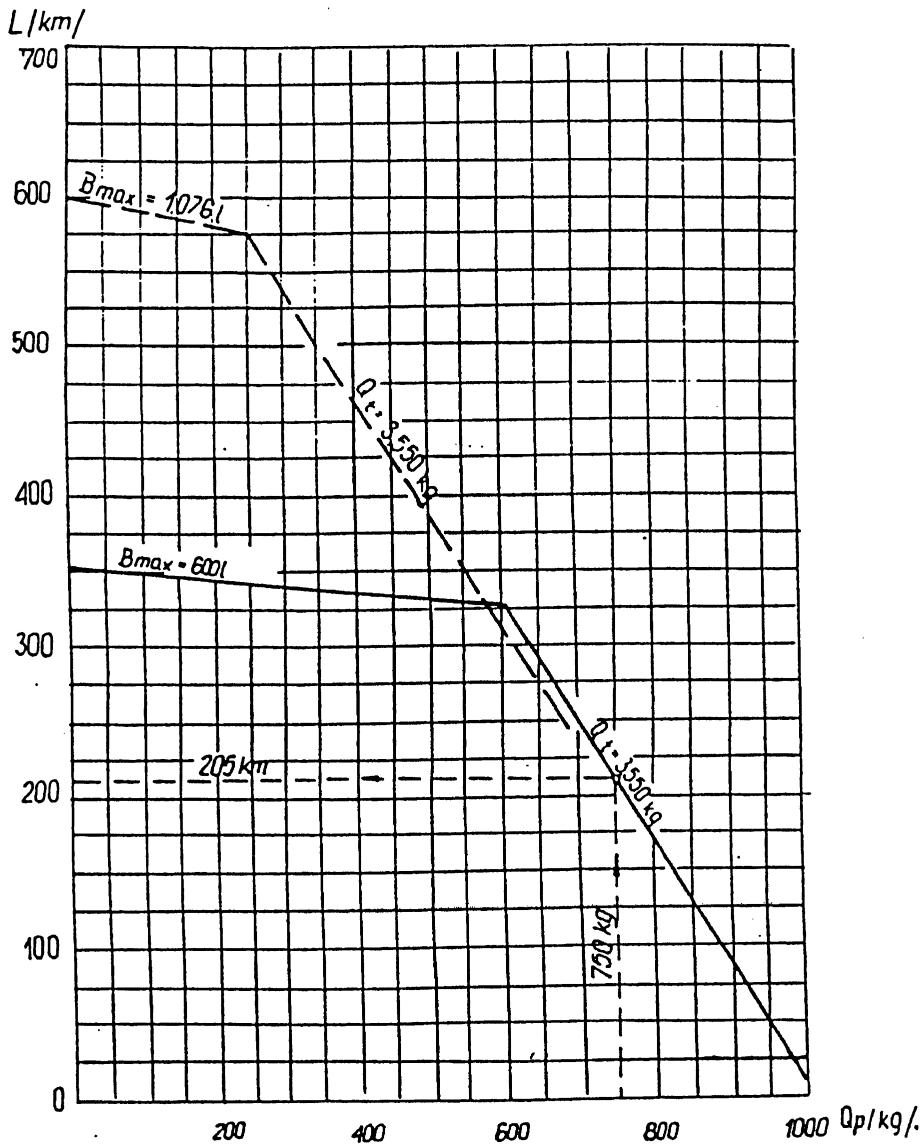


Fig. 5.8. RANGE AT 100 m PRESSURE ALTITUDE

RANGE AT 500m PRESSURE ALTITUDE

ENGINE RATING — CRUISE POWER
AIRSPEED — 190 km/h IAS
ISA CONDITIONS

——— helicopter without auxiliary fuel tanks
— — — helicopter with two auxiliary fuel tanks.

Example:

With payload of 750 kg, the range at 500 m pressure altitude is 217 km.

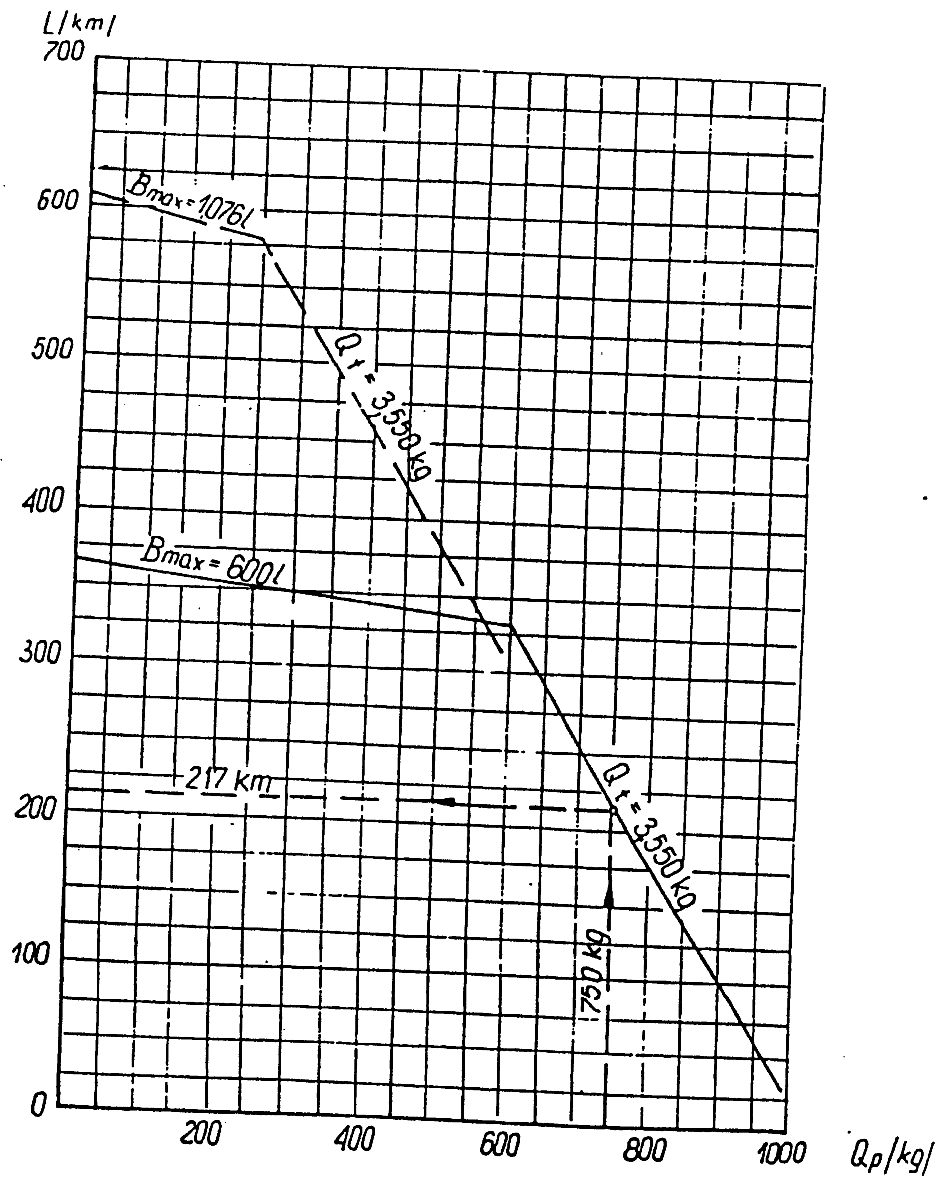


Fig. 5.9. FLIGHT RANGE AT 500 m PRESSURE ALTITUDE

RANGE AT 1,000m PRESSURE ALTITUDE

ENGINE RATING — CRUISE POWER
AIRSPEED — 190 km/h IAS
ISA CONDITIONS

——— helicopter without auxiliary fuel tanks
— — — helicopter with two auxiliary fuel tanks

Example:

With payload of 750 kg, the range at 1,000 m pressure altitude is 225 km.

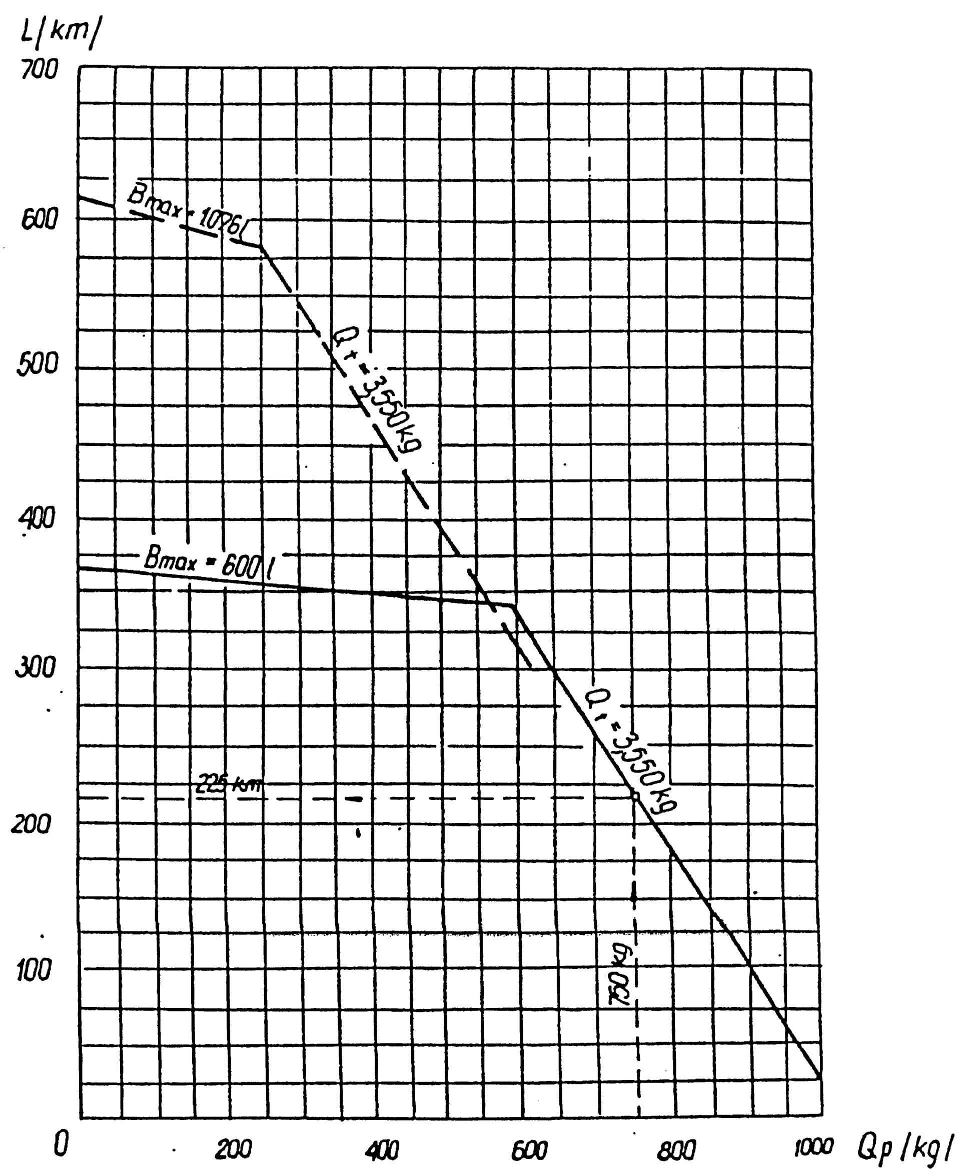


Fig 5.10. FLIGHT RANGE AT 1,000 m PRESSURE ALTITUDE

RANGE AT 2,000m PRESSURE ALTITUDE

ENGINE RATING – CRUISE POWER
AIRSPEED – 160 km/h IAS
ISA CONDITIONS

——— helicopter without auxiliary fuel tanks
— — — helicopter with two auxiliary fuel tanks

Example:

With payload of 750 kg, the range at 2,000 m is 217 km.

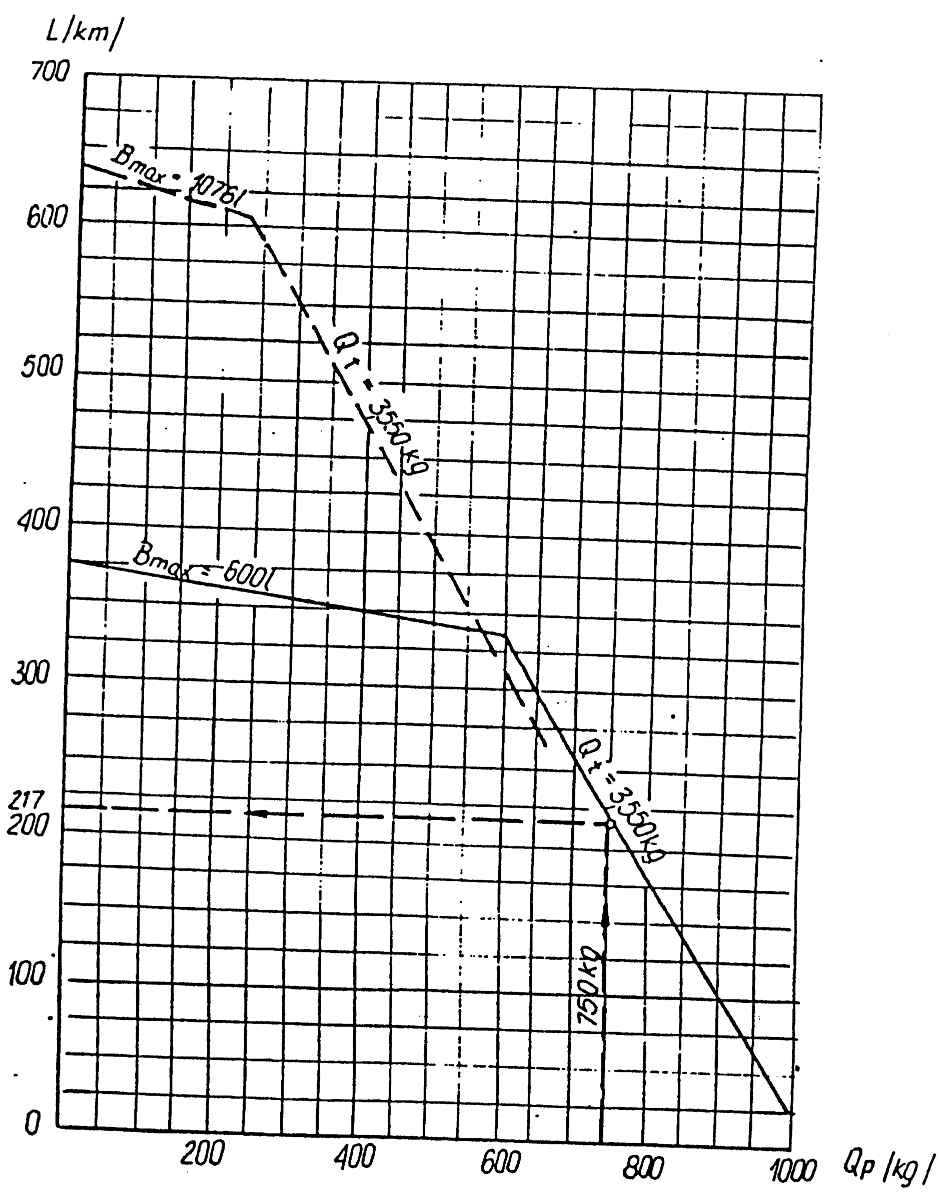


Fig. 5.11. FLIGHT RANGE AT 2,000 m PRESSURE ALTITUDE

RANGE AT 3,000 m PRESSURE ALTITUDE

ENGINE RATING — CRUISE POWER

AIRSPEED — 120 km/h IAS

ISA CONDITIONS

——— helicopter without auxiliary fuel tanks

— — helicopter with two auxiliary fuel tanks

Example:

With payload of 750 kg, the range at 3,000 m pressure altitude is 212 km.

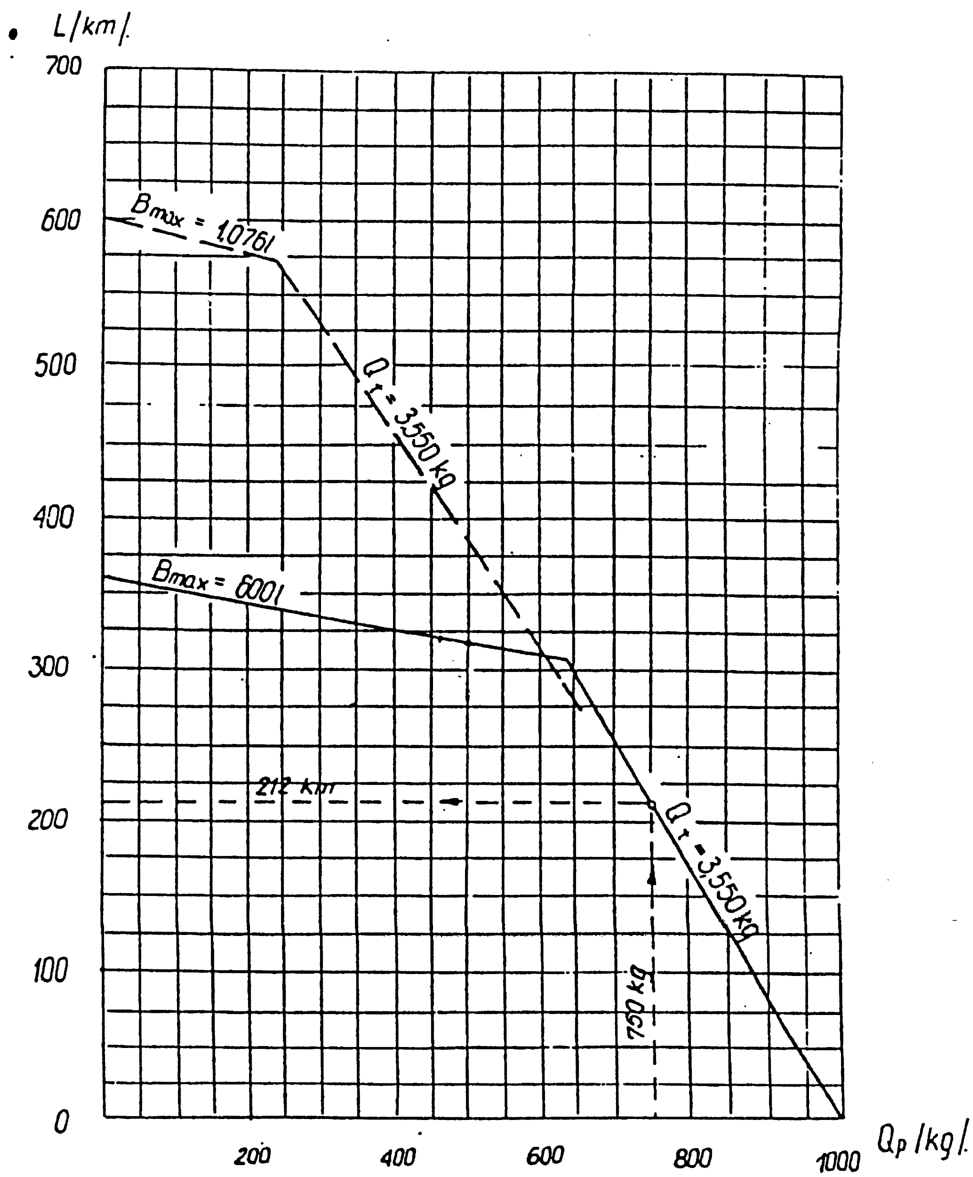


Fig. 5.12. FLIGHT RANGE AT 3,000 m PRESSURE ALTITUDE

RELATIONSHIP BETWEEN RANGE AND "EQUIVALENT HEAD-WIND"

Example:

With head "equivalent wind" speed of 35 km/h, the theoretical range of 380 km decreases to 305 km.

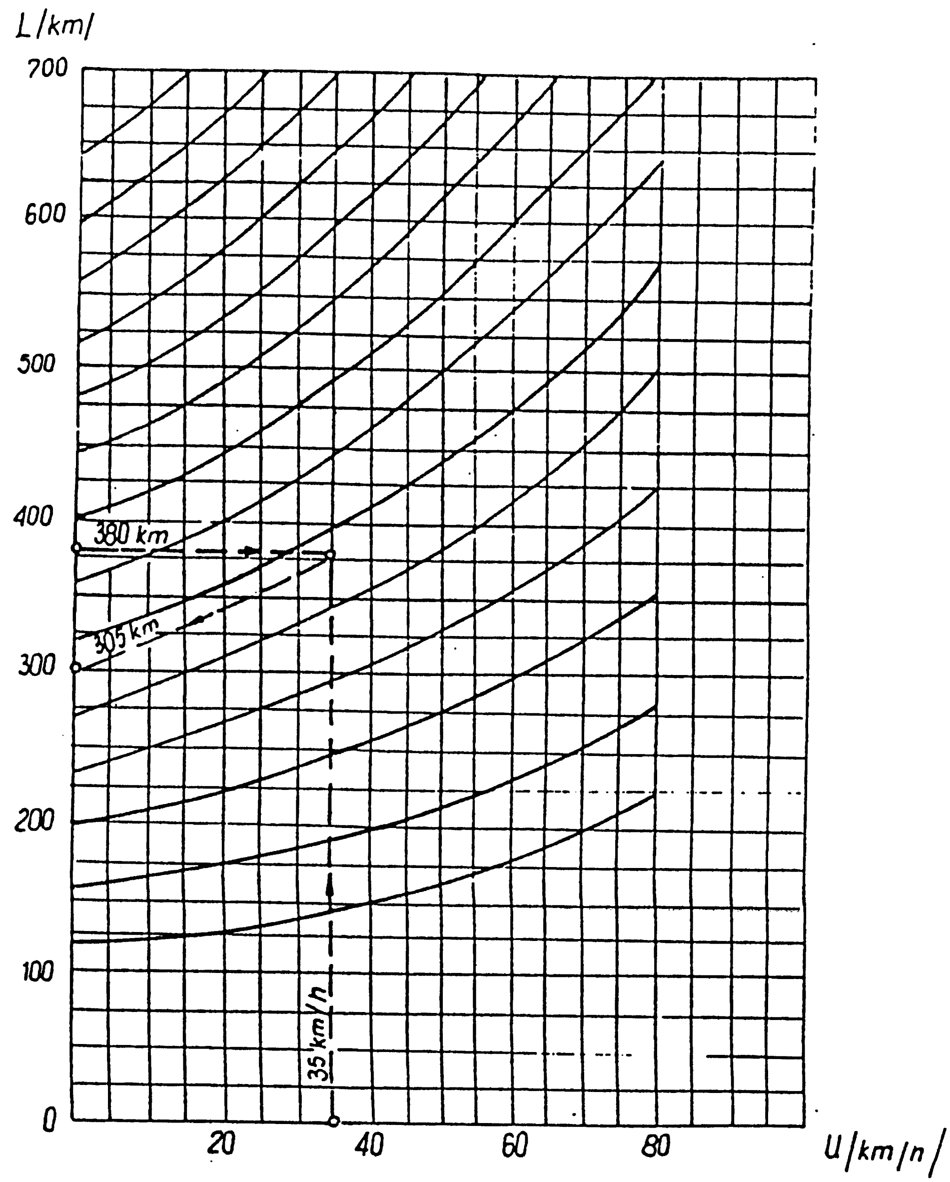


Fig. 5.13. RELATIONSHIP BETWEEN FLIGHT RANGE AND HEAD "EQUIVALENT WIND" SPEED

RELATIONSHIP BETWEEN RANGE AND "EQUIVALENT TAIL-WIND"

Example:

With tail "equivalent wind" speed of 45 km/h the theoretical range of 510 km increases to 635 km.

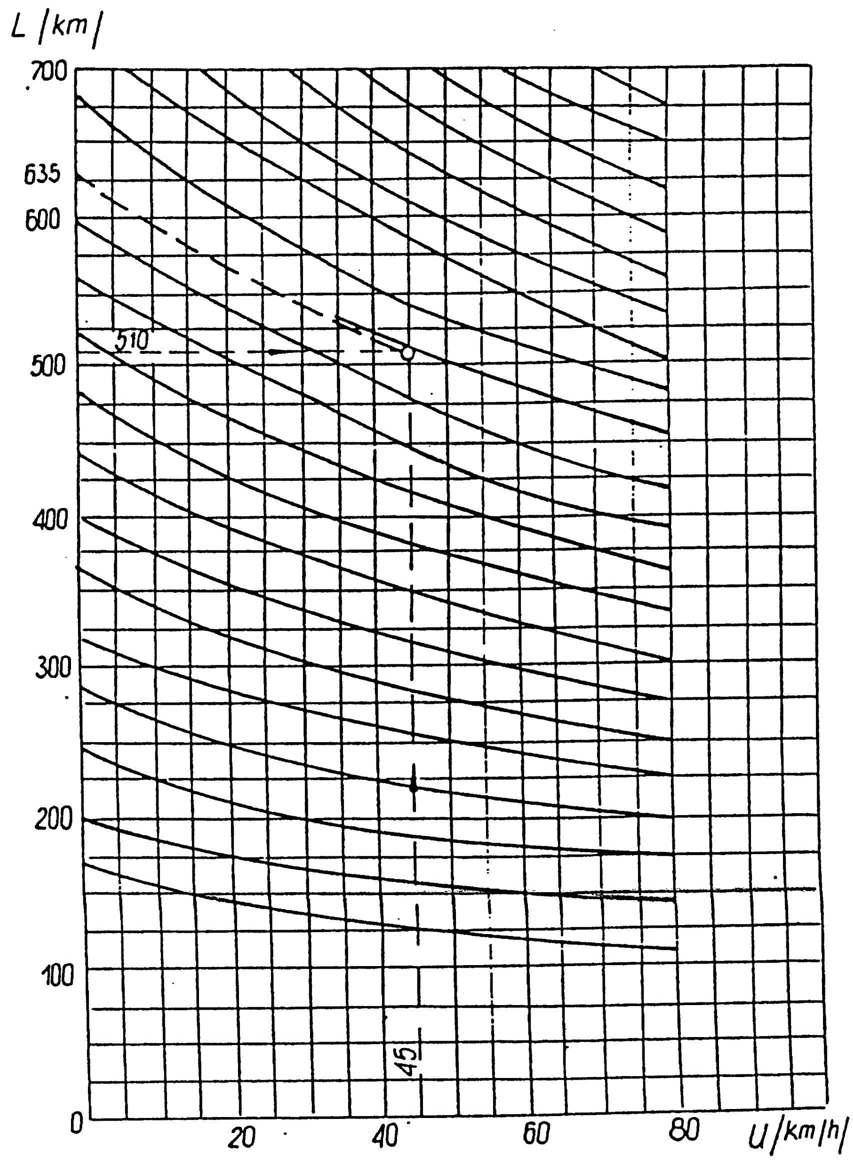


Fig. 5.14. RELATIONSHIP BETWEEN RANGE AND TAIL "EQUIVALENT WIND" SPEED

Table V-5 shows the relationship between the speed of so-called "equivalent wind" and the actual wind speed/direction. The "equivalent wind" is a result of ground speed and indicated airspeed subtraction.

The charts in Figs. 5-13 and 5-14 show how the "equivalent head/tailwind" affects the range determined on the basis of charts in Figs. 5-8, 5-9, 5-10, 5-11 or 5-12.

The flight range is determined in the following sequence:

1. Choose a suitable flight altitude.
2. Calculate the gross weight /using the procedure in Appendix No. 1/ and determine the quantity of fuel required.
3. From the applicable charts in Figs. 5-8, 5-9, 5-10, 5-11 or 5-12 read a corresponding theoretical flight range for windless conditions.
4. Read the "equivalent wind" speed from Table V-5.
5. From the chart in Figs. 5-13 or 5-14, as applicable, read the actual range for the given wind conditions.

NOTE: With the skis installed, the range is reduced by about 5 %.

WARNING

WITH THE SAME CARGO WEIGHT BUT LOWER TAKEOFF WEIGHT THAN 3,500 kg, THE FLIGHT RANGE AT A GIVEN FLIGHT ALTITUDE WILL BE REDUCED AS COMPARED WITH THE APPLICABLE CHARTS.

NOTE: 1. The takeoff weight is subject to limitations given in Chapter II "Limitations" as in Fig. 2-1.

2. With the skis installed, the range decreases by about 5 %.

TABLE V-5. "EQUIVALENT WIND"

Wind	Wind angle		"Equivalent wind" speed /km/h/ at actual wind speed km/h								Wind
	Drift to the right	Drift to the left	10	20	30	40	50	60	70	80	
1	2	3	4	5	6	7	8	9	10	11	12
Tailwind	0	360	10	20	30	40	50	60	70	80	Tailwind
	10	350	10	20	30	39	49	59	59	78	
	20	340	9	19	28	37	46	55	64	73	
	30	330	9	17	25	34	42	49	57	65	
	40	320	8	15	22	29	35	46	48	54	
	50	310	6	12	18	23	28	33	37	41	
	60	300	5	9	13	17	25	22	24	26	
	70	290	3	.6	8	10	11	12	12	12	
	80	280	1	2	3	6,94	2	1	1	3	
Headwind	90	270	0	1	2	4	7	10	14	18	Headwind
	100	260	2	4	7	11	15	20	25	31	
	110	250	4	8	12	18	23	29	36	43	
	120	240	5	11	17	23	30	37	45	54	
	130	230	-6	13	21	28	36	44	53	62	
	140	220	8	16	24	32	41	50	59	68	
	150	210	9	17	26	36	45	54	64	74	
	160	200	9	19	28	38	47	57	67	77	
	170	190	10	20	30	39	49	59	69	79	
	180	180	10	20	30	40	50	60	70	80	

5.7. RADIUS OF ACTION

The radius of action is the greatest distance which the helicopter is able to cover while flying to the destination point and back to the point of departure. At the given gross weight and flight regime, radius of action depends on fuel quantity.

While determining the weight of useful load, observe the maximum takeoff weight limit, i.e. 3,550 kg.

The weight and center of gravity location should be calculated as in Appendix No. 1 "Helicopter Weight and Center of Gravity Calculation".

The selection of flight regime depends on the mission.

It should be remembered, however, that during cruise at altitudes up to 1,000 m the radius of action will increase with flight altitude.

NOTE: In order to achieve the radius of action specified in this Chapter, maintain the cruising speeds /IAS/ as in Table V-3.

The charts in Figs. 5-15, 5-16, 5-17, 5-18 and 5-19 provide a means of determining the radius of action for specific flight altitude and loading.
The values in the charts refer to windless conditions and flight with no altitude changes during cruise.
While preparing the radius of action information, the following assumptions have been made:

a/ Payload is carried from the point of departure to the point of unloading, which is situated at the end of radius of action,

b/ Ground run of the engines before takeoff /starting and warming up/ for 5 minutes,

c/ Climbing to the flight altitude at one-hour power and airspeed of 100 km/h IAS,

d/ Rate of descent while approaching in compliance with the requirements specified in Table V-4.

e/ A 10 % fuel reserve remains after landing.

In order to make allowances for the wind speed, refer to Table V-5 and charts in Fig. 5-20.

Table V-5 shows the relationship between the speed of so called "equivalent wind" and the actual wind speed/direction. The "equivalent wind" is a result of ground speed and indicated air speed subtraction.

The chart in Fig. 5-20 shows the "equivalent head/tailwind" affects the radius of action determined on the basis of charts in Figs. 5-15, 5-16, 5-17, 5-18 or 5-19, i.e. the initial section of flight path /from the point of departure to the point of unloading/.
The radius of action is determined in the following sequence:

1. Choose a suitable flight altitude.
2. Calculate the helicopter weight /using the procedure in Appendix No.1/ and determine the quantity of fuel required.
3. From the applicable charts in Figs. 5-15, 5-17, 5-18 or 5-19, read a corresponding theoretical radius of action for windless conditions.
4. Read the "equivalent wind" speed from Table V-5.
5. From the chart in Fig. 5-20, read the actual radius of action for the given wind conditions.

RADIUS OF ACTION AT 100 m PRESSURE ALTITUDE

ENGINE RATING — CRUISE POWER
AIRSPEED — 190 km/h IAS
ISA CONDITIONS

———— helicopter without auxiliary fuel tanks
– – – – helicopter with two auxiliary fuel tanks

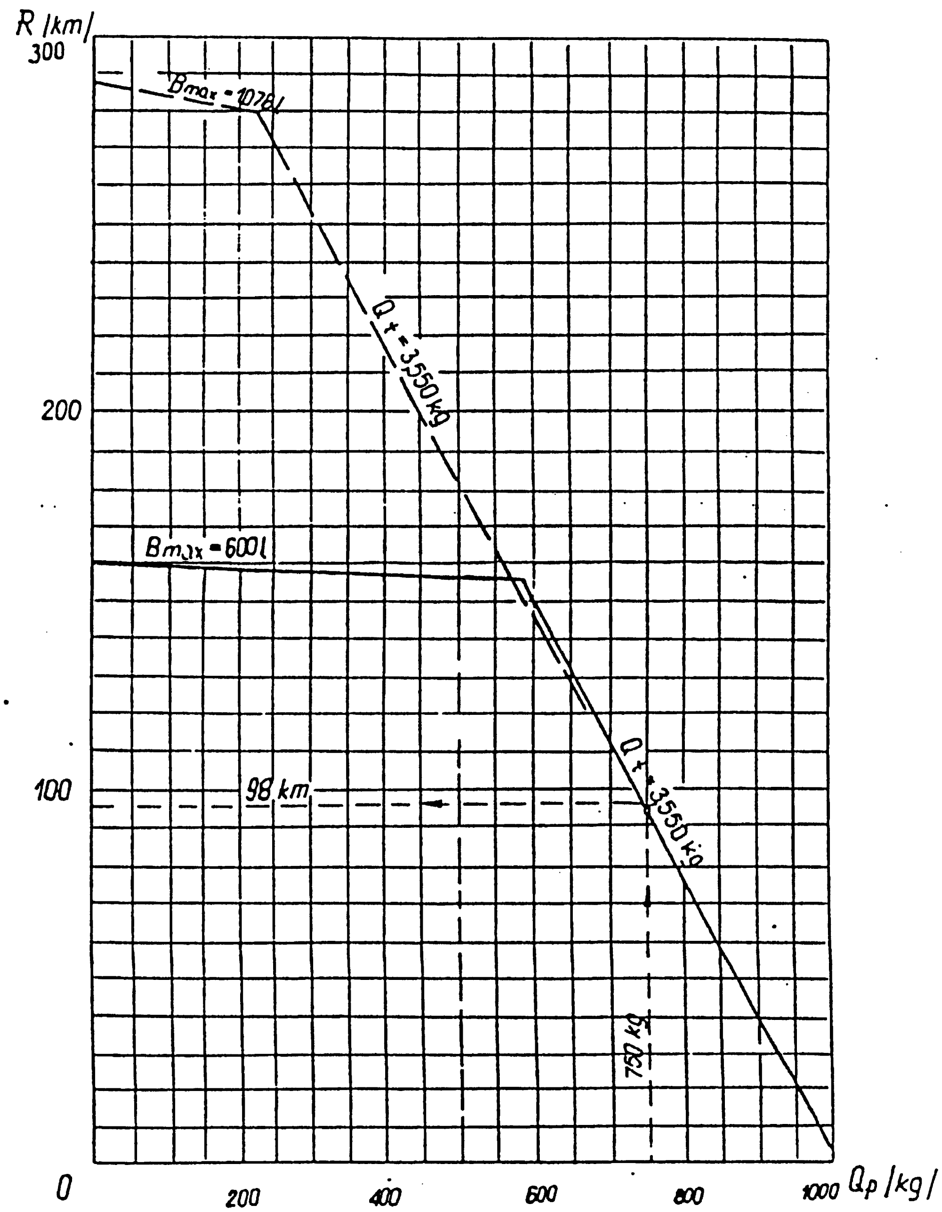


Fig. 5.15. RADIUS OF ACTION AT 100 m PRESSURE ALTITUDE

RADIUS OF ACTION AT - 500 m PRESSURE ALTITUDE

ENGINE RATING — CRUSE POWER
AIRSPEED — 190 km/h IAS
ISA CONDITIONS

———— helicopter without auxiliary fuel tanks
— — — helicopter with two auxiliary fuel tanks

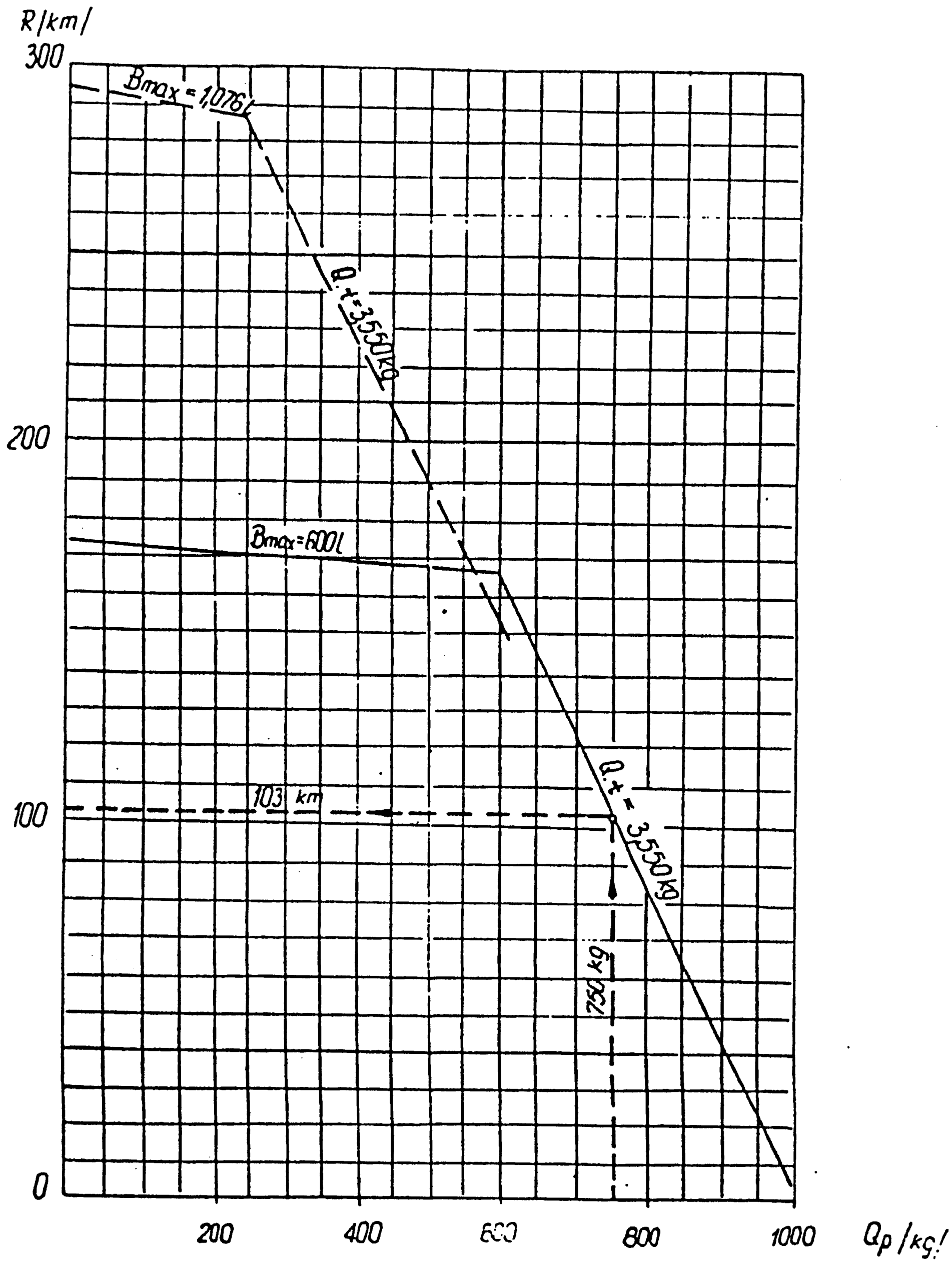


Fig. 5.16. RADIUS OF ACTION AT 500 m PRESSURE ALTITUDE

RADIUS OF ACTION AT 1,000 m PRESSURE ALTITUDE

ENGINE RATING —— CRUISE POWER
AIRSPEED —— 190 km/h IAS
ISA CONDITIONS

—— helicopter without auxiliary fuel tanks
– – – helicopter with two auxiliary fuel tanks

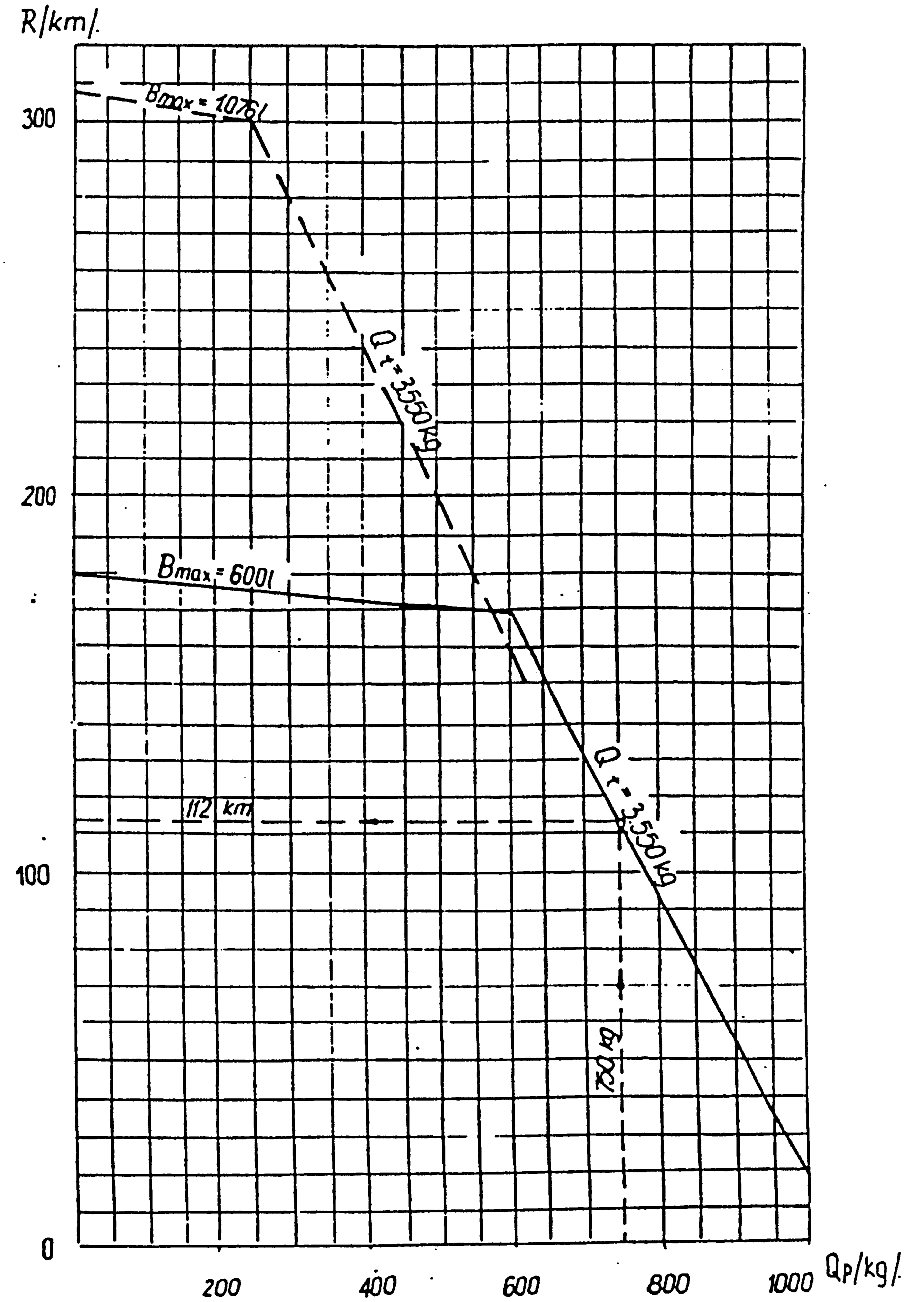


Fig. 5.17. RADIUS OF ACTION AT 1,000 m PRESSURE ALTITUDE

RADIUS OF ACTION AT 2,000m PRESSURE ALTITUDE

ENGINE RATING —— CRUISE POWER
AIRSPEED —— 160 km/h IAS
ISA CONDITIONS

—— helicopter without auxiliary fuel tanks

— — helicopter with two auxiliary fuel tanks

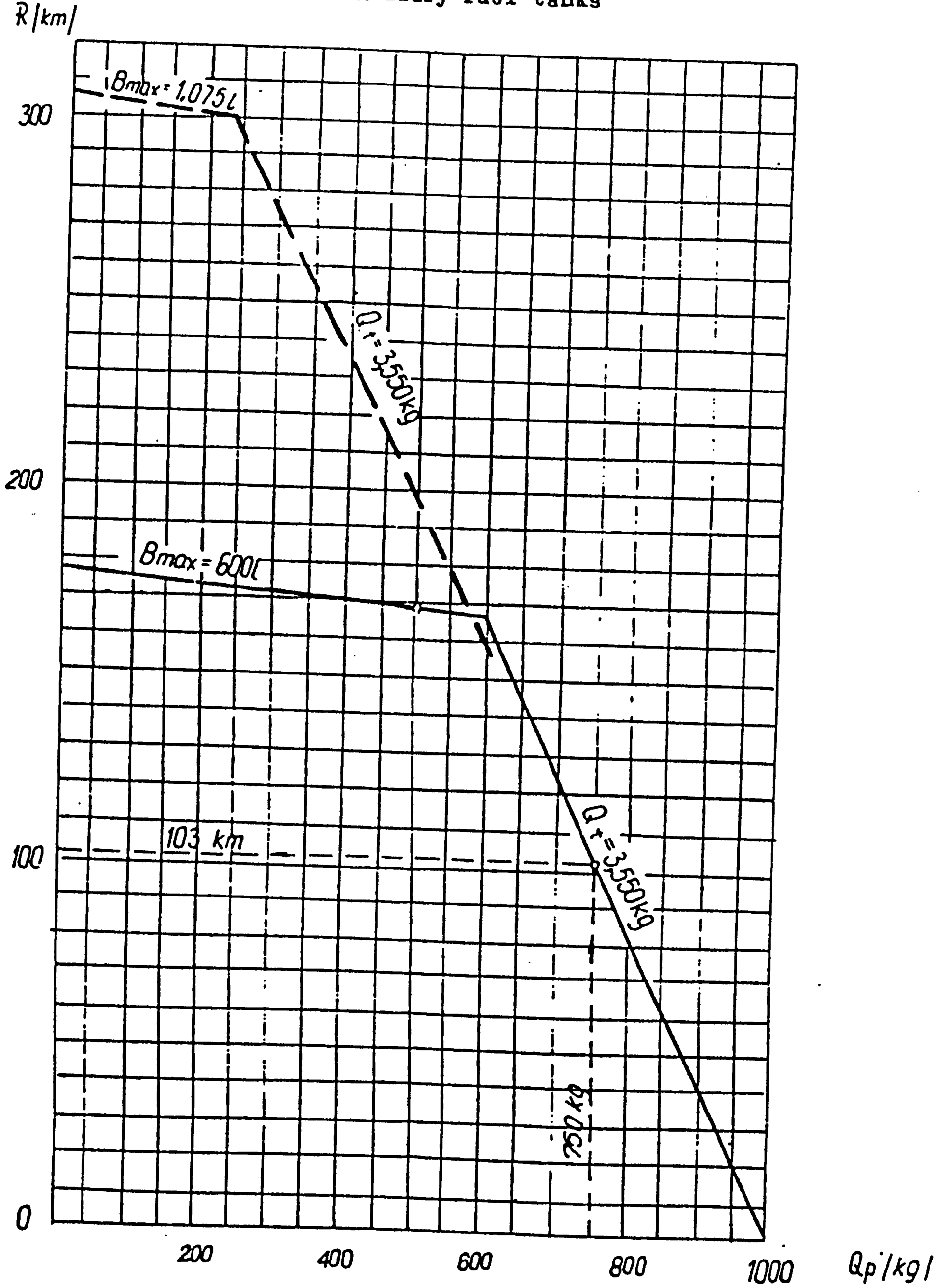


Fig. 5.18. RADIUS OF ACTION AT 2,000 m PRESSURE ALTITUDE

RADIUS OF ACTION AT 3,000 m PRESSURE ALTITUDE

ENGINE RATING — CRUISE POWER
AIRSPEED — 120 km/h IAS
ISA CONDITIONS

——— helicopter without auxiliary fuel tanks
— — — helicopter with two auxiliary fuel tanks

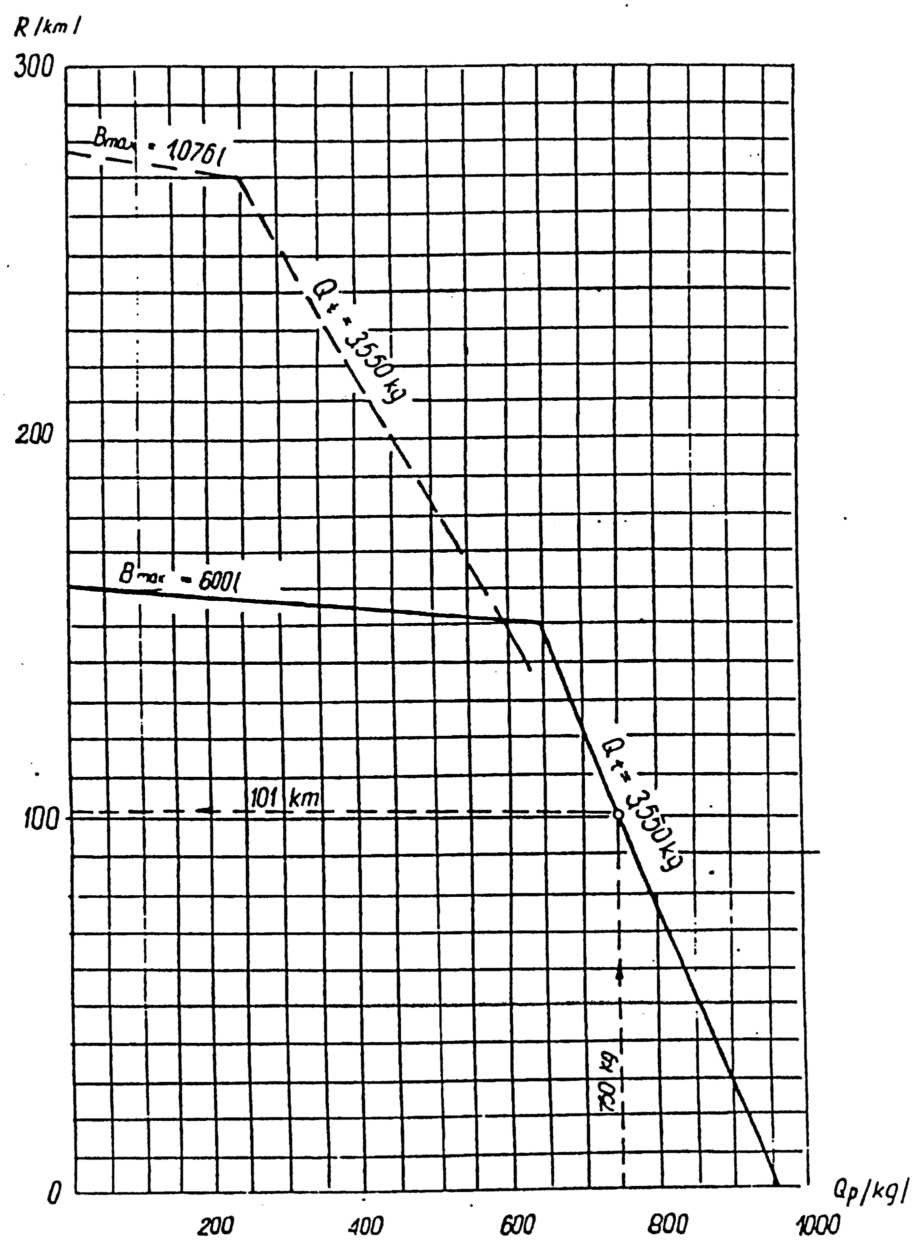
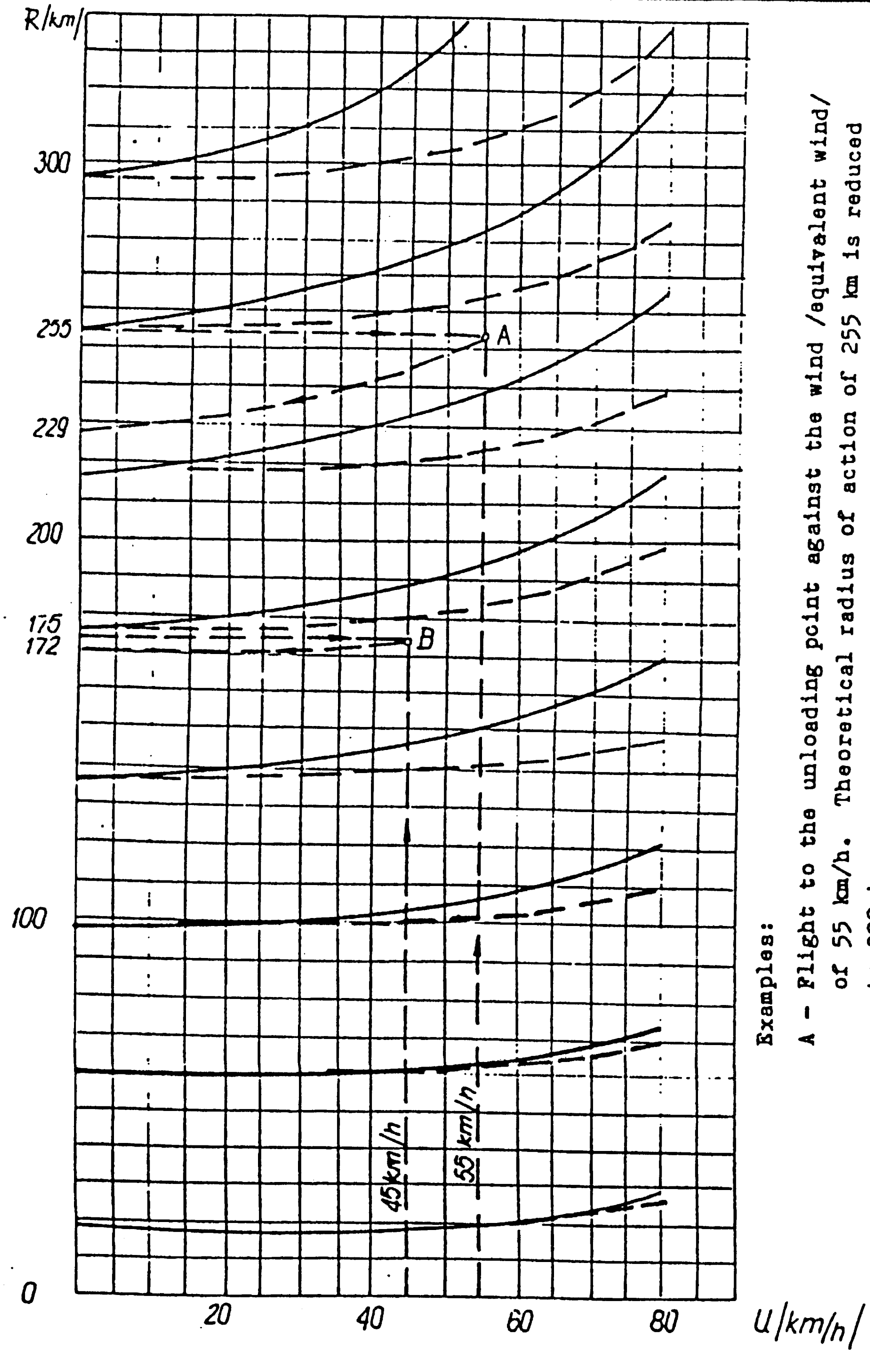


Fig. 5-19. RADIUS OF ACTION AT 3,000 m PRESSURE ALTITUDE

RELATIONSHIP BETWEEN RANGE OF ACTION AND „EQUIVALENT HEAD/TAIL-WIND"



—— headwind while flying to the unloading point

– – – tailwind while flying to the unloading point

Examples:

A - Flight to the unloading point against the wind /equivalent wind/ of 55 km/h. Theoretical radius of action of 255 km is reduced to 229 km.

B - Flight to the unloading point with tailwind /equivalent wind/ of 45 km/h Theoretical radius of action of 175 km is reduced to 172 km.

Fig. 5.20. RELATIONSHIP BETWEEN RADIUS OF ACTION AND "EQUIVALENT HEAD/TAILWIND"

WARNING

WITH THE SAME CARGO WEIGHT BUT LOWER TAKEOFF WEIGHT THAN 3,550 kg, THE RADIUS OF ACTION AT A GIVEN FLIGHT ATTITUDE WILL BE REDUCED AS COMPARED WITH THE APPLICABLE CHARTS.

NOTE: 1. The takeoff weight is subject to limitations given in Chapter II "Limitations" as in Fig. 2-1.

2. With the skis installed, the radius of action decreases by about 5 %.

5.8. ENDURANCE

The endurance, as dependent on the quantity of fuel in the main fuel tank before starting the engine, is shown in the chart of Fig. 5-21. The chart has two lines signifying as follows:

A - Nominal endurance: after landing a fuel reserve of 100 l remains in the fuel tank.

B - Emergency endurance.

WARNING

PROLONGED FLIGHT BEYOND THE NOMINAL ENDURANCE INCREASES THE POSSIBILITY OF POWER-OFF LANDING DUE TO LACK OF FUEL.

The assumptions being made while preparing the endurance information are the following:

a/ Flight in calm weather conditions.

b/ Climbing to the flight altitude at one-hour power and airspeed of 100 km/h IAS.

c/ Approach at 100 km/h /IAS/ with engine power reduced to maintain a rate descent of about 3 m/s.

d/ Descending is initiated about one minute per each 200 metres of flight altitude before desired landing point.

ENDURANCE AS A FUNCTION OF FUEL QUANTITY

HELICOPTER WEIGHT — 3,550 kg
PRESSURE ALTIDUDE — 500 m
AIRSPEED — 100 km/h IAS

Example:

With fuel quantity of 520 l the nominal endurance is 1 h 47',
and emergency endurance 2 h 15'.

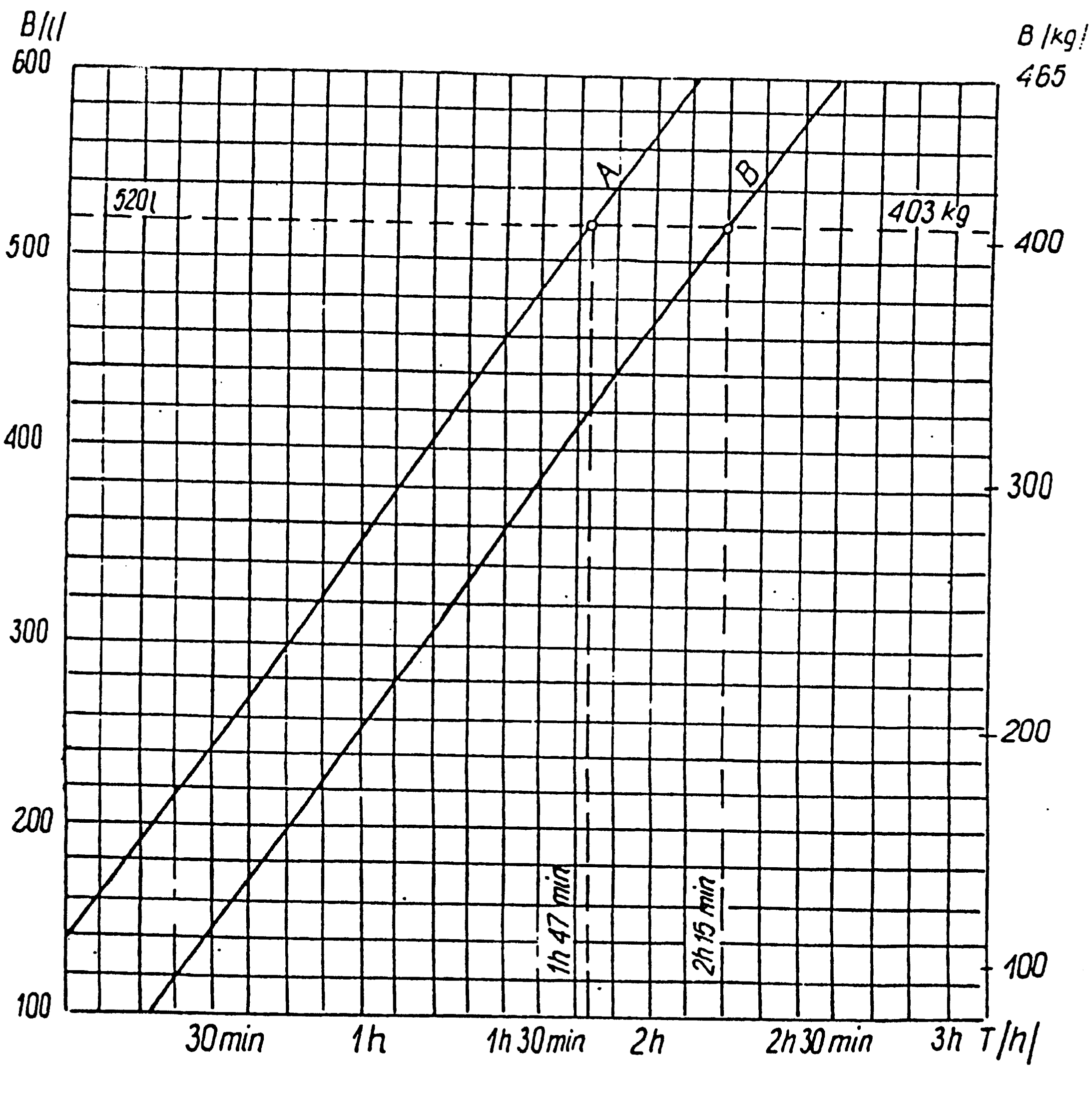


Fig. 5-21. ENDURANCE AS A FUNCTION OF FUEL QUANTITY

A P P E N C I C E S

APPENDICES - TABLE OF CONTENTS

APPENDIX NO. 1

HELICOPTER WEIGHT AND CENTER OF GRAVITY CALCULATION

1. DEFINITIONS OF WEIGHTS AND LOADS

Takeoff gross weight Q_t is the weight of helicopter ready for flight. It consists of empty weight Q_e and useful load Q_u.

$$Q_t = Q_e + Q_u$$

Helicopter empty weight Q_e is the weight of the helicopter structure with its powerplant and all the equipment required to make flights, undrainable fuel, undrainable engine oil and hydraulic fluid.

Useful load Q_u is the sum of loads aboard the helicopter during flight. It consists of engine fuel and oil weight Q_7, crew weight Q_8, and payload Q_9:

$$Q_u = Q_7 + Q_8 + Q_9$$

Engine fuel and oil weight Q_7 is the weight of fuel and oil required to drive the helicopter, except for undrainable fuel and undrainable engine oil.

Crew weight Q_8 is the weight of the pilot and other persons aboard necessary for performing a flight.

Payload Q_9 is the weight of persons and cargo carried by the helicopter.

Steady weight Q_s is the conventionally assumed empty weight and minimum crew.

Payload and optional equipment weight Q_p is the sum of payload Q_9 and weight of optional equimpment not included in steady weight.

2. DEFINITIONS OF TERMS USED IN BALANCING

Plane of reference /Fig. A1-1/ is a conventional vertical plane in front of the helicopter from which all horizontal distances /design co-ordinates/, necessary for determining the CG location, are measured.

Arm is a horizontal distance /in meters/ from the plane of reference to the center gravity of individual load items.

Moment is the arm multiplied by weight.

CG location is a co-ordinate which defines the helicopter center of gravity position. The CG location is computed in the following way:

a/ add all the component weights of the helicopter in order to obtain its total weight,

b/ add all moments of component weights /together with those of helicopter and crew weights/,

c/ divide the sum of moments by the sum of weights.

Center of gravity limits - maximum and minimum values beyond which the helicopter is not allowed to be operated due to reduction of control margins.

The helicopter center of gravity at takeoff, landing and in flight should remain within these limits. These limits are given in Chapter II "Limitations" under 2.3. /Table II-3/.

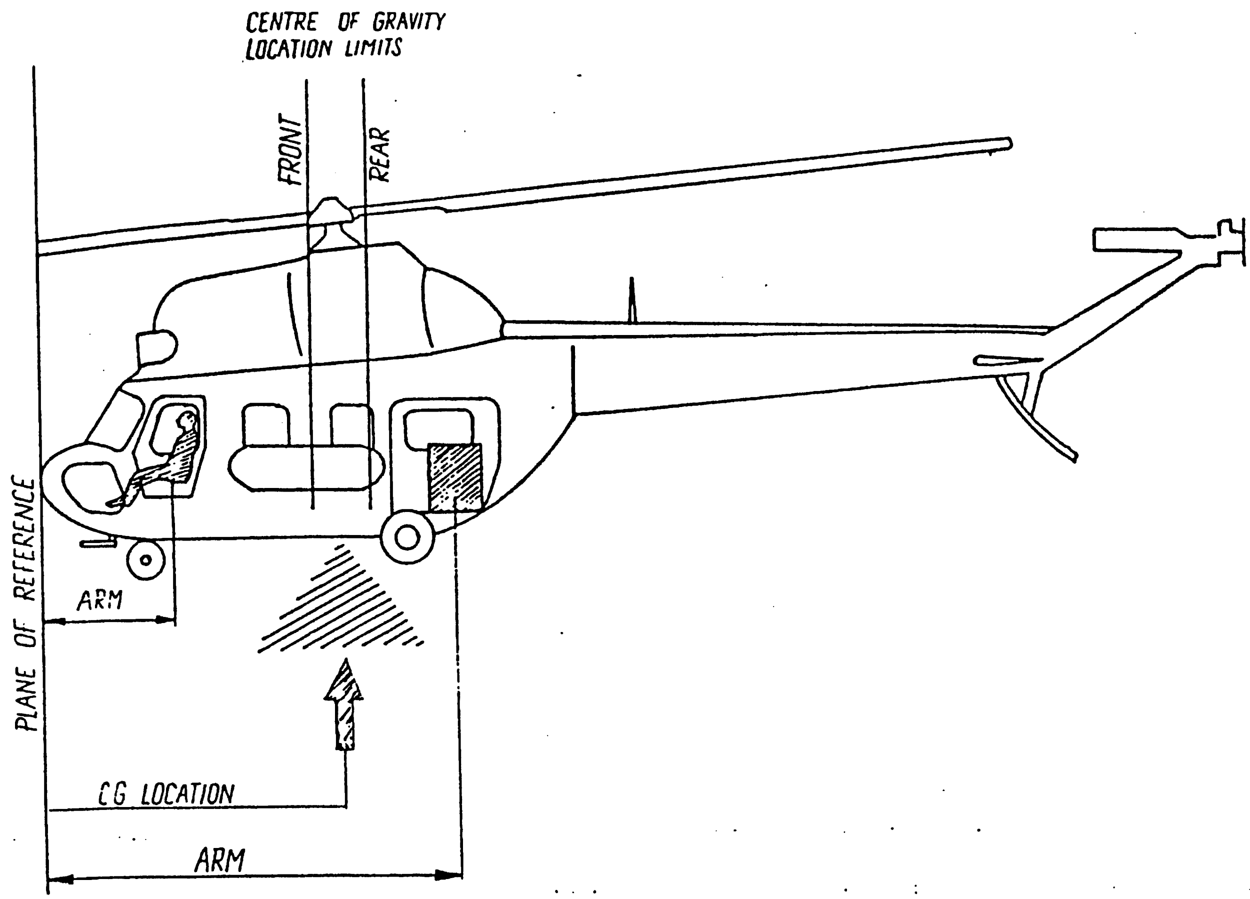


Fig. A1-1 PLANE OF REFERENCE AND ARMS

Load item	Arm
Batteries	0.20 m
Pilot and navigator seats	1.35 m
Front passenger seat	2.50 m
LH auxiliary tank	2.60 m
Main fuel tank	2.85 m
RH auxiliary tank	2.90 m
Empty helicopter with pilot	3.00 m
External cargo hook	3.00 m
Rear passenger seats	3.20 m
Seat beside radio compt.	4.30 m

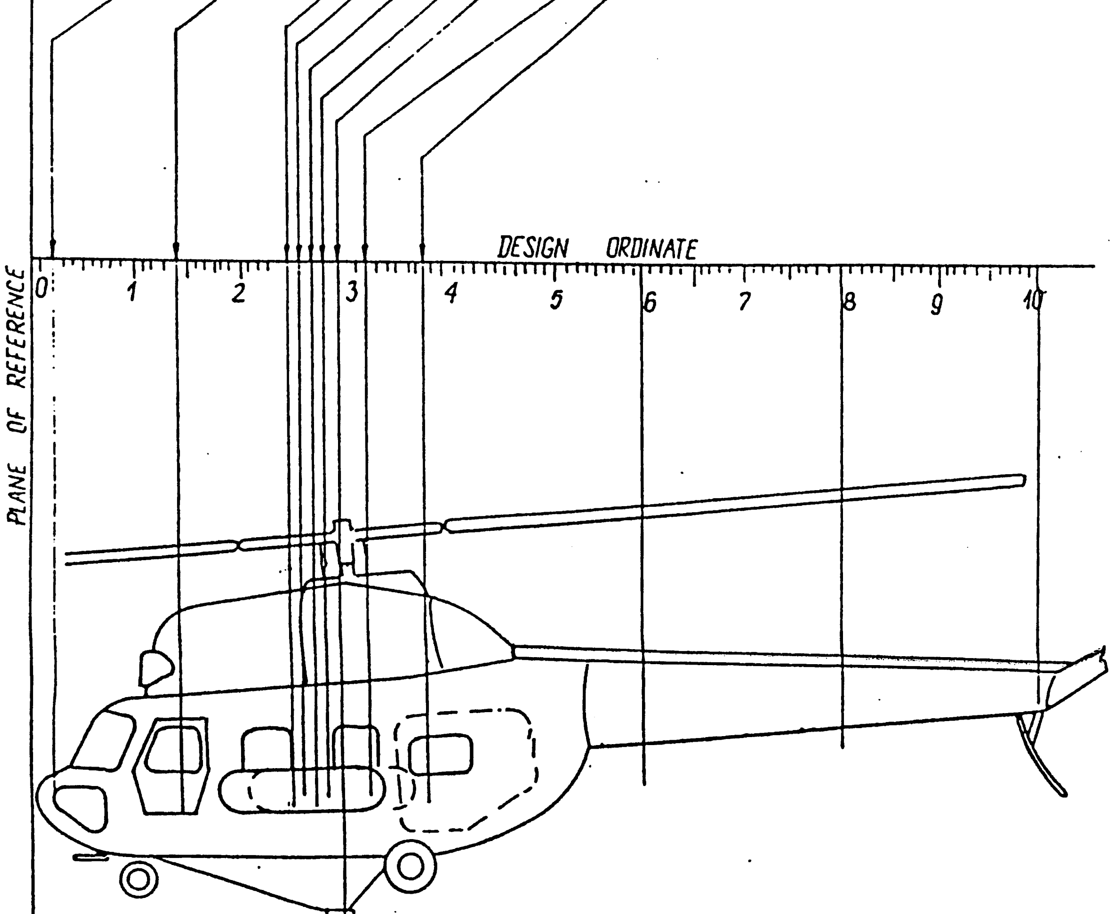


Fig. A1-2 DESIGN CO-ORDINATES

3. HELICOPTER WEIGHT CALCULATION

3.1. TAKEOFF GROSS WEIGHT

To simplify calculations of helicopter weight it is assumed that the sum of empty weight Q_e and a minimum flight crew /1 person/ weight is constant.

$$Q_s = Q_e + Q_8 = 2{,}500 \text{ kg} = \text{const.}$$

The above value /steady weight/ refers to helicopter without any optional equipment.

If it is necessary to take optinal equipment or more crew members, add applicable weights to the payload Q_9.

3.2. ADDITIONAL WEIGHTS

Passenger /no luggage/	80 kg
Crew member	90 kg
Parachutist with parachute	100 kg
Inside cargo securing equipment	7 kg
Ambulance equipment	40 kg
External /rescue/ hoist	20 kg
Auxiliary fuel tank	16 kg
Snow skis on wheels /complete/	54 kg x/
External cargo hook	17 kg
Passenger version equipment /seats, safety belts/	21 kg

N O T E

In a dual - controls version a 12 kg ballast on the tail skid is required.

3.3. PAYLOAD AND OPTIONAL EQUIPMENT WEIGHT

Q_p is calculated as a sum of payload and optional equipment weight as in list under 3.2. While calculating the payload one should take 80 kg per each passenger and 100 kg per each parachutist and actual weight of the cargo, and other objects on board.

$$Q_p = Q_9 + Q \quad /Q = \text{optional equipment weight}/$$

3.4. WEIGHT AND FUEL QUANTITY

Weight and fuel quantity which may be taken in fuel tanks due to maximum takeoff weight limits can be read on the diagram in Fig A1-3.

More fuel can be taken in the tanks if the surplus is expected to be used up on ground before takeoff.

The surplus of fuel can be calculated on assumption that fuel consumption at idle is 2 kg/min or 2.6 l/min.

---

x/ aerodynamic loading included

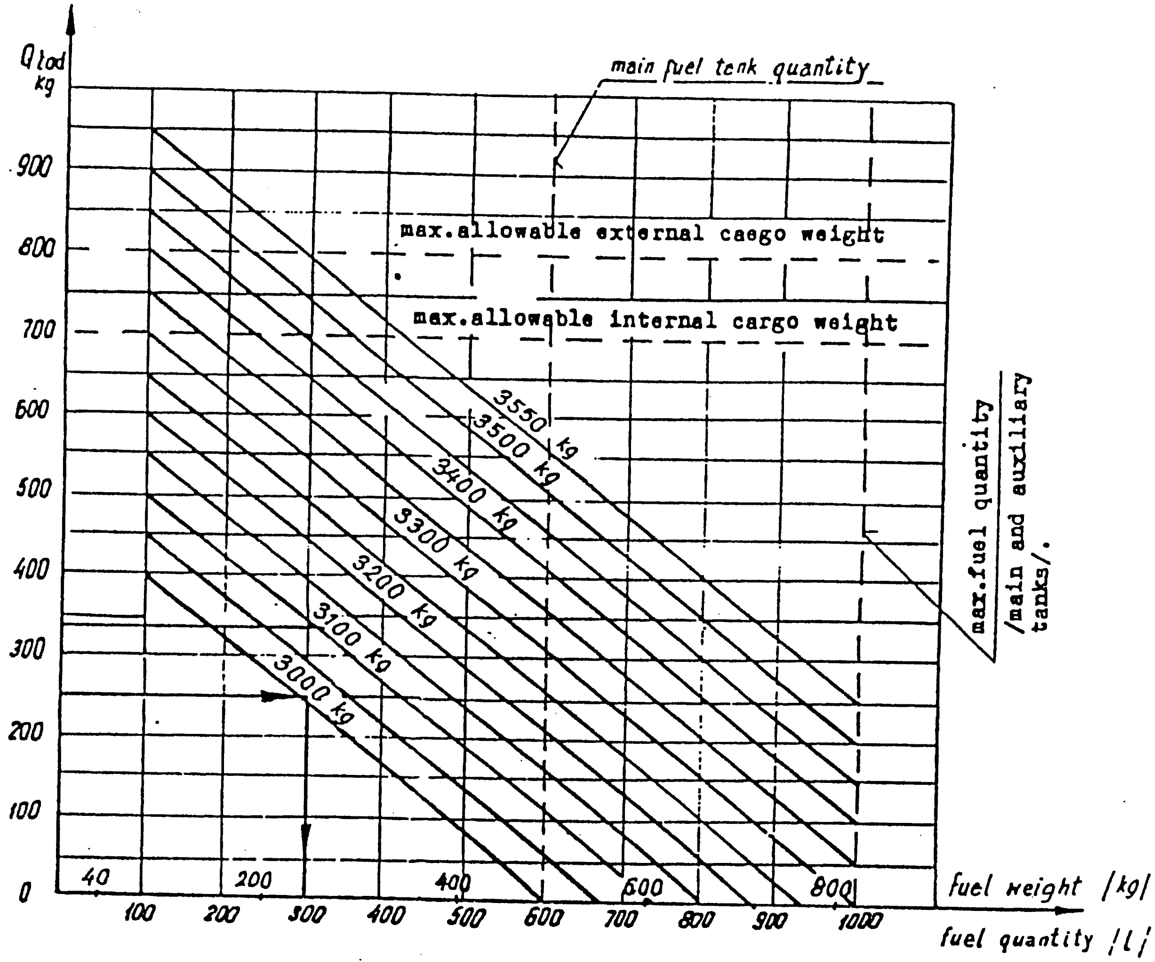


Fig. A1-3 RELATIONSHIP OF FUEL QUANTITY TO CARGO WEIGHT FOR VARIOUS TAKEOFF GROSS WEIGHTS

NOTE:

empty weight with pilot	2,500 kg
passenger weight /no luggage/	80 kg

Example:

For takeoff gross weight of 3,000 kg /as in Fig 2.1 Chapter II "LIMITATIONS"/ and a paylod of 250 kg, the maximum fuel quantity is 300 l /240 kg/.

165

4. HELICOPTER CENTER OF GRAVITY CALCULATION

To determine center of gravity location it is necessary to know the arms at which individual load items are located /see Fig. A 1-2/.

The component weights and their arms are to be listed, as in table below, and weights and moments summed up to calculate the CG location in the following way:

$$\text{CG location} = \frac{\text{sum of moments}}{\text{sum of weights}}$$

If the CG is located within the limits specified in Chapter II under 2.3. /Table II-3/, i.e. between 2.905 m and 3.100 m, the helicopter's horizontal CG location is correct and the flight can be made.

An example of how weight and CG location are calculated:

No	Item	Weight /kg	Arm /m/	Moment /kgm/
1.	Helicopter with pilot	2,500	3.00	7500.00
2.	Navigator	90	1.35	121.50
3.	3 passengers on rear seats	240	3.20	768.00
4.	2 passengers on front seats	160	2.50	400.00
5.	Box	100	4.10	410.00
6.	Fuel in main tank	410	2.85	1168.50
	TOTAL	3,500	-	10,368.00

$$\text{CG location} = \frac{10{,}368 \text{ km}}{3{,}500 \text{ kg}} = 2.96 \text{ m}$$

In case of improper CG location, re-distribute the cargo accordingly. If GC is located too much to the rear, shift the cargo forward, and if it is too much to the front, move the cargo backward.

NOTE: To facilitate cargo distribution triangular placards are provided on the cabin walls. They indicate proper cargo location of particular weights.
The placard 200, for example, shows where a 200 kg cargo is to be placed to ensure that a proper helicopter CG location is achieved.

APPENDIX No 2

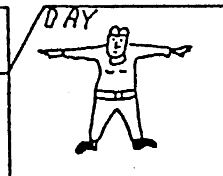
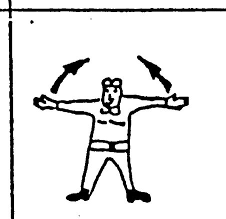
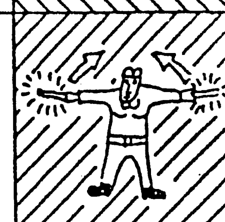
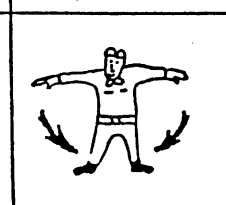
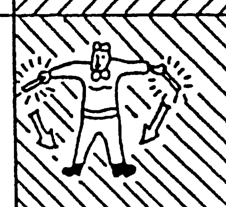
EXTERNAL SIGNALIING

In some circumstances the precision of helicopter manoeuvering, especially while hovering, depends on signals received by the pilot from a ground controller. This is the case with a landing in a cofined area, or depositing an externally carried cargo in the desired place, etc.

Fig. A2-1 illustrates the standardized signals given by a ground controller and their significance for the pilot during hovering in daylight or at night.

Fig. A2-2 illustrates similar signals used during cargo hook operations.

The signals are to be given in the following way:

Significance	Description	DAY	NIGHT
Initiate hover	Arms spread horizontally		
Move up	Arms spread horizontally, palms upwards. Swing arms from level position upwards. Speed of arm movement indicates rate of climb.		
Move down	Arms speed horizontally, palms downwards. Swing arms from level position downwards. Speed of arm movement indicates rate of descent.		
Move left	Right arm extended horizontally. Left arm repeatedly moved across body. Speed of arm movement indicates rate of helicopter movement.		

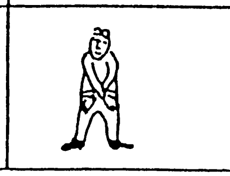
Significance	Description		
Move right	Left arm extended horizontally. Right arm repeatedly moved across body. Speed of arm movement indicates rate of helicopter movement.		
Land	Arms down crossed in front of body.		

Fig. A 2-1 EXTERNAL SIGNALLING FOR HELICOPTER IN A HOVER

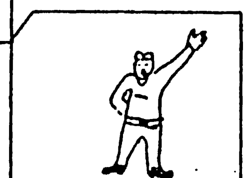
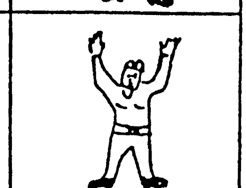
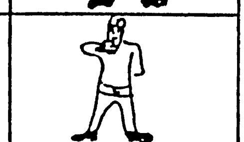
Significance	Description	
Takeoff	Right or left arm raised and extended to indicate direction against wind.	
Move forward backward	Arms raised at elbows, repeatedly moved from vertical position towards helicopter and back to vertical. Palms indicate direction of helicopter movement.	
Release load	Right arm level with chest, hand across mouth.	
Move away from hovering place	Either arm extended horizontally, other arm raised and moved repeatedly to indicate direction of departure.	

Fig. A 2-2 EXTERNAL SIGNALLING FOR HELICOPTER AS A CRANE

APPENDIX No 3

CONVERSION OF DATA CONTAINED IN THIS MANUAL INTO BRITISH UNITS

In some circumstances, e.g. during operation in the countries where British units are in common use, or to compare Polish equipment with its British or American equivalents, etc, it may be necessary to convert the data contained in this Manual into the Britsh system.

Tables and formulas given below will facilitate conversion.
The following Britsh units are used to specify performance and limitations:

a/ temperature	–	degree Fahrenheit	–	^oF
b/ height	–	foot	–	f_t
c/ airspeed	–	knot	–	kt
d/ rate of climb	–	foot per minute	–	fpm
e/ distance	–	statute mile	–	mile

Temperature

The relationship netween the temperatures specified in degrees Celsius and degrees Fahrenheit is as followa :

$$t_C = \frac{t_F - 32}{1,8} \quad \text{or} \quad t_F = 1,8\, t_C + 32$$

For quick conversion of t_C into t_F or vice versa, refer to Table A 3-I.

TABLE A 3-I. TEMPERATURE

t_F ←	t_C ↓ t_F →	t_C	t_F ←	t_C ↓ t_F →	t_C
-58	-50	-45.5	95	35	1,7
-49	-45	-42,8	104	40	4,4
-40	-40	-40,0	113	45	7.2
-31	-35	-37.2	122	50	10.0
-22	-30	-34.4	131	55	12.8
-13	-25	-31.7	140	60	15.6
-4	-20	-28.9	149	65	18.3
5	-15	-26.1	158	70	21.2
14	-10	-23.3	167	75	23.9
23	-5	-20.6	176	80	26.7
32	0	-17.8	185	85	29.4
41	5	-15.0	194	90	32.2
50	10	-12.2	203	95	35.0
59	15	-9.4	212	100	37.9
68	20	-6.7	221	103	40.6
77	25	-3.9	230	110	45.3
86	30	-1.1	239	115	46.1
89.6	32	0	248	120	48.9

Height

The relationship between the heights in feet /hft/ and metres /hm/ is as follows:

$$h_m = 0,305\ h_{ft} \qquad \text{or}\ h_{ft} = 3,29\ h_m$$

For quick conversion of h_m into h_{ft} or vice versa, refer to Table A3-II.

TABLE A3-II HEIGHT

h_{ft} ←	h_m ↓ h_{ft}	→ h_m
-3,290	-1,000	-305
-1,645	-500	-152.5
-329	-100	-30.5
-165	-50	-15.2
0	0	0
165	50	15.2
329	100	30.5
657	200	61.0
975	300	91.5
1,645	500	152.5
3,290	1,000	305
6,570	2,000	610
9,750	3,000	915
13,400	4,000	1,220
16,450	5,000	1,525
19,710	6,000	1,830
23,030	7,000	2,135
26,800	8,000	2,440
29,610	9,000	2,745
32,900	10,000	3,050

Airspeed

The relationship between the airspeed specified in knots $/V_{kt}/$ and kilometres per hour $/V_{km/h}/$ is as follows:

$$V_{kt} = 0.5397\ V_{km/h} \qquad \text{or } V_{km/h} = 1,853\ V_{kt}$$

For quick conversion of $V_{km/h}$ into V_{kt} or vice versa, refer to Table A3-III.

TABLE A3-III AIRSPEED

V_{kn} ←	$V_{km/h}$ ↓ V_{kn} →	$V_{km/h}$	V_{kn} ←	$V_{km/h}$ ↓ V_{kn} →	$V_{km/h}$
3	5	9	57	105	195
5	10	19	59	110	204
8	15	28	62	115	213
11	20	37	65	120	222
14	25	46	68	125	232
16	30	56	70	130	241
19	35	65	73	135	250
22	40	74	76	140	259
24	45	83	78	145	269
27	50	93	81	150	278
30	55	102	84	155	287
32	60	111	86	160	297
35	65	121	89	165	306
38	70	130	92	170	315
41	75	139	94	175	324
43	80	148	97	180	334
46	85	158	100	185	343
49	90	167	103	190	352
51	95	176	105	195	361
54	100	185	108	200	370

Rate of climb

The relationship between the rates of climb specified in feet per minute /w_{fpm}/ and meters per second /$w_{m/s}$/ is as follows:

$$w_{m/s} = 19{,}8\ w_{fpm} \quad \text{or} \quad w_{fpm} = 0.0507\ w_{m/s}$$

For quick conversion of $w_{m/s}$ into w_{fpm} or vice versa, refer to Table A3-IV.

TABLE A3-IV RATE OF CLIMB

w_{fpm} ←	$w_{m/s}$ ↓ w_{fpm}	→ $w_{m/s}$	w_{fpm} ←	$w_{m/s}$ ↓ w_{fpm}	→ $w_{m/s}$
0,	0	0	305	20	1,01
19,8	1	0,05	592	30	1,52
39.6	2	0,10		40	2,02
59,3	3	0.15		50	2.53
79.0	4	0.20		60	3.04
98.7	5	0.25		80	4.05
118.6	6	0.30		100	5.07
138.7	7	0.35		120	6.08
158.0	8	0.41		140	7.09
178.2	9	0.46		160	8.11
198.0	10	0.51		180	9.12
				200	10.14

Rate of climb

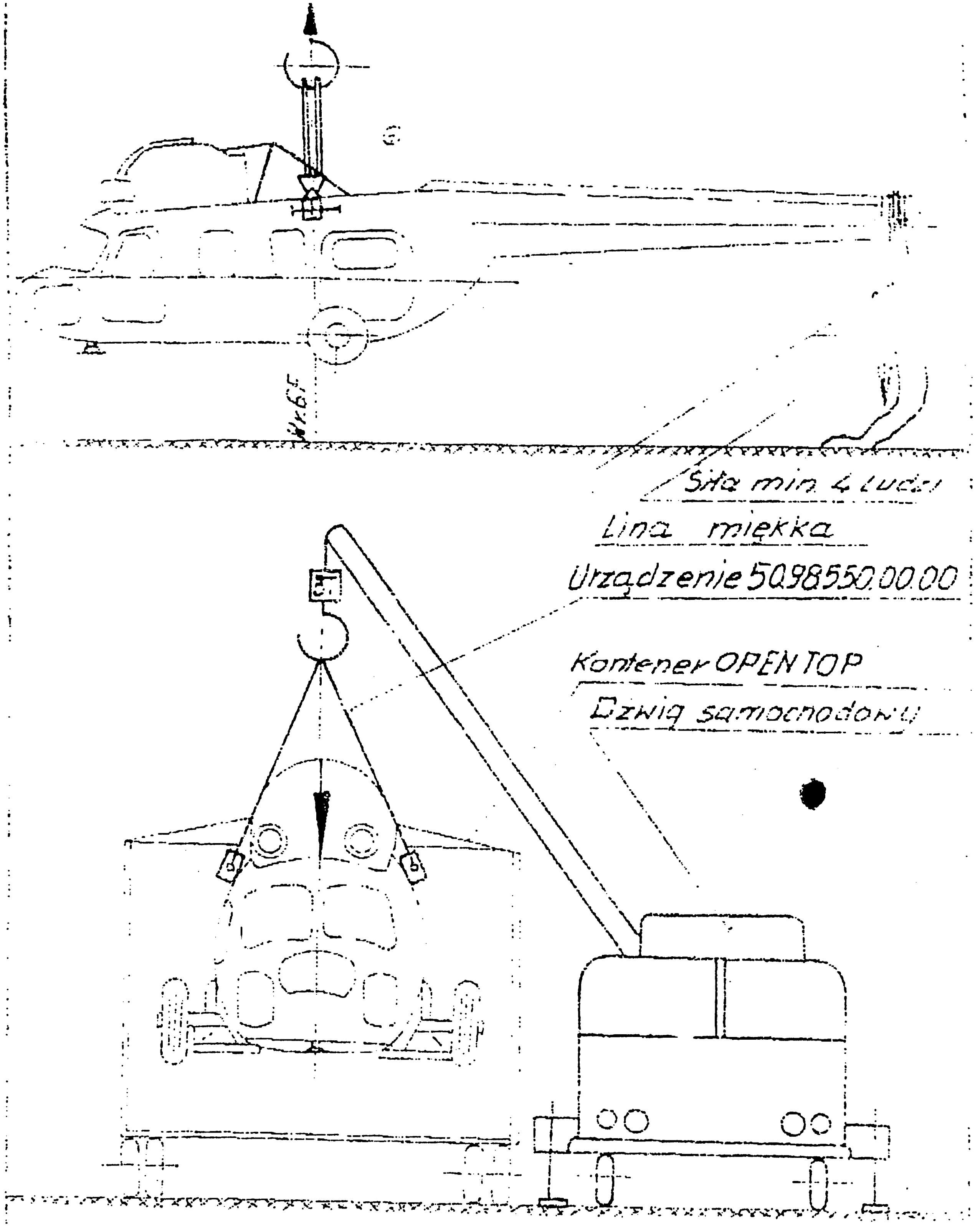
The relationship between the rates of climb specified in feet per minute /w_{fpm}/ and meters per second /$w_{m/s}$/ is as follows:

$$w_{m/s} = 19{,}8\ w_{fpm} \quad \text{or} \quad w_{fpm} = 0.0507\ w_{m/s}$$

For quick conversion of $w_{m/s}$ into w_{fpm} or vice versa, refer to Table A3-IV.

TABLE A3-IV RATE OF CLIMB

w_{fpm} ←	$w_{m/s}$ ↓ w_{fpm} →	$w_{m/s}$	w_{fpm} ←	$w_{m/s}$ ↓ w_{fpm} →	$w_{m/s}$
0,	0	0	305	20	1,01
19,8	1	0,05	592	30	1,52
39.6	2	0,10		40	2,02
59,3	3	0.15		50	2.53
79.0	4	0.20		60	3.04
98.7	5	0.25		80	4.05
118.6	6	0.30		100	5.07
138.7	7	0.35		120	6.08
158.0	8	0.41		140	7.09
178.2	9	0.46		160	8.11
198.0	10	0.51		180	9.12
				200	10.14



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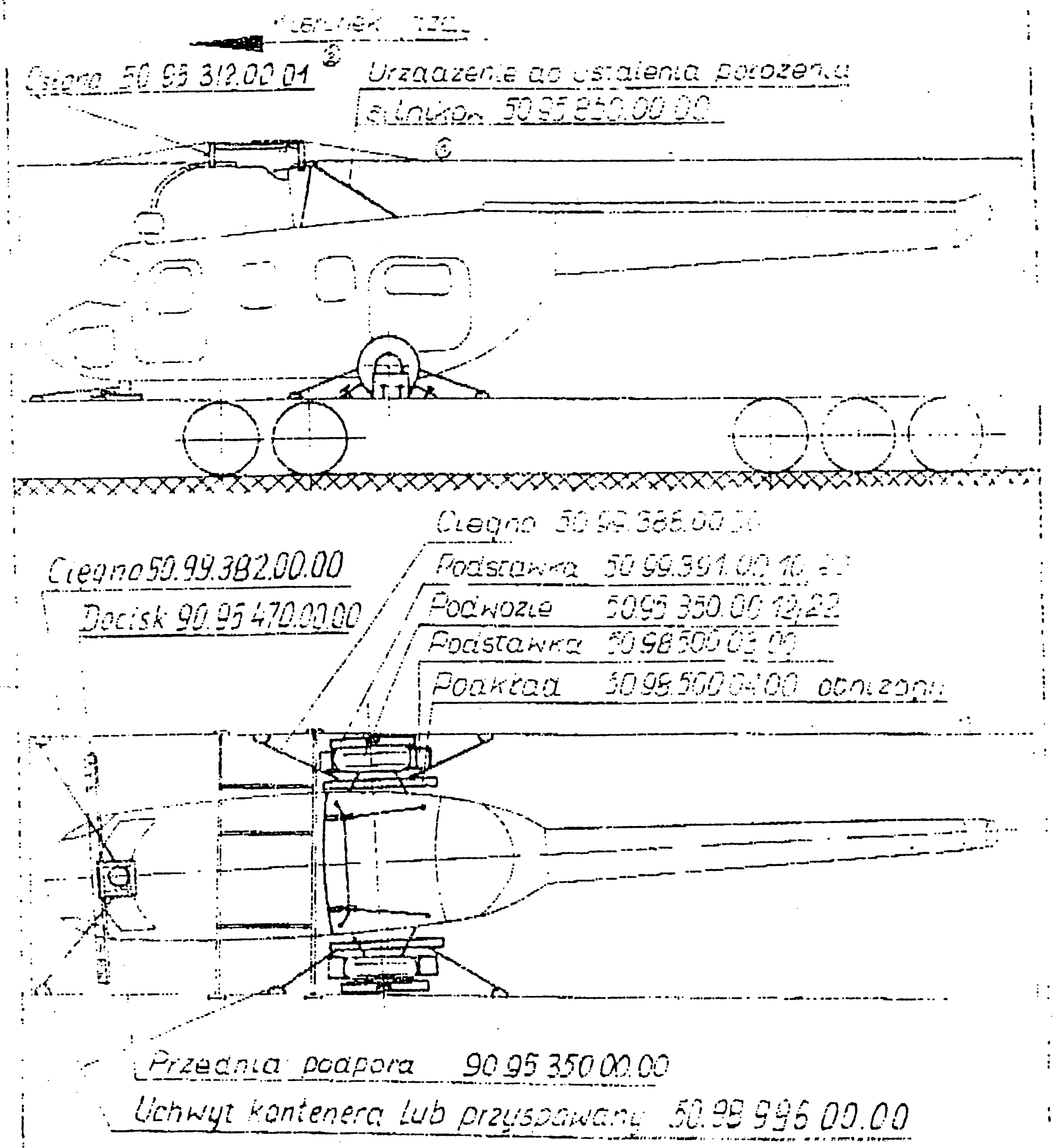
Schemat Nr 1

Schemat ustawienia śmigłowca Mi-2



Schemat Nr 2