HELICOPTER Mi-17-1V

Flight manual

KAZAN
HELICOPTERS
КАЗАНСКИЙ ВЕРТОЛЁТНЫЙ ЗАВОД

FLIGHT MANUAL

Ми-17-1В
HELICOPTER

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Section 1

GENERAL

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1. GENERAL

1.1. Main data

Normal takeoff weight ..... 11100 kg

Maximum takeoff weight ..... 13000 kg

Troop carrier load:

Maximum ..... 4000 kg

Number of persons carried 24

Maximum limit speed in horizontal flight at altitude from 0 to 1000 m:

At normal takeoff weight ..... 250 km/h

At maximum takeoff weight ..... 230 km/h

Cruising speed at altitude from 0 to 1000 m:

At normal takeoff weight ..... 220 to 240 km/h

At maximum takeoff weight ..... 205 to 215 km/h

Hovering ceiling at normal takeoff weight, ISA, air bleed to dust protection device ejectors being off ..... 3980 m

Service ceiling:

At normal takeoff weight ..... 6000 m

At maximum takeoff weight ..... 4800 m

Time to climb at normal power and best climbing speed (anti-icing system being off, armament racks being not installed):

At normal takeoff weight:

to 1000 m ..... 1,6 min

to 3000 m ..... 4,8 min

to 4000 m ..... 6,5 min

to 5000 m ..... 8,7 min

At maximum takeoff weight:

to 1000 m ..... 2,3 min

to 3000 m ..... 7,1 min

to 4000 m ..... 10,4 min

Service range at altitude of 500 m and cruising speed, with main fuel tanks full and 5% fuel reserve:

At payload of 3500 kgf ..... 600 km

With one auxiliary fuel tank full ..... 880 km

With two auxiliary fuel tanks full ..... 1160 km

1.2. Types of operation

The Ми-17-1В transport helicopter with two ТВ3-117ВМ series 02 turboshaft engines is intended for transportation of personnel and various types of cargo in the cargo compartment and for transportation of bulky loads attached to the external load sling system.

Listed below are the Ми-17-1В helicopter types of operation:

(1) Cargo version:

(a) Without auxiliary fuel tanks (for transportation of load with total weight up to 4000 kg in the cargo compartment).

(b) With one auxiliary fuel tank.

(c) With two auxiliary fuel tanks.

(d) Transportation of external loads of total weight up to 3000 kg.

(e) Transportation of bulky loads.

Note: A semi-open position of the cargo compartment doors is provided for transportation of bulky cargo (like the main rotor blades) in the cargo compartment.

(2) Troop carrier version - for transportation of troopers (24, maximum).

(3) Ambulance version:

(a) For stretcher cases (12, maximum).

(b) Combination - stretcher and seated cases, maximum 20 in number (3 stretcher cases and 17 seated cases).

(c) With one auxiliary fuel tank and seated cases (15, maximum).

1.3. Operating conditions

The Ми-17-1В helicopter is capable of successful operation and carrying out its assigned duties by day and night, in VFC and IFC.

1.4. Crew

The helicopter crew comprises three members: Pilot (Captain), co-pilot (Pilot-Navigator) and flight engineer.

1.5. Loading. Center of Gravity

(1) To keep the helicopter in-flight CG position within the allowed limits it is necessary to load the helicopter in strict accordance with the instructions of Section 5 of the present Flight Manual.

(2) In case of transportation in the cargo compartment of bulky loads the center of gravity of which cannot be positioned between the arrows and in case of change in the removable equipment of a certain version it is necessary to calculate the helicopter weight and CG position proceeding in accordance with the Ми-17-1В Helicopter Weight and Balance Manual.

The Ми-17-1В helicopter takeoff weights and loads for various variants of loading are given in Table 1.1. The helicopter empty weight and CG position data are taken from the Helicopter Log Book. All the calculations should be performed in accordance with the Ми-17-1В Helicopter Weight and Balance Manual.

(3) At any of the above variants the helicopter is capable of performing rescue operations after installation of hoist boom and a winch.

Ми-17-1В Helicopter Loading for Various Types of Operation

Table 1.1.

Load	Type of operation and weight data (kg)					
	Cargo				Ambulance	Carrier
	Without auxiliary fuel tanks	With the auxiliary fuel tank	With two auxiliary fuel tanks	With external load		
Empty helicopter	7142,0	7142,0	7142,0	7142,0	7142,0	7142,0
Total load including:	3801,0	3958,0	3958,0	3958,0	3111,0	3958,0
(1) Crew and operation items:	381,0	429,0	474,0	371,0	511,0	385,0
(a) Crew:	270,0	270,0	270,0	270,0	270,0	270,0
- pilot with parachute (2 persons)	180,0	180,0	180,0	180,0	180,0	180,0
- Flight engineer with parachute	90,0	90,0	90,0	90,0	90,0	90,0
(b) Operational items:	43,4	91,4	136,8	33,6	173,1	47,9
- entrance stairs	7,3	7,3	7,3	7,3	7,3	7,3
- loading ramps (2 items)	31,6	31,6	31,6	-	31,6	-
- auxiliary fuel tank	-	48,0	93,4	-	-	-
- seats for 22 troopers with seat belts	-	-	-	-	36,1	36,1
- medical equipment	-	-	-	-	93,6	-
- external load system (without load slings)	-	-	-	21,8	-	-
(c) Oil	71,7	71,7	71,7	71,7	71,7	71,7
(2) Fuel:	1420,0	2130,0	2840,0	546,0	1420,0	1153,0
(a) In service tank	346,0	346,0	346,0	346,0	346,0	346,0
(b) In external tanks	1074,0	1104,0	1104,0	200,0	1074,0	807,0
(c) In auxiliary tanks	-	680,0	1390,0	-	-	-
(3) Useful load:	2000,0	1399,0	644,0	3041,0	1180,0	2420,0
(a) Cargo with tie-down provisions	2000,0	1399,0	644,0	-	-	-
(b) Special equipment	-	-	-	-	-	-
(c) Troopers (24 persons)	-	-	-	-	-	2400,0

Load	Type of operation and weight data (kg)					
	Cargo				Ambulance	Carrier
	Without auxiliary fuel tanks	With the auxiliary fuel tank	With two auxiliary fuel tanks	With external load		
(d) Swivel mounts (removable portions), 6 pcs	-	-	-	-	-	19,8
(e) Stretcher cases (12 persons)	-	-	-	-	1080,0	-
(f) Medical attendant (1 person)	-	-	-	-	90,0	-
(g) Water and liquid disinfectant	-	-	-	-	10,0	-
(h) External load slings	-	-	-	40,9	-	-
(i) External load	-	-	-	3000,0	-	-
(j) УБ-32 pods (loaded) 6 pcs	-	-	-	-	-	-
(k) Bombs	-	-	-	-	-	-
(l) УБ-32 pods (unloaded)	-	-	-	-	-	-
Normal take off weight	10943,0	11100,0	11100,0	11100,0	10253,0	11100,0
Additional load	2000,0	1900,0	1900,0	1900,0	-	267,0
(1) Cargo with tie-down provisions	2000,0	1900,0	1900,0	1026,0	-	-
(2) Fuel	-	-	-	874,0	-	267,0
(3) Troopers (19 persons)	-	-	-	-	-	-
Maximum takeoff weight	12943 (with 4000kg cargo)	13000 (with 3299kg cargo)	13000 (with 2544kg cargo)	13000	-	11367

Notes: 1. The empty weight and the empty helicopter CG position are indicated for each individual helicopter in its Log Book, Section "Individual features".

2. The fuel weight is indicated without 35 kg of fuel used on the ground (for starting the engines, their run up and taxiing to starting position).

3. The weight data and CG positions of removable items for specific helicopter are taken for calculations from the Ми-17-1В Helicopter Weight and Balance Manual.

1.6. Weights

(1) The maximum takeoff (landing) weight of the helicopter for out of ground effect vertical takeoff (landing) is determined according to the graphs in Figs 1.1 and 1.2 and for in ground effect take off according to the graphs in Figs 1.3 and 1.4.

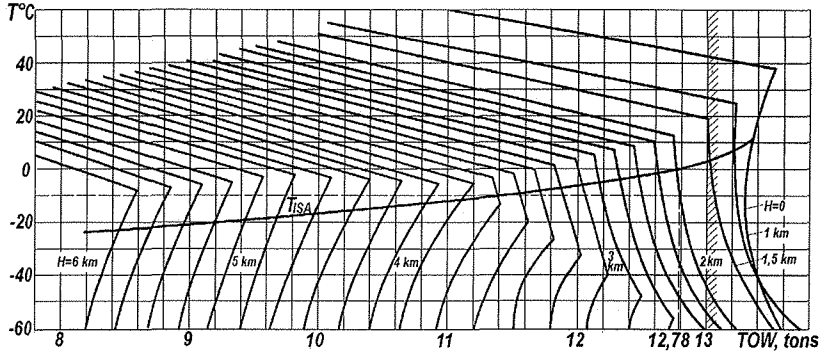

Fig. 1.1. Maximum Take off Weight at Vertical Takeoff and Landing Out of Ground Effect (Takeoff Power, n_{mr} = 93,5%, with DPD installed, without Air Bleed to DPD Ejector).

Takeoff weight shall be reduced:
By 200 kg with DPD ejector ON.
By 800 kg with engine and rotors anti-icing ON.

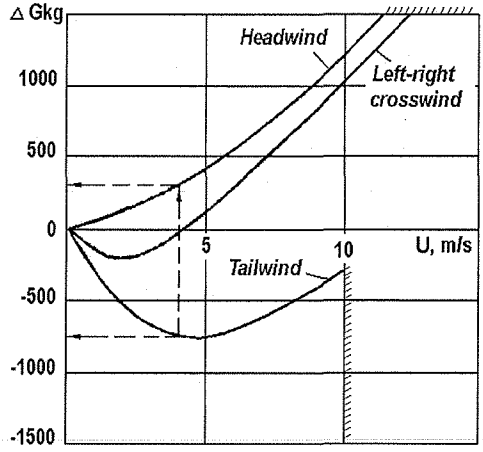

Fig. 1.2. Maximum Weight Increment versus Wind Speed and Direction at Take-off or landing Out of Ground Effect

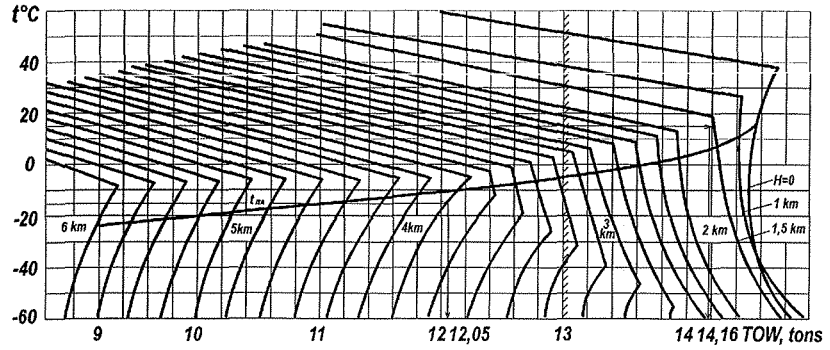

Fig. 1.3. Maximum Takeoff Weight at Vertical Takeoff and Landing In Ground Effect (Takeoff Power, n_{mr} = 93,5%, with DPD installed, without Air Bleed to DPD Ejector)

Takeoff weight shall be reduced:

by 200 kg with DPD ejector ON.

by 800 kg with engine and rotors anti-icing ON.

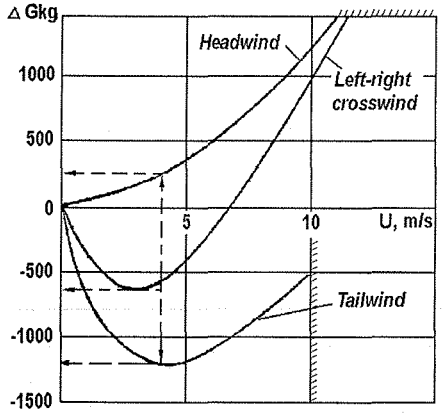

Fig.1.4. Maximum Weight Increment versus Wind Speed and Direction at Take-off and Landing In Ground Effect

The graphs 1.1. and 1.3 take into account the use of engine take off power and do not take into account the air bleed for dust-protection device operation.

(2) The maximum takeoff weight determined by the graphs should be reduced:

(a) By 300 kg, the engine efflux screen being installed.

(b) By 200 kg, the dust protection device ejector being ON.

(c) By 800 kg with the engine and rotors anti-icing ON.

(3) To determine the helicopter maximum weight increment (decrement) under no-wind conditions versus the wind direction and speed use the graphs illustrated in Figs 1.2 and 1.4.

In calculation of the maximum weight with the wind effect accounted for, keep in mind that both the wind direction and speed may change during takeoff and landing. Therefore, in calculation of the maximum weight in unsteady wind conditions assume the minimum value of the maximum weight for the possible wind component range.

If the wind data are not available and it proves impossible to determine its direction during landing, calculate the maximum weight for the most adverse combination of the wind speed and direction (tailwind of 4 to 6 m/s).

(4) Due to a possible difference of the helicopter main rotor takeoff power operational lift from the design value it is necessary to perform a check hovering before each flight to make sure the helicopter maximum weight is determined correctly.

(5) The graphs are provided with key patterns serving for explanation of their use. Given below is an example of determination of the helicopter maximum weight.

Example: Determine the helicopter maximum weight for vertical takeoff in ground effect from a field located at an altitude of 1500 m above sea level, at an air temperature of +15 °C and a wind speed of 4 m/s.

Solution: (1) On the graph in Fig. 1.3 find the maximum takeoff weight for no-wind conditions. At the air temperature scale (t°) find a point corresponding to a temperature of +15°C, and draw a horizontal line to intersection with an altitude line of 1500 m. From the point obtained draw a vertical line to the horizontal scale and read the helicopter maximum weight for no wind conditions – 14160 kg.

(2) On the graph in Fig. 1.4, on the wind scale (U) find a point corresponding to a wind speed of 4 m/s, and draw a vertical line up to the curve marked "Headwind" (tailwind, left or right crosswind).

From the point obtained draw a horizontal straight line up to the vertical scale and read the increment (decrement) of the helicopter maximum weight in no-wind conditions (+250 kg for headwind, -610 kg for left or right crosswind, and -1180 kg for tailwind).

(6) Sum up the helicopter maximum weight for no-wind conditions and the weight increment (decrement) for a wind speed of 4 m/s to obtain the helicopter maximum takeoff weights:

(a) at headwind. 14410 kg (but it must be not more than 13000 kg)

(b) at left or right crosswind. 13550 kg (but it must be not more than 13000 kg)

(c) at tailwind. 12980 kg

Calculate the helicopter takeoff or landing maximum weight out of ground effect following the same procedure and using the graphs in Figs 1.1 and 1.2.

(7) Increase the maximum weight determined according to the graph in Fig. 1.3 by 500 kg (but not more than 13000 kg) for running takeoff and landing.

On performing a running takeoff execute a check hovering at a height of 1 m minimum to make sure that the maximum takeoff weight is determined correctly.

1.7. Flight range, radius of action and duration

1.7.1. General

The helicopter range and duration of flight at a selected load depend on the helicopter fuel load and flight condition characterized by altitude and indicated airspeed (IAS).

The helicopter load and fuel quantity determine the helicopter actual takeoff weight which should not exceed the maximum takeoff weight derived from the graphs for the selected takeoff procedure and actual ambient conditions at the takeoff field (Ref. Figs 1.1, 1.2, 1.3, 1.4).

1.7.2. Fuel

The total fuel load (TF) is determined by the formula:

TF = TOW - OZFW + GF, where

TOW - helicopter takeoff weight (less fuel used on the ground);

OZFW - operational weight including all operational items less fuel (i.e. operational zero-fuel weight);

GF - fuel used for engines ground run determined by the engine ground run time and average fuel flow rate (7 kg/min).

The total fuel load (the amount of fuel before takeoff) is equal to the volume of fuel filled in liters multiplied by the fuel specific gravity.

If the fuel actual specific gravity is unknown, use the design values depending on the fuel grade.

The helicopter fuel system capacity for various variants of fueling, the total fuel load with the tanks full and for various fuel grades, as well as the design values of specific gravity for each grade are given in Table 1.2.

GF = 35 kg is assumed for calculation with the engines running before take-off for 5 minutes (starting, warming up, ground testing and taxiing to take-off position).

Table 1.2

Capacity of Fuel Tanks and Design Specific Gravity of Each Fuel Grade

Tanks	Capacity of tanks filled, liters	Total fuel load, kg	
		T-1 fuel of 0.8 kg/lit specific gravity	TC-1 or T-7 fuel of 0.775 kg/lit specific gravity
Main tanks and service tank	2615	2092	2026
Main tanks, service tank and one auxiliary tank	3530	2228	2735
Main tanks, service tank and two auxiliary tanks	4445	3556	3445
Main and service self-sealing tanks	2585	2068	2003

1.7.3. Horizontal Flight Fuel

Fuel consumed in horizontal flight (HFF) is determined by the formula:

HFF = TF - GF - TOF - GLF - RF - UF, where

TOF - fuel used for takeoff, establishing of steady flight condition and climb (derived from Table 1.3).

Table 1.3

Fuel Used, Distance and Time at Takeoff and Climb.

Engine Normal Power

Altitude, m	Takeoff weight, kg					
	11100			13000		
	Fuel used, G_{fc}, kg	Distance, L_c,km	Time, t_c, min	Fuel used, G_{fc}, kg	Distance, L_c,km	Time, t_c, min
Takeoff, acceleration, establishing of steady climb	15	-	1	15	-	1
100	20	-	1,5	20	-	1
500	25	-	2	30	-	2
1000	35	4,0	2,5	40	5	3
2000	55	7,0	4,0	70	10	5,5
3000	75	10	6,0	100	15	8
3500	-	-	-	-	-	11,5
4000	95	15	7,5	140	30	11,5
4800	-	-	-	215	40	18,0
5000	115	20	9,5	-	-	-
6000	170	30	15	-	-	-

GLF - fuel used for glide, deceleration, hovering and landing (derived from Table 1.4).

RF- reserve fuel (for possible deviation from the selected route, variation of weather conditions, etc.). In each specific case the reserve fuel is determined by the Captain. In the present calculation the reserve fuel is assumed to be equal to 5 % of the fuel filled.

UF - unusable fuel equal to 20 kg.

Table 1.4

Fuel Used, Distance and Time in Descent and Landing

Descent initiation altitude, m	IAS, km/h	Vertical speed of descent, m/s	Fuel used,kg	Distance, km	Time, min
Deceleration, hovering and landing	-	-	15	-	1
100	130	2 to 4	20	-	2
500	130	5 to 6	25	5	3
1000	140	5 to 6	30	10	4
2000	140	5 to 6	45	20	7
3000	140	5 to 6	60	30	11
4000	120	3 to 4	90	40	17
5000	120	3 to 4	130	55	25

1.7.4. Flight Range and Duration

The range of flight (R) is determined by the formula:

$$R = HFR + TOD + LD, \text{ where}$$

HFR - horizontal flight range equal to $\frac{HFF}{q}$, where

q - fuel consumption per kilometre (derived from Table 1.5 for the average gross weight).

TOD - climb distance at the best climb speed (derived from Table 1.3).

LD - glide distance at the best glide speed (derived from Table 1.4).

The duration of flight (T) is determined by the formula:

$$T=HFT+TOT+LT, \text{ where}$$

HFT- duration of horizontal flight equal to $\frac{HFF}{Q}$, where

Q - hourly fuel consumption (derived from Table 1.6 for the average gross weight).

TOT - duration (time) of climb at the best climb speed (derived from Table 1.3).

LT - duration (time) of glide at the best glide speed (derived from Table 1.4).

The values of the fuel consumption per hour (Q) and per kilometre (q) are determined for a helicopter gross weight being average for the route segment in question.

The graphs given in Figs 1.5 and 1.6 present the minimum values of fuel consumption per kilometre and hour corresponding to the cruising and economic speeds versus the helicopter gross weight at various altitudes.

The service range and duration of flight of the helicopter without the dust protection device, with 5 % reserve fuel at various altitudes, for two takeoff weights (11100 kg and 13000 kg) versus the fuel load (fuel specific gravity of 0.775 kg/lit) are given in Figs 1.7, 1.8, 1.9, 1.10. If the reserve fuel (RF) selected exceeds 5 %, while reading the graphs (fig.1.7-1.10) reduce the fuel load (TF) by the difference of the reserve fuel (RF - 0.05 TF).

The fuel consumption rates indicated in Table 1.5 and in Figs 1.5, 1.6, 1.11 should be increased:

By 1% with the dust protection device installed.

By 2 % with the main and tail rotors anti-icing on.

By 5 % with the engines air intakes and IGV heaters turned on in flight.

With the KO-50 combustion heater on, the hourly fuel consumption is increased by 8,7 kg/h.

During transportation of external loads the hourly fuel consumption depends on the value of additional drag developed by the external load.

The additional drag is determined by the cross section of load in the ram airflow and the load configuration.

Note: In determining the load cross section in the ram airflow keep in mind that long loads (tubes, logs, etc.) are positioned crosswise relative to the ram airflow.

In calculation of the flight range with an external load add the fuel consumption per kilometer rate increment Δq equal to the value derived from Fig. 1.12 for the selected IAS multiplied by the load cross section in the ram airflow to the fuel consumption rate determined from the graphs in Fig. 1.11.

Table 1.5

Fuel Consumption per Kilometres and Hour at Maximum Range Speed versus Gross Weight and Flight Altitude.

Main Rotor Speed = 95%

Flight Altitude, m	IAS, km/h		Gross weight, kg									
			9000		10000		11000		12000		13000	
	Weight not in excess of 11100kg	Weight above 11100kg	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h
100	230	215	2,66	620	2,69	627	2,75	641	2,84	621	2,93	640
500	225	210	2,55	593	2,60	605	2,67	621	2,76	601	2,86	623
1000	220	205	2,44	569	2,49	580	2,57	599	2,69	587	2,81	614
2000	210	195	2,24	525	2,33	546	2,44	572	2,56	559	2,71	592
3000	195	160	2,11	485	2,22	510	2,35	540	2,63	500	2,91	554
4000	170	120	2,00	426	2,14	455	2,36	502	3,16	486	3,73	575
5000	120	-	2,18	354	2,50	406	3,00	488	-	-	-	-
Transport version												
6000	100	-	2.62	380	3,31	480	4,62	665	-	-	-	-

Table 1.5a

Indicated and Air Speeds at Maximum Range Condition, ISA

Pressure altitude, m	Gross weight, kg			
	up to 11,100		over 11,100	
	Flight speed, km/h			
	indicated	Air	indicated	Air
100	230	233	215	219
500	225	233	210	218
1000	220	233	205	218
2000	210	234	195	218
3000	195	230	160	190
4000	170	213	120	154
5000	120	163	-	-
5500	110	155	-	-
6000	100	145	-	-

Table 1.6

Fuel Consumption per Kilometer and Hour at Maximum Flight Time Speed versus Gross Weight and Flight Altitude

Flight Altitude, m	IAS, km/h		Gross weight, kg									
			9000		10000		11000		12000		13000	
	Weight = 11100kg maximum	Weight above 11100kg	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h	Fuel consumption, kg/km	Fuel consumption, kg/h
100	130	130	3,75	499	3,88	516	4,01	533	4,16	553	4,37	583
500	130	130	3,50	479	3,63	497	3,77	517	3,92	537	4,16	570
1000	130	130	3,27	458	3,41	478	3,58	501	3,71	520	3,99	558
2000	130	130	2,86	423	3,02	447	3,20	474	3,40	503	3,63	534
3000	120	120	2,76	397	2,96	426	3,22	464	3,35	483	3,73	537
4000	120	120	2,51	377	2,74	411	3,03	455	3,23	485	3,81	571
5000	120	-	2,28	354	2,63	407	3,14	486	-	-	-	-

1.7.5. Radius of Action and Range of flight over mountains.

The radius and range of flight over mountain areas should be calculated with additional limitations imposed by the conditions of takeoff from and landing on the elevated field accounted for. In order to make sure that this limitation is respected it is necessary, after normal calculation of the range, to calculate the helicopter weight for takeoff from or landing on the elevated field.

If the takeoff or landing weight proves to be in excess of the maximum weight, determine a new refined radius or range to meet the above limitation.

Determine the maximum weights for various procedures of takeoff and landing proceeding as instructed in Section 1.6.

The helicopter takeoff weight is calculated in accordance with the load to be transported and the fuel quantity aboard.

The procedure of calculation of the helicopter landing weight depends on the type of operation. Let us consider, for example, the procedure of calculation for a flight over a selected range (R).

The helicopter weight at the initial point of horizontal flight segment

$$IHW = TOW - GF - TOF$$

The helicopter weight at the end of horizontal flight segment

$$EHW = IHW\text{-}HFF, \text{ where}$$

$$HFF = q \cdot HFR.$$

$$HFR = R - TOD - LD.$$

The fuel consumption per kilometre (q) is selected for a helicopter average gross weight (AGW) for the horizontal flight segment.

$$AGW = IHW - 0{,}47\, q_{in} \cdot HFR, \text{ where}$$

q_{in} - fuel consumption per kilometre at IHW.

The helicopter landing weight equals

LW = EHW - GLF

The values of GF, TOF, GLF, TOD, LD and q are derived from the Tables as instructed in 1.7.2, 1.7.3.

1.7.6. Wind Effect

Because of the helicopter relatively low airspeed the wind direction and speed have a pronounced effect on the flight range and duration.

To account for the wind effect the equivalent wind concept is introduced, the equivalent wind, being only tailwind or headwind, changes the range in the same way as an actual wind with its direction. The equivalent wind speed is equal to the difference between the ground speed and the true air-speed. Table 1.7 shows the equivalent wind speed versus the actual wind speed and direction (for TAS within the range of 180 to 250 km/h).

The wind effect on the range is accounted for by means of the graph in Fig. 1.13, the equivalent wind being the input value.

Before each flight the calculation should be refined with the use of the wind direction and speed data for various altitudes taken no longer than 1 hour before.

Calculation of the range in wind (the range in no-wind condition assumed known) is performed in the following way:

(a) With the actual wind speed and direction being known the equivalent wind and its direction (tailwind or headwind) are derived from Table 1.7.

(b) On the graph in Fig. 1.13 from the point of intersection of the lines depicting the range in no-wind condition and the equivalent wind draw a line equidistant to the wind lines (tailwind or headwind) until it intersects the R axis and have the range in wind (tailwind or headwind).

Table 1.7

Equivalent Wind Speed

Wind direction	Wind angle, deg		Actual wind speed, km/helicopter							
	Left drift	Right drift	10	20	30	40	50	60	70	80
			Equivalent wind speed, km/h							
Tail-wind	0	360	10	20	30	40	50	60	70	80
	10	350	10	20	30	39	49	59	69	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	42	48	54
	50	310	6	12	18	23	28	33	37	41
	60	300	5	9	13	17	20	22	24	26
	70	290	3	6	8	10	11	12	12	12
	80	280	1	2	3	3	2	1	1	3
Head wind	90	270	0	1	2	4	7	10	14	18
	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

1.7.7. Example Calculations

Example 1. Determine the maximum range and duration of the helicopter flight in the ferrying version at an altitude of 500 m with the normal takeoff weight TOW = 11100 kg, the total fuel load TF = 2514 kg and a reserve fuel of 5 % of the total fuel load.

Solution: The reserve fuel equals: RF = 2514 x 0.05 = 125.7 kg ~ 126 kg.

Fuel used in the horizontal flight (HFF) is calculated by the formula:

HFF = TF- GF - CF - LF - RF - UF, where

TF= 2514 kg - total fuel load;

GF= 35 kg - fuel used on the ground;

TF - GF = TOF = 2514 - 35 = 2479 kg - takeoff fuel load;

CF=30 kg - fuel used during takeoff and climb to 500 m;

LF= 25 kg - fuel used in descent from 500 m and landing;

UF= 20 kg - unusable fuel;

HFF= 2514 - 35 - 30 - 25 - 20 - 126 = 2278 kg.

Helicopter operational weight with zero fuel:

OZFW = TOW - TOF = 11100 - 2479 ~ 8620 kg.

Helicopter gross weight at the initial point of horizontal flight segment:

IHW = TOW - CF = 11100 - 30 = 11070 kg.

Helicopter gross weight at the end of horizontal flight segment:

EHW = OZFW + RF + UF + LP = 8620 + 126 + 20 + 25 = 8791 kg.

Helicopter average gross weight at the horizontal flight segment:

$$AGFW = \frac{IHW + EHW}{2} = \frac{8791 + 11070}{2} = 9930kg$$

Use the graphs in Figs 1.5 and 1.6 to derive the minimum fuel consumption per kilometer at the cruising IAS and the minimum hourly consumption at the economic IAS for the helicopter average gross weight in horizontal flight segment:

q = 2.59 kg/km (cruising IAS = 230 km/h)

Q = 496 kg/h (economic IAS = 130 km/h)

Horizontal flight range at cruising speed:

$$HFR = \frac{HFF}{q} = \frac{2278kg}{2.59kg/km} = 879.5km \approx 880km$$

Distances in climb and descent (Ref. Tables 1.3 and 1.4) are equal to 0 and 5 km respectively.

Service range (SR): SR = HFR + CD + DD

SR = 880 + 5 + 0 = 885 km.

Duration of horizontal flight at the economic speed:

$$HFT = \frac{HFF}{Q} = \frac{2278}{496} = 4.593h = 4h36min$$

Duration of flight in climb and descent (Ref. Tables 1.3 and 1.4) is 2 min (0.033 h) and 3 min (0.05 h) respectively.

Service duration of flight (ST): ST = HFT + CT + DT

ST = 4.593 + 0.033 + 0.05 = 4.676=- 4 h 41 min.

When using the graphs in Figs 1.7 thru 1.10 bear in mind that the total fuel load (including GF = 35 kg) is laid off on the TF axis.

The graphs in Figs 1.7 and 1.9 give for TF = 2514 kg the same values as in the calculation:

SR = 885 km

ST = 4,67 = 4 h 41 min.

Example 2. The service range in no-wind conditions is 420 km. The actual wind speed is 30 km/h, tailwind, the wind angle is equal to 10°.

Solution: The equivalent wind speed EWS = 30 km/h is derived from Table 1.7.

On the graph in Fig. 1.13 find a point corresponding to the range in no-wind conditions and to the equivalent wind speed and draw a line equidistant to the grid from this point to the range axes. The range in wind is 480 km.

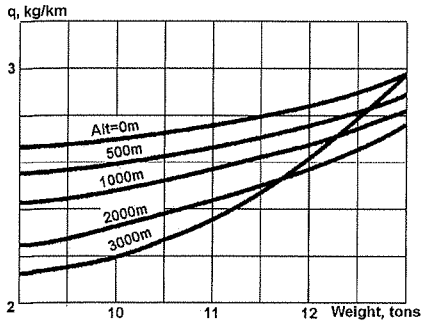

Fig. 1.5 Minimum Fuel Consumption per Kilometer

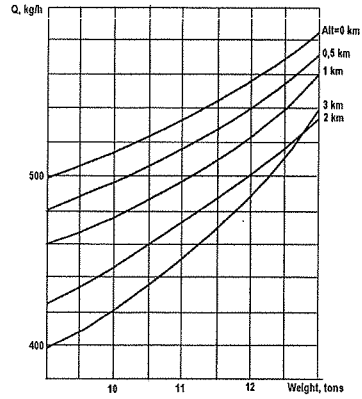

Fig. 1.6 Minimum Fuel Consumption per Hour

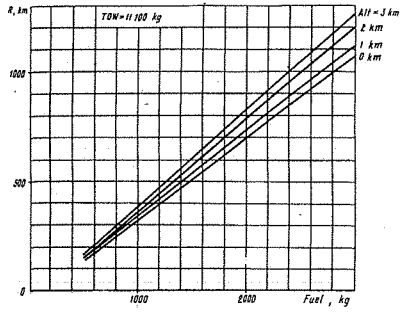

Fig. 1.7 Service Range

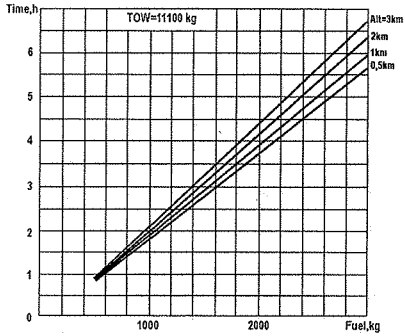

Fig. 1.8 Service Duration of Flight

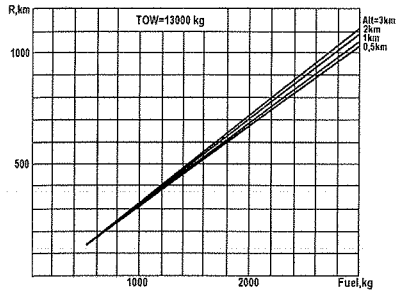

Fig. 1.9 Service Range

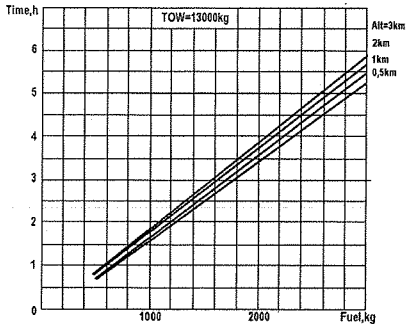

Fig. 1.10 Service Duration of Flight

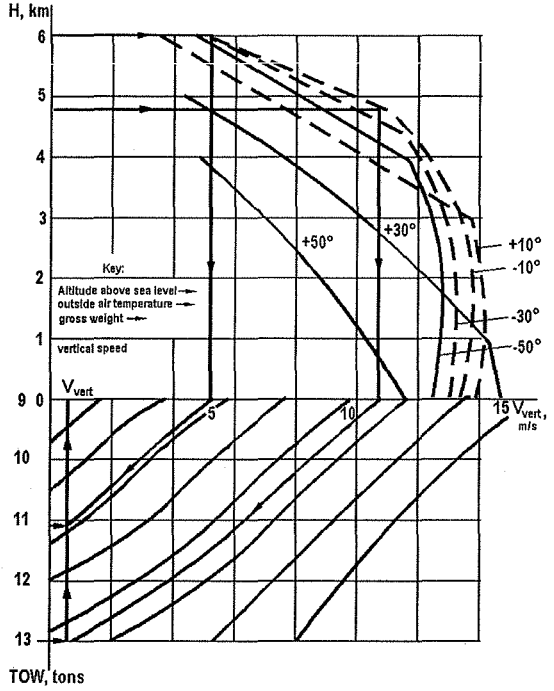

Fig. 1.10a Vertical Speed Versus Flight Altitude and Outside Air Temperature with Two Engines Operating at Maximal Continuous Power at the Best Speed (Anti-Icing off).

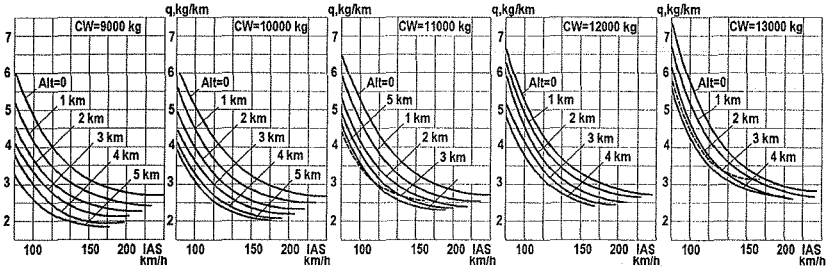

Fig. 1.11 Fuel Consumption per Kilometer versus Gross Weight, Altitude and IAS in Standard Ambient Conditions (Without special trusses and Dust Protection Devices)

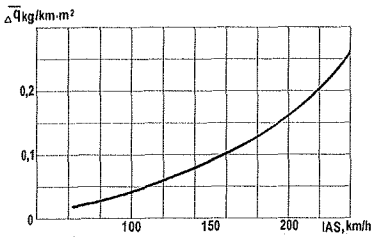

Fig. 1.12 Increment of Fuel Consumption per Kilometer per 1 Square Meter of External Load Cross Section Area versus IAS

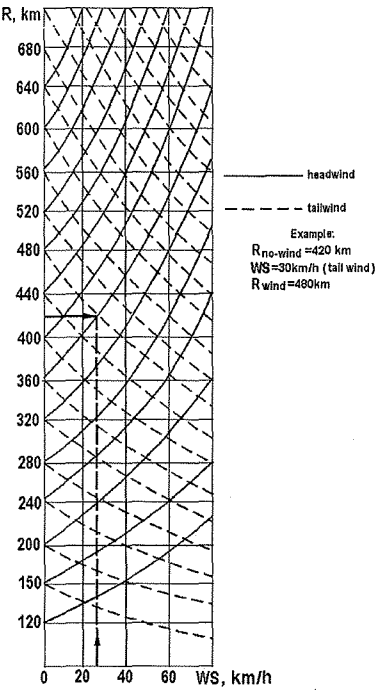

Fig. 1.13 Range versus Equivalent Wind

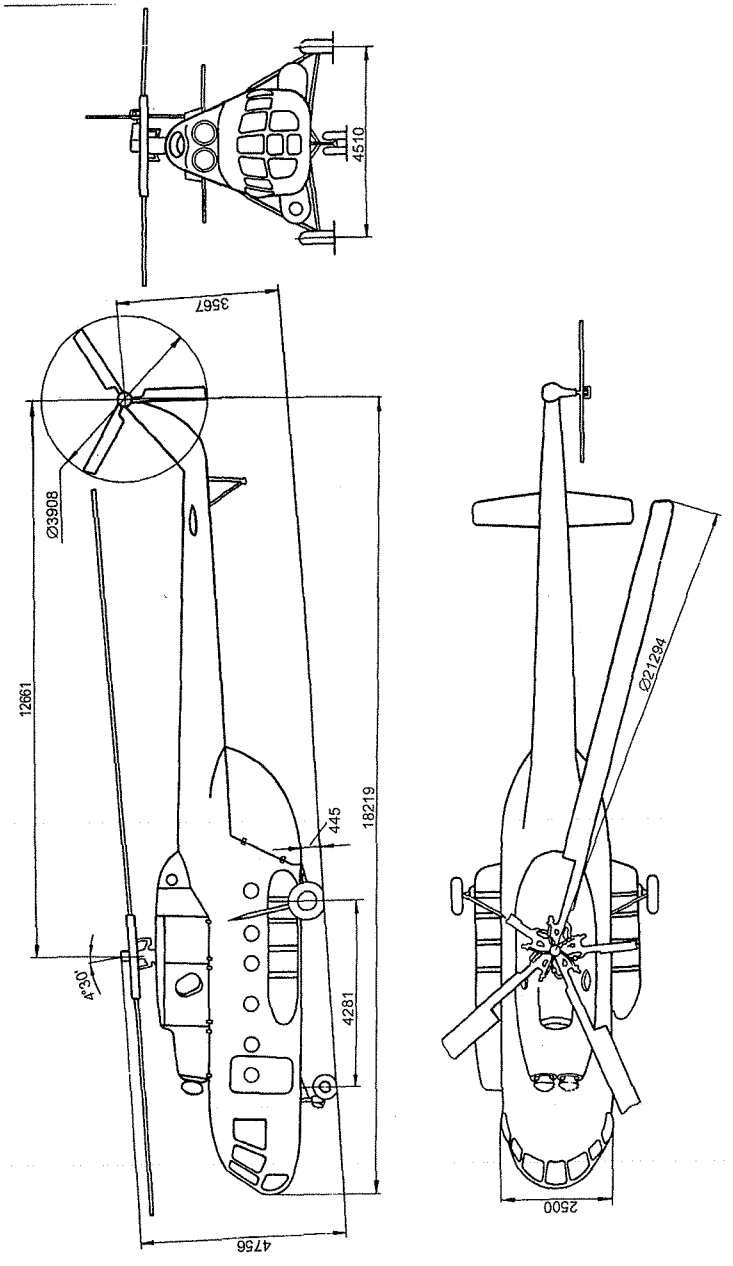

Fig. 1.14 Principal overall dimensions of helicopter

Section 2

LIMITATIONS

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2. LIMITATIONS

2.1. Weight limitations

(1) Normal takeoff weight ..... 11100 kg
(2) Maximum takeoff weight ..... 13000 kg
(3) Maximum useful load ..... 4000 kg
(4) Maximum external load weight ..... 3000 kg

Note: The maximum takeoff weight for flying over mountains areas at high ambient temperatures is determined for the actual ambient conditions at the take-off field from the graphs included in subsection 1.6, but in all cases the maximum takeoff weight shall not exceed 13000 kg.

2.2. CG Limitations

(1)Forward CG limit is +300 mm (forward of main rotor rotation axis)

(2) Aft CG limit is -95 mm (aft of main rotor rotation axis)

2.3. Weather limitations

(1) Operation of the helicopter is allowed at ambient temperature within the range of -50 to +50 °C.
(2) Flying in clouds is allowed at altitude up to 3500 m.

2.4. Performance limitations

(1) It is allowed to climb, to perform horizontal flight, power-on and autorotation glide within the speed range indicated in Table 2.1.

Table 2.1

Altitude, m	IAS limits, km/h			
	13000 kg takeoff weight		11100 kg takeoff weight	
	maximum	minimum	maximum	minimum
Up to 1000	230	60	250	60
2000	195	60	230	60
3000	160	60	210	60
4000	120	60	170	60
4800	100	60	-	60
5000	-	-	130	60
6000	-	-	100	80

Notes: 1. At the normal takeoff weight and CG at the aft limit (with the common center of gravity of cargo aligned with the respective red arrow at the RH side wall of the cargo compartment) the maximum flight speed is limited by 240 km/h.
2. At a gross weight exceeding the normal gross weight and with the negative center of gravity the maximum flight speed in climb is limited by 220 km/h.

(2) To improve safety of flight it is allowed to perform hovering at altitudes indicated in Table 2.2. At altitudes exceeding those indicated in Table 2.2 hovering is allowed during transportation of external load and due to tactical considerations.

Table 2.2

Takeoff weight, kg	Hovering altitude, m
11100 and below	Up to 10
Above 11100	Up to 5

Do not hover within the range of altitudes differing from those indicated in Table 2.2 down to 110 m, except for the cases of extreme urgency.

(3) The maximum speed in horizontal flight with the cargo doors semi-open (for transportation of the main rotor blades and other bulky cargo items) is 230 km/h, and 200 km/h with the doors removed.

(4) Flying over heavily broken terrain is allowed at an altitude of not less than 20 m and IAS not less than 60 km/h.

(5) The minimum allowed altitude is 15 m over even terrain and 150 m for flying by night.

(6) Turn in hovering at angular rates not exceeding 12 deg/s.

(7) The time of full reversal of the pedals necessary to change the helicopter sense of rotation should be not less than 3 s.

(8) It is allowed to execute 360-degree turns in hovering near the ground at a wind speed not exceeding 10 m/s.

(9) It is allowed to start and stop the main rotor and to execute hovering, takeoff and landing at wind speeds indicated in Table 2.3.

Table 2.3

Wind direction	Maximum allowed wind speed, m/s	
	At main rotor starting and stopping	At takeoff and landing
Headwind	25	25
Right side crosswind	10	10
Left side crosswind	15	10
Tailwind	8	10

(10) Taxiing is allowed at a wind speed not exceeding 15 m/s, at headwind nor exceeding 25 m/s.

(11) Power-on glide is allowed within the range of speeds indicated in Table 2.1.

(12) Autorotation glide is allowed within the range of speeds indicated in Table 2.1.

(13) Turns with the main rotor autorotating are allowed with bank angles not exceeding 20°.

(14) The maximum main rotor speed (read on the tachometer indicator) is allowed for not more than 20 s:

- 101% at engine power above cruising 2.
- 103 % at engine power below cruising 2.

(15) The minimum allowed main rotor speed (speed drop):
In flight in transient conditions is 88 % (on the indicator) for a period not exceeding 30 s.
The minimum allowed main rotor speed during autorotation landing is 70 %.
To avoid a main rotor speed drop during execution of various maneuvers involving acceleration of the engines move the collective pitch control lever from idle to maximum power within a period of time not less than 5s.
To prevent the main rotor overspeed above the allowed maximum limit the collective pitch control lever downwards motion rate should not exceed 1 deg/s (except for the cases of engine failure).

(16) It is allowed to engage the АП-34Б autopilot altitude channel in horizontal flight at an altitude not less than 50 m.

(17) It is allowed to execute turns and spirals within the allowed range of airspeeds at bank angles indicated in Table 2.4.

Table 2.4

Altitude, m	Maximum bank, deg	
	Gross weight of 11100 kg or below	Gross weight above 11100 kg
50 to 3000	30	20
Above 3000	15	15

Notes: 1. It is allowed to execute accelerated turns at altitude of 50 to 1000 m at the normal and subnormal takeoff weight and the airpseed within the limits of 120 to 250 km/h at bank angles up to 45°.
2. At height up to 50 m above the terrain the bank angle is allowed to be equal to the actual altitude but not in excess of values indicated in Table 2.4.

(18) It is allowed to execute zooms and dives at gross weights of 11100 kg or below.

(19) The maximum allowed speeds for initiation of zoom and recovery from dive are indicated in Table 2.5.

Execute zooms and dives at constant collective pitch of the main rotor blades, equal to its initial setting in the horizontal flight at a given speed. Depending on the horizontal flight altitude and initial speed execute dives with the helicopter pitch changing from the initial attitude in horizontal flight at a given speed but not in excess of the values indicated in Table 2.6

Table 2.5

Altitude, m	Maximum allowed speed for zoom entry from horizontal flight, km/h	Maximum allowed speed for recovery from dive, km/h
0 to 500	220	300
500 to 1000	200	300
1000 to 2000	180	250

Table 2.6

Altitude, m	Maximum pitch angle change for dive (in deg) for dive entry speeds, km/h			
	150 or below	180	200	220
Up to 500	20	20	15	10
500 to 1000	20	20	15	-
1000 to 2000	20	10	-	-

The maximum speed for initiation of recovery from dive should be 30 km/h below the allowed speeds indicated in Table 2.5, with the pitch angle changing by 20°, and 15 km/h below these speeds with the pitch angle changing by 10°.

The maximum change of the pitch angle from the initial setting in the horizontal flight at a given speed should not exceed 20° in execution of zoom.

Warning: Entry in dive and recovery from zoom within a period of time less than 5 to 6 seconds are not allowed.

(20) To prevent the main rotor overspeed above the maximum allowed limits in transient conditions of flight never reduce the main rotor collective pitch at rates of 1 deg/s or more with the helicopter pitch angle rising simultaneously at rates of 1 deg/s or more.

(21) To avoid possible hitting of the tail boom by the main rotor blades:
- Never change the main rotor collective pitch in execution of zooms and dives.
- Never try to sharply reduce the main rotor collective pitch with the control stick being simultaneously sharply pushed forward and subsequently pulled back in execution of transient maneuvers.

2.5. External load limitations

(1) The helicopter maximum takeoff weight for transportation of external load (including the load weight) is determined for the actual conditions of takeoff from the graph placed in subsection 1.6 but in all cases it should not exceed 13000 kg.
The maximum weight of external load is 3000kg.

(2) The maximum allowed speed for transportation of external load should be determined in each case depending on the load behavior (which is dictated by its aerodynamic configuration) but not in excess of the speeds indicated in Table 2.1 (depending on the takeoff weight).

2.6 Power plant limitations

(1) The maximum operational characteristics of the engines at all altitudes and airspeeds are indicated in Table 2.7.

Table 2.7

Engine maximum operating parameters at different power ratings.

Power	Maximum gas generator turbine inlet gas temperature, °C	Maximum gas generator turbine speed, %
Takeoff (both engines operating and 2,5 min power, OEI) (contingency)	990	101.15
30 min. power, OEI (takeoff)	990	101.15
Continuous power, OEI (normal)	955	99.0
Cruising 1	910	97.5
Cruising 2	870	95.5
Idle	780	see Fig.3.3

Notes: 1. In case of failure of the TGT Regulator limit the maximum allowed parameters by decreasing the engine power.
2. In case of failure of EEC the maximum allowed gas generator speed at indicated powers is 102.5%. If necessary, limit the parameters by decreasing the engine power. It is allowed to have not more than 3 failures within TBO at every gas generator overspeeding > 101%

(2) The power settings and respective operational parameters of the engines are indicated in Table 2.8.

Table 2.8

Engine operating parameters

Power	Rotational speed, %			Oil Pressure, Kgf/cm^2	Oil outlet temperature °C				Time of continuous operation, min
	Gas generator	main rotor			Maximum	Recomended	Minimum for continuous operation for power below	Minimum for acceleration above idle	
		OEI	Two engines operating						
Idle	Acc. to chart in Fig.3.3	40-55	55 $^{+15}_{-10}$	2 minimum					20 max
Cruising 2	Acc. to EPR Indicator ИР-117М and acc. to chart in Fig.4.2 but not exceeding the values given in Table 2.7	95±2	95±2	3.5±0.5	150	80-140	70	30	Not limited
Cruising 1		95±2	95±2	3.5±0.5	150	80-140	70	30	Ditto
Max continuous (normal)		95±2	95±2	3.5±0.5	150	80-140	70	30	60 max
Take off		93±1	93±1	3.5±0.5	150	80-140	70	30	6 (See Note1)
Contingency		93±1	-	3.5±0.5	150	80-140	70	30	(See Note 2)

Notes:

1. The engine operating time at take off power should not exceed 10% of the total operating time throughout the TBO, allowed time of continuous operation is 6 minutes.
   In case of necessity it is allowed to run the engine continuously for 15 minutes at takeoff power provided the summed operating time in these conditions does not exceed 1,25% of allowed operating time throughout the TBO (included in 10%). In case of failure (shut down) of one of the engines it is allowed to run the other engine at take off power for 30 minutes within 0,5% per TBO.
2. The engine contingency power is used only in case of failure of one of the engines.
   The engine operating time at contingency power should not exceed 0,1% of total operating time throughout the TBO. It is allowed to run the engine continuously at contingency power for 2,5 minutes without any limitations within the mentioned operating time.
3. The gas generator rotor speed oscillation at steady power settings is allowed within ±0.5%.
4. With the engine running at steady ratings oscillation of the TGT indicator pointer within ±25 °C is allowed providing the maximum limit TGT is not exceeded.
5. The difference in the gas generator rotor speeds during simultaneous operation of both engines should not exceed the following limits:
   2% at normal power and cruising power 1.
   3% with the TGT regulator operating.
6. The oil pressure oscillation within ±0.25kgf/cm^2 read on the indicator are allowed at all steady power settings provided the established limits are not exceeded.
7. The engine oil pressure should not exceed 4.8 kgf/cm^2 at oil temperatures of less than 70 °C during the engine warming up at idle.

(3) The minimum allowed time interval between subsequent settings of take-off or normal power after running the engines at these power ratings for the maximum allowed continuous operation time is 5 minutes.

(4) The gas generator turbine maximum allowed inlet gas temperature during start of the engine should not exceed the value indicated in Fig. 3.3.

(5) The reliable start of the engines is ensured up to the altitude of 4000 m. It is allowed air to start the engines at gas generator rotor speed not exceeding 7 %

(6) The acceleration time periods are as follows:
From idle up to takeoff power ..... 9s, max
From cruising power 1 up to takeoff power ..... 4s, max.
From idle up to the rightmost setting of the throttle control twist grip (with the collective pitch control lever at the lower stop)..... 3 to 6 s, max.

(7) At ambient temperatures equal to or below -40 C it is allowed to start the engines only after pre-heating.

(8) The allowable operational characteristics of the main gearbox:
(a) Oil pressure
At idle ..... 0.5 kgf/cm^2, min
In sideslip flight (for not more than 30 s)..... 2.5 kgf/cm^2, min
At other power ratings ..... 3.5±0.5 kgf/cm^2
(b) Main gearbox inlet oil temperature at all power ratings:
Maximum ..... 90°C, max.
Recommended..... 50 to 80°C
Minimum allowed for acceleration from
idle up to operational power ratings..... -15°C
Minimum allowed for continuous operation.... +30°C
Minimum allowed for starting the engines
without main gearbox heating..... -40°C
The maximum oil temperature in the tail and intermediate gearboxes is 110 °C.

Operation time for every power rating

Table 2.9

Power	Allowed time of continuous operation, min	Allowed time of operation for power rating per TBO, %
Two engines operating		
Take-off	6	10%
	over 6 to 15	1,25%(included into 10%)
Maximum continuous (normal)	60	35%
Cruising	not limited	not limited
Idle	20	not limited
In case of failure (shut-down) of one of the engines		
2,5 minute power, OEI (contingency)	2,5	0,1%
30 minute power, OEI (take-off)	30	0,5%
Continuous power, OEI (normal)	60	0,85%

Note. 2,5 minute power, OEI (contingency) is allowed to use also in case of newly installed engine test or in case of EEC replacement (maximum 30 seconds long, quantity and total time of operation are not taken into account).

2.7. APU АИ-9В limitations

(1) The maximum operational altitude for the АИ-9В APU engine (starting, air bleed for starting the ТВ3-117ВМ engine, operation in generator mode) is 4000 m.

(2) The maximum allowed TGT of АИ-9В APU engine:

At start ..... 880°C
At idle ..... 720°C
At air bleed and generator modes ..... 750°C

(3) The maximum continuous operation time in generator mode is 30 minutes.

Section 3

PREFLIGHT CHECK

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3. PREFLIGHT CHECK

3.1. General

(1) The Flight Engineer is responsible for performing of the preflight checks in full scope and with high quality.

(2) The helicopter preflight check is carried out by the Flight Engineer in accordance with the requirements of Maintenance Manual and the present Flight Manual.

3.2. Preflight inspection

Preflight inspection of the helicopter is carried out in order to determine its readiness for flight.

The crew inspects the helicopter following the walk-around circuit shown in Fig. 3.1.

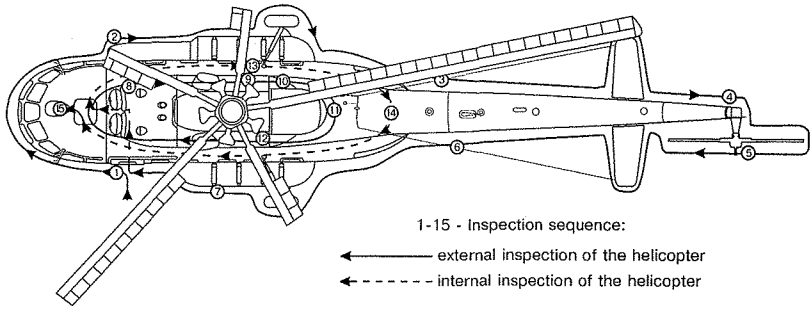

Fig. 3.1. Preflight external inspection circuit.

3.2.1. Flight Engineer

(1) Inspect the flight compartment nose section glazing and the movable blisters.

(2) Inspect the pitot-static tubes, check them for proper attachment and cleanliness of the orifices.

(3) Make sure the nose LG shock strut and tyres are properly charged. The nose LG shock strut compression should not exceed 150 mm by the indicator at various combinations of the helicopter weight and CG position, the nose LG tyres deflection should not exceed 43 mm.

(4) Inspect the RH fuel tank, the combustion heater KO-5O air intake and cowlings, make sure there are no fuel leaks, dents and other visible defects.

(5) Make sure the RH main LG shock strut is properly charged, there are no indications of hydraulic liquid leak on the rod, and the main LG wheel tyre is properly inflated (the shock strut rod extension measured on the rod face should be as follows:

(a) 240 MM With no load aboard;

(b) 90±20 mm at the helicopter weight of 11100 kg;

(c) 68±20 mm at the helicopter weight of 13000 kg;

Deflection of tyres should not exceed 68 mm.

(6) Inspect the main rotor blades to make sure that they are free from visible damage. Check whether the blades spars are pressurized (the pressure indicator strip should be sunk).

(7) Inspect the tail rotor to make sure that its hub and blades are free from damage and from ice and snow in winter time. Check the level and color of oil in the blade feathering hinge sight gauges (the oil level in the sight gauge should be at the mark level with the blade leading edge facing down).

(8) Check the oil levels in the intermediate and tail rotor gearboxes by reading the respective sight gauges. The oil level should be between the marks made on the sight gauges.

(9) Check the fuselage, tail boom and pylon, stabilizer, tail bumper fittings for condition.

(10) Make sure the cargo doors are reliably closed.

(11) Inspect the LH fuel tank and the LH main LG shock strut following the same procedure as for the RH main LG shock strut.

(12) Inspect the sliding door and make sure it is locked reliably in the closed position.

(13) Make sure that the portable fire extinguishers are installed in the cargo compartment.

(14) Check the helicopter loading for compliance with the anticipated flight mission.

(15) Make sure that the cargo is placed in accordance with the balancing marks made on the cargo compartment wall and check the cargo for reliable tie-down.

(16) Make sure that the helicopter takeoff weight does not exceed the maximum takeoff weight derived from the graph.

(17) Remove the covers from the engines air intakes, the shields of the fan and exhaust pipes, and make sure that they are free from damage and foreign objects.

(18) Open the engines, main gearbox and АИ-9В APU cowlings.

(19) Inspect the dust protection devices fairings and check them for reliable attachment. Check the fairing heater electrical wire bundle for proper attachment.

(20) Remove the shields from the АИ-9В APU air intake and exhaust pipes to make sure that they are free from visible damage and foreign objects.

(21) Inspect the inlet section and compressor blades of the АИ-9В APU.

(22) Check the oil level in the engines oil tanks which should be between the FULL (ПОЛНО) and LOW (ДОЛЕЙ) marks of the sight gauge.

(23) Check the oil level in the main gearbox by the sight gauge which should be between the gauge glass marks.

(24) Check the oil level in the АИ-9В APU oil tank which should be between the FULL (ПОЛНО) and LOW (ДОЛЕЙ) marks.

(25) Check the АМГ-10 fluid level in the hydraulic system reservoirs which should be at the upper mark of the dipstick.

(26) Check the АМГ-10 fluid level in the hydraulic dampers compensation tank which should be between the upper and lower marks.

(27) Read the fire extinguisher bottles pressure gauges to make sure that the pressure is at the level specified for the actual ambient temperature.

(28) Close and lock all the cowling panels.

(29) Lock the engine access door.

(30) Make sure the grounding cable is placed in its well.

(31) Drain 1.5 to 2 liters of fuel sediment through the fuel tanks drain valves.

(32) Inspect the flight compartment to make sure that it is free from foreign objects.

(33) Make sure that the instruments, annunciators, levers, switches are free from visible damage.

(34) Check the engine separate control levers for smooth movement.

(35) Make sure that the sliding blisters move easily and can be locked reliably.

(36) Check the pneumatic system pressure which should be 40 to 50 kgf/cm^2 and operation of the LG wheel brakes (on releasing the brakes there should be no residual pressure in the wheel brakes).

Note: In winter time after removing the dust protection device fairings make sure that the inside surfaces of the engines air intakes are free from ice, and check the compressor rotor blades for freezing: carefully turn the compressor rotor by using the manual cranking wrench without applying excessive forces. In case of freezing of the compressor rotor blades or detection of ice on the engine components heat the engine by delivering hot air into its air duct.

(37) On completing the helicopter inspection and all the preparatory operations the Flight Engineer should report to the Captain the helicopter readiness for the assigned flight mission, amount of fuel filled, compliance of the helicopter load and CG position with the assigned flight mission and elimination of the helicopter units and systems troubles reported upon the preceding day's flying.

3.2.2.Captain (Pilot)

(1) Listen to the Flight Engineer's report on the helicopter readiness for flight to have information on the amount of fuel filled, compliance of the helicopter load and CG position with the assigned mission, elimination of the units and systems troubles detected in the preceding day's flying and works performed on the helicopter after the last day's flying.

(2) Make sure that the fire fighting means are available in the parking area adjacent to the helicopter, and the parking area is free from foreign objects which may be touched by the rotor blades or get into the engines. In case of an off-field start make sure that the airborne fire fighting means are available.

(3) Inspect visually the following units and components:

(a) The main rotor for condition of the blades (freedom from dents, punctures, burnt-through areas on the heated surfaces, bulging of rubber coating, ice or frozen snow), the blade fixed trim tabs and the rotor blades tip lights glasses.

(b) Position of the spar pressure indicators.

Warning: The helicopter flying is strictly forbidden if the red strip of the main rotor spar pressure indicator cap becomes visible.

(c) The fuselage, tail boom and tail boom pylon for condition of the skin and the flight compartment glazing (freedom from snow and ice), condition and proper attachment of the antennas and pitot static tubes. Inspect the engine and main gearbox access doors, cowlings and servicing platforms for closed condition.

(d) Absence of covers on the Pitot tubes, CO-121 ice detector and icing indicator.

(e) Freedom of the dust protection device, engines, АИ-9В APU, fan and engine exhaust pipes from the shields, snow and ice.

(f) Freedom from leaks of fuel, oil and other liquids.

(g) Integrity of the navigation and anti-collision lights glasses.

(h) The stabilizer for condition of the skin (freedom of its surface from ice and snow).

(i) The tail rotor for condition of the blades (freedom from mechanical damage, burnt-through areas on the heated surfaces, bulging of rubber coating, ice or frozen snow), freedom from leaks of oil, freedom of the hub from ice and snow.

(j) The anti-icing system wires for freedom from damage.

(k) The landing gear for condition of the shock struts (freedom of the rods from fouling and leakage of hydraulic fluid).

(l) Proper charging of the shock struts, condition and deflection of the LG wheel tyres.

(m) The external fuel tanks for freedom from fuel leaks, for reliable closing of the filler caps, condition of the tank fasteners.

(n) Before flight in which the external sling system is to be used check the guards of the hatch, the external sling system fittings at frames Nos 7 and 10, the lock pivot for easiness of rotation.

Use maintenance stands for inspection of highly located units of the helicopter.

(4) Inspect the cargo compartment to make sure:

(a) The floor is free from damage and deformation.

(b) The windows and skin are free from damage.

(c) There are no leaks of fuel and АМГ-10 hydraulic fluid.

(d) The cargo doors and their locks are reliably locked.

(5) Brief the personnel accompanying the cargo on behavior during flight, on signals and procedure of emergency escape, check their knowledge of the main rules of parachute usage and emergency jettisoning of the entrance door and escape door and appoint a group leader.

3.2.3. Pilot-Navigator

(1) Check the following in the course of preflight inspection:

(a) Compliance of the helicopter load with the assigned flight mission.

(b) Correct arrangement of the cargo with the CG limitations and cargo compartment floor loading limitations accounted for.

(c) Correct seating of the persons and their knowledge of the orders and signals issued in flight.

(d) Persons' knowledge of the emergency escape means usage rules (brief, if necessary).

(e) Correct arrangement of cases (injured men).

(2) On completing the preflight inspection the Pilot-Navigator should report the results of inspection to the Captain.

3.3. Flight compartment preflight inspection and preparation

3.3.1. Captain (Pilot)

(1) When inspecting the flight compartment, check that:

(a) The flight compartment is free from foreign objects.

(b) The overhead hatch is reliably closed.

(c) The blisters emergency jettisoning handles are in proper condition and locked.

(d) The flight compartment glazing is clean and intact.

(e) All the circuit-breakers and switches are set to OFF (ВЫКЛЮЧЕНО), the valves are set to CLOSED (ЗАКРЫТО), the buttons provided with the safety guards are closed by them, the engine throttle levers are latched in the neutral position, the control stick is set to neutral.

(f) The seat belts are intact and the seats are properly adjusted.

(2) On completing the inspection call the crew to take places at their stations, don the parachutes, take place in the seats and perform the following operations:

(a) Adjust and latch the safety harnesses.

(b) Connect the parachute oxygen regulator flexible pin lanyard snap hook to the special fitting of the seat (place the extension line In such a way as to preclude its ingress into the control linkage).

(c) Adjust the seat and the directional control pedals to own stature.

(d) Make sure that the braking system is leak-free and operates normally (after depression of the brake handle and attainment of a pressure of 31 to 34 kgf/cm^2 in the brake line there should be no noise created by outgoing air and, after releasing the brakes there should be no residual pressure in the brakes).

(e) Connect the headset to the intercom cable.

(f) Check the sliding blister for reliable opening and closing.

(g) Inspect the instruments visually to check them for serviceability by observing their appearance and position of pointers.

(h) Set the pressure altimeter pointers to zero and check the barometric pressure display for compliance with the actual aerodrome pressure with an accuracy of ±1.5 mm Hg.

Caution: Never try to eliminate the difference between the pressure altimeter reading and the actual aerodrome pressure by turning the knob.

(i) Make sure that the engine throttle levers are intact and move smoothly.

(j) Give an order to connect the ground power source or energize the helicopter electrical system.

(k) After the Flight Engineer reports that the electrical system voltage is OK switch on the command radio station, check the interphone communication with all the crewmembers.

(l) At ambient temperatures of +5°C or below make sure the pitot static tube heater indication is OK.

(m) Check the windscreen wiper (by momentary switching on until it starts moving on the dry windscreen).

(n) Make sure the РИ-65 information reporting system switch is set to OFF (ВЫКЛ.) and the SWITCH INF REPORT ON (ВКЛЮЧИ РИ-65) annunciator illuminates.

(o) Make sure the СПУУ-52 tail rotor pitch limit system switch is set to OFF (ВЫКЛ.) and the respective switch-light at the Flight Engineer's centre control panel illuminates.

(3) During preparation for night flying, in addition to the above operations perform the following:

(a) Switch off the white lighting before inspecting the flight compartment.

(b) Switch on the red lighting of the instruments and panels.

(c) Switch on the navigation and МСЛ-3 anti-collision lights.

(d) Test the landing lights.

3.3.2. Flight Engineer

(1) On the order of the Captain the Flight Engineer should do the following;

(a) Cut in the storage batteries by setting the BATT 1-2 (АККУМУЛ 1, 2) switches to ON (ВКЛ.).

(b) Check the voltage at the storage battery bus by setting the wafer selector switch to BATT BUSES (ШИНЫ АККУМУЛ) (the voltage should be not less than 24V).

(c) Check condition of the aircraft storage batteries proceeding in the following way:

Set the EXT PWR (АЭРОД ПИТАН.) selector switch to OFF (ВЫКЛ).

Set the selector switch of the DC POWER (ПОСТОЯННЫЙ ТОК) control panel to BATT 1 (АККУМУЛ 1).

Set the BATT 2 (АККУМУЛ 2) switch to OFF (ВЫКЛ).

Start the fuel booster pump and read the voltmeter (the voltage should be not less than 24 V).

Set the wafer selector switch to BATT 2 (АККУМУЛ 2).

Set the BATT 2 (АККУМУЛ 2) switch to ON (ВКЛ) and the BATT 1 (АККУМУЛ 1) switch to OFF (ВЫКЛ) and read the voltmeter (the voltage should be not less than 24V).

Switch OFF the fuel booster pump.

Set the BATT 1 (АККУМУЛ 1) switch to ON (ВКЛ).

Set the selector switch to BATT BUSES (ШИНЫ АККУМУЛ).

(d) If a need exists to use the ground AC power source give an order to connect the AC ground power source cable to the respective helicopter receptacle. After the EXT PWR ON (АЭР. ПИТ. ВКЛЮЧЕНО) annunciator comes on (upon correct connection of the ground power source) check the ground power source voltage by setting the wafer selector switch to EXT PWR (АЭРОДРОМ. ПИТАН.) (the voltage should be within the limits of 200 to 205 V). Set the EXT PWR (АЭРОД. ПИТАН.) switch to ON (ВКЛ), the RECTIFIERS 1-2-3 (ВЫПРЯМИТЕЛИ I, II, III) switches to ON (ВКЛ) and check the rectifier bus voltage by setting the wafer selector switch to RECT BUSES (ШИНЫ ВЫПР.) (the voltage should be within the limits of 27 to 29V). Set the ПО-500А INV 115 VAC (ПО-500А ~ 115) and ПТ-200 INV 36 VAC (ПТ-200 ~ 36) selector switches to AUTO (АВТОМАТ).

(e) Set the wafer selector switch at the AC POWER (ПЕРЕМЕННЫЙ ТОК) control panel to 115 (the voltage should be 115V).

(f) If a need exists to use the ground DC power source give an order to connect the ground power source cable to the helicopter EXT PWR (ШРАП) receptacle. After the EXT PWR ON (АЭР. ПИТ. ВКЛЮЧЕНО) annunciator comes on check the ground power source voltage for which purpose set the wafer selector switch to EXT PWR (АЭРОДРОМ ПИТАН.) (the voltage should be within the limits of 27 to 29V).

Set the EXT PWR (АЭРОД. ПИТАН) switch to ON (ВКЛ.) and the ПО-500А INV 115 VAC (ПО-500А ~ 115) selector switch to MAN (РУЧНОЕ).

Check the inverter output voltage by setting the AC POWER (ПЕРЕМЕННЫЙ ТОК) control panel wafer selector switch to 115 VAC (~115) (the voltage should be 115 V).

(g) Read the fuel quantity gauge to check the fuel amount in the tanks.

(h) Alternately start the fuel booster and transfer pumps and monitor their operation by illumination of the annunciators.

(i) During cold seasons test the КО-50 combustion heater proceeding in accordance with 7.4 of the present Flight Manual.

(j) At ambient temperatures below +10°C warm up the БУР-1ж flight recorder system for which purpose, after making sure that the MAIN (ОСНОВН) and AUX (ДУБЛИР) hydraulic system circuit breakers are set to OFF (ВЫКЛ), set the switch, located on the flight recorder control panel, to MAN (РУЧН).

At subzero ambient temperatures the warming up time should be not less than 15 minutes.

(2) Check the fire extinguishers squibs for serviceability and test the ССП-ФК fire warning system proceeding as follows:

(a) Switch off the command radio.

(b) Switch on the FIRE EXTINGUISHING SYSTEM (ПРОТИВОПОЖАРНАЯ СИСТЕМА) circuit breaker.

(c) Alternately set the SQUIBS TEST (КОНТРОЛЬ ПИРОПАТРОНОВ) selector switch to I and II and make sure the squibs circuits are OK (the amber lights on the fire extinguishers discharge indication

panel should be off).

(d) Set the FIRE DET TEST - FIRE EXTING (КОНТРОЛЬ ДАТЧИКОВ - ОГНЕТУШЕНИЕ) selector switch to TEST (КОНТРОЛЬ) and observe the FIRE DET TEST (КОНТРОЛЬ ДАТЧИКОВ) light to come on.

(e) Alternately set the wafer selector switch to all six channels. With the selector switch set to 1 and 2 the L ENG FIRE (ПОЖАР ЛЕВ. ДВ), R ENG FIRE (ПОЖАР ПРАВ. ДВ), COMBUST HTR FIRE (ПОЖАР КО-50) and APU GEAR FIRE (ПОЖАР РЕДУК. АИ-9) lights should illuminate.

Upon setting of the selector switch to 3 the COMBUST HTR FIRE (ПОЖАР КО-50) light should go out.

With the selector switch set to 4, 5 and then to 6 the APU GEAR FIRE (ПОЖАР РЕДУК. АИ-9) light should illuminate and the other lights should go out.

(f) Set the wafer selector switch to OFF (ВЫКЛ.).

(e) Switch off the FIRE EXTINGUISHING SYSTEM (ПРОТИВОПОЖАРНАЯ СИСТЕМА) circuit breaker.

Caution: To prevent discharge of the first (automatic) main discharge fire extinguishers never turn the wafer selection switch knob from «OFF» (ВЫКЛ) with the «FIRE DET TEST- FIRE EXTING» (КОНТРОЛЬ ДАТЧИКОВ - ОГНЕТУШЕНИЕ) selector switch set to «FIRE EXTING» (ОГНЕТУШЕНИЕ) for set the «FIRE DET TEST- FIRE EXTING» (КОНТРОЛЬ ДАТЧИКОВ - ОГНЕТУШЕНИЕ) selector switch set to «FIRE EXTING» (ОГНЕТУШЕНИЕ) before the wafer selection switch is set to «OFF» (ВЫКЛ).

(3) During preparation for flight in which icing may occur functionally check the anti-icing system following the procedure covered in Section 7.

(4) During preparation for flight intended for transportation of external load inspect and functionally check the external sling system following the procedure covered in Section 5.

(5) During preparation for flight intended for hoisting of loads or lifting of men to the helicopter by means of the hoist boom with the ЛПГ-150М winch inspect and functionally check them following the procedure covered in Section 5.

(6) The Flight Engineer should report to the Captain the checks performed and, upon his order, don the parachute, take his seat and perform the following operations:

(a) Adjust and lock the safety harnesses.

(b) Connect the parachute oxygen regulator lanyard to the extension line.

(c) Connect the headset to the interphone cable.

3.3.3 Pilot-Navigator

(1) Upon the Captain's order the Pilot-Navigator should put the parachute on, take his seat and perform the following operations

(a) Adjust and lock the safety harnesses.

(b) Connect the parachute oxygen regulator lanyard to the extension line and place it in such a way as to preclude its contact with the controls.

(c) Adjust the seat and directional control pedals to own stature.

(d) Make sure the precise time is set to the clock and the clock is wound up.

(e) Read the fuel quantity gauge to check the fuel amount and set its selector switch to SERVICE (РАСХ).

(f) Connect the headset to the interphone cable.

(g) Check the sliding blister for reliable opening and closing.

(h) Prepare for use the necessary navigation documentation and equipment.

(i) Check the instruments for serviceability by observing their appearance and position of the pointers.

(j) ДИСС15 Doppler system mode selector switch, located on the ДИСС15 control panel, should be set to OPERAT (РАБОТА).

3.4. АИ-9В APU and ТВ3-117ВМ engine preparation for starting

3.4.1. Captain (Pilot)

(1) Release the main rotor brake by lowering the brake lever fully down.

(2) Make sure the collective pitch control lever is at the lower stop and the throttle control twist grip is turned fully to the left, the engines throttle levers are latched in the neutral position, the control stick is in a position close to neutral and the fuel shutoff valves control levers are in the rear position (closed).

(3) Order the Flight Engineer to switch on all the circuit-breakers and switches required for starting the АИ-9В APU and engines (the starting system, ignition systems of АИ-9В APU and ТВ3-117ВМ engines, fire protection system, hydraulic systems, trim actuators, fuel tank pumps, fuel quantity gauge, engine anti-icing system, friction clutch, electric clutch, ВК-53РШ, gyro erection cutout switch, АГБ-3К gyro horizon, УГР-4УК (or ПНП-72-15) indicator, autopilot, РИ-65 voice warning system, СПУУ-52 tail rotor pitch limit system, ПО-503Б cockpit voice recorder, МСЛ-3 anti-collision light, and make sure that the respective systems and units are on.

(4) Make sure that the AC generators switches are set to OFF (ВЫКЛ) and the transformers ДИМ selector switch is set to MAIN (ОСНОВНОЙ).

(5) Test the РИ-65 information reporting system and the quality of oral message by depressing the test button located on the information reporting system control panel with the СПУ-7 interphone ON.

(6) Set the FIRE DET TEST - FIRE EXTING (КОНТРОЛЬ ДАТЧИКОВ - ОГНЕТУШЕНИЕ) selector switch to FIRE EXTING (ОГНЕТУШЕНИЕ).

(7) Make sure that the CONTING. PWR (CONTINGENCY) circuit breaker is on.

(8) Order the Flight Engineer to test or test by himself the vibration indicating equipment for which purpose depress the VIBR IND TEST (КОНТРОЛЬ ИВ-500В) button and observe the L ENG (ЛЕВ. ДВ), R ENG (ПРАВ. ДВ) VIBR (ВИБР. ПОВ), SHUTDWN L ENG (ВЫКЛЮЧИ ЛЕВ. ДВ), SHUTDWN R ENG (ВЫКЛЮЧИ ПРАВ. ДВ) annunciators to come on, and listen to an oral message of DANGEROUS VIBRATION OF LEFT ENGINE or DANGEROUS VIBRATION OF RIGHT ENGINE.

(9) Order the Flight Engineer or test by himself the 2ИА-6 EGT indicating system for which purpose depress the EGT IND-GROUND (КОНТРОЛЬ 2ИА-6 -ЗЕМЛЯ) button. This done, the indicator should read an EGT above the maximum limit.

(10) On receiving the Flight Engineer's and Pilot-Navigator's reports on readiness for start make sure that the fuel booster and transfer pumps are on and the fuel shutoff valves are open.

(11) Switch on the command radio and request the engine starting clearance.

3.4.2. Flight Engineer

(1) Make sure there are no foreign objects near the helicopter.

(2) Upon the Captain's order switch on all the circuit breakers and switches required for starting and ground-testing the engines and transmission, engines and АИ-9В APU starting systems, instruments, fuel fire shutoff valves, main and auxiliary hydraulic systems, fire protection system, autopilot and electric clutches, fuel tank pumps and fuel quantity gauge, the flashing system, МСЛ-3 anti-collision light and engine anti-icing system.

(3) Through questioning of ground personnel or own observation check the anti-collision light for serviceability.

(4) Set the БУР-1ж flight data recorder control panel selector switch to MAN (РУЧН) and observe the indication light to blink to make sure that the tape drive mechanism operates normally.

Departure with the flight data recorder inoperative is not allowed.

(5) Make sure the fire detector test selector switch of the fire protection system is set to FIRE EXTING (ОГНЕТУШЕНИЕ) and the FIRE DET TEST (КОНТРОЛЬ ДАТЧИКОВ) annunciator is off.

(6) Check the position of the fuel shutoff valve levers which should be in the rear position of ENG SHUTDOWN LEFT, RIGHT (ОСТАНОВ ДВИГ. ЛЕЗ. ПРАВ).

(7) Make sure that all the selector switches of the hydraulic system are set to ON (ВКЛ).

(8) Make sure that the AC generators switches are set to OFF (ВЫКЛ).

(9) Start the fuel booster pumps of the service tank and the fuel transfer pumps of the main tanks.

(10) Open the fuel fire shutoff valves.

(11) Report the helicopter readiness for starting of the АИ-9В APU and engines to the Captain.

3.5. АИ-9В APU starting

(1) Before starting the helicopter engines start the АИ-9В APU for which purpose proceed as follows:

(a) Set the START-CRANK-FALSE START (ЗАПУСК-ПРОКРУТ-ЛОЖНЫЙ ЗАПУСК) selector switch on the APU starting control panel to START (ЗАПУСК).

(b) Depress the START (ЗАПУСК) button for 2 to 3 s. This done, the AUTO CONT ON (АВТОМАТ. ВКЛЮЧЕНА) annunciator should come on. The APU automatically gains the idling speed. This condition being indicated by illumination of the OIL PRESS NORMAL (ДАВ. МАСЛ. НОРМА) and NORMAL SPEED (ОБОРОТЫ НОРМА) annunciators. The time to gain the idling speed should not exceed 20 s.

(2) The following events are allowed in the course of APU start:

(a) TGT surge not in excess of 880°C.

(b) Blinking of the OIL PRESS NORMAL (ДАВЛ. МАСЛ. НОРМА) annunciator.

(c) Voltage drop in the electrical circuit not below 18 V.

(3) After the APU gains the idling speed check its operational parameters and make sure:

(a) The turbine exhaust temperature does not exceed 720°C.

(b) The OIL PRESS NORMAL (ДАВ. МАСЛ. НОРМА) and NORMAL SPEED (ОБОРОТЫ НОРМА.) annunciators illuminate.

(c) The air pressure in the air bleed line used for starting the engines is in accordance with the graph in Fig. 3.2.

(d) The STBY GEN (РЕЗЕРВН. ГЕНЕРАТ.) selector switch is set to OFF (ВЫКЛ).

(4) The Flight Engineer should report completion of the APU start to the Captain, and after warming up of the APU for not less than 1 min the Flight Engineer should report readiness for starting the ТВ3-117ВМ engines.

Caution: 1. Is case of inadvertent shutdown of the APU it is necessary to depress the "APU OFF" (ВЫКЛЮЧЕНИЕ АИ-9В) button for 2 to 3 seconds in order to cut off fuel supply to the APU engine.

2. Discontinue the APU start by depression of the "APU OFF" (ВЫКЛЮЧЕНИЕ АИ-9В) button for 2 to 3 seconds if at least one of the following events occurs:

The turbine exhaust temperature indicator reading is zero within 9 s since the beginning of start.

The starting circuit voltage drops below 18 V.

The turbine exhaust temperature tends to rise above 880°c.

The automatic start control unit operation indicating light continues illuminating after expiration of 30 s since the beginning of starting cycle.

Some other troubles of the APU and its systems are detected.

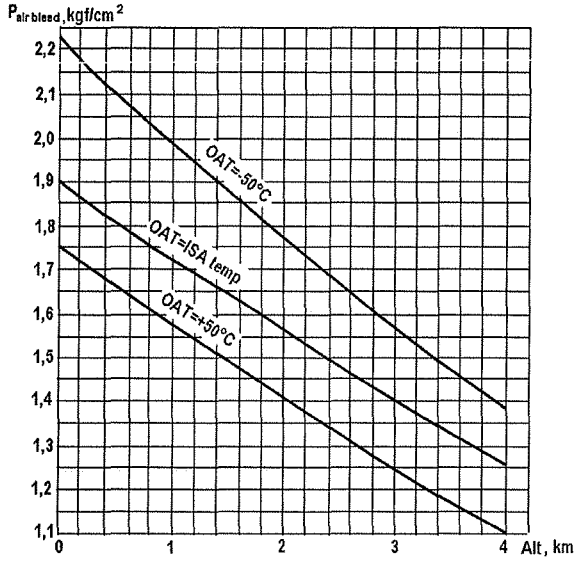

Fig.3.2 APU Air Bleed Line Pressure (Loads OFF) versus Ambient Temperature (OAT) and Airfield Altitude above Sea Level

3. In case of unsuccessful start, crank the APU proceeding in the following way:
   Set the "START-CRANK-FALSE START" (ЗАПУСК-ПРОКРУТ -ЛОЖНЫЙ ЗАПУСК) selector switch to "CRANK" (ПРОКРУТ).
   Depress the "START" (ЗАПУСК) button and observe the "AUTO CONT ON" (АВТОМАТ. ВКЛЮЧЕНА), "OIL PRESS NORMAL" (ДАВ. МАСЛА НОРМА) annunciators to come on.
4. At ambient temperatures of -40°C or below heat the APU before start with hot air at a temperature of +80 to +90°C for 25 to 30 min.
5. It is allowed to perform three APU starts each followed with intervals not less than 3 min. Thereafter the APU should be shut down and cooled for not less than 15 min.
6. It is allowed to perform 10 starts of the APU in sequence using the aircraft storage batteries (if a ground power source is not available) provided the limitation of step 5 (cooling down after three starts) is respected.
7. It is allowed to perform three successive air bleeds from the APU for the purpose of starting the ТВ3-117ВМ engines.
   The duration of each air bleed cycle should not exceed 45 seconds with intervals between the air bleed cycles not less than 1 min. during which the APU runs at idle. The continuous time of the APU operation in this condition should not exceed 10 min. and thereafter the APU should be shut down for 15 min. for the purpose of cooling.

8. The APU continuous operation time in the "STBY GEN" (РЕЗЕРВЫ. ГЕНЕРАТ) mode should not exceed 30 min, and thereafter the APU should be shut down for 15 min. for the purpose of cooling.
9. In case of necessity it is allowed to perform five successive air bleed cycles for starting the ТВ3-117ВМ engines, each cycle having a duration not exceeding 45 s with intervals between the cycles of not less than 1 min. during which the APU is run at idle. In this case, the total time of continuous operation should not exceed 13 min., and thereafter the APU should be shut down and cooled for not less than 15 min.
10. Never bleed air for starting the ТВ3-117ВМ engine nor select the generator mode for the starter-generator while the APU is starting.

3.6. ТВ3-117ВМ engines starting

(1) The Captain or, upon his order, the Flight Engineer are authorized to start or shut down the engines. In this case the Captain should be seated at his station. Only the Pilot is authorized to warm up and run up the powerplant.

(2) The engines starting order depends on the wind direction and dictated by the even usage of the established service life of the engines as well. The first to be started is the engine at the leeward side.

(3) Before start it is necessary to call OFF ROTORS and set the engine mode selector switch to START (ЗАПУСК) and the LEFT RIGHT (ЛЕВ. ПРАВ) selector switch as required. Make sure that the fuel fire shutoff valves switches are set to OPEN (ОТКРЫТО).

(4) Having received reply ALL CLEAR depress the START (ЗАПУСК) button for 2 to 3 seconds and thereafter move the fuel shutoff valve of the engine being started to OPEN (ОТКРЫТО).

The engine should gain the idling speed within not more than 60 s. The AUTO CONT ON (АВТОМАТ. ВКЛЮЧЕНА) and STARTER ON (СТАРТЕР РАБОТАЕТ) annunciators should illuminate in the course of start. After completion of the automatic starting cycle the annunciators should go out (the AUTO CONT ON (АВТОМАТ. ВКЛЮЧЕНА) annunciator in 30 s and the STARTER ON (СТАРТЕР РАБОТАЕТ) annunciator at the moment the gas generator rotor attains a speed of 60 to 65%).

If in the course of the engines acceleration up to the idling speed and spinning up of the rotor the blades centrifugal droop limiters hit the stops, this event being accompanied by pounding, the Captain should slightly move the control stick to a position at which this pounding discontinues.

(5) In the course of start the Flight Engineer should monitor:

(a) Ground (aircraft) power source voltage.

(b) Rate of oil pressure rise in the engine and main gearbox.

Note: At gas generator rotor speed exceeding 45% the engine oil pressure should be not less than 1 kgf/cm^2.

(c) Gas generator rotor speed.

(d) Rate of the turbine inlet temperature rise.

(e) Pressure in the hydraulic system.

(f) Starting line air pressure.

(g) Steady illumination of the OIL PRESS NORMAL (ДАВЛ. МАСЛ. НОРМА), NORMAL SPEED (ОБОРОТЫ НОРМА) and STARTER ON (СТАРТЕР РАБОТАЕТ) annunciators.

(h) Disengagement of the pneumatic starter at a gas generator rotor speed of 60 to 65%. If the pneumatic starter is not disengaged, shut down the APU.

If some abnormal readings of the instruments are detected or the ground observer issues come warning command it is necessary to report to the Captain and shut down the engine by closing the fuel shutoff valve and depressing the START DISCONT (ПРЕКРАЩЕНИЕ ЗАПУСКА) button.

(6) After the engine gains the idling speed the Flight Engineer should check its operational parameters which should remain within the following limits:

(a) The gas generator rotor speed - in accordance with the graph of Fig. 3.3.

(b) The turbine inlet temperature - in accordance with the graph of Fig. 3.3.

(c) The engine oil pressure - 2 kgf/cm^2, minimum.

(d) The main gearbox oil pressure - 0.5 kgf/cm^2 , minimum,

(e) The fuel pressure - 18 to 22 kgf/cm^2.

(7) Set the LEFT - RIGHT (ЛЕВ - ПРАВ) selector switch to the position required to start the second engine proceeding in a similar way.

After two engines are started and have gained the idling speed the main rotor speed should be within the limits of *55* to 70%.

(8) After starting the ТВ3-117ВМ engines shut down the АИ-9В APU having previously cooled it down at idle for 0.5 to 1.0 min.

Note: If the engines are started only from the aircraft storage batteries do not shut down the APU until warming up run of the engines is completed and the engines are accelerated to a power above idle (up to a main rotor speed above 80%*)*.

To power the necessary loads with the engines running at idle it is necessary to switch on the СТГ-3 APU generator by setting the STBY GEN (РЕЗЕРВН. ГЕНЕРАТ.) and EQUIPM TEST (ПРОВЕРКА ОБОРУД) switches to ON (ВКЛ).

(9) With the ТВ3-117ВМ engines running monitor the ИВ-500Е vibration Indication annunciators.

(10) If in winter the engine oil temperature is minus 30-40°C before start it is necessary to perform 2 engine crankings, with 3 minutes intervals between them.

(11) In order to ensure reliable start of the engines in winter at ambient temperatures of -5°C or below after a prolonged parking period (for 24 h or more) it is necessary to crank the engines before start.

(12) Discontinue the engine start by depression of the START DISCONT (ПРЕКРАЩЕНИЕ ЗАПУСКА*)* button and closing of the fuel shutoff valve if at least one of the following events occurs:

(a) The FUEL FLTR CLOG L ENG, FUEL FLTR CLOG R ENG annunciator is ON.

(b) The turbine inlet gas temperature rises above the limits indicated in the graph of Fig. 3.3.

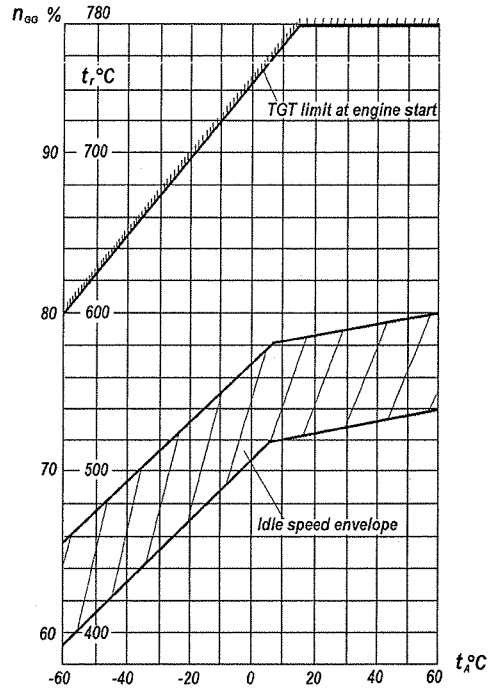

Fig.3.3. Gas Generator Idle Speed and Maximum TGT (by T-102 Thermocouples) at Engine Start versus Ambient Temperature

1. EGT limit at engine start
2. Idle speed envelope

(c) The gas generator rotor fails to accelerate during start (hangs) for more than 3 s.

(d) No oil pressure in the engine or the main gearbox or the engine oil pressure is less than 1 kgf/cm^2 at a gas generator rotor speed above 45%.

(e) Zero pressure in the hydraulic system and the collective pitch control lever spontaneously moves up.

(f) The fuel fails to be ignited in the engine (the turbine inlet temperature fails to rise).

(g) Leakage of oil or fuel is detected.

(h) Torching from the exhaust pipe.

(i) The pneumatic starter fails to be disengaged at a gas generator rotor speed of 60 to 65%, this condition being indicated by illumination of the STARTER ON (СТАРТЕР РАБОТАЕТ) annunciator.

(j) The engine fails to gain the idling speed within 60 sec.

(k) The main rotor fails to spin up upon attainment of the gas generator rotor speed of 20 to 25%.

(l) Kicking engagement of the freewheel clutch accompanied by a sharp sound in the area of the main gearbox and shaking of the helicopter.

(m) The engine inlet oil pressure is less than 2 kgf/cm^2 at idle or the main gearbox oil pressure is less than 0.5 kgf/cm^2.

(n) A necessity arises to shut down the АИ-9В APU.

(o) The ground observer issues a signal to stop the start.

Caution: 1. It is allowed to start and shut down the engines only at wind speed not exceeding the limits indicated in Table 2.4.

2. It is allowed to restart the engine only after the gas generator rotor comes to a complete stop or after cranking if the engine start has been discontinued due to failure to light up or TGT over temperature.

3. Never start the engine if its instruments are faulty.

4. It is allowed to restart the engine only after the reasons for unsuccessful starts are cleared and eliminated. In so doing, the restarting attempt should be preceded by cranking for the purpose of purging.

5. The number of starts following each other and the time intervals between them should not exceed the respective limits indicated in caution, 7 and 9 (Ref. 3.5(4)).

6. Never start the engines if ice exists at the dust protection devices, air intakes and the main and tail rotors blades.

7. At ambient temperatures of +5°C or below switch on the engines and air intakes heaters immediately after start of the engines if an excessive air humidity (drizzle, wet snow) exists.

8. In case of strong gusty wind having a speed of 15 to 25 m/s the maximum clearance between the spinning blade of the main rotor and the tail boom is provided with the helicopter so positioned that it is blown by the left side headwind at an angle of 45°.

9. Further operation of the HP-3BM fuel flow control unit after an attempt to start the engine with the fuel fire shutoff valves closed is not allowed.

10. Never operate the engine start selector switch until the engine being started gains the idling speed.

11. At ambient temperature of +5°C or below crank the compressor rotor and the free turbine rotor without applying excessive forces.

If the compressor rotor blades are frozen to the stationary components or icing is detected on the engine components heat the engine with hot air at a temperature rot exceeding 80°C using ground heaters for the purpose deliver hot air into the engine gas flow duct. After heating make sure that the rotors rotate easily and are free from ice.

(13) After the engines are started, the ground electrical power source is disconnected and the AC generators energize the aircraft electrical system

the Pilot-Navigator should do the following:

(a) Switch on the gyro horizon and test it.

(b) Test the pitot static tube heater.

(c) Switch on the ADF and tune it to a desired locator station (the procedure of tuning is covered in Section 7).

(d) Switch on the ДИСС-15 Doppler system.

(e) Test the compass system by setting the mode selector switch to MSO (МК), the 0 - TEST - 300 (0 - КОНТРОЛЬ - 300) selector switch, located on the compass system control panel, to 0 or 300. This done, the compensator and indicators should read 0 ± 10° or 300 ± 10° and the GYRO TILT (ЗАВАЛ ГА) warning light should illuminate.

(f) After the compensator pointer sets to the ramp heading set the mode selector switch to DGO (ГПК).

(g) On the Captain's order test the autopilot yaw channel for which purpose depress the ON (ВКЛ), YAW (НАПРАВЛЕНИЕ), ROLL (КРЕН), PITCH (ТАНГАЖ), ALTITUDE (ВЫСОТА) switch-lights on the autopilot controller. Depress the HS (ЗК) momentary switch for a short time to the left and remove feet from the tiptoe pedals. This done, the YAW (НАПРАВЛЕНИЕ) dial at the controller should rotate clockwise. Repeat the test with the HS (ЗК) momentary switch depressed to the right.

(h) On the Captain's order check the autopilot for reliable disengagement upon depression of the AP OFF (ВЫКЛ. АП) button on the control stick and for reliable disengagement of the altitude channel upon depression of the FRICT (ФРИКЦИОН) button on the collective pitch control lever.

(i) Before night flying test the flight compartment dome light and the landing light.

Report the Captain for the checks performed.

3.7. Powerplant warm-up. Test of flight controls and hydraulic system

(1) Warm up the powerplant at idle power with the collective pitch control lever at the lower stop, the throttle control twist grip turned fully to the left, the engines throttle levers latched in the neutral position.

(2) In the course of the powerplant warming up monitor the powerplant instruments which readings should be within the limits indicated in Section 2.

In all cases the warming up period should be not less than 1 min.

(3) It is allowed to accelerate the engines from idle up to higher power ratings after the engine outlet oil temperature reaches +30°C and the main gearbox oil temperature reaches at least -15 °C.

(4) In the course of the engines warming up switch on the command radio.

(5) Test the flight controls and the hydraulic systems at idle power following the procedure below:

(a) Alternately move the control stick and pedals to make sure that the controls move smoothly, without jerks and jamming.

(b) At ambient temperature below 30°C apply the control stick in small

increments to ensure pumping of the АМГ-10 hydraulic fluid through the system for the purpose of its warming up.

Note: In the course of the engines starting with the MAIN HYD SYSTEM (ОСНОВНАЯ ГИДРОСИСТЕМА) switch ON, the auxiliary hydraulic system may operate instead of the main hydraulic system. In this case, before clearing the main hydraulic system trouble, depress the AUX SYS OFF (ОТКЛ. ДУБЛИР) button on the central subpanel of the pilots' electrical control panel and keep it depressed until the MAIN SYS ON (ОСНОВН ВКЛЮЧЕНА) annunciator comes on and the AUX SYS ON (ДУБЛИР ВКЛЮЧЕНА) annunciator goes out.

(c) Make sure that with the flight controls being moved the main hydraulic system pressure varies within the limits of 45 ± 3 to 65^{+8}_{-2} kgf/cm^2 and the auxiliary hydraulic system pressure is zero as read by the pressure gauge and the MAIN SYS ON (ОСНОВН. ВКЛЮЧЕНА) annunciator illuminates.

(d) Set the MAIN HYD SYSTEM (ОСНОВН. ГИДРОСИСТЕМА) switch to OFF (ВЫКЛ) and make sure that the AUX SYS ON (ДУБЛИР. ВКЛЮЧЕНА) annunciator comes on and the MAIN SYS 0N (ОСНОВН ВКЛЮЧЕНА) annunciator goes out, the auxiliary hydraulic system pressure rises rapidly and varies within the limits of 45 ± 3 to 65^{+8}_{-2} kgf/cm^2 with the flight controls deflected, the main hydraulic system pressure remains constant within the limits of 45 ± 3 to 65^{+8}_{-2} kgf/cm^2.

(e) Select the main hydraulic system and make sure the MAIN SYS ON (ОСНОВН ВКЛЮЧЕНА) annunciator comes on, the main hydraulic system pressure remains within the above limits, the AUX SYS ON (ДУБЛИР. ВКЛЮЧЕНА) annunciator goes out and the auxiliary hydraulic system pressure drops to zero.

Note. After switching on the MAIN HYD SYSTEM (ОСНОВН. ГИДРОСИС-ТУМА) switch select the main hydraulic system by depression of the AUX SYS OFF (ОТКЛ. ДУБЛИР) button and keeping it depressed until the MAIN SYS ON (ОСНОВН ВКЛЮЧЕНА) annunciator comes on and the AUX SYS ON (ДУБЛИР. ВКЛЮЧЕНА) annunciator goes out.

When testing the hydraulic systems observe the annunciators to make sure that the РИ-65 information reporting system issues correct voice messages.

With the ground power source connected, switch on and test the aircraft equipment. If the ground power source is not available use the 115 VAC inverters (with the APU operating), or perform these tests after cutting the AC generators in.

3.8. Engine ground testing. Test of flight, navigation and radio equipment, autopilot and tail rotor pitch limit system

(1) Make sure that the engines and main gearbox are warmed up and all the

units operate normally, test the equipment and engines. During ground run of the engines all the crewmembers should communicate to each other through the interphone. If a FUEL FLTR CLOG L ENG, FUEL FLTR CLOG R ENG annunciator comes on, stop testing the affected engine and shut it down.

(2) Rotate the throttle control twist grip to the right, set the AC generators and rectifiers switches to ON (ВКЛ.). Call DISCONNECT GROUND POWER SOURCES. After the ground power sources are disconnected and the AC and DC power EXT PWR ON (АЭР. ПИТ. ВКЛЮЧЕНО) annunciator goes out, set the EXT PWR (АЭРОДР. ПИТАН) selector switches to OFF (ВЫКЛ).

Check the AC generators output voltage which should be within the limits of 200 to 205 V, the ВУ-6А rectifiers output voltage which should be within the limits of 27 to 29V and the transformer output voltage which should be 115 VAC.

Set the ПО-500 INV 115 VAC (ПО-500 ~ 115) and ПТ-200 INV 36 VAC (ПТ-200 ~ 36) selector switches to AUTO (АВТОМАТ).

(3) Switch on all the flight, navigation, radio communication and electronic equipment required for the flight, and test the equipment for proper functioning. Before switching on the GYRO (АВИАГОРИЗ) switch depress the АГБ-3К gyro horizon caging button.

(4) Test the СПУУ-52 tail rotor pitch limit system by setting the СПУУ-52 switch located on the electric overhead panel LH panel to ON (ВКЛ), and assess the system operational status by going out of the OFF (ОТКЛ) red switch-light installed on the face panel of the БУ-32 unit.

Depress the OFF (ОТКЛ) switch-light and set the "В" switch to "Р". This done, the null indicator pointer should align with the left intermediate mark on its dial. Switch off switch "В" and release the switch-light. The null indicator pointer should set to the central position. Test the temperature channel in the similar way for which purpose set switch "В" to "t".

(5) Test the autopilot following the procedure below:

(a) Depress the ON (ВКЛ.) switch-lights of all the channels on the autopilot controller. This done, all the switch-lights should come on, the ИН-4 trim indicator pointers should be centered within the pointer width with the flight controls in neutral position. Deflect the control stick to make sure that the pointers К and Т of the ИН-4 indicator respond to control inputs (the directions of control stick and indicator pointers movements should match). Check the autopilot channels for disengagement upon depression of the AP OFF (ВЫКЛ. АП) button at the control stick, this condition being displayed by going out of all the lights.

(b) Check the altitude channel for engagement upon depression of the ALT ON (ВКЛ. ВЫСОТА) switch-light. Momentarily depress up the TEST (КОНТРОЛЬ) selector switch and observe indicator pointer В to move upward. Move the collective pitch control lever 1° up from the lower stop, engage the altitude channel again and momentarily depress the TEST (КОНТРОЛЬ) selector switch down. This done, pointer В should move downward. Check the altitude channel for disengagement upon depression of the FRICT (ФРИКЦИОН) button located on the collective pitch control lever.

(c) Test the autopilot directional channel. With the pedals set neutral

and feet removed from the pedals depression of the YAW ON (ВКЛ. НАПРАВЛЕНИЕ) switch-light should come on. As this takes place pointer H of the indicator should be centered. Rotation of the YAW (НАПРАВЛЕНИЕ) dial more than 1.5 turn to the left or to the right should cause a pedal movement in the same direction. With the pedals set neutral, the pointer H of the indicator and the YAW (НАПРАВЛЕНИЕ) dial of the control panel should return to their initial positions.

(d) Depress the YAW OFF (ОТКЛ. НАПРАВЛЕНИЕ) button at the control panel and observe the YAW ON (ВКЛ. НАПРАВЛЕНИЕ) switch-light to go out.

Caution. When testing the autopilot on the ground avoid the helicopter breakaway or turning for this purpose move the pedals and control stick smoothly and not more than ±50 mm from the neutral position.

(6) Check the engines partial acceleration performance, i.e. from the idling speed up to a gas generator speed 1 to 1.5% below the speed with the throttle control twist grip in the right position. For this purpose:

(a) Smoothly rotate the throttle control twist grip to the right and note the gas generator rotor speed. The power plant operation parameters should correspond to the values of the Table 2.9.

(b) Smoothly set the engines to idle power and again set the throttle control twist grip to the right position within a period of 1 to 2 s. In so doing, measure the time elapsed since the beginning of turning the throttle control twist grip to the right up to the moment when a speed is 1 to 1.5% below that with the throttle control twist grip at the right position. The TGT should not exceed the limits indicated on the graph of Fig. 3.4.

The partial acceleration time should not exceed 3 to 6s.

(7) With throttle control twist grip turned to the right, test the serviceability of the FT – ЭРД–3ВМ EEC circuits:

- Set the FT 1 TEST- OPERAT - FT 2 TEST (КОНТРОЛЬ СТ1 - РАБОТА-КОНТРОЛЬ СТ 2) selector switch to FT 1 TEST (КОНТРОЛЬ СТ1), the FREE TURB OVERSP L ENG, FREE TURB OVERSP R ENG annunciators should go on.
- Set the selector switch to OPERAT position; the annunciators should go off.
- Set the FT 1 TEST- OPERAT - FT 2 TEST (КОНТРОЛЬ СТ1 - РАБОТА-КОНТРОЛЬ СТ 2) selector switch to FT 2 TEST (КОНТРОЛЬ СТ 2), the FREE TURB OVERSP L ENG, FREE TURB OVERSP R ENG annunciators should go on.
- Set the selector switch to OPERAT position; the annunciators should go off.

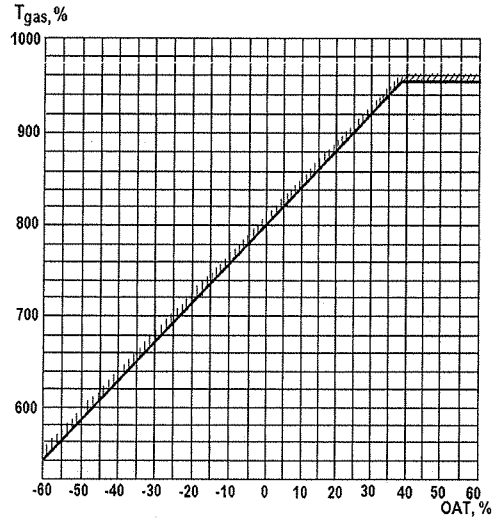

Fig. 3.4. Maximum TGT (by T-102 Thermocouples) versus Ambient Temperature (OAT) in Partial Acceleration Test

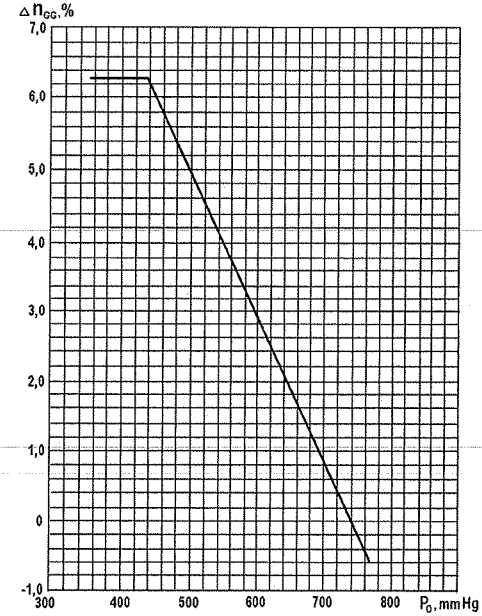

Fig. 3.4a Gas Generator Speed at Take-off and Maximum continuous powers Versus Air Pressure

Warning: If during the FT-EEC circuit serviceability test the FT1 TEST – OPERAT – FT2 TEST selector switches being set to FT1 TEST or FT2 TEST position and the Main Rotor RPM being 91,5±2%, the FREE TURB OVERSP L (R) ENG annunciator is not ON or is flashing the operation of the engine with EEC is prohibited until the trouble is shot. At main rotor overspeed 113±2% the EEC switches the engine off and the yellow annunciator, located on the LH instrument panel, goes on.

(8) Test the dust protection device as follows:

(a) Set the engine ENG DUST PROT LEFT - RIGHT (ПЗУ - ЛЕВ ПРАВ) selector switch on the right panel of electric overhead panel to ON (ВКЛ.) and observe the L DUST PROT ON (ЛЕВ ПЗУ ВКЛЮЧЕН), R DUST PROT ON (ПРАВ. ПЗУ ВКЛЮЧЕН) annunciators to come on and the turbine inlet gas temperature to rise by 10 to 15°C.

Note. The dust protection device is functionally checked with the throttle control twist grip turned to the right.

(9) Check the main rotor speed vibration range as follows:

(a) Operate the collective pitch control lever to set a pitch of 3° as read by the main rotor pitch indicator and make sure that the throttle control twist grip is set to the rightmost position, and the main gearbox oil temperature is not less than 30°C.

(b) Deflect down the main rotor speed trim selector switch on the collective pitch control lever and after the main rotor speed stops changing check RPM value which should be 91±2%

(c) Deflect the speed trim selector switch up and make sure that the main rotor speed is 97^{+2}_{-1} %.

If the upper limit of the main rotor speed of 97^{+2}_{-1} % is not attained warm up oil in the main gearbox up to a temperature of 40 to 60°C and repeat the check. After completion of the main rotor speed variation range check operate the speed trim selector switch to set the main rotor speed to 95% and deflect the collective pitch control lever fully down.

(10) The following types of run up are established for ground tests of the engines and their systems:

(a) Simultaneous run up of the engines at a power rating at which the helicopter liftoff is excluded.

(b) Independent run up of the engines at the limited takeoff power. In so doing, the engines not to be run up should be shut down.

(c) Engines testing at hovering.

(11) The first type of run up is used for checking the serviceability of the engines and their systems at the beginning of the day's (night's) flying.

The second type of run up is used after replacement or adjustment of the power plant unit, main and tail rotors, after scheduled maintenance operations, as well as after elimination of troubles detected in flight.

The third type of run up is used for the purpose of checking the joint operation of the engines, as well as for functional check of the power plant before each flight (Ref. 4.2).

(12) To perform simultaneous run up of the engines including a power rating at which the helicopter liftoff is excluded proceed as follows:

(a) Make sure that the engines and main gearbox are warmed up. Test the EEC - free turbine circuits proceeding as instructed in (7).

(b) Set the throttle control twist grip to the rightmost position.

(c) Operate the main rotor speed trim selector switch on the collective pitch control lever to set a main rotor speed of 95%

(d) Pull the collective pitch control lever up to a position at which power is increased to a level excluding the helicopter liftoff. Make sure that the collective pitch control levers move smoothly and collective pitch control lever hydraulic unlocking clutch operates normally.

(e) Make sure that pulling up of the collective pitch control lever causes the engine power increase.

(f) Push the collective pitch control lever fully down. Make sure the engines run at steady power, note the engines speeds at this power setting and turn the throttle control twist grip to the leftmost position corresponding to idling. Run the engines at this power for 1 min.

(g) Check the power plant operational characteristics which should be in compliance with the data indicated in Table 2.9.

The schedule of engines simultaneous ground testing is shown in Fig.3.5

(13) Perform independent run up of the engines with setting the take-off power at direct headwind or at headwind blowing at an angle of 20° to the right.

Before carrying the independent run up of the engines with setting of the takeoff power, load the helicopter to a gross weight not less than 13000 kg.

Perform independent run up of the engine with setting the take-off power, proceeding in accordance with the Engine Maintenance Manual.

(14) In the course of the engine ground test check the ИР-117М EPR indicator for correct readings as follows:

(a) Set the normal power corresponding to a gas generator rotor speed 0.5% above the values derived from graph "C" in the engine Log Book for an actual ambient temperature.

(b) Make sure that the side index of the EPR indicator of the engine being tested is at the upper half of central index "H".

Notes: 1. The normal power gas generator rotor speed is derived from the Engine Log Book by the Flight Engineer.

2. If the side index is beyond the established limits at the power setting being checked adjust the EPR indicator.

Set and monitor the engine power ratings using the ИР-117М EPR indicator readings, the gas generator rotor speed and TGT maximum limits established for the selected power should not be exceeded.

In case of failure of the EPR indicator, set and monitor the engine power ratings basing on the gas generator rotor speed.

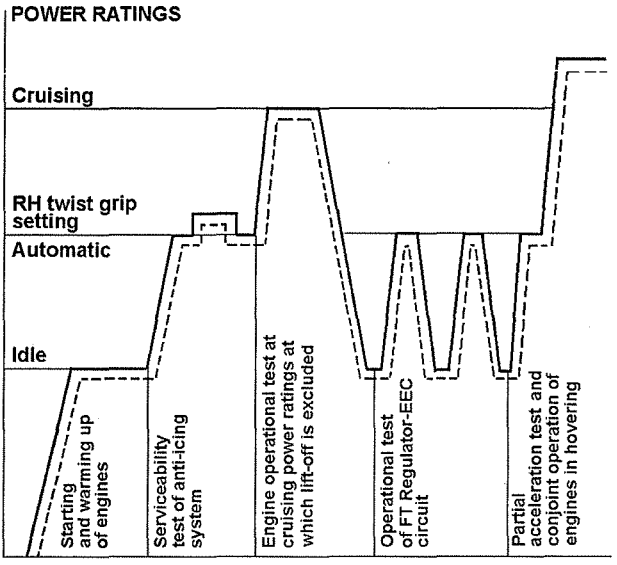

Fig.3.5 Schedule of Simultaneous Ground Test of Two Engines

1. - Cruising
2. - RH twist grip setting
3. - Automatic
4. - Idle
5. - Starting and warming up of engines
6. - Serviceability test of anti-icing system
7. - Engine operational test at cruising power ratings at which lift-off is excluded
8. - Operational test of FT Regulator - EEC circuit.
9. - Partial acceleration test and conjoint operation of engines in hovering

(15) During ground testing of the engines pay particular attention to the helicopter behavior and apply the controls to keep it stationary.

Caution: During run up of the engines on the ground under icing conditions manually switch on the engine anti-icing system after gaining the idling speed.

After warming up to an engine outlet oil temperature of at least +30°C and a main gearbox inlet oil temperature of at least -15°C run the engine at gas generator rotor speed not less than 80%.

(16) In the course of power plant ground testing the Flight Engineer should monitor the engine instruments and report malfunctions, if any, to the Captain. Upon the Captain's order the Flight Engineer should test the AC generators at the main rotor speed occurring with the throttle control twist grip turned fully to the right, and the anti-icing system.

Test AC generator No. 1 and the transformer in the following way:

(a) Check generator No. 1 output voltage by alternately setting the voltmeter wafer selector switch to GENERATOR N1 I - II (ПЕРВЫЙ ГЕНЕРАТ I –II), GENERATOR N1 II - III (ПЕРВЫЙ ГЕНЕРАТ II - III). GENERATOR N1 III - I (ПЕРВЫЙ ГЕНЕРАТ III –I), and the voltmeter should read 200 to 205V.

(b) Check the transformer output voltage by setting the voltage wafer selector switch to 115VAC (~115 В), and the voltmeter should read 115 V.

Test AC generator No. 2 and the transformer proceeding in the similar way.

(c) Test the induction-type pressure gauges installed on the center control pedestal when powered by the standby transformer ДИМ. With the TRANSF ДИМ MAIN - STBY (ТРАНСФ. ДИМ. ОСНОВН - ЗАПАСН) selector switch set to STBY (ЗАПАСН), the induction-type pressure gauges indicate pressure.

(d) Check the serviceability of the rectifiers:

Switch the generators NN1&2 on by setting the generator NN1&2 switches to ON position.

Set the selector switch, located on the DC switch panel situated on the RH side panel of the electric switch panel, to RECT BUS position.

Check the DC electrical system voltage by setting alternately the RECTIFIERS I,II,III switches, located on the DC switch panel, to ON position; the voltmeter, located on the switch panel of the electric switch panel, should indicate 27-29 V.

Switch the ВУ-6 rectifiers NN1,2,3 on

Set the selector switch to BATT BUS position: the voltmeter should indicate 27-29V

Note: If the voltmeter indicates 24 V, the BATT annunciator is on and the ammeters indicate the discharge current (the pointer is to the right from "0"), this means that the rectifier bus is not connected to the battery bus (ДМР-200Д failure).

Note. Test the AC generators with the ground AC power source disconnected, since the AC generators will not cut in with the ground AC power source connected.

(17) If icing is anticipated in the next flight the Captain should order the Flight Engineer to test the anti-icing systems as instructed in Section 7.

(18) If the anticipated flight does not involve fulfillment of extremely urgent task, after testing the engine, order the Flight Engineer to switch off all the electrical loads except for the power plant instruments, turn the throttle control twist grip fully to the left, cool down the engines at idle for 1 to 2 min in summer and 2 to 3 min in winter. Prior to shut down the engines pull the control stick about 1/3 travel. After the engines are cooled down, order the Flight Engineer to shut down the engines.

3.9. Engine shutdown

3.9.1. Flight Engineer

(1) Switch off all the electric loads except for those required for operation of the engines and its monitoring upon the Captain's order before he sets idle power.

(2) Switch off the rectifiers, set the ПО-500А INV selector switch to MAN (РУЧНОЕ), switch off the AC generators and report to the Captain.

(3) After cooling down the engines at idle shut them down by setting the fuel

shutoff valves levers to ENG SHUTDWN LEFT, RIGHT (ОСТАНОВ. ДВИГ. ЛЕВ. ПРАВ).

(4) During the engines rundown listen to their noise to make sure that it is free from unusual pitch and make sure that the gas generator rotors rotate easily (the gas generator rotor rundown time should be not less than 50 s).

(5) Stop the main rotor in such a position that none of the blades is over the tail boom and stabilizer.

(6) Close the fuel fire shutoff valves after the engines shut down completely.

(7) Switch off the fuel booster and transfer pumps.

(8) Switch off all the circuit breakers and switches.

(9) Switch off the storage batteries.

(10) Set the БУР-1ж flight data recorder control panel selector switch to AUTO (АВТОМ).

3.10. Helicopter inspection after engine ground testing

(1) After the engines are ground-tested and shut down the Flight Engineer should inspect the helicopter following the procedure below:

(a) Open the engine and main gearbox cowling panels.

Check the fuel, oil and hydraulic systems for freedom from leaks, and inspect the following components and units:

The main rotor hub and swash plate assembly for freedom from oil leaks and grease squeezed out of the hub hinges and hydraulic dampers.

The main rotor blades for freedom from visible damage.

The tail rotor for freedom from oil leaks and grease squeezed out of the hinges.

The fuselage bottom skin for freedom from oil and fuel leaks.

(b) Drain fuel from the drain tank.

(2) Upon completion of inspection the Flight Engineer should do the following:

(a) Make sure that the filler necks of all the systems, drain valves, oil dipsticks, access doors are reliably closed.

(b) Close the engine and main gearbox cowling panels

(c) Make sure that the helicopter is free from foreign objects.

(d) Remove the rubber safety cap from the visual icing indicator.

(e) Check the helicopter for proper loading and tie-down of cargo.

(f) Fill in the checklist.

(g) Report the Captain on the helicopter readiness for the assigned flight mission.

(3) Having received the Flight Engineer's report of the helicopter readiness for flight, start the APU and engines in accordance with the instructions given in 3.5, 3.6, and proceed to preparation for taxiing out.

3.11. Emergency engine shutdown

(1) Perform emergency shutdown of the engine during ground-test in the following cases:

(a) Sudden drop of the engine or main gearbox oil pressure below the minimum limits.

(b) Sudden rise of the compressor turbine inlet temperature above the maximum limit.
(c) Fuel or oil leakage.
(d) Important vibration of the engine or unusual noise.
(e) Sudden drop or rise of the gas generator rotor speed.
(f) At the ground observer's order.
(g) Initiation of fire.
(h) Severe torching from the exhaust pipe.

Perform emergency shutdown of the engines by setting the fuel shutoff valves to ENG SHUTDWN LEFT, RIGHT (ОСТАНОВ ДВИГ. ЛЕВ, ПРАВ).

In case of failure of the fuel shutoff valve shut the engine down by closing the fuel fire shutoff valve.

Effect emergency shutdown of the engines with the engines running at any power.

If a necessity to execute emergency shutdown of an engine arises during run up in hovering do it after the helicopter landing.

Caution: Further operation of the engines after its emergency shutdown is allowed after clearing the reasons which have caused it.

3.12. ТВ3-117ВМ engine cranking

(1) Crank the engine for the purpose of purging fuel accumulated in the combustion chamber upon abortive start, determination of the maximum speed attained by the gas generator rotor during spinning by the pneumatic starter and checking the auto start control unit cycle of operation.

(2) To perform cold cranking set the mode selector switch to CRANK (ПРОКРУТКА), the LEFT - RIGHT (ЛЕВ - ПРАВ) selector switch to the desired engine, and depress the starting button for 1 to 2 s.

Check the gas generator rotor for being accelerated up to a speed of 20% minimum by the pneumatic starter and check duration of the auto start control unit cycle of operation which should be within the limits of 51 to 59 sec. The engine oil pressure should be 0,5 kgf/cm^2 minimum.

3.13. Engine false start

(1) False start is to be performed in case of necessity to test the systems involved in the starting process and during preservation and depreservation of the engine fuel system.

(2) Perform false start in a way similar to cranking but with the fuel fire shutoff and engine shutdown valves open (no fuel ignition).

Perform false start as follows:

(a) Set the mode selector switch to CRANK (ПРОКРУТКА) and the LEFT -RIGHT (ЛЕВ - ПРАВ) selector switch set to the desired engine.
(b) Start the service tank fuel booster pump and open the fuel fire shutoff valves.
(c) Depress the starting button for 1-2 s, and set the fuel shutoff valve of the engine being tested to OPEN (ОТКРЫТО).

At engine false starting the gas generator rotational speed should be 20% minimum.

Duration of the auto start control unit cycle of operation during false start is the same as during cranking (51 to 59 s). The engine oil pressure should be 0,5 kgf/cm^2 minimum. At the engine false starting make sure that the fuel goes out from the exhaust pipe.

Caution: Perform cranking before start of the engine, following false start.

Section 4

FLIGHT

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4. FLIGHT

4.1. Taxiing

(1) Before taxiing the Flight Engineer should make sure that:

(a) The ground electrical power source cables are disconnected.

(b) The grounding cable is placed in its well.

(c) The airborne ladder is loaded into the helicopter and the cargo compartment doors are closed.

(d) CP (contingency power) switches (located on the centre console) of both engines are ON.

(e) The ЭЦН-91Б fuel pumps are on as indicated by the setting of the switches and illumination of the annunciator. Report the Captain: "Ready for takeoff, fuel pumps on".

(2) Having received the crewmembers reports on readiness for taxiing the Captain should make sure the APU is shut down, all the circuit breakers are switched on, readings of all the instruments are OK and there are no obstacles on the taxiing course. This done, proceed as follows below:

(a) Turn the throttle control twist grip to the rightmost position.

(b) Turn on the dust protection device disregarding the degree of preparation of the field or aerodrome.

(c) Make sure the main rotor speed is 95±2%.

(d) Establish radio link with the airfield controller and receive clearance for taxiing.

(e) Release the main LG wheel brakes.

(f) Increase the main rotor collective pitch to 1 to 2° and smoothly push the control stick to establish translational motion of the helicopter.

(3) It is allowed to taxi on hard and even surface with the engine dust protection devices on, and avoiding lift off condition. If the surface properties do not allow taxiing proceed to hops at low height.

(4) The taxiing speed should not exceed 15 to 20 km/h. Control the taxiing speed to environment and surface properties by application of the LG wheel brakes, bearing in mind that the brakes are highly effective.

Turn during taxiing by application of the pedals. In so doing, avoid complete unloading of the nose LG shock strut.

(5) Taxi at wind speed not exceeding 15 m/s, at headwind not exceeding 25m/s. When taxiing in crosswind the helicopter shows a tendency to weathervane into the wind. Counteract this tendency by appropriate application of the pedals and the rolling tendency by application of the control stick.

(6) If forward visibility is nil due to severe dust or snow swirl induced by the main rotor, stop the helicopter.

To stop the helicopter during taxiing set the control stick to a position close to neutral, apply the wheel brakes. Continue taxiing after making sure there are no obstacles ahead.

Caution: 1. If ever increasing oscillations of the helicopter arise during taxiing immediately reduce the main rotor collective

pitch down to the minimum level and retard the throttle control twist grip. If the helicopter oscillations do not stop or increase their magnitude immediately shut down the engines and stop the helicopter.

2. Never decelerate the helicopter motion by the main rotor (by pulling the control stick).
3. Do not turn the throttle control twist grip to the left during taxiing since this may cause a deceleration of the main rotor below 88% at which the ac generators may cut out.

(7) During taxiing the Pilot-Navigator should observe the space forward and to the right from the helicopter and report the Captain of obstacles.

Having reached the point of takeoff test the flight and navigation equipment and make sure the gyro horizon is energised (there is no flag on the АГБ-3К gyro horizon display), the АРК-15(ADF) indicates correct bearing to the locator station, the compass system is slaved and its reading agrees with the actual takeoff heading.

Start the aircraft clock elapsed flight time readout.

(8) During taxiing the Flight Engineer should monitor operation of the power plant, hydraulic system and generators.

4.2. Hovering

(1) Hover near the ground in the following cases:
- (a) Before each flight with a new variant of loading.
- (b) In case of necessity to test some helicopter systems.
- (c) For functional check of the power plant and flight controls.

(2) To execute hovering proceed as follows below:
- (a) Position the helicopter to meet the wind speed and direction limitations (into the wind where possible).
- (b) Make sure the instrument readings are normal and the throttle control twist grip is set to the rightmost position.
- (c) Smoothly pull up the collective pitch control lever to set the collective pitch to 3°.
- (d) Make sure the main rotor speed is within 95%. If it exceeds 95%, operate the main rotor speed resetting switch to bring the speed to the specified limits.

  Warning: It is not allowed to operate main rotor speed resetting switch in flight.
- (e) Engage the autopilot by depression of the ROLL-PITCH (КРЕН-ТАНГАЖ) and YAW (НАПРАВЛЕНИЕ) switch-lights, and the ROLL-PITCH ON (ВКЛ.КРЕН-ТАНГАЖ) and YAW ON (ВКЛ.НАПРАВЛЕНИЕ) green indication lights should come on.
- (f) Request clearance for hovering over the radio channel.
- (g) Smoothly pull up the collective pitch control lever to lift the helicopter off the ground and ascend to a desired hovering height.

(3) Increasing of the main rotor collective pitch during lift-off should be smooth, process of setting takeoff power to the engines should continue for not less than 5 *s*, thus maintaining the main rotor speed unchanged within the limits of 92 to 97 %.

Setting of takeoff power is determined by the Pilot by a main rotor speed

drop to 92 to 94% (with the collective pitch control lever being pulled up) and by attainment of the gas generator rotors speeds corresponding to takeoff power for the given ambient temperature.

Increasing of the main rotor collective pitch at a rate which yields setting of takeoff power in a period of less than 5 *s* or an attempt to increase it after the takeoff power is set may cause overloading of the main rotor, its speed dropping below 88% and settling of the helicopter down to landing.

(4) At lift-off the helicopter shows a tendency to shift forward and to the left which should be counteracted by appropriate applications of the flight controls, and small forces appearing at the controls therewith are removed by depression of the ЭМТ-2 trim actuator button.

(5) It is allowed to turn the helicopter in hovering at angular rates not exceeding 12 deg/s.

When reversing a turn avoid full reversal of the pedals within a period less than 3 s.

(6) It is allowed to execute 360° turns during hovering near the ground at wind speed not exceeding 10 m/s. At a wind speed exceeding 10 m/s hover the helicopter headed into the wind.

(7) The altitudes allowed for helicopter hovering are indicated in Table 2.2, versus gross weights. It is allowed to hover al altitudes exceeding those indicated in Table 2.2 during transportation of external loads and by tactical considerations.

Notes: 1. Abstain from hovering within the range of altitudes differing from those indicated in Table 2.2 up to an altitude of 110 m except for urgent necessity since within this altitude range a complete safety of landing in case of failure of one engine (or both) due to possible loss of the main rotor speed can not be ensured.

2. At small shifts and unstable hovering the 270-LITER FUEL RSV (ОСТАЛОСЬ 270 л) annunciator may blink and voice message EMERGENCY FUEL RESERVE is issued by the РИ-65 voice warning system.

(8) Listed below are approximate limit travels of the control stick from ,the neutral position in hovering:

(a) 1/4 full travel back at aft CG limit and normal CG positions, and 1/2 full travel back at forward CG limit.

(b) 1/4 full travel to the right disregarding the CG position.

4.3. Shifts and hops at low altitude

(1) It is allowed to perform shifts and hops at low height for the training purposes, for special operations and in cases when the field surface condition does not allow taxiing.

(2) Execute forward hops and shifts at a height up to 10 m at a speed not exceeding 20 km/h. In so doing, refer to the ground and use the ДИСС-15 Doppler system, with respect to the wind direction and speed near the ground. At a wind speed above 10 m/s execute hops only with the helicopter headed into the wind.

(3) Execute sideward and backward shifts at a speed not exceeding 10 km/h. In so doing, refer to the ground and previously make sure that the anticipated course is free from obstacles.

Bear in mind when using the A-037 radio altimeter the RAD ALT INOP (A-037 НЕ РАБОТАЕТ) annunciator may momentarily blink (for 1 to 2s) with the radio altimeter serviceable. If the annunciator illuminates continuously for more than 2 s disregard the radio altimeter readings.

(4) Abstain from hops near the ground at altitudes and speeds being within the cross-hatched altitude - speed envelope of the graph in Fig. 4.1 without urgent necessity, since complete safety of landing in case of failure of an engine (both engines) is not ensured for this envelope.

(5) Perform low level flying over rough terrain (spurs and bluffs) at altitude not less than 20 m over the terrain profile and at not less than 60 km/h IAS.

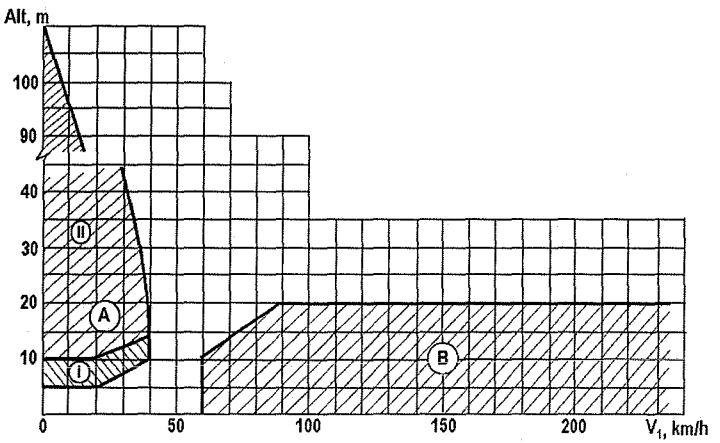


Fig. 4.1 Altitude-Speed Envelope

Gross weight limitation in hovering and flight at low altitude and near the ground

I-GW = 11100 to 13000 kg

II-GW = 11100 kg

Caution: avoid flying in cross-hatched areas as far as possible.

4.4. Takeoff

(1) Execute takeoff using one of the following procedures:

(a) Vertical takeoff with acceleration in ground effect.

(b) Vertical takeoff with acceleration out of ground effect.

(c) Running takeoff with run up to a speed of 20 to 50 km/h required for lift-off.

The minimum dimensions of airfield required for takeoff and landing at altitudes up to 1500 m are listed below:

50x50 m for vertical takeoff and landing out of ground effect. 50x120 m for vertical takeoff and landing in ground effect.

50x200 m for running takeoff and landing.

The obstacles elevation line in the approach clearways should have an inclination to horizon not exceeding 1:15

4.4.1. Vertical Takeoff with Acceleration in Ground Effect

(1) It is allowed to execute vertical takeoff with acceleration in ground effect in conditions when the helicopter is capable of hovering at a height of not less than 3 m above the ground with the engines running at limited takeoff power.

The maximum gross weight for takeoff and acceleration in ground effect is derived from the graph in Fig. 1.3 proceeding as instructed in Section 1.

(2) Before takeoff position the helicopter headed into the wind as possible, lift it off the ground and perform check hovering. Make sure the instruments readings are normal and the hovering height is adequate for vertical takeoff, descend down to a height of 0.5 to 1m and smoothly push the control stick forward along with simultaneous advancement of power up to takeoff so as to avoid a main rotor speed drop below 92%. Accelerate in the ground effect with shallow climb so as to have 60 to 70 km/h IAS at a height of 20 to 30 m.

Alleviate changes in the helicopter lateral and directional trim, as well as its tendency to loose height at the initial moment of acceleration by application of the flight controls. After acceleration to 60 to 70 km/h IAS proceed to climb with simultaneous acceleration up to 120 km/h.

(3) In takeoff in crosswind alleviate the sideslipping tendency by deflecting the control stick into the wind. Takeoff in RH crosswind is more difficult than takeoff in LH crosswind and requires elevated alertness.

4.4.2.Vertical Takeoff with Acceleration out of Ground Effect

(1) The vertical takeoff with acceleration out of ground effect is executed in cases when the airfield is limited dimensionally and surrounded by obstacles and the helicopter takeoff weight is low enough for hovering out of ground effect.

The maximum gross weight for takeoff and acceleration out of ground effect is derived from the graph in Fig. 1.1 following the procedure given in Section 1.

(2) Before takeoff position the helicopter headed into the wind as possible, lift it off the ground and ascend strictly in vertical direction to a height ensuring flyover of the obstacles with a clearance not less than 10 m. In the course of increasing the collective pitch, monitor the main rotor speed which may not drop below 92%

Smoothly push the control stick forward to accelerate up to a speed of 20 to 50 km/h and thereafter proceed to climb with simultaneous acceleration up to a speed of 120 km/h.

4.4.3.Running Takeoff

(1) It is allowed to execute running takeoff if the helicopter is capable of hovering at a height of not less than 1 m above the ground with the engines running at limited takeoff power. In so doing, only the roll and pitch channels of the autopilot should be engaged.

The maximum takeoff weight for running takeoff is determined in accordance with the instructions covered in Section 1.

(2) Make sure the instruments readings are normal and the throttle control twist grip is turned to the rightmost position, execute check hovering, land

the helicopter by reducing the collective pitch down to a level, at which the helicopter stands firmly on the ground, push the control stick forward and simultaneously increase the collective pitch to establish acceleration up to a speed of 20 to 50 km/h. increase the main rotor collective pitch further on (up to limited takeoff power) and slightly pull the control stick back to lift off.

(3) After lift-off with shallow climbout accelerate to a speed of 120 km/h and proceed to climb. The use of this procedure yields a takeoff distance of 250 to 300 m.

(4) At takeoff from fields of limited dimensions surrounded by obstacles climb at a speed of 50 to 60 km/h to reduce the takeoff distance.

4.5. Climb

(1) The best climb speed is 120km /h at altitudes up to 2000 m, 100 km/h at an altitude of 3000 m, 4000m, 5000 m; 90 km/h at an altitude of 6000 km/h. Climb is performed normally at engine maximum continuous power rating, for rate of climb refer to Fig.1.10a (section 1). In case of necessity climb may be performed at takeoff power within values indicated in the Table 2.9a (for not more than 15 min) and at power ratings below maximum continuous one.

(2) Engine power is set by the Pilot by referring to the ИР-117М (EPR) indicator at an altitude up to 2500 m and is determined by setting of its side index with respect to central bugs 'H' and 'K':

(a) Takeoff power - side indexes are above central bug "H".

(b) Maximum continuous power - side indexes are above central bug "K" up to alignment with index "H".

(c) Cruising power-side indexes are aligned with or below central bug "K".

Notes: 1. Engine power is determined by the ИР-117М (EPR) indicator until the gas generator rotor maximum limit speed or maximum TGT are attained (Ref. Table 2.8). Upon attainment of the gas generator rotor maximum speed or maximum TGT specified in Table 2.8, set and monitor the power referring to the parameter first to attain its maximum limit.

(3) In climb at maximum continuous power and the main rotor pitch constant the main rotor speed is maintained constant at 95±2% up to altitude of 3600 m, ISA. In further climb the main rotor speed decreases due to reduction of the engines output power by the gas generator rotor speed governors. In this case smoothly reduce the main rotor pitch to avoid a main rotor speed drop below 92% (94-95% at altitude close to the service ceiling).

Under ISA conditions the engines maximum continuous power is limited from altitude of 3600 m. If the outside air temperature is below the ISA schedule, limitation of power will take place at a higher altitude and vice versa.

In climb at cruising power the main rotor speed is maintained constant up to altitude of 3600m.

In climb at takeoff power and a constant main rotor pitch the main rotor speed is not maintained automatically constant at a level of 92 to 94%.

In this case maintain the main rotor speed by successive reduction of the collective pitch.

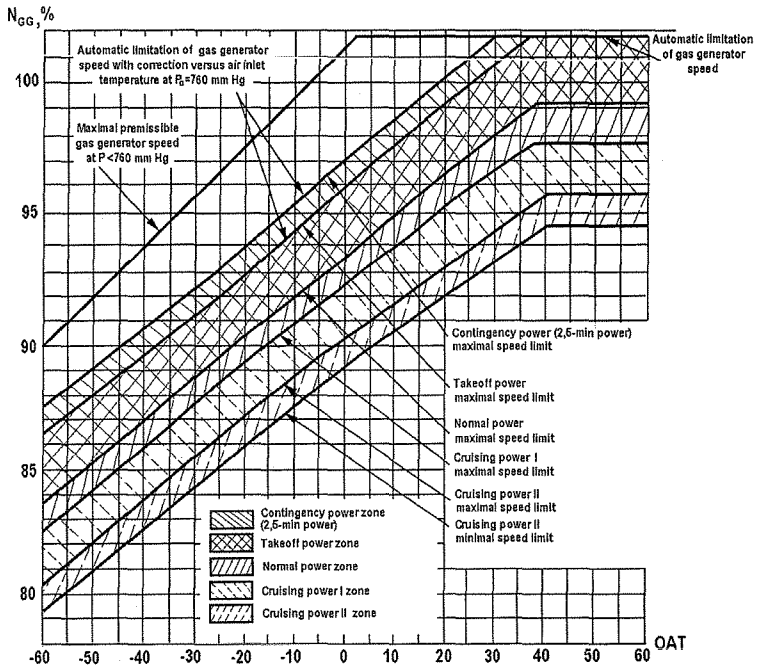


Fig. 4.2. Gas Generator Speed versus Engine Inlet Air Temperature (H=0, V=0)

(4) The gas generator rotor speeds of the left and right engines are allowed to differ in flight. At engine operational power ratings this difference should not exceed 2%.

If the difference in the engines gas generator rotor speeds exceeds 2%, or 3% upon actuation of the TGT limiter it is necessary to smoothly change the collective pitch in small increments to set another power at which the difference does not exceed the specified value.

(5) In the course of steady climb continuously monitor operation of the power plant, transmission, systems and units of the helicopter by reading the respective instruments.

(6) Upon reaching a desired altitude proceed to horizontal flight.

(7) Before proceeding to flight to an altitude above 3000 m don the oxygen mask on the ground. The procedures of use of the oxygen equipment are covered in Section 7.

4.6. Horizontal flight

(1) The allowed horizontal flight IAS ranges are indicated in Table 2.1 for altitude and helicopter takeoff weight.

(2) Execute prolonged enroute flying at the following speeds

(a) At the normal takeoff weight of 11100 kg:

230 to 220 km/h at altitudes up to 1000 m

220 to 210 km/h at altitudes from 1000 to 2000 m

210 to 195 km/h at altitudes from 2000 to 3000 m.

(b) At the maximum takeoff weight of 13000 kg:

215 to 205 km/h at altitudes up to 1000 m

205 to 195 km/h at altitudes from 1000 to 2000 m

(3) The recommended horizontal flight speed for traffic circuit flying is 160 km/h.

(4) In turbulent atmosphere (at severe bumping) fly at IAS indicated in para. 4.26.

(5) It is allowed to execute turns banked up to 30° at the normal takeoff weight and up to 20° at the maximum takeoff weight.

(6) Abstain from prolonged flying at speeds within the range from 20 to 50km/h accompanied by abnormal vibration of the helicopter.

(7) Listed below are the Pilot-Navigator's duties in flight:

(a) Gently hold the flight controls during takeoff and landing.

(b) Refine the calculated data.

(c) Monitor the flight and navigation instruments.

(d) Carry on visual orientation, execute navigation calculations rapidly and correctly.

(e) Retune the radio navigation equipment to work the problems of reaching a selected area, approach and aiming at the landing point.

(f) Periodically, every 10 to 15 min in flight, check the fuel consumption and the fuel reserve. The check over, set the fuel flow-meter selector switch to FLOW (PACX).

(g) Always know the flight duration up to the moment of landing.

(h) Be capable to restore orientation in flight.

(i) Follow the Captain's instructions.

(8) Listed below are the Flight Flight Engineer's duties during takeoff, flight and landing:

(a) Monitor the power plant instruments.

(b) Check the correct distribution of load between the generators and adjust it, if necessary.

(c) Monitor the operation of the hydraulic system.

(d) Turn on the compartments heating or ventilation systems by the Captain's order. With the KO-50 combustion heater on, the storage batteries heating should be turned off.

(e) Upon the Captain's permission periodically enter the cargo compartment to check the fuel, oil and hydraulic systems for freedom from leaks, and the cargo for reliable tie-down.

(f) Immediately report to the Captain on all malfunctions detected.

(g) If possible icing is anticipated in flight or severe snowfall occurs, periodically inspect the condition of the engines air intakes looking through the inspection window made in the power plant access door and immediately report to the Captain about appearance of indications of icing.

4.7. Transient flight conditions

(1) To proceed from vertical climb to hovering upon attainment of a selected

altitude discontinue the helicopter ascent by smooth decrease of the main rotor collective pitch and smoothly deflect the collective pitch control lever to maintain the selected hovering altitude.

(2) To proceed from hovering to vertical descent at a main rotor speed of 94 to 97% it is necessary to push the collective pitch control lever down to reduce the main rotor collective pitch to a level providing a descent vertical speed not more than 0.2 m/s by the moment of touchdown.

(3) To proceed from hovering to horizontal flight push the control stick forward to establish acceleration.

Simultaneously, operate the collective pitch control lever to keep the helicopter at a constant altitude and counteract the turning and side slipping tendencies by appropriate applications of the control stick and pedals. After attainment of a desired speed pull the control stick back to discontinue acceleration.

(4) To proceed from horizontal flight to hovering at the same altitude smoothly apply the collective pitch control lever to decrease the main rotor collective pitch and apply the control stick to slow down the forward speed.

After attainment of an airspeed of 50 to 60 km/h the helicopter shows a tendency to descend. To counteract this tendency increase the main rotor collective pitch.

Upon deceleration below 50 km/h the helicopter develops vibration disappearing in further deceleration. Upon deceleration below 40 to 20 km/h the helicopter shows a tendency to turn to the left.

It is necessary to timely apply the control stick in order to keep the helicopter from rolling, and simultaneously push the right pedal appropriately to keep the helicopter from turning.

(5) To proceed from horizontal flight to power-on glide reduce the main rotor collective pitch and operate the control stick to establish a desired gliding speed.

(6) To proceed from power-on glide to horizontal flight operate the collective pitch control lever to set power required for horizontal flight and apply the control stick to establish a desired speed.

(7) In flying in transient conditions the main rotor speed is maintained automatically within the range of 95± 2% only at a certain rate of the collective pitch control lever movement, namely:

(a) Not more rapidly than 5 seconds from a collective pitch of 1 to 3°up to a pitch corresponding to the limited takeoff power.

(b) Not more rapidly than 1 deg/s down at any initial value of the collective pitch.

At higher rates of the collective pitch control lever movement up, the main rotor speed may drop below the minimum allowable limit (88 %), or overspeed above the maximum allowable limit (103%) when moving the lever down.

If the main rotor speed becomes beyond 95+ 2% it is necessary to appropriately apply the collective pitch control lever to maintain the main rotor speed within the specified limits.

A vigorous application of the control stick causes a main rotor speed drop during acceleration and an increase in speed during deceleration. The higher is the control stick application rate, the

more intensive is the speed variation.

Caution: 1. Decrease of the collective pitch at a rate of 1 deg/s with simultaneous pitching up of the helicopter at a rate of 1 deg/s or more is prohibited due to possible over-speed of the main rotor beyond the allowable limits.

2. Automatic shutdown of the engines by the free turbine protection system takes place at a main rotor speed of 113± 2%.

(8) Relieve the forces arising in transient conditions from the flight controls by momentary depressions of the (ЭМТ-2) trimming button after small applications of the flight controls.

Notes: 1. Before depressing the trimming button avoid application of great forces to the control stick or pedals since depression of the trimming button causes practically immediate release of the ЭМТ-2 unit and hand (or foot) efforts cause excessive application of the flight controls which may lead to swinging of the helicopter.

2. It is not recommended to fly in transient conditions with the trimming button depressed since this may cause swinging of the helicopter.

4.8. Descent

Depending on the altitude, power-on vertical descent and descent along sloped paths (glide) are allowed.

Autorotation descent is allowed only along sloped paths.

4.8.1. Power-on Vertical Descent

(1) Power-on vertical descent from a height of 10 m down to the ground is allowed in all conditions, and from a height of 110 m down to a height of 10m is allowed only when it proves impossible to glide due to some obstacles or from tactical considerations. Descent from the service ceiling down to a height of 110 m is allowed in glide at forward speeds according to Table 2.1.

(2) In vertical descent from a height of 110 m down to a height of 10 m avoid vertical speeds of descent more than 3 m/s. Execute descent from a height of 10 m down to the ground with the vertical speed of descent continuously reducing so as it equals to 0.2 m/s by the moment of touchdown.

In case of inadvertent increase of vertical speed of descent reduce it by smooth increase of the main rotor collective pitch but avoiding excessively high pitches. If, in so doing, the power available proves to be inadequate proceed to flight at a forward speed.

In near proximity of the ground execute vertical descent with the helicopter headed into the wind as possible. Assess the verticality of helicopter path in descent by referencing to the ground reference objects and reading the ДИСС-15 Doppler radar.

4.8.2. Power-on Glide

(1) In glide maintain the main rotor speed within the specified limits by changing the main rotor collective pitch.

Gradual reduction of the collective pitch down to the minimum level is allowed for maintaining the vertical speed of descent with the altitude reducing, but with the main rotor speed kept within the specified limits therewith.

The recommended main rotor speed is 95± 2%.

The recommended gliding speed at altitudes below 2000 m is within the limits of 120 to 180 km/h, the vertical speed of descent being 3 to 5 m/s.

The allowed gliding speeds are indicated in Table 2.1, Section 2.

4.9. Autorotation descent

(1) Execute autorotation descent in case of failure of two engines in flight and for training purposes as well.

To establish the autorotation condition proceed as follows below:

(a) Reduce the main rotor collective pitch down to the minimum limit.

(b) Counteract the helicopter tendency to the right turn and nose-down by appropriate applications of the controls.

(c) Turn the throttle control twist grip fully to the left.

(d) After transition to autorotation operate the collective pitch control lever to maintain the main rotor speed within the specified limits.

(2) The IAS given in Table 2.1 are allowed for autorotation power-on descent:

The best gliding speed yielding the maximum distance of glide at altitudes below 2000 m is 180 km/h.

(3) The vertical speed of descent depends on the selected gliding speed and lies within the limits of 10 to 12 m/s.

The lowest vertical speed of descent corresponds to a gliding speed of 120 km/h and equals to 10 m/s.

(4) In autorotation descent execute turns with bank angles not exceeding 20°.

(5) Execute recovery from power-on autorotation descent following the procedure below:

(a) Smoothly turn the throttle control twist grip to the right monitoring acceleration of the gas generator rotors and main rotor.

(b) At altitudes above 1500 m counteract the main rotor tendency to overspeed beyond the specified maximum limits by timely increasing the main rotor pitch up to 3 to 4° displayed on theУП-21 indicator.

(c) At altitudes below 1500 m increase the collective pitch after setting the throttle control twist grip to the rightmost position. The rate of collective pitch control lever upward motion should be such as not to allow the main rotor speed drop below 92%.

Caution: Due to excessive loads applied to the freewheel clutch upon setting of the throttle control twist grip to the rightmost position, frequent use of the main rotor autorotation is not recommended.

(6) Execute power-off autorotation descent in accordance with the instructions of Section 6.

4.10. Landing

(1) The following landing procedures are authorized for the helicopter:
   (a) Vertical landing with hovering in ground effect.
   (b) Vertical landing with hovering out of ground effect.
   (c) Power-on running landing.
   (d) Landing with one engine inoperative.
   (e) Power-off autorotation landing (only in emergency conditions).

(2) Execute all landings with the helicopter headed into the wind, as possible. Before landing with a forward speed, including autorotation landing, disengage the autopilot direction and altitude control channels.

Before proceeding to landing check the tail rotor pitch limit system by observing the null indicator on the tail rotor pitch limit system control panel. The movable pointer should be to the left from the neutral index (the higher are the altitude and the outside air temperature the closer is the movable index to the left-most position).

4.10.1. Vertical Landing with Hovering in Ground Effect

(1) Before landing glide at 120 km/h IAS from the height of 100 m smoothly pull in the control stick to initiate reduction of forward speed so as to bring the speed to 60 to 50 km/h at a height of 60 to 50 m.

At a height of 8 to 5 m smoothly pull back the control stick and increase the collective pitch as required to establish hovering at a height of 2 to 3m.

In the course of deceleration and transition to hovering relieve the controls forces by momentary depressions of the trimming button.

Caution: Initiate increase of engine power for the purpose of the helicopter deceleration in advance. Pull up the collective pitch control lever smoothly to maintain the main rotor speed within the specified limits. Any lag in timely increase of power and sharp increase of power immediately before hovering may result in excessively high pitches to the main rotor and rough landing.

(2) After hovering smoothly reduce the collective pitch to execute vertical descent with gradual reduction of vertical speed of descent so as to bring it to a level not exceeding 0.2 m/s by the moment of touchdown.

Avoid lateral shifts of the helicopter before touchdown. Reduce the main rotor collective pitch down to the minimum limit only being completely sure that the helicopter wheels are positively supported by hard surface.

(3) In crosswind landing hold the helicopter by application of the control stick into the wind until the helicopter is sure to land and stands firmly on the ground.

4.10.2. Vertical Landing with Hovering out of Ground Effect

(1) Execute vertical landing with hovering out of ground effect in cases when obstacles at the airfield clearways do not allow hovering near the ground.

Procedure of landing with hovering out of ground effect does not differ from that when hovering in ground effect.

Begin smooth deceleration at a height of 50 m above the obstacles so as to establish hovering at a height of not less than 5 m above the surrounding obstacles.

In cases when the Pilot did not manage to smoothly decelerate the helicopter in approaching a limited area discontinue further descent and deceleration, proceed to go around and execute repeated landing approach in a proper way.

In the course of descent all the crew members should observe the obstacles surrounding the area and timely report to the Captain of helicopter approach to them.

4.10.3. Power-on Running Landing

(1) Execute power-on running landing in cases when it is impossible to establish hovering due to lack of available power of the engines (elevated airfields, high ambient temperatures) and for training purposes.

An aerodrome or even well known airfield can be used for landing provided safe clearways are available.

(2) Glide on final leg at a speed of 120 km/h.

Maintain the glideslope in such a way that down to a height of 40 m the current airspeed is 20 km/h higher than the present height. Execute further descent at a constant deceleration rate of airpseed and vertical speed of descent so as at a height of 1 to 0.5 m the airspeed equals 50 to 40 km/h and the vertical speed of descent equals 0.1 to 0.2 m/s.

(3) Smoothly make the main LG wheels touch down and reduce the collective pitch down to the minimum limit and thereafter rotate the helicopter to make the nose LG wheels touch down, set the throttle control twist grip neutral and apply the wheel brakes to reduce landing run which should be equal to 20 to 30 m in this case. The total field length including clearways should be not less than 100 m.

(4) If the airfield dimensions do not allow running landing with a landing run of 20 to 30 m, but it is necessary to follow this procedure, execute running landing with short landing run.

(5) Procedure of shortened running landing is as follows below:

(a) Begin smooth reduction of forward and vertical speeds at a height of 40 to 50 m above the field by increasing the main rotor collective pitch and pitching up the helicopter, maintaining the main rotor speed within the specified limits.

(b) Execute landing deceleration manoeuvre so as to have power close to takeoff rating at a height of 5 to 10 m and the forward ground speed within the limits of 40 to 20 km/h.

(c) At a height of 5 to 10m push the control stick forward to bring the helicopter to a landing attitude precluding the tail bumper touch down, but ensuring further reduction of the forward speed down to 15 to 10 km/h by the moment of touchdown.

(d) Beginning with a height of 5 to 10 m reduce the vertical speed through further increasing of the collective pitch at a rate of 2 to 4 deg/s so as the vertical speed of descent does not exceed 0.2 m/s by the moment of touchdown.

(e) After touchdown push the control stick forward 1/3 to 1/4 full travel from the neutral position, reduce the collective pitch down to the

minimum limit, turn the throttle control twist grip to the leftmost position and apply the LG wheel brakes.

Warning: 1. Only the pilots gained necessary skill in training flights are authorized to perform shortened running landing on fields of limited dimensions.

2. In performing pre-landing deceleration, take special care to maintain the main rotor speed within the specified limits.

4.11. Go-around

(1) If it proves impossible to land on a selected field, or the helicopter carrying external load fails to establish hovering out of ground effect, proceed to go-around, for this purpose smoothly pull up the collective pitch control lever to advance power up to takeoff and simultaneously push forward the control stick to accelerate the helicopter.

Upon attainment of a speed of 100 to 120 km/h proceed to climb at engine takeoff or maximum continuous power.

4.12. Flying and landing with one engine inoperative for training purposes

One engine runs at idle or is shut down, the operating one comes to higher power rating (up to contingency power).

(1) Land the helicopter with one engine inoperative for training purpose on an even field having safe clearways or on an aerodrome. In so doing, the helicopter weight should not exceed the normal takeoff weight.

(2) Execute landing approach with one engine inoperative for training purposes with the helicopter headed into the wind or at a crosswind not exceeding 5 m/s.

(3) At a height of 300 m, before starting the АИ-9В (APU), switch off the engine anti-icing system and the dust protection devices if they have been on.

Start the APU.

Observe readings of the APU instruments and illumination of the OIL PRESS NORMAL (ДАВЛ.МАСЛА НОРМА), NORMAL SPEED (ОБОРОТЫ НОРМА) annunciators to make sure the APU operates normally.

(4) To shut down one engine for training purposes at a high airspeed proceed as follows below:

(a) At a height of 300 m above the aerodrome the Captain establishes horizontal flight at an airspeed of 180 to 200 km/h and calls:

"Be ready to shutdown left (right) engine". Upon this order the Flight Engineer prepares the respective engine for shutdown. The Pilot-Navigator increases alertness in monitoring the power plant operation and maintenance of the main rotor speed.

(b) Move the throttle lever of the engine to be shut down fully down. This done, the other engine should automatically gain an elevated power with its throttle lever latched at the midway position.

(c) The Pilot-Navigator notes the time.

(d) Operate the collective pitch control lever to maintain the main rotor speed within the limits of 95 ± 2%.

(e) To set the operating engine to contingency power it is necessary to set the CONTINGENCY POWER (CP) switch, located on the EEC

control panel, to ON position. The separate throttle control lever of the operating engine should be latched at the midway position.

Warning: if, with setting idle to one engine, the other engine fails to gain an elevated power or horizontal flight with one engine operating at contingency power proves to be impossible, do not shut down one engine. In this case proceed to flight with two engines operative, for this purpose latch the separate throttle control lever of the engine running at idle at the middle position.

(f) 1 minute after setting the throttle lever of the engine to be shut down to idle, make sure the Flight Engineer holds the HP fuel shut-off lever of the same engine, and give him an order to shut down the engine, and simultaneously apply the control stick and pedals in an appropriate way to counteract arising rolling and turning. Out-of-trim condition due to shut down of one engine is unsignificant and can be easily alleviated by the flight controls.

(g) Pull the control stick back to decelerate the helicopter down to a speed of 120 to 130 km/h.

(h) Operate the collective pitch control lever to set a power to the operating engine at which the helicopter flies without loss of altitude.

(i) Continue flying at this speed for 2 to 3 minutes and thereafter start the previously shut-down engine.

(5) To shut down the engine for training purposes at a low airspeed follow the procedure below:

(a) At a height of 300 m above the aerodrome the Captain establishes horizontal flight at an airspeed of 70 km/h and calls: "Be ready for shutdown of left (right) engine". Upon this order the Flight Engineer prepares the respective engine for shutdown, the Pilot-Navigator increases alertness in monitoring the power plant operation and maintenance of the main rotor speed.

(b) Move the throttle lever of the engine to be stopped fully down. This done, the other engine should automatically gain an elevated power with *its* throttle lever latched at the middle position.

(c) The Pilot-Navigator notes the time.

(d) Operate the collective pitch control lever to maintain the main rotor speed within the limits of 95± 2%.

(e) Make sure that the CONTINGENCY POWER (CP) switch, located on the EEC control panel, is set to ON position. The separate throttle control lever of the operating engine should be latched at the middle position.

(f) 1 minute after setting the throttle lever of the engine to be shut down to idle, make sure the Flight Engineer holds the HP fuel shut-off lever of the same engine, and give him an order to shutdown the engine. Out-of-trim condition due to shut-down of one engine is unsignificant and can be easily alleviated by the flight controls.

(g) Accelerate the helicopter by smoothly pushing the control stick to a speed of 120 to 130 km/h.

(h) Operate the collective pitch control lever to set the engine power at which there is no altitude loss.

(i) Continue flying at this speed during 2 to 3 min, and start the previ-

ously shut-down engine.

4.12.1. Engine Airstart for Training: Purposes

(1) It is allowed to air start the engine for training purposes at altitudes not exceeding 4000 m.

Before start proceed as follows below:

(a) Make sure the АИ-9В APU operates normally.

(b) Make sure the throttle lever of the engine to be started is set to the lower stop.

(c) Establish an airspeed of 120 km/h.

(d) Make sure the compressor rotor of the engine to be started is windmilling and the autorotation speed does not exceed 7%.'

(e) Make sure the STBY GEN (РЕЗЕРВН.ГЕНЕРАТОР) switch is set to OFF (ВЫКЛ.).

Start the engine following the normal procedure.

Warning: If the gas generator rotor tachometer indicator pointer fails to move off the zero graduation within 5 seconds since depression of the starting button, depress the "START DISCONT" (ПРЕКРАЩЕНИЕ ЗАПУСКА) button, let the engine cool down for 2 minutes, and perform cranking of the engine. If during cranking the gas generator rotor tachometer indicator pointer fails to move off the zero graduation, do not airstart the engine, continue flying with one engine inoperative, and land.

(f) After the engine being started attains steady idling speed set the CONTINGENCY POWER (CP) switch to OFF position.

(g) Check the throttle control twist grip position (turn it to the right most position).

(h) Set the throttle lever of the started engine to the midway position and latch.

(i) Check the main rotor speed which should be within the limits of 95± 2%.

(j) Establish a desired flight condition.

(k) Shut down the АИ-9В APU.

Warning: 1. The duration of flight with one engine operative at power above continuous one should not exceed 6 minutes.

2. The time run by the main gearbox driven by one engine should not exceed 10% of the main gearbox overhaul period (5% for each engine).

3. If in training flight the oil temperature of the shutdown engine drops below +30°C, warm up the engine after start until the oil temperature rises up to +30°C and thereafter set the throttle lever to the midway position and latch.

4.12.2. Landing with One Engine Inoperative for Training Purposes

(1) Execute training landing with one engine inoperative so as the helicopter touches down at speeds of 10 to 20km/h or 50 km/h (upon the Captain's decision) following the procedure below:

(a) At a height of 200 m and an airspeed of 120 km/h, on final leg shut down the engine proceeding as instructed in 4.12, (4).

(b) Operate the collective pitch control lever to maintain the main rotor speed within the limits of 95± 2%.

(c) Make sure the operating engine has gained the contingency power.

(d) On the glideslope maintain such a condition that the airspeed is 20 km/h higher than the current height in meters.

(e) Assume landing attitude at a height of 7 to 5m.

(f) Beginning from a height of 3 to 5 m proceed to reducing the vertical speed of descent by increasing the main rotor pitch up to the moment of touchdown. In so doing, smoothly apply the right pedal to counteract the helicopter tendency to turn to the left and operate the control stick to maintain the landing pitch attitude. In increasing the collective pitch preclude the main rotor speed from dropping below 88%.

(g) After touchdown, immediately push smoothly the collective pitch control lever fully down and simultaneously push the control stick 1/3 to 1/4 full travel forward to preclude hitting of the tail boom by the main rotor blades.

(h) After rotation to touch down by the nose LG wheel apply the wheel brakes. When using such a procedure the helicopter touches down at a speed of 10 to 20 km/h, and the landing run is 5 to 20m.

To touch down at a speed of 50 km/h maintain such a flight condition on the glideslope that the airspeed is 20 km/h higher than the current height value in meters down to a height of 40 m. Maintain an airspeed of 60 km/h down to a height of 5 to 7 m.

Touch down following the conventional procedure covered above which yields a landing run of 80 to 100 m.

4.13. Autopilot controlled flight

(1) Flying under the autopilot control is the main flying procedure.

At all stages of flight up to landing the ROLL-PITCH (КРЕН-ТАНГАЖ) and YAW (НАПРАВЛЕНИЕ) channels should be engaged.

(2) In case of the autopilot disengagement in flight (during its normal operation) it may be re-engaged in any steady condition of flight.

(3) Engage the autopilot before takeoff by depressing the appropriate channels switch-lights, and monitor their operation by observing illumination of the green lights of the engaged channels.

(4) Execution of takeoff and flight with the autopilot engaged is easier than with the autopilot disengaged and does not require double strokes of the control stick.

In hovering the autopilot holds bank and pitch attitudes (angles) and, with the pedals free, yaw attitude, this feature significantly facilitating the helicopter flying.

(5) The autopilot is functionally checked in hovering by observing the indicators at the autopilot controller.

Normal operation of the autopilot is displayed by small oscillations of pointers "K" and "H" of the indicator near the neutral position.

Notes: 1. Pointer "H" of the Indicator should oscillate only with the pedals released. If the pilot's feet are on the pedals and the tiptoe

pedals are depressed the yaw channel is in the synchronisation mode and pointer "H" should be in the neutral position.

2. If pointer "T" or "K" set in hovering to a position close to the stops, the Pilot-Navigator should set them upon the Captain's order to the neutral position by operating trimming knobs "T" or "K" on the autopilot controller.

(6) In steady conditions of horizontal flight, climb or descent the helicopter holds its attitude with the free controls, but slowly deviates from a selected airspeed since the autopilot holds the pitch angle but not the airspeed. Therefore in extended flying with the controls free, restore a selected flight condition periodically by application of the control stick and pedals. It is not recommended to free the controls when flying at a height below 50 m.

(7) In execution of turns be sure to place feet onto the pedals and depress the tiptoe pedals.

Warning: Never remove feet from the pedals during turn since this causes severe skidding of the helicopter due to an autopilot tendency to hold the heading occurring at the moment of releasing the pedals.

(8) The altitude channel is intended for holding a selected pressure altitude in steady horizontal flight. It is allowed to engage this channel after trimming the helicopter in horizontal flight at a height not less than 50 m. Operation of the altitude channel is displayed by oscillations of indicator pointer B, variation of the main rotor collective pitch displayed by the respective indicator and a characteristic shuddering of the helicopter due to counteraction by the altitude channel to vertical displacements.

Normal operation of the altitude channel is characterised by the altitude holding within ±10 m and oscillations of indicator pointer "B" about the neutral position.

(9) Execute landing approach, deceleration and landing following conventional procedures with the autopilot engaged and feet on the pedals.

After taxiing to a parking area disengage the autopilot by depression of the AP OFF (ВЫКЛ. АП) button.

(10) If some malfunctions or complete failure of the autopilot are detected in flight disengage the autopilot by depression of the AP OFF (ВЫКЛ. АП) button. Continue flight piloting the helicopter without the use of the autopilot. In so doing, the control inputs should be more smooth and small, especially during landing.

Notes: 1. Execute running takeoff and landing with one and two engines operative, as well as autorotation landing with the autopilot altitude and yaw channels disengaged.

2. Jerks of the rudder pedals may take place at the moment of disengagement of the yaw channel in flight or during autopilot ground test. This feature is conditioned by the design of the servo and is not a trouble.

3. Pressing the collective pitch lever locking button, with the altitude channel being on, can cause a slight jerk of the collective pitch lever. This does not indicate a failure of the autopilot.

4.14. Termination of flight

(1) After taxiing to the parking area apply the parking brake and de-energise

all the consumers, except for the power plant instruments. Turn the throttle control twist grip to the leftmost position, run the engines at idle for 1 to 2 minutes in summer or 2 to 3 minutes in winter for the purpose of cooling.

(2) After cooling give to the Flight Engineer an order to shut down the engines. Before engine shutdown set the control stick approximately 1/3 fully travel back.

(3) Upon the Captain's order the Flight Engineer shuts down the engines proceeding as instructed in para. 3.9.

After the engine rotors come to a complete standstill de-energise all the consumers remaining on and switch off the storage batteries.

(4) In the course of flying outside of the base aerodrome or flights with stopovers at other aerodromes the Flight Engineer should timely change and submit for processing the БУР-1ж flight data recorder tapes and use them for assessment of the helicopter and its systems status together with the Captain.

4.15. Search and rescue operations

(1) Before departure for search proceed as follows below:

(a) Switch on the VHF ADF (РАДИОКОМПАС УКВ) circuit breaker on the overhead electric power system panel.

(b) On the VHF ADF (АРК-УД) control panel, set the mode selector switch to "NS", the frequency selector switch to VHF (УКВ) and the CHANNELS (КАНАЛЫ) selector switch to 4.

(c) On the intercom control box, set the selector switch to РК2 and the INT - RADIO (СПУ-РАДИО) selector switch to RADIO (РАДИО), with the interphone control box volume control at the maximum volume position.

(d) Fly the helicopter to enter the search area, and bear in mind that the VHF ADF (АРК-УД) detection and homing ranges increase with altitude (at a height of 500 m the coverage is not less than 25 km). Set the selector switch MF ADF – VHF ADF to VHF ADF position (for helicopters which are not equipped with БСУП indicator)

(e) With the ADF operating in the standby reception mode detection of a beacon (station) signal should cause coming on of an appropriate indicating light.

(2) After detection and identification of the beacon (radio station) determine its location proceeding as follows:

(a) Set the mode selector switch to a position corresponding to the illuminating light: narrow band NB (УП) or broad band BB (ШП).

If the NB indicating light illuminates set the mode selector switch to "NB".

(b) Operate the ANT L (АНТ. Л) or R (П) buttons to move the Indicator pointer to the left or to the right of the bearing, and make sure that pointer returns to the initial position with the button released.

(c) Turn the helicopter so as the heading indicator pointer sets to "0", fly the helicopter keeping the pointer in this position. At great distances from the beacon (radio station) begin homing in the narrow band NB (УП) mode, and as the signal volume heard In the headphones increase select the broad band BB (ШП) mode since the reliability of the VHF ADF (АРК-УД) operation in this mode in higher.

When passing over the emergency radio station the heading indicator reading reverses by 180°.

Notes: 1. At great distances from distressed persons the MAX-MIN (Б-М) selector switch on the VHF ADF control panel should be set to MAX (Б) (high sensitivity).
At small distances from distressed persons set the above selector switch to MIN (М) (low sensitivity) to reduce oscillations of the heading Indicator pointer.
2. The P-863 transceiver transmission may interfere with the VHF ADF. In this case set the VHF ADF INTERLOCK (БЛОКИРОВКА АРК-УД) switch to ON (ВКЛ).
3. In performing search and rescue operations by night extend and switch on the ПРФ-ЧМ search lights.

4.16. Flying (hovering) over unmarked terrain using ДИСС-15 doppler system

(1) The hovering and low speed Indicator provides visual indication of the ground speed within the following speed ranges:

0 to 50 km/h forward.

0 to 25 km/h backward.

0 to 25 km/h to the left and to the right.

(2) The along-track and cross-track speeds are displayed by the figure marks set against indexing pointers, the vertical speed is indicated on the dial in the indicator left portion by the triangle white pointer. Before takeoff switch on the doppler system by setting the DOPPLER (ДИСС) circuit breaker on the pilots' overhead panel and the DOPPLER (ДИСС) switch on the pilots' RH console to ON (ВКЛ).

(3) In hovering observe indications of the indexing pointers of the hovering indicator.

Apply the control stick in a direction opposite to extension of the indexing pointers, trying to keep them within the circle in the indicator centre. The vertical speed indexing pointer should be set to "0".

When the terrestrial horizon is not seen, hover with the use of the doppler indicator, monitoring the helicopter attitude by referring to the gyro horizon and other flight and navigation instruments.

Check the hovering height by reading the radio altimeter.

The hovering indicator provides correct readings up to an altitude of not more than 1000 m.

Upon attainment of an airspeed exceeding 50 km/h the OFF (ВЫКЛ) annunciator on the hovering indicator comes on to Indicate deactivation of the hovering indicator.

4.17. Night flying in normal weather conditions

(1) Procedure of start, ground test and shutdown of the engines is the same as for the day. Before start besides the circuit breakers switched on for a day flight, switch on the LAND LIGHTS (ФАРЫ), NAV LTS (АНО), FORM LIGHTS (СТРОЕВ.ОГНИ) circuit breakers on the electric overhead control panel RH CB panel and set the DOME LT RED - WHITE (ПЛАФОН КРАСНЫЙ - БЕЛЫЙ) selector switches to WHITE (БЕЛЫЙ) on the electric overhead control panel LH and RH switch panels. Set the red lighting

rheostats at the electric control panel RH and LH subpanels and over the flight compartment door opening to the lowest resistance.

Switch on ФР-100 taxi light.

(2) After starting the engines and disconnection of the external electrical power source switch off the white dome lights, set the DAY - NIGHT (ДЕНЬ - НОЧЬ) selector switch to NIGHT (НОЧЬ) and switch on the FLASH (МИГАЛКА), ANTI-COLL LIGHT (ПРОБЛЕСК) and BLADE TIP (КОНТУР.ОГНИ) switches.

Set the navigation and formation lights switches to BRIGHT (ЯРКО) or DIM (ТУСКЛО) depending on the assigned mission.

Taxi with the ФР-100 taxi light on. Switch on the ФПП-7 landing/search lights in case of necessity for more thorough observation of forward space, and before execution of turns. The ФПП-7 landing/search lights operational duty is 5 minutes on, 5 minutes off.

(3) Take off with both the ФР-100 taxi and ФПП-7 landing/search lights on. Adjust the direction of the lights beams in hovering at a height of 3 to 5 m by operating the respective selector switches Installed at the collective pitch control lever. Procedure of takeoff by night does not practically differ from that by day, but at the moment of lift-off pay attention to lateral shifts, and maintain direction by referring to the runway lights and the helicopter landing and taxi lights.

(4) Execute acceleration and climbout to a height of 50 m more gradually than by day. At a height of 30 to 50m completely select to instrument flying and switch off the landing and taxi lights. Maintain the same climb, horizontal flight and gliding speeds as during day flying, Execute turns with banks not more than 15°.

(5) During night flights pilot the helicopter by referring mainly to the instruments and periodically observe the air space.

Inadvertent ingress into clouds is displayed by appearance of a navigation lights reflection and disappearance of ground reference objects.

Warning: In case of inadvertent entering an icing area (this event being displayed by illumination of the "ICING" (ОБЛЕДЕН) annunciator or detection of ice on the windshield or the side blisters) manually switch on the main and tail rotor anti-icing system, windshield and pitot tubes heaters, report to the flying control officer, and take measures to leave the icing area.

The Pilot-Navigator should follow the instructions of para. 4.18, (13) in night flying.

(6) Execute approach and landing manoeuvres following the same procedure as by day. At a height of 50 to 70m switch on the ФР-100 taxi and ФПП-7 landing/search lights. If these lights cause appearance of light screen reducing observation of the ground, switch off the lights and find out the landing area on the ground illuminated by the stationary landing lights or referring to other lighted objects. In execution of landing assess the true height by reading the radio altimeter and check it by observation of illuminated ground areas and reference objects. If the ground surface is inadequately illuminated by the ФПП-7 lights or they fail, switch on and extend the ПРФ-4 lights. Execute landing with the ПРФ-4 lights on (the operational duty of the ПРФ-4 lights is 5 minutes on, 5 minutes off).

(7) After touchdown reduce the main rotor pitch very slowly and only being completely sure the helicopter stands firmly on the ground. Taxi to the

parking area with the ФР-100 taxi light on.

4.18. Day and night flying in adverse weather conditions (IFR)

(1) Before proceeding to flying in adverse weather conditions thoroughly study the general weather conditions in the area of anticipated flights. In so doing, pay special attention to presence and severity of icing, the wind speed and direction. It is allowed to fly in clouds at altitudes up to 3500 m.

(2) Before taxiing out of the parking area make sure the circuit beakers and switches of all the systems required in the anticipated flight are on, the autopilot, gyro horizons, turn indicator, MF and VHF ADF (АРК-15 and АРК-УД), compass system, radio altimeter, windshield wipers operate normally, the clock is wound up and correctly set, functionally check the ДИСС-15 doppler ground speed and drift angle indicator. The pressure indicated by the pressure-actuated altimeter, with the pointers set to zero, should be equal to the actual aerodrome pressure. The Pilot-Navigator should make sure the compass system is on, the fix latitude is entered, the mode selector switch is set to МН (МК) and the ДИСС-15 doppler system operates normally, which is displayed by illumination of the OPERAT (РАБОТА) annunciator on its control panel.

Notes: 1. The gyroscopic instruments should be switched on not later than 3 to 5 min before takeoff.

2. Bear in mind that with the «Ядро-1а» HF radio transmitting, the MF and VHF ADF (АРК-15 and АРК-УД) may experience interference.

(3) At an ambient temperature of +5°C or below switch on the pitot tubes heaters before taxiing out of the parking area and switch them off after taxiing to the parking area, irrespective of presence or absence of icing conditions.

If ground is covered with snow or during flying in adverse weather conditions (at ambient temperatures of +5°C or below) switch on the pitot static tubes heaters after starting the engines.

At subzero ambient temperatures, to avoid misting and icing of the flight compartment canopy, switch on the flight compartment heating system, the windshield and clock heaters before taxiing out of the parking area, and switch on the windshield wipers, if necessary.

Before taxiing out of the parking area at an ambient temperature of +5°C or below switch on the engine anti-icers to prevent icing of the air intakes and ingress of ice into the engines, for this purpose set the ANTI-ICING SYSTEM. ENG DUST PR-LEFT (ОБОГРЕВ ДВИГ. ПЗУ ЛЕВ) switch to ON (ВКЛ) and the ENG DUST PR-RIGHT (ОБОГРЕВ ДВИГ. ПЗУ ПРАВ) switch to MAN (РУЧНОЕ).

(4) The Pilot-Navigator should set the chart angle for the selected route on the co-ordinate indicator of the ДИСС-15 doppler system, set the distance and track angle error to zero, switch off the control panel by depressing the OFF (ВЫКЛ) button located on this control panel.

(5) After taxiing to the takeoff position slave the compass system, set the heading selector to the takeoff magnetic heading, and make sure that:

(a) The radio altimeter is on and the alert altitude selector is set as required.

(b) The gyro horizon is energized (the power failure flag is out of view on the АГБ-3К gyro horizon scale).

(c) The APK-15 ADF indicates correct bearing of the omnirange station.

(6) The Pilot-Navigator should check the flight and navigation equipment in the same scope.

(7) After assessment of the air traffic situation by requesting appropriate services through radio communication channels and inspection of respective areas of airspace by each pilot, the Captain requests for takeoff clearance and executes takeoff after receiving it. In hovering near the ground observe it visually.

(8) At the moment of lift-off the Pilot-Navigator should start the aircraft clock elapsed time counter. When passing over the initial waypoint start the ДИСС-15 doppler system co-ordinate indicator upon the Captain's order by depressing the ON (ВКЛ) button on its control panel. It is not recommended to use the ДИСС-15 doppler system at altitudes exceeding 3000 m.

(9) After takeoff, before entering clouds establish a climb speed of 150 km/h IAS and a rate-of-climb of 3 to 4 m/s. Trim out the flight controls, make sure the gyro horizon, turn indicator, radio altimeter and compass system indicator readings are correct. Check the АГБ-3К gyro horizon and ЭУП-53 turn indicator for correct display when establishing the desired climb condition by comparison of the helicopter actual attitude relative to the natural horizon and the display of the gyro horizon when the roll and pitch attitudes change by ± 5°. The difference in readings of the left and right gyro horizons exceeding 2° indicates faulty condition of one of them. In this case land at the departure airfield.

The compass system indicator and the ADF are checked for correct readings by comparing them with the actual position of the helicopter relative to the runway centerline and the omnirange station (with the drift angle disregarded).

In conditions where the natural horizon cannot be seen, check the gyro horizon functionally by comparing its readout with those of the heading indicator and rate-of-climb indicator. With the helicopter not banked the heading will be retained unchanged, in horizontal flight the rate-of-climb indicator will read zero.

Being 25 to 30 m short of clouds proceed to completely instrument flying.

After entering the clouds, in case of detection of icing indicated by illumination of the annunciator and observation of the visual icing indicator leave the icing zone.

(10) Listed below are conditions recommended for flying in clouds:

(a) Climb speed of 150 km/h IAS at rate-of-climb of 3 to 4 m/s.

(b) Descent speed of 120 to 200 km/h IAS at rate-of-descent of 3 to 4 m/s.

(c) Horizontal flight speed of 160 to 180 km/h during standard approach.

Execute prolonged enroute flying at altitudes up to 1000 m at the following IAS:

220 km/h at the normal takeoff weight.
200 km/h at the maximum takeoff weight.

The minimum speed for horizontal flight in clouds is 100 km/h. During instrument flying execute turns so as not to exceed bank angles of 15°.

(11) During Instrument flying in bumpy air maintain heading by co-ordinated

applications of the control stick and pedals. An attempt to bring the helicopter to course only by application of the pedals may cause its swinging in yaw. Establish the airspeed for flying in bumpy air in accordance with the instructions of para. 4.26.

When flying the helicopter in clouds refer to the gyro horizon and the compass system indicator with periodical check of the readings of airspeed indicator, rate-of-climb indicator, altimeter and slip indicator.

If the light screen induced by the navigation lights after entering the clouds diverts pilots' attention from the flight instruments set the navigation lights DIM-BRIGHT (ТУСКЛО-ЯРКО) selector switch to DIM (ТУСКЛО).

When flying in clouds continuously monitor and compare the flight instruments readings to timely detect their failure.

Failure of the gyro horizon can be detected by appearance of the flag on its dial (indicating failure of the AC power supply), by comparing the readouts of gyro horizon, rate-of-climb indicator and compass system indicator. Failure of the pressure-actuated instruments can be detected by comparing their readings with those of the gyro horizon and the Pilot-Navigator's instruments.

If failure of one or several instruments is detected proceed to piloting the helicopter referring to the standby instruments, report to the flying control officer and act in accordance with his instructions.

During instrument flying more frequently check heading since even at small banks practically not displayed by the gyro horizon the helicopter deviates from the selected heading.

(12) During instrument flying the distribution of pilot's attention should be approximately as follows below:

(a) In climb: gyro horizon - rate-of-climb indicator, gyro horizon - compass system indicator - altimeter, gyro horizon - airspeed indicator and further in the same order with periodical check of the engine power setting.

(b) In horizontal flight: gyro horizon - rate-of-climb indicator, gyro horizon - compass system indicator - altimeter, gyro horizon - airspeed indicator and further in the same order with periodical check of the engine power setting.

(c) In turns: gyro horizon (miniature aircraft - ball) - rate-of-climb indicator, gyro horizon - airspeed indicator, gyro horizon -compass system indicator - rate-of-climb indicator and further in the same order.

(d) In glide on final approach: gyro horizon - compass system indicator - rate-of-climb indicator, gyro horizon - compass system indicator - altimeter - airspeed indicator and further in the same order.

(e) With the use of duplicating instruments upon failure of the gyro horizon: turn and slip indicator - compass system indicator, turn and slip indicator - rate-of-climb indicator, turn and slip indicator - airspeed indicator - altimeter.

(13) In flight the Pilot-Navigator should monitor the selected condition of flight and calculated data of the manoeuvre being performed such as the time, heading, altitude, airspeed and ADF relative bearings and particularly current height in descent on final approach, report to the Captain the turn initiation time during landing approach, be ready in any moment to assume control of the helicopter.

(14) Instrument landing approach in clouds and under hood is performed by referring, as a rule, to the ADF tuned to the omnirange station placed on the landing course in one of the ways described in paras 4.19, 4.20,4.21.

In each particular case the landing approach procedure is selected depending on the air traffic, type of mission and landing approach descent procedure established for the aerodrome.

4.19. Wide rectangular traffic pattern approach

(1) Execute instrument landing approach and landing in clouds or under hood by referring to the locator middle marker (LMM) placed at a distance of 1300 m from the landing point. In preparing for flying rectangular approach traffic pattern calculate from the known wind the magnetic headings, estimated time of flight for each segment of the approach traffic pattern, relative and magnetic bearings of the marker locator for all turning points and on-the-beam positions with the drift angles taken into consideration. Tabulate the data obtained and use for flight. The recommended altitude for flying approach traffic pattern is 300 m, the horizontal flight speed is 160 km/h IAS, the bank angle to be maintained in turns is 10°. The diagram of the wide rectangular approach traffic pattern, is shown in Fig. 4.3.

(2) After takeoff establish a selected climb condition at an airspeed of 150 km/h and a rate-of-climb of 3 to 4 m/s.

Before entering clouds make sure the gyro horizon display is correct and proceed to instrument flying.

Execute crosswind turn at a height not less than 150 m and a distance of 3500 m from the starting line or at the moment of expiration of estimated elapsed time with the wind accounted for (1 min 32 s for no wind conditions).

Upon reaching a height of 300 m proceed to horizontal flight and establish an airspeed of 160 km/h. During repeated approach without landing execute crosswind turn 2 minutes after passing over the marker locator.

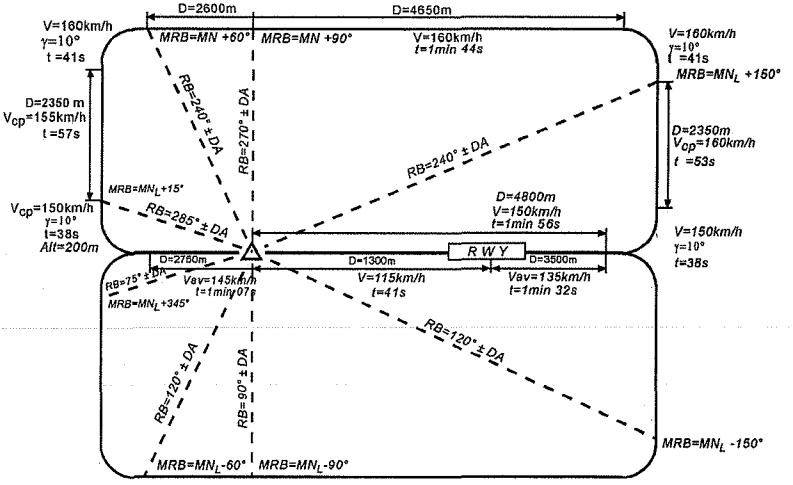


Fig. 4.3 Wide Rectangular Approach Traffic pattern

Execute downwind turn at RB = 240° ± DA (120° ± DA in right-hand approach traffic pattern) or being at desired MRB (magnetic radio bearing) in 3 min 27 s after takeoff.

Execute base turn at RB = 240° ± DA (120° ± DA in right-hand approach traffic pattern) or being at the estimated MRB. On the base leg descent at a rate of 2 to 3 m/s and establish a forward airspeed of 155 km/h.

Descent down to a height of 200 m.

Execute final turn in horizontal flight at a height not less than 200 m and an airspeed of 150 km/h. Initiate final turn at RB = 285° ± DA (75° ± DA in right-hand approach traffic pattern) or being at the desired MRB.

(3) Initiate all the turns and abeam flying at the estimated moments of time and report to the flying control officer. At initiation of final turn the pointed end of the ADF pointer set close to the heading selector pointer upper edge to make an angle of about 15° with the latter (Ref. to Fig. 4.4).

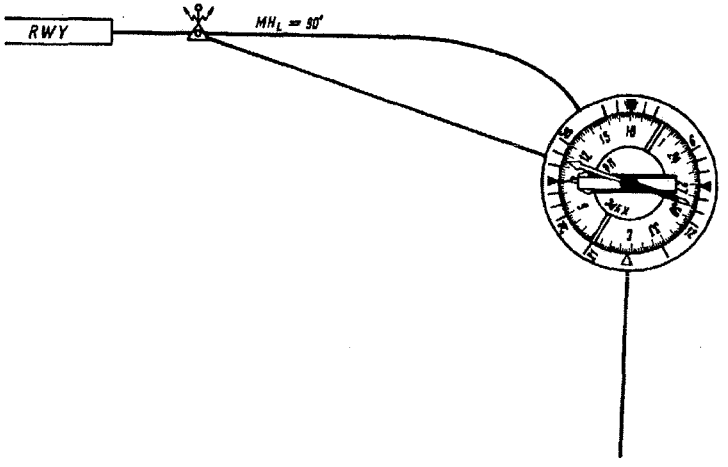


Fig. 4.4 Course Indicator Display before Capturing Landing Heading at Correct Execution of Turn

In correctly executed final turn both pointers should align at the moment when the helicopter is approximately 30° short of the landing heading (Ref. to Fig. 4.5).

Continue turning with the pointers aligned. If the angle between the ADF pointer and the heading selector bar remains constant or .even increases during the first half of turn, reduce the bank angle. If the ADF pointer begins lagging behind the heading selector pointer after alignment, increase the bank angle but not in excess of 15°. At zero drift recover from turn In such a way that the aligned ADF pointer and heading selector pointer set under the course indicator (ПНП) index. If drift is present set the aligned pointers with the drift angle accounted for, and maintain the heading with a crab angle.

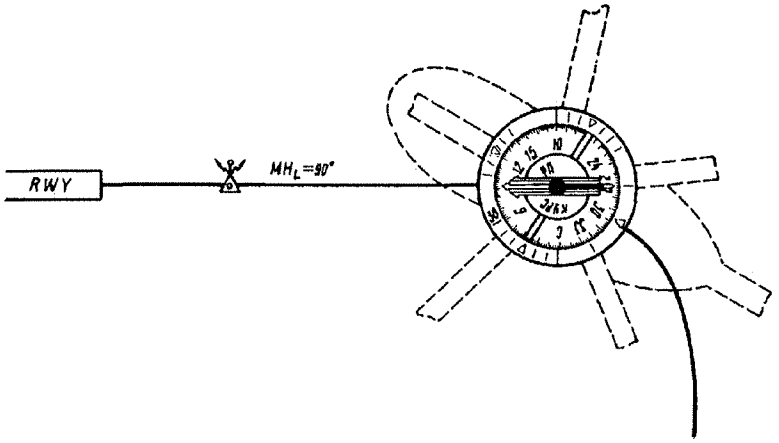


Fig. 4.5 Course Indicator Display 30° Short of Landing at Correct Execution of Turn

After recovery from the final turn proceed to descent at a rate of 2 to 3 m/sec and reduce airspeed so as it equals 100 to 140 km/h when passing over the locator middle marker at a height of 100 m. If the helicopter has descended to a height of 100 m before passing over the LMM, proceed to horizontal flight.

(4) If recovery from the turn to the LMM yields a heading differing from the landing heading, correct the error in the course of descent ,for this purpose note the difference between the actual magnetic heading and the landing heading at RB = 0. If the difference exceeds 5° correct the final heading error in descent by turning toward the ADF pointer (from the heading selector pointer) so as the ADF pointer set midway between the index and the heading selector pointer. If the course indicator (ПНП) reads a magnetic heading exceeding the landing heading, execute corrective turn. to the right, if otherwise execute corrective turn to the left.

Having completed the corrective turn, maintain the corrected magnetic heading until the ADF pointer matches with the heading selector pointer and thereafter turn the helicopter so as to align the ADF pointer and the heading selector pointer under the index (at no drift on the landing heading) or aside of it through a drift angle. At RH drift maintain the heading selector pointer set to the landing magnetic heading and the ADF pointer aligned to each other and deflected to the right from the upper stationary index through the drift angle.

(5) After passing over the LMM keep on the selected landing heading.

In day time, after breaking through clouds visually refine the helicopter landing attitude, heading and position by referring to the land marks and airfield marks. In night time, determine the moment of recovery from clouds after passing over the LMM only by the appearance of the airfield lights.

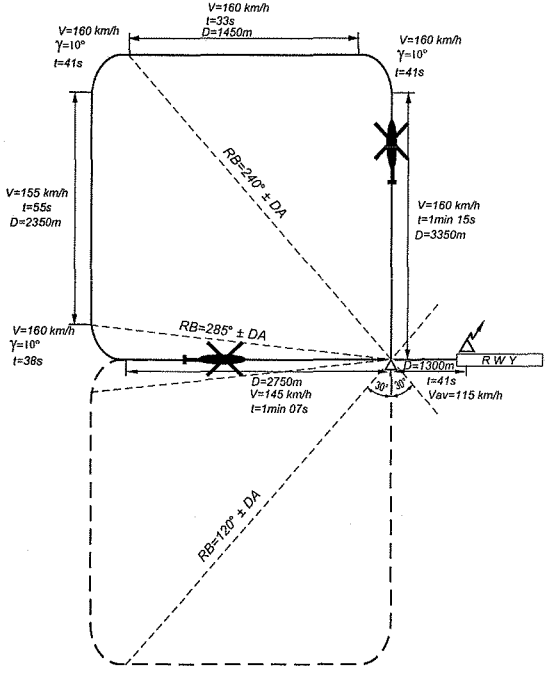
(6) If the wide rectangular approach pattern procedure is choosen for approach, upon returning from mission and passing over the LMM assume the landing heading and, upon expiration of an estimated time (2 min for no-wind conditions), turn to crosswind leg and fly wide approach pattern.

Use the wide approach pattern procedure in conditions when the LMM is

passed over on a heading equal to the landing heading or differing not more than 60° from the latter.

(7) If the LMM Is passed over on a magnetic heading differing from the landing heading more than 60°, but less than 120° use tight approach pattern for landing, if the use of this procedure is provided for the aerodrome (upon permission of the flying control officer).

When flying tight rectangular approach traffic pattern (Fig. 4.6), after passing over the LMM, get on the course perpendicular to the landing heading with the drift angle accounted for (distracted for the left-hand pattern and added for the right-hand pattern). Upon expiration of the estimated flight time (1 min 15 s for no-wind conditions) turn to the heading reciprocal to the landing one with the drift angle accounted for. Further procedure of approach and aiming at the landing point are the same as at the wide approach pattern. Fly the tight approach pattern following the above instructions.



Tight Rectangular Approach Traffic Pattern

Figure 4.6

4.20. Straight-in teardrop approach

(1) If the LMM is approached on a magnetic heading reciprocal to the landing one or if the difference exceeds 60°, perform a teardrop approach having received clearance from the flying control officer.

When preparing for flight with the wind being known calculate the magnetic headings (MH) and flight times for each segment of manoeuvre, as well as the estimated turn-away (ETA) angle.

The estimated turn-away angle is determined by the formula:

$$tg\ ETA = \frac{2R}{GS \bullet HFT}, where$$

R - radius of turn to landing heading, m.

GS - ground speed in horizontal flight up to turn to landing heading, m/s

HFT - time of flight from LMM up to final turn initiation point, in seconds.

The estimated turn-away angle, with the horizontal flight speed and bank angle in turn being constant, depends on the time of horizontal flight calculated by the formula:

$$HFT = \frac{(H - 100)ACS}{GS - VS} + 30, where$$

H - altitude of capturing the landing heading, m.

AGS - average ground speed in final descent, km/h.

VS - vertical speed of descent, km/h.

GS - ground speed in horizontal flight, km/h.

The values of HFT and ETA for various altitudes of capturing the landing heading are calculated in advance and indicated in tables or graphs (for example Table 4.1).

Table 4.1

H, m	300	400	500	600	700	800	900	1000
ETA, deg	28	19	14	12	10	8	7	6
HFT, min, s	1,30	2,15	3,00	3,45	4,30	5,15	6,00	6,45

Note: No-wind conditions are assumed for compilation of the table:
HFS = 160 km/h
VS = 2 to 3 m/s
AGS = 150 km/h
Bank (Y) = 10°

(2) During straight-in teardrop approach (Fig. 4.7) fly to the LMM at a selected height. After passing the LMM, upon the Pilot-Navigator's order execute RH or LH turn-away through an estimated angle with the drift angle accounted for and continue flying on this heading until turn at the estimated point. Upon expiration of the estimated time of horizontal flight (HFT) proceed to descent at an airspeed of 150 km/h and a vertical speed of 2 to 3 m/a, turn to the landing heading at a bank angle of 10° and an altitude loss of 200 m. In final descent account for the drift angle, maintain the desired condition of flight and avoid sideslipping and skidding.

Having reached a height of 100 m proceed to horizontal flight, pass the LMM at a height of 100 m and an airspeed of 100 to 140 km/h.

In descent the Pilot-Navigator should monitor altitude and breaking through clouds.

After breaking through clouds refine the helicopter position, descend and land. Execute turns and align with the runway centrelines using the procedures established for wide rectangular approach traffic pattern.

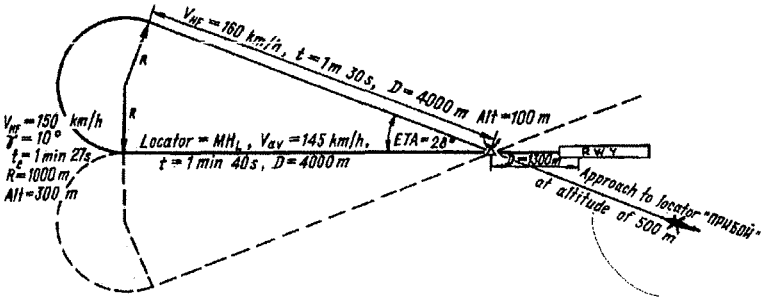


Fig. 4.7 Straight-In Teardrop Approach

4.21. Flying in icing conditions

(1) Deliberate flying at an ambient temperature below -10°C in icing conditions is forbidden.

(2) At ambient temperatures of +5°C or below execute all flights with the engine and dust protection devices anti-icing system manually switched on, for this purpose set the ANTI-ICING SYSTEM, ENG DUST PR-LEFT (ОБОГРЕВ ДВИГ. ПЗУ ЛЕВ) selector switch to ON (ВКЛ) and the ENG DUST PR RIGHT (ОБОГРЕВ ДВИГ. ПЗУ ПРАВ.) selector switch to MAN (РУЧНОЕ). At the above ambient temperatures switch on the engine and dust protection device anti-icing system on the ground after starting the engines.

Note: In case of urgent necessity (to improve the helicopter cargo carrying capacity through complete usage of the available power of the engines) it is allowed to switch off the engine anti-icers for a period of time required for takeoff or landing (1 to 2 min), provided Icing conditions are absent. This done, switch on the anti-icers and report to the flying control officer that the anti-icers are on.

The ice detector heater operation mode selector switch should be set to AUTO (АВТОМАТ), locked and sealed.

If the engines anti-icers failed to be switched on manually at a ground ambient temperature above +5°C and the ambient air temperature drops in flight, switch them on again manually in flight upon attainment of an ambient temperature of +5°C or below, for this purpose set the ANTI-ICING SYSTEM, ENG DUST PR-RIGHT (ОБОГРЕВ ДВИГ. ПЗУ ПРАВ) selector switch to MAN (РУЧНОЕ) and the ENG DUST PR-LEFT (ОБОГРЕВ ДВИГ.ПЗУ ЛЕВ) selector switch to ON (ВКЛ). Monitor variation of the ambient temperature by reading the ambient temperature Indicator Installed In the flight compartment.

Warning: Delayed switching on of the engines and dust protection devices auti-icers may cause inadvertent shutdown of the engines due to ingress of ice accumulated in the air intakes into the engine.

In flight switch on the engines anti-icers manually and alternately to prevent possible simultaneous shutdown of both engines due to ingress of ice Into their air intake ducts.

After switching on of the anti-icing system of one of the engines make sure its operation is stable and thereafter switch on the anti-icing system of the other engine.

Warning: If an engine shuts down upon switching on of its anti-icing abstain from switching on the anti-icing of the other engine, leave the icing zone, switch off the anti-icing 0f shutdown engine and start it.

(3) If Icing conditions such as (drizzle, fog, wet snow) exist on the ground at ambient temperatures of +5°C or below switch on manually the main and tail rotors, pitot static tubes and windshield heaters before taxiing out of the parking area. For this purpose set the GENERAL-MAN-AUTO (ОБЩЕЕ РУЧН-АВТОМ) selector switch to MAN (РУЧН), the ANTI-ICING SYSTEM, ENG DUST PR-RIGHT (ОБОГРЕВ ДВИГ. ПЗУ) selector switch to MAN (РУЧНОЕ), the ENG DUST PR-LEFT (ОБОГРЕВ ДВИГ. ПЗУ ЛЕВ) selector switch to ON (ВКЛ).

Caution: If the engines have been run on the ground in icing conditions at gas generator speeds below 80% for more than 5 minutes, shut down the engines, inspect the air intakes, dust protection devices, struts, nose cones and inlet guide vanes and remove ice (if accumulated) following the instructions prescribed in the helicopter maintenance manual.

(4) The ICING (ОБЛЕДЕН) annunciator should come on when the helicopter encounters an Icing zone. As this takes place, the anti-icing system is actuated by the signal of the ice detector.

If the ICING (ОБЛЕДЕН) annunciator fails to come on upon ice accretion on the windshield, side blisters and visual icing indicator (delay in delivery of the icing signal) switch on the anti-icing system and the ice detector heater manually.

(5) Descend in probable icing conditions at engine gas generator speeds not less than 86%.

(6) Monitor operation of the anti-icing system by observing readings of the ammeter indicating the current drawn, the ANTI-ICE ON (ПОС ВКЛЮЧЕНА), L ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ЛЕВ), R ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ПРАВ), L DUST PROT FWD (ЛЕВ.ПЗУ ПЕРЕДН), R DUST PROT FWD (ПРАВ. ПЗУ ПЕРЕДН), L DUST PROT REAR(ЛЕВ. ПЗУ ЗАДН), R DUST PROT REAR (ПРАВ. ПЗУ ЗАДН), HEATER OK (ОБОГРЕВ ИСПРАВЕН) annunciators.

(7) Leave the icing zone and report to the flying control officer if one of the following events occurs:

(a) The engine outlet oil temperature and the main gearbox Inlet oil temperature rise above the limits Indicated in para. 2.6.

(b) The GEN 1 FAIL (ГЕНЕРАТ. 1 ОТКАЗАЛ), GEN 2 FAIL (ГЕНЕРАТ. 2 ОТКАЗАЛ) annunciators come on to indicate failure of the AC generator.

(c) The current drawn by the main and tail rotors heaters rise above he maximum limits indicated in para. 7.1.

(d) Occurrence of icing conditions at an ambient temperature below -5°C.

Note: During flight in icing conditions the КО - 50 combustion heater may turn off due to icing of its air intake.

(8) The anti-icing system Is switched on and off by the Flight Engineer on the Captain's order.

The procedures of switching the anti-icing system on and off, as well as monitoring its operation are indicated in para. 7.1.

(9) At an ambient temperature of +5°C or above select the helicopter anti icing system to the automatic mode.

If icing takes place, switch off the main and tail rotors heaters after taxiing to the parking area before switching off the AC generators, and the engines anti-icing system before shutting them down.

Caution: With the main and tail rotors heaters operating, the range of omnirange station call signs reception is reduced. To listen to the omnirange station call signs switch off the main and tail rotors heaters for this purpose set the respective circuit breakers to "off" (выкл) for not more than 30 seconds. This done, the engines air intakes anti-icing should operate in manual control mode.

4.22. Flying over highland areas

(1) Reliable start of the engines at elevated fields from the airborne and ground electrical power sources is ensured up to an elevation of 4000 m.

Land on fields elevated above 4000 m above sea level without shutting down the engines.

(2) Only the pilots gained special skill in execution of takeoff from and landings on elevated fields of limited dimensions are authorized to perform flights over highland areas including landings.

(3) Flying over highland areas requires from the crew thorough study of the weather conditions in the area of flights before executing a mission and systematic monitoring of weather variations in flight.

Special care should be exercised in determination of the wind speed and direction, as well as presence of clouds and their development.

(4) Due to limited number of fields suitable for landing in mountains it is advisable to find them out and investigate in advance. During investigation of unknown fields the helicopter weight should be within the limits ensuring its hovering out of ground effect.

(5) Flying in summer over mountains with steep slopes, sharp ridges, sharp protrusions of rocks appear to be most complex since non-uniform heating of the mountain slopes causes heavy up - and downdrafts, the first on the sunny side and the second on the shadow side.

These drafts should be accounted for takeoff and landing on elevated fields, as well as in flying at minimum altitudes.

(6) Flying in near proximity of mountain ridges in wind or in presence of vertical clouds becomes even more complicated due to intensive bumpiness and somewhat deteriorated controllability, particularly in flights with external loads.

(7) When flying over highland areas it is not recommended to come close to the mountain slopes and heavy cumulus clouds which develop in day time above the mountains.

Cross mountain ridges with a clearance not less than 600 m above terrain. If it proves impossible to cross a ridge with such a clearance, cross it at a sharp angle to the ridge to provide a possibility to rapidly turn aside

from the ridge summit in case of sudden loss of altitude caused by ingress In downdraft.

The main indication of presence of severe down - and updrafts which may constitute a flight safety hazard the heavy cumulus clouds occuring over the mountains in day time. The most appropriate conditions for flying in mountains are noted In morning and evening time.

(8) Crossing of mountain ridges in wind is accompanied by pronounced bumpiness near the mountain slope.

When crossing the mountain ridge into the wind this bumpiness begins to be percepted at higher distances from the ridge than when crossing it downwind. The intensity of bumpiness increases as the helicopter approaches the mountain slope and if the height clearance above the ridge summit in inadequate, flying may become unsafe due to severe downdrafts.

(9) Lack of even fields and unobstructed clearways to them is a characteristic feature of flying over highlands, therefore takeoffs and landings in mountains on fields of limited dimensions require excellent piloting technique from the pilot and firm knowledge of peculiarities of flying in mountains.

In determining the possibility to takeoff from and land on the selected field the pilot should skilfully assess the situation and take a correct decision proceeding from the specific terrain, dimension of the field and condition of its surface, altitude above sea level, the nature of obstacles under takeoff or landing flight path, as well as the wind direction and speed.

(10) Before flight in a ravine calculate the radii of turns at various air-speeds at the maximum bank angles for the actual conditions of flight,

Fly at a height of 50 to 100m above the ravine bottom keeping close to one side of the ravine, better illuminated, to ensure possibility of turn in the event of egress from ravine in the opposite direction.

Depending on the ravine width maintain such an airspeed that allows execution a 180-degree turn at any moment of flight.

(11) In flight over highland area the radio altimeter gives unstable readings. Reference -to the radio altimeter readings only in flight over shallow even slopes and when hovering over fields.

(12) Usage of the ADF involves difficulties due to mountain reflection effect. The ADF errors in mountains are as high as +25 to 30° and even more in some cases.

The error magnitude depends on the height of the mountains, distance to them, frequency at which a radio station transmits, absolute altitude of the helicopter, and mutual position of mountains, helicopter and radio station. To improve the accuracy of taking the bearing of the radio station tune to radio stations transmitting at shorter waves (higher frequencies). If the ADF readings are unstable abstain from determination of navigational elements by means of this instrument.

(13) Prepare and execute enroute flying in mountains following the recommendations covered In the Air Navigation Manual.

Determine the ground speed and drift angles by referring to the ground speed and drift angle indicator of theДИСС-15 doppler system.

In the highland areas there is the lack of reference objects required for detailed orientation. Use mountain valleys, plateaus, characteristic moun-

tain summits, mountain rivers and populated areas for visual orientation. In enroute flying select reference objects on the open site of mountain slopes.

(14) In transportation of external loads adhere to the instructions covered in Section 5.

When flying in mountains in turbulent air the external load stability deteriorates and its swinging appears. Eliminate swinging by smooth reduction of airspeed.

4.22.1.Peculiarities of Takeoff and Landing Procedures on High-Level Fields

(1) The minimum dimensions of a field suitable for vertical takeoff and landing in ground effect, with no obstacles In the clearway should be 50x50 m and as listed below with obstacles up to 15m high at the field boundaries:

50x120 m at altitudes up to 1500 m.
50x165 m at an- altitude of 2000 m.
50x255 m at an altitude of 3000 m.
50x300 m at an altitude of 3500 m.
50x345 m at an altitude of 4000 m.

The minimum dimensions of a field for running takeoff and landing should be as follows below:

50x200 m at altitudes up to 1500 m.
50x225 m at an altitude of 2000 m.
50x350 m at an altitude of 3000 m.
50x410 m at an altitude of 3500 m.
50x475 m at an altitude of 4000 m.

The minimum dimensions of a field for running landing with one engine inoperative at altitudes up to 1500 m should be 50x190 m.

(2) Use vertical takeoff with acceleration out of ground effect in cases where the field is of limited dimensions and surrounded with obstacles, and the engine power available does not allow hovering out of ground effect.

Use vertical landing with hovering out of ground effect for landing on a field of limited dimensions at helicopter gross weight allowing hovering out of ground effect.

(3) Use vertical takeoff with acceleration in ground effect In cases where the engine power available allows hovering at a height not less than 3 m and the field dimensions allow acceleration In ground effect.

Use vertical landing with hovering In ground effect in cases where the field dimensions and clearways, as well as the engine power available allow deceleration and hovering in ground effect.

(4) Use running takeoff in cases where the engine power available is adequate for hovering at a height not less than 1 m, and the field surface properties allow safe takeoff run of the helicopter over a distance of 80 to 100 m and subsequent acceleration in ground effect.

Use running landing in cases where the field surface condition and dimensions allow usage of this procedure.

The fields to be used for flights involving running takeoffs and landings should be prepared and inspected in advance.

(5) Execute vertical takeoffs and landings with hovering in and out of ground effect, as well as running takeoffs and landings Including landings with one engine inoperative following the respective procedures covered In Section 4.

(6) Derive the helicopter maximum weight for vertical takeoff and landing with hovering in and out of ground effect, as well as for running take-off and landing from the graphs in Figs 1.1 and 1.3.

(7) The helicopter can be used for selection of landing fields in mountains by aerial reconnaissance preceded by study of the mountain geological relief on the large-scale charts. In selection of the landing fields place particular emphasis on the field clearways, presence of obstacles, slope, wind speed and direction.

To determine these elements of highland fields of limited dimensions and complex clearways execute preliminary flyover of the field at a height of 20 to 30 m and an airspeed of 60 to 70 km/h.

To determine the wind direction give an order to the Flight Engineer to drop a smoke pot at the moment of passing over the field.

(8) Sharp and frequent changes of wind direction and speed is noted during flying over highland areas, therefore, execute landing approach immediately after determination of wind direction by observing smoke from the pot.

(9) Select the landing approach procedure according to the specific conditions. Fly rectangular approach pattern or execute two 180-degree turns at an airspeed of 100 to 120 km/h.

Execute final turn at a distance not less than 1.5 km from the selected field threshold.

Execute landing approach in such a way as to be capable of veering off and go-around, if it proves impossible to hover at a safe height over the field.

(10) When landing on field located in mountains at elevations exceeding 500 m above sea level the helicopter shows lagging response to application of the control stick in fore-and-aft direction and to increasing the collective pitch in order to reduce the forward and vertical speeds of descent during deceleration preceding touchdown. At these altitudes the helicopter performance in deceleration deteriorates, it becomes more sluggish in relation to its behaviour during deceleration over the fields located at altitudes near to sea level.

(11) The distance required for slowing down of the forward speed, and the height required for slowing down of the vertical speed of descent increase. Therefore it is necessary to proceed to deceleration earlier than during landing approach to a field located at sea level. Movements of the control stick and the collective pitch control lever should be smooth and co-ordinated.

(12) Vigorous pitching up of the helicopter in the course of deceleration preceding touchdown causes settling in of the helicopter. Moreover, considerable pitching up impairs visibility of the landing area and, therefore, makes accurate aiming at this area more difficult.

(13) Execute deceleration before hovering in ground effect in such a way that by the moment the selected field threshold is reached the height does not exceed 2 to 3 m and the speed is within the limits of 5 to 10 km/h.

Hover over the center of the field as possible, and thereafter select the touchdown area and assess the surface fitness for landing.

Approach the selected touchdown area at a speed of 5 to 10 km/h.

(14) During landing approach to a field having obstacles at its inlet boundary below the landing approach path, pass the obstacles having a clearance

not less than 10 m.

(15) The highland fields have inadequate strength of the ground in most cases. After landing on such fields the helicopter wheels sink, the helicopter tilts and may turn over.

When landing on such fields decrease the main rotor collective pitch down to the minimum limit only after preliminary inspection of the ground condition on the selected field by the Flight Engineer and on his visual commands.

If tendency of the helicopter tilting is detected, lift off the helicopter and select another landing area within the selected field and shift the helicopter to this area by hopping at a height of 1 to 2m. Taxiing on such fields is unsafe and may cause turnover of the helicopter.

(16) During prolonged hovering (manoeuvering) near the ground at over zero ambient temperatures and, particularly in tailwind, the engine and main gearbox oil temperatures may rise up to the maximum limits.

If these limits are reached, land the helicopter and shut down the engines for the purpose of cooling the engines and gearbox.

(17) When performing approach for lowering the external load decelerate the helicopter well in advance. The deceleration distance in approach to a highland field increases 1.5 to 2 times as compared with the deceleration distance in lowland. An attempt to increase the deceleration rate leads to complication of piloting technique and causes swinging of the external load.

4.22.2. Takeoff and Landing on Sloped Fields

(1) The highland fields nearly always have slopes of various steepness.

The maximum slopes of fields used for vertical takeoff and landing without shutdown of the engine are listed below:

7° for the uphill headed position.
5° for the downhill headed position.
7° for the LH side uphill position.
3° for the RH side uphill position.

The maximum slopes of fields used for vertical takeoff and landing with shutdown of the engines after touchdown are listed below:

3° for the uphill and downhill headed positions, and LH side uphill position.
3° for the RH side uphill position.

The fields should have hard surfaces precluding sinking of the LG wheels.

(2) It is allowed to execute vertical takeoffs and landings on the sloped fields at wind up to 5 m/s disregarding the helicopter position relative to the wind, in wind above 5 m/s it Is allowed to execute these manoeuvres only into the wind with the maximum allowed limits of slopes taken into consideration.

Execute takeoff and landings on the sloped fields with the helicopter nose or LH side uphill, where possible.

The most safe are takeoff and landing with the helicopter headed uphill.

(3) When hovering over a sloped field the helicopter shows a tendency to shift downhill which should be counteracted by application of the control stick in the direction opposite to shift. This feature results in a helicopter banked uphill attitude in hovering across the slope of the field, the angle

of bank being approximately equal to the angle of slope.

Hovering over a field in the uphill headed position occurs in nose down attitude, hovering in the downhill headed position occurs in nose up attitude.

(4) Ground effect in hovering over fields whose slope exceeds 3° is less pronounced than in hovering over level fields.

Therefore, calculate the helicopter gross weight for landing on sloped fields with possible hovering out of ground effect accounted for.

(5) While landing in nose uphill position the helicopter first touches down by the nose and then by the main LG wheels. After the nose LG wheel touchdown keep the helicopter from rolling backward downhill by appropriate pushing of the control stick forward.

At takeoff from a field in nose uphill position the main LG wheels unstick first and then the nose LG wheel. After the main LG wheels unstick keep the helicopter from rolling backward downhill by appropriate pushing of the control stick forward. By the moment the nose LG wheel unsticks, the helicopter experiences a sharp nose-down jerk which can be easily counteracted by a gentle application of the control stick backward.

Avoid sideward shifts of the helicopter in vertical descent after touchdown by the nose LG wheel and in vertical ascent after the main LG wheels unstick, and during takeoff to prevent damage to the nose LG shock strut fittings.

(6) When landing in nose downhill position hover at a height not less than 3 m to avoid touchdown by the tail bumper. After hovering, descend strictly in vertical direction, avoid helicopter shifts, particularly with tail uphill.

By the moment of hovering at a height of 3 m above the field the distance from the tail bumper to the ground is 0.8 to 0.6 m, this distance is 0.3 m when the helicopter lifts off during takeoff and touches down during landing. At vigorous deceleration before hovering and vigorous decrease of the main rotor collective pitch the tail bumper touch down may take place.

(7) Land on a sloped field and takeoff from this field with the helicopter longitudinal axis along the slope with the LG wheels brakes applied. After landing, place the chocks under the main LG wheels.

(8) When landing on a sloped field across the slope keep the helicopter from sideward shifts downhill by application of the control stick in the direction opposite to the shift. If free from shifts, the helicopter hovers over the field in a banked attitude.

When landing in LH side uphill position the helicopter touches down by the LH LG wheel first, when landing in RH side uphill position it touches down by the RH LG wheel first. Thereafter the second main and nose LG wheels touch down. After touchdown by one of the LG wheels avoid sideward shifts and turns.

(9) Decrease the main rotor collective pitch down to the minimum limit only after being completely sure the helicopter stands firmly on the ground by all the LG wheels and is free from any tendency to turn over when pushing the collective pitch control lever down.

When landing on a field across the slope set idle power to the engines and shut them down only after the Flight Engineer inspects the surface condition and assesses position of the wheels on the ground.

(10) During takeoff with the helicopter positioned across the slope lift off

strictly in vertical direction avoiding lateral shifts and turns of the helicopter.

During takeoff with the helicopter LH side facing uphill it experiences a sharp rolling jerk to the left, and with the helicopter RH side facing uphill - a sharp jerk to the right, which should be counteracted by an appropriate motion of the control stick.

(11) During approach to an unknown field bear in mind that it is very difficult to correctly determine the actual slope by aerial observation. Therefore, during landing on a sloped field, disregarding the helicopter position relative to the slope reduce the collective pitch smoothly, preventing the helicopter banking and slopewise motion by application of the flight controls and LG wheel brakes.

Warning: If in the course of decreasing the main rotor collective pitch the cyclic pitch control stick or the directional control pedal move close to its respective stop, abort landing on this field, smoothly lift off and land on another field with less slope.

(12) It is allowed to taxi and turn while taxiing on fields with slopes not exceeding 3°. In case of greater slopes move over the field by hopping.

4.23. Peculiarities Of Helicopter Operation On Fields Covered With Snow (Dust)

(1) Flying over fields covered with snow or dust is particularly difficult. Only the pilots additionally trained for takeoff and landing in these conditions are authorized to perform such flying.

The helicopter takeoff (landing) weight for takeoff (landing) from (on) a field covered with snow or dust should not exceed the limit ensuring helicopter hovering out of ground effect.

(2) During operation of the helicopter on the fields covered with dust switch on the dust protection devices after the engines gain the idling speed. To do so switch on the ENG DUST PROT LEFT-RIGHT (ПЗУ ДВИГАТЕЛЕЙ ЛЕВ. ПРАВ) selector switches on the right side console electrical panel. This done, the L DUST PROT ON, R DUST PROT ON (ЛЕВ. ПЗУ ВКЛЮЧЕН,ПРАВ. ПЗУ ВКЛЮЧЕН) annunciators should come on. Actuation of the dust protection device is accompanied by a TGT rise by 10 to 15°C and the gas generators speeds may increase by not more then 0.5% from the initial value.

After takeoff and egress from the dusty area switch off the dust protection devices.

Before proceeding to landing approach to a field covered with dust switch on the dust protection device. Switch off the dust protection device after taxiing to the parking area with the engines running at idle.

(3) It is allowed to execute vertical takeoff from and landing on a field covered with snow provided the snow covering depth does not exceed 50 cm and there is a hard snow blanket on its surface precluding formation of snow vortex reducing the horizontal and vertical visibility down to zero.

(4) It is allowed to execute taxiing and running takeoff from and landings on fields with non-rolled snow covering having depth up to 15 cm being sure there are no obstacles under snow.

(5) Hoverings, hops, running takeoff and landings when the horizontal and vertical visibility is nil are prohibited.

(6) In execution of takeoff from the fields covered with snow, in some condi-

tions snow can be blown out by the main rotor downwash to a degree of visibility ensuring vertical takeoff or landing.

(7) Taxiing, hovering, hops, takeoff and landing in headwind above 5 m/s have no peculiarities since in this case the dust or snow vortex generated by the main rotor downward shifts backward leaving the horizontal visibility practically unchanged.

(8) If the horizontal visibility is nil it is allowed to taxi on the fields covered with snow at a speed not exceeding 10 km/h and execute turns in taxiing at a speed not exceeding 5 km/h. Never pivot the helicopter to avoid breaking loose of the LC wheel tires.

(9) Before initiation of taxiing read the compass to note the helicopter heading, make sure there are no obstacles on the anticipated taxiing course, turn the throttle control twist grip to the rightmost position and initiate taxiing upon attainment of a main rotor speed of 95% During taxiing maintain heading by referring to the compass and monitor taxiing speed by observation of a visible ground area near the helicopter. To refine direction and observation of the taxiing path periodically stop the helicopter, turn the throttle control twist grip to the left, wait until snow (dust) settles, inspect the next area of terrain when it becomes visible and continue taxiing.

(10) Before transition to hovering use the main rotor downwash to blow out snow (dust) around the helicopter so as the space 5 to 10 m ahead and sideward of the helicopter becomes visible.

(11) During vertical takeoff, after liftoff climb to a height of 3 to 5 m observing the helicopter position relative to the ground reference objects through the flight compartment lower glazing and, using readings of the ДИСС-15 doppler system hovering indicator to maintain the required hovering condition.

Takeoff and hover with the helicopter headed strictly into the wind. When hovering make sure the helicopter attitude relative to the ground is normal and there is power margin. Accelerate the helicopter from a height of 2 to 3 m using takeoff power. In the course of acceleration avoid descent and rolling.

When passing through the snow cloud monitor the helicopter attitude by referring to the instruments and ground reference objects (mountains, trees, etc.) situated at considerable distances from the point of take-off.

(12) In execution of running takeoff lift off the helicopter (advance engine power up to takeoff) after passing through the snow (dust) cloud. Until leaving the snow (dust) cloud maintain the takeoff heading by referring to the heading indicator and monitor the helicopter lateral attitude by referring to the gyro horizon.

Upon attainment of a speed of 25 to 30 km/h the helicopter leaves the snow (dust) cloud and the horizontal visibility is restored.

(13) During vertical landing on fields covered with snow (dust) proceed to hovering at a height free from snow (dust) cloud generated by the helicopter rotor downwash. After hovering descend smoothly so as to provide reliable vertical visibility by the moment of deterioration of horizontal visibility up to the moment of touchdown. Vertical visibility is attained through blowing out of snow covering by the main rotor downwash. At vertical descent avoid lateral shifts and continuously monitor the helicopter position by referring to the ground and ground reference objects (tree branches, flags) looking through the lower glazing and side blisters and observing

the ДИСС-15 doppler system hovering indicator.

If the ground reference object is lost immediately proceed to go around gaining altitude and speed and avoiding rolling. Search of a ground reference object by shifting the helicopter near the ground with the horizontal and vertical visibility nil is forbidden.

(14) At running landing in headwind less than 5 m/s touch down at a speed of 30 to 50 km/h depending on the field length. If horizontal visibility deteriorates before landing immediately accelerate the helicopter and go around. During repeated approach the touchdown speed should be a bit higher than during previous approach. After touchdown decrease the main rotor collective pitch down to the minimum level, retard the throttle control twist grip and apply the LG wheel brakes.

It is necessary to bear in mind that braking on a field covered with snow may cause skidding of braked wheels.

Note: The engine dust protection devices do not provide 100 per cent cleaning of air supplied to the engines. Therefore it is desirable, where possible, to avoid operation of the helicopter on sand or dusty fields without previous watering of the field surface.

4.24. Navigation

(1) In the course of preflight preparation the crew must do the following:

(a) Obtain refined weather data.

(b) Obtain refined flight data for the route segments and selected altitudes with actual wind data accounted for.

(c) Perform preflight check of the helicopter flight, navigation and air delivery equipment.

(d) Set precise time to the aircraft clock.

4.24.1. Initial Waypoint Approach

(1) To approach the initial waypoint (IWPT) select a manoeuvre to approach the initial waypoint on a heading close to the desired magnetic track angle (DSRMTK) proceeding from the conditions of flight (such as take-off heading, altitude, distance to the initial waypoint, etc.).

(2) Depending on actual navigation situation approach the initial waypoint observing landmarks, referring to the ДИСС-15 doppler system, using the course and time data calculated from known wind, the ground radio means and the air control center information.

(3) When passing over the initial waypoint refer to the УГР-4УК (or ПНП-72-15) compass system indicator bo bring the helicopter on a course with the drift angle accounted for to fly the desired track to the point of destination (target) or a next waypoint (IWPT), depress the OFF-ON (ОТКЛ-ВКЛ) key on the co-ordinate indicator to start reckoning of co-ordinates, start the stopwatch and note the time of the initial waypoint flyover on the chart.

(4) When flying along a route with great number of turns it is advisable to use the compass system in the magnetic slaved mode (MAG). In this case it is not recommended to use the compass system slaving selector "CRS SELECT" for determining the heading since oscillations of the flux-gate detector during slaving may cause an error.

Slave the system before taxiing out of the parking area and again on the

runway before takeoff.

In long flights it is recommended to use the compass system in the directional gyro mode (ДГ).

4.24.2. Rollout on Desired Track

(1) Rollout on the desired track can be effected by using the following methods:

(a) Flying on the course calculated on the ground corrected for the known wind and refined in flight by use of the ДИСС-15 doppler system.

(b) Selection of the course aligned with two or three reference objects (landmarks or check points).

(e) Elimination of the cross track error at the check point.

(d) Flying using the signals of an omnirange radio station or locator beacon located on the desired track (or aligned with the track).

(2) To capture the desired track flying on the course corrected for the wind data obtained from the pilot balloon and refined in flight by the ДИСС-15 doppler system bring the helicopter to the selected magnetic course with the drift angle accounted for when being 2 to 3 km short of the initial waypoint. This method is the basic one.

When flying the desired track on the course aligned with reference points there should be two to three characteristic check points on the desired track. These check points should be aligned with the initial waypoint.

(3) To rollout on the desired track aligned with the check points bring the helicopter to the calculated magnetic heading on the alignment line at a distance of 3 to 4 km to the initial waypoint, and mark a sighting point on the flight compartment canopy front portion which is aligned with two reference points simultaneously - the initial waypoint and check point.

(4) Maintain the magnetic heading and observe the alignment line to determine the across track deviation.

If the check point alignment line deviates to the right from the sighting point it means that the helicopter drifts to the left. In this case execute a corrective turn to the right. The amount of turn will be dictated by the rate of the alignment line runout from the sighting point. Execute the first corrective turn to roll out on the desired track, i.e. the alignment line and, thereafter, execute a corrective turn in the opposite direction through an angle equal to a half of the first corrective turn angle. If necessary repeat this manoeuvre several times until completely aligned with the desired track.

(5) On capturing the desired track through elimination of the cross track error select a characteristic reference point on the desired track at a distance of 15 to 20 km from the initial waypoint.

Fly over the initial waypoint on MH - DSRMTK and maintain this heading to the check point. While approaching the check point determine the cross track error or distance (in degrees or kilometres) by noting the helicopter fix (POS) and introduce a correction on the magnetic heading determined for the cross track error, and an additional correction for the distance to go to the check point.

(6) Continue flying on the corrected heading until reaching the check point or initial waypoint. If the desired track is captured before reaching the next waypoint the additional correction for the distance to go should be disregarded.

(7) To roll out on the desired track and fly on it from the omnirange station

(locator beacon) located at the initial waypoint, set the УГР-4УК (or ПНП-72-15)indicator heading selector to the first route leg track angle when approaching the station. Determine the moment of passing over the initial waypoint (station) by 180-deg reversal of the ADF pointer.

(8) On passing the omnirange station (locator beacon) proceed to selection of the heading using the УГР-4УК (or ПНП-72-15)indicator. When the helicopter flies precisely on the desired track the pointers of ADF indicator and heading selector remain aligned.

If the ADF indicator pointer deviates to the left or to the right from the heading selector pointer (this event being caused by the helicopter drift) turn the helicopter in a direction opposite to deflection of the ADF pointer rear end. Continue turning until the heading selector pointer is midway between the УГР-4УК (or ПНП-72-15) indicator triangle index and the ADF pointer rear end. Then fly on a straight line and as soon as the angle between the ADF pointer rear end and the heading selector pointer decreases, smoothly turn the helicopter towards the ADF pointer rear end until both pointers are completely aligned. This done, note the magnetic heading graduation aligned with the triangle index of the УГР-4УК (or ПНП-72-15) indicator, and maintain this heading, keeping the ADF and heading selector pointers aligned.

(9) When flying from the locator beacon bring the helicopter to the heading equal to the desired track angle and note the time of flyover. Fly 3 to 5 minutes and request for the magnetic radio bearing (MRB) (Прибой) and calculate the helicopter magnetic bearing (MB) (MB = MHB ± 180°) which is the actual magnetic track angle.

(10) Proceeding from the helicopter magnetic bearing determine the direction and the amount of cross track error. To roll out on the desired track introduce the correction equal to twice the drift angle into the heading:

$$MH_2 = MH_1 - (\pm 2DA)$$

On this heading the helicopter will capture the desired track in the same time interval as after passing the locator beacon by the moment of correction of the heading (3 to 5 minutes). Upon expiration of this time request for radio bearing to make sure helicopter flies on the desired track.

While flying on the desired track, turn the helicopter to a new magnetic heading MH,) with a drift angle considered to fly the desired track.

4.24.3. Enroute Flight

(1) When flying on a selected route monitor the on-course condition and introduce necessary corrections in distance and heading.

The navigation control is effected by determination of the helicopter fix by reading the co-ordinate indicator, by ground contact or by means of the radio navigation aids.

(2) When flying on a primary great circle course (using primary great circle spherical co-ordinates) and approaching the next way point, compare the waypoint rectangular co-ordinates on the chart with the readings of the ДИСС-15 doppler system co-ordinate indicator. When approaching the waypoint determine the dead reckoning error and, if necessary, update the present position by momentarily depressing the RIGHT (ВПРАВО) - LEFT (ВЛЕВО), FORWARD (ВПЕРЕД) - BACKWARD (НАЗАД) keys to set the desired values of the waypoint spherical co-ordinates to the XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ - км) and TRACK (km) (ПУТЬ - км) digital readouts. Perform similar operations when approaching the reference point of known rectangular co-ordinates and subse-

quent waypoints.

(3) When flying on a navigation leg (using navigation leg co-ordinates system) determine the helicopter fix (present position) by reading the TRACK (km) (ПУТЬ - км) and XTK DISTANCE (км) (БОКОВОЕ УКЛОНЕНИЕ - км) digital readouts monitoring and updating their readings visually or by means of the radio navigation aids.

(4) When approaching the next waypoint proceed to detailed observation of ground reference objects, refine the helicopter fix (position) and prepare the co-ordinates readout for the next leg as follows:

(a) Start the co-ordinate reckoning mode.

(b) Set the chart angle of new navigation leg on the co-ordinate indicator, and its data on the TRACK (km) (ПУТЬ - км), XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ - км) readouts.

(c) When passing over the waypoint start the co-ordinate reckoning mode and fly the helicopter to maintain the track angle error equal to zero.

(5) While visually monitoring the track use first characteristic natural and artificial ground reference objects. In flying over unmarked terrain use for orientation not only large but small reference objects such as buildings, high grounds and bench marks, bluffs, cliffs, roads, walking tracks, bushes and configurations of woods.

(6) In determination of the helicopter fix (position) by means of the radio navigation aids it is advisable to use the radio stations located aside of the track within an angle of 60 to 120° to it and the departure aerodrome beacon or the omnirange stations (beacons) which are closer to the helicopter longitudinal axis.

The track navigation control is considerably facilitated if the ground radars are available on the course.

In this case two helicopter fixes (positions), heading and time may be used for determination of the actual track angle, track angle error, drift angle and ground speed. These data can be then used for determination of the correction to heading and determination of wind.

(7) Start and stop the stopwatch at the moment when the co-ordinates are requested.

(8) When flying from the omnirange station or locator beacon located at the initial waypoint, use the ground radar for checking the track distance.

(9) Update to the course required for reaching the next check point or waypoint upon occurrence of track angle errors (cross track distance) on the route or at the selected check point. The corrections to course for the track distance flown or to go are indicated in Table 4.2.

Table 4.2

Distance flown (to go), km	Cross track distance (XTK), km										
	2	3	4	5	6	7	8	9	10	11	12
	Corrections to course, deg										
15	8	11	15	18	22	-	-	-	-	-	-
30	4	6	8	9	11	13	15	17	18	20	-
40	3	4	6	7	9	10	11	13	14	15	17
60	2	3	4	5	6	7	8	9	10	10	11

80	2	2	3	4	4	5	6	7	7	8	9
100	1	2	2	3	3	4	5	5	6	6	7

(10) To facilitate determination of correction to course at the check points it is advisable to plot track angle errors on the chart.

Corrections to course can be calculated by means of the НЛ - 10 navigation computer following the procedure below:

(a) If the actual magnetic track angle is known to the crew use the drift scale to measure the track angle error (TKE) as the angular difference between the actual and desired tracks. Then calculate the correction to course (CC) from the track angle error, trip distance (TD), distance flown (FD) by means of the НЛ - 10 navigation computer. For this purpose set the track angle error (TKE) on the tangent scale against the trip distance (TD) and distance-to-go (GD), and read the correction to course (CC) against the trip distance.

(b) If the cross track distance (XTK) is known, the correction to course can be calculated as the sum of track angle error in degrees and the additional correction (AC).

(c) The elapsed time (ET), time-to-go (GT), and trip time (TT) of the route leg can be taken for calculation of the correction to course instead of FD, GD and TD.

(11) Determine the ground speed and estimated time to waypoint (ETE) from the distance flown and time elapsed when flying over the route check leg. Determine the wind data from the ground speed and drift angle by means of the wind drift computer. Using the known wind data calculate the course and time for the next route leg, as well as the estimated time to the field (target).

If it is impossible at a given moment to determine the helicopter position visually or by moment of the radio navigation aids monitor the track separately in direction and distance.

(12) Use one of the following methods to compensate for the error of the estimated time to the field (target):

(a) Change in the route length.

(b) Change in the speed.

(c) Corrective turn of 60° from the course.

(d) S-turns.

4.24.4. Approach to Field (Target)

(1) The approach to the field (target) can be effected by the following methods whose selection depends on the actual conditions:

(a) By visual ground contact from the initial reference object with the heading and elapsed time accounted for.

(b) With the use of the ДИСС-15 doppler system.

(c) With the aid of ground radars.

(d) By means of two radio navigation stations, one of which is located on the desired track and the second is aside of this track.

(2) The helicopter approach to the field (target) by the visual ground contact from the initial reference object with the heading and elapsed time accounted for is the basic method. It can be used both by day and night if the ground reference objects are visible and a characteristic, easily identifiable reference object is available near the field (target).

(3) Employment of the ДИСС-15 doppler system facilitates considerably the helicopter approach onto the target (field) not only when the ground reference objects are visible, but when flying in adverse weather conditions and over unmarked terrain.

(4) The helicopter approach to the field (target) with the aid of ground radars is effected by direction from the ground by the flying control officer (director) or by the crew using the ground radar data transmitted over the radio channel.

(5) The helicopter approach to the field (target) by means of two radio navigation stations is used only in conditions where the two above methods cannot be used. In so doing, one of the radio navigation stations (omnirange station or locator beacon) should be selected on the desired track and the second aside of the desired track so as it is at a distance not exceeding 100 to 120 km from the field (target) and the angle at which the magnetic radio bearing crosses the desired track at the descent initiation point is within the limits of 60 to 120 .

(6) If a command radio station is available on the field, and the VHF ADF (АРК-УД) can be used as a standby radio aid for approach to the field.

4.24.5. Approach to Terminal Waypoint

(1) Having completed the mission the crew flies the helicopter to the return waypoint and then flies to the terminal waypoint and the aerodrome of destination. Navigation on the leg from the field (target) to the terminal waypoint is effected in the same way as in flight to the field.

(2) If an omnirange station is installed at the terminal waypoint it is necessary, in order to keep on-course, to set the УГР-4УК indicator heading selector pointer to a desired magnetic track angle (DSRMTK) and maintain the magnetic heading (MH) with the estimated drift angle (DA) accounted for:

$$MH = DSRMTK - (\pm DA)$$

With the estimated drift angle being equal to the actual one the helicopter will fly precisely on the desired track and the ADF and heading selector pointers remain aligned. In case of deviation of the helicopter from the desired track, an angle between the APK-15 ADF and heading selector pointers occurs.

In this case execute a corrective turn to the desired truck through such an angle as required for bringing the APK-15 ADF pointer to a position between the triangle index and the heading selector pointer, and fly on this heading until the pointers are aligned (the desired track interception). After rollout on the desired track, fly a new heading accounting for the drift angle increased or decreased by 3 to 5°. If when flying on the new heading the pointers continue displacing, correct the heading again in a similar way. Change the heading until the mismatch of the APK-15 ADF pointer and the heading selector pointer is eliminated. It indicates that the heading is selected correctly.

(3) If only a locator beacon is installed at the terminal waypoint use the compass system for approach and periodically correct the heading in accordance with the radio bearings provided by the locator beacon.

Request for the radio bearing every 5 to 6 minutes and, when approaching the locator beacon, every 1 to 2 minutes.

(4) In adverse weather conditions and at night use the radio navigation aids

of the landing system for approaching the aerodrome of destination. The landing director of the system informs the crew of the heading and distance to the aerodrome.

The elapsed time between two points known can be used to refine the ground speed and estimated time to the terminal waypoint.

4.24.6. Peculiarities of Navigation at Extreme Low Altitudes

(1) The helicopter navigation at extreme low altitudes has several peculiarities, which are caused by difficulties in visual orientation, complication of piloting technique, reduction of the VHF locator beacon and radar ranges and more profound dependence of the wind parameters on the terrain profile.

(2) Difficulties in visual orientation are dictated by limited visibility of terrain, reduction of time of observation of the reference objects being flown over due to high angular velocity of their movement in the field of vision.

(3) Transition from climb to descent (or vice versa) in flight over broken terrain causes changes in airspeed, this feature affecting the accuracy of determination of the ground speed and dead reckoning.

(4) The course should be laid over terrain having the maximum possible number of characteristic reference objects such as small lakes and pools, road forks, river and road curves, river mouths, railway bridges and stations, populated areas, forest glades and border edges, etc.

Select the reference objects at distance of I5 to 20 km.

(5) To reduce the in-flight calculations, plot on the chart additional marks of track angle errors and heading corrections near the reference objects for each route segment.

(6) To determine ground speed select route check legs of 15 to 20 km long.

Select linear reference objects located normal or at an angle of 60 to 120° to the track as the initial and terminal reference objects of a route check leg.

(7) When studying the route I note the locations and characteristic features of the linear and area reference objects limiting the route in direction and distance.

When studying the terrain profile it is necessary to acquire knowledge of locations of terrain high grounds and artificial obstacles having effect on the flight safety.

(8) Intercept the desired track on a heading calculated from reported wind, which is refined in flight from the readings of the ДИСС-15 doppler system. In limited visibility use radio navigation aids (omnirange stations or locator beacons) placed at the initial waypoint for checking the on-course condition.

(9) To improve accuracy of helicopter navigation and flight safety by continuously watching the ground surface, performing dead reckoning, continuous visual orientation and close maintenance of the selected condition of flight, and employing the radio means.

Conduct visual orientation in the route segments between the reference objects with the appearance of a next reference object being waited for. It means that 2 to 3 minutes before estimated time to the next reference object exercise care in identification of special features of this reference object.

This procedure allows to limit identification only to characteristic points of a given reference object.

If this procedure is not followed the pilot will have to identify the reference

object proper and find out its characteristic points selected in advance that is rather difficult due to limited visibility of terrain.

Adherence to this procedure is particularly important in limited visibility since even at small deviations from course the next reference object may be left unidentified or fall out of the field of vision. These conditions involve difficulties in helicopter navigation and in some cases may cause loss of orientation.

(10) In the course of preparation for enroute flight investigate possible procedures of restoration of orientation in route segments lacking characteristic reference objects.

If the next reference object fails to appear at estimated time increase altitude up to 100 to 150 m to improve the terrain observation.

When flying by day in normal weather conditions and at limited horizontal visibility it is advisable to maintain altitude visually with periodical reference to the radio altimeter. In IFR flying use the pressure altimeter with reference to the radio altimeter.

4.24.7. Peculiarities of navigation at Night

(1) Helicopter navigation at night has several peculiarities which include deterioration of conditions in which visual orientation is conducted due to poor visibility of natural reference objects, difference of artificially illuminated reference objects configurations from their true configurations and difficulties in visual determination of distances to illuminated reference objects.

(2) At night the range of radio navigation means and accuracy of navigation data obtained by means of ADF deteriorate as well. Apart of this, determination of navigation data with the use of common means and observation of weather dynamics become more difficult.

(3) Procedure of employment of the radio navigation means in flying by night is basically the same as by day. But when using the ADF account for night effect which may cause errors as high as 10 to 15°. The sign and magnitude of the error vary continuously and cannot be determined in advance.

(4) The locator beacons are free from night effects. Therefore it is advisable to use them in night flying for checking the on-course condition and flying the helicopter to approach the destination aerodrome.

(5) In night flight the crew is recommended to devote much time to visual orientation and use various types of navigation computers as rare as possible.

(6) Successful fulfilment of a flight mission depends to great extent on the crew's skill in fast and accurate mental dead reckoning and performance of sight estimation.

(7) It is advisable to select course so as it has less possible number of turns, adequate number of characteristic illuminated reference objects or reference objects which are well visible in the given weather conditions and at actual altitude, and radio navigation aids available.

(8) On studying the route bear in mind characteristic features of the illuminated and natural reference objects and clarify the possibility of their identification at a given altitude and visibility. The landing field (target) area should be studied particularly thoroughly.

(9) Before flight calculate the flight data considering the reported wind, functionally check the flight and navigation equipment and the cabin lighting.

(10) In all conditions of flying by night it is recommended to determine the ground speed and drift angle in each route segment. For this purpose select the route check legs of 30 to 40 km long.

Select characteristic illuminated and natural reference objects as the initial and terminal reference objects of the route check legs.

(11) Check the on-course condition by using all the ways available in a given flight.

The best accuracy is provided by the radio navigation means free from night effects (such as radars, VHP locator beacons).

Employment of the above radio navigation means in combination with visual orientation enables the crew to take decision for changing the flight condition for the purpose of reaching the field (target) at estimated time.

4.24.8. Peculiarities of Navigation in Adverse Weather Conditions (IFR)

(1) The main peculiarity of helicopter navigation in adverse weather conditions is limitation or complete precluding of possibility to check the on-course condition through visual ground contact.

Dead reckoning and check of the on-course condition by means of radio direction finders (omnirange stations, locator beacons) and radio direction and range finders (radars) assume vital importance.

(2) Lay the course through characteristic area reference objects located on the linear reference objects so as to make possible rapid and guaranteed determination of the helicopter position when reaching the clouds.

(3) Use an omnirange station, locator beacon or an aerodrome coded neon light beacon as the route initial and terminal waypoints. Select a route check leg of 25 to 30 km long to refine the ground speed and drift (wind) angle.

(4) Assume the initial waypoint as the initial reference object and a characteristic linear or area reference object as a terminal reference object.

(5) In low clouds refine the ground speed without breaking them and use radio aids for the purpose.

(6) Assume the radio navigation station located at the initial waypoint as the initial point of the route check leg. Determine the moment of reaching the end of the route leg by using the slant distance to a ground radar or the bearing to a side radio station.

(7) Determine the drift angle by selecting the heading with the helicopter magnetic bearing remaining unchanged.

The difference between the helicopter magnetic bearing and the magnetic heading equals to the drift angle.

(8) Select radio navigation aids (main and standby) for each route segment which are to be used for checking the on-course condition both in heading and distance.

(9) Thoroughly study the. operational data of the alternate aerodromes radio navigation aids, as well as descent and landing approach procedures established for these aerodromes.

(10) Calculate the flight data considering the reported wind near the ground or wind determined by the weather reconaissance aircraft. Write down the estimated data such as a magnetic heading, ground speed and elapsed

time in the helicopter Flight Log for each route segment. Refine these data on the route check leg exercising special care in calculating total duration of flight and fuel reserve.

4.24.9. Peculiarities of ДИСС-15 Doppler System Used for Navigation

(1) The ДИСС-15 doppler system (ground speed and drift angle meter) is intended for continuous automatic measurement and indication of the speed vector in hovering, ground speed and drift angle, reckoning; and indication of the helicopter position in spherical co-ordinates. These functions are effected in conjunction with the compass system and vertical gyro installed on the helicopter.

(2) The helicopter estimated position can be displayed by the co-ordinate indicator digital readout relative either to the primary great circle or to the navigation leg selected.

(3) If the primary great circle navigation is to be used in anticipated flight the Pilot-Navigator should perform the following:

(a) During preparation for flight plot on the chart the co-ordinate axes parallel and perpendicular to the true meridian with the point of origin at the point representing the aerodrome of departure.

(b) Plot on the chart grids with lines spaced 2 cm apart irrespective of the chart scale, with the lines marked with figures every 20 to 40 km.

(c) Take from the chart and record the co-ordinates of the initial waypoint, enroute waypoints, field (target), and terminal waypoint relative to the point of origin of co-ordinates.

(d) Set the grivation equal to the magnetic track angle of the primary great circle on the co-ordinate indicator.

If the primary great circle direction is aligned with the true meridian, set the graviton equal to reverse value of the variation (ΔM) at the point of origin of co-ordinates.

For example, if ΔM =+8° set a grivation of 352°, and if ΔM = -5°set a grivation 5°.

Bear in mind that the grivation selector is provided with a mechanical stop at the 0° position which cannot be passed through.

(e) Slave the compass system and select it from the magnetic slaved (MAC) mode to the directional gyro (DG) mode.

(f) Start the co-ordinate computer at takeoff by pressing the ON (ВКЛ) button on the co-ordinate indicator, and the ON (ВКЛЮЧЕНО) annunciator should come on.

(g) Read the XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ - КМ) and TRACK (km) (ПУТЬ - КМ) digital readouts to monitor the distance flown by the helicopter since the start of co-ordinate reckoning relative to the primary great circle.

If the primary great circle direction is aligned with the true meridian in the co-ordinate reckoning starting point read the distance flown by the helicopter in northern direction on the FORWARD (ВПЕРЕД) digital readout, in southern direction on the BACKWARD (НАЗАД) digital readout, read the cross track distance in western direction on the LEFT (ВЛЕВО) digital readout and in eastern direction on the RIGHT (ВПРАВО) digital readout.

(h) Correct readings of the XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ - КМ) and TRACK (km) (ПУТЬ - km) digital readouts by using visual ground contact and omnirange stations.

(4) When flying along a navigation leg the Pilot-Navigator should proceed as follows below:

(a) Operate the L (ВЛ) and R (ВПР) keys to set the XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ - km) digital readout to zero and the FWD (B) and BKWD (H) keys to set the TRACK (km) (ПУТЬ - КМ) digital readout to zero or to the BACKWARD (НАЗАД) position equal to the distance from the initial waypoint to the first enroute waypoint.

If the TRACK (km) (ПУТЬ - km) digital readout is set to zero the distance flown from the initial waypoint will be displayed, and if the readout is set to the BACKWARD (НАЗАД) the distance to go to the enroute waypoint will be displayed.

(b) Slave the compass system and select it from the magnetic slaved (MAG) mode to the directional gyro (DG) mode.

(c) Fly over the initial waypoint on a heading equal to the desired magnetic track angle of the first route segment with the drift angle accounted for. At the moment of passing over the initial waypoint start the dead reckoning by depressing the ON (ВКЛ) key on the co-ordinate indicator and check it for starting by illumination of the ON (ВКЛЮЧЕНО) annunciator.

(d) Read the XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ - КМ) digital readout to monitor the magnitude and sign (direction to the left or to the right) of cross track distance, and read the TRACK (km) (ПУТЬ - km) digital readout to monitor the distance flown from the initial waypoint (or the distance to go to the enroute waypoint).

(e) Correct deviations from the desired track by execution of appropriate corrective turns and on intercepting; the desired track continues flying maintaining the cross track error equal to zero.

(f) Depress momentarily the FORWARD (B), BACKWARD (H), L (ВЛ) and R (ВПР) keys to correct readings of the XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ -КМ) and TRACK (km) (ПУТЬ - КМ) digital readouts by using visual ground contact and omnirange stations.

(g) Before reaching the enroute waypoint proceed to detailed visual orientation, refine the helicopter position and prepare the ДИСС-15 (doppler system co-ordinate indicator for selection to a new navigation leg (the new route leg), for this purpose proceed as follows:

Stop reckoning of co-ordinates by depressing the OFF (ОТКЛ) key on the co-ordinate indicator and check the reckoning for deactivation indicated by going out of the ON (ВКЛЮЧЕНО) annunciator.

Set a chart angle corresponding to the magnetic track angle of the next route segment on the co-ordinate indicator and its data on the XTK DISTANCE (km) (БОКОВОЕ УКЛОНЕНИЕ - km) and TRACK (km) (ПУТЬ - km) digital readouts.

Bring the helicopter to a new route segment magnetic heading with the drift angle accounted for, start reckoning of co-ordinates when passing the route waypoint, and continue flying maintaining the cross track distance equal to zero.

4.25. Flight Manoeuvres

(1) It is allowed to execute flight manoeuvres outside of clouds at horizontal visibility of not less than 2000 m, with the; airspeed and gross weight within their respective allowed limits.

It is allowed to execute the following manoeuvres:

(a) Turns and spirals.

(b) Dives.

(c) Zooms.

(d) Chandelles.

(2) Before execution of flight maneuvers disengage the autopilot altitude channel.

(3) In execution of turns and spirals maintain bank angles indicated in Table 2.7 for altitude and gross weight provided the airspeed is within the allowable limits.

(4) It is allowed to execute power turns and turns at altitudes from 50 up to 1000 m with bank angles up to 45° at normal and subnormal takeoff weights and airspeeds within the limits of 120 to 250 km/h.

(5) At absolute altitude, up to 50 m above the terrain profile the bank angle in degrees may be as high as the altitude in meters but not in excess of the values indicated in Table 2.7.

Monitor the bank angle by reading the АГБ gyro horizon.

4.25.1. Turns and Spirals

(1) Before execution of turn proceed, as follows below:

(a) Check whether airspace in the direction of turn is clear.

(b) Trim the helicopter in horizontal flight at the selected speed and relieve the cyclic pitch control stick loads (pressures) by depression of the trimming button.

(c) Select a reference object for recovery from turn.

(2) Enter a turn through co-ordinate application of the control stick and pedals and maintain selected speed and altitude by changing the main rotor collective pitch.

In entry into LH turn the helicopter shows a tendency to nose down, and in entry into RH turn the helicopter shows a tendency to nose up. Counteract these tendencies by appropriate application of the control stick.

(3) Upon attainment of the selected bank angle indicated on the АГБ gyro horizon note the position of natural horizon relative to the flight compartment glazing at this bank angle and retain this position in the course of turn.

In LH turn the helicopter shows a tendency to increase roll, in RH turn the helicopter shows a tendency to decrease roll.

(4) Counteract the helicopter-rolling tendency by application of the control stick out of turn while in LH turn and into turn while in RH turn, and co-ordinate the turn by appropriate application of the directional control pedals.

(5) Being 15 to 20° short of the selected reference object or desired heading apply the control stick and pedals in a co-ordinated manner out of turn to begin recovery from turn so as the bank angle is completely removed when the helicopter reaches the selected reference object or intercepts the desired heading.

(6) After recovery from turn set the engine power required for horizontal flight.

It is allowed to execute power turns and turns with bank angles up to 45° either with the main rotor collective pitch constant or changed in the course of turn.

(7) If the turn entry speed is less than 200 km/h execute power turns at a constant collective pitch of the main rotor, at turn entry speeds of 200 to 250 km/h execute turns either at a constant collective pitch or with the collective pitch reduction by 2 to 5° as read on the (УШВ) main rotor collective pitch indicator.

During a vigorous entry into a power turn, with the main rotor collective pitch unchanged, the main rotor speed increases by 2 to 2.5%.

Entry into power turn or turn with reduction of the collective pitch is accompanied by vigorous overspeeding of the main rotor. Therefore the rate and degree of the main rotor collective pitch reduction and control stick backward motion in turn should not allow the main rotor speed to exceed the allowable limits.

(8) In execution of a power turn maintain the selected altitude by changing deceleration rate or decreasing the bank angle.

(9) Upon attainment of a speed of 100 km/h smoothly push the control stick forward to discontinue further deceleration and advance the engine power to hold altitude. Initiate recovery from turn being 15 to 20° short of the selected reference object (course).

(10) Execute steady ascending and descending spirals at bank angles indicated in Table 2.7.

(11) Before execution of a spiral, trim the helicopter at a selected speed and relieve forces from the control stick.

(12) Enter a spiral from horizontal flight, climb or descent by co-ordinated application of the control stick and pedals with simultaneous change of the engine power to the rating, which maintains the selected vertical speed constant.

4.25.2. Dive

(1) Before initiation of dive proceed as follows below:

(a) Observe airspace, particularly in the direction of dive.

(b) Establish a desired speed and respective engine power.

(c) Relieve the cyclic pitch control stick force.

(d) Set the radio altimeter altitude selector to the dive recovery altitude.

(2) Depending on the altitude and initial speed in the horizontal flight execute dive with pitch angle changes (from the initial pitch angle the selected speed) not exceeding values indicated in Table 4.3.

Table 4.3

Altitude, m	Maximum pitch-down angle from initial pitch angle (in degrees) for dive entry speed, km/h			
	150 and less	180	200	220
Up to 500	20	20	15	10
500 to 1000	20	20	15	-
1000 to 2000	20	10	-	-

Read the diving angles on the АГБ-3К gyro horizon.

(3) After execution of a manoeuvre (zoom, chandelle, etc.) enter dive at

pitch-down angles not exceeding those indicated in Table 4.3 for a speed of-150 km/h.

(4) Enter dive from horizontal flight with the pitch angle changing up to 20° within a period of time not less than 5 to 6 s and the control stick being pushed forward at a constant main rotor pitch, preventing the helicopter from turning and rolling.

A dive entry is accompanied by a main rotor speed drop by 1 to 2%.

(5) To enter dive from a turn in which the helicopter is banked up to 30° smoothly push the control stick forward to establish a selected diving angle with simultaneous rolling out (recovery from bank).

(6) Execute dive at a constant main rotor collective pitch.

Counteract the helicopter tendency to decrease the dive angle with speed increasing by timely and smooth pushing the control stick forward.

Monitor the dive angle, freedom from rolling, skidding and slipping visually and by reading the АГБ gyro horizon.

The maximum dive recovery initiation speeds are indicated in Table 4.4 or the dive pitch-down angle and altitude.

Table 4.4

Altitude, m	Maximum dive recovery initiation speed (in km/h) for diving pitch-down angle (in degrees)	
	10	20
Up to 1000	285	270
1000 to 2000	235	220

(7) On reaching a selected diving speed or a selected dive recovery altitude, with a sharp loss of altitude accounted for, pull vigorously the control stick backward at a constant main rotor collective pitch to initiate recovery from dive.

Execute recovery from dive within a period of time not less then 8 to 9 s, avoiding main rotor overspeeding above 103%.

The altitude sharp loss in dive recovery within a period of time of 6 to 9 s is indicated in Table 4.5 for the dive recovery initiation speed and the dive pitch-down angle.

(8) On reaching a pitch-up angle of 10° during recovery from dive and discontinuation of descent, push smoothly the control stick forward to establish horizontal flight avoiding main rotor speed drop below 89% and set the engine power corresponding to the next regime of flight or maneuver.

Table 4.5

Dive recovery initiation speed, km/h	Altitude loss (in meters) for diving pitch-down Angle (in degrees)	
	10	20
180	60	90
200	70	120
220	85	150
240	100	180
260	115	200
280	130	220

4.25.3. Zoom

(1) Before entering zoom proceed as follows below: Observe the airspace in

the direction of zoom.

(b) Establish a selected speed end respective engine power.

(c) Relieve the cyclic pitch control stick pressure (force).

(2) Enter zoom from horizontal flight by pulling the control stick back at speeds not exceeding the maximum limits indicated in Table 2.8.

The recommended zoom entry speed is not less than 150 km/h.

The rate and travel of the control stick backward motion should be such as the helicopter pitch angle changes by 20° within a period of time not less than 6 to 7s. Maintain the main rotor collective pitch constant during entry and recovery from zoom.

(3) Upon reaching a selected pitch-up angle fix this angle by slightly pushing the control stick forward. Counteract the helicopter tendency to decrease the pitch-up angle with the speed decreasing in the straight segment of the zoom path by timely and appropriate application of the control stick backward.

(4) Monitor the pitch-up angle in zoom, freedom from bank, skidding and slipping by reading the АГБ gyro horizon.

(5) Initiate recovery from zoom upon attainment of a speed of 110 to 100 km/h by pushing the control stick forward at a rate ensuring establishment of horizontal flight within a period of time not less than 5 to 6s, avoiding deceleration below the minimum speed level established for a given altitude.

(6) After recovery from zoom to horizontal flight set the engine power required for the next regime of flight or manoeuvre.

(7) The average values of climb and time of zoom execution for initiation altitudes up to 1000 m and initiation speeds of 180 to 200 km/h with a respective change in the pitch-up angles are indicated in Table 4.6.

Table 4.6

Pitch-up angle, deg	Climb in zoom, m		Zoom execution time, s	
	Initial speed of 180 km/h	Initial speed of 200 km/h	Initial speed of 180 km/h	Initial speed of 200 km/h
10	130	200	22	30
20	100	150	14	17

4.25.4 Chandelle

(1) The chandelle is used for rapid 180° (90°) turn after climbing in zoom.

The procedure of execution of the first half of chandelle does not differ from that of zoom.

The recommended zoom entering speed is within the limits of 180 to 220 km/h provided it does not exceed values indicated in Table 2.1.

Execute a chandelle with the main rotor collective pitch constant.

(2) On reaching a speed of 120 km/h in zoom apply the control stick and pedals towards the direction of turn to make a turn with a bank angle up to 30° (the steeper is zoom, the higher should be the angle of bank in turn).

(3) On reaching a selected bank angle push smoothly the control stick for ward to reduce the helicopter pitch angle to maintain the co-ordinated turn condition and avoid speed decrease below 70 km/h.

(4) In execution of a left chandelle the helicopter demonstrates a tendency to increase roll, in execution of a right chandelle the helicopter demon-

strates a tendency to decrease roll. Counteract the helicopter rolling tendencies by application of the control stick out of turn in left turn and into the turn in right turn, and maintain the co-ordinated turn condition by appropriate application of the pedals.

(5) Being 15 to 20° short of a selected reference object (course) apply the control stick and pedals in a co-ordinated manner to recover from turn into horizontal flight at a speed of not less than 70 km/h.

Warning: 1. Never execute dive entry and recovery from zoom within a period of time less thar 5 to 6 seconds.
2. Never change the main rotor collective pitch in zoom or dive.

4.26. Flying In Turbulent Atmosphere (Bumpy Air)

(1) Piloting of the helicopter in slight and moderate turbulence does not represent great difficulties: indicated airspeed varies within the limits of 20 to 30 km/h, the readings of rate-of-climb indicator are unstable, heading varies within the limits of 4 to 6°. Load factors are moderate therewith and are felt slightly. With the autopilot disengaged the amount of the flight controls displacement increases.

(2) The helicopter flying in heavy turbulence features considerable increments of load factors, frequent and sharp bumps up and down, jerks in roll, pitch and yaw, and considerable speed variations.

Warning: Never conduct prolonged flying in heavy turbulence (bumpiness) characterized by vertical bumps more than 30 to 50 m in height, variation of the indicated airspeed up to 30 to 40 km/h, marked rise of load factors.

Upon entering a zone of heavy turbulence change altitude to leave the zone or abort mission and land on the departure or alternate aerodrome.

In case of urgent necessity to continue flight perform it at 160 to 190 km/h IAS and altitudes up to 2000 m. At altitudes above 2000 m fly at a speed which is 15 to 30 km/h IAS below the maximum speed limits established for the respective altitude.

(3) In flight at an altitude up to 300 m in gusty wind exceeding 8 m/s or at any altitude in heavy turbulence, keep the autopilot altitude channel disengaged. If jerks are felt on the pedals disengage the autopilot YAW (km) (НАПРАВЛЕНИЕ) channel.

During prolonged flying in low turbulence at an altitude above 50m keep all the autopilot channels engaged, and at an altitude below 30 m fly with the altitude channel disengaged.

Section 5

PERSONNEL AND CARGO TRANSPORTATION

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5. PERSONNEL AND CARGO TRANSPORTATION

5.1. Transportation of personnel and cargo in cargo compartment

(1) All the loading/unloading operations should be performed on the helicopter in accordance with the present Flight Manual. Positions and duties of the loading team members as well as the arrangement of cargo and equipment in the helicopter cargo compartment and their tie-down procedures are set forth by the instructions for aerial transportation of specific type of equipment.

(2) Loading, tie-down, release and unloading of cargo are performed by teams of units sending or receiving the cargo.

The teams are briefed on safety precautions and operational procedures by the Captain or, upon his order, by the Pilot-Navigator.

(3) Loading and arrangement of cargo in the helicopter are supervised by the Captain, unloading is supervised by the Flight Engineer, the latter being also responsible for correct and reliable tie-down of cargo.

(4) Before loading the Captain should require from the leader of the team sending the cargo a bill of lading listing the cargo nomenclature, overall dimensions and weight of each item. Each cargo item should be marked with the CG position marks.

5.1.1. Loading of Helicopter

(1) Load bulky cargo items through the cargo door with the use of ramps. Small cargo items may be loaded through the sliding door located at the LH side. Before loading open and lock open the cargo doors, adjust the ramps to a required track of the equipment (cargo on a trolley), check availability and serviceability of the required hoisting and tie-down equipment.

(2) Before loading the equipment should be placed as close as possible to the ramps on the aircraft center line. Load the non-self-propelled equipment provided with wheels (cargo on the trolley) by means of the ЛПГ-150М loading winch powered by the ground electric power source or by the aircraft electrical system with the engines running.

The ЛПГ-150М winch is operated by the Flight Engineer.

(3) Load the equipment provided with wheels (cargo on the trolley) which weight does not exceed 750 kg by means of the ЛПГ-150М winch without a pulley block. Load the equipment which weight is within the limits of 750 to 1500 kg by means of the winch with a two-fold pulley block, at the weight being within the limits of 1500 to 2500 kg with a four-fold pulley block, and at the weight being within the limits of 2500 to 3000 kg with a five-fold pulley block should be used.

Load the self-propelled equipment being self-propelled or by means of the ЛПГ-150М winch.

When loading the tricycle equipment first place one of the ramps in the central .position under the forward wheel. After the forward wheel is rolled into the cargo compartment position the ramps at their extreme positions under the main wheels and continue loading.

(4) Never load the cargo by dragging except for the cases specified in the instructions for aerial transportation of specific types of equipment and cargo.

(5) During arrangement of cargo observe the floor loading limitations for specific areas of the cargo compartment which are indicated on the placard placed on the cargo compartment RH side wall panel.

(6) To maintain the CG position within the specified limits arrange the cargo items lengthwise of the cargo compartment so as their common CG is between the blue and red arrows corresponding to the total weight of cargo marked on the cargo compartment RH side wall.

At the helicopter maximum takeoff weight (13000 kg) the load weight including the tie-down provisions should not exceed 4000 kg.

(7) After completion of loading place the ramps into their respective stowage and close the cargo doors.

5.1.2. Unloading of Helicopter

(1) Unload the equipment from the helicopter reversing the loading procedure. Unload individual light cargo items manually.

Unload the self-propelled equipment both self propelling and by means of the ЛПГ-150М winch.

5.1.3. Transportation of Personnel

(1) The maximum number of landing troopers transported by the helicopter is 24 persons (with an average weight of each of 100 kg). The landing troopers should be placed only on the seats. With 22 to 24 landing troopers aboard place them in accordance with the numbers of the seats. With less than 22 landing troopers aboard place them in seats beginning with No.3. Leave seats Nos 1 and 2 vacant. To perform search and rescue operations (lifting of a person or a load of 150 kg by the aircraft hoist boom) troopers are to be seated beginning with No. 7 and should occupy seats Nos 1 to 7 in the last turn to ensure the forward CG limit.

The leader of the landing party should occupy the seat No. 22. In this case he is allowed to walk around in the cargo compartment in flight.

Warning: The landing troopers are not allowed to walk around in the cargo compartment in flight.

5.1.4. Transportation of Cases

(1) The helicopter is capable of transportation of 12 stretcher cases. If the number of cases is less than 12 the first three of them are placed on three stretchers in the rear along the helicopter RH side. Then on three stretchers in the front along the LH side, and then on three stretchers in the rear along the LH side, and then on three stretchers - in the front along the RH side.

(2) The medical attendant accompanying the cases is allowed to move to any place of the cargo compartment in flight.

(3) The maximum number of cases including the medical attendant should not exceed 24. The order of their accommodation in the seats is the same as for transportation as 5.1.3 (1).

(4) If, in case of combined transportation, the number of cases is 20 they should include 3 stretcher cases and 17 seated cases, and one medical attendant.

5.2. Transportation of hazardous cargo

(1) In transportation of hazardous cargo (explosives, toxic substances, etc.) the Captain should adhere to the respective "Rules for aerial transportation of hazardous cargo".

5.3. Preflight inspection and functional check of external load sling system

(1) Before a flight in which use of the external load sling system is anticipated, the Flight Engineer should proceed as follows:

(a) Inspect the external load sling system fittings at frames Nos. 7and 10

(b) Check the door for easy opening.

(c) Check the pivoting shackle for easy rotation.

(d) Install the hatch guards.

(e) Check the weight meter.

(f) Check the door for reliable locking at the hatch guards.

(j) Run the winch cable through the pulley system to the hatch in the cargo compartment floor.

(h) Connect the ПУЛ-1А system cable to the connector at the cargo compartment ceiling.

(i) Switch on the SHACKLE CONTROL (УПРАВЛЕНИЕ), MAIN (ОТКР. ЗАМКА ОСНОВН.) and AUX (УПР. ОТКР. ЗАМКА ДУБЛИР) circuit breakers.

(g) Set the AUTO RELEASE (АВТОМАТ. СБРОС) switch to the lower position. This done, the SHACKLE OPEN (ЗАМОК ОТКРЫТ) green annunciator should come on if the lock is released.

(k) Close the external load sling system shackle. This done, the SHACKLE OPEN (ЗАМОК ОТКРЫТ) annunciator should go out.

(l) Check functionally the load normal release system by depressing the NORMAL RELEASE (ТАКТИЧЕСКИЙ СБРОС) button located at the Captain's collective pitch control lever. This done, the external load sling shackle should be released and the SHACKLE OPEN (ЗАМОК ОТКРЫТ) annunciator should come on.

(m) Check functionally the load emergency release system by depressing the EMERGENCY RELEASE (АВАРИЙНЫЙ СБРОС) button at the Captain's collective pitch control lever. This done, the external load sling shackle should be released and the SHACKLE OPEN (ЗАМОК ОТКРЫТ) annunciator should come on.

(n) Check functionally the load automatic release system for which purpose close the shackle and set the AUTO RELEASE (АВТОМАТ. СБРОС) selector switch to the upper position. This done, the shackle should be released.

(o) Check the load mechanical release system for which purpose close the shackle, open it by means of the mechanical control handle pushing it upward. This done, the SHACKLE OPEN (ЗАМОК ОТКРЫТ) annunciator should come on.

(p) Check operation of the СПУ-7 interphone system from the control box installed near the external load hatch.

5.4. Flight with external load

(1) Only the crews skilled in piloting the helicopter with the maximum takeoff weight are authorized to fly the helicopter with external loads.

A special site is set up on the airfield and a flying control officer is appointed for training the crews for external load transportation.

Successful execution of flights with external load depends mainly on efficient cooperation of the Pilot with the flying control officer and harmony in work of the Pilot and the Flight Engineer.

(2) The flying control officer stands on the ground within the Captain's field of vision at a distance of *50* to 100 m from the point of load attachment (release) and guides the helicopter to the load by issuing orders through the radio channel.

After the load comes within the field of vision of the Flight Engineer, further precise guidance to the load is effected by Flight Engineer's orders. The flying control officer reports only the helicopter clearance above the load in hovering.

(3) After the load is attached and lifted, as well as during approach to the load release area, the flying control officer assumes control. He reports to the Captain the load behavior in flight, the load clearance above the ground, gives permission to proceed from hovering to forward flight.

(4) Training of the crews for flying with external load should be commenced with external loads up to 1000 kg. The external load weight should be increased up to the maximum value gradually, as the crew experience is gained.

The maximum weight of external load should not exceed 3000 kg (5000kg – reinforced load sling) with the helicopter maximum takeoff weight (including that of the external load) not exceeding 13000 kg.

(5) The helicopter maximum speed for transportation of external load depends on the behavior of external load in each specific case but it should not exceed 250 km/h IAS.

(6) Depending on actual conditions, attachment of load to the helicopter external load sling system can be carried both with the helicopter landed on a site near the load or hovering (the latter procedure being used when landing on a site near the load is impossible).

5.5. Attachment of external load after landing

(1) Lend the helicopter near the load, taxi close to the load so as it is at a distance of 1 to 2 m from the main LG wheel and set idle power to the engines. To facilitate takeoff and approach to the load it is advisable to land and taxi so as the load is to the left from the helicopter.

(2) Switch on the SHACKLE CONTROL (УПРАВЛЕНИЕ), MAIN (ОТКР. ЗАМКА ОСНОВН.), AUX (УПР. ОТКР. ЗАМКА ДУБЛИР.) circuit breakers.

(3) Set the AUTO RELEASE (АВТОМАТ. СБРОС) switch to the lower position and make sure that the ДГ-64 shackle is released which is indicated by illumination of the SHACKLE OPEN (ЗАМОК ОТКРЫТ) annunciator.

(4) The Captain should execute takeoff and proceed to hovering so as the main LG wheels are not more than 1 to 2 m clear of the ground, and make sure that the power plant and special equipment instruments readings are normal.

(5) Give an order to the Flight Engineer to unreel the helicopter winch cable through the cargo compartment floor hatch to pull up the extension cable and lock it by the ДГ-64 shackle.

(6) A ground technician should engage the extension cable hook with the external load slings pivot ring, with the slings snap hooks being previously connected to the load fittings. After the hook attached to the helicopter winch cable touches the ground connect it to the extension cable lug, give a signal to the Flight Engineer indicating that the load is attached and move 25 to 30m away from the load.

(7) The Flight Engineer, after receiving the ground technician's signal indicating attachment of the load, should pull in the helicopter winch cable with the extension cable attached to it and connect the extension cable lug to the ДГ-64 shackle, disconnect the helicopter winch cable hook from the extension cable lug, and report to the Captain about the load readiness for lift.

(8) The Captain, after receiving the Flight Engineer's report, should check the ДГ-64 shackle for closed position indicated by going out of the SHACKLE OPEN (ЗАМОК ОТКРЫТ) annunciator, and slightly lift off the helicopter to execute a small shift towards the load so as the distance from the main LG wheels to the load is 1 to 2m.

(9) In the course of shift and transition to hovering above the load the Flight Engineer observes the load through the cargo compartment hatch and corrects the pilot's actions by transmitting short orders through the inter phone system in which he indicates, apart of the direction, approximate distance and height (0.5 m back, 1 m down, etc.).

(10) On hovering above the load smoothly move up the collective pitch control lever to increase the helicopter hovering altitude until the external load sling system cables are completely pulled up.

Keep the helicopter strictly above the load and avoid longitudinal and lateral shifts (following the Flight Engineer's orders).

(11) After the external load sling system cables are completely pulled up smoothly move up the collective pitch control lever to advance power up to takeoff and lift the load off the ground to clear it not less than 3 m from the ground.

(12) Make sure the load behavior in hovering is normal and the load clearance from the ground is not less than 3 m for safety reason in acceleration, push smoothly the control stick forward to establish forward speed. If transition from hovering to forward flight is executed smoothly the helicopter does not practically lose altitude.

(13) On attaining a speed of 100 km/h IAS, climb and reduce the engine power to the maximum continuous power rating.

When transporting the external load, execute maneuvers (such as acceleration, deceleration and turns) smoothly and slowly to avoid swinging of the load.

Behavior of the external load is dictated mainly by its aerodynamic configuration. Therefore, in the initial stages of flight, select such condition of flight by changing the speed at which behavior of the external load is most quiet. But it is necessary to bear in mind that the fuel consumption per kilometer will reduce with speed rising up to the best one.

(14) The Flight Engineer should monitor behavior of the external load in flight through the cargo compartment blisters.

(15) In flight with external load it is recommended to descend along a shallower path with altitude and speed decreasing smoothly and gradually. Descend down to the deceleration initiation point at a vertical speed not exceeding 2 to 3 m/s maintaining gliding speed within the limits of 100 to 110 km/h depending on behavior of the external load.

(16) Decelerate the helicopter gradually with the engine power being advanced smoothly and without significant changes in pitch attitude. Due to this feature deceleration proves to be more extended in time than in normal vertical landing and is accompanied by high vibration of the helicopter (from a speed of 70 km/h down to complete transition to hovering).

(17) When reduction of speed (deceleration) is initiated too early, hover with the external load being short of its point of release (in hovering the external load ground clearance should be not less than 3 m) and then shift to the point of release at a speed of 5 to 10 km/h.

(18) If the pilot did not manage to reduce speed by the moment of approach to the point of release, abort further deceleration, accelerate up to 100 km/h IAS without reduction of the engine power and proceed to climb, and execute repeated approach to the external load release area.

(19) On establishing hovering above the point of release smoothly push the collective pitch control lever down to reduce the hovering height and bring the external load in contact with the ground. This done, slacken the external load sling system cables by reducing the hovering height, shift the helicopter a bit aside from the load so as during release the external load sling system cable and the extension cable would not fall onto the load, and depress the external load normal or emergency release button. Thereafter the SHACKLE OPEN (ЗАМОК ОТКРЫТ) annunciator should come on.

(20) Make sure that the shackle is released (by illumination of the annunciator) and the external load is released (upon the report of the Flight Engineer) increase the hovering altitude by 1 to 2m, shift away from the external load in a selected direction and land.

If the external load is to be released by automatic release of the external load shackle, before deceleration in the course of landing approach switch on the AUTO RELEASE (АВТОМАТ. СБРОС) switch. In this case the external load shackle will be automatically released at the moment the external load contacts the ground. But bear in mind that in case of automatic release of the external load shackle, some items can be damaged by the released cables of the sling system. Therefore, in selection of the external load release procedure it is necessary to account for the load nature.

5.6. Attachment of external load in hovering

(1) Establish hovering in close proximity to the external load so as the main LG wheels-to-ground clearance does not exceed 2 m.

(2) Give to the Flight Engineer an order to unreel the helicopter winch cable through the cargo compartment floor hatch to pull up the extension cable and its connection to the ДГ-64 shackle.

(3) After the hook attached to the helicopter winch cable touches the ground the ground operator should connect it to the extension cable lug.

On completing the load attachment operations the ground personnel should go away to a safe area to avoid hitting by the load or the external load sling system cable if they are released.

(4) The Flight Engineer should operate the helicopter winch to pull up the extension cable, attach it by means of the connection lug to the shackle, disconnect the helicopter winch hook from the extension cable lug, and report readiness to lifting of the load to the Captain.

(5) After the Flight Engineer reports the completion of the load attachment procedure, the Pilot executes a shift towards the load with a slight ascent to pull up the external load sling system cable and position the helicopter precisely above the load. Smoothly pull up the collective pitch control lever to establish vertical ascent until the load lifts off the ground.

Further actions of the helicopter crew and the flying control officer are the same as upon attachment of the load after landing of the helicopter.

Warning: 1. To protect the ground personnel from static electricity effects they are not allowed to begin load attachment operations before the winch cable contacts the ground.

2. To avoid injury of hands the ground personnel is not allowed to reposition the external load sling system hooks during pulling up of the external load sling system cables in hovering.

3. The Flight Engineer is not allowed to work without the safety belt put on.

4 The Flight Engineer is not allowed to work if the cargo compartment floor hatch guard is not installed.

(6) The ground condition should be taken into consideration in flight with external load. If snow or dust is present on the ground it is necessary to establish hovering before initiation of the attachment procedure and blow off snow or dust from the spot by the main rotor down wash. Only after the load is clearly visible in hovering proceed to approach maneuver and attachment.

The load release area should be prepared in advance by removing obstacles, watering if dusty, or rolling if covered with newly fallen snow.

5.7. Peculiarities of night flying with external load

(1) Only the crews skilled in night flying and in transportation of external loads by day are authorized to execute night flight with external load.

Only the loads which behaviour has been checked during transportation by day time are allowed to be carried externally at night.

The crew actions in transportation of external load at night, as well as the load attachment (release) procedures are the same as by day.

In order to improve the operating conditions during attachment of the load it is advisable to illuminate the load by a floodlight or other means.

Warning: In flight with external loads made of metal the radio altimeter readings may be erroneous. Under such a condition assess the hovering height visually and by the reports of flying control officer.

If the ground lights are not available, attachment (release) of the load may be effected with the area illuminated only by the helicopter landing lights.

In all conditions, including illumination of the area by a ground floodlight proceed to hovering above the load with the helicopter landing lights on. The right light beam should be directed downward and illuminate the load

and terrain below the helicopter, the left landing light beam should be directed forward and downward and illuminate the terrain in front of the helicopter.

After attachment and lift-off of the load assess the ground clearance by reading the radio altimeter which alert altitude selector is set before take-off to an altitude exceeding the total length of the external load by 3 to 5 m.

(2) Accelerate and climb with the lights on. At an altitude of 70 to100 m switch off the lights and proceed to IFR flying.

The Flight Engineer should monitor the load behaviour in flight for which purpose the Pilot-Navigator should periodically illuminate the load by the landing light.

The load release area should be marked with a light beacon.

Execute approach to the landing area, landing and release of the load the landing lights being on: the right light beam being directed downward and the left light beam being directed forward and downward.

During the flight thoroughly monitor altitude by reading the radio altimeter. Actuation of the alert altitude selector indicates that the load-to-ground clearance is 3 to 5 m. Refine aiming at the load release area without descent.

5.8. Preflight inspection and functional check of helicopter hoist boom and ЛПГ-150М winch

(1) Before flight in which use of the hoist boom is anticipated the Flight Engineer should proceed as follows:

(a) Inspect visually the hoist boom for proper condition and attachment, proper attachment of the ЛПГ-150М winch to the boom, proper condition of the hook.

(b) Check the hoist boom and lock it in the operating position.

(c) Switch on the B2 and B3 circuit breakers at the КУЛ-150 control box.

(d) Slacken the winch cable by momentary depression of the EXTEND (ВЫПУСК) button and the switch, located on the ПУЛ-1А control panel.

Disconnect the snap hook from the hoist boom handle lug, remove the pivot from the lug and lower it to the operating position.

(e) Depress the EXTEND (ВЫПУСК) button and the switch on the ПУЛ-1А control panel to unreel 1.5 to 2 m of cable preventing the pivot from contacting the ground. The winch cable should unreel at half speed.

(f) Depress the EXTEND (ВЫПУСК) button on the ПУЛ-1А control panel (without depression of the switch) and unreel 8 to 10 m of cable. The cable should be tensioned by a load not less than 5 to 6 kg.

The winch cable should unreel at the full speed.

(g) Depress the RETRACT (УБОРКА) button on the ПУЛ-1А control panel, and the cable should reel in at the full speed.

When 4 to 6 m of cable are left the winch should select to half speed.

(h) Switch off the B2 circuit breaker of electric motor No. 1, and the cable retraction should discontinue.

(i) Switch on the EMER MOTOR START AT FAILURE AT CABLE RETRACTION END (АВАР. ВКЛ. ДВИГ. ПРИ ОТКАЗЕ В КОНЦЕ УБОРКИ) switch, located on the КУЛ-150 control box, and the cable starts retracting at half speed by electric motor No. 2.

(j) After the cable is completely retracted and the winch is stopped, switch off the EMER MOTOR START AT FAILURE AT CABLE RETRACTION END (АВАР. ВКЛ. ДВИГ. ПРИ ОТКАЗЕ В КОНЦЕ УБОРКИ) switch.

(k) Connect the pivot snap hook to the hoist boom handle lug, unreeling the cable as required and take up the cable slack.

(l) Switch off the B2 and B3 circuit breakers and lock the hoist boom in the stowed position.

5.9. Lifting of men (load) aboard helicopter in hovering by hoist with ЛПГ-150М winch

(1) Give the following order to the Flight Engineer: "Put safety belt on, open cargo compartment entrance door and prepare for operation of hoist boom".

(2) The Flight Engineer should proceed as follows below:

(a) Take the station near the cargo compartment entrance door upon the Captain's order.

(b) Connect the headset receptacle to the interphone selector panel at frame No. 5H. Set the ON - OFF (ВКЛ - ВЫКЛ) microphone switch, located on the interphone selector panel to ON (ВКЛ).

(c) Switch the MOTOR 1 (ПЕРВЫЙ ДВИГАТЕЛЬ) and MOTOR 2 (ВТОРОЙ ДВИГАТЕЛЬ) circuit breakers, located on the ЛПГ-150М winch control box, on.

(d) Put the safety belt on, insert the retainer pin into the safety belt lock and attach the safety belt cable snap hook to the ring at the strap. The other end of the cable should be attached to the fitting provided at the web of frame No. 5H.

(e) Open the entrance door, set the hoist boom to the operating position and report readiness for operation to the Captain.

(3) Hover over the area from which lifting will be performed so as the clearance above the person (load) to be lifted is 6 to 15 m. If surrounding obstacles are present, hover at a height ensuring a clearance not less than 3 to 5 m above the obstacles (the load up and down travel should not exceed 40 m).

Give the following order to the Flight Engineer: "Unreel hoist boom cable".

(4) Upon the Captain's order the Flight Engineer extends the winch cable until the grounding cable touches the ground to prevent the ground personnel exposure to static electricity. As this takes place, the main cable should remain tensioned, this condition being ensured by a weight of 5 kg provided by the construction.

Notes: 1. To avoid injury to the person (damage to load) being lifted by the cable hook, extend the cable aside of the person (load).

2. When the hook loaded by the 5 kg load touches the ground, this condition being indicated by slackening of the cable, the ЛПГ-150М winch stops the extension of the cable automatically.

(5) After the grounding cable touches the ground the ground personnel attaches the sling system of the person (load) being lifted to the hook, and gives a signal to the Flight Engineer indicating readiness of the person (load) for lifting.

(6) The Flight Engineer should proceed as follows:

(a) Having made sure that the sling system of the person (load) being lifted is attached to the hoist boom winch cable, the Flight Engineer reports to the Captain readiness of lifting and upon his order lifts the person (load) and moves him (it) into the cargo compartment simultaneously monitoring the person (load) behavior on the winch cable. Control the winch operation by means of the ПУЛ-1А control panel.

(b) If swinging of the person (load) being lifted is observed proceed as follows: when the person (load) being lifted is at a distance of 2 to 4- m beneath the helicopter, temporarily discontinue reeling the cable up, snap the cable by hand in a glove and stop swinging, for which purpose make 2 to 3 strokes by hand in opposite phases to the person (load) oscillation and further on continue reeling the cable up using one motor of the winch.

(c) At the end of lifting .procedure, after completion of the cable reeling up, assist the person in climbing into the cargo compartment through the entrance door or pull the load being lifted into the cargo compartment (at the end of lifting, upon contact of the hook pivot with the hoist boom, the ЛПГ-150М winch is automatically de-energized).

(d) Report to the Captain that the person (load) being lifted is aboard the helicopter, set the hoist boom to the stowed position and close the entrance door.

(e) Arrange the lifted load in the compartment, tie it down, occupy own station, report to the Captain that the load is lifted aboard and tied down.

Warning: 1. At the initial and end phases of lifting the person, load or the hook with the 5-kg load only one electric motor of the ЛПГ-150М winch should be energized (with the control panel switch depressed).

2. In all cases when the cargo compartment door is open in flight (when handling the hoist boom or external load) the Flight Engineer should have the safety belt put on.

3. When lifting the load (or conducting the search and rescue operations) by means of the ЛПГ-150М winch and at simultaneous arrangement of the load in the cargo compartment it is necessary to have the service tank completely filled to 445 liters.

5.10. Training parachute jumping from helicopter cargo compartment

(1) It is allowed to execute single and group parachute jumps from the helicopter through the entrance door opening and the cargo door opening, the latter with the cargo doors removed. The number of parachutists in the group is determined by the jumping control officer depending on their skills.

(2) It is allowed to use the emergency, sport and training parachutes for bailing out from the helicopter in horizontal flight at 60 to 250 km/h IAS with the parachute packs being ripped out not earlier than 2 seconds after jumping from the helicopter, and at speeds of 140 km/h and more with the parachute packs being ripped out by the static lines.

Warning: Do not jump from the helicopter with the parachutes which static lines rip out the parachute packs and pull the bag from the canopy.

The minimum altitude of the helicopter during jumping of the parachutists is selected by the Jumping control officer in accordance with appropriate instructions.

(3) The maximum number of parachutists accommodated on the cargo compartment seats is 20.

In case of partial loading of the helicopter with the parachutists they are arranged in accordance with the orders of the Captain or the Pilot-Navigator.

When the cargo door is used for Jumping with parachutes, the double-place seats located near the door opening edge should be left vacant and set to the stowed position to ensure the door guard opening in flight. In this case the number of parachutists accommodated on the seats should not exceed 16.

(4) When the group jumping is carried out during a single pass, the time interval in jumping at speeds above 140 km/h should be not less than 1 s, and 2 to 3 s at speeds below 140 km/h.

Warning: 1. Never perform group jumping through the cargo door opening with the use of the manually-released sport-training and emergency parachutes whose release mechanisms are actuated by means of the static line.

2. Never execute training jumping simultaneously through the entrance and cargo door openings.

(5) The dimensions of a landing area for parachute jumping are determined depending on the specific conditions.

If the parachutists jump from several helicopters flying in formation the landing area dimension should be increased by a value equal to the helicopter formation width.

When jumping with delayed parachute deployment it is necessary to account for displacement of the parachutists in free falling until the parachute is deployed.

If skilled parachutists execute jumping with the sport parachutes, the dimensions of landing area may be reduced upon decision of the jumping control officer.

5.10.1.Preflight Check before Parachute Jumping

(1) The Flight Engineer should proceed as follows:

(a) Check the presence and proper condition of the equipment and provision used for parachute jumping in the helicopter.

(b) Check the entrance door opening edge for proper condition to avoid cutting of the parachute static lines.

(c) Make sure that two flags, white and red, 32x22 cm in size, attached to sticks of 40 cm long and intended for duplication of signals during jumping of the parachutists are available.

(d) Report to the Captain about readiness of the equipment and provisions used for parachute jumping.

(2) During preflight preparation the Pilot-Navigator should proceed as follows:

(a) Use the pilot balloon data to estimate the parachute jumping initiation point.

(b) Test the audio and light indication system used for issuing signals for jumping of the parachutists.

(c) Check the parachutists for correct accommodation in the cargo compartment and their knowledge of the commands and signals given in flight.

(3) The jumping control officer should make sure the parachutists are ready for jumping and correctly accommodated in the helicopter, and report this to the Captain.

(4) After the parachutists are accommodated on the cargo compartment seats the Flight Engineer should close the entrance door and the cargo door opening protective guard, and report readiness of the parachutists for jumping to the Captain.

5.10.2. Crew Members' Duties in flight at Parachute Jumping Mission

(1) Captain is responsible for accurate arrival of the helicopter to the estimated point of parachute jumping and accurate hold of the selected altitude and speed during parachute jumping.

His duties are listed below:

(a) Before departure give an order to the parachutists to engage the static lines snap hooks with the static cables.

(b) After giving the JUMP command to the parachutists abstain from any changes in the flight condition until jumping of the parachutists is completed and the static lines are removed.

(c) Report to the flight control center and the jumping control officer about completion of the mission and presence of the parachutists remaining in the helicopter.

(d) Exercise special care during takeoff and landing to avoid collision with the descending parachutists.

(e) Maintain communications with the leader of the group of parachutists through the interphone system or the Flight Engineer.

(2) Pilot-Navigator is responsible for accurate navigation and accurate jumping of the parachutists in location and time.

His duties are listed below:

(a) Know location, dimensions and characteristic features of the parachutists landing (splash-down) area, as well as the pass course, speed, altitude and sequence of jumping of the parachutists.

(b) Refine in flight the estimated point of jumping by dropping the drift parachutes or jumping of one or two parachutists.

(c) 1 minute before initiation of jumping give voice call BE READY or through the interphone, and JUMP command given by prolonged signal of the horn at the moment the helicopter reaches the jumping initiation point.

(d) Discontinue jumping in case of necessity and upon expiration of the estimated time required for jumping of the parachutists by immediately calling AS YOU WERE.

(3) The Flight Engineer's duties are listed below:

(a) Transmit all the Captain's orders and instructions to the jumping control officer and inform the latter of the weather conditions in the landing area.

(b) On the Pilot-Navigator's call BE READY give the signal to the parachutists by raising the flag over the head and on the JUMP command wave the flag. Order AS YOU WERE is given by waving the red flag.

(c) Upon completion of parachute jumping remove the static lines and close the entrance door.

(d) Conduct all operations in close proximity to the helicopter entrance door with the parachute and safety belt put on.

(4) The jumping control officer's duties are listed below:

(a) 2 to 3 minutes before initiation of jumping, upon the Captain's order rise from his seat, stow the seats, open the entrance door or the cargo door opening guard and observe the terrain below, the signals of the crew members (Flight Engineer) and watch the parachutists.

(b) After separation of the parachutists jumping in one pass, remove the static lines with bags into the helicopter compartment and close the door or the guard.

Before disconnection of the static lines snap hooks, the bags should lay on the cargo compartment floor (outside of the rubber carpet for 5 to7 s to discharge static electricity).

(5) If the bags get caught by the airframe components so as it proves impossible to take them into the cargo compartment the jumping control officer reports this condition to the Captain. The Captain discontinues jumping of the parachutists and lands the helicopter. During landing the jumping control officer attaches himself to the airframe by means of the safety belt, keeps the static lines with bags and, if they get free near the ground (at a height of 5 to 7m) quickly takes the bags into the helicopter to avoid their catching by the main rotor blades.

(6) If the parachutists hang up, the jumping control officer discontinues jumping, reports this event to the Captain and without releasing the hung-up parachute static line snap hook from the static cable engages one snap hook of the safety belt cable with the static line and another snap hook of this cable with the attachment fitting provided over the flight compartment entrance opening or with the tie-down fitting on the cargo compartment floor, takes the static lines with bags into the helicopter and reports readiness for landing to the Captain.

In this case the Captain should abort the mission and proceed to descending without sharp maneuvers. Decelerate smoothly the helicopter and establish hovering at altitude of 20 m. After establishing hovering descend smoothly the helicopter until the parachutist touches the ground. Thereafter execute further descent with simultaneous shift to the right to prevent

catching of the bag with parachute canopy by the main rotor blades.

(7) When performing a flight for parachute jumping all the crew members should have the emergency parachutes.

Section 6

EMERGENCY PROCEDURES

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6. EMERGENCY PROCEDURES

In all cases of in-flight failures the Captain must report the event over the radio channel to the flying control officer and, depending on the nature of failure, flight conditions and reserve time, proceed following the instructions of the present Section and the flying control officer.

6.1. Failure of one engine

In case of failure of one of the engines the second one (CONTINGENCY POWER switch being ON) automatically gains an elevated power rating up to contingency power depending on the helicopter gross weight. The engine contingency power attainment is recognised by 1% gas generator rotational speed increment over the takeoff one and by illumination of the L ENG CP/R ENG CP annunciator.

Note: 1. In case of in-flight failure of ЭРД-3ВМ EEC the engine cannot gain the contingency power.

2. It is permitted to perform OEI flight providing that the second engine runs at contingency power for 2,5 minutes without limitations within 0,1% per TBO.

(1) Indications:

(a) Out-of-trim condition of the helicopter felt as a jerk to the right. The magnitude of out-of-trim depends on the power setting at the moment of failure and airspeed (the higher is the power setting and the lower is the airspeed, the higher is out-of-trim).

(b) Reduction of the gas generator rotor speed and TGT of the failed engine.

(c) Increased gas generator rotor speed of the operating engine.

(d) Reduction of the main rotor speed.

(2) Crew's actions upon failure of an engine at altitudes above 100 m:

(a) Reduce the main rotor collective pitch as required for maintenance of the main rotor speed at a level of not less than 92 %.

(b) Counteract the rolling and turning tendencies by simultaneous and appropriate application of the control stick and pedals.

(c) Read the engines instruments to recognize the failed engine. Make sure that CP (contingency power) switch of the operating engine is set to ON.

(d) Accelerate or decelerate the helicopter to establish an airspeed of 120 km/h.

(e) Move the separate throttle control lever of the failed engine fully downward.

(f) Give an order to the Flight Engineer to close the HP fuel shutoff and fuel fire shutoff valves of the failed engine.

(g) Upon attainment of an airspeed of 120 km/h establish horizontal flight condition.

(h) Operate the collective pitch control lever to set such a power to the operating engine at which the helicopter flies without loss of alti-

tude. Having normal and maximum gross weight the helicopter can perform the horizontal flight with one engine operating at contingency power, under ISA conditions, at a speed, indicated in Table

Table 6.1

Flight Speed Vs Helicopter Weight and Flight Pressure altitude

Pressure altitude, maintenance	Indicated speed, km/h, at flight weight	
	Normal	Maximum
0	60-215	95-185
500	60-215	95-180
1000	60-210	95-175
2000	60-195	110-145
3000	75-175	-

(i) Make sure the engine operates normally and the helicopter is capable of performing horizontal flight. Continue flying to the nearest aerodrome continuously monitoring the TGT of the operating engine or select a landing area and execute landing.

Warning: Never start the failed engine in flight

1) With a helicopter gross weight below 12000 kg proceed as follows:
   (a) On the descent glide path maintain such a flight regime so that the airspeed is 20 km/h higher than the actual altitude in meters down to a height of 40 m.
   (b) At a height of 40 m initiate smooth deceleration by pulling back the control stick so as to have an airspeed of 40 km/h at a height of 3 m with a vertical speed of 3 to 2 m/s.
   (c) Establish the landing attitude at a height of 7 to 5 m.
   (d) At a height of 5 to 3 m initiate slowing down of the vertical speed by increasing the main rotor collective pitch at a rate of 2 to 4 deg/s. In so doing, smoothly apply the RH pedal to counteract the helicopter turning to the left and operate the control stick to maintain the landing pitch angle. When increasing the main rotor collective pitch avoid the main rotor speed drop below 88 %.
   (e) Land at a speed of 30 km/h.
   (f) Immediately after touchdown smoothly push the collective pitch control lever fully down with simultaneous pushing of the control stick 1/3 to 1/4 full travel forward to prevent the main rotor blades from hitting the tail boom.
   (g) Apply the main LG wheel brakes after touchdown of the nose LG wheel.

2) With a helicopter gross weight above 12000 kg account for the following specific features:
   (a) On the glide slope reduce airspeed in such a way that an airspeed of 70 to 60 km/h is maintained down to a height of 10 to 5 m.
   (b) Touch down at a speed of 50 km/h.
   (c) Before touchdown exercise special care to maintain the main rotor speed at a level of not less than 88 %.

Note: If airspeed was below 120 km/h at the moment of engine failure and the helicopter failed to attain a speed adequate for horizontal flight with one engine running at contingency power in acceleration up to a height of 20 to 10m, proceed to vigorous slowing down of the vertical and forward speeds and execute landing following the instructions of Para. (2).

(3) Crew's actions upon failure of one engine at a height below 100 m:

(a) Reduce the main rotor collective pitch to a value required for maintaining the main rotor speed at a level of not less than 92 %.

(b) Simultaneously and appropriately apply the control stick and pedals to counteract rolling and turning.

(c) Read the engines instruments to recognize the failed engine. Make sure that CP (contingency power) switch of the operating engine is set to ON.

(d) Proceed to deceleration of the helicopter in climb by pitching up to 10 to 15 deg if the airspeed was above 120 km/h.

(e) Move the separate throttle control lever of the failed engine fully downward.

(f) Give an order to the Flight Engineer to close the HP fuel shutoff and fuel fire shutoff valves of the failed engine.

(g) Upon attainment of an airspeed of 120 km/h establish horizontal flight condition.

(h) Operate the collective pitch control lever to set such a power to the operating engine at which the helicopter flies without loss of altitude.

(i) Make sure the engine operates normally and the helicopter is capable of performing horizontal flight.

(j) Continue flying to the destination aerodrome at this speed or select an area and land the helicopter proceeding as instructed in Para. (2).

1) If the airspeed is less than 80 km/h at the moment of engine failure proceed as follows below:

(a) Reduce the main rotor collective pitch to a value required for maintaining the main rotor speed at a level of not less than 92 %.

(b) Simultaneously and appropriately apply the control stick and pedals to counteract rolling and turning.

(c) Make sure that CP (contingency power) switch of the operating engine is set to ON.

(d) Accelerate or decelerate the helicopter to establish an airspeed of 40 to 60 km/h depending on the helicopter gross weight.

(e) Establish descent at a vertical speed not exceeding 3 to 4 m/s.

(f) Descend to a selected area. Execute landing as instructed in Para. (2).

(4) Crew's actions upon an engine failure in hovering:

(a) At a hovering height up to 3 m:

1) When the helicopter begins to descend immediately pull up the collective pitch control lever to reduce the vertical speed

and to prevent the helicopter turning and rolling.

2) After touchdown reduce the main rotor collective pitch down to the minimum level and close the HP fuel shutoff valves of both engines.

3) Give an order to the Flight Engineer to close the fuel fire shut-off valves of both engines.

(b) At a hovering height of 3 to 5 m:

1) Apply the control stick and pedals appropriately to counteract rolling and turning without changing the collective pitch control lever setting.

2) Upon reaching a height of 3 m vigorously pull the collective pitch control lever fully upward to reduce the vertical speed and to prevent the helicopter turning and rolling.

After touchdown proceed as instructed in Para. (4), (a).

(c) At a hovering height of 5 to 10 m:

1) Immediately reduce the main rotor collective pitch by 2 to 4^0 with simultaneous counteraction of rolling and turning tendencies by appropriate application of the control stick and pedals.

2) Set the CP (contingency power) switch of the operating engine to ON.

3) At a height of 3m pull up the collective pitch control lever at the maximum possible rate to reduce the vertical speed by the moment of touchdown and prevent the helicopter turning and rolling. After touchdown proceed as instructed in Para. (4), (a).

(d) At hovering altitudes of 110 m and above:

1) Immediately reduce the main rotor collective pitch to a value required for maintaining the rotor speed at a level of not less than 92 %.

2) Apply the control stick and pedals to counteract rolling and turning.

3) Proceed to acceleration at a pitch-down angle up to -15°.

4) Make sure that CP (contingency power) switch of the operating engine is set to ON.

5) After acceleration to a speed of 80 to 100 km/h establish horizontal flight condition.

6) Execute next climb and flight for selection of a landing area at a speed of 120 km/h.

Note: If the helicopter is failed to accelerate up to the horizontal flight speed with one engine operating at contingency power (Ref. Table 6.1) in descent to a height of 20 to 10 m and continues descending, proceed to vigorous slowing down of the vertical and forward speeds and land the helicopter as instructed in para. (2).

(5) Crew's actions in case of an engine failure during takeoff:

(a) At altitudes up to 10 m and airspeeds of 60 km/h or below proceed and follows:

1) Reduce the main rotor collective pitch to establish descent and avoid a main rotor speed drop below 92 %.

2) Apply the control stick and pedals to counteract rolling and

turning.

3) Apply the control stick to assume the landing attitude in pitch.

4) After reaching a height of 2 to 3 m vigorously pull the collective pitch control lever fully upward to reduce the vertical speed and ensure running touchdown of the helicopter main LG wheels.

5) Rotate to touch down by the nose LG wheel, immediately reduce the main rotor collective pitch down to the minimum level, simultaneously pushing the control stick 1/3 to 1/4 full travel forward and apply the LG wheel brakes.

6) After the helicopter comes to a complete standstill the Flight Engineer should close the HP fuel shutoff and fuel fire shutoff valves of both engines.

(b) At a height above 10 m and airspeed above 60 km/h proceed as follows:

1) Vigorously push down the collective pitch control lever to avoid a main rotor speed drop below 92 %.

2) Apply the control stick and pedals to counteract roiling and turning.

3) Make sure that CP (contingency power) switch of the operating engine is set to ON.

4) At a height of 1 to 5 m bring the helicopter to landing attitude.

5) Pull back the control stick to decelerate the helicopter so as to touch down at a speed within the limits of 20 to 10 km/h at a gross weight of 11100 kg or at a speed of 30 km/h at a gross weight of 12000 kg.

6) After touchdown reduce the main rotor collective pitch down to the minimum value, simultaneously pushing the control stick 1/3 to 1/4 full travel forward.

7) After the helicopter comes to a complete standstill close the HP fuel shutoff and fuel fire shutoff valves of both engines.

If it proves impossible to execute safe landing in straightforward direction set takeoff power to the operating engine and thereafter accelerate up to 80 to 120 km/h and execute continued takeoff with one engine inoperative. Execute approach and landing on the aerodrome of departure.

(6) At the normal and maximum takeoff weights the helicopter is capable of flying without loss of altitude with one engine operating at contingenc power, in standard ambient conditions and within the speed range indicated in Table 6.1.

With the anti-icing system on, the horizontal flight speed range is reduced as compared with that indicated in Table 6.1 (the minimum speed increases and the maximum speed decreases by 20 km/h).

At other speeds and altitudes the helicopter will fly with descent.

It is recommended to fly with one engine inoperative at a speed of 120 to 130 km/h since at this speed the power required for flight assumes the minimum value.

The hourly fuel flow rates in flight with one engine operating at contingency power are indicated in Table 6.2.

Table 6.2

Altitude (pressure), m	Hourly fuel flow, kg/h	
	Normal gross weight	Maximum gross weight
500	515	550
1000	460	460
2000	410	-
3000	360	-

In all cases when one engine fails in flight and it proves impossible to execute horizontal flight with one engine operating at contingency power select a landing area and land thereon.

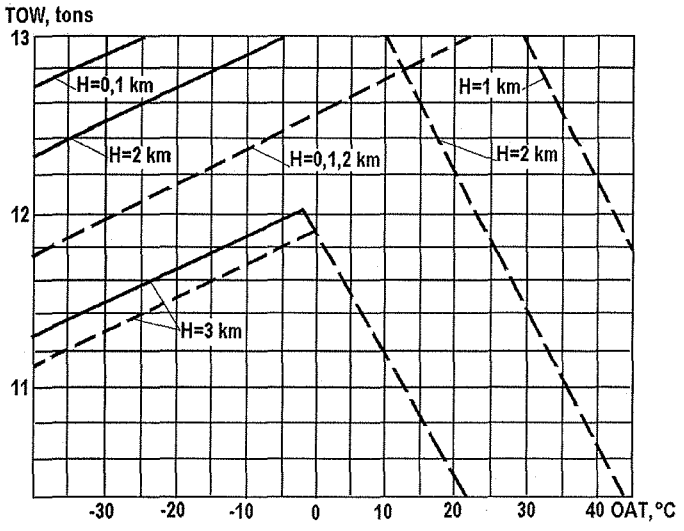

Fig. 6.1. Maximum Helicopter Weight in Horizontal Flight with One Engine In operative IAS=120km/h (Anti-Icing off).
_____ 2.5 – min power
_ _ _ _ _30 – min power

6.2. Failure of two engines. Autorotation landing

(1) Indications:

(a) Sudden out-of-trim condition of the helicopter appearing as a sharp helicopter jerk to the right. The magnitude of out-of-trim condition depends on the airspeed (the higher is power setting and the less is the airspeed the more is abrupt occurrence of the out-of-trim condition).

(b) Change of noise pitch of the engines.

(c) Sharp main rotor speed drop.

(d) Drop of R.P.M. and TGT of both engines.

(2) Crew's actions:

(a) If the engines fail at altitudes above 100 m and airspeed above 80 km/h immediately establish autorotation, for this purpose proceed

as follows:

1) Reduce the main rotor collective pitch down to the minimum level and further on, in the course of descent operate the collective pitch control lever to maintain the main rotor speed within the limits of 98 to 100 %.

2) Shut down the engine by closing the HP fuel shutoff valves, give an order to the Flight Engineer to close the fuel fire shutoff valves and switch off the fuel booster and transfer pumps.

3) Accelerate or decelerate the helicopter to establish a gliding speed of 100 to 120 km/h IAS.

4) Select a landing area so as to land into the wind.

5) At a height of 60 to 70 m begin vigorously reducing the forward speed to 60 to 70 km/h by pitching up the helicopter.

6) At a speed of 60 to 70 km/h begin smooth reduction of pitch angle so as it would be close to the landing value (4 to 6°) by the moment of touchdown.

7) At a height of 10 to 20 m begin reducing the vertical speed by rapid and continuous increase of the main rotor collective pitch at a rate of 6 to 8 deg/s.

8) While increasing the main rotor collective pitch maintain the landing pitch attitude by small deflection of the control stick forward.

9) After touchdown push the collective pitch control lever fully down with simultaneous application of the control stick 1/3 to 1/4 full travel forward and apply the LG wheel brakes.

(b) If the area selected for landing is outside of course or a necessity to change the landing course arises due to the wind direction (provided the altitude margin is adequate) execute a required manoeuvre in steady autorotation condition.

The altitude should be not less than 650 m to execute autorotation landing with a 180-degree turn and bank of 15^0.

(c) In case of failure of both engines at altitude below 100 m and airspeed above 120 km/h proceed as follows:

1) Immediately push the collective pitch control lever fully down with simultaneous proceeding to vigorous slowing down of the forward speed by pitching up the helicopter to 15 to 20^0.

2) Shut down the engine by closing the HP fuel shutoff valves, give an order to the Flight Engineer to close the fuel fire shutoff valves and switch off the fuel booster and transfer pumps.

3) Upon attainment of a speed of 50 to 60 km/h initiate smooth reduction of the pitch angle so as the helicopter pitch attitude would be close to landing one (4 to 6°) by the moment of touchdown.

4) At a height of 10 to 20 m begin reducing the vertical speed by rapid and continuous increase of the main rotor collective pitch at a rate of 6 to 8 deg/s.

5) While increasing the main rotor collective pitch maintain the landing pitch attitude through small deflection of the control stick forward.

6) After touchdown push the collective pitch control lever fully down with simultaneous application of the control stick 1/3 to 1/4 full travel forward and apply the LG wheel brakes.

(d) In case of failure of both engines at altitude below 100 m and airspeed below 80 km/h proceed as follows:

1) Immediately push the collective pitch control lever fully down and, if the altitude allows, accelerate up to a speed of 50 to 60 km/h.

2) Shut down the engines by closing the HP fuel shutoff valves, give an order to the Flight Engineer to close the fuel fire shutoff valves and switch off the fuel booster and transfer pumps.

3) At a height of 15 to 20m initiate reducing the vertical speed by rapid and continuous increase of the collective pitch at the maximum possible rate (10 to 12 deg/s).

4) After touchdown push the collective pitch control lever fully down with simultaneous application of the control stick 1/3 to 1/4 full travel forward.

(e) When landing on wood, water or swamp, or if some other obstacles are present, continue pre-landing deceleration at a pitch angle of 15 to 25° until slowing down of the vertical speed by increasing of the main rotor collective pitch is initiated and, in case of necessity, touch down at the pitch angle used for deceleration.

6.3. Fire

(1) Indications

(a) Illumination of the FIRE (ПОЖАР) annunciator on the left instrument panel and the red warning annunciator on the pilots' overhead panel center subpanel (the fire protection system control panel) indicating the area of fire: L ENG FIRE (ПОЖАР ЛЕВ. ДВ.). R ENG FIRE (П0ЖАР ПРАВ. ДВ.), COMBUST HTR FIRE (П0ЖАР К0-50), APU GEAR FIRE (ПОЖАР РЕДУК. АИ-9).

(b) The РИ-65 information reporting system gives voice warning:

"Fire in ... compartment".

(c) Appearance of smoke, flame or burning smell in the flight compartment.

When indications of fire appear recognize the fire zone by means of the fire warning annunciator, voice warning of the РИ-65 information reporting system or visually.

(2) Upon occurrence of fire in the left or right engine compartments the FIRE (ПОЖАР) master annunciator and red L ENG FIRE (П0ЖАР ЛЕВ. ДВ.) or R ENG FIRE (П0ЖАР ПРАВ. ДВ.) annunciators come on. Simultaneously, the main discharge (1-st shot) fire extinguishers discharge automatically fire extinguishant into the affected engine compartment, which is indicated by illumination of the amber MAIN DISCH (1 ОЧЕРЕДЬ) annunciator of the respective compartment.

(3) Crew's actions

(a) After the L ENG FIRE (П0ЖАР ЛЕВ. ДВ.) or R ENG FIRE (ПОЖАР ПР. ДВ.) annunciator become illuminated on the fire protection system control panel the Captain should proceed as follows:

1) Shut down the engine whose compartment Is on fire by the

HP fuel shutoff valve.

2) Give an order to the Flight Engineer to close the fuel fire shut-off valve of the left (or right) engine.

3) Proceed to flight with one engine inoperative as instructed in para. 6.1, (1) thru (6).

(b) If fire persists after discharge of the main discharge fire extinguisher and the FIRE (ПОЖАР) master annunciator on the left instrument panel continues illuminating after being tested by depression of the FIRE WARN OFF (ВЫК. СИГНАЛА ПОЖАРА) button discharge manually the alternate discharge (2-nd shot) fire extinguisher into the affected engine compartment for which purpose depress the MANUAL CONTROL ALTN DISCH (РУЧНОЕ ВКЛЮЧЕНИЕ 2 ОЧЕРЕДИ) button.

Caution: Never start the engine in whose compartment fire was suppressed.

(c) If the APU gearbox compartment or the APU compartment are on fire the master FIRE (ПОЖАР) annunciator comes on and the APU GEAR FIRE (ПОЖАР РЕДУК. АИ-9) red annunciator on the fire protection system control panel comes on.

The main discharge fire extinguisher is discharged simultaneously which is indicated by illumination of the MAIN DISCH (1 ОЧЕРЕДЬ) amber annunciator.

If fire persists after discharge of the main discharge fire extinguisher proceed as instructed in para. (b).

(d) If the K0-50 combustion heater compartment is caught by fire, the COMBUST HTR FIRE (ПОЖАР КО-50) red annunciator comes on simultaneously with the FIRE (ПОЖАР) master annunciator and the main discharge fire extinguisher is discharged automatically.

If fire persists after discharge of the main discharge fire extinguisher proceed as instructed in para. (b).

(e) If the crew detects fire in some of the protected compartments from some indications but the automatic fire extinguishing system has failed to discharge 'the appropriate fire extinguisher, depress one of the buttons marked MANUAL CONTROL MAIN DISCH (РУЧНОЕ ВКЛЮЧЕНИЕ 1 ОЧЕРЕДЬ) and located below the L ENG FIRE (ПОЖАР ЛЕВ. ДВ.), R ENG FIRE (ПОЖАР ПР. ДВИГ.), COMBUST HTR FIRE (ПОЖАР КО-50), APU GEAR FIRE (ПОЖАР РЕДУК. АИ-9) annunciators depending on the location of fire.

This done, the main discharge fire extinguisher should dircharge and the MAIN DISCH (1 ОЧЕРЕДЬ) amber annunciator of a respective compartment should come on. Further on, in case of necessity to discharge the alternate discharge fire extinguisher depress the MANUAL CONTROL ALTN DISCH (РУЧНОЕ ВКЛЮЧЕНИЕ 2 ОЧЕРЕДЬ) button located under the annunciator of a respective compartment.

(f) After suppression of fire in one of the compartments by means of the main (automatic) fire extinquishant dirscharge, arm the fire extinquishing system to the state of readiness of extinguishing of fire which may occur in another protected compartment, set momentarily the FIRE EXTING - FIRE DET TEST (ОГНЕТУШЕНИЕ -

КОНТРОЛЬ ДАТЧИКОВ) selector switch to FIRE DET TEST (КОНТРОЛЬ ДАТЧИКОВ) and thereafter reset it to FIRE EXTING (ОГНЕТУШЕНИЕ). This done, the Captain, or, upon his order, the Flight Engineer, should discharge manually the alternate discharge fire extinguisher by depression of the MANUAL CONTROL, ALTN DISCH (РУЧНОЕ ВКЛЮЧЕНИЕ 2 ОЧЕРЕДЬ) button located below a respective compartment annunciator, since the main discharge (1-st shot) fire extinguisher has been discharged automatically.

(g) If fire occurs in the cargo or flight compartment extinguish the fire by means of the portable airborne fire extinguisher.

If the electrical wiring is on fire, de-energize the circuit in which fire is detected (if it is impossible to detect what circuit is on fire, de-energize the helicopter completely).

Warning: 1. Abort the mission after suppression of fire in any of the compartments and proceed to landing.

2. If fire persists after depletion of all the fire extinguishers, the captain should make a decision on either immediate landing or abandonment of the helicopter by the crew depending on the actual situation.

6.4. Troubles in gearboxes

(1) Indications

(a) In case of troubles in the main, intermediate or tail gearboxes unusual noise or vibrations of the helicopter are percepted, the oil temperature rises and oil pressure drops sharply, the CHIPS IN MAIN G/B (СТРУЖКА ГЛ. РЕДУК.), CHIPS IN INTERM G/B (СТРУЖКА ПРОМ. РЕДУК.), CHIPS IN TAIL G/B (СТРУЖКА ХВ. РЕДУК.) annunciator flashes or illuminates steadily.

(2) Crew's actions

(a) If unusual noise, vibration, oil overtemperature or oil under pressure are detected, immediately proceed to descent at low power and an airspeed of 120 to 140 km/h, and land on a selected field. Execute vertical or running landing, depending on actual conditions.

(b) If the CHIPS IN MAIN G/B (СТРУЖКА ГЛ. РЕДУК.), CHIPS IN INTERM G/B (СТРУЖКА ПРОМ. РЕДУК.), CHIPS IN TAIL G/B (СТРУЖКА ХВ. РЕДУК.) annunciator comes on and flashes or illuminates continuously in flight but the gear boxes operation parameters do not change, abort the mission and fly to the nearest aerodrome exercising elevated alertness in monitoring the gearbox parameters. If illumination of the annunciator is accompanied by changing the gear box parameters, immediately proceed to descent at low power and execute either vertical or running landing on a selected field.

6.5. In-flight troubles in engine automatic control system

Engine electronic control failure.

Indications: L (R) ENG EEC OFF annunciator is ON

Crew's actions: Switch the failed EEC off. Continue performing the mission, monitor the operation parameters of the engine with failed EEC. In case of

failure (switching off) of the EEC the maximum gas generator rotational speed should not exceed 102,5%.

In-flight troubles in the engine automatic control system require various actions of the pilot, which depend on the indications of troubles.

(1) Indications

(a) Variation in the gas generators rotor speeds within more than 1 %.

(b) The power ratings of one of the engines fail to change when the collective pitch control lever is being moved.

Upon detection of these indications the main rotor speed is maintained automatically at 95±2%.

(2) Pilot's actions

(a) Upon detection of one of the above indications abort the mission and land on the nearest aerodrome.

(3) Indications

(a) A difference in the gas generators rotor speeds of the engines exceeding 2 %.

(b) Spontaneous increase in the main rotor speed (one or both of these indications).

(4) Pilot's actions in hovering during takeoff or pre-landing glide

(a) Land if at least one of the above indications are detected.

(b) If the main rotor overspeeds up to 101 %, smoothly turn the throttle control twist grip to the left and simultaneously pull up the collective pitch control lever to set the main rotor speed to 95±2%, and maintain it at this level manually (by moving the collective pitch control lever up and turning the throttle control twist grip to the left).

(5) Pilot's actions under other conditions of flight

(a) Pull up the collective pitch control lever to set the main rotor speed to 92 to 93 %.

(b) Determine the nature of the automatic control system trouble, for this purpose smoothly push down the collective pitch control lever, preventing the main rotor speed increase up to 98 %, and then pull it up. The following cases of variations in the gas generator rotor and main rotor speeds may take place:

1). Case 1. Operation of the collective pitch control lever causes variation in the gas generator rotor speeds of both engines, the main rotor speed Is maintained automatically within the limits of 95±2%. In this case establish horizontal flight and an airspeed of 100 to 150 km/h. Abort the mission and land on either the departure or nearest aerodrome.

2). Case 2. With the collective pitch control lever being pushed down the gas generator speed of one of the engines decreases, with the collective pitch control lever being pulled up this speed increases, the main rotor speed is maintained automatically within 95±2%, the other engine runs at takeoff power and its gas generator speed does not change.

In this case smoothly push the collective pitch control lever down to set the main rotor speed to 95 %. Smoothly move down the throttle control lever of the engine with the faulty

automatic control system to reduce its gas generator rotor speed by 3 %. The gas generator rotor speed of the engine with the serviceable automatic control system rises. Further piloting of the helicopter does not differ from normal procedures except for more smooth operation of the control stick and the collective pitch control lever since keeping of the main rotor speed within the range of 95±2% is ensured by the automatic control system of only one engine (the throttle control twist grip should be set in this case to the rightmost position). Abort the mission, establish a horizontal flight speed of 100 to 150 km/h, and execute vertical or running landing on the nearest field or aerodrome, if flight is performed in the aerodrome zone.

3). Case 3. With the collective pitch control lever being pushed down the gas generator rotor speed of one engine (operating at takeoff power) does not change, the gas generator rotor speed of the other engine decreases slowly, and the main rotor speed is not maintained at 95±2% but rises. In this case stop pushing down the collective pitch control lever as soon as the main rotor speed reaches 96 %. Turn the throttle control twist grip to the left until a main rotor speed of 95% is attained. To change the required power setting, control the engines by smoothly turning the throttle control twist grip with simultaneous deflection of the collective pitch control lever so as the main rotor speed is maintained at 95±2% manually (the collective pitch control lever up - the throttle control twist grip to the right, the collective pitch control lever down - the throttle control twist grip to the left).

Abort the mission, establish a horizontal flight speed of 100 to 150 km/h and execute vertical or running landing on the nearest selected field or aerodrome, if flight is performed in the aerodrome zone.

(6) Failure of EEC free turbine controls. Indications

(a) Illumination of the FREE TURB OVERSP L ENG - R ENG (ПРЕВЫШЕНИЕ ОБОРОТОВ СВОБОДНОЙ ТУРБИНЫ ЛЕВ. ДВ. - ПРАВ. ДВ.) annunciator.

(b) The engine continues operating.

(7) Pilot's actions

(a) Momentarily switch off the EEC of the affected engine.

(b) Make sure the FREE TURB OVERSP L ENG - R ENG annunciator has gone out.

(c) Switch on the engine electronic control (EEC). If the annunciator continues illuminating after switching on of the EEC increase alertness in monitoring the engine operational parameters, abort the mission and land on the aerodrome of departure.

(d) If after switching on of the EEC the annunciator is not illuminated make sure that the engine monitoring instruments readings are normal and continue performing the mission, increase alertness in monitoring the engine operational parameters.

Warning: In all cases if after illumination of the FREE TURB OVERSP L ENG - R ENG annunciator the deviation of

engine operational parameters occurs, abort the mission, shut the engine down manually and proceed according to Ми-17-1В Flight Manual.

6.6. Abnormal vibration of engine

(1) Indications

(a) Illumination of the amber annunciators.

(b) Illumination of the red annunciators.

(2) Crew's actions

(a) Upon illumination of the amber annunciators increase alertness in monitoring operation of the engines and continue fulfilment of the mission.

(b) Upon illumination of the red annunciators reduce the engine power setting by means of the collective pitch control lever in order to reduce the vibration magnitude. If the red annunciator goes out abort the mission, establish an airspeed of 130 to 140 km/h, and proceed to the nearest aerodrome. Execute running landing.

If the red annunciator fails to go out shut down the engine affected by abnormal vibration and proceed in accordance with the instruction for actions required at one engine failure.

6.7 Low engine oil pressure. Illumination of the L ENG (R ENG) LOW P_{OIL} annunciator.

(1) Indications

(a) Flashing or steady illumination of the L ENG LOW OIL PRESSURE or R ENG LOW P_{OIL} amber annunciators.

(2) Crew's actions:

(a) If the parameters are normal, continue performing the mission, increase alertness in monitoring engine oil pressure and temperature. If the engine oil pressure is decreased by 2 kgf/cm^2 proceed as follows:

(b) Operate the respective throttle lever to reduce the affected engine power setting to a minimum allowing continuation of flight, and make sure the engine oil temperature does not exceed 150 ^{0}C.

Abort the mission and proceed to the nearest aerodrome.

Execute running landing. Should the engine oil pressure drop below 2 kgf/cm^2 shut down the engine and proceed in accordance with the instructions required for actions with one engine failed.

6.7A. Illumination of the CHIPS IN L ENG or CHIPS IN R ENG (for helicopters the engine oil system of which is equipped with CC-78 chip detector).

(1) Indications:

(a) Flashing or steady illumination of the CHIPS IN L ENG or CHIPS IN R ENG amber annunciators.

(2) Pilot's actions:

(a) Monitor the engine oil pressure and temperature.

(b) If the engine parameters are normal, abort the mission, increase alertness in monitoring engine oil pressure and temperature and land on the nearest aerodrome (.selected ground).

(c) If the engine oil pressure and temperature exceed the admissible limits, abort the mission, shut the engine down and proceed according to instructions given in subsection 6.1. "Failure of one engine"

6.8. Unstable operation of engine

(1) Indications

(a) Characteristic noise produced by the engines (rough operation).

(b) Sharp drop of the engine gas generator rotor speed.

(c) TGT rise.

(d) Sharp drop of the compressor delivery pressure (oscillatory in nature) displayed as sharp oscillation of the ИР-117 EPR indicator side index.

(2) Pilot's actions:

(a) In case of indications of engine unstable operation move the separate throttle control lever of the affected engine to IDLE position. If after that the gas generator rotational speed and TGT correspond to idle rating, move the throttle lever again to reset the initial power rating. If the engine operation persists to be unstable, press, the APU being off, the engine start button for 1-2 sec., close the HP fuel shutoff valve for 1-2 sec. and open it again. If after that the engine gains the gas generator RPM and TGT which correspond to IDLE mode reset the initial power rating by moving the separate throttle control lever.

(b) If the engine operation persists to be unstable start the APU.

(c) Shut the engine down by the HP fuel shut off valve and perform the starting. Perform the starting at an altitude H≤4000 m. If it proves impossible to discontinue surging, shut down the affected engine and proceed as instructed for the case of failure of one engine.

6.9. Failure of turbine gas temperature (TGT) control

(1) Indications

(a) The TGT indicator reads 990 °C or more.

(2) Pilot's actions

(a) Reduce the engine power setting and avoid the gas generator rotor run at a speed beyond 101 %.

(b) Continue fulfilment of the mission, increase alertness in monitoring TGT.

6.10. Failure of fuel system (fuel booster and transfer pumps)

6.10.1. Failure of Fuel Booster Pump

(1) Indications

(a) The NO FLOW (РАСХОД НЕ РАБОТАЕТ) annunciator goes on upon failure of the service fuel tank booster pump.

(b) Failure of the fuel booster pump may be accompanied by a momentary engine speed drop by 2 to 5 %, a fuel pressure drop by 3 to 4 kgf/cm^2 and a main rotor speed drop by 1 to 3 %.

(c) The РИ-65 voice warning system gives the message:

" Service fuel tank pump failed ".

(2) Crew's actions

(a) Continue fulfilment of the mission upon failure of the fuel booster pump. Normal operation of the engines is ensured in this case by the ДЦН-70 engine-driven fuel pumps.

6.10.2. Failure of Fuel Transfer Pumps

(1) Indications

(a) The LEFT FAIL (ЛЕВЫЙ БАК НЕ РАБОТАЕТ) or RIGHT FAIL (ПРАВЫЙ БАК НЕ РАБОТАЕТ) annunciator or both of them go on.

(b) The РИ-65 information reporting system gives the voice warning:

" Main fuel tank pumps failed ".

(c) Untimely depletion of the service tank fuel.

(2) Crew's actions

(a) In case of failure of one fuel transfer pump (one LEFT FAIL (ЛЕВЫЙ БАК НЕ РАБОТАЕТ) or RIGHT FAIL (ПРАВЫЙ БАК НЕ РАБОТАЕТ) annunciator goes on), continue fulfilment of the mission. Under this condition the fuel is transferred to the service tank by one fuel transfer pump operating.

(b) In case of failure of both transfer pumps (for example, with the helicopter electrical power system de-energized) fuel is not transferred from the main tanks to the service tank and only 320 liters of fuel contained in the service tank can be used. With the service tank fuel supply depleting assess the possibility to land on the destination or alternate aerodrome, or a selected field and make a decision to land.

Note: A fuel quantity of 320 liters is adequate for flight during 21 min at an altitude of 500 m and 220 km/h IAS over a distance of 70 km, and for vertical landing.

6.11. 270-LITER FUEL RSV (ОСТАЛОСЬ 270 Л) annunciator illumination

(1) Indications

(a) The РИ-65 information reporting system gives the voice warning:

"Emergency fuel reserve".

(2) Crew's actions

(a) Upon illumination of the 270-LITER FUEL RSV (ОСТАЛОСЬ 270 Л) annunciator proceed as follows:

1) Check the amount of fuel by reading the fuel quantity indicator.

2) Assess the possibility to reach the destination point bearing in mind that the 270-liter fuel reserve is adequate for flight during 17 min at an altitude of 500 m and an airspeed of 220 km/h over a distance of 55 km, and for vertical landing.

3) Make a decision either to continue flight or land on the alternate aerodrome (a selected field).

4) Control the helicopter smoothly, execute only coordinated turns avoiding slipping and skidding to prevent ingress of air into the fuel system and spontaneous shutdown of the engines.

(b) The 270-LITER FUEL RSV (ОСТАЛОСЬ 270 Л) annunciator illumi-

nation may be caused by jamming of the service tank float valve with the external fuel tanks not depleted. If the 270-LITER FUEL RSV (ОСТАЛОСЬ 270 л) annunciator illuminates steadily, note the service tank fuel guantity and then monitor its usage for 5 min. If depletion of the service tank takes place on a helicopter provided with the emergency transfer line open the valve 768600M, set the BYPASS (ПЕРЕПУСК) selector switch on the FUEL SYSTEM (ТОПЛИВНАЯ СИСТЕМА) control panel to OPEN (ОТКРЫТ) and then control the fuel usage only manually to avoid overflowing of the service tank and spillage of fuel from the air vents. The amount of fuel in the service tank should not exceed 370 to 390 liters.

6.11A. Illumination of the L ENG FUEL FILTER CLOG or R ENG FUEL FILTER CLOG annunciator.

(1) Indications

(a) Flashing or steady illumination of the L ENG FUEL FILTER CLOG or R ENG FUEL FILTER CLOG annunciator.

(2) Crew' s actions:

(a) Abort the mission and land on the nearest aerodrome. In case of simultaneous flashing or steady illumination of both annunciators choose the landing field and land the helicopter.

6.12. Failure of directional control system

(1) Indications

(a) In case of complete failure of the tail rotor or its transmission in flight the helicopter sharply turns to the left, rolls to the right and pitches down.

(2) Crew's actions

(a) Immediately reduce the main rotor collective pitch and order the crew members to abandon the helicopter if altitude allows.

(b) If altitude is not adequate for abandonment of the helicopter proceed as follows below:

1) Proceed to autorotation glide and roll out of turn in order to maintain direction.

2) Trim the helicopter in flight by slipping. Counteract the helicopter yawing tendency by applying lateral control.

3) Select an appropriate field for landing.

4) Shut down the engines by the HP fuel shutoff valves.

5) Close the fuel fire shutoff valves, switch off the fuel booster and transfer pumps.

6) Execute autorotation landing. Before landing reduce bank to fully level the helicopter by the moment of touchdown.

(c) If the tail rotor drive is intact but the control linkage is damaged (this condition being displayed by a helicopter failure to respond to application of the pedals) establish an airspeed of 120 to 130 km/h IAS by reducing the main rotor pitch down to a value corresponding to horizontal flight or flight with a slight descent, continue flying until a field fit for safe landing is selected, trim the helicopter by slipping and execute running landing. Never operate the collective pitch

control lever before touchdown to prevent loss of trim.

(d) If the directional control is lost in hovering or shifts at a low altitude proceed as follows:

1) Immediately but smoothly reduce the main rotor collective pitch and descend to touchdown.

2) During descent apply the right pedal and the control stick to the right in order to eliminate left turning and drift, and pull back the control stick to counteract nose heaviness.

3) At the moment of touchdown by the main LG wheels immediately and vigorously reduce the main rotor pitch down to the minimum value and shut down the engines.

4) If the helicopter turns upside down immediately abandon it through the emergency exits.

6.13. Failure of hydraulic system

(1) Indications

(a) In case of failure of the main hydraulic system (pressure drop), the hydraulic actuators are automatically selected to the auxiliary hydraulic system, and the AUX SYS ON (ДУБЛИР. ВКЛЮЧЕНА) annunciator comes on and the auxiliary hydraulic system pressure quickly rises from 45±3 to 65^{+8}_{-2} kgf/cm^2, the РИ-65 information reporting system gives the voice warning: "Main hydraulic system failed".

(b) Failure of the main hydraulic system may cause flashing of the AUX SYS ON (ДУБЛИР. ВКЛЮЧЕНА) annunciator accompanied by periodical build-up and drop of the auxiliary hydraulic system pressure.

(2) Crew's actions

(a) In case of failure of the main hydraulic system, immediately set the MAIN HYD SYSTEM (ОСНОВНАЯ ГИДРОСИСТЕМА) switch to OFF (ВЫКЛ), abort the mission and land on a selected field.

Note: Upon selection of the auxiliary hydraulic system the АП-34Б autopilot and the collective pitch control lever friction lock get disengaged. In this condition select an adequate tightening of the collective pitch control lever friction lock to have optimum efforts required for operation of the control lever.

(b) In case of failure of the main and auxiliary hydraulic systems in flight (indicated by severe creeping of the control stick and depressurization of both hydraulic systems) the crew should abandon the helicopter upon the Captain's order. If the altitude does not allow to abandon the helicopter proceed as follows:

1) Do not release the collective pitch control lever lock.

2) Reduce airspeed.

3) Change the engine power setting by means of the throttle control twist grip.

4) Overcome the control pressure together with the Pilot-Navigator.

5) Execute landing.

6.14. Ground resonance

(1) Indications

(a) Occurrence of rapidly increasing oscillations of the helicopter during the engine ground test, taxiing, landing run or takeoff.

(2) Crew's actions

(a) Upon occurrence of rapidly increasing oscillations of the helicopter in the course of the engine ground test, vigorously push the collective pitch control lever down and simultaneously turn the throttle control twist grip fully to the left.

(b) Upon occurrence of increasing oscillations during landing run, takeoff and taxiing reduce the helicopter forward speed by pulling back the control stick (to a position close to neutral) and apply the LG wheel brakes.

If the helicopter oscillations persist shut down the engines in any condition stated above.

6.15. Inadvertent overspeeding above maximum limit speed

(1) Inadvertent overspeeding above the maximum limit speed may cause stalling of the main rotor blades accompanied by increased vibration, deteriorated controllability and rocking of the helicopter.

In this case smoothly reduce the main rotor collective pitch and simultaneously pull back the control stick to reduce the airspeed down to a desired level.

6.16. Inadvertent slowing down below minimum limit speed

(1) Indications

(a) Occurrence of the helicopter vibration similar to that occurring during pre-landing deceleration.

(b) Helicopter turning and nose heaviness.

(c) Inadvertent loss of altitude at various vertical speeds depending on the initial power setting with the collective pitch control lever position unchanged.

(d) Unsteady readings of the airspeed indicator (oscillation of the pointer within the range of 50 to 350 km/h).

(e) Oscillation of the engine tachometer indicator pointers within ±2 % with the collective pitch control lever fixed.

(2) Crew's actions for recovery from inadvertent slowing down below the minimum limit speed are as follows:

(a) If the helicopter attains a speed below the minimum limit at power settings corresponding to horizontal flight or climb proceed as follows:

1) With the engine power unchanged, smoothly push the control stick forward to establish a pitch angle within the limits of -(.5 to 10)° and initiate acceleration of .the helicopter.

2) On reaching a forward speed of 80 to 100 km/h establish the horizontal flight condition and a desired speed.

(b) If the helicopter is slowed down below the minimum limit speed in glide proceed as follows:

1) Push the control stick forward to establish a pitch angle within the range of -(5 to 10)° with simultaneous advancement of power up to takeoff.

2) On reaching an airspeed of 80 to 100 km/h IAS establish the horizontal flight condition and a desired forward speed.

(c) Reduction of the gas generator rotor speed below 85 to 88 % at an airspeed close to zero even at the main rotor speed within the acceptable limits, causes transition of vertical descent at a speed up to 20 m/s (vortex ring condition).

(d) To recover from the vortex ring condition proceed as follows:

1) Push the control stick forward to establish forward speed at a pitch angle within the range of -(5 to 10)°.

2) On reaching an airspeed of 80 to 100 km/h IAS smoothly increase the main rotor collective pitch and establish horizontal flight condition.

Note: Altitude loss is 50 m approximately in recovery from vertical descent to horizontal flight. No peculiarities in controllability characteristics in the course of recovery are noted.

6.17. Low frequency oscillation in flight

(1) If low frequency oscillation occurs in flight, disengage the autopilot.

If vibration does not change considerably for 3 to 6 s after disengagement of the autopilot, momentarily change the flight condition by reduction of the main rotor collective pitch by 2 to 3°.

After oscillation disappears engage the autopilot and continue flight observing the requirements of the present Flight Manual without additional limitations. If oscillation occurs after engagement of the autopilot, disengage it, change the condition of flight in case of necessity, and abort the mission.

6.18. Failure of AC generators and rectifiers

6.18.1. Failure of One AC Generator

(1) Indications

(a) The РИ-65 information reporting system gives the voice warning: "Generator No. 1 failed" or "Generator No. 2 failed"..

(b) The GEN 1 (2) FAIL (ГЕНЕРАТОР 1 (2) ОТКАЗАЛ) annunciator becomes illuminated on the AC POWER (ПЕРЕМЕННЫЙ ТОК) control panel.

(c) The failed generator ammeter pointer deflects to zero.

(d) With the voltmeter selector switch set to the failed generator position the voltmeter pointer deflects to zero.

(2) Crew's actions

(a) Set the failed generator GENERATORS 1 (2) (ГЕНЕРАТОРЫ 1 (2)) switch to OFF (ВЫКЛ).

(b) Switch off the main rotor blades anti-icing system.

(c) The Captain should make a decision of further fulfilment of the mission.

Note: With one of the generators failed the second operating generator is capable of powering all the helicopter loads except for the main and

tail rotor anti-icing system.

6.18.2. Failure of Two AC Generators

(1) Indications

(a) The РИ-65 information reporting system gives the voice warning: "Generator No. 1 failed." or "Generator No. 2 failed".

(b) The GEN 1 FAIL (ГЕНЕРАТОР 1 ОТКАЗАЛ) and GEN 2 FAIL (ГЕНЕРАТОР 2 ОТКАЗАЛ) annunciators on the AC POWER control panel come on.

(c) The pointers of the ammeters of both generators deflect to zero.

(d) With the voltmeter selector switch set either to GENERATOR 1 (ГЕНЕРАТОР 1) or GENERATOR 2 (ГЕНЕРАТОР 2) the voltmeter pointer deflects to zero.

(e) With both AC generators failed the electrical loads are automatically switch over to the storage battery bus. As this takes place the following loads remain energised:

- АИ-9В auxiliary power unit (APU);
- ПО-500А and ПТ-200Ц inverters;
- ЭМИ-3РИ and ЭМИ-3РВИ three-pointer indicators;
- Main rotor pitch indicator;
- 2ИА-6 TGT indicator;
- РТ12-6-2С TGT control;
- ИВ-500Е vibration indicating system;
- ИР-117 EPR indicator;
- Main and auxiliary hydraulic systems;
- ГА-192 solenoid valve in engine takeoff power control circuit;
- Left pitot tube heater;
- Fire protection system;
- Flight compartment dome lights;
- Second group of red lights;
- Cargo compartment standby lights;
- Navigation lights;
- МСЛ-3 anti-collision lights;
- Р-863 radio set;
- АРК-15 automatic direction finder;
- Transponder;
- СПУ-7 interphone system;
- АГБ-3К gyro horizon, left;
- А-037 radio altimeter;
- МС-61 voice recorder;
- БУР-1-2 flight data recorder system;
- ДГ-64 external load shackle;
- External store emergency release circuits;
- Pilot's windshield wiper;
- Fuel tank pumps;
- МП-100М-2С electric actuators in engine speed governor system;
- Fuel bypass valve;
- Engine fuel fire shutoff valves;
- Inert gas system;
- Engine air inlet hot air anti-icers;
- РИО-3 ice detector;

- ЭКСР-46 flares;
- СПУУ-52 tail rotor pitch limit system;
- РИ-65 information reporting system;
- ЭМТ-2М solenoid-operated brakes;
- ГА-192 solenoid valve controlling hydraulic fluid supply to collective pitch control lever lock;
- ФПП-7 landing/search light, right.

(2) Crew's actions

(a) Set the GENERATORS 1, 2 (ГЕНЕРАТОРЫ 1, 2) switch to OFF (ВЫКЛ), switch the anti-icing system off.

(b) Start the АИ-9В APU engine proceeding as instructed in para. 3.5. After starting the engine set the STBY GEN (РЕЗЕРВН. ГЕНЕРАТ) switch to ON (ВКЛ). Set the DC POWER (ПОСТОЯННЫЙ ТОК) control panel voltage selector switch to STBY GEN (РЕЗЕРВ. ГЕНЕРАТ). Read the APU generator output voltage on the voltmeter which should be 27 to 29V and the GEN LOAD (ТОК ГЕНЕРАТОРА) ammeter reading which should not exceed 100 A. The time of APU engine continuous operation in the generator mode should not exceed 30 min.

(c) Within the above period of time the Captain should make a decision either to abort the mission and return to the departure aerodrome or to proceed for landing on an alternate aerodrome.

Note: With the loads listed in 6.18.2 being powered only by the storage batteries their capacity is adequate for 6 to 7 min of flight.

6.18.3. Failure of One Rectifier

(1) Indications

(a) The failed rectifier ammeter pointer deflects to zero.

(2) Crew's actions

(a) Set the failed rectifier switch labelled RECTIFIERS 1, (2, 3) (ВЫПРЯМИТЕЛИ 1 (2, 3)) on the DC POWER control panel to OFF (ВЫКЛ).

Continue the mission.

Note: With one of the rectifiers failed the two remaining operating rectifiers are capable of powering all the electric loads essential for continuing the flight.

6.18.4. Failure of Two Rectifiers

(1) Indications

(a) The failed rectifier ammeter pointers deflect to zero.

(2) Crew's actions

(a) Set the failed rectifiers switches labelled RECTIFIERS 1, 2, (3) (ВЫПРЯМИТЕЛИ 1, 2, (3)) on DC POWER control. panel to OFF (ВЫКЛ).

(b) Switch off one of the AC generators by setting the GENERATORS 1. 2 (ГЕНЕРАТОРЫ 1 (2)) on the AC POWER control panel to OFF (ВЫКЛ).

(c) Switch off all the loads except for those essential for flight.

(d) Monitor the operating rectifier current by reading the ammeter on the DC POWER control panel. The current drawn should not exceed 200 A.

(e) The Captain should make a decision to either abort the mission and return to the departure aerodrome or land on an alternate aerodrome.

6.18.5. Failure of ДМР-200Д equipment

(1) Indications

(a) The BATT red annunciator lights up.

(2) Crew' s actions:

(a) Make sure that the rectifier bus voltage is not less than 27V, the battery ammeters read the discharge current (the pointer is to the right from the scale zero point);

(b) unlock the safety latch and turn on the CCT TO RECT (СЕТЬ НА ВУ) switch located on the cockpit center pedestal.

(c) Make sure that BATT annunciator has gone out, the batteries N1 &N2 voltage has increased up to 27V and the ammeters read the charge current.

(d) Continue performing the mission.

Warning: If the CCT TO RECT switch being turned on, the ammeters persist to read the discharge current the Captain should make decision: continue the flight up to the nearest aerodrome or land the helicopter on the chosen landing field.

6.19. Failure of autopilot

(1) Main indications of failure

(a) An insignificant but clearly felt jerk of the helicopter in yaw, roll, pitch or altitude with simultaneous displacement of the trim indicator respective channel movable index to an extreme position.

(b) Occurrence of helicopter oscillation about one of the axes accompanied by oscillations of the trim indicator respective channel movable index.

(c) Slow change in the established flight regime.

(2) Crew's actions

(a) In case of changes in the helicopter attitude timely apply the flight controls to prevent rotation of the helicopter and establish horizontal straightforward flight. Determine the failed channel (channels) of the autopilot which in indicated by a displacement of the movable index of the trim indicator to the extreme position on the autopilot controller. Disengage the failed channel and make sure the helicopter can be flown with the channel inoperative. Make a decision to either continue or abort the mission.

(b) If the helicopter oscillation occurs, disengage the autopilot by depression of the button located on the cyclic pitch control stick and make sure the helicopter oscillation has discontinued.

(c) Engage the autopilot channels in succession and monitor occurrence of the helicopter oscillation. As soon as the oscillation occurs disengage the channel whose engagement has caused oscillation.

(d) Make sure the helicopter can be flown with the failed channel inop-

erative and make a decision to either continue or abort the mission.

(e) If the helicopter drifts off the established flight regime recognize the failed channel by displacement of the trim indicator movable index to the extreme position, disengage the failed channel, and make a decision to either continue or abort the mission.

(f) In case of an inadvertent turning of the helicopter in yaw immediately place feet on the pedals. This done depression of the tiptoe pedals will cause disengagement of the directional channel and movement of the pedals will stop.

Caution: never re-engage the failed autopilot channel in flight.

6.20. Failure of gyro horizon

(1) Indications

(a) Appearance of the gyro horizon failure warning flag.

(b) The miniature aircraft fails to respond to changes in roll and pitch attitudes.

(c) The miniature aircraft rotates about its axis.

(d) A jerk of the helicopter in roll and pitch with the right gyro horizon failed and the autopilot engaged.

(2) Pilot's actions

(a) If the gyro horizon fails during flight in adverse weather conditions abort the mission and land on the nearest aerodrome.

(b) With the gyro horizon inoperative refer to the following indicators: turn indicator, altimeter, rate-of-climb indicator and the operating gyro horizon. In VFR flight conditions the pilot should make a decision to either continue or abort the mission.

Note: Failure of the left gyro horizon is accompanied by the same indications except for freedom from jerks in roll and pitch with the autopilot engaged. In case of failure of the left gyro horizon the pilot (Captain) makes a decision to either continue or abort the mission depending on the actual weather conditions.

6.21. Failure of compass system

(1) Indications

(a) A sharp change in the heading displayed by the УГР-4УК (or ПНП-72-15) indicator at the moment of failure.

(b) Discrepancies in readings of the УГР-4УК (or ПНП-72-15) indicator and the КИ-13 magnetic compass in horizontal straightforward flight.

(c) A sharp but minor-in-magnitude jerk in yaw at the moment of the system failure in flight with the autopilot engaged.

(d) Failure of the УГР-4УК (or ПНП-72-15) indicator pointer to respond to variation in the heading.

(e) Illumination of the GYRO TILT (ЗАВАЛ ГА) warning light on the ГМК-1А compass system control panel.

(2) Pilot's actions

(a) Fly to the nearest aerodrome using the ADF and КИ-13 magnetic

compass. When referring to the magnetic compass the bank and pitch angles should not exceed 10°.

6.22. Failure of pressure altimeter

(1) Indications
  (a) Unstable readings.
  (b) Variation of readings with the altitude unchanged.
  (c) Unchanged readings with the altitude changing.

(2) Pilot's actions
  (a) Check whether the pitot - static tube heater is on.
  (b) Set the static pressure selector first to LEFT (ЛЕВАЯ) and then to RIGHT (ПРАВАЯ), and assess the correctness of altimeter readings in these positions. If the altitude readings are stable and correspond to the actual condition of flight with the altimeter being fed from either left or right static vent, leave the static pressure selector in the position at which the correct readings take place and continue the mission.

  If the indications of altimeter failure persist maintain altitude by referring to the radio altimeter, second pressure altimeter and rate-of-climb indicator.

6.23. Failure of left УС-450К airspeed indicator

(1) Indications
  (a) Unstable readings.
  (b) Discrepancies in readings of the pilot's co-pilot's airspeed indicators.
  (c) Disagreement between the airspeed indicator readings and the actual flight regime.

(2) Pilot's actions
  (a) Check whether the pitot – static tube heater is on. Set the static pressure selector switch first to LEFT (ЛЕВАЯ) and then to RIGHT (ПРАВАЯ), and assess the correctness of the airspeed indicator readings in these positions.

  If the airspeed readings are stable and correspond to the actual condition of flight with the airspeed indicator being fed from either left or right static vent, leave the static pressure system selector in the position at which the correct readings take place, and continue the mission.
  (b) If the readings are unstable or disagree with the actual condition of flight with the static pressure selector set to either L (Л) or R (П) refer to the right airspeed indicator.
  (c) Make a decision on the possibility either to continue the mission further on or land on the nearest aerodrome.

6.24. Failure of VHF radio set with two control panels

(1) Indications
  (a) No response of the ground radio station to a request.
  (b) No sidetone is heard with the radio operating in the TRANSMISSION (ПЕРЕДАЧА) mode.

(2) Pilot's actions

(a) Check the headset connector for reliable connection, and functionally check the headset by intercommunication.

(b) Make sure the CMND RADIO (КОМАНД. РС) and INT (СПУ-7) circuit breakers are closed and the channel selector on the intercom selector panel is set to VHF (УКР). "Radio-СПУ" – to "Radio" position, "MAIN-STANDBY" – to "STANDBY" position.

(c) Check whether a desired communication channel is set correctly (wave number).

(d) Check whether the volume control, located on the radio control panel, is set to the maximum volume position.

(e) Check radio communications through other channels.

(f) If radio communications are not established after the above check, proceed to communication through the HF radio, report to the flying control officer and act in accordance with his instructions.

6.25. Failure of APK-15 ADF

(1) Indications:

(a) The ADF indicator pointer remains stationary with the heading changing.

(b) Continuous rotation of the ADF indicator pointer or its wide oscillation in a straight flight.

(c) The call signs of the ground radio station which the ADF is tuned to are not heard.

(2) Pilot's actions

(a) Make sure the ADF (РАДИОКОМПАС АРК-15) circuit breaker is on, the ADF mode selector switch is set to COMP (КОМПАС) and the communication channel selector on the intercom selector panel is set to ADF 1 (РК 1).

(b) Request the flying control officer whether the locator beacon is operating, and check the ADF tuning.

(c) If it is impossible to restore the ADF serviceability report the situation to the flying control officer.

(d) Approach the aerodrome of landing at an approach altitude established for this aerodrome with the radio aids out, or upon the orders of the flying control.

6.26. Abandonment of helicopter

(1) When flying at altitudes up to 100 m, including hovering, hops and shifts near the ground, as well as when transporting passengers and cases at any altitude, the crew members are allowed not to have their parachutes donned. In these cases special pads should he placed on the seats and the crew members should be fastened by the seat belts. In all other conditions the crew members should have the emergency parachutes donned in flight. A standby parachute actuator should be provided for the purpose of ripping the parachute pack and set to an actuation altitude of 500 m (above the terrain) and to an actuation delay time of 2 sec.

(2) After taking places at their respective stations the crew members should connect the parachute actuator rip pin static line snap hook to the ring provided at the seat pan. In case of necessity to leave his station in flight

each crew member should disconnect this snap hook from the ring.

(3) If an emergency arises in flight at which safe landing is not ensured and the lives of passengers and crew members are in danger the Captain must abort the mission and give an order to abandon the helicopter.

(4) Abandonment of the helicopter in flight is performed upon the Captain's orders.

If the helicopter retains its controllability two orders are given: the preparatory order PREPARE FOR BAILOUT and the final order BAILOUT. If the helicopter is not under control only one order is given BAILOUT.

(5) On abandoning the helicopter it is necessary to delay deployment of the parachute after separation from the helicopter, the period of delay depending on the altitude as listed below:

(a) 5 sec. at altitude above 500 m.

(b) 2 sec. at altitude from 200 to 500 m.

(c) Immediately at altitude below 200 m. *

(6) If the parachute actuators with the rip pin static line having 2 meters in length are used, the actuator will rip out the parachute pack only after the Pilots abandon the helicopter in bailout through the side emergency exits and after the Flight Engineer bails out either through the Pilots' emergency exit or the cargo door.

If the Pilot need to bail out through the cargo door it is necessary to disconnect the rip pin static line snap hook from the special fitting at the seat pan.

(7) The crew members can bail out from the helicopter either through the Pilots' emergency exits after the sliding blisters are released or through the cargo door opening after the door is released.

The passengers carried in the cargo compartment abandon the helicopter through the entrance door and through the emergency exit in the rear portion of the helicopter cargo compartment.

(8) The crew members abandon the helicopter in the following sequence: the first to bail out is the Pilot-Navigator, the second is the Flight Engineer (bailing out through the Pilot-Navigator's emergency exit). In some conditions it is advisable for the Flight Engineer to abandon the helicopter through the cargo door. If there are persons with parachutes in the cargo compartment the Captain will abandon the helicopter after them.

(9) Actions of the Pilot-Navigator in abandoning the helicopter upon the Captain's order:

(a) Pull out the blister emergency release handle by the right hand and unfasten the safety harness.

(b) Move the left-leg over the collective pitch control lever and step on the floor between the Pilots' seats.

(c) Grip the semi-soft loop in the blister opening forward upper corner with the left hand and abut the right hand against its lower edge at the RH side.

(d) Raise from the seat, remove the parachute pack from the seat pan, turn to the right so as to face the blister opening, and step with the right foot onto the seat pan.

(e) Jump on both legs and vigorously pull yourself with both hands through the blister opening and bail out of the helicopter with the

head down.

(10) Actions of the Flight Engineer upon the Captain's order:

(a) For bailout through the Pilot-Navigator's blister the Flight Engineer should proceed as follows:

1) Unfasten the safety harness.

2) Raise from the seat and make a step forward, with the left leg.

3) Turn to the right to face the blister opening and step with the right foot onto the Pilot-Navigator 'a seat pan.

4) Hold the blister opening side edges with both hands.

5) Jump on both legs and simultaneously pull yourself with both hands to bail out of the helicopter with the head down.

(b) For bailout through the cargo door the Flight Engineer should proceed as follows:

1) Unfasten the safety harness

2) Raise from the seat and turn 180° to the left.

3) Fold up the seat by the left hand.

4) Open the cargo compartment door by the right hand.

5) Enter the cargo compartment, turn the entrance door emergency release handle to the left and push it out.

6) Step with the left foot at the left corner of the door opening and jump both legs to bail out of the helicopter with the head down.

(11) Actions of the Captain (Pilot) in abandoning the helicopter:

(a) Pull out the blister emergency release handle with the left hand.

(b) Unfasten the safety harness with the right hand,

(c) Move the right leg into the aisle and step onto the floor between the Pilots' seats.

(d) Grip the semi-soft loop in the blister opening upper corner with the right hand and abut the left hand against the opening left lower corner.

(e) Raise a bit, remove the parachute pack out of the-seat pan, turn to the left to face the opening and step with the left leg onto the seat pan

(f) Jump on both legs and simultaneously pull yourself by both hands to bail out of the helicopter with the head down.

(12) Actions of the Service passengers when abandoning the helicopter upon the Captain's order:

(a) Release the entrance door (if it has not been released by the Flight Engineer) and the emergency exit door in the cargo compartment rear portion (to be carried out by the senior members of the team appointed by the Captain .before flight).

(b) Engage the parachute static line snap hook with the cable near the entrance door (emergency exit).

(c) Bail out through the entrance door opening and the emergency exit in sequence indicated by the Captain before flight.

(d) To bail out through the entrance door opening step with the left leg at the door opening left lower corner and push yourself by this leg aside to abondon the helicopter with the head down.

(e) To bail out through the emergency exit kneel on one knee, hold the exit opening side edges with both hands and push yourself by the hands and legs to abandon the helicopter with the head down.

(13) If after pulling out the blister (door, cover) emergency release handle it fails to be released push vigorously the blister (door, cover) outside with a leg or hand.

(14) In flight with the use of the ККО-ЛС oxygen equipment, before abandoning the helicopter make sure (after raising from the seat) the oxygen line is disconnected. If otherwise, disconnect it manually by pulling the red ball at the P-58 connector.

6.27. Emergency evacuation on the. ground

(1) Emergency evacuation of the occupants from the helicopter on the ground should be performed in the following way:

(a) The crew members leave the helicopter through the openings of the released blisters and cargo compartment entrance door.

(b) The passengers leave the helicopter through the openings of the released entrance doors and emergency exits of the cargo compartment.

(2) Before emergency evacuation unfasten the safety harness and get out through the nearest unobstructed emergency exits.

After evacuation from the helicopter run to a safe distance, and aid persons injured.

6.28. Loss of radio communication

(1) The radio communication with the flying control service is considered lost if, with all the frequency channels used, the flying control officer does not answer multiple requests during 5 min.

(2) If the radio communication is lost, switch on the "Distress" call transmission and proceed in accordance with the Flight Operational Rules.

6.29. Failure of tail rotor pitch limit system

(1) Indications

(a) The null indicator movable index does not change its position or deflects to the right (to limit the right pedal travel) with the altitude or outside air temperature increasing.

(b) Illumination of the OFF (ОТКЛ) red switch-light and deflection of the movable index to the leftmost position.

(2) Crew's actions

(a) Upon occurrence of the first indication of tail rotor pitch limit system failure in flight set the PITCH LIM SYS (ПОДВИЖ. УПОРЫ) switch to the lower position and make sure the movable index sets to the leftmost position. In this case, as well as upon occurrence of the next failure indication execute normal landing avoiding sharp and large travels of the pedals in order to prevent overloading of the helicopter transmission.

(b) If the movable index fails to set to the leftmost position with the PITCH LIM SYS (ПОДВИЖ. УПОРЫ) switch set in the lower position, execute running landing. If it proves to be impossible, drop the external stores, use fuel contained in the main fuel tanks and execute vertical landing with the helicopter headed into the wind.

Section 7

OPERATION OF SYSTEMS

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7. OPERATION OF SYSTEMS

7.1 Anti-icing system

(1) Check the anti-icing system before flight at an ambient temperature of +5°C or below, as well as before flight in IMC.

Caution: Check the rotor blade anti-ice system only with the engines running.

After starting the engines and with the generators operating normally functionally check the anti-icing system proceeding in the following way:

(a) Switch on the ANTI-ICING SYSTEM (ПРОТИВООБЛЕДЕНИТЕЛЬНАЯ СИСТЕМА), CONTROL (УПРАВЛЕНИЕ) ENG DUST PROT, LEFT (ПЗУ ДВИГАТ. ЛЕВОГО), ENG DUST PROT RIGHT (ПЗУ ДВИГАТ. ПРАВОГО), ice detector, HEATING W/S (ОБОГРЕВ СТЕКОЛ) circuit breakers.

(b) On the anti-icing system control panel set the MAN-AUTO (РУЧН-АВТОМАТ) selector switch to MAN (РУЧН). This done, the main and tail rotor, windshield, right engine, right forward and right rear dust protection devices anti-icers become energised and the ANTI ICE ON (ПОС ВКЛЮЧЕНА) R ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ПР.), R DUST PROT FWD (ПРАВ ПЗУ ПЕРЕДН) and R DUST PROT REAR (ПРАВ. ПЗУ ЗАДН.) annunciators come on, but the left engine, the left forward and rear dust protection devices anti-icing remain off.

The left engine anti-icing should be switched on manually and the L ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ЛЕВ.), L DUST PROT FWD (ЛЕВ. ПЗУ ПЕРЕДН) and L DUST PROT REAR (ЛЕВ. ПЗУ ЗАДН) annunciators come on.

(c) Set the LOAD CURRENT (ТОК ПОТРЕБИТЕЛЕЙ) selector switch alternately to MAIN ROTOR BLADES 1-2-3-4-5 (ЛОПАСТИ НЕСУЩ. ВИНТА 1-2-3-4-5 and read the ammeter to check the current drawn by each section of the main rotor blade anti-icing system. The number of section under test is determined by illumination of the SECTION 1 (1 СЕКЦИЯ), SECTION 2 (2 СЕКЦИЯ), SECTION 3 (3 СЕКЦИЯ), SECTION 4 (4 СЕКЦИЯ) lights. The ammeter reading for each section of the main rotor blade heaters should be within the limits of 60 to 80 A.

(d) Set the LOAD CURRENT (ТОК ПОТРЕБИТЕЛЕЙ) selector switch to TAIL ROTOR (ХВОСТ. ВИНТ). The anti-icing system ammeter readings for the tail rotor blades heaters should be within the limits of110 to 150 A.

Caution: It is allowed to energize the main and tail rotor blade anti-icing system on the ground for a period of one cycle. If the check is not completed during cycle energize the anti-icing to complete the check not earlier then in five minutes.

(e) Functionally check the windshield heaters by setting the wafer selector switch to HEATING W/S (ОБОГРЕВ СТЕКОЛ), and the anti-icing system ammeter readings should be within the limits of 40 to 90 A.

The actual value of current drawn is obtained after dividing the am-

meter readings by 6.

Note: The windshield heaters will become energized only if the ambient temperature is below the heat control setting (20°).

(f) Illuminator of the R ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ПРАВ), R DUST PROT FWD (ПРВ. ПЗУ ПЕРЕДН), R DUST PROT REAR (ПРВ. ПЗУ ЗАДН) annunciators indicates that the valves controlling supply of hot air to the right engine air intake and dust protection device are open.

(g) Switch off the anti-icing system by setting the ammeter selector switch to OFF (ВЫКЛ). On the anti-icing system control panel set the MAN-AUTO (АВТОМ) and depress the anti-icing system switching off button. The ANTI-ICE ON (ПОС ВКЛЮЧЕНА), R ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ПР), R DUST PROT FWD (ПРАВ. ПЗУ ПЕРЕДН), R DUST PROT REAR (ПРАВ. ПЗУ ЗАДН) annunciators should go out.

Functional check of the engine anti-icing system and windscreen heaters can be performed independently from a functional check of the main and tail rotors blade anti-icing. To functionally check the engine anti-icing system set the ENG DUST PROT LEFT (ДВИГАТ ПЗУ ЛЕВ) selector switch to ON (ВКЛ) and observe the L ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ЛЕВ), L DUST PROT FWD (ЛЕВ. ПЗУ ПЕРЕДН), L DUST PROT REAR (ЛЕВ. ПЗУ ЗАДН) annunciators to come on.

(h) Set the ENG DUST PROT RIGHT (ДВИГ. ПЗУ ПРАВ) selector switch to MAN (РУЧНОЕ) and observe the R ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ПР), R DUST PROT FWD (ПРАВ. ПЗУ ПЕРЕДН), R DUST PROT REAR (ПРАВ. ПЗУ ЗАДН) annunciators to come.on.

(i) Set the ENG DUST PROT LEFT (ДВИГ. ПЗУ ЛЕВ), ENG DUST PROT RIGHT (ДВИГ. ПЗУ ПРАВ) selector switches to OFF (ВЫКЛ) and AUTO (АВТОМАТ) respectively. The L ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ЛЕВ), L DUST PROT FWD (ЛЕВ. ПЗУ ПЕРЕДН), L DUST PROT REAR (ЛЕВ. ПЗУ ЗАДН), R ENG ANTI-ICE (ОБОГРЕВ ДВИГ. ПРАВ), R DUST PROT FWD (ПРАВ. ПЗУ ПЕРЕДН), R DUST PROT REAR (ПРАВ. ПЗУ ЗАДН) go out, and the electric actuators close the valves and get de-energized.

Notes: 1. With the engine anti-icing system turned on, the turbine inlet temperature rises by 25 to 50°C and the gas generator rotor speed may rise by 1 to 2%, thus indicating that hot air is supplied to the anti-icing system.

2. At ambient temperatures above +15°C energize the antiicing system at engine power not exceeding normal.

After completion of the anti-icing system functional check make sure that the voltmeter selector switch is set to 115, the anti-icing system GENERAL MAN-AUTO (ОБЩЕЕ РУЧН-АВТОМ) selector switch is set to AUTO (АВТОМ), the ENG DUST PROT RIGHT (ДВИГ. ПЗУ ПРАВ). W/S (СТЕКОЛ), ice detector selector switches are set to AUTO (АВТОМ) and the ENG DUST PROT LEFT (ДВИГ. ПЗУ ЛЕВ) selector switch is set to OFF (ВЫКЛ).

Note: With the ice detector (SO-121) circuit breaker closed, the ICING (ОБЛЕДЕН) annunciator may come on and go out in 15 to 30 s.

7.2. Electronic equipment

(1) Before switching on the electronic equipment make sure the aircraft DC system voltage is 28.5 V and the aircraft AC system voltage is 115 V.

Monitor the DC and AC voltages by reading the voltmeters installed on the overhead electrical control panel in the flight compartment.

7.2.1. СПУ-7 Interphone system

The interphone system provides internal communication between the crew members. In addition, each crew member can use any radio equipment he needs in flight by means of the interphone control box.

To use the interphone system proceed as follows:

(1) The Pilot-Navigator closes the INT (СПУ-7) circuit breaker installed on the RH CB sub-panel of the overhead electrical control panel to energize the interphone system.

(2) Each crew member connects his headset to the interphone control box cable.

(3) Set the MAINS 1-2 (СЕТЬ 1 - СЕТЬ 2) selector switches on the interphone control boxes to 1 (СЕТЬ 1).

(4) Call the desired crew member by depressing the interphone button (the ICS-RADIO (СПУ-РАДИО) selector switch) on the helicopter control stick, the CALL (ЦВ) button on the interphone control box or the CALL (ВЫЗОВ) button at the additional interphone panel.

In all cases the internal communication between the crew members should be established and maintained irrespective of the radio communication selector switch position and the ICS-RADIO (СПУ-РАДИО) selector switch position on the interphone control box.

When conducting the internal communication both pilots should simultaneously listen to (at a reduced volume) transmission of the station to which the selector switches of the interphone control boxes are set.

(5) When testing the interphone system make sure the voice messages are distinct and loud enough. Adjust the volume by the volume controls installed on the interphone control boxes and the additional interphone panels.

(6) To listen to the signals received by the automatic direction finders set the MONITOR MF ADF - VHF ADF (ПРОСЛУШ. АРК-9 - АРК-УД) selector switch at the Flight Engineer's station to MF ADF (АРК-9) or VHF ADF (АРК- УД), as desired. The Pilot (left or right) should depress the CALL (ЦВ) button on his interphone control box in order to establish internal communication with the Flight Engineer (or the Instructor).

(7) If a crew member occupying the Flight Engineer's station wants to communicate with the Pilots, he should set the MONITOR MF ADF - VHF ADF (ПРОСУШИВ. АРК-9 - АРК-У2) selector switch to the neutral position and depress the INT (СПУ) button or, leaving the MONITOR MF ADF –VHF ADF (ПРОСЛУШИВ. АРК-9 - АРК-У2) selector switch in the position corresponding to the ADF being listened to, depress the CALL (ВЫЗОВ) button on the additional interphone panel.

7.2.2. P-863 VHF-UHF Radio

Use the P-863 VHF-UHF radio as follows:

(1) Energize the radio station by pressing the CMND RADIO (КОМАНД. РС) and INT (СПУ) circuit breaker on the right CB panel, and the radio control panel should become red light illuminated.

(2) On the interphone control box, set:

(a) ICS-RADIO (СПУ-РАДИО) selector switch to RADIO (РАДИО).

(b) Radio means selector switch to VHF (УКР).

(c) MAINS-1, 2 (СЕТЬ-1, 2) selector switch to 1.

(3) On the radio control panel, set:

(a) NS-OFF (ПШ-ШКЛ) switch to OFF (ВЫКЛ).

(b) Volume control to the extreme right position (maximum volume).

(c) CHANNEL (КАНАЛ) selector switch to the number of the communication channel required.

(d) FM-AM (ЧМ-АМ) selector switch to the position corresponding to the respective user's operation mode.

Note: 1. The AM mode is used when ground (helicopter) radio stations operate in the amplitude modulation mode.

2. The FM (ЧМ) mode - when ground (helicopter) radio stations operate in the frequency modulation mode.

(4) Open the NS (ПШ) switch when flying at a great distance from the communicating station.

(5) Select the radio station from the RECEPTION mode to the TRANSMISSION mode by setting the ICS-RADIO (СПУ-РАДИО) switch on the control stick to 2 (the second click is heard).

(6) Test the radio station by conducting a two-way communication with other radio stations or hearing a side-tone and noise in the headphones.

Note: When the P-863 radio receives some information, the Карат-М24 radio is not recommended to operate for transmission, as some interference in reception may occur.

7.2.3. "Ядро-1а" HF Radio

Use the Ядро-1а - HF radio as follows:

(1) Energize the radio station and interphone by closing the COMM RADIO-INT (СВЯЗНАЯ РС) circuit breaker installed on the left CB sub-panel of the overhead switch panel and the COMM RADIO switch on the right sub-panel of the electrical control panel.

(2) Set the interphone control box radio communication means selector switch to MF (СР) and the ICS - RADIO (СПУ-РАДИО) selector switch to RADIO (РАДИО).

(3) Turn the volume control, located on the radio station control panel, fully to the right. Tune the radio station to the desired frequency, after that the TUNING annunciator, located on the radio station control panel, should go on, and in 5 sec. maximum the annunciator should go out. Set the modulation selector switch OFF- SSB- AM to a position which corresponds to a modulation of the ground station. Set the NS-OFF switch to OFF position.

(4) Depress the TEST (КОНТРОЛЬ) button on the control panel. If the radio station is serviceable and operates in reception mode the TEST light, located on the control panel, goes on and a noise is heard in the headphones; if the radio operates in transmission mode an aural signal should be heard and the TEST light should go on.

(5) Functionally check the radio station by establishing two-way communication with other radio stations, the noise suppressor being ON/OFF or using the built-in test

Note: 1. If the TUNING annunciator does not go out after 5 seconds set the operating frequency again. If after that the TUNING annunciator persists in being illuminated the radio station is failed.

2. If the EMERG (emergency) annunciator goes on switch the radio station off and turn it on again. If the EMERG annunciator persists in being illuminated it means that the radio power supply circuit is failed. Switch the radio off.

(6) To operate the radio in flight, proceed as for testing. If the readability gets worse switch the NS off. To turn the radio station off, set the COMM RADIO circuit breaker to OFF position.

7.2.4. БАКЛАН-20 VHF Radio.

To use the command VHF radio proceed as follows:

(1) Set the radio communication means selector switch, located on the interphone control box in the cockpit, to VHF position; set the INT-RADIO selector switch to RADIO position.

(2) Switch on the CMND RADIO and INT circuit breaker, located on the left CB panel of overhead electric panel.

(3) Set the left operating frequency setting knob, located on the radio control panel, to a position which corresponds to first three digits of a required communication channel; set the right knob to a position which corresponds to last three digits of a required communication channel. Set the NS switch to the lower position.

(4) Using the GENERAL controls, located on the interphone control box, adjust the required volume. If the sensitivity of the receiver is normal the receiver noise should be heard in the pilot's and co-pilot's headphones

(5) To change over the radio from reception to transmission press the INT-RADIO trigger, located on the helicopter control sticks, until the second step starts operating and make a trial voice transmission: your own message should be heard in the headphones.

(6) To switch on the noise suppressor set the NS switch, located on the control panel, to NS position.

(7) Check the radio for operation by establishing two-way communication with other radio stations or by side-tone monitoring and listening to noise in the headphones.

(8) Switch on the STAND-BY RADIO circuit breaker, set the selector switch, located on the interphone control box, to KP position and check the БАКЛАН-20 stand-by radio for operation proceeding the same way.

Caution: While one of БАКЛАН-20 radio is operating in transmission mode, a signal received by the other radio becomes interlocked.

7.2.5. П-503Б Voice Recorder

To turn on the voice recorder and perform recording proceed as follows:

(1) Set the voice recorder control panel switch to ON (ВКЛ) with the INT (СПУ-7) circuit breaker closed. The recorder control panel is located on the left side panel of electric overhead panel.

(2) On the voice recorder control panel set the AUTOSTART - CONT OP (continuous operation) (АВТОПУСК - НЕПРЕРЫВНАЯ РАБОТА) selector switch to CONT OP (НЕПРЕРЫВНАЯ РАБОТА) and the ICS-MIKE (СПУ-ЛАР) selector switch to ICS (СПУ). The RECORD (ЗАПИСЬ) and BRT (ПОДСВЕТ) indication lights on the voice recorder control panel should come on to indicate that the recorder operates. The operation mode is to be selected depending on time in flight. The CONTINUOUS OPERATION mode is more preferable, because it ensures recording without any separate sound loss, which happens while starting the recorder in AUTOSTART mode. If the time in flight does not exceed 4 hours the CONTINUOUS OPERATION and auto reverse are to be selected for the recorder. If the time in flight is from 4 up to 9 hours auto reverse off mode may be selected providing that the rewinding mechanism will be set in the initial position. The ICS-MIKE selector switch is to be set to a position, which corresponds to the input from which the recording will be performed. The recording from MIKE input is used if a need is to record an information, which is not intended for broadcasting. In this case the operator has no access to interphone path, but he has a possibility to listen with a lower volume to the information from interphone output of the other radio communication means (call signal). The recorder operation is monitored with the RECORD light and by self-listening. If the tape transport mechanism operates the RECORD light is illuminated. The recorder being supplied with power the red lighting of control panel illuminates. The dimming control of the red lighting is performed with BRT potentiometer.

The MIKE (ЛАР) mode is used when a need in covert recording of information not intended for broadcasting arises. In this case the pilot has no possibility to go on the air for a radio contact.

(3) Set the AUTOSTART - CONT OP(АВТОПУСК - НЕПРЕРЫВНАЯ РАБОТА) selector switch to AUTOSTART (АВТОПУСК). This done, the tape transport should stop and the RECORD (ЗАПИСЬ) light should go out.

When the first work is pronounced into the interphone microphone or through any radio station the RECORD (ЗАПИСЬ) light should come on to indicate operation of the tape transport in the AUTOSTART (АВТОПУСК) mode.

At a lapse of 5 to 25 s after the end of voice message the tape transport should stop and the RECORD (ЗАПИСЬ) light should go out.

(4) Beside the manual energization of the voice recorder by means of the switch on its control panel, the power is supplied to the voice recorder automatically after the LG wheels come clear of the ground.

7.2.6. АРК-15 MF Automatic Direction Finder

Use the automatic direction finder (ADF) as follows:

(1) Switch on the ADF (АРК-15) and INT circuit breaker located on the overhead CB panel. For use of УГР-4УК indicator while operating the MFADF

(АРК-15) and VHF-UHF ADF there is a MF ADF – VHF ADF selector switch, located on the left instrument panel.

(1a) Set the MF ADF – VHF ADF selector switch to MF ADF position (for helicopters which are not equipped with БСУП-2К indicator of the VHF-UHF ADF).

(2) Set the ADF control panel mode selector switch to ANTENNA (АНТ).

(3) Set the interphone control box communication channel selector switch to ADF 1 (РК-1), set the ICS –RADIO selector switch to RADIO position.

(4) Set the channel selector switch to position 1, using the 1st channel band selector switch set the omnirange station operation frequency and listen to its call sign (it should be heard clearly).

(5) Adjust the volume of received signals by operating the volume controls on the ADF control panel and the interphone control box.

(6) Set the ADF control panel mode selector switch to COMPASS (КОМ) and check the displayed radio station relative bearing for correctness.

(7) Functionally check the VOICE-CW (ТЛФ-ТЛГ) selector switch by occurrence of an audio frequency buzzing in the headphones in the C-W mode and its discontinuation in the VOICE (ТЛФ) mode.

(8) Press the LOOP (РАМ) button and move the КУР ПНП-72-15 indicator pointer by an angle of 90° ... 120° from the initial position. Release the button: the КУР indicator pointer should return to the initial position. Set the ADF to channel 2 position.

Note: It is necessary to take into account that the aural bearing value will be two-valued with a shift of 180°.

7.2.7. АРК-УД VHF-UHF Automatic Direction Finder

Use the АРК-УД UHF VHF ADF proceed as follows:

(1) Switch on the VHF ADF (РАДИОКОМПАС УКВ) and INT (СПУ) circuit breakers located on the overhead electrical control panel.

(1a) Set the MF ADF –VHF ADF switch to VHF ADF position (for the helicopters, which are not equipped with БСУП-2К indicator of the VHF-UHF ADF).

(2) Set the interphone control box communication channel selector switch to ADF 2 (РК 2) and the ICS-RADIO (СПУ-РАДИО) selector switch to RADIO (РАДИО).

(3) Set the mode selector switch on the control panel to ВВ (ШП), the frequency range selector switch to USW (УКВ) and the CHANNELS (КАНАЛЫ) selector switch to 4, and the receiver own noise should be heard in the earphones.

(4) Depress the TEST (КОНТР) button and keep it depressed until the ADF indicator pointer sets to 180° ± 13°. As it takes place, the NB (УП) and ВВ (ПШ) indicating lights should illuminate and the audio frequency signal should be heard in the headphones.

(5) Depress the LOOP L (АНТ. Л) or LOOP R (АНТ. П) button and, holding the TEST (КОНТР) button depressed, set the ADF indicator pointer to 30° (or 330°), release the L (Л) or R (П) button, and the pointer should return to 180° ± 13°.

(6) Perform a similar test with the mode selector switch set to NB (УП) position (the NB (УП) light should come on) and then to PULSE (И) position (the И and possibly УП lights should come on). With the mode selector switch set to PULSE (И), an audio signal of reduced frequency should be heard in the

headphones.

(7) Set the frequency range selector switch on the ADF control panel to DMW (ДЦВ) and the CHANNEL (КАНАЛ) selector switch to 1. Functionally check the UHF VHF ADF in the BB (ШП), PULSE (И) and NB (УП) modes following the above procedure.

Note. It is allowed to functionally check the ADF in the frequency ranges and modes to be used in the mission.

7.2.8. A-037 Radio Altimeter

To switch on and functionally check the radio altimeter proceed as follows:

(1) Switch on the RADIO ALTIMETER switch installed on the right CB subpanel of the overhead electrical control panel.

(2) Set the RADIO ALT ON-OFF switch installed on the left instrument panel to ON. After the radio altimeter is switched on, the altitude indicator pointer should deflect within the dial black sector and after 1-2 minutes it should be set within the dual zero mark marked with figure, and the altitude indicator warning flag should disappear. If the alert altitude bug is set within measured altitude range, beginning from 5 m, at the moment the pointer is against alert altitude mark the alert altitude warning light, located on the radio altimeter indicator front panel, goes on. The pilots, as well, should be warned by an aural signal heard in their headphones.

(3) Press the TEST button, located on the radio altimeter indicator front panel, the indicator pointer should be set within the scale test sector. Release the TEST button: the indicator pointer should return to initial position.

7.2.9. РИ-65 Voice Warning System

Use the РИ-65 Voice Warning system as follows:

(1) Supply power to the РИ-65 information reporting system by closing the INF REP (РИ-65) switch installed on the left switch panel of the overhead electrical control panel, and the SWITCH INF REPORT ON (ВКЛЮЧИ РИ-65) annunciator goes out (switch on the voice warning system after the engines are started).

(2) Functionally check the РИ-65 information reporting system by depressing the TEST (ПРОВЕРКА) button on the information reporting system control panel, and the "Information reporting system OK" voice message should be heard twice in the headphones.

In the course of reproduction of the above voice message depress the OFF (ОТКЛ) button, and the voice message being reproduced discontinues.

Depress the REPEAT (ПОВТОР) button for not less than 1 s, and the "Information reporting system OK" voice message should be heard twice in the headphones.

7.2.10 СРО-2 Transponder

Use the СРО-2 transponder as follows:

(1) Switch ON the TRSP (СРО) circuit breaker located on the overhead CB panel and set the POWER-OFF (ПИТАНИЕ-ВЫКЛ) switch located on the control panel to POWER (ПИТАНИЕ).

(2) Operate the code selector knob on the control panel to select a desired channel.

(3) Functionally check the transponder by illumination of the POWER TEST

(КОНТР ПИТ) and CODE ON (КОД ВКЛ) lights and momentary flashes of the TRANSMISSION (ИЗЛУЧ) lights.

7.3. Oxygen equipment

Warning: In flights at altitudes above 4000 m use the oxygen equipment.

(1) Before a flight in which the use of oxygen equipment is anticipated inspect and functionally check the oxygen equipment for which purpose each crew member should do the following:

(a) Make sure the ККО-ЛС oxygen equipment sets are installed and securely fastened.

(b) Make sure the P-38 connector disconnect is locked.

(c) Fasten the P-58 connector with its lock to the right leg loop below the circular strap semi-loop, and the КП-58 oxygen regulator on the circular strap at the right side below the parachute harness shoulder buckle.

(d) Connect the P-58 connector cord snap hook to the bracket fastened to the seat pan, and adjust the cord length so as the cord does not hinder the crew member's motions in flight and free from excessive slackness.

(e) Connect the КМ-16Н oxygen mask to the КП-58 oxygen regulator, don the mask and fit it against the face. Then jam the mask corrugated hose and try to make an inhalation. If it proves to be impossible the mask is tight and properly fitted.

(f) Open the КП-21 oxygen regulator cutoff valve and read the pressure gauge to make sure the oxygen pressure in the bottle is normal (30 kgf/cm^2 at an ambient temperature of 15 to 20°C).

(g) Functionally check the ККО-ЛС oxygen equipment act for which purpose open the КП-21 oxygen regulator emergency delivery valve and make several inhalations and exhalations. If breathing is not hindered and the oxygen flow indicator float responds to inhalation and exhalation the ККО-ЛС oxygen equipment set is considered OK.

(h) Close the КП-21 oxygen regulator emergency delivery valve.

(2) To use the oxygen equipment in flight proceed as follows :

(a) Make sure the КИ-16Н mask is fitted properly, connected to the КП-58 oxygen regulator and the КП-21 oxygen regulator cutoff valve is open.

(b) At an altitude of 2000 m observe the oxygen flow indicator to make sure breathing oxygen is supplied.

(c) Periodically monitor the oxygen flow indicator which should respond to inhalation and exhalation and periodically check the oxygen bottle pressure. If the oxygen pressure in one of the crew members' bottles drops to 10 kgf/cm^2, descend to an altitude not exceeding 4000 m.

Warning: In case of failure of the oxygen regulator, difficulties in breathing or feeling open the КП-21 oxygen regulator emergency delivery valve.

(3) The oxygen supply in the ККО-ЛС oxygen equipment bottle is adequate for flying with the oxygen used for not more than 45 min, at altitudes of 4000 to 5000 m for not more than 30 min, at altitudes of 5000 to 6000 m for not more than 20 min.

(4) The functional check of the oxygen equipment set provided with the КМ-

15М oxygen mask for oxygen supply to cases is as instructed in item (1).

(5) The cases are fed with oxygen on the ground and in flight periodically, in case of necessity (upon the medical attendant's decision).

Use oxygen as follows:

(a) Connect the КМ-15П oxygen mask to the КП-21 oxygen regulator.

(b) Don the mask and make sure it fits against the face.

(c) Open the cutoff valve.

(d) On the ground and in flight at altitudes up to 2000 m to feed oxygen open the КП-21 oxygen regulator emergency delivery valve. Open the КП-21 oxygen regulator emergency delivery valve as well upon failure of the oxygen regulator, difficulties in breathing or when feeling sick at any altitude.

7.4. ККО-ЛС2 Oxygen Equipment.

Use the oxygen equipment for flight above 4000 m altitude.

(1) The equipment includes 3 sets of quick-removable ККО-ЛС2 oxygen equipment installed on the crew work stations.

Each set includes:

- КП-75А oxygen regulator;
- КП-58 oxygen regulator;
- Р-58 connector;
- КМ-16Н oxygen mask with lock.

(2) To prepare and use the oxygen equipment in flight the oxygen regulator is provided with:

- connection for oxygen bottle;
- oxygen supply connection;
- oxygen supply valve provided with a pressure gage for checking the oxygen presence;
- handle for opening the additional oxygen supply valve (blue); the handle has two positions MIXTURE and 100% O_2.;
- handle for opening the oxygen continuous supply valve (red); the handle has ON/OFF positions.

(3) Up to an altitude of 2000 m, the additional oxygen valve handle being set to MIXTURE position, the respiration is ensured by ambient air, sucked through the mask oxygen dilutor valve. At a higher altitude the air-diluted oxygen will be automatically supplied: the higher is an altitude, the more oxygen is supplied. The oxygen supply is monitored with a flow indicator which is integrated into the disconnector hose. The equipment design allows to select the pure oxygen respiration and to turn on a continuous oxygen supply.

(4) Before flight with use of oxygen equipment it is necessary to inspect and check the equipment for operation, to do this each crew member should:

- make sure that there are no oil spots on the equipment parts;
- make sure that the additional oxygen handle is set to MIXTURE position and the continuous oxygen supply handle is to OFF position;
- make sure the disconnector pin is locked (with thread);

- before donning the parachute, feed the right leg loop through a slide with lock. The slide is designed to fix the disconnector in such a way that, the parachute being donned, the lock is on the external side (the lock latch may be at any position).
- secure the lock of the mask disconnector on the parachute strap;
- feed the right leg loop through a sling bracket and insert its adapter into the parachute lock;
- fasten the snap hook of the disconnector tie to the bracket and adjust the tie lenght in such a way that it does not obstruct the pilot's movement in flight and at the same time it should not be too long;
- connect the mask to the regulator, don the mask and adjust it to fit your face;
- check the mask for air-tightness: close the hole of the outlet valve seal with finger and make an exhalation. If it proves to be impossible, the mask is airtight and is properly fitted
- connect the disconnector hose to the mask connector;
- moothly and fully open the regulator valve and using the pressure gage make sure that there is oxygen in the bottle;
- set the continuous supply valve handle to ON position and to make sure the oxygen is supplied to the mask make several inhalations and exhalations. The flow indicator should be at upper position. Set the continuous supply handle to OFF position.
- set the additional oxygen valve handle to 100% O_2 position and make several inhalations and exhalations. If breathing is not hindered and the oxygen flow indicator float responds to inhalation/exhalation, the oxygen equipment set is considered OK;
- close the oxygen supply valve and relieve pressure from regulator making several inhalations and exhalations;
- after the flow indicator float stops responding to respiration make sure the pressure gage reads 0 kgf/cm^2 and pull the mask off;
- set the handle of additional oxygen valve to MIXTURE position.

Warning: 1. In case of flight to an altitude of more than 4000 m don the mask on the ground.

2. In order to prevent an early failure of oxygen regulator after closing the valve release obligatory the oxygen from the regulator.

(5) To use the oxygen equipment in flight proceed as follows:

- make sure that the additional oxygen handle is to MIXTURE position and continuous supply handle is to OFF position;
- the helicopter being on the ground, don the mask and open the oxygen supply valve;
- monitor the oxygen supply to the mask by how easy is the respiration and by motion of flow indicator float;
- monitor the oxygen presence using the pressure gage. In case of bottle pressure decrease to 25 kgf/cm^2 report it to Captain;
- if you do not feel well and there are difficulties in breathing set the continuous supply handle to ON position, check that the oxygen supply valve is open and report to Captain;

Warning: If the oxygen pressure is decreased to 25 kgf/cm^2 or the continuous supply valve is open, even by one of crew members, the Captain should report about it to Flying Control Officer and decrease the flight altitude to 3000 m maximum;

(6) When flying under contaminated environment conditions, set, after the Captain order, the additional oxygen handle to 100% O2 position.

(7) In case of necessity to walk around the cabin, the parachute being donned, proceed as follows:

- decrease the flight altitude to 3000 m maximum;
- separate the P-58 disconnector bayonet lock from the КП-58 regulator hose and pull the disconnector hose from under the strap. After coming back to the work station secure the disconnector into the lock with slide, put the disconnector hose to the КП-58 regulator under the right leg loop, connect the disconnector bayonet lock to the КП-58 regulator hose and open the КП-75А regulator valve.

(8) After stopping use of the oxygen equipment or if the helicopter is at an altitude of 3000 m maximum, close the valve, release pressure, pull the oxygen mask off. Set the additional oxygen handle to MIXTURE position. The oxygen equipment use for cases or wounded persons should be performed according to subsection 7.3. of the present Mi-17 helicopter Flight Manual.

7.5. Heating and ventilation

(1) It is recommended to use the КО-5О combustion heater in the following conditions:

(a) On the ground at an ambient temperature of +10°C or below.

(b) In flight with the engines running in any mode of flight.

At emergency landing switch off the КО-50 combustion heater before landing.

The combustion heater can be operated in the automatic, manual and fan modes.

For heating purpose the air is drawn from the atmosphere and partially from the cargo compartment or, for the purpose of fast warming up, only from the cargo compartment (recirculation mode) and delivered into the heater.

For ventilation purpose the air is drawn from the atmosphere.

(2) To heat the helicopter compartments in the automatic mode proceed as follows:

(a) Set the КО-5О combustion heater air intake fan shutter to a heater starting position. When starting the heater on the ground the shutter should be open, and be closed in flight.

(b) Switch on the COMB HTR (ОБОГРЕВАТЕЛЬ), HEATER AND PUMP (ПОДОГРЕВАТЕЛЬ И НАСОС) circuit breakers.

(c) Set the selector switch on the combustion heater control panel to AUTO (АВТОМАТ).

(d) Set the temperature selector as required.

(e) Depress the START (ЗАПУСК КО-50) button, and the HEATER (ПОДОГРЕВ ТОПЛИВА) annunciator on the control panel should come on. Then the IGNITION (ЗАЖИГАНИЕ) annunciator should

come on and the FUEL HEAT (ПОДОГРЕВ ТОПЛИВА) annunciator should go out. The COMBUST HTR ON (ОБОГРЕВАТЕЛЬ РАБОТАЕТ НОРМАЛЬНО) annunciator comes on simultaneously with the IGNITION (ЗАЖИГАНИЕ) annunciator. At a lapse of not more than 40 s the IGNITION (ЗАЖИГАНИЕ) annunciator goes out to indicate establishment of steady burning process in the K0-50 combustion heater.

(3) To heat the helicopter compartments in the manual control mode proceed as follows:

(a) Set the combustion heater fan shutter to a starting position.

(b) Switch off the COMB HTR (КО-5О) circuit breaker.

(c) Set the selector switch on the combustion heater control panel to MAN (РУЧНОЕ).

(d) Set the selector switch to FULL RATE (ПОЛН. РЕЖ) (maximum power) or MED RATE (СРЕД. РЕЖ) (medium power).

(e) Depress the HTR START (ЗАПУСК КО-50) button.

Caution: 1. If the combustion heater failed to light up within 40 seconds (The "IGNITION" (ЗАЖИГАНИЕ) annunciator fails to go out), set the "AUTO-MAN" (АВТОМАТ-РУЧНОЕ) selector switch on the combustion heater control panel to the midway position, eliminate the trouble proceeding as instructed in the Ми-17 Helicopter Maintenance Manual and restart the heater.

2. Before setting the "AUTO-MAN" (АВТОМАТ-РУЧНОЕ) selector switch from "AUTO" (АВТОМАТ) to "MAN" (РУЧНОЕ) and vice versa shut down the combustion heater, cool it down for 10 to 15 min and restart the heater.

3. Never start the combustion heater in recirculation mode if the air temperature in the cargo compartment exceeds +15°c.

(4) If a need arises to speed up heating of the helicopter compartments in the automatic or manual mode at an ambient temperature below -13°C select the recirculation mode by setting the air shutter control handle from OUTSIDE AIR (ИЗ АТМОСФЕРЫ) to CABIN AIR (ИЗ КАБИНЫ).

(5) To shut down the combustion heater set the AUTO-MAN (АВТОМАТ-РУЧНОЕ) selector switch neutral.

After landing drain fuel from the drain tank.

(6) To select the helicopter compartment ventilation mode set the FAN (ВЕНТИЛЯТОР) switch on the combustion heater control panel to ON (ВКЛ).

7.6.ДИСС-15 Doppler system

(1) Functionally check the ДИСС-15 Doppler system proceeding as follows:

(a) Set the selector switch on the Doppler monitor panel (behind of the co-pilot) to MEMORY (ПАМЯТЬ).

(b) Set the LAND-SEA("C-M") and OPERATION-MONITORING ("K-P") selector switches to LAND ("C") and OPERATION ("P"), respectively.

(c) Close the DOPPLER (ДИСС) circuit breaker, and set the DOPP (ДИСС) switch and, if necessary, the DOPPLER LIGHT (ПОДСВЕТ ДИСС) switch to ON (ВКЛ). The TEST (КОНТР), "М" and "В" annunciators on the monitor panel and the "П" annunciator on the ground speed and drift angle indicator, and the DOPP FAIL (ДИСС ОТКАЗАЛ) annunciator on the RH instrument panel should come on.

(d) Test the Doppler system for solving the test problems by successively setting the selector switch on the Doppler monitor panel to 1, 2 and 3. The readings of the hovering and low speed indicator should not differ by more than ±2.5 km/h and ±0.5 m/s respectively, from the values indicated on the monitor panel, and the readings of the ground speed and drift angle indicator should be 136 ±3.5 km/h and 0 ± 1°, respectively.

(e) Test the Doppler system in the SEA (МОРЕ) mode by setting the "С-М" (land-sea) selector switch on the ground speed and drift angle indicator to "М" with the monitor panel selector switch set to SPEED-136 (СКОРОСТЬ-136), DRIFT-O (СНОС-0).

The ground speed should rise by 3 km/h. Leave the "С-М" selector switch either in "С" or "М" position depending on the type of an anticipated flight - overterrain or over sea.

(f) Test the coordinate indicator, for which purpose set the TRACK-KM (ПУТЬ КМ), XTK DISTANCE-KM (БОКОВОЕ УКЛОНЕНИЕ-КМ), GRIVATION (УГОЛ КАРТЫ) digital readouts to zero by operating the "Н", "В", "ВЛ", "ВПР". "-" and "+" keys. With the Doppler monitor panel selector switch set to SPEED-136 (СКОРОСТЬ-136), DRIFT-0 (СНОС-0), a ground speed reading of 136 ± 3.5 km/h and a drift angle reading of 0 ± 1°, depress the ON (ВКЛ) key on the coordinate indicator. With the Doppler system operating properly, the FORWARD (ВПЕРЁД) digital readout of the coordinate indicator should display 11.3 km in 15 min.

(g) Check the computer for correct processing of the test problem introduced from the ground speed and drift angle indicator by setting the "K-P" selector switch to "K".

The ground speed reading should be 306 ±3.5 km/h, and the drift angle reading should be 15±11°.

(h) Check the doppler aystem for selection of the MEMORY mode by setting the monitor panel selector switch to MEMORY (ПАМЯТЬ), and the ground speed reading should change by not more than ±4 km/h and the drift angle reading by not more than ±3°.

The "П" annunciator on the ground speed and drift angle indicator should come on simultaneously.

After completion of the above checks set the "K-P" selector switch to "P", and the monitor panel selector switch to OPERAT (РАБОТА).

The time required for warming up of the ДИСС-15 doppler system at ambient temperatures above –40°C is 5 min, at lower temperatures this time is at least I5 min.

7.7. Tail rotor pitch limit system

Switch on and check the СПУУ-52 tail rotor pitch limit system as follows:

(1) After start of the engines close the circuit breaker on the RH CB panel,

set the PITCH LIM SYS (СПУУ-52) switch on the left sub-panel of the pilots' electrical control panel to ON (ВКЛ).

(2) Set the pedals neutral.

(3) Depress the OFF (ОТКЛ) switch-light on the pilots' central control pedestal (the switch-light should come on) and, keeping it depressed, set the momentary selector switch to "t" (the null indicator bar deflects to the right intermediate mark and then to "P") (the bar deflects to the left mark).

(4) Release the switch-light and the momentary selector switch. The switch-light should go out and the null indicator bar assumes the center position.

(5) Depress the OFF (ОТКЛ) switch-light and, keeping it depressed, turn the TEST (КОНТРОЛЬ) knob on the tail rotor pitch limit system control panel to set the null indicator bar to the rightmost position.

(6) Set the PITCH LIM SYS (СПУУ-52) switch to OFF (ВЫКЛ) and release the switch-light, and the null indicator bar should deflect to the rightmost position and the switch-light continue illuminating.

(7) Set the PITCH LIM SYS (СПУУ-52) switch to ON (ВКЛ), depress the switchlight and, keeping it depreesed, turn the TEST (КОНТРОЛЬ) knob to set the null indicator bar to the center position.

Before a flight all the circuit breakers and the PITCH LIM SYS (СПУУ-52) switch should be switched on, the null indicator bar should be in the center position determined by the ambient temperature and pressure and the OFF (ОТКЛ) switch-light should be off.

In flight the null indicator bar deflects to the left with the outside air temperature rising or pressure decreasing.

7.8. Control and check of electrical power sources

(1) Switch on the storage batteries as follows:

(a) Set the BATT 1-2 (АККУМУЛ 1, 2) switch to ON (ВКЛ).

(b) Check ths storage battery bus voltage by setting the wafer selector switch to BATT BUSES (ШИНЫ АКК). The voltage should be not less than 24 V.

(c) Check the condition of the storage batteries proceeding as follows:

1) Set the EXT PWR (АЭРОДР. ПИТАН) switch to OFF (ВЫКЛ).

2) Set the DC power control panel selector switch to BATT 1 (АККУМУЛ 1).

3) Set the BATT 2 (АККУМУЛ 2) switch to OFF (ВЫКЛ).

4) Energize the fuel booster pump and read the voltage on the voltmeter which should be not less than 24 V.

5) Set the wafer selector switch to BATT 2 (АККУМУЛ 2).

6) Set the BATT 2 (АККУМУЛ 2) switch to ON (ВКЛ), the BATT 1 (АККУМУЛ 1) switch to OFF (ВЫКЛ), and read the voltage on the voltmeter which should be not less than 24 V.

7) De-energize the fuel booster pump.

8) Set the BATT 1 (АККУМУЛ 1) switch to ON (ВКЛ).

9) Set the wafer selector switch to BATT BUSES (ШИНЫ АКК).

(2) Use a ground electrical power source as follows:

(a) To use the ground AC power source give an order to connect the

power source cable to the ШРАП-400-3Ф receptacle. After the EXT PWR ON (АЭР. ПИТ. ВКЛЮЧЕНО) annunciator comes on (this event occurs upon correct connection of the ground source), check the ground power source output voltage by setting the EXT PWR (АЭРОДР.ПИТАН) switch to ON (ВКЛ) and the wafer selector switch to EXT PWR (АЭРОДРОМ. ПИТАН). The voltage should be within the limits of 200 to 205 V.

Set the RECTIFIERS 1, 2, 3, (ВЫПРЯМИТЕЛИ I, II, III) switches to ON (ВКЛ), check the rectifier bus voltage by setting the wafer selector switch to RECT BUSES (ШИНЫ ВЫПР). The voltage should bewithin the limits of 27 to 29 V.

Set the ПО INV 115 VAC (ПО-5ООА "115") and ПТ INV 36 VAC (ПТ-200 "36") selector switches to AUTO (АВТОМАТ). Set the AC power control panel wafer selector switch to 115. The voltage read by the voltmeter should be 115 V.

(b) To use the ground DC power source give an order to connect the power source cable to the ШРАП-500К receptacle. After the EXT PWR ON (АЭР. ПИТ. ВКЛЮЧЕНО) annunciator comes on, set to EXT PWR (АЭРОДР. ПИТАН) switch to ON (ВКЛ). Check the ground power source output voltage by setting the wafer selector switch to EXT PWR (АЭР. ПИТАН). The voltage should be 27 to 29 V.

Set the ПО INV 115 VAC (ПО-5ООА 115) selector switch to MAN (РУЧНОЕ).

Check the inverter output voltage by setting the AC power control panel wafer selector switch to 115. The voltage should be 115 V.

7.9. АИ-9В APU starting

(1) Before starting the helicopter engines, start the АИ-9В APU, for which purpose proceed as follows:

(a) Give an order to start the APU.

(b) On the APU starting control panel set the START - CRANK – FALSE START (ЗАПУСК - ПРОКРУТ - ЛОЖНЫЙ ЗАПУСК) selector switch to START (ЗАПУСК).

(c) Depress the START (ЗАПУСК) button for 2 to 3 s. This done, the AUTO CONT ON (АВТОМАТ. ВКЛЮЧЕНА) annunciator should go on, the APU engine should automatically gain the idling speed which is indicated by illumination of the OIL PRESS NORMAL (ДАВЛ. МАСЛ. НОРМА), NORMAL SPEED (ОБОРОТЫ НОРМА) annunciators. The time to gain the Idling speed should not exceed 20 s.

(2) The following events are acceptable in the course of the APU start:

(a) Sudden rise in EGT not above 880°C.

(b) Flashing of the OIL PRESS NORMAL (ДАВЛ. МАСЛ. НОРМА) annunciator.

(c) A mains voltage drop not below 18 V.

(3) After the APU engine gains the idling speed check its operational parameters to make sure:

(a) The EGT does not exceed 720°C.

(b) The OIL PRESS NORMAL (ДАВЛ. МАСЛА НОРМА), NORMAL SPEED (ОБОРОТЫ НОРМА) annunciators illuminate.

(c) The air bleed line pressure is within the limits indicated on the graph in Fig. 3.2.

(d) The STBY GEN (РЕЗЕРВН. ГЕНЕРАТ) selector switch is set to OFF (ВЫКЛ).

(4) After warming up of the APU engine for not less than 1 min report readiness for start of the engines to the Captain.

(5) In case of inadvertent shutdown of the APU depress the APU OFF (ВЫКЛЮЧЕНИЕ АИ-9В) button for 2 to 3 s to cut off fuel supply to the APU engine.

(6) Abort the APU start by pressing the APU OFF (ВЫКЛЮЧЕНИЕ АИ-9В) for 2 to 3 s, if at least one of the following events occurs;

(a) No EGT indication in 9 s since the beginning of the starting cycle.

(b) The Starting circuit voltage drops below 18 V.

(c) The EGT tends to rise above 880°C.

(d) The auto start control unit operation indicating light continues illuminating 30 s after the beginning of the starting cycle.

(e) Some other malfunctions of the APU and its systems are detected.

(7) In case of an abortive start crank the APU engine as follows:

(a) Set the START - CRANK - FALSE START (ЗАПУСК - ПРОКРУТ – ЛОЖНЫЙ ЗАПУСК) selector switch to CRANK (ПРОКРУТ).

(b) Depress the START (ЗАПУСК) button and the AUTO CONT ON (АВТОМАТ. ВКЛЮЧЕНА) and OIL PRESS NORMAL (ДАВ. МАСЛА НОРМА) annunciators should come on.

(8) At an ambient temperature of -40°C or below heat the APU engine before start with hot air at a temperature of +60 to +90°C for 25 to 30min.

If the ambient temperature is below -40°C and the APU has been run for more than 10 min it is allowed to restart it within a period of 1 hour since shutdown.

(9) It is allowed to perform three successive starts of the APU engine with intervals of not less than 3 min. This cycle should be followed by shutdown and cooling for not less than 15 min.

(10) It is allowed to perform three successive air bleed cycles with intervals of not less than 1 min and the APU running unloaded. The duration of each air bleed cycle should not exceed 45 s. The total time of APU continuous operation in this mode should not exceed 10 min and should be followed by shutdown for the purpose of cooling during 15 min.

(11) The time of APU continuous operation in the standby generator mode should not exceed 30 min which should be followed by shutdown for the purpose of cooling during 15 min.

(12) In case of necessity it is allowed to perform five successive air bleed cycles to start the ТВ3-117МТ engines, each cycle not exceeding 45 s with intervals of not less than 1 min between air bleed cycles, with the APU running unloaded during the intervals. The total time of continuous operation should not exceed 13 min followed by shutdown for the purpose of cooling for not less than 15 min.

(13) When starting the АИ-9В APU engine NEVER bleed air for starting the ТВ3-117МТ engines, nor use the starter-generator as a generator.

7.10. A-813Ц Weather Radar.

7.10.1. Radar set purpose and its components.

(1) The A-813Ц radar set (KONTUR 10) is a third class weather radar, designed to solve the following tasks:

- radar detection of zones of both thunderstorm formation activities and turbulent cloud cover, with the estimation of degree of weather hazard;
- scanning over the earth surface, providing a possibility navigational orientation with reference to prominent land (over-sea) marks (objects).

(2) The radar set includes an antenna, transceiver provided with a waveguide transmission line, and a display.

(3) The Captain's and Navigator's work stations are equipped with all necessary to energize the radar, to prepare it for operation in flight, as well as to check it for serviceability and to operate it in flight.

7.10.2. Radar operational test.

(1) The radar operational test is performed with built-in test system on the ground as well as in flight in case of radar malfunction.

Note: It is prohibited to use any radar operating mode, while ground testing as well as while taking off until the helicopter taxies out to the runway.

On the ground the radar must be checked only in TEST mode to avoid the radiation into the environment.

(2) To switch on the radar proceed as follows:

- switch on the RADAR circuit breaker, located on the right ACB panel of the cockpit.
- press the ON button, located on the display front panel.

After that, the LED, located on the right side from the display screen, lights up and the radar is automatically set to TEST mode with 20 km scale.

(3) After the test picture has been displayed, make sure that it is identical to the reference one, Fig. 7.1. If the pictures are completely identical, it means that the radar is serviceable. If the test picture differs from the reference one, detect the failed unit using the Table 7.1.

Note: If after 3 minutes the test picture is not displayed, use the BRIGHTNESS control to display it.

Table 7.1

№	Test picture distortion	Failed unit
1.	There is no transceiver test signal rings or they are less than 3	Transceiver
2.	There is no one or several display test signal rings	Display
3.	There is no scanning line or NO SCANNING is displayed	Antenna
4.	Curvature of the picture field	Display

(3) De-energize the radar: press the ON button again and switch off the RADAR circuit breaker.

7.10.3. In-flight radar operation.

(1) Prior to take off switch the radar on following the para. 7.10.2.2.

(2) In flight the radar can be used in 3 main operation modes: TERRAIN (ЗЕМЛЯ), WEATHER (METEO) and OUTLINE (КОНТУР).

(3) Radar operation in TERRAIN mode.

- use the TERRAIN mode for radar reference points navigational orientation;
- switch on the TERRAIN mode by pressing the MODE button until the TERRAIN (ЗЕМЛЯ) is displayed;
- set the required picture range by pressing the upper (lower) SCAN R button;
- make sure that the 340°, 0° and 20° blue azimuth marks are displayed;
- by pressing the upper (lower) UP-DOWN tilt button display the green image of those terrain sector where you expect the prominent reference points to appear;
- control the brightness of the picture displayed using BRIGHTNESS control;
- using the TD control obtain an optimum display of the reference point by red colour on the green background;
- using the MGC control adjust an acceptable contrast range of the reference point display;
- detect and identify the reference point comparing the map with radar picture;
- as approaching to the reference point change the antenna tilt angle and the picture scale.

Note: 1. The configuration of the reference points displayed on the screen can differ from their configuration on the aeronautical chart.

2. A momentary disappearance of the displayed picture is allowed when the helicopter makes <10° banked turns. The picture disappearance is explained by the fact that the total pitch and bank angle exceeds the limits which ensure the antenna stabilization.

3. The distortion of the displayed reference points is possible in case of the radome icing

4. If necessary, you can cancel the indication of the azimuth marks on the display screen by pressing the MARKS button. The repeat pressing of the MARKS button will display the marks again.

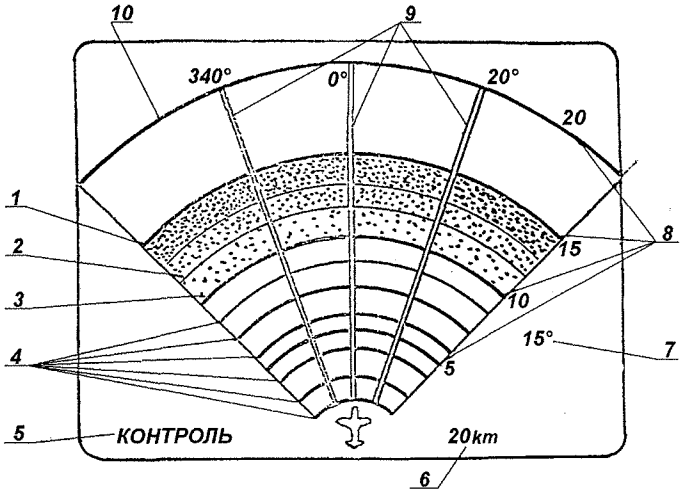


Fig. 7.1. TEST image

1. Image of indicator test signal - the 1st level (green)
2. Image of indicator test signal - the 2nd level (yellow)
3. Image of indicator test signal - the 3d level (red)
4. Image of transceiver test signal (green)
5. Mode - ON indication (blue)
6. Scale - ON indication (blue)
7. Antenna tilt indication (blue)
8. Calibration range marks with figure marking (blue)
9. Calibration azimuth marks with figure marking (blue)
10. Line simulating the antenna scanning (a dark one on a signal background)

(4) Radar operation in WEATHER and OUTLINE modes:

- use the WEATHER mode to detect the hazard weather formations (cumulonimbus clouds and thunderstorm clouds);
- turn on the WEATHER mode by pressing the MODE button until the METEO indication appears on the screen;
- set 200 km range scale by pressing the upper SCAN R button;
- set the optimum antenna tilt angle (0...+5°) by pressing the UP-DOWN tilt buttons.
- control the brightness of the displayed picture using the BRIGHTNESS control;
- after the clouds have been detected, determine the distance to them and their azimuth position about the helicopter;
- identify the nature of the clouds using the 3-colours picture;
- evaluate the danger of the detected clouds using the OUTLINE mode, to turn on this mode press the MODE button until the КОНТУР indication appears on the screen;
- as approaching to the clouds select in sequence 100 km, 40 km, 20 km, 8 km scale for the best surveillance of the clouds;
- if necessary control the picture brightness using the BRIGHTNESS control;

- identify the most dangerous zone (displayed in red colour) for the flight and make decision to avoid it.

Warning: It is temporary prohibited, until the degree of danger of the clouds is evaluated in WEATHER and OUTLINE modes, to use the obtained information for the clouds avoidance (passage).

7.10.4. General Information.

(1) Main data.

- scanning scale and respective range calibration marks (in brackets): 8(2), 20(5), 40(10), 100(25), 200(50) km
- azimuth mapping sector is ±45°;
- pitch angle azimuth marks: 340°, 0°, 20°;
- total angle of antenna beam stabilization is ±15°;
- vertical antenna deviation range is 15°;
- antenna beam is fan-shaped (6° in azimuth and 10° in elevation).

(2) The radar main operation modes are TERRAIN, WEATHER, OUTLINE. In these modes there is a radiation into the space.

The TEST (КОНТРОЛЬ) mode is an auxiliary one. It starts operating automatically when the radar gets supplied with power. There is no radiation into the space in this mode. The TEST mode serves to check the radar serviceability by comparing a displayed picture with the reference one (Fig. 7.1).

The failed unit is detected by comparing the difference between the test picture and the reference one (see Table 7.1).

The TERRAIN (ЗЕМЛЯ) mode allows to perform the navigation orientation using the prominent ground objects displayed on the screen.

The WEATHER (METEO) mode is designed to display the clouds radar picture in polar coordinates "Azimuth- Range". To determine the nature of clouds they are displayed with 3 colours: green, yellow, red. Yellow and red colour indication means a high degree of danger for flight.

The OUTLINE (КОНТУР) mode is designed to mark on the screen the most dangerous clouds zone. In this mode the dngerous zones are displayed in red colour.

(3) The radar switching ON/OFF and control on the ground and in flight is performed with the following controls, located on the display front panel beneath the screen (Fig.7.2):

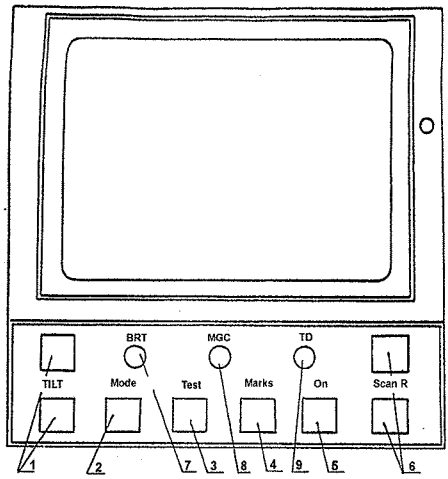


Fig. 7.2. Front panel of radar indicator

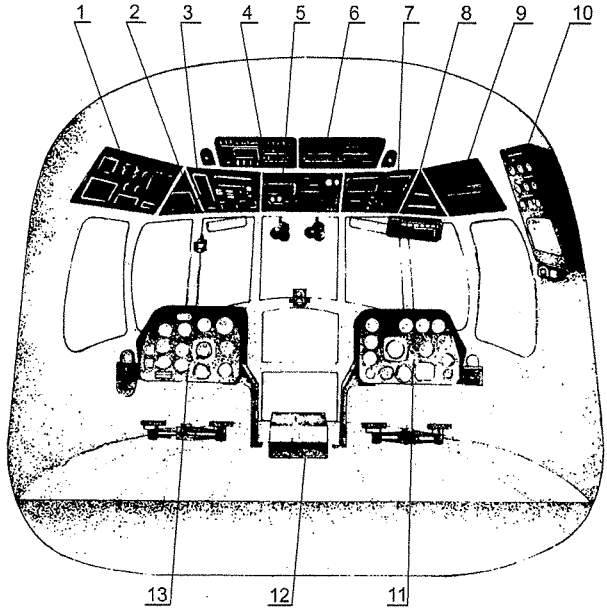
1. Two buttons TILT (Up-Down) for anenna tilt control.
2. Button MODE for switching on the main operatingl modes of the radar.
3. ButtonTEST for activation of the TEST mode (if one of the main modes of the radar has been already set).
4. Button MARKS for switching on/off azimuth marks.
5. Button ON for radar turn on/off.
6. Two buttons SCAN R (Larger-smaller) for image scale selection.
7. BRT brightness control for image brightness control on the indicator screen.
8. MGC control for manual gain control of the receiver and for selection of prominent reference points in the TERRAIN mode.
9. TD (target detection) control for reference points selection on the ground surface background with manual control of a red signal level.

- ON button designed for radar switching on/off;
- MODE button designed for changing over from one main operation mode to another;
- TEST button intended for switching on the TEST mode (in case if the radar is operating in one of the main modes: WEATHER, OUTLINE, TERRAIN);
- MARKS button intended for switching on/off the azimuth marks;
- TILT buttons designed for controlling the antenna tilt;
- two SCAN R buttons intended for selecting the picture scale;
- BRT control designed for the displayed picture brightness control;
- MGC control intended for manual gain control of the receiver and for selection of prominent reference points in TERRAIN mode;
- TD control intended for reference points selection on the terrain background by manual control of a red signal level.

7.10.5. Crew's actions in case of radar in-flight malfunction.

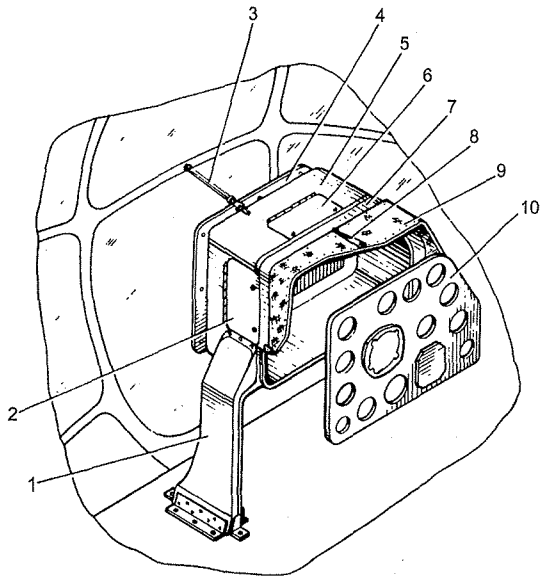
(1) In case of A-813Ц radar in-flight malfunction check the serviceability of the radar using TEST mode following the para.7.10.2. In case of failure switch the radar off and do not use it in flight.

SUPPLEMENT



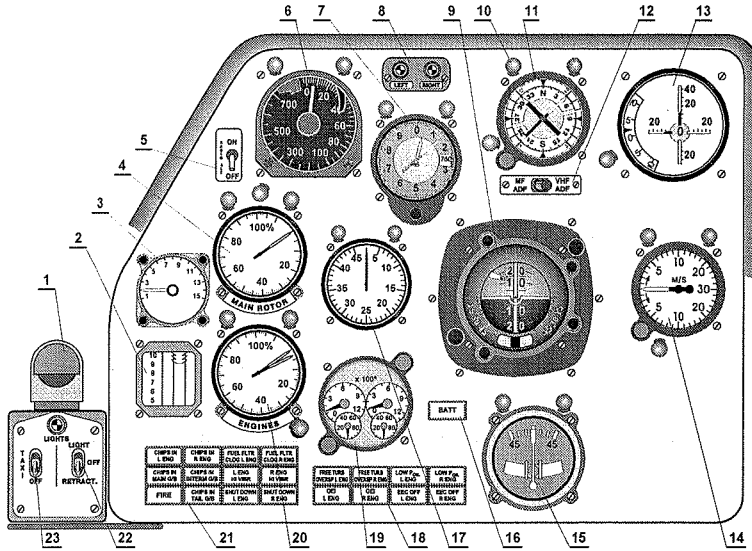
1. Left side panel of electric overhead panel
2. Left switch panel of electric overhead panel
3. Left panel of electric overhead panel
4. Left automatic circuit breaker panel
5. Center panel of electric overhead panel
6. Right automatic circuit breaker panel
7. Right panel of electric overhead panel
8. Right switch panel of electric overhead panel
9. Right side panel of electric overhead panel
10. Electric switch panel
11. Right instrument panel
12. Center console
13. Left instrument panel

Fig. 1 Arrangement of instrument panels and control panels in flight compartment



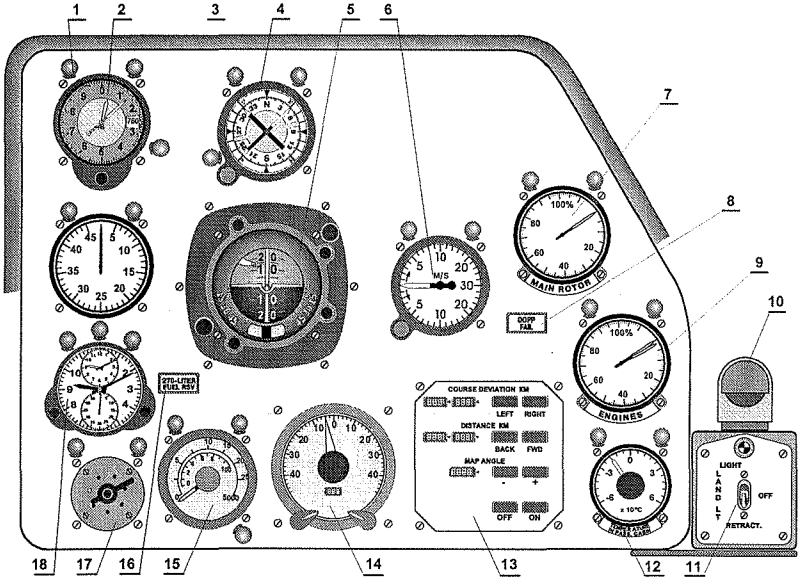
1. Support
2. 6. Access door cover
3. Rod
4. Casing cover
5. Casing
7. Glareshield
8. Distance piece
9. Anti-dazzle blind
10. Panel

Fig. 2 Instrument panel



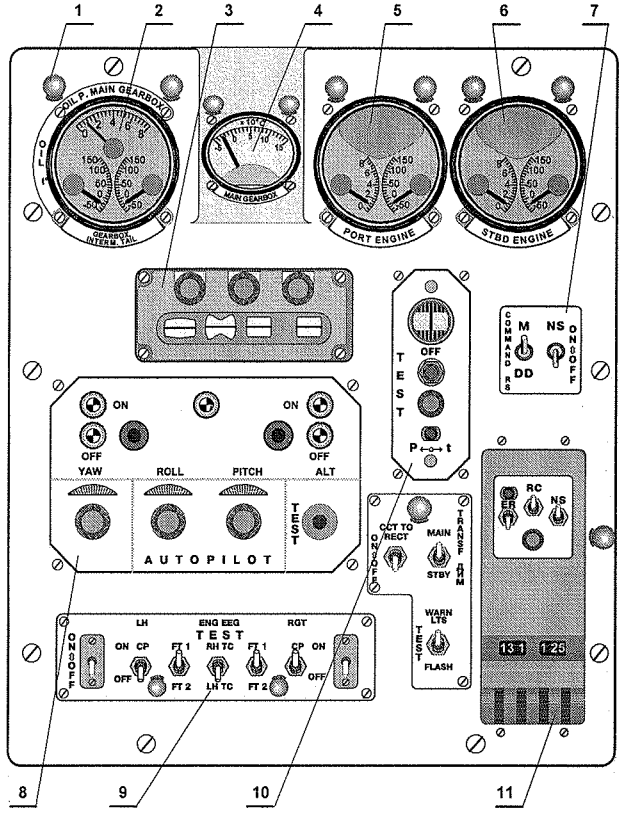
2. УР-117М indicator of ИР-117 engine pressure ratio meter
3. ИП-21 indicator of УП-15 main rotor collective pitch indicator
4. ИТЭ-1Т tachometer indicator of main rotor speed
5. А-037 radio altimeter disengage switch
6. А-034-4-22 altitude indicator
7. ВД-10ВК altimeter
9. АГБ-3К gyro horizon
10. Light CB
11. УГР-4УК indicator of ГМК-1АЭ compass system
12. Automatic direction finders selector switch.
13. Indicator of hovering and low speeds (unit 6) of ДИСС-15 Doppler system equipment
14. ВАР-30МК vertical speed indicator
15. ЭУП-53 turn indicator
16. Warning light
17. УС-450К speed indicator
18. Warning lights
19. ТВ3-117ВМ engine exhaust gases temperature indicator 2УТ-6К of 2ИА-6 dual measuring equipment.
20. ИТЭ-2Т two-pointer indicator of ТВ3-117ВМ engines RPM
21. Warning lights
22. Selector switch of ФПП-7М left landing taxi light
23. Switch of ФР-100 taxi light

Fig 3 Left instrument panel



1. Light CB
2. ВД-10ВК altimeter
3. УС-450К speed indicator
4. УГР-4УК indicator of ГМК-1АЭ compass system
5. АГБ-3К gyro horizon
6. ВАР-30МК vertical speed indicator
7. Tachometer ИТЭ-1Т indicator of main rotor RPM
8. Annunicator
9. ИТЭ-2Т two-pointer indicator of ТВ3-117ВМ engines
11. Selector switch of ФПП-7М right landing-taxi light
12. Thermometer ТВ-1
13. Position indicator (unit 8) of ДИСС-15 Doppler system equipment
14. Indicator of ground speed and drift angle (unit 7) of ДИСС-15 Doppler system equipment
15. БЭ-09К indicator of СКЭС-2027В fuel quantity gauge
16. Annunciator of emergency fuel reserve in service tank
17. П-8УК selector switch of СКЭС-2027В fuel quantity gauge
18. АЧС-1 clock

Fig. 4 Right instrument panel



1. Light CB
2. ЭМИ-3РВИ engine gage unit УИЗ-6 three-pointer indicator of oil pressure at main gear box inlet and of oil temperature in intermediate and tail gear boxes.
3. ИН-4 trim indicator of АП-34Б autopilot
4. ТУЭ-48 indicator of oil temperature in main gear box of ТУЭ-48Т thermometer.
5. ЭМИ-3РВИ engine gage unit УИЗ-3 three-pointer indicator of fuel pressure, oil pressure and temperature of left engine.
6. ЭМИ-3РВИ engine gauge unit УИЗ-3 three-pointer indicator of fuel pressure, oil pressure and temperature of right engine.
7. Р-863 radio station selector switch with DD or M
8. Control panel of АП-34Б autopilot.
9. Control panel of ЭРД-3ВМ engine electronic control.
10. БУ-32 control unit of СПУУ-52 tail rotor pitch limit system
11. Control panel of Р-863 command radio station with DD.

Fig. 5 Center console

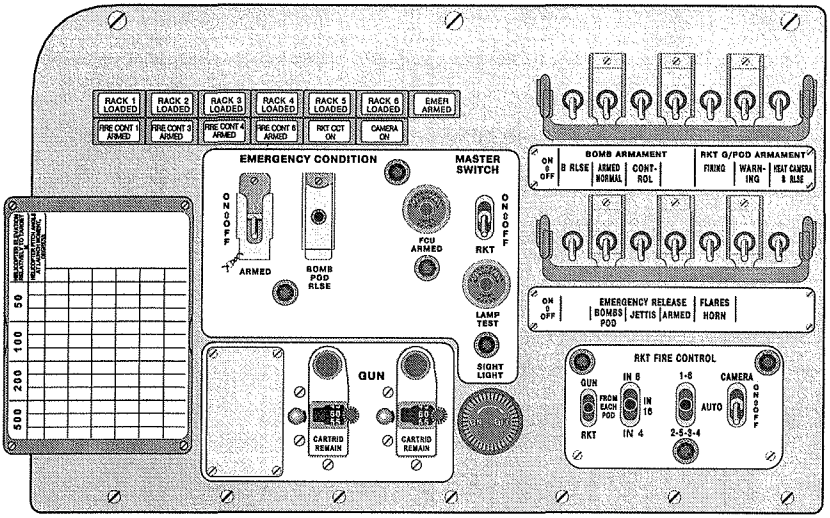


Fig. 6 Left automatic circuit breaker panel

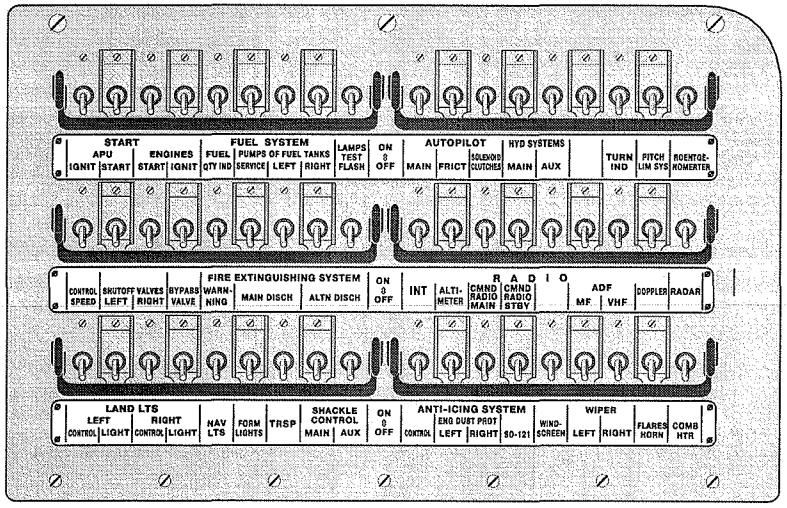
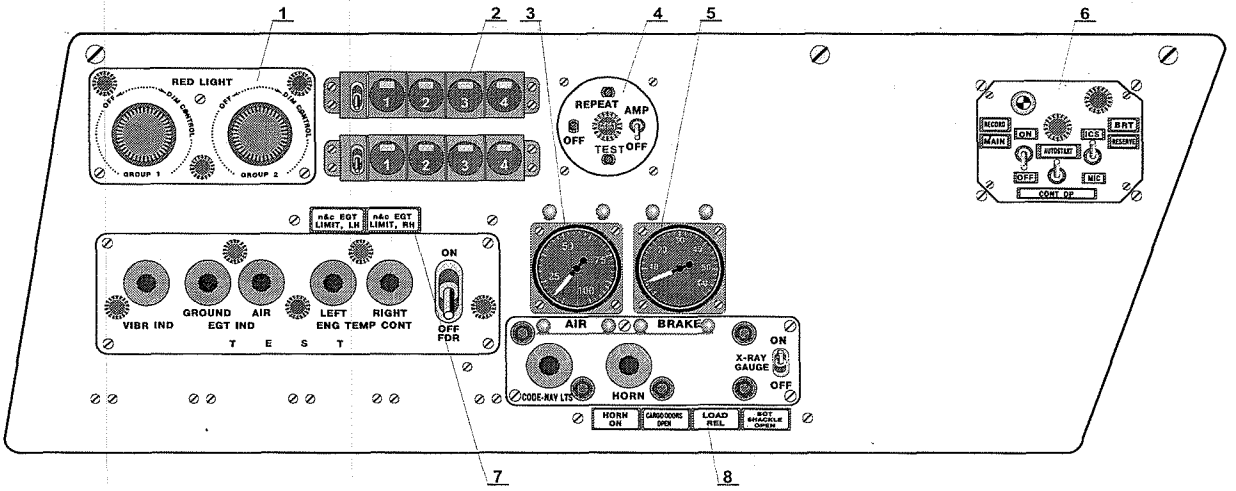


Fig. 7 Right automatic circuit breaker panel



1. Control rheostats of the electric overhead panel red illumination
2. ЭП662 signal flare control panel
3. МВУ-10К pressure gauge for air pressure monitoring in pneumatic system
4. РИ-65-20 remote control panel of РИ-65 voice warning system
5. МА-60К pressure gauge for air pressure monitoring in the landing fear wheels brake system
6. Control panel of П-503 Б voice recorder
7. Annunciator
8. Annunciator

Fig. 8 Left side panel of electric overhead panel

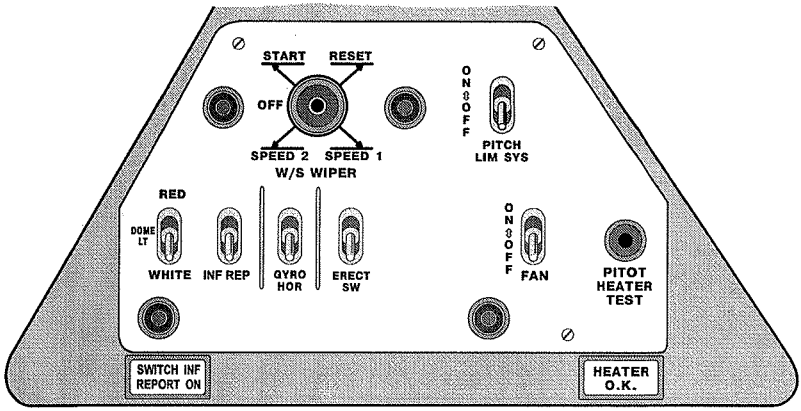


Fig. 9. Left switch panel of electric overhead panel

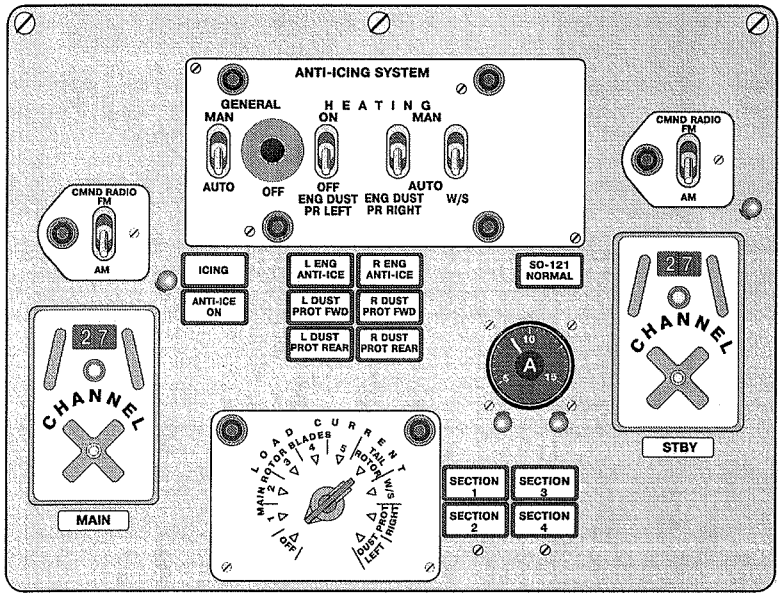


Fig. 10 Left panel of electrical overhead panel

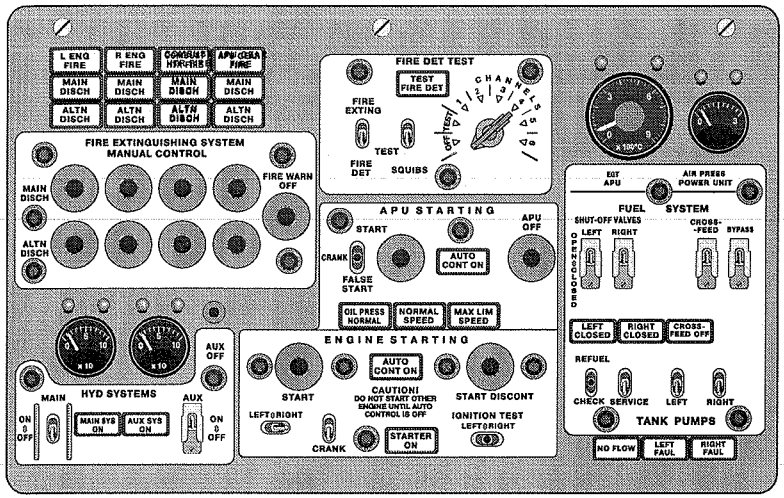
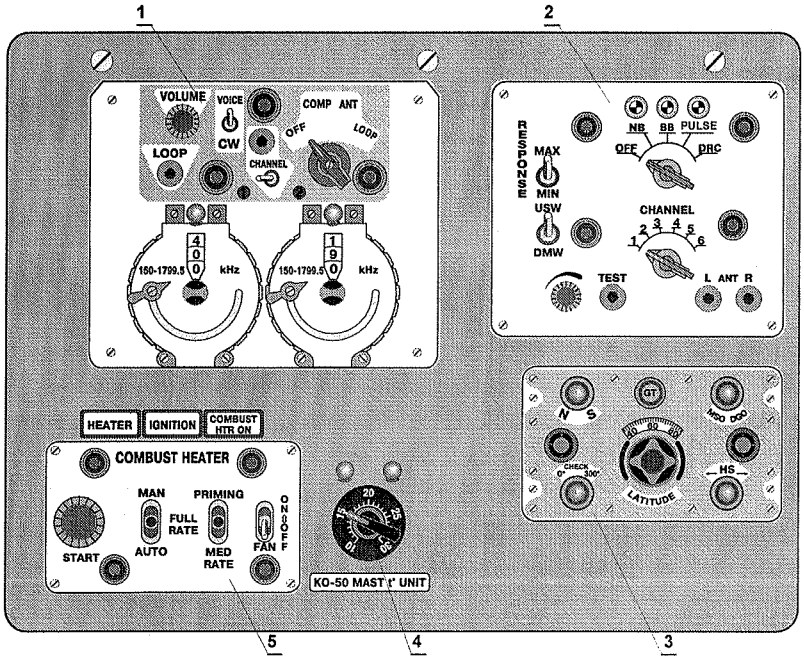


Fig. 11 Central panel of electric overhead panel.



1. Control panel of АРК-15М automatic direction finder
2. Control panel of АРК-УД automatic direction finder
3. ПУ-26 control panel of ГМК-1А Э compass system
4. Selector of air temperature in cargo cabin
5. Control and warning equipment of kerosene combustion heater КО-50

Fig. 12 Right panel of electric overhead control

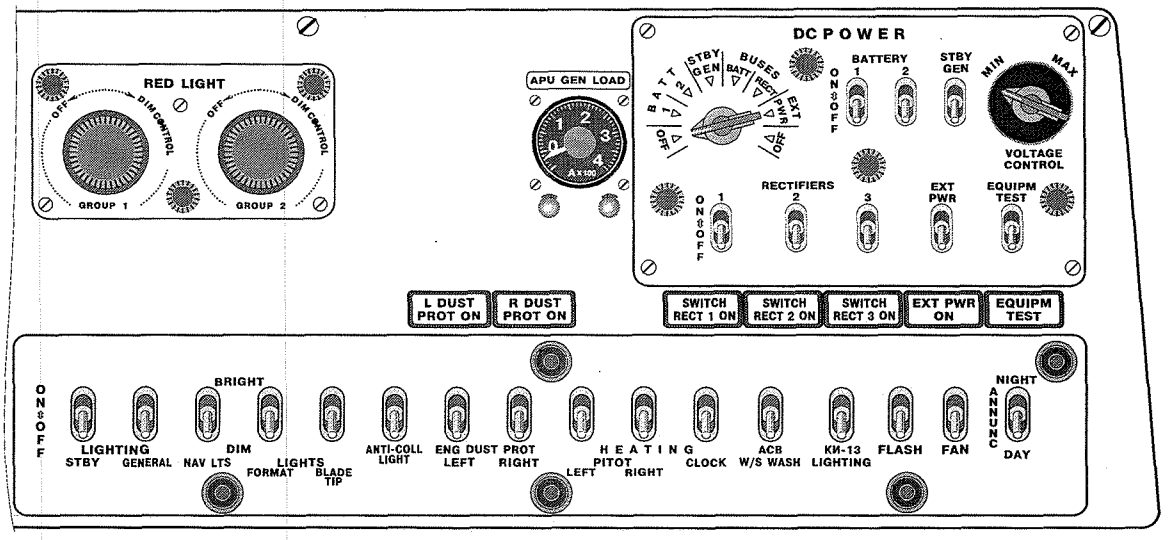


Fig. 13 Right side panel of electric overhead panel.

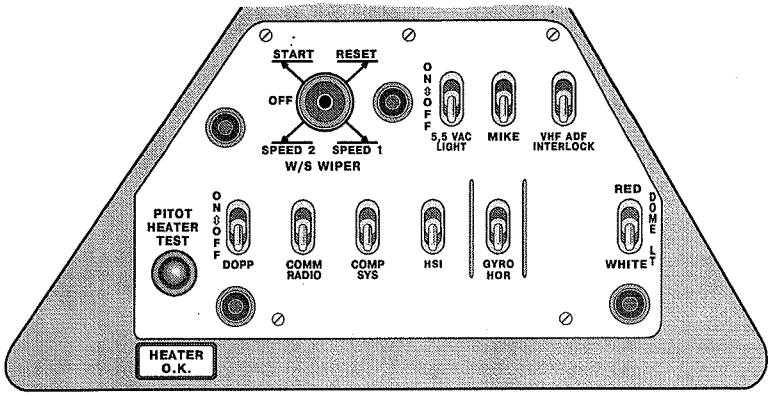


Fig. 14 Right switch panel of electric overhead panel.