

Tu-154M Brief Flight Manual



This document is a short version of the real Tu-154M Flight Manual that was compiled for Project Tupolevs (www.protu-154.com) Tu-154M pilots and students of the PT Flight School. All sections in this Flight Manual describe normal flight operations and do not include operations in emergency situations, aircraft systems description and other sections of the real Tu-154M Flight Manual which will not be considered during primary training program. This Flight Manual is also not applicable for PT Tu-154B2. Its based on the English FCOM of Syrian Airlines Tu-154M.

Chapter 1. Limitations

1.1 Weight restrictions

Maximum taxi weight	100 500 kg
Maximum take-off weight	100 000 kg
Maximum landing weight	80 000 kg
Maximum zero fuel weight	74 000 kg
Maximum pax/cargo load	18 000 kg
Maximum fuel load	39 750 kg

Operation of the aircraft is allowed for up to 100 000 kg MTOW.

In case of an urgent necessity, landing is allowed even with weight exceeding maximum landing weight 80 000 kg at captains discretion.

1.2 Take-off and landing restrictions

Airport (runaway) elevation	-305 - +3000 m
Friction coefficient	$\geq 0,3$
Runway covered with:	
- ice	Not Allowed
- water	≤ 10 mm
- slush	≤ 12 mm
- dry snow	≤ 50 mm
Headwind, Tailwind component	≤ 30 m/sec, ≤ 5 m/Sec
Crosswind component	
- dry runway	≤ 17 m/Sec
- precipitation layer on the runway ≤ 3 mm	See table below
- precipitation layer on the runway ≥ 3 mm	5 m/Sec
- in case of hydraulic system nr. 2 failure (dry runway)	10 m/Sec
Max runway gradient	$\pm 2\%$

Table 3.1.12.2

Runway surface condition	Average friction coefficient or precipitation layer height
Clean, dry, moist	More than 0.5
Wet (including presence of puddles)	0.45
Dry snow (partially removed*)	0.45
Pressed snow (evenly spread)	0.4
Frozen snow with ice	0.4
Wet snow, slush (partially removed*)	0.35
Hoar-frost or rime (not more than 1 mm thick)	0.35
Ice (partially removed*)	0.3
Ice (over the whole runway)	Less than 0.3
Water (over the whole runway)	3 to 10 mm high
Wet snow, slush (over the whole runway)	3 to 12 mm high
Dry snow (over the whole runway)	10 to 50 mm high

*Partially removed - not more than 10 % of the runway surface is covered with precipitation.

Relation between the allowed crosswind component and runway friction coefficient can be found in the following table:

Friction coefficient	0,3	0,35	0,4	0,45	0,5	0,55	>0,6
Crosswind component (m/Sec)	5	7,2	9,3	11,3	13,6	15,8	17

1.3 Center of gravity (CG) restrictions

(1) Forward center of gravity limit for takeoff,

LG down 21 % MAC

(2) Forward center of gravity limit for landing,

LG down 18 % MAC

(3) Aft center of gravity limit, LG up:

(a) for takeoff, enroute and landing 32 % MAC

(b) for conditions with no payload or with payload

available not allowing to shift the center of gravity to 32 % MAC and farther forward, at take-off weights up to 80,000 kg and altitude of 10,200 m, with AFCS operating only in manual control mode 40 % MAC

1.4 Power Plant

Engines are allowed to work at take-off thrust setting for the purposes of flight safety, however, for no longer than 15 minutes.

In case of flight level change at altitudes $H \geq 8000$ m, thrust should be advanced to nominal first - for engines nr. 1 and 3; and after 6 seconds of climb also for engine nr. 2, provided the situation allows nominal or take-off thrust for all three engines. Under such conditions, RPM and EGT should be monitored closely.

Operational modes of engines D30KU-154-II

Operational mode	P _H =760MM _{HG} , T=15°C H=0M		H=11 000M M=0.8 at MCA	
	revolutions КНД / N1	revolutions КВД / N1	revolutions КНД / N1	revolutions КВД / N1
Maximum	85.5...88.0 %	94.5...96.0 %	93.5...95.0 %	95.5...97.5 %
Nominal	82.0...85.0 %	93.0...95.0 %	88.0...90.5 %	93.0...95.0 %
0.9 nominal	78.5...81.5 %	91.5...93.5 %	85.5...88.0 %	91.5...93.5 %
0.7 nominal	71.0...74.0 %	87.5...90.0 %	79.5...82.5 %	87.5...90.0 %
0.6 nominal	67.0...70.0 %	85.5...88.0 %	76.0...79.0 %	85.5...88.0 %
0.42 nominal	57.5...60.5 %	81.0...83.5 %	68.0...70.5 %	81.0...83.5 %
Idle	30 %	59.5...61.5 %	63.0 %	78.0 %

1.5 Airspeeds and M-speeds

- (1) Maximum operating limit speed V_{MO} and M_{MO} :
- at altitudes from sea level up to 7000 m 600 km/hr
 - at altitudes from 7000 m up to 10,300 m 575 km/hr
 - at altitudes of 10,300 m and above $M = 0.88$
- (2) Maximum operating limit speed with roll damper or yaw damper inoperative, at all gross weights 525 km/hr or $M = 0.85$
- (3) Maximum flap extended speed V_{FE} with flaps extended to:
- 15° 420 km/hr
 - 28° 360 km/hr
 - 36° 330 km/hr
 - 45° 300 km/hr
- (4) Maximum landing gear operating speed V_{LO} :
- In normal conditions 400 km/hr
 - In emergency descent within limitations of 2.5.4.1(1)
- NOTE: In case of emergency (ferry flight with the landing gear down or the landing gear retraction after takeoff with the LG doors closed), it is allowed to perform flight at a speed not more than 450 km/hr.
- (5) Maximum spoiler extended speed:
- With mid-wing spoilers extended within limitations of 2.5.4.1(1)
 - With inboard spoilers extended 300 km/hr
- (6) Maximum stabilizer operating speed 425 km/hr
- (7) Maximum slat extended speed 425 km/hr

(cont'd)

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(8) In the course of slat retraction, an acceleration up to 450 km/hr is allowed, this limit being attained by the moment of complete retraction of the slats

(9) Maximum landing light extension speed 340 km/hr

(10) Maximum ground speeds:

For rotation 315 km/hr

For lift-off 325 km/hr

For touchdown by main LG wheels 280 km/hr

For touchdown by nose LG wheels 270 km/hr

For initial application of wheel brakes during
landing roll 230 km/hr

(11) Maximum taxiing speed:

Straightforward 30 km/hr

In turns with radii of 40 m and more 30 km/hr

In turns with minimum radius (7 m) 10 km/hr

NOTE: The taxiing speed is decreased in turns
from 30 km/hr down to 10 km/hr progressively
with the radius of turn decreasing
from 40 down to 7 m.

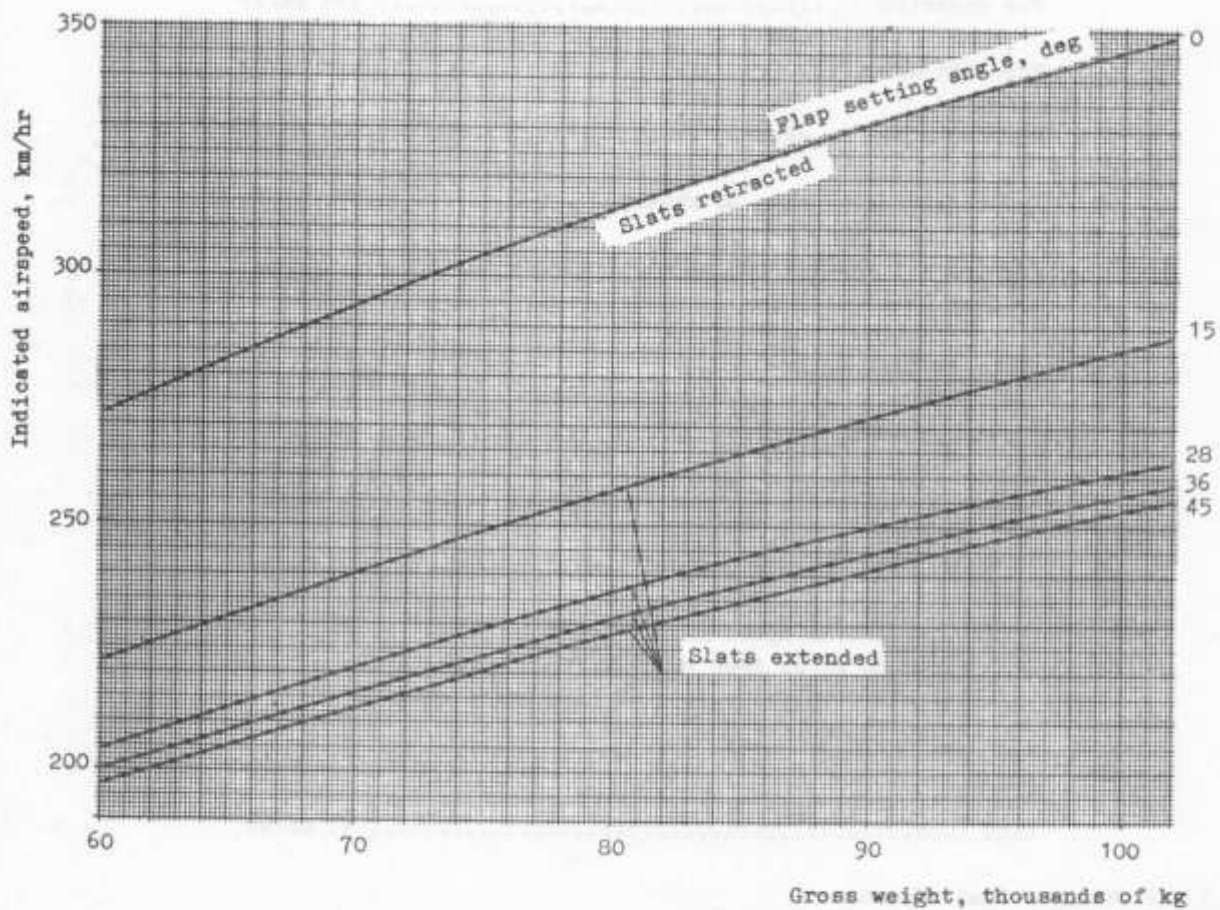
On runway covered with atmospheric precipitation 15 km/hr

1.6 Minimal allowed airspeed

Minimum Limit Speeds

(1) The minimum limit speeds approved for takeoff and landing of the airplane (at which the automatic angle-of-attack and acceleration warning system (AAT) actuates) and the stalling speeds are shown in Figs 2.5.1, 2.5.2.

(2) The minimum safety speed during flight in enroute configuration shall be not less than 1.3 of stalling speed at altitudes below 5000 m and not less than 1.35 of stalling speed at altitudes above 5000 m (Ref. Fig. 7.8.1).



Minimum Takeoff and Landing Speeds

Figure 2.5.1

- (3) The crew is warned of attainment of the minimum limit speed at acceleration of 1 g by actuation of the light and audio warning devices which are actuated by the AAT (the red light on the AAT indicator at the Captain's station and the red STALL (α_{KP}) annunciator at the Co-pilot's station come on, and the loudspeaker installed at the crew's wardrobe partition sounds continuously).

2.5.4.3. Airplane Configurations for Various Stages of Flight

- (1) For takeoff:

Flaps 15° or 28° (Ref. paragraph 3.1.5).

Slats extended.

Stabilizer in a harmonized position (Ref. Table 2.5.4.1).

Spoilers retracted.

LG down.

- (2) For climb, enroute flight and descent:

Flaps retracted.

Slats retracted.

Stabilizer in the enroute position (0°).

Spoilers retracted (the mid-wing spoilers are extended in descent, if required).

LG up.

- (3) For emergency descent:

Flaps retracted.

Slats retracted.

Stabilizer in the enroute position (0°).

Mid-wing spoilers extended.

LG down.

(cont'd)

(4) For landing:

Flaps:

45° or 36° in normal conditions, as established by paragraph 3.1.6.

45°, 36° or 28° with two engines operating, as established by paragraph 3.1.6.

15° with one engine operating.

Slats extended.

Stabilizer in a harmonized position (Ref. Table 2.5.4.1).

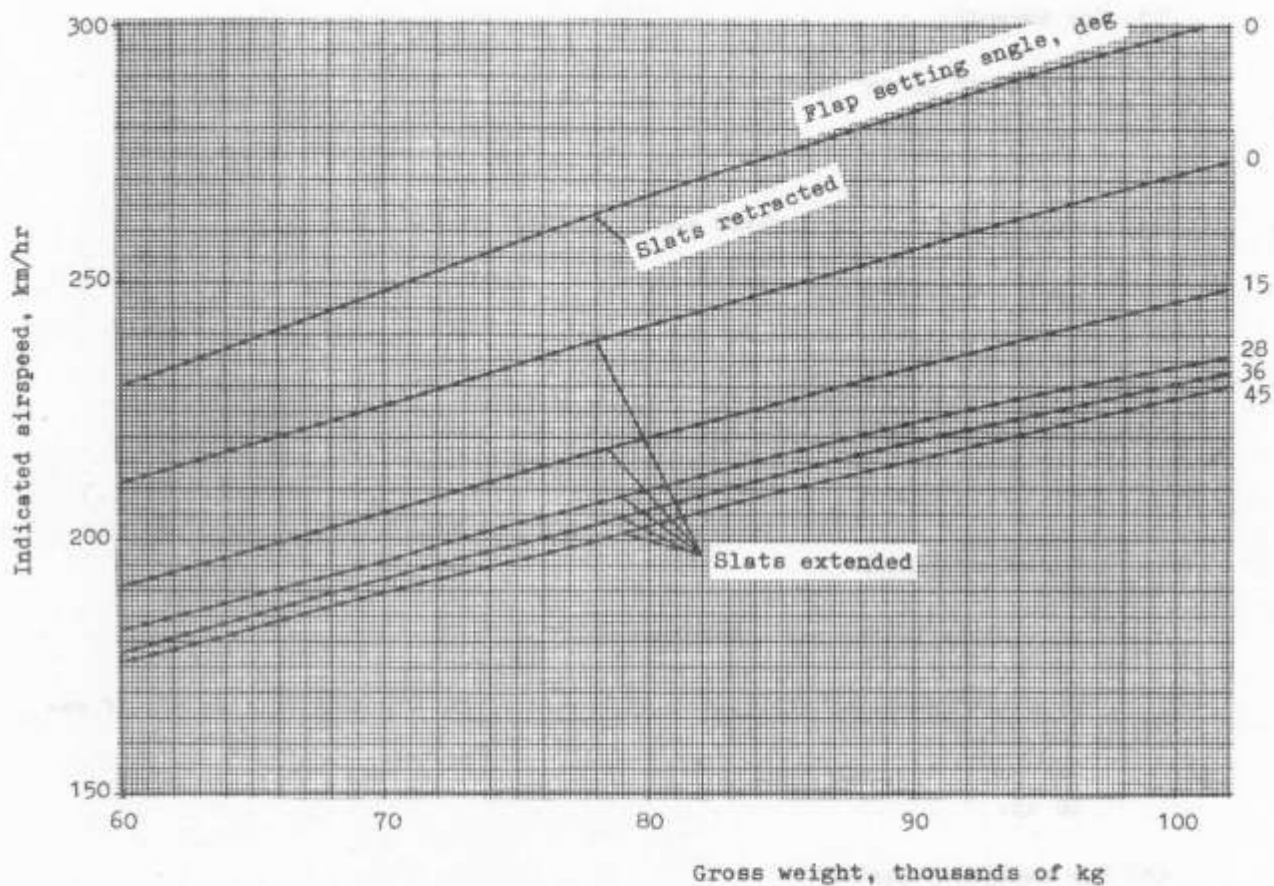
Mid-wing and inboard spoilers extended (automatically after touchdown).

LG down.

(5) Harmonized positions of stabilizer and wing high-lift devices.

Table 2.5.4.1

Airplane configuration	Flap setting angle, deg.	Slat position	CG position, % MAC		
			18 to 24	24 to 32	32 to 40
			Stabilizer control setting		
			II (FWD) green	C (MIDWAY) black	3 (AFT) yellow
			Stabilizer harmonized position, deg.		
Enroute	0	Retracted	0	0	0
Takeoff	15, 28	Extended	3	1.5	0
Landing	36, 45	Extended	5.5	3	0



Stalling Speeds
Figure 2.5.2

1.7 Angle of attack (AoA) indicator setting

Flap angle $\delta_3=45^\circ$, slats extended, $V_{\text{alarm}} = 1,13 \cdot V_{\text{stall}}$;
 Flap angle $\delta_3=28^\circ$, slats extended, $V_{\text{alarm}} = 1,13 \cdot V_{\text{stall}}$;
 Flap angle $\delta_3=15^\circ$, slats extended, $V_{\text{alarm}} = 1,16 \cdot V_{\text{stall}}$;
 Flap angle $\delta_3=0^\circ$, slats extended, $V_{\text{alarm}} = 1,17 \cdot V_{\text{stall}}$.

1.8 Landing gear restriction

Minimum aircraft turn radius on ground - 7 m. Front landing gear turn radius - 23 m.

Turning the aircraft on the ground by locking or applying full braking action one of the main landing gear bogies is **FORBIDDEN!**

1.9 Allowed G-force and bank angles

G-force (Ny) min/max:

- Flaps/Slats retracted Manuveringlimits operational	-1 to +2,5 0,5 - 1,8
- Flaps/Slats extended Manuveringlimits operational	0- 2,0 0,5 – 1,8

Bank angle (γ) max :

- for $H \leq 250$ m or $V < 340$ Km/h on take-off / $V < 280$ on landing	+ -15°
- in all other cases	+ -33°
- while executing SID with an initial turn at $H \geq 50$ m	25°

Bank angle alarm will sound:

- on take-off and landing when exceeding	$15 \pm 2^\circ$
- in cruise when exceeding	$33 \pm 4^\circ$

Bank angle alarm modes will change automatically when:

- "LANDING PREPARATION" switch - "ПОДГОТ. ПОСАДКА" is on and the altitude reaches	250 m
- "LANDING PREPARATION" switch - "ПОДГОТ. ПОСАДКА" is off and the speed :	
i) on take-off reaches	340 Km/h
ii) on approach decreases to	280 Km/h

1.10 APU (BCY) restrictions

Limitations:

- maximum altitude for start-up	3 000 m
- Vmax during start-up and/or flying with APU running	≤ 525 Km/h
- max running time (not interrupted)	≤ 5 hours

EGT at start-up:

- normal conditions	$\leq 680^\circ\text{C}$
- emergency conditions	until automatic stop occurs, but $\leq 720^\circ\text{C}$

Flying with the APU not running and the APU ram door open, other than the time required for preparing the APU for start-up, is **FORBIDDEN!**

If the electrical system is fed by batteries, repeated APU start-up in cruise is **FORBIDDEN!**

1.11 Various restrictions

Avoidance of cumulonimbus clouds shall be done by maintaining at least 15 km distance from the nearest radar contour indication.

Avoidance of frontal cloud systems shall be done by flying between separated storm centres, where the distance between radar contour indication is at least 50 km. When flying above such weather, minimal vertical distance of 500 m above the upper cloud border must be maintained.

1.12 Maximum flight altitudes related to aircraft weight

With CG up to 32 % MAC

Flight level	390	380	370
Pressure altitude, m	11900	11600	11300
Maximum gross weight, kg	84000	90000	96000

With CG aft of 32 % MAC, flight level is 330 (10,050 m)

Takeoff and landing of the airplane are allowed from/on the aerodromes located at elevations corresponding to pressure altitudes within the range from -305 up to 3000 m.

1.13 Control restrictions

Stabilizer and slats may be moved from one end position to the other and vice versa up to five times with 1 minute pause before each next movement (if so needed, one of the pauses may be shortened to 3 seconds).

Approach without touchdown may be repeated up to 10 times.

After the stated cycle has been completed, the slat and stabilizer equipment has to be cooled using at least 1 hour without any equipment activity.

In order to ensure stable engine performance, advance thrust setting during take-off from high-altitude airports ($H > 700$ m) as follows:

- in 3-5 seconds all 3 engines to 0,4 of nominal thrust;
- in 10 seconds all engines to nominal thrust;
- in 2-3 seconds engine nr. 1 and 3 to take-off thrust;
- in 2-3 seconds engine nr. 2 to take-off thrust.

Rolling take-off at airports with high runway elevation ($H > 700$ m) is **FORBIDDEN!**

1.14 Temporary restrictions

Throttling up the engines to take-off thrust after line-up and take-off clearance, shall be done as follows:

- Allow 3-5 seconds to advance the thrust levers until engine air bleed valves close;
- Verify successful closure of the air bleed valves on the flight engineers panel (control light "BLEED VALVES" - "КЛАПАНЫ ПЕРЕПУСКА" goes off);
- Wait 2-3 seconds, and advance thrust levers to take-off thrust setting.

Operation of the aircraft on a glide slope with an angle higher than 4° is **FORBIDDEN!**

Chapter 2. Normal operations

2.1 Pre-flight preparations

Check and analyze the meteorological conditions. In case of temperature inversion, calculations are made using the maximal temperature taken from the range 0 m – 150 m and adding 150 m to the barometric airport altitude.

Determine maximum take-off weight (MTOW) and maximum landing weight. Choose appropriate method for take-off.

Determine V_1 , V_R , V_2 , V_{REF} speeds.

Determine the aircraft's Centre of Gravity (CG) position. For a flight with less than a full load of passengers calculate the aircraft load using CG 27–28 % MAC.

2.2 Preparations for take-off

ATTENTION! The F/E is obliged to check the performance of the fuel system at all flight phases and report any discrepancies to CPT.

2.2.1 Preparation for taxi.

Upon receiving start-up clearance, the CPT commands the F/E to start-up the engines.

Before commencing taxi, all equipment must be checked and be in a correct position or show correct parameters. The navigator aligns the gyroscopic equipment (TKC-П2), the F/O turns on the beacon lights, reads the "Before taxi Checklist" and requests taxi clearance from ATC.

2.2.2 Taxi

- (6) The maximum taxi speed on a dry taxiway is 30 km/hr, that, with the taxiway covered with a layer of precipitation, is 15 km/hr.
- (7) Neither taxi with the wing high-lift devices extended except for taxiing to the parking area after landing in icing conditions, on a runway covered with snow or dirt, nor use reverse thrust before the airplane comes to a complete standstill.

Ground Maneuvering

- (1) The minimum allowable radius of turn is 7 m, the radius being measured from the main LG bogie located inside the turn path (Ref. Fig. 4.1.1).

At the minimum allowable radius of turn the least radius of the nose LG wheels rolling path is 23 m.

- (2) The airplane needs a taxiway, 45 m wide, to turn through 180° . In case of necessity to turn on a taxiway, less than 44 m wide, it is allowed to slightly apply the brakes of the inside LG bogie wheels.

Pivoting about one stationary LG bogie is FORBIDDEN.

- (3) During taxiing avoid sharp movements of the nose LG steering wheel to avoid application of excessive loads to the nose LG.

CAUTION: NEVER SHARPLY APPLY BRAKES IN TURNS TO AVOID DAMAGE TO THE NOSE LG STEERING MECHANISM.

- (4) Before the airplane comes to a complete standstill, align the nose LG wheels with the airplane centerline.

General

- (1) While taxiing it is allowed to control the airplane from the LH or RH pilots' stations with the flight crew complete.
- (2) Before taxiing, perform all the operations listed in the "Before taxiing" checklists (Ref. 3.2.5) and the "Before taxiing" section (Ref. paragraph 4.8.2.2.) of Procedures.
- (3) During taxiing in an area where obstacles may be encountered, to improve vision open both direct vision windows of the flight compartment and watch the wings to prevent their contact with the obstacles. Perform all the operations listed in the "During taxiing" section of the Procedures (Ref. paragraph 4.8.2.3).
- (4) The crewmembers must report obstacles they see within the airplane taxiing area. The Flight engineer monitors the operation of the engines and the airframe systems.

Taxiing Procedure

- (1) Before initiation of taxiing, release the parking brake.
- (2) After the airplane breaks away, during straightforward movement, switch on the nose LG steering system and select its mode selector switch to the taxiing mode whose onset is indicated by coming-on of the 63 DEG STEER (PA3BOPOT 63⁰) annunciator.

CAUTION: NEVER STEER THE NOSE LG BY MEANS OF THE STEERING SYSTEM IN STATIONARY CONDITION, BEFORE THE AIRPLANE BREAKS AWAY.

- (3) After the airplane begins rolling, test first the main and then the emergency brakes, both by the pilot's and copilot's controls. If, upon application of the main brakes, braking proves to be ineffective, immediately apply the emergency brakes until the airplane comes to a complete standstill, and shut down the engines.

CAUTION: NEVER USE THE MAIN AND THE EMERGENCY BRAKES SIMULTANEOUSLY.

- (4) As a rule, taxi with the engines running at idle. Operation of the engines at the compressor air bleed valves operation speeds (76.5 to 80 %) is NOT RECOMMENDED.
- (5) Fuel used on the ground for starting the engines and taxiing is 500 kg. For the purpose of fuel economy it is allowed to taxi after landing with one engine No. 2 operating.

- (6) The maximum taxi speed on a dry taxiway is 30 km/hr, that, with the taxiway covered with a layer of precipitation, is 15 km/hr.
- (7) Neither taxi with the wing high-lift devices extended except for taxiing to the parking area after landing in icing conditions, on a runway covered with snow or dirt, nor use reverse thrust before the airplane comes to a complete standstill.

Ground Maneuvering

- (1) The minimum allowable radius of turn is 7 m, the radius being measured from the main LG bogie located inside the turn path (Ref. Fig. 4.1.1).

At the minimum allowable radius of turn the least radius of the nose LG wheels rolling path is 23 m.

- (2) The airplane needs a taxiway, 45 m wide, to turn through 180° . In case of necessity to turn on a taxiway, less than 44 m wide, it is allowed to slightly apply the brakes of the inside LG bogie wheels.

Pivoting about one stationary LG bogie is FORBIDDEN.

- (3) During taxiing avoid sharp movements of the nose LG steering wheel to avoid application of excessive loads to the nose LG.

CAUTION: NEVER SHARPLY APPLY BRAKES IN TURNS TO AVOID DAMAGE TO THE NOSE LG STEERING MECHANISM.

- (4) Before the airplane comes to a complete standstill, align the nose LG wheels with the airplane centerline.



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.8.1

Takeoff Speeds With Flaps 15°

Takeoff weight, 1000 kg	Rotation speed V_R , km/hr	Takeoff safety speed V_2 , km/hr	Climbout speed with all engi- nes operating V_{2n} , km/hr	Speed at start of extendable (high- lift) devices re- traction V_3 , km/hr
80-82	250	265	290	310
82-84	250	270	290	310
84-86	255	275	295	315
86-88	260	275	300	320
88-90	260	280	305	325
90-92	265	285	305	325
92-94	265	285	310	330
94-96	270	290	315	335
96-98	275	290	315	335
98-100	275	295	320	340

Table 3.1.8.2

Takeoff Speed With Flaps 28°

Takeoff weight, 1000 kg	Rotation speed V_R , km/hr	Takeoff safety speed V_2 , km/hr	Climbout speed with all engi- nes operating V_{2n} , km/hr	Speed at start of extendable (high-lift) devices retraction V_3 , km/hr	
				at 1-st segment (flaps from 28 to 15°)	at 2-nd segment (flaps from 15 to 0°)
80-82	230	250	275	265	310
82-84	235	255	275	270	310
84-86	235	260	280	275	315
86-88	240	260	285	275	320
88-90	240	265	290	280	325
90-92	245	270	290	285	325
92-94	250	270	295	285	330
94-96	250	275	300	290	335
96-98	255	280	300	290	335
98-100	255	280	305	295	340

(cont'd)

General

- (1) Execute takeoff with flaps 28° or 15°. Select the flap setting angle basing on the calculated flight data (Ref. paragraph 3.1.5).

2.2.3 Preparation for take-off

"PITOT HEAT" - "Обогрев ППД" should be turned on 1 minute before commencing the take-off roll in temperatures above zero, and 3-5 minutes before commencing the take-off roll in temperatures at or below zero.

(3) Switch on the glazing heaters at LOW (СЛАБО).

(rem.: Refers to the window-heaters)

If take-off is expected in icy conditions (rain, snow, fog, drizzle, low clouds at temperatures equal to, or below +5°C), "PITOT HEAT" - "Обогрев ППД" should be turned on before taxi. In case of a delay (10 minutes or more) it has to be turned off to ensure the cooling down of pitot tubes. Heat should be turned on again 3-5 minutes prior to commencing the take-off roll.

2.2.4 Holding point procedures

Check control surfaces movement. During their movement, the hydraulic pressure in all systems need not fall below 180 kg/cm²;

Extend flaps for take-off and verify the take-off/landing mode control light - "ВЗЛЁТ. ПОС. РВ" turns on.

Read the checklist, make sure all altimeter settings are correct.

Request line-up clearance.

2.2.5 Procedures on the runway.

Taxi along the runway centreline for 5-10 meters, then switch the front gear mode to "10°" - after which, the control lights "FRONT GEAR 63°" - "РАЗБОРОТ 63°" and "NOT READY FOR TAKE-OFF" - "К ВЗЛЁТУ НЕ ГОТОВ" should turn off.

IT IS STRICTLY FORBIDDEN to take/off with the control light "NOT READY FOR TAKE-OFF" - "К ВЗЛЁТУ НЕ ГОТОВ" on.

In case the control light "NOT READY FOR TAKE-OFF" - "К ВЗЛЁТУ НЕ ГОТОВ" goes on during the take-off roll the CPT shall proceed as follows:

- if $V \leq V_1$ abort take-off;
- if $V > V_1$ continue with take-off. When reaching traffic pattern altitude, decide upon further action (land at departure airport/continue flight) based on the circumstances and the causes of the failure.

Control light "NOT READY FOR TAKE-OFF" - "К ВЗЛЁТУ НЕ ГОТОВ" lights up when:

- nose gear steering mode is at "63°" position;
- inner spoilers locking mechanism is open;
- main/cargo doors locking mechanism is open or passenger/service door latches are closed;
- emergency/back-up doors and emergency hatch latches are closed;
- "BOOSTER CONTROL" - "БУСТЕРНОЕ УПРАВЛЕНИЕ" (rem: Refers to the flightcontrols hydraulic boosters) switches lid is open;
- slats retracted and flaps unextended for take-off configuration.

When the nose gear steering mode is set to "10°", the control light "NOT READY FOR TAKE-OFF" - "К ВЗЛЁТУ НЕ ГОТОВ" will only flash if the inner spoilers or main door and cargo locking mechanisms are open.

2.3 Take-off

2.3.1 Take-off in normal conditions.

CAUTION! In case the alarm sounds after setting thrust levers to take-off position, it is mandatory to abort take-off and check that slats and flaps are extended.

During takeoff from a wet, ice-, snow- or slush-covered runway, bear in mind that the airplane cannot be held stationary by the wheel brakes after the engines have accelerated to takeoff power, therefore one must not attempt to hold it stationary by the wheel brakes. Accelerate the engines to takeoff power in the course of takeoff run, after the airplane breaks away.

CAUTION! Take-off with airplane's CG position at the front limit and MTOW requires bigger deflection angle of the elevator at the moment of rotation. Therefore in case of more intense rotation the angle of the elevator may even reach its limit. Because of high pitch on such take-offs it is required to precisely observe all take-off speeds – such take-offs should be executed as pure instrument take-off starting at the moment of rotation until full retraction of the flaps.

After rotation, accelerate the airplane while climbing so that when reaching 10,7 m AGL, the IAS equals or exceeds V_2 .

Due to a high position of the airplane nose during takeoff (particularly during takeoff with the flaps 15°) and a necessity to closely maintain the airplane speed and attitude, proceed to IPR flying beginning with the moment when rotation speed V_R is attained until the wing high-lift devices are retracted.

After lift-off, do not brake the wheels as they are braked automatically.

(8) Crew's actions during normal takeoff

Takeoff run and climbout to 10 m

Captain	Copilot	Flight engineer
At the lineup position calls "Request takeoff clearance" After receiving takeoff clearance calls "Takeoff power, hold throttles" Switches on the external lights at night or in adverse ornithological condition	Reports readiness to take off to the start controller Requests takeoff clearance	Smoothly and synchronously advances the throttle levers to a position of 0.4 maximum continuous within a period of time of 3 to 5 s Checks the compressor air bleed valves for closing (the BLEED VALVES (КЛАПАНА ПЕРЕПЛАВКА) annunciators must go out. Calls "Compressor air bleed valves closed" Makes an interval of 2 to 3 seconds and advances the throttle levers to TAKEOFF (ВЗЛЕТНЫЙ РЕЖИМ) Makes sure the engines and airframe systems

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Captain	Copilot	Flight engineer
		operational parameters are within the specified limits
		Adjusts the throttle lever brake
		Calls "Takeoff power, parameters OK, throttles held"
Starts the clock	Starts the clock	Starts the clock
Warns the crew: "Takeoff, next check (V_1)"	Retains alertness to assume control	Observes the engines and systems instruments and annunciators to monitor their operation and reports malfunctions, if any, to the Captain
Releases the wheel brakes, maintains the direction of the airplane movement aligned with the runway centerline (during takeoff by night refers to the runway lights line) by the steerable nose LG with further transition to the rudder control	Reports airplane deviations from the runway centerline, if any, to the Captain Monitors the speed and reports it every 20 km/hr	
Calls "Continue takeoff", if no reasons for abortion of takeoff are detected	Calls "Check" upon attainment of speed V_1	
	Calls "Rotate" upon attainment of speed V_R	
At speed V_R pulls the control column to rotate, pilots the airplane according to IPR		
Calls "Up gears" at a height not less than 3 m		

(cont'd)

Captain	Copilot	Flight engineer
Accelerates the airplane up to speed V_2 in climb-out to 10 m	Sets the LG control valve handle to retraction Calls "Safety speed" upon attainment of speed V_2	

Climb to Traffic Altitude

- (1) The crew's actions during takeoff are covered in the "Climb to traffic altitude" sequence diagram.
- (2) During takeoff by night, switch off and retract the lights at a height not less than 50 m. If clouds are present do the same before entering them.

Max speed for lights out: 340 km/h

At 5-10 m AGL retract the landing gear and continue climbing while accelerating to V_2+40 Km/h. Maintain this speed until 120 m, and when IAS reaches 330 Km/h begin flaps retraction to 15° . When the IAS reaches 340 Km/h continue flaps retraction to 0° . IAS at clean configuration should be 380-400 Km/h.

During takeoff with the flaps 15° retract them in one step.

Note: The moment the flaps retract from 28° to 15° neither slats nor the stabilizer move. This takes place only when "FLAPS" - "ЗАКРЫЛКИ" lever is set to zero.

During takeoff from an aerodrome having obstacles exceeding 120 m in height below the takeoff path, retract the wing high-lift devices and accelerate the airplane in accordance with the instructions of subsection 7.3.

At takeoff weights of 92,000 kg and less, it is allowed to reduce power (to a level not less than maximum continuous) at altitudes below the traffic altitude in order not to exceed the maximum speed limits.

During take-off at turbulent conditions the AoA signalization alarm may sound.

Remark: If the standard departure chart requires a turn before flaps retraction, such a turn shall be executed at a height no lower than 50 m AGL at $IAS = V_2+40$ Km/h while climbing. In case of turns exceeding 15° bank if the bank limit alarm sounds, special attention should be paid to the artificial horizon working condition and 25° bank limit shall not be exceeded. Flaps retraction should be executed after turn completion on a straight portion of the flight.

At takeoff weights of 92,000 kg and less, it is allowed to reduce power (to a level not less than maximum continuous) at altitudes below the traffic altitude in order not to exceed the maximum speed limits.

REMARK: PT-Tupolev flightschool Normal T.O.:

Perform standard T/O procedure at nominal thrust, as following:

- *flaps 28* position;*
- *set nominal thrust that is about 93,5% RPM;*
- *rotate at Vr;*
- *accelerate to 330-340 km/h until 120 meters AGL;*
- *retract flaps from 28* to 15* not lower than at the height of 120 meters and at IAS not less than 330 km/h.*
- *retract flaps from 15* to 0* position at IAS not less than 360 km/h with intention to have 410 km/h < IAS < 430 km/h when flaps fully retracted.*

Perform crosswind turn at (200) meters AGL.

At (450) meters AGL reduce thrust to the regime which is required to maintain in the level flight at IAS = 380-400 km/h (about 74% RPM).

(7) Crew's actions during normal takeoff

Climb to traffic altitude

Captain	Copilot	Flight engineer
Continues acceleration in climb up to $V_2 + 40$ km/hr	Calls "Gears up" after retraction of the LG	Monitors the operation of the engines
Switches off and retracts the lights	Monitors the regime of climb and assists the Captain in piloting the airplane	
	Calls "Altitude 50"	
	Calls "Altitude 120"	
<u>During takeoff with flaps 28°</u>		
Increases the speed up to 330 to 340 km/hr		
	Calls "Speed 330"	
Calls RETRACT FLAPS		
Increases the speed up to 340 to 350 km/hr	Retracts the flaps from 28° to 15°	
<u>During takeoff with flaps 15°</u>		
Increases the speed up to 340 to 350 km/hr		
	Calls "Speed 340"	
Calls "Retract flaps"		
Relieves forces from the control column by trimming out the elevator	Retracts the flaps from 15° to 0°, retains alertness to act in case of malfunctions in the wing high-lift devices and the horizontal stabilizer	

(cont'd)

Captain	Copilot	Flight engineer
By the end of the flap retraction cycle accelerates the airplane up to a speed of 380 to 400 km/hr so as to avoid the airplane settling-in Increases the speed up to the selected speed in climb to the flight level Climbs up to the traffic altitude Executes maneuver required for entering the corridor In turn calls "Bank 15°" Monitors readings of the attitude indicators, altimeters and airspeed indicators Upon attainment of the traffic altitude and the selected speed, calls "Set maximum continuous"	Monitors retraction of the wing high-lift devices and at the end of the retraction cycle calls "Flaps and slats retracted, stabilizer zero" Sets the landing gear control valve neutral Selects the traffic controller communication frequency on the VHF transceiver control panel and reports takeoff Monitors maneuver of entering the corridor	Sets maximum continuous power on the engines and calls "Maximum continuous ready"

(cont'd)

Rem: "Corridor" means the SID : standard instrument departure

Captain	Copilot	Flight engineer
In case of necessity calls "Switch on engine heaters, switch on anti-icing system"		Notes the time of engines operation at takeoff power Switches on the engine heaters Switches on the anti-icing system

4.2.3. Crosswind Takeoff

- (1) The maximum limit wind components are indicated in paragraph 2.2.3.
- (2) During crosswind takeoff run the airplane has a tendency to weathervane into the wind. Execute takeoff run with the control column pushed forward. Maintain the heading during takeoff run by appropriate application of the pedals.
- (3) Upon attainment of the rotation speed during takeoff run, set the pedals neutral simultaneously with pulling the control column. In this case the airplane lifts off with a wind correction angle established.
- (4) At the moment of lift-off and thereafter counteract possible rolling of the airplane due to the wind gust by appropriate application of the ailerons.
- (5) After lift-off and in climb, maintain the heading by establishing a wind correction angle.

4.2.4. Takeoff in Icing Conditions

In case of takeoff in icing conditions (clouds, fog, snowfall, rain or drizzle at ambient temperatures of $+5^{\circ}\text{C}$ and below), switch on the anti-icing heaters at the following stages of flight:

The engines and air intakes heaters after starting the engines and setting idle.

The slats, horizontal stabilizer and wing heaters after lift-off.

(confd)

Climbing shall be performed using one of following modes:

- Maximum climb gradient (high speed) mode: for $H \leq 9\,750$ m maintain $V=575$ Km/h; for $H > 9750$ m maintain $M=0,85$;
- Maximum distance mode: for $H \leq 9450$ m maintain $V=550$ Km/h, for $H > 9450$ m maintain $M=0,8$.

At 450 m, reduce thrust to nominal. For low TOW it is allowed to reduce thrust to nominal at lower heights to avoid exceeding IAS limits, however thrust reduction shall not be made lower than 260m.

Upon reaching an altitude of the constant Mach number, continue climb at the constant selected Mach number, having selected the AFCS from the speed holding mode to the Mach number holding mode.

NOTES: 1. In case of emergencies it is allowed to use powers above maximum continuous (up to takeoff power inclusive) in climb and horizontal flight.

2. At ambient temperatures exceeding the standard temperatures by more than 10 °C, execute climb in the high-speed cruise mode at an IAS of 575 km/hr up to an altitude of 8850 m, further on at a constant Mach number of 0.8.

3. Never use autothrottle in T.O., climb, cruise or descent, on approach only on full ILS-approaches.

In case the ground proximity (CCOC) alarm sounds before the moment of flap retraction, immediately stop the descent, if such occurs - and ensure that the aircraft starts to climb. In case the ground proximity (CCOC) alarm sounds after flaps retraction while flying over mountainous areas, swiftly manoeuvre the aircraft for a more steep trajectory (while watching that G-force and AoA limits are observed), set take-off thrust and maintain it until the alarm ceases to sound. At turbulent conditions it is possible that ground proximity (CCOC) alarm may sound up to 2 seconds without requiring the flight crew to change the flight trajectory.

At transition altitude set standard pressure (760 mm) for all altimeters, and check the indication accuracy on all of them.

2.3.2 Short stop take-off.

Take-off roll which starts before engines take-off thrust has been reached is allowed at airports with runway elevation up to 700 m and runway visual length not less than 400 m.

Read checklist "On holding point" during taxi to line-up.

Simultaneously release brakes and advance thrust levers for take-off position.

CAUTION! In case an alarm sounds after setting thrust levers for take-off position, it is mandatory to abort the take-off.

The moment take-off regime is reached (N1), the F/E reports "take-off thrust set" - "Режим взлётный" (Rezhim vzl'otni).

At IAS=150 Km/h navigator calls about accelerating to control speed - "Контрольная" (Kontrol'naya). If there is no call about crossing the control speed before take-off thrust has been reached, it is mandatory to abort the take-off.

CAUTION! If a headwind component is more than 15 m/Sec take-off thrust could be reached after passing IAS=150 Km/h.

Further actions after the calls “Control speed” and “Take-off thrust set”, as well as in case the ground proximity (CCOC) alarm sounds are similar to standard take-off procedure.

2.3.3 Non-stop take-off (Rolling takeoff).

Read the checklist during taxi along the runway centerline without short stops and on idle thrust. CPT commands to commence the take-off right after the checklist is complete.

Such take-off is allowed at airports with runway elevation up to 700 m and runway visual length no less than 400 m. Required take-off distance is increased by 120 m when performing non-stop take-off.

2.3.4 Take-off with flaps 15°.

Such take-off is performed with the same stabilizer position as with flaps 28°. Determine take-off speeds for flaps 15°. Take-off roll, rotation, landing gear retraction are similar to take-off in normal conditions. The takeoff itself (ground detachment) takes place at a higher AoA ($\Delta\lambda \approx 1^\circ\text{-}2^\circ$).

After the landing gear retraction accelerate to V_2+40 Km/h and continue climbing until 120 m. At $H \geq 120$ m accelerate to 360-380 Km/h, retract flaps reaching 380-400 Km/h at the moment of full retraction.

Further actions are similar to take-off in normal conditions.

2.3.5 Take-off in crosswind and tailwind conditions.

Maximum crosswind and tailwind components should not exceed figures mentioned in the table on page 2. During take-off roll aircraft turns against the wind. Push the yoke away, maintain the take-off direction by using rudder pedals deflection. At rotation speed set the rudder pedals at neutral position and simultaneously pull the yoke. During and after rotation the plane may bank a little. Keep the take-off direction after rotation by maintaining the original course (compensate for drift).

The take-off procedure with tailwind component is similar to take-off in normal conditions.

2.3.6 Take-off with noise abatement procedure.

Noise-Abatement Takeoff Procedure

- (1) Execute takeoff run, lift-off and retraction of the LG in accordance with the instructions of paragraph 4.2.2. "Normal Takeoff".
- (2) After lift-off accelerate the airplane up to $V_2 + 20$ km/hr in the course of the LG retraction. In further climb maintain a speed equal to $V_2 + 20$ km/hr and take-off power.
- (3) At an altitude of 450 m or being 500 m short of the noise check point, reduce power to a level providing a rate-of-climb of 3 to 4 m/s.
- (4) After climbing above 900 m, advance power up to maximum continuous, in the course of acceleration retract the flaps at a speed of 330 to 340 km/hr and accelerate the airplane up to speeds recommended for climb.

NOTE: In some instances it is allowed to divert from the populated areas to obtain additional abatement of noise being not less than 100 m clear of the obstacles and banked not more than 15° .

Remark: In PT flightschool a different noise abatement procedure is being used:

flaps 28*, t/o thrust;

- at the height of (260) meters (850 feet) AGL reduce thrust and maintain V_2+20 km/h with vertical speed 3-4 mps until (900) meters (2962 feet) AGL;
- at (900) meters (2962 feet) set nominal thrust and accelerate on schedule.

2.3.7 Take-off at nominal regime.

At takeoff weights of 92,000 kg and less, it is allowed to reduce power (to a level not less than maximum continuous) at altitudes below the traffic altitude in order not to exceed the maximum speed limits.

2.3.8 Take-off in wind sheer conditions.

Take-off procedure with information about wind sheer:

- determine strength of wind sheer and make a decision for take-off. If there is a strong or sharp wind sheer take-off is **FORBIDDEN!**
- take-off should be performed at take-off thrust using the longest runaway with the lowest possible flap angle;
- in case of a rapid decrease in acceleration, it is mandatory to abort take-off if V_1 was not reached;
- rotation speed should be 10-15 Km/h higher than the speed determined during flight preparation;
- after rotation keep the speed no lower than V_2 .

ATTENTION! Decreasing the pitch angle for acceleration purposes does not allow to achieve a maximum climb gradient therefore it could be used at heights that guarantee a safe trajectory to avoid obstacles.

- retract flaps/slats after leaving the wind sheer area.

Take-off procedure with no information about wind sheer :

- in case of a quick decrease of acceleration it is mandatory to abort take-off if V_1 was not reached;
- if wind sheer occurs, rotation speed should be 10-15 Km/h higher than that calculated during flight preparation;
- if take-off is originally performed at nominal regime, advance thrust levers for take-off position;
- when wind sheer occurs after rotation, follow the same guidelines as above.

CAUTIONS!

- For an airport having obstacles higher than 120 m at the take-off direction, retract flaps and slats and accelerate using the maximum climb gradient recommendations.

- In case the ground proximity (CCOC) alarm sounds during acceleration, immediately stop the descent, ensure that the aircraft starts to climb and(or) execute a turn keeping a speed no lower than the allowed minimum.
- If the standard departure chart requires a turn before flaps retraction, such a turn shall be done at height no lower than 50 m AGL at IAS= V_2+40 Km/h while climbing. In case of turns exceeding 15° bank if the bank limit alarm sounds, special attention should be paid to artificial horizon working condition and 25° bank limit shall not be exceeded. 25° bank decreases the vertical speed approximately by 1 m/Sec. Flaps retraction should be executed after turn completion on straight portion of flight.

2.4 Climb

(1) In accordance with the calculated flight data (Ref. paragraph 3.1.3) use the following modes for climb:

- (a) The best-range cruise mode at an IAS of 550 km/hr up to an altitude of 9450 m, further on at a constant Mach number of 0.8.
- (b) The high-speed cruise mode at an IAS of 575 km/hr up to an altitude of 9750 m, further on at a constant Mach number of 0.85.
- (c) Upon reaching an altitude of the constant Mach number, continue climb at the constant selected Mach number, having selected the AFCS from the speed holding mode to the Mach number holding mode.

NOTES: 1. In case of emergencies it is allowed to use powers above maximum continuous (up to takeoff power inclusive) in climb and horizontal flight.

2. At ambient temperatures exceeding the standard temperatures by more than 10 °C, execute climb in the high-speed cruise mode at an IAS of 575 km/hr up to an altitude of 8850 m, further on at a constant Mach number of 0.8.

2.5Cruise:

(2) It is recommended to execute enroute flight at the speeds established for the best-range cruise mode (Ref. paragraph 4.4.2).

(3) It is not allowed to execute enroute flight:

At speeds exceeding the maximum operational limit speed V_{MO} (Ref. subparagraph 2.5.4.1).

At speeds less than the minimum enroute safety speed depending on the altitude and the gross weight (Ref. subsection 7.8).

At altitudes above the maximum altitude of flight established for the gross weight (Ref. paragraph 2.2.2).

If required, power exceeds maximum continuous.

(4) At the end of horizontal enroute segment, the crew must perform all the operations listed in the "Before descent" checklists (Ref. paragraph 4.5.2) and in the "Before descent" section of the detailed procedure (Ref. subparagraph 4.8.2.6).

For reducing fatigue and for prophylactic purposes, all the crewmembers are recommended to breathe oxygen under 100 % - flow condition or mixture for 10 min after every 2 hours of flight, if time in flight exceeds four hours.

Best Range Cruise

Weight, thousands of kg Flight level	98 to 94	94 to 90	90 to 86	86 to 82	82 to 78	78 to 74	74 to 70
390	-	-	-	0.81	0.81	0.805	0.8
370	0.815	0.815	0.81	0.81	0.805	0.8	0.79
350	0.81	0.81	0.81	0.805	0.8	0.79	0.78
330	0.805	0.8	0.795	0.785	0.775	0.765	0.755
310	0.79	0.785	0.775	0.765	0.755	0.74	0.73
290	0.775	0.765	0.75	0.74	0.73	0.71	0.7
270	0.75	0.74	0.73	0.715	0.7	0.69	0.67
250	0.72	0.71	0.7	0.69	0.675	0.66	0.65
230	0.69	0.68	0.67	0.66	0.65	0.63	0.62
200	0.64	0.63	0.62	0.61	0.6	0.58	0.575
140	0.56	0.555	0.55	0.545	0.535	0.53	0.52

In the high-speed cruise the speeds close to the maximum ones are maintained:

IAS = 600 km/hr at flight levels up to 230

IAS = 575 km/hr at flight levels 230 up to 330

M = 0.87 at flight levels above 330

Peculiarities of Airplane Stability and Responses at High Altitudes, Speeds and Mach Numbers

- (1) The control column forces vary slightly in the course of acceleration and must be completely relieved by trimming.

The airplane responses to control inputs are normal.

- (2) Execution of turns at the maximum operating limit speeds and Mach numbers presents no problems.

- (3) Within the Mach number range from 0.7 to 0.8 the airplane roll response to the rudder input is normal, at Mach numbers exceeding 0.895 the airplane shows a reverse roll response consisting in a changed response to the rudder input: upon application of the left pedal the airplane rolls right, upon application of the right pedal the airplane rolls left. In case of inadvertent overspeeding beyond a Mach number of 0.88, take measures to reduce the Mach number by reducing power.

Due to good lateral controllability of the airplane the reverse response does not practically involve difficulties in the airplane control.

. Peculiarities of Airplane Stability and Responses at Low Speeds in Enroute Configuration

- (1) At all stages of flight do not allow the airspeed drop below the minimum limit speeds (Ref. subparagraph 2.5.4.2).

In case of inadvertent loss of speed the AAT warning system actuates. As this takes place, immediately take measures to increase the speed.

- (2) Execution of maneuvers at speeds exceeding the minimum limits by 20 - 30 km/hr requires increased alertness from the pilot. Execute a maneuver (turn, transition from descent to horizontal flight, etc) at the minimum possible load factors, using smooth movements of the controls and at bank angles not exceeding 20° .

. Peculiarities of Airplane Piloting in Turbulent Atmosphere and during Stalling

- (1) Whenever the airplane enters an area of severe bumping (causing load factors exceeding 1.5), this event being indicated by sharp shaking and separate shocks, proceed as follows:

Establish an IAS of 500 km/hr or, at altitudes above 10,750 m - a Mach number of 0.8.

Discontinue the altitude holding mode if it has been on.

Fly with the controls semi-fixed.

Do not try to precisely maintain altitude and speed, fly the airplane referencing to average readouts of the gyro horizon, rate-of-climb indicator, airspeed indicator, altimeter and course indicators. In so doing, maintain the average values of the parameters of flight by smooth applications of the flight controls.

Avoid pitching-up and any maneuvers involving bank angles in excess of 10 to 15°.

- (2) When being close to thunderstorm areas execute turns at Mach numbers not exceeding 0.8.

Having entered a severe updraft, try to maintain a selected pitch attitude indicated by the gyro horizon. If a severe shaking is experienced in this condition, push the control column without changing the power setting and see to it that thereafter the Mach number does not exceed 0.88 at altitudes above 10,300 m or the speed maximum operational limits (Ref. subparagraph 2.5.4.1) are not exceeded at lower altitudes.

In case of sharp descent of the airplane caused by a severe downdraft, do not prevent this descent, keep the controls at the initial (balanced) position and monitor the speed so as not to allow it exceed the operational limits.

- (3) With the airplane piloted correctly, its stalling is practically ruled out. But if it takes place (this condition being detected by the coming-on of the AAT warning system light, a speed drop below the minimum limit and vigorous pitching-up) immediately push the control column fully forward. After decreasing the angle of attack and increasing the speed up to a level exceeding the minimum limit speed by not less than 50 to 70 km/hr, establish horizontal flight. During stall recovery, avoid establishing excessive load factors (more than 1.2 to 1.3) to prevent repeated stalling.

If correct piloting is employed, loss in the altitude during stall recovery does not exceed 650 m.

- (4) If during flight in severe turbulence an unstable operation of the engine (engine stalls) is detected, which is accompanied by an engine speed drop, temperature rise and possible change in the engine noise pitch, the Flight engineer must closely watch variation of the engine operational parameters. If after the engine stalls it fails to return to normal operation, shut down the engine upon the Captain's order avoiding a temperature surge beyond the allowed limit.

After the airplane reaches the normal angles of attack, start the engine in accordance with the instructions of paragraph 8.1.2.

5. Flight with One Engine Inoperative

In case of failure of one engine in enroute flight, land on the departure or an alternate aerodrome or continue enroute flight up to the destination aerodrome, decision being dependent on the situation and instructions of the ATC service. In so doing, proceed as follows:

Descend at the best-range cruise mode in accordance with the instructions of paragraph 4.5.3 (1) (with deceleration if speeds exceeding those of the best-range cruise mode have been used in enroute flight) down to the nearest flight level being within the limits of two-engine-operating service ceiling (Ref. subsection 7.8).

Continue enroute flight maintaining a constant Mach number of 0.7 at flight levels above 8750 m or an IAS of 500 km/hr at flight levels below 8750 m.

Descend down to the traffic altitude proceeding in accordance with the instructions of paragraph 4.5.3 (7).

Land as directed in paragraph 4.6.4.

2.6 Descent

Execute normal descent with all the engines running at idle.

CAUTION: WITH THE AIR BLEED FOR AIR CONDITIONING AND THE ANTI-ICING SYSTEM ENGAGED, IT IS PROHIBITED TO DECREASE THE ENGINE POWER RATING BELOW 62 % HP COMPRESSOR TO AVOID DISENGAGEMENT OF THE CSD UNIT.

Determine the descent initiation moment using the instructions of paragraph 7.6.1 for a selected mode of descent.

At the end of descent, the crew must perform all the operations listed in the "After selection of aerodrome pressure" section of the checklist (Ref. subparagraph 4.8.2.7).

Regimes of Descent

- (1) In the best-range cruise mode, execute descent at $M = 0.8$ down to an altitude of 10,750 m and further on at $IAS = 500$ km/hr. In so doing, do not extend the mid-wing spoilers within the entire range of altitudes.
- (2) In the high-speed cruise mode, execute descent at $M = 0.85$ down to an altitude of 9750 m, further on at $IAS = 575$ km/hr. In so doing, extend the midwing spoilers to 45° within the range of altitudes from 7000 to 3000 m. In case of necessity it is allowed to extend the spoilers to 30° in the course of descent from 9000 to 7000 m. In case of necessity it is allowed to use the spoilers for deceleration of the airplane at altitudes below 3000 m.
- (3) Execute descent under control of the ATC service in accordance with their instructions with the speed limitations observed.
- (4) With one engine inoperative, descend down to the traffic altitude with two engines running at idle maintaining the speeds established for the best-range cruise. In so doing, do not use the midwing spoilers within the entire range of altitudes.
- (5) The descent performance data are given in paragraph 7.6.1.

Emergency Descent

- (1) To execute emergency descent from the enroute altitude, proceed as follows:

Retard the throttle levers to IDLE (МАЛЫЙ ГАЗ) position.

Extend the midwing spoilers to 45° .

At a speed not exceeding $M = 0.88$ or $IAS = 575$ km/hr set the LG (ШАССИ) control switch to EXTSN (ВЫПУСК).

Without waiting for the LG to lock down (the main LG extension cycle completes in 10 to 12 s) proceed to descent at a load factor of 0.3 to 0.5 and establish the vertical speed of descent at a level of 60 to 70 m/s. If the nose LG fails to lock down, continue descent with the nose LG in this position (the nose LG will lock down after reduction of IAS to 470 km/hr).

- (2) In emergency descent maintain Mach number and IAS so as not to exceed their respective limits (Ref. subparagraph 2.5.4.1).

The time of emergency descent from an altitude of 11,000 m down to an altitude of 4000 m is 3 min if the above procedure is followed.

The airplane displays good controllability and stability in descent.

- (3) Upon attainment of a safe altitude (not more than 4000 m if descent has been caused by loss of pressurization in the pressurized compartments), smoothly pull the control column to establish horizontal flight with load factors of 1.2 to 1.3, retract the spoilers. In so doing, the loss of altitude in descent recovery is 300 to 400 m.

Descent in Turbulent Atmosphere

In entering an area of high turbulence, maintain IAS not higher than 500 km/hr and Mach number not higher than 0.8.

The peculiarities of the airplane behaviour in turbulent atmosphere are covered in paragraph 4.4.5.

Descent in Icing Conditions

- (1) In enroute flight and in descent, switch on the anti-icing heaters in the following cases:

Before entering an area of possible icing.

Upon coming-on of the ICING (ОБЛЕДЕНЕНИЕ) or IGV ICING (ОБЛЕДЕНЕНИЕ ВНА) annunciators.

- (2) Select the windshield heater to HIGH (СИЛЬНО) in advance before entering an area of possible icing (before crossing clouds, in haze or fog). Upon leaving the icing area, make sure ice is removed from the glazing heated surfaces and thereafter select the windshield heaters to LOW (СЛАБО).
- (3) In icing conditions descend with all the three engines operating at idle, at the speeds corresponding to high-speed cruise mode, with the midwing spoilers fully extended within the entire range of altitudes.
- (4) After leaving the icing area, switch off the heaters having made sure there is no ice on the airplane surfaces but not earlier than 10 to 15 minutes after leaving the above area.
- (5) If icing conditions are encountered in enroute flight and continuous occurrence of these conditions exceeds 10 minutes, report to the ATC service and take measures to leave the icing area.

(5) Crew's actions in descent

Captain	Copilot	Flight engineer
Having obtained the ATC controller's clearance to descend calls "Initiating descent" Sets the throttle levers to IDLE (МАЛЫЙ ТАЗ) and establishes descent at a selected vertical speed If it is decided to descend in the automatic mode calls "Control through autopilot" Executes descent at the selected airspeeds Sets the spoiler position depending on the regime of descent Corrects the vertical speed of descent depending on the distance to the aerodrome Maintains the established regime of flight beginning with the speed limiting threshold. Calls "Test radio altimeter" Functionally checks the radio altimeter	Observes the instruments to monitor descent in automatic mode or, upon the Captain's order, pilots the airplane according to IFR and selected parameters In reaching the flight level established by the ATC controller, calls "Selected flight level" Checks the distance to aerodrome, introduces corrections to the regime of descent After crossing the flight level closest to the selected one warns the Captain of this condition and reports it to the ATC controller When approaching the speed limitation altitude, warns the Captain. Uses the weather radar to watch thunderstorm cells and receives an ATC controller's approval of the diversion route. Depresses the TEST (КОМПРОБ) button and checks the radio altimeter	Monitors operation of the engines and the airframe systems Monitors variation of the cabin altitude (a rate-of-descent not more than 3 m/s, the pressure differential decreases)

(cont'd)



FLIGHT MANUAL

NORMAL PROCEDURES - Descent

Captain	Copilot	Flight engineer
	Reports altitude of flight and landing approach mode to the traffic controller. Receives from the traffic controller the data on aerodrome pressure, the pressure selection flight level and clearance to landing approach, and reports these to the Captain.	
Continues descent in the manual control mode down to the pressure selection altitude.		
At the pressure selection altitude calls "Control taken over"		
Smoothly establishes horizontal flight, retracts the spoilers and calls "Set pressure"	Calls "Control transferred"	
Sets the aerodrome pressure to the altimeters	Sets the aerodrome pressure and calls "Pressure set".	Sets the aerodrome pressure to the altimeter
Monitors the altitude of flight read by the Copilot's altimeter	Monitors the altitude of flight read by the Captain's altimeter.	
	Reports the pressure set to the altimeters to the ATC controller	
Calls CHECK		
Replies to the checklist items	Replies to the checklist items	Reads out the "After selection of aerodrome

(cont'd)

Captain	Copilot	Flight engineer
Continues descent to the traffic altitude at a vertical speed of 5 to 7 m/s in the direction indicated by the Copilot or the ATC controller and, in case of necessity, executes maneuver required for diversion from thunderstorm cells	Monitors the distance to runway and lateral deviation	pressure" section of the checklist Replies to the checklist items Monitors the engine and aircraft systems operational parameters

2.7 Approach

2.7.1 Approach procedure in normal conditions.

Execute the approach maneuvers with bank up to 25°, bank on final turn in automatic or FD modes is up to 20°.

At traffic altitude before landing gear extension and IAS 400 Km/h determine the required setting for the "Stabilizer Position Lever" - "ЗАДАТЧИК СТАБИЛИЗАТОРА".

Abeam the outer marker (or at a distance of 25 km from the threshold in case of 400 m AGL circuitheight or 30 km and 500/600 m circuitheight for straight-in approach) extend the landing gear. 20-25 second after the last green light of landing gear position indicator ППС-2МК turned on and after pressure recovery in hydraulic system nr. 1 (up to 200-220 kg/cm²) set landing gear lever to neutral position and fix it.

Base turn is performed with a bank of not more of 30° at IAS=380-370 Km/h.

On base reduce to 360 km/h (or at a distance of 18-20 km from the threshold for straight-in approach) extend flaps to 28° maintain speed of 300 Km/h. Assure that the adjusted stabilizer position was set. 4/3 km before glideslope interception set final approach flaps (36 or 45 deg according landing datas).

(4) For landing:

Flaps:

45° or 36° in normal conditions, as established by paragraph 3.1.6.

45°, 36° or 28° with two engines operating, as established by paragraph 3.1.6.

15° with one engine operating.

Slats extended.

Stabilizer in a harmonized position (Ref. Table 2.5.4.1).

Mid-wing and inboard spoilers extended (automatically after touchdown).

LG down.

(5) Harmonized positions of stabilizer and wing high-lift devices.

Table 2.5.4.1

Airplane configuration	Flap setting angle, deg.	Slat position	CG position, % MAC		
			18 to 24	24 to 32	32 to 40
			Stabilizer control setting		
			II (FWD) green	C (MIDWAY) black	3 (AFT) yellow
			Stabilizer harmonized position, deg.		
Enroute	0	Retracted	0	0	0
Takeoff	15, 28	Extended	3	1.5	0
Landing	36, 45	Extended	5.5	3	0



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4.6. LANDING APPROACH

4.6.1. General

- (1) In the course of landing approach, before initiating base turn at the traffic altitude or being at a distance of 20 to 25 km from the runway threshold, execute all the operations listed in the "Before base turn or at a distance of 20 to 25 km from runway threshold" section of the procedures (Ref. subparagraphs 4.8.2.8 and 4.8.2.9).
- (2) Execute landing approach either in the manual, flight director or automatic modes of the airplane control.

4.6.2. Piloting Technique and Regimes

4.6.2.1. General

- (1) Execute intermediate approach in accordance with the standard pattern established for a given aerodrome and instructions of the ATC service. The procedure is described in the "Actions of crew members during landing approach" sequence diagram (Ref. paragraph 4.6.3).
- (2) Select the regimes of flight during landing approach in accordance with the instructions of paragraph 3.1.8 or subsection 7.7.
- (3) If upon attainment of the traffic altitude the pressure-actuated altimeter readings differ from the radio altimeter readings in more than 100 m (330 feet), discontinue descent, request the ATC controller for the aerodrome pressure and refine the airplane position.

After comparing the readings of the altimeters, select YB-5 radio altimeter No. 2 to the decision height or to an altitude of 200 feet if the decision height exceeds 200 feet.

- (4) Refine the airplane alignment with the runway centerline immediately after completion of final turn.

CAUTION: IF THE PILOTS DID NOT MANAGE TO BRING THE AIRPLANE TO THE LANDING CONFIGURATION BEFORE AN ALTITUDE OF 100 M IS REACHED, NEVER CONTINUE LANDING PROCEDURE. IN THIS CASE PROCEED TO GO-AROUND.

- (5) When on the glide slope, operate the ELEV FEEL (ЗАПВЯТЕЛЪ PB) button to trim out the airplane. When flying on the glide slope in the flight director mode of landing, correct deviations of the vertical speed from the design values by application of the elevator and deviations from the selected IAS only

(cont'd)

by changing the power setting. It is recommended to maintain the gliding speed by small variations in the throttle levers settings causing the engine speed variations within $\pm 5\%$, timely responding to initiation of the airspeed variations.

CAUTION: IF THE ENGINES SPEEDS DROP BY 10 % AND MORE THE SPEED OF THE AIRPLANE IN THE LANDING CONFIGURATION DROPS RAPIDLY. THEREFORE, IF A NECESSITY TO SIGNIFICANTLY REDUCE THE SPEED ARISES, THE PILOTS MUST EXERCISE INCREASED ALERTNESS IN MAINTAINING THE REGIME OF DESCENT TO AVOID DANGEROUS LOSS OF SPEED.

- (6) In case of crosswind landing correct for drift, after final turn up to the moment of touchdown, only by establishing a wind correction angle without slipping and bank. When selecting to manual control, ensure maintenance of the established wind correction angle.
- (7) During landing approach switch on the landing lights at an altitude of 150 to 100 m. When flying in clouds, switch on the lights after leaving clouds. In snowfall, rain and haze the Captain takes decision to switch on the lights.

NOTE: During landing approach in snowfall, rain and dust, switching-on of the light causes appearance of the so called "light screen" which hinders piloting of the airplane. It is recommended in this case to switch on all the lights simultaneously and separately the fuselage and wing lights for short periods of time, execute landing with the landing illumination most favourable for given weather conditions or proceed to an alternate aerodrome.

4.6.2.2. Procedure of Correction of Lateral Deviations

- (1) Before reaching the decision height, the Captain must assess the magnitudes of the airplane path deviations from the runway centerline (lateral deviation) and from the glide slope.

The maximum acceptable lateral deviations from the runway centerline are tabulated below

Maneuver initiation altitude, m	100	80	60	45	30
Distance to runway threshold, m	1950	1500	1050	700	400
Maximum acceptable lateral deviation	100	70	40	30	30 (but not more than half runway width)

(cont'd)



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The actual magnitudes of lateral deviation are assessed by the Captain by the coming-on of the course and glide slope maximum limit deviation annunciators or visually, by referencing to the runway lights and other reference objects (by day and night).

The following light aids are used as the reference objects for these purposes:

VASI (visual approach slope indicator) light bar No. 1 (closest to inner marker), whose half width on both sides from the runway centerline is 42 m (for VASI with six light bars) and 37 m or 27 m (for VASI with five light bars).

Runway edge lights whose distance from the runway centerline is determined by the runway width.

Runway end identifier lights (red) (lateral distance of extreme lights from the runway centerline is 12 to 15 m).

Runway threshold lights (green).

If the actual lateral deviation exceeds the maximum acceptable limit the Captain must proceed as follows:

In the automatic approach mode immediately select the automatic go-around mode.

In the flight director approach mode discontinue piloting to the command bars and immediately proceed to go around in the automatic or manual modes of control.

- (2) If the actual lateral deviation is within the acceptable limits the Captain, deciding to land, must disengage the autopilot or discontinue piloting to the command bars and immediately initiate maneuver aimed at elimination of the lateral deviation.

(a) At maneuver initiation altitudes of 60 m and more:

Execute turn towards the runway centerline by coordinated application of the controls. The lateral maneuver track has the form of letter S and consists of two conjugated turns. The first turn (towards the runway centerline) is performed at a bank angle of 10 to 12° and the second turn (out of the runway centerline) is performed at a bank angle of 6 to 8°. The maximum angle of bank must not exceed 15° at the beginning of the maneuver and 2 to 3° at the runway threshold.

(cont'd)



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- (b) At maneuver initiation altitudes below 60 m down to 30 m inclusive

An approach must be considered successful (crosswind landing approach as well) if the direction of the ground speed vector does not go beyond the runway width, i.e. at the moment the decision height is attained the airplane is in such a position and moves in such a way that it will not go beyond the continued runway border lines.

- (3) If, with the airplane at the decision height, its lateral deviation is within the stopway red lights (12 to 15 m), the decision to land may be taken even with the runway threshold not seen, and landing can be executed without correction for lateral deviation. With the lateral deviations exceeding 12 to 15 m up to 30 m inclusive (but not in excess of half the runway width) the decision to land may be taken if the runway threshold is seen. In this case landing includes correction for the lateral deviation for which purpose a single corrective turn towards the runway centerline through an angle of 1 to 3° banked up to 5° is executed through coordinated application of the controls. Execute turn in such a way that the airplane touches down having the same or a lower angle with the runway centerline, within the area between the centerline and the inner touchdown zone lights at the lateral deviation side. This done, align the airplane with the runway centerline or a line parallel to it. An airplane touchdown off the runway centerline increases hazard of overrunning the runway. The maximum acceptable landing path deviations in altitude not needing corrections are ± 1 dot on the horizontal situation indicator (about ± 5 m).

Such errors cause variation of the airborne segment by approximately 100 m due to lengthwise shift of touchdown point.

(cont'd)

4.6.3. Crew's Actions in Landing Approach (Manual Mode)

Captain	Copilot	Flight engineer
Upon reaching the traffic altitude, smoothly proceeds to horizontal flight Sets power required for a speed of 400 km/hr Determines correlation of the altitude and the distance to the rectangular pattern point of entry Prepares himself for extension of LG At the traffic altitude and a speed of 400 km/hr trims out the airplane in pitch and sets the HOR STAB SELECT (ЗАДАТЧИК СТАБИЛИЗАТОРА) selector switch to a position corresponding to the elevator position indicator color coding Calls DOWN GEARS	Monitors the descent speeds Upon reaching the traffic altitude, this event being indicated by the coming-on of the radio altimeter warning light, resets its index to the decision height. Compares the radio altimeter readings with the pressure-actuated altimeters readings (with the terrain profile accounted for) Monitors the direction of flight, the distance to the runway, lateral deviation After reaching the outer marker abeam position, starts the stopwatch and calls "Abeam outer marker, lateral deviation km" During straight-in approach calls "Distance to runway 22 to 25 km" Selects the LG control valve to EXTEN (ВЫД/ВК) Monitors the process of extension	Before engagement of the autothrottle, checks the throttle levers for unlocked condition and calls "Throttles unlocked". Upon engagement of the autothrottle, checks the AUTO THR ON (АТ ВКЛ/ВКЛ!) annunciator for coming on. Monitors the operational parameters of the engine and the airplane systems. Monitors the extension of the LG. 20 to 25 s after coming-on of the LG position indication lights and attainment of a pressure of 200 to

(cont'd)

Captain	Copilot	Flight engineer
	<u>NOTE:</u> The LG is extended at a distance of 25 km from the runway threshold with a traffic altitude of 400 m and at a distance of 30 km from the runway threshold with a traffic altitude of 500 to 600 m. Sets the LG valve neutral, locks it and calls "LG down" Reports passing-over of the outer marker beam to the ATC controller	220 kgf/sq.cm in hydraulic power system 1 calls "Time LG valve neutral"
Makes sure the LG is down.		
Maintains the speed at 380 to 370 km/hr		
Calls "Check"		
Replies to the checklist items	Replies to the checklist items	Reads the "Before base turn or at distance of 20 to 25 km" section of the checklist
	Determines the moment of initiation of base turn	Carries out the commands to change the power setting (in flight without using the autothrottle)
	Calls "Base turn"	
Executes base turn at a bank angle not exceeding 30° and a speed of 380 to 370 km/hr	Reports initiation of base turn to the ATC controller	Monitors the operational parameters of the engine and the airplane systems

(cont'd)

Captain	Copilot	Flight engineer
After base turn, reduces the speed down to 360 km/hr	Monitors reaching the selected course	
Calls "Flaps 28"		
	Sets the flap control handle to 28°	
	After extension of the flaps and the slats, resetting of the horizontal stabilizer, calls "High-lift extended"	
Makes sure the wing high-lift devices are set to correct positions	Monitors automatic disengagement of the elevator and rudder enroute artificial feel units. If they fail to disengage, sets the ENROUTE FEEL (ПОЛЕТНЫЙ ЗАПРЯВЕТЕЛЬ) selector switch to TOL (ВЗЛЕТ ПОСАДКА)	
Trims out the airplane in pitch		
Maintains the speed at 300 km/hr	Determines the moment of initiation of final turn and calls "Final turn"	
Depresses the APPROACH (ЗАХОД) light button	Reports to the traffic controller initiation of final turn.	
Executes final turn banked not more than 30°	Assists the Captain in piloting the airplane	
Maintains the selected parameters (angle of bank, speed, altitude).	Reports to the landing controller the heading and altitude	
Rolls the airplane in or out to align it with the runway centerline.	In approaching the glide slope interception point, calls "..... Kilometers to glide slope interception point"	

(cont'd)

Captain	Copilot	Flight engineer
Controls power or orders the Flight engineer "Power" (in flight without the use of the auto-throttle) Extends the lights Being at a distance of 4 to 5 km to the glide slope interception point calls "Flaps 36" or "Flaps 45"	Resets the flap control handle to 36° (or 45°) Monitors final extension of the flaps and resetting of the horizontal stabilizer (immediately reports any malfunctions detected in the course of extension). When crossing the estimated point of glide slope interception, calls "Glide slope intercepted, vertical speed m/s"	
Trims out the airplane and establishes descent at the selected vertical speed (or flies the airplane referencing to the command bars while landing in the flight director mode) Calls "Check" Replies to the checklist items	Replies to the checklist items	Reads the "Before interception of glide slope" of the checklist

(cont'd)



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Captain	Copilot	Flight engineer
Maintains the required heading	Monitors the actual position of the airplane relative to the landing course and the glide slope, reports deviations to the Captain.	On the Captain's command, sets the required power on the engines (in flight without the use of the auto-throttle).
Monitors maintenance on the glide slope attitude	Reports readiness for landing to the ATC controller	Under icing conditions, switches on the anti-icing system and monitors its operation
Controls power or gives respective orders to the Flight engineer in flight without use of the autothrottle	If the speed deviates from the target value by ± 10 km/hr, calls "Low (High) speed"	
	If the vertical speed exceeds 5 m/s, calls "Steep descent"	
	When crossing the outer marker, calls "Outer marker, altitude m"	
	At a height exceeding the decision height by 30 m, calls "Assess, holding to instruments"	
Establishes visual contact with ground reference objects		
Assesses and corrects the airplane attitude relative to the landing course, the glide slope and the runway centerline		
Controls the speed and the power of the engines.		

(cont'd)

4.6.9.2. Peculiarities of Piloting Technique at Low Speeds

CAUTION: NEVER REDUCE THE SPEED INTENTIONALLY BELOW THE RECOMMENDED LEVEL.
(REF. 3.1.8).

- (1) Reduction of speed down to the minimum speed (Ref. Fig. 2.5.1) is indicated by:

Continuous sounding of the loudspeaker.

Coming-on of the STALL (α_{kp}) annunciator.

Coming-on of the red annunciator on the AAT control panel.

In this condition the Captain must take all measures to reduce the angle of attack and increase the speed.

NOTE: The airplane does not show other symptoms of approaching the stalling speed.

- (2) The AAT actuation speeds and the stalling speeds for the flap setting angle are indicated in subparagraph 2.5.4.2.

4.6.10. Go-Around Piloting Technique

- (1) The piloting technique and interaction of the crewmembers during go-around are covered in the sequence diagram.
- (2) Go-around can be performed both with all the engines operating and with the engine inoperative.
- (3) The go-around piloting technique is the same both with all the engines operating and with one engine inoperative.

CAUTION: TO AVOID EXCEEDING OF THE STRENGTH LIMITATIONS IN GO-AROUND WITH ALL THE ENGINES OPERATING, REDUCTION OF POWER SETTING TO A LEVEL NOT LESS THAN MAXIMUM CONTINUOUS IS ALLOWED AT ALTITUDES NOT LESS THAN THE TRAFFIC ALTITUDE.

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(4) Crew's Actions during Go-Around in Manual Control Mode

Captain	Copilot	Flight engineer
At the decision height, having made the decision to go around, immediately advances all the throttle levers to the takeoff power position and calls "Takeoff power, going around"	If at the decision height the Captain did not give order "Landing" or "Going around", warns the crew "Going around, takeoff power"	
Advances power up to takeoff		
Calls "Flaps 28°"		Checks setting of the throttle levers to the takeoff power position and calls "Takeoff power set"
Discontinues descent and establishes climb without loss of speed and change in the heading.	Resets the flap control handle to 28°.	Monitors operation of the engines
Monitors resetting of the flaps and the horizontal stabilizer	Checks the wing high-lift devices and the horizontal stabilizer for synchronous resetting.	
After onset of a positive vertical speed, calls "Up gears"	Pulls the control column to recover from descent.	
	Maintains the heading without rolling.	
	Monitors the speed	
	Resets the LG control valve to retraction.	
	After the LG is retracted, calls "Gears up"	
After the LG is retracted, calls "Switch off and retract lights"		
Keeps the airplane level	Switches off and retracts the lights	

(cont'd)

Captain	Copilot	Flight engineer
Upon attainment of a speed of 320 km/hr, calls "Retract flaps" Monitors retraction of the wing high-lift devices and resetting of the horizontal stabilizer Maintains the heading Upon attainment of a speed of 400 km/hr at the traffic altitude, reduces power or gives an order to do so to the Flight Engineer After completion of the go-around procedure, takes a decision either to execute repeated landing approach or proceed to an alternate aerodrome	Resets the flap control handle to 0° After retraction of the wing high-lift devices, calls "Flaps, slats retracted, stabilizer zero" Requires maintenance of the on-course condition in case of deviations by calling "Going left (right)" At an altitude of 200 m, sets the traffic controller communication frequency to the VHF transceiver After retraction of the wing high-lift devices, calls "Heading". Reports execution of go-around procedure to the ATC controller	Upon the Captain's order sets the required power and calls "Power set". Monitors the operational parameters of the airplane systems

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NORMAL PROCEDURES - Landing

4.7. LANDING

4.7.1. Landing Procedure

- (1) Joint actions of the crewmembers during landing are described in the sequence diagram.
- (2) Cross the runway threshold and fly further down to a height of 6 to 4 m along the continued glide slope. Select the target touchdown point in such a way that at the moment of touchdown the lateral deviations of the airplane from the runway centerline do not exceed 1/4 runway width and the direction of the ground speed vector is parallel to the runway centerline or directed at the runway centerline.

If these requirements are not met, proceed to go-around before the throttle levers are retarded down to idle.

During glide at vertical speeds up to 4 m/s the minimum height for initiation of go-around procedure is 6 to 4 m, this at vertical speeds up to 5 m/s along a steep glide slope is 15 m provided the airplane landing weight does not exceed the maximum limit indicated in paragraph 3.1.6.

With an engine failed during glide, the minimum height for initiation of go-around is 15 m.

- (3) During landing approach along a non-standard glide slope (with a slope above 3° and a vertical speed in excess of 4 m/s) reduce the vertical speed down to 3 to 4 m/s at a height of 20 to 15 m and maintain the recommended landing approach speed.
- (4) At a height of 6 to 4 m, reduce the power setting of the operating engines down to idle and initiate flare-out.

At the end of flare-out, apply the elevator to prevent pitching-up and land avoiding holding-off and ballooning which cause extension of the landing distance.

- (5) If correct piloting technique is used the airplane touches down within the target area located at a distance of 300 to 600 m from the runway threshold, at a speed 5 to 10 km/hr below the landing approach speed and at a vertical speed of 0.5 to 1.0 m/s.

(cont'd)

- (6) Deploy the thrust reverser:

At a height not more than 3 to 2 m if there is no necessity to correct for lateral deviations.

On the ground after complete elimination of lateral deviations.

- (7) In case of bouncing fix the control column in the landing position (the position taking place at the moment of touchdown), deploy the thrust reverser (if it has not been deployed earlier) and, avoiding nose-down motion, execute repeated touchdown by the main LG wheels.

- (8) After touchdown, eliminate the wind correction angle by applying the pedals.

The inboard and midwing spoilers will extend automatically at the moment of touchdown. Smoothly rotate the airplane to touch down by the nose LG wheels with subsequent pushing of the control column home forward (the Copilot keeps the control column in this position until the landing roll is completed). Smoothly align the airplane with a line parallel to the runway centerline.

- (9) Initiate braking at the speed determined in accordance with the instructions of subsection 7.7. Apply the brakes by smoothly and synchronously depressing the brake pedals.

CAUTION: TO PREVENT INADVERTENT AND ERRONEOUS ACTIONS DURING APPLICATION OF THE RUDDER AND THE BRAKES IN THE COURSE OF LANDING APPROACH AND LANDING ROLL, ADHERE TO THE FOLLOWING RULES:

- (a) IN THE COURSE OF LANDING APPROACH THE FEET MUST BE SO POSITIONED AT THE PEDALS THAT THE HEEL IS IN CONTACT WITH THE FLOOR AND THE MIDDLE PORTION OF THE FOOT TIP IS AT THE LOWER EDGE OF THE PEDAL. THIS POSITION MUST BE RETAINED UNTIL APPLICATION OF THE BRAKES IS INITIATED.
 - (b) BEFORE APPLICATION OF THE BRAKES, PLACE THE FEET TIPS SO THAT THE MIDDLE PORTION OF THE HEEL IS AT THE LOWER EDGE OF THE PEDAL AND THE FEET TIPS ARE PLACED UPON THE UPPER PORTION OF THE BRAKE PEDALS. THIS POSITION ENSURES AN ADEQUATE TRAVEL OF THE BRAKE PEDALS REQUIRED FOR THEIR FULL DEPRESSION.
 - (c) WHEN MOVING THE DIRECTIONAL CONTROL PEDALS TO THEIR EXTREME POSITIONS, AVOID INADVERTENT DEPRESSION OF THE BRAKE PEDAL DEFLECTED REARWARD.
- (10) During landing roll maintain the heading by smooth application of the rudder and timely counteract the airplane tendency to yaw off the runway centerline. To maintain the heading at speeds of 230 km/hr and less in case of necessity apply

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the aileron into the required turn through not more than half the control wheel full deflection angle.

Differential application of the wheel brakes is also allowed on a dry runway.

- (11) After making sure the airplane has touched down without overshoot, the conditions of the runway and the brakes provide efficient braking and the remaining runway distance adequate for bringing the airplane to a complete standstill at a speed not below 120 km/hr, gradually stow the thrust reversers.

At a speed of 60 to 70 km/hr, retract the thrust reverser doors to the direct thrust position.

- (12) In case of necessity (landing on a slippery runway, failure of the brakes, inadequate length of the runway, etc) it is allowed to use the maximum reverse thrust up to the moment the airplane comes to a complete standstill.

After landing in which reverse thrust has been used up to the moment of a complete standstill, inspect the IGV and compressor stage 1 to assess their condition.

CAUTION: IF THE AIRPLANE TENDS TO RUN OFF THE RUNWAY CENTERLINE AND OVERRUN THE RUNWAY EDGE PROCEED AS FOLLOWS:

- (a) IMMEDIATELY RETRACT THE THRUST REVERSER DOORS OF BOTH ENGINES AND SIMULTANEOUSLY RELEASE THE WHEEL BRAKES COMPLETELY.
 - (b) APPLY THE DIRECTIONAL CONTROL PEDALS AND THE AILERONS AND, WHILE ON A DRY RUNWAY, DIFFERENTIALLY APPLY THE WHEEL BRAKES TO MAKE THE AIRPLANE MOVE PARALLEL TO THE RUNWAY CENTERLINE.
 - (c) AFTER COMPLETE REGAINING OF CONTROL AND STEADY MOTION PARALLEL TO THE RUNWAY CENTERLINE APPLY THE WHEEL BRAKES AND, IN CASE OF NECESSITY, DEPLOY THE THRUST REVERSER DOORS AGAIN AND USE REVERSE THRUST UP TO THE MOMENT THE AIRPLANE COMES TO A COMPLETE STANDSTILL.
 - (d) DIFFERENTIAL REVERSING OF THE ENGINES FOR THE PURPOSE OF ELIMINATION OF THE AIRPLANE LATERAL DEVIATIONS IS NOT ALLOWED.
 - (e) EMPLOYMENT OF S-TURNS DURING LANDING ROLL FOR THE PURPOSE OF ELIMINATION OF THE LATERAL DEVIATIONS IS NOT ALLOWED.
- (13) When landing on a runway possessing a low friction coefficient, it is necessary to closely maintain the landing approach speed and the threshold speed recommended by the Flight Manual.
 - (14) In case of failure of one thrust reverser and occurrence of hazard to overrun the runway edge, discontinue using reverse thrust.

(cont'd)

after returning the airplane to required direction of motion, set reverse thrust again if required.

If after setting the thrust reverser control levers to the direct thrust position, the thrust reverser doors fail to retract to the direct thrust position, this condition being indicated by continued illumination of the RVSR LOCK (PAMOK PEHEPCA) annunciator, shut down the respective engine.

- (15) During night landing, upon completion of the landing roll, set the LIGHT BEAM (CBET QAP) selector switches to TAXIING (PYAEHIII).
- (16) After completion of the landing roll, retract the midwing spoilers.
- (17) After completion of the landing roll, the Captain selects the nose wheel steering control to 63°. The Flight engineer dumps the cabin pressure and, in case of necessity, starts the APU to provide air conditioning and illumination of the passenger compartment during taxiing and disembarkation of the passengers after shutting down the engines.

CAUTION: NEVER START THE APU IF THE TEMPERATURE OF OIL IN THE APU OIL TANK READ BY THE "OIL TEMP" (T° MACJA) INDICATOR IS LESS THAN -25 °C.

NOTE: After completion of the landing roll and cooling down the engines at idle for 1 minute, it is recommended to shut down engines No. 1 and No. 3 and taxi on one engine No. 2.

Before taxiing into the parking area, make sure the brakes operate normally and there is pressure (210 kgf/sq.cm) in the hydraulic power systems.

- (18) When approaching the parking area, stop the airplane at a distance of 50 m therefrom and begin taxiing following the signals of a signalman standing on the ground. In the course of taxiing-in, watch the signals given by the signalman. In the course of taxiing-in, the Copilot monitors the obstacles and timely reports them when detected. Use of reverse thrust for taxiing in the parking area is allowed only in cases of extreme urgency and only on aerodromes whose surface coating precludes ingress of foreign objects into the engine air duct.
- (19) After the airplane taxiing into the parking area and coming to a complete standstill, perform all the operations listed in the "Before leaving airplane at parking area" checklist.

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(20) Crew's Actions during Landing

Captain	Copilot	Flight engineer
In VFR flight, switches on the lights at an altitude of 150 to 100 m (at night, on leaving clouds, in adverse ornithological conditions) Makes sure a reliable visual contact with the ground reference objects (high-intensity lights) is established After attainment of the decision height, calls "Landing" Assumes control In correcting the airplane lateral or vertical deviations from the target path, avoids sharp movements of the control surfaces particularly of the elevator By the moment of initiation of flare-out, operates the throttle levers himself By the moment of initiation of flare-out, maintains the vertical speed not in excess of 3 to 4 m/s	Without leaving the controls free, observes the instruments to monitor the airplane attitude, vertical speed, air speed, angle of bank. If the respective limits are exceeded calls "Excessive bank, steep descent" Down from a height of 60 m reads aloud the radio altimeter readings every 10 meters and down from a height of 20 m every 5 m up to the moment of touchdown	In bumping conditions assists the Captain in operating the throttle levers

(cont'd)

Captain	Copilot	Flight engineer
After crossing the runway threshold, at a height of 6 to 4 m, sets the throttle levers to the idling position and begins flare-out At a height not exceeding 3 to 2 m or after touchdown, having eliminated lateral deviations calls "Reverser" Smoothly rotates the airplane to touch down by the nose LG Initiates braking Maintains the heading during landing roll keeping the airplane aligned with the runway centerline Calls "Off reverser" At the end of landing roll and at a taxi speed, selects the nose LG steering mode selector switch to 63°	Deploys the thrust reversers and holds the thrust reversers control levers in the course of landing roll Holds the control column in the foremost position until the landing roll is completed Notes and reports to the Captain the moments of crossing the runway midway point and the point located at a distance of 600 m to the runway end Retracts the thrust reversers Makes sure the thrust reversers control levers remain in the OFF (ВЫКЛ/ВЫН) position	Monitors deployment of the thrust reversers by coming-on of the PWSR DOORS (СТБОРКА РЕВЕРСА) annunciators Calls "Reversers on" Monitors operation of the engines in the reverse thrust mode. In the course of landing roll, reports the current values of speed every 20 km/hr particularly accentuating 120 km/hr (at which the thrust reversers must be retracted) Checks the thrust reverser doors for setting to the retracted position by going-out of the annunciators. Calls "Reversers off"

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Captain	Copilot	Flight engineer
		<u>CAUTION:</u> IN CASE OF UNSTABLE OPERATION OF AN ENGINE (ENGINES) IN THE REVERSE THRUST MODE OR A FAILURE TO DISCONTINUE THIS MODE, THE FLIGHT ENGINEER MUST REPORT THIS CONDITION TO THE CAPTAIN AND SHUT DOWN THE ENGINE (ENGINES) UPON HIS ORDER.
At the end of landing roll, stops the ELAPSED TIME (BPEMI HOMETA) pointers of the aircraft clock	At the end of landing roll, stops the ELAPSED TIME (BPEMI HOMETA) pointers of the aircraft clock.	Calls "Steering 63°"
Calls "Retract high-lift"	Reports landing to the ATC controller, receives from him instructions for taxiing	
Retracts the spoilers	Retracts the wing high-lift devices	
Leaves the runway by taxiing along the nearest taxiway	Switches off the pitot tubes and windshield heaters.	
Determines the direction of taxiing to the parking area	After leaving the runway, reports to the taxiing controller that the airplane taxis on taxiway No.	
Calls "Cool down engines, shut down engine No. 3" (or No. 1, No. 2 depending on the situation and the direction of taxiing)	Reports the airplane fuel quantity (upon request)	

(cont'd)

Captain	Copilot	Flight engineer
		After cooling down the engines for 1 minute, shuts down the engine (engines) as requested and calls "Engine No. (engines Nos) shut down" Switches off the air conditioning system. In case of necessity, starts the APU Within 30 min after landing, turn off the LG VENTIL switch

CAUTION: EXTEND THE FLAPS TO 28°, 36° AND 45° IN THE COURSE OF LANDING APPROACH IN SUCH A WAY THAT AT THE END OF THE FLAP EXTENSION IAS DOES NOT EXCEED THE ESTABLISHED LIMITS: 360 KM/HR FOR FLAPS 28°, 330 KM/HR FOR FLAPS 36° AND 300 KM/HR FOR FLAPS 45°.

Notes:

- If traffic pattern width is 12 km landing gear extension is allowed on base before flaps are extended to 28°;
- If traffic pattern width is 8 km and a bank of up to 25° is required for approach maneuvers, landing gear extension is allowed above of outer marker, provided the completion of all procedures prior to base turn.

On final at $IAS \leq 300$ Km/h before FAF (3-4 km before FAF in automatic mode) extend flaps to 45°, reducing the speed down to V_{REF} according to the table below:

Landing Approach Speed for Landing Weight and Flap Setting Angle

Flap setting angle, deg.			0	15	28	36	45
Landing weight, 1000 kg	60-62	Landing approach speed V_{LA} , km/hr	290	250	240	235	230
	62-64		295	255	245	240	235
	64-66		300	260	250	240	240
	66-68		305	265	250	245	245
	68-70		310	270	255	250	245
	70-72		315	275	260	255	250
	72-74		315	275	265	255	255
	74-76		320	280	265	260	255
	76-78		325	285	270	265	260
	78-80		330	290	275	265	265
	80-82		335	290	275	270	-
	82-84		340	295	280	275	-
	84-86		340	300	285	275	-
	86-88		345	300	285	280	-
	88-90		350	305	290	285	-

Control the stabilizer deflection and check its adjusted position (elevator indicator should be inside the green sector of the gauge; i.e. in the range of 3°-10°).

If the aircraft is stabilized and the elevator indicator shows a deflection outside the 3°-10° range, make corrections to the stabilizers position.

In case the elevator indicator is below the green sector push the electrical trimmer to "Nose Down" - "ПИКИР" position.

In case the indicator is above the green sector:

- if the stabilizer position angle is less than 5,5° set "Stabilizer Position Lever" - "ЗАДАТЧИК СТАБИЛИЗАТОРА" to forward CG position in combined mode or use the manual stabilizer setup lever - "СТАБИЛИЗАТОР";
- if the stabilizer was already set for 5,5° increase V_{REF} by 10 Km/h.

If the above measures did not lead to an elevator angle correction to the appropriate value, then it is necessary to execute a go-around procedure and change CG in horizontal flight.

If it is impossible to change CG, execute the approach and landing with flaps at 28° and stabilizer at a 5,5° angle.

When necessary the go-around procedure can be performed with 28° flaps position without any change of the stabilizers position.

The stabilizers position during go-around can be changed either through manual or combined mode - before flaps retraction.

In case the CG is between forward and central (28% MAC) or central and rear (35%) position and the stabilizer angle is 3°, it is allowed to continue approach with elevator angle indication up to 12°.

Notes:

- Approach with partially used enroute fuel reserve is done at $V_{REF}+10$ Km/h.
- If the elevator indicator is around 10° it is recommended to start flaring at H=8 m;

- Approaching airports at FAF altitude higher than 400 m, it is allowed to start flaps extension to 45° in steady descent and no lower than at H=400 m;
- Landing with flaps 28° position is allowed in case the runway satisfies the Flight Manual requirements.

If before FAF the aircraft is not in landing configuration, it is mandatory to execute the go-around.

Thrust should be stable prior to overflying the outer marker.

Thrust corrections to adjust vertical speed should not exceed $\pm 2-3\%$ fan speed, and any vertical offsets should be corrected by yoke movement.

Notes:

- Thrust correction within $\pm 5\%$ leads to a difficulty in stabilizing the approach and is undesired for the final flight stages. Thrust reduction by 10% is unacceptable because it may lead to a vertical speed increase of 8-10 m/Sec in comparison with the determined V_y for descent on the glide slope. That's why thrust should be set precisely and be invariable, especially after overflying the middle marker.
- Avoid swinging the aircraft in yoke control (hand fly) mode when performing maneuvers for vertical profile adjustments, do not make thrust correction if the IAS had changed within ± 10 Km/h.
- All vertical maneuvers must be finished before the middle marker, and this rule relates to any glide slope angle. Otherwise execute a go-around procedure.
- Above the middle marker, descent should be stabilized, vertical speed should be kept within ± 1 m/Sec range. Offsets which do not exceed the boundaries of the aircraft silhouette on the PNP-I gauge (the little plane represented in the centre of the HSI) - should not be corrected, keep the descent on the extended glide slope.
- If the conditions above are not met it is mandatory to execute a go-around procedure.

In case of a ground proximity system alarms immediately decrease vertical speed and control vertical profile as well as landing gear position – if it is not extended, the go-around is mandatory. In case of a ground proximity system alarms before visual contact is established, the go-around is mandatory.

Note: Cruising at low altitudes or in turbulence conditions as well as approaching airports with hard relief (REM: Rocks etc.) on final, including high angle glide slopes, short term alarms of ground proximity system that has 2 seconds duration are possible. It does not require any actions for correction of descent trajectory.

2.7.2 The late landing gear and flaps extension approach procedure.

Execute the approach maneuvers with bank up to 25°, bank on final turn in automatic or FD modes should be up to 22°.

At traffic altitude before landing gear extension and IAS=400 Km/h determine the required setting for the “Stabilizer Position Lever” - **“ЗАДАТЧИК СТАБИЛИЗАТОРА”**.

Base and final turns are performed at IAS $\geq$ 380 Km/h.

On final at a distance of 6 km from the FAF extend the landing gear reducing airspeed to IAS $\leq$ 360 Km/h. After the last green light on the landing gear position indicator ППС-2МК turns on, extend flaps to 28° reducing airspeed to IAS=280-300 Km/h. 20-25 seconds after pressure recovery in hydraulic system nr. 1 (up to 200-220 kg/cm²) set the landing gear lever to neutral position and fix it.

Notes:

- If it is impossible perform the base turn so that there is a 6 km distance from the FAF after the final turn, or in case of hydraulic system nr. 1 failure - extend the landing gear on base leg;
- Descending on glide slope at IAS $\leq$ 300 Km/h extend flaps to 45° position and assure that the adjusted stabilizer position was set accordingly. Flaps extension to 45° should be started at H $\geq$ 350 m. Further piloting is similar to the standard approach procedure.

2.7.3 Features of steep glide slope approach (glide slope angle from 3°31' to 4°)

Flaps and slats should be fully extended before FAF in case of a steep glide slope.

In automatic or FD mode as well as during NDB approach it is necessary to start descent on the glide slope earlier.

For all approach modes it is necessary to execute a go-around procedure in yoke control mode if vertical speed exceeds:

- for glide slopes from 3°31' to 4°00':
 - i) 10 M/sec – to intercept the glide slope;
 - ii) 7 M/sec – flying on glide slope before Decision Height.
-

Autothrottle is allowed to be used in automatic mode before flare height. If the aircraft tends to accelerate on the glide slope with a constant thrust setting, switch off the autothrottle.

Maximum lateral offsets from runways centerline at decision altitude:

Glide slope angle	≤3°31'	3°31'≤4°00'	
Decision altitude, m	100	80	
Offset, m	80	50	

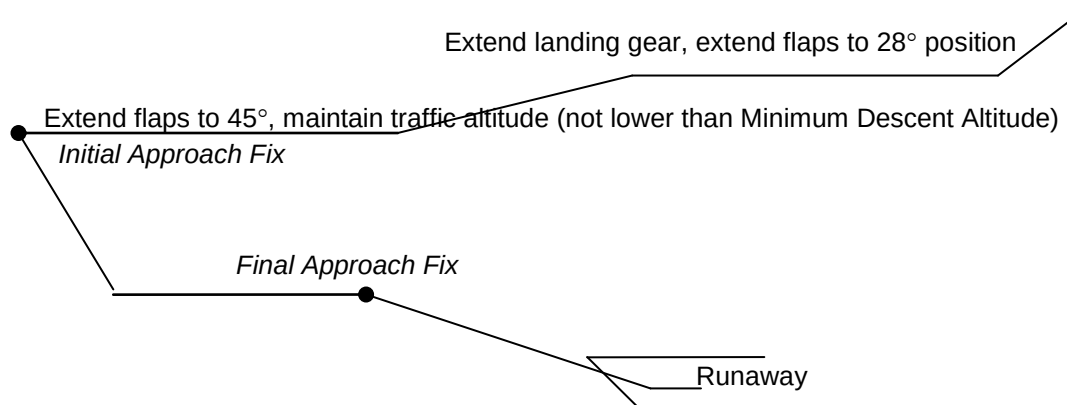
2.7.4 Visual approach features.

Visual approach is allowed if the runway or its reference objects are visible.

Entering the airport area is performed according to STAR procedures, approach and descent [profile] towards the visual approach IAF are performed using all the available airport navigation aids.

Extend landing gear and flaps to 28° before the IAF.

Usually, a visual approach route is not defined. Visual approach is performed, generally, inside the visual contact area of the runway according to traffic pattern at traffic altitude but no lower than MDA.



If visual contact with the runway or reference objects is not established at the assigned IAF altitude, roll out the aircraft to a horizontal flight until visual contact is established.

After visual contact was established, the CPT must inform ATC "Runaway In Sight" and coordinate the type of visual maneuver.

Note: If the runway is not in sight or visual contact is lost, it is necessary to execute a turn towards the runway climbing up to traffic altitude and a go-around procedure according to the defined scheme for the particular airport, followed by an IFR approach.

For a visual approach, a bank of up to 30° is allowed.

Before turning towards the runway at $H \geq MDA$ it is necessary to:

- extend flaps to 45° position;
- set IAS to $V_{REF} + 10 \text{ Km/h}$;
- read the "Before Glide Slope Capture" checklist.

Final turns are done descending at $IAS = V_{REF} + 10 \text{ Km/h}$. Vertical speed should not exceed -5 M/sec before final approach fix altitude. Recommended bank is 20° but not more than 30°. Height at final approach fix should not be lower than 150 m AGL.

ATTENTION! When executing the final turns, "MAXIMUM LEFT(RIGHT) BANK" - "КРЕН ЛЕВ (ПРАВ) ВЕЛИК" alarm indication is permitted.

On final the CPT should be aware of the aircrafts position relative to the runway and determine the offsets. If the offsets are within the permissible limits, reduce the airspeed to V_{REF} .

The CPT flies the aircraft after VDP. The F/O monitors the flight parameters and notifies the CPT if a maximal 30° bank is reached.

2.8 Landing

2.8.1 Landing in normal conditions

Cross the runway threshold and fly further down to a height of 6 to 4 m along the continued glide slope. Select the target touchdown point in such a way that at the moment of touchdown the lateral deviations of the airplane from the runway centerline do not exceed $1/4$ runway width and the direction of the ground speed vector is parallel to the runway centerline or directed at the runway centerline.

If these requirements are not met, proceed to go-around before the throttle levers are retarded down to idle.

During glide at vertical speeds up to 4 m/s the minimum height for initiation of go-around procedure is 6 to 4 m, this at vertical speeds up to 5 m/s along a steep glide slope is 15 m provided the airplane landing weight does not exceed the maximum limit indicated in paragraph 3.1.6.

With an engine failed during glide, the minimum height for initiation of go-around is 15 m.

During landing approach along a non-standard glide slope (with a slope above 3° and a vertical speed in excess of 4 m/s) reduce the vertical speed down to 3 to 4 m/s at a height of 20 to 15 m and maintain the recommended landing approach speed.

At a height of 6 to 4 m, reduce the power setting of the operating engines down to idle and initiate flare-out.

At the end of flare-out, apply the elevator to prevent pitching-up and land avoiding holding-off and ballooning which cause extension of the landing distance.

If correct piloting technique is used the airplane touches down within the target area located at a distance of 300 to 600 m from the runway threshold, at a speed 5 to 10 km/hr below the landing approach speed and at a vertical speed of 0.5 to 1.0 m/s.

Deploy the thrust reverser:

At a height not more than 3 to 2 m if there is no necessity to correct for lateral deviations.

On the ground after complete elimination of lateral deviations.

In case of bouncing fix the control column in the landing position (the position taking place at the moment of touchdown), deploy the thrust reverser (if it has not been deployed earlier) and, avoiding nose-down motion, execute repeated touchdown by the main LG wheels.

After touchdown, eliminate the wind correction angle by applying the pedals.

The inboard and midwing spoilers will extend automatically at the moment of touchdown. Smoothly rotate the airplane to touch down by the nose LG wheels with subsequent pushing of the control column home forward (the Copilot keeps the control column in this position until the landing roll is completed). Smoothly align the airplane with a line parallel to the runway centerline.

Initiate braking at the speed determined in accordance with the instructions of subsection 7.7. Apply the brakes by smoothly and synchronously depressing the brake pedals.

Notes:

- During pre-flare thrust reduction is intolerable due to a possibility of hard landing;
- Yoke movement "away from" prior to or during pre-flare is intolerable because can lead to hard landing.

In case of ballooning, keep the yoke fixed and avoid nose dropping. Land again on the main gear, extend spoilers in case they had not been extended, pull down the front landing gear, move the yoke to full forward position. Make sure that touchdown occurred in the landing area, runway condition and brakes permit effective braking and residual runway length is sufficient for a safe stop, cut off reverse thrust at $V \geq 115$ Km/h (for aircraft w/o automatic flap/slat devices control system) or on $V \geq 100$ Km/h (for aircraft with automatic wing flap/slat control system).

ATTENTION!

- Engines operations time in reverse mode must not exceed 1 minute.
- In case of necessity use reverse thrust until the aircraft comes to a complete stop.
- If reverser doors don't return to forward thrust position within 7-9 seconds (control light "REVERSE LOCK" - "ЗАМОК РЕВЕРСА" turned on), increase engines thrust up to 67% high pressure fan speed (N1), and the control light should turn off. If it has not turned off within another 5 seconds, cut off the engine.
- Braking should be carried out by smooth synchronous pressure on brake pedals at speeds in the range of limits.

If friction coefficient is less than 0,4 apply full braking starting from speed 150 Km/h. Maintain the direction on landing roll using rudder, on dry runaway light differential braking is allowed.

ATTENTION!

If the aircraft skids sideways off the centerline and is at risk of overrunning the runway :

- immediately reduce reverse thrust of both engines to idle regime, stop braking;
- using rudder pedals and ailerons as well as differential brakes on dry runaway, direct the aircraft towards the centerline;
- if the aircraft keeps skidding, switch off nose gear "GEAR STEERING"- "ПАЗБОПОТ КОЛЕСА" to self-orientation mode (disable nose wheel steering) . After the aircraft skids no longer, set the rudder pedals at neutral, switch on "GEAR STEERING"- "ПАЗБОПОТ КОЛЕСА" again and steer the aircraft parallel to the runway centerline;
- after full control of the aircraft is regained, and its running along the centerline, apply brakes and, if necessary, advance reverse thrust until it comes to a complete stop;
- do not apply differential reverse thrust to correct the skid;

- do not allow S-shaped maneuver of the aircraft on landing roll.

Approaching a runway with low friction coefficient, keep estimated V_{REF} and control threshold crossing height very strictly.

In case of one engine reverse failure and risk of overrunning the runway, reduce reverse for both engines. After regaining control over the aircraft apply the reverse thrust on the fault-free engine again.

At the finish of landing run:

- switch nose gear mode switch to "63°";
- retract flaps and ensure that the stabilizer has moved to adjusted position;
- retract spoilers;
- switch off "PITOT HEAT" - "ОБОГРЕВ ППД".

CAUTION! In case of the reverse thrust usage until full stop as well as landing on a runway covered with snow or dirt, do not retract flaps/slats until parking. On parking ensure the absence of ice and dirt on flaps, slats and spoilers, then retract control surfaces and lights.

It is allowed to retract flaps to 28° position before parking.

2.8.2 Landing in crosswind conditions.

Crosswind Landing

- (1) Cross wind landing is allowed at the crosswind velocities indicated in paragraph 2.2.3.
- (2) In bumpy air the gliding speed must be 10 km/hr higher than in normal conditions up to the moment of touchdown.
- (3) The minimum limit runway friction coefficient for crosswind landing is 0.4.
- (4) Make landing with lead angle, without bank and drift.
- (5) Immediately after touchdown, eliminate the wind correction angle by application of the pedals. Smoothly rotate the airplane to touch down by the nose LG wheels and thereafter push the control column home forward (the Copilot holds the control column in this position up to the end of landing roll). Smoothly bring the airplane to a track parallel with the runway centerline.

If the airplane moving parallel to the runway centerline touches the runway surface off the centerline, maintain the initial direction of the airplane travel parallel to the centerline.
- (6) The crosswind landing piloting technique is the same as that covered in paragraph 4.7.1.

2.8.3 Landing in wind sheer conditions.

Approach is **FORBIDDEN** in case of wind longitudinal components on ground and at 100 m AGL differ by 15 m/Sec or more. Approaching in wind sheer conditions, increase IAS by 10-15 Km/h if it has not been increased for other reasons.

Keep speed on glide slope with small corrections of thrust level in the range of 5% N1 (high pressure fan speed). Thrust level should be also corrected if IAS changed by 15 Km/h after the aircraft had stabilized on the glideslope.

ATTENTION! Simultaneous elevator deflection and thrust level correction could result in a misbalance on final approach and aircraft swinging.

If the required thrust at 200 m height or below is higher than nominal regime (92,5%) or less than 70%, it is necessary to execute a go-around procedure.

2.8.4 Correction of lateral offsets from runaway centerline in automatic or FD approach modes.

Upon reaching decision height CPT must verify a lateral offset from centerline and offset from glide slope. Maximum lateral offsets from centerline are listed in the table below:

Height, m	100	80	60	45	30
Distance before runaway threshold, m	1950	1500	1050	700	400
Maximum lateral offset from centerline, m	100	70	40	30	30 (but no more than 1/2 runaway width)

The lateral offsets are estimated are based on the aircraft position relative to runaway landing lights or other visible objects.

If maximum lateral offset are reached, CPT must:

- In automatic mode press the “GO-AROUND” button on the yoke;
- In FD mode: cancel flight by flight directors and start go-around procedure in automatic or FD mode.

If lateral offset is within the limits, the CPT must switch off ABSU and auto throttle and start maneuvers for correction of the lateral offset.

At 60 m AGL or above:

- Execute S-shaped maneuver composed of two coupled turns towards runaway centerline. First turn (towards centerline) should be executed with a bank of 10-12° and counter turn with a 6-8° bank. Maximum bank should not exceed 15° in the beginning of this maneuver and 2-3° over the runaway threshold.

From 60 m AGL to 30 m (including):

- Approach is accepted as correct if at decision height a ground speed vector is directed inside the limits of runaway width. If at decision height a lateral offset is in the red lights area of the stop way ($\pm 12-15$ m), decision on landing can be made with no visibility of the runaway threshold, landing is executed without correction of lateral offset. If the lateral offset does not exceed 30 m but not more than $\frac{1}{2}$ runaway width decision on landing must be made with clear visibility of the runaway threshold. In that case landing is performed by applying a correction using a single turn towards the centerline at an angle of 1-3° with a bank that not exceeding 5°. Touchdown between centerline and runaway side lights from the side of the lateral offset with further correction to get running on or along centerline. Touchdown across the centerline increases the risk for overrunning.

Maximal offset on glide slope at decision height should not exceed the boundaries of the “aircraft silhouette” in the centre of the PNP-I (HSI) gauge, which may result in an approximate landing distance extension of up to 100 m.

2.8.5 Go-around procedure with all operating engines or one faulty engine.

A safe missed approach is possible:

- before starting pre-flare;
- during pre-flare;
- at 4-6 m, or at 10 m AGL with one faulty engine.

CAUTION!

- Altitude lost (“dive depth”) while aborting a balanced approach for a go-around procedure equals to:

- 4 - 8 m at $V_y = -3,5 \div -4,0$ m/Sec;
- 10 - 12 m at $V_y = 5,0$ m/Sec;
- 15 - 18 m at $V_y = 6,0$ m/Sec;
- 20 - 24 m at $V_y = 7,0$ m/Sec;
- 28 - 32 m at $V_y = 8,0$ m/Sec.

- When executing a go-around from an unstable approach (yoke movement, thrust correction, swinging) there is a possibility for doubled depth.

-When executing a go-around at 25 m height or less, the depth decreases due to an increase in ground effect.

Executing go-around procedure CPT:

- after the go-around decision is made, notifies the crew, starts pulling up the aircraft and commands to advance thrust levers to take-off position;
- commands to retract flaps to 28° in case they had been set for 45° or to 15° if flaps were at 28, maintain the current speed from the moment the go-around procedure is commenced;
- after reaching a positive vertical speed commands to retract landing gear;
- climb while accelerating 300-310 Km/h ($\delta\beta=28^\circ$) or 320-330 ($\delta\beta=15^\circ$) Km/h;
- when IAS reaches 300-310 Km/h ($\delta\beta=28^\circ$) or 320-330 Km/h ($\delta\beta=15^\circ$) commands to start flaps retraction to 0° decreasing angle of ascent while retracting the flaps to accelerate to 340-400 Km/h;
- control flaps retraction and stabilizer movement to the adjusted position;
- climb to traffic pattern altitude at 340-400 Km/h ;
- at traffic pattern altitude reduce thrust and execute another approach.

Note: If go-around procedure requires a turn before flaps retraction, such a turn shall be done after flaps retraction from 45° to 28° or from 28° to 15° at a height no lower than 50 m at IAS 300 Km/h or higher while climbing. In case of turns exceeding 15° bank if the bank limit alarm sounds, special attention should be paid to artificial horizon working condition and 25° bank limit shall not be exceeded. Flaps retraction should be performed after turn completion on a straight portion of the flight.

2.8.6 Taxi to gate.

After leaving the runaway, F/E should pump over the remaining fuel from tanks nr. 3 to tanks nr. 2 and, if necessary, start APU.

After completing the landing roll and engines cooling on idle mode for 1 minute it is recommended to cut off engine nr. 2 or nr. 2 and nr. 3. Before cutting off the engine nr. 2 switch on the electrical pump of hydraulic system nr. 2.

Prior to stop at gate assure normal braking and normal pressure in hydraulic systems (200-220 kg/sm²).

2.9 Training flights

2.9.1 Take-offs.

For training flights purpose it is allowed to execute take-offs on take-off or nominal thrust.

During series of take-offs CPT must control spoilers retraction to zero position, null position of spoiler lever and control light "SPOILERS LOCK OPEN" - "ЗАМКИ ИНТЕРСЕКТОРОВ ОТКРЫТЫ" turned off.

2.9.2 Go-around procedure.

For training flights purpose it is allowed to execute go-around on take-off or nominal thrust.

Nominal thrust is allowed to be applied:

- in case all engines are running and weight does not exceed 75 000 kg;
- for training with an engine failure simulation and weight that does not exceed 70 000 kg;
- landing with 28° flaps position and weight that does not exceed 92 000 kg.

ATTENTION!

In case of one engine failure during take-off on nominal regime with weight no more than 70 000 kg it is necessary to advance thrust levers for take-off position.

Note: At any stage of go-around procedure at nominal regime it is allowed to increase thrust to take-off regime.

2.9.3 Touch and go procedure.

Conditions for touch and go procedure:

- Initial landing weight should not exceed 80 000kg, flaps at 45° in each approach and landing;
- All flights should be executed with the extracted landing gear, flight duration should not be less than 15 minutes, a time interval between flights not more than 10 minutes.

CAUTION! When performing flights with the extracted landing gear it is necessary recycle the “GEAR STEERING” - “РАЗБОРОТ КОЛЕСА” switch, so as to avoid landing with the turned nose gear.

On landing run usage of reverse thrust is mandatory.

IAS for start braking should not more be than 160 Km/h. Braking action should not be intensive, $\frac{1}{2}$ of brake pedals travel that relates to a pressure of 50-60 kg/cm² in braking system.

The number of such flights should not exceed:

- 5 if ground temperature is +20°C or lower;
- 3 if ground temperature is in the range +20°C ÷ +30°C.

For training flights in the above conditions, the runway length should not be less than 3 500 m.

2.10 Piloting at maximum airspeeds or M-speeds

Minor forces on control column during acceleration caused by elevator position should be fully relieved by the trimmer. Aircraft “behavior” should be normal. Turns execution on maximum airspeed or M-speed should not present difficulties. In case of unpremeditated acceleration to M=0,88 decrease M-speed by reducing thrust.

At H=11 000 and M=0,7-0,8 there is a direct aircraft reaction on rudder deflection, at M>0,895 there is a back reaction, i.e. deflecting left rudder pedal the aircraft rolls to the right, deflecting right rudder pedal it rolls to the left, but due to good cross controllability the back reaction does not complicate piloting.

CAUTION! In order to avoid airframe vibration when flying at high altitudes and airspeeds it is necessary to avoid violent maneuvers and overriding G-force more than 1,2g-1,3g.

2.11 Piloting at minimum airspeeds

At all stages of flight an airspeed decreasing lower than recommended value for respective configuration is not allowed. In case of an unpremeditated airspeed decrease down to minimum airspeed the AoA indicator shall sound an alarm. If the AoA indicator has alarmed take an action to increase airspeed.

During flights in any configuration at low airspeeds there should be no airframe vibration, aircraft behavior should be normal. Maneuvers at speeds that are close to minimum require increased attention, perform smooth deflection of the control column and yoke to prevent high G-force value. Bank should not exceed 20°.

2.12 Aircraft piloting in intensive turbulence conditions

Upon entering into a zone with intensive turbulence (G-force>1,5g):

- set IAS=500 Km/h; and at H>10 750 set M-speed=0,8;
- switch off automatic mode of ABSU;
- execute soft control of aircraft;
- do not aim at maintaining precise altitude and airspeed, execute piloting by smooth deflection of control axes using average values.
- do not allow high pitch and don't exceed 10°-15° bank.

Execute turns near frontal cloud systems at $M \leq 0,8$. When entering strong upward blast keep a constant pitch on the artificial horizon. If an intensive airframe vibration arise, deflect the control column forward, not changing thrust levers position and not allowing the maximum airspeed or M-speed to exceed.

Entering into a strong downward blast (quick altitude loss), continue descent keeping all control axes in balanced position, do not allow maximum airspeed or M-speed to exceed. If adhered to, a stall is almost impossible.

In case of stall, immediately push the control column to the full forward position. After AoA decreased and aircraft accelerated to minimum airspeed + 50-70 Km/h, pull up aircraft to horizontal flight reaching G-force not more than 1,2g-1,3g. Altitude loss should not be more than 650 m.

In case of engine surge reduce thrust to idle. If after thrust reduction, normal operation of the engine was not restored, cut off the engine. Start the engine over again on normal AoA if EGT during the surge has not exceeded 680°C.

2.13 Night flights

2.13.1 Preparation for night take-off.

During preparation for night take-off (additionally to standard operations):

- check pilot console lighting, set brightness;
- check position lights/strobes;
- extract and check "LANDING" - "ПОСАДОЧНЫЙ" and "TAXI" - "РУЛЕЖНЫЙ" lights;
- "DAY-NIGHT" - "ДЕНЬ-НОЧЬ" switch to "NIGHT" - "НОЧЬ" position;

Upon receiving clearance to taxi, extend and turn on "TAXI" - "РУЛЕЖНЫЙ" light. When necessary, it is allowed to use "LANDING" - "ПОСАДОЧНЫЙ" light for over viewing a taxiway but its usage should not be more than 5 minutes.

On holding point ensure sufficient lighting of all gauges.

2.13.2 Night take-off features.

Take-off is executed with landing lights turned on. Hold visually the take-off direction based on visibility of runway centerline lights and displacement of side lighting. After rotation guide yourself by runaway lights, PNP, artificial horizon, IAS and vertical speed indicators with further transition to pure instrumental flight. At H=50 m switch off and retract the landing lights.

2.13.3 Night approach and landing procedures.

Approach procedure at night is similar to standard approach procedure.

Extend wing and fuselage lights prior to reaching FAF. Landing lights should be turned on at H=100-150 m after a visual contact with landmark was established.

CAUTION! Approaching in fog, haze or atmospheric precipitations the landing lights could be switched on upon CPT decision. In case of light reflection immediately turn off the light.

Landing is similar to standard landing procedure.

Upon finishing a landing run switch light to "TAXI" - "РУЛЕЖНЫЙ".

2.14 Piloting features if CG 32-40% MAC

Such CG is allowed if it's not possible to move CG forward. At that, take-off weight should not exceed 80 000 kg. Stability and controllability of aircraft at CG >32% MAC are almost the same in comparison to forward CG, But it is necessary to take into account the following terms:

- on taxi short differential braking is needed to turn the aircraft;
- significant force needs to be applied on the control column during pull up on take-off and landing;
- stabilizer should be set to "REAR" - "3" position at CG >35% MAC;
- maximum flight level is 10 100 m.

Chapter 3. Aircraft characteristics. Auxiliary tables.

3.1 Crosswind, headwind and tailwind components

Wind Angle Wind speed	0°	± 10°	± 20°	±30°	± 40°	±50°	± 60°	± 70°	± 80°	± 90°
4 m/Sec	0 4	1 4	1,5 4	2 3,5	3 3	3 3	3,5 2	4 1,5	4 1	4 0
6 m/Sec	0 6	1 6	2 5,5	2,5 5	4 4	4 4	5 2,5	5,5 2	6 1	6 0
8 m/Sec	0 8	1,5 8	3 7,5	4 7	5 6	6 5	7 4	7,5 3	8 1,5	8 0
10 m/Sec	0 10	2 10	3,5 9,5	5 9	6,5 8	8 6,5	9 5	9,5 3,5	10 2	10 0
12 m/Sec	0 12	2 12	4 11	6 10	8 9	9 8	10 6	11 4	12 2	12 0
14 m/Sec	0 14	2,5 14	4 13	7 12	9 11	11 9	12 7	13 4	14 2,5	14 0
16 m/Sec	0 16	3 16	5,5 15	8 14	10 12	12 10	14 8	15 5,5	16 3	16 0
18 m/Sec	0 18	3 18	6 17	9 16	11,5 14	14 11,5	16 9	17 6	18 3	18 0
20 m/Sec	0 20	3,5 20	7 19	10 17	13 15	15 13	17 10	19 7	20 3,5	20 0
22 m/Sec	0 22	4 22	7,5 21	11 19	14 17	17 14	19 11	21 7,5	22 4	22 0

In the upper row the crosswind component is indicated, and in the lower row the headwind or tailwind components depending on wind direction are indicated.

3.4 Take-off distance (Flaps 28°)

Maximum Allowable Takeoff Weight, Decision Speed and Flap Setting Angle for
Aerodrome Temperature and Altitude (with Stopway, 400 m Long,
and Clearway)

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero- drome alti- tude, m	Aero- drome tempe- rature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
0	0	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	15	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	20	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	25	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	30	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	35	98.9 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	40	96.3 230	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	45	93.7 225	97.8 230	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
100	0	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	15	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	20	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.1, cont'd

Factored field length available, m	2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome altitude, m	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
Aero-drome temperature, °C											
100	25	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	30	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	35	97.9 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	40	95.3 225	99.4 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	45	92.7 225	96.8 230	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245
200	0	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	100 230	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	15	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	20	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	25	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	30	99.4 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	110 245	100 245
	35	96.4 230	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	40	93.8 225	97.9 230	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	45	91.3 220	95.2 230	98.8 234	100 240	100 240	100 245	100 245	100 245	100 245	100 245

(cont'd)

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3.1.4.1



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.1, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome alti-tude, m	Aero-drome tempe-rature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
400	-5	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	0	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	15	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	20	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	25	100 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	30	97.1 230	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	35	94.2 225	98.3 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	40	91.6 220	95.6 230	99.1 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
600	-5	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	0	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	15	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.1, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome altitude, m	Aero-drome temperature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
500	20	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	25	98 240	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	30	94.8 225	99 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	35	91.9 220	95.9 230	99.5 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	40	89.2 215	92.5 225	96.5 230	99.3 235	100 240	100 240	100 245	100 245	100 245	100 245	100 245
800	-5	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	0	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	15	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	20	99.1 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	25	95.6 225	99.8 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	30	92.5 225	96.5 230	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	35	89.5 220	93.4 225	96.9 230	99.7 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245
	40	86.7 215	90.5 220	93.9 230	96.6 230	99 235	100 240	100 240	100 245	100 245	100 245	100 245

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.3, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome altitude, m	Aero-drome temperature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
1000	-5	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	0	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 235	100 245	100 245
	15	100 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	20	96.9 230	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	25	93.5 225	97.6 230	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	30	90.4 220	94.3 225	97.9 235	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245
	35	87.3 215	91.2 225	94.6 230	97.3 235	99.7 240	100 245	100 245	100 245	100 245	100 245	100 245
	40	84.5 200	88.2 220	91.5 225	94.2 230	96.5 235	98.3 235	98.8 245	100 245	100 245	100 245	100 245
1500	-10	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	-5	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	0	99.5 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	98.2 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	97.1 230	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.1, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero- drone alti- tude, m	Aero- drone tempe- rature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
1500	15	94.7 225	98.8 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	20	91.3 220	95.3 230	98.9 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	25	87.9 215	91.8 225	95.2 230	97.9 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245
	30	85 215	88.7 220	92 225	94.7 230	97 235	98.8 235	99.4 245	100 245	100 245	100 245	100 245
	35	82.1 210	85.7 215	88.9 220	91.5 225	93.7 230	95.5 230	96 245	97.5 245	98.5 245	100 245	100 245
2000	-15	100 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	-10	99.3 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	-5	97.4 230	100 235	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	0	95.6 225	99.8 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	5	94 225	98.1 230	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	10	92.3 225	96.3 230	99.9 235	100 240	100 245	100 245	100 245	100 245	100 245	100 245	100 245
	15	89.3 220	93.2 225	96.7 230	99.5 235	100 235	100 240	100 245	100 245	100 245	100 245	100 245
	20	85.9 215	89.7 220	93 225	95.7 230	98.1 235	99.9 245	100 245	100 245	100 245	100 245	100 245
	25	82.7 210	86.3 215	89.5 220	92.1 225	94.4 230	96.1 230	96.7 245	98.1 245	100 240	100 245	100 245
	30	79.8 205	83.3 210	86.4 220	88.9 220	91.1 225	92.8 230	93.3 240	94.7 240	96.7 245	98.8 245	100 240

(cont'd)

3.6 Take-off distance (Flaps 15°)

Maximum Allowable Takeoff Weight, Decision Speed and Flap Setting Angle for
Aerodrome Temperature and Altitude (No Stopway and Clearway)

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome altitude, m	Aero-drome temperature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
0	0	100 235	100 245	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	100 235	100 245	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	10	100 230	100 240	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	15	99.9 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	20	99.1 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	25	98.4 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	30	96.4 230	100 235	100 245	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	35	93.8 225	98.6 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	40	91.3 220	95.3 230	99.3 240	100 245	100 255	100 260	100 260	100 260	100 260	100 260	100 260
	45	88.8 220	92.8 225	96.7 235	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260
100	0	100 230	100 245	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	100 235	100 245	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	10	100 230	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	15	99.5 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	20	98.7 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	25	98.1 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	30	95.3 225	99.6 230	100 245	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260

(cont'd)



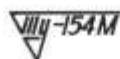
FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.2, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome altitude, m	Aero-drome temperature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
100	35	92.7 220	96.8 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	40	90.3 220	94.3 230	98.2 235	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260
	45	87.9 215	91.8 225	95.6 235	99 240	100 250	100 250	100 260	100 260	100 260	100 260	100 260
200	0	100 230	100 245	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	100 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	10	99.7 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	15	98.9 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	20	98.1 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	25	97.1 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	30	94.2 225	98.4 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	35	91.4 220	95.5 230	99.4 240	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	40	88.9 220	92.9 225	96.8 235	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260
400	45	86.5 215	90.3 220	94.1 235	97.4 240	100 245	100 255	100 260	100 260	100 260	100 260	100 260
	-5	100 230	100 240	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	0	100 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	99.7 230	100 240	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	10	98.9 230	100 240	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	15	98.1 230	100 240	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.2, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero- drone alti- tude, m	Aero- drone tempe- rature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
400	20	97.5 230	100 235	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	25	94.9 225	99.1 230	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	30	92 220	96.1 230	100 240	100 250	100 255	100 260	100 260	100 260	100 260	100 260	100 260
	35	89.3 220	93.2 225	97.2 235	100 245	100 250	100 255	100 260	100 260	100 260	100 260	100 260
	40	86.8 215	90.6 220	94.4 230	97.7 240	100 245	100 250	100 255	100 260	100 260	100 260	100 260
600	-5	100 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	0	99.7 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	99.0 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	10	98.2 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	15	97.4 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	20	95.9 225	100 235	100 245	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	25	92.8 220	96.9 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	30	89.9 220	93.8 230	97.8 240	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260
	35	87.1 215	90.9 225	94.8 230	98.1 240	100 245	100 250	100 255	100 260	100 260	100 260	100 260
	40	84.5 210	88.2 220	91.9 230	95.2 235	98 240	100 250	100 255	100 260	100 260	100 260	100 260
800	-5	99.7 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	0	98.9 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	98.2 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260

(cont'd)



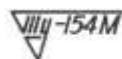
FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.2, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome alti-tude, m	Aero-drome tempe-rature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
800	10	97.5 230	100 235	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	15	96.7 230	100 235	100 250	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	20	94 220	98.1 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	25	90.6 220	94.6 230	98.8 240	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260
	30	87.6 215	91.5 225	95.4 230	98.7 240	100 250	100 250	100 260	100 260	100 260	100 260	100 260
	35	84.9 210	88.6 220	92.3 230	95.6 240	98.4 240	100 250	100 260	100 260	100 260	100 260	100 260
	40	82.2 210	85.8 215	89.4 225	92.6 230	95.3 240	97.5 240	99.3 250	100 250	100 250	100 255	100 260
1000	-5	98.9 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	0	98.2 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	97.5 230	100 235	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	10	96.8 225	100 235	100 245	100 260	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	15	95.4 225	99.6 230	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	20	91.8 220	95.9 230	99.9 240	100 250	100 255	100 260	100 260	100 260	100 260	100 260	100 260
	25	88.5 215	94.5 225	96.4 235	99.8 240	100 250	100 255	100 260	100 260	100 260	100 260	100 260
	30	85.7 210	89.4 220	93.2 230	96.5 240	99.3 245	100 250	100 255	100 255	100 255	100 260	100 260
	35	82.8 210	86.4 220	90.1 225	93.2 230	96 245	98.2 245	100 250	100 250	100 250	100 260	100 260
	40	80.1 205	83.7 210	87.2 220	90.2 230	92.9 245	95 240	96.8 245	98.2 250	99.8 250	100 250	100 255
1500	-10	96.8 225	100 235	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.5.2, cont'd

Factored field length available, m		2100	2300	2500	2700	2900	3100	3300	3500	3700	3900	4100
Aero-drome alti-tude, m	Aero-drome tempe-rature, °C	Maximum allowable takeoff weight in 1000 kg and decision speed V_1 in km/hr										
1500	-5	95.7 225	99.9 235	100 245	100 255	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	0	94.3 225	98.5 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	5	93.1 220	97.2 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	10	92 220	96.1 230	100 240	100 250	100 255	100 260	100 260	100 260	100 260	100 260	100 260
	15	89.7 215	93.7 225	97.7 235	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260
	20	86.5 215	90.3 225	94.2 230	97.5 240	100 250	100 255	100 260	100 260	100 260	100 260	100 260
	25	83.3 210	87 220	90.7 230	93.8 225	96.6 240	98.8 245	100 250	100 255	100 260	100 260	100 260
	30	80.5 205	84.1 215	87.7 225	90.7 230	93.4 240	95.5 245	97.4 250	98.7 250	100 250	100 250	100 260
	35	77.8 200	81.3 210	84.7 220	87.7 225	90.2 230	92.3 235	94.1 240	95.3 245	96.9 250	99 250	100 250
2000	-15	96 225	100 230	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	-10	94.2 225	98.3 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	-5	92.3 220	96.4 230	100 240	100 250	100 260	100 260	100 260	100 260	100 260	100 260	100 260
	0	90.6 220	94.6 230	98.6 240	100 245	100 250	100 260	100 260	100 260	100 260	100 260	100 260
	5	89.1 220	93 225	96.9 235	100 250	100 250	100 255	100 260	100 260	100 260	100 260	100 260
	10	87.9 215	91.3 225	95.2 230	98.5 240	100 245	100 250	100 260	100 260	100 260	100 260	100 260
	15	84.7 210	88.4 220	92.1 230	95.3 235	98.2 240	100 245	100 260	100 260	100 260	100 260	100 260
	20	81.4 210	85 215	88.6 225	91.7 230	94.4 240	96.7 240	98.4 245	99.8 250	100 250	100 255	100 260
	25	78.4 200	81.8 210	85.3 220	88.3 225	90.9 230	92.9 235	94.7 240	96 245	97.6 250	99.7 250	100 250
	30	75.7 200	79 210	82.3 215	85.2 220	87.7 230	89.7 235	91.4 235	92.7 250	94.2 250	96.3 250	98.1 250

(cont'd)

3.7 Wind and runaway slope correction for required T/O distance, m

Wind direction			Tailwind	Headwind			
Wind velocity, m/s			5	5	10	15	20
Takeoff field length available, m	2000	Factored takeoff field length available, m	1890	2365	2735	3100	3475
	2200		2085	2585	2985	3115	3765
	2400		2270	2810	3255	3685	3645
	2600		2465	3060	3505	3945	4410
	2800		2650	3260	3775	4225	4710
	3000		2855	3500	4015	4515	5015
	3200		3045	3720	4254	4790	5305
	3400		3240	3940	4475	5015	5545
	3600		3430	4170	4755	5325	5910
	3800		3615	4370	4965	5570	6175
	4000		3820	4600	5205	5845	6380

3.9 Recommended flight level

3.1.3. Selection of Flight Level and Best Enroute Mode of Flight

- (1) Select the best altitude from Table 3.1.3.1 for the known distance to the destination aerodrome. For distances exceeding 600 km the optimum enroute flight level is the highest possible flight level allowed by the actual gross weight. The best will be the flight level indicated in the Table for a certain direction of flight.
- (2) The main recommended mode of flight ensuring the lowest fuel consumption is the best-range cruise (ERC). When flying using this mode maintain speeds and Mach numbers which yield the maximum level of specific range. This mode of flight ensures transportation of the maximum payload in conditions where its value is limited by the takeoff weight or the fuel tanks volumetric capacity. To select the Mach number in enroute flight at ERC for the flight level and gross weight refer to paragraph 4.4.2 or subsection 7.5.
- (3) In case of necessity to reduce the block time execute climb, horizontal flight and descent at speeds and Mach numbers of the high-speed cruise (HSC) (Ref. paragraph 4.4.2 or subsection 7.5).
- (4) The minimum enroute safety speeds at zero flaps and slats are maintained with the following margins above the stalling speeds:
30 % at altitudes from zero up to 5000 m and 35 % at altitudes above 5000 m (Ref. subsection 7.8).
- (5) At altitudes of 8400 m and more maintain the speeds not less than those of the best-range cruise mode (Ref. Fig. 7.5.1).

(cont'd)



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PREPARATION FOR FLIGHT - Calculation of Flight Data

CF - compensation fuel required for compensation of various errors assumed to be equal to 3 % of the main fuel supply (NWP + WCP).

(2) Determine NWP, WCP and CF from Tables 3.1.4.1 through 3.1.4.31 for the route length (no-wind distance), flight level and mode of flight (Ref. Table 3.1.4.0).

Table 3.1.4.0

Flight level	Pressure altitude, m	Mode of flight			
		HRC	M=0.82	M=0.84	HRC
		Table number			
140	4250	3.1.4.1	-	-	3.1.4.21
200	5100	3.1.4.2	-	-	3.1.4.22
230	7000	3.1.4.3	-	-	3.1.4.23
250	7600	3.1.4.4	-	-	3.1.4.24
270	8250	3.1.4.5	-	-	3.1.4.25
290	8850	3.1.4.6	-	-	3.1.4.26
310	9450	3.1.4.7	3.1.4.12	-	3.1.4.27
330	10050	3.1.4.8	3.1.4.13	3.1.4.17	3.1.4.28
350	10650	3.1.4.9	3.1.4.14	3.1.4.18	3.1.4.29
370	11300	3.1.4.10	3.1.4.15	3.1.4.19	3.1.4.30
390	11900	3.1.4.11	3.1.4.16	3.1.4.20	3.1.4.31

(cont'd)



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PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.4.11

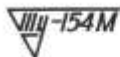
Mach Number, Fuel Used (NWP), Compensation Fuel (CF), Block Time (BT) for No-Wind
Distance (NWD) and Flight Level with Wind Correction (WCF) Included

BEST-RANGE CRUISE

FLIGHT LEVEL 390 (11900 m)

NWD, km	NWP, kg	Mach number	WCF, kg	CF, kg	BT, hr
500	4500	0.81	50	150	1.0
1000	6800	0.81	150	200	1.60
1500	9350	0.81	250	300	2.15
1600	9700	0.81	250	300	2.25
1700	10300	0.81	250	300	2.40
1800	10700	0.81	300	350	2.50
1900	11200	0.81	300	350	2.60
2000	11600	0.81	300	350	2.70
2100	12250	0.81	300	400	2.85
2200	12900	0.81	350	400	2.95
2300	13500	0.81	350	400	3.10
2400	14000	0.81	350	450	3.20
2500	14500	0.81	350	450	3.30
2600	15000	0.81	400	450	3.40
2700	15700	0.81	450	500	3.55
2800	16100	0.81	450	500	3.65
2900	16700	0.81	450	500	3.80
3000	17200	0.81	500	550	3.90
3100	17750	0.81	500	550	4.0
3200	18200	0.81	500	550	4.10
3300	19000	0.81	500	600	4.20
3400	19500	0.81	500	600	4.35
3500	20000	0.81	550	600	4.40
3600	20500	0.81	550	600	4.55
3700	21000	0.81	550	650	4.70
3800	21800	0.81	550	650	4.80
3900	22300	0.81	600	700	4.90
4000	23000	0.81	600	700	5.0
4100	23300	0.81	600	700	5.10
4200	23750	0.81	600	700	5.20
4300	24200	0.81	650	750	5.35
4400	24800	0.81	650	750	5.45
4500	25200	0.81	700	750	5.60
4600	25500	0.81	700	800	5.70
4700	26000	0.81	700	800	5.80
4800	26600	0.81	750	800	5.90
4900	27000	0.81	750	800	6.05
5000	27400	0.81	800	850	6.15

(confd)



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PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.4.31

Mach Number, Fuel Used (NWF), Compensation Fuel (CF), Block Time (BT) for No-Wind
Distance (NWD) and Flight Level with Wind Correction (WCF) Included

HIGH-SPEED CRUISE

FLIGHT LEVEL 390 (11900 m)

NWD, km	NWF, kg	Mach number	WCF, kg	CF, kg	BT, hr
500	4500	0.87	50	150	0.78
1000	7200	0.87	200	200	1.33
1500	9900	0.87	200	300	1.83
1600	10200	0.87	250	300	2.00
1700	10700	0.87	250	300	2.10
1800	11300	0.87	300	350	2.22
1900	11800	0.87	300	350	2.32
2000	12400	0.87	350	400	2.42
2100	13000	0.87	400	400	2.53
2200	13500	0.87	400	400	2.65
2300	14000	0.87	400	400	2.75
2400	14500	0.87	450	400	2.85
2500	15100	0.87	450	450	2.95
2600	15600	0.87	450	450	3.10
2700	16300	0.87	500	500	3.22
2800	17000	0.87	500	500	3.35
2900	17500	0.87	500	500	3.45
3000	18000	0.87	500	550	3.55
3100	18400	0.87	500	550	3.65
3200	19000	0.87	500	600	3.75
3300	19700	0.87	500	600	3.85
3400	20200	0.87	500	600	3.93
3500	20900	0.87	500	600	4.05
3600	21400	0.87	550	600	4.15
3700	22000	0.87	550	650	4.25
3800	22750	0.87	550	700	4.40
3900	23150	0.87	600	700	4.45
4000	23800	0.87	600	700	4.65
4100	24200	0.87	650	700	4.70
4200	24800	0.87	650	750	4.80
4300	25200	0.87	650	750	4.95
4400	25500	0.87	700	750	5.05
4500	26000	0.87	700	800	5.15
4600	26500	0.87	700	800	5.25
4700	26900	0.87	700	800	5.40
4800	27400	0.87	750	800	5.50
4900	28000	0.87	750	850	5.60
5000	28300	0.87	750	850	5.70

(cont'd)

Table 3.1.3.1.

Flight Levels for Flight Distance

Distance, km	Heading			
	0° to 179°	180° to 359°	0° to 179°	180° to 359°
	Flight level		Pressure altitude, m	
Below 300	190	200	5800	6100
300 to 400	270	280	8250	8550
400 to 500	300	320	9150	9750
500 to 600	330	350	10050	10650
600 and more	380	360 to 390*	11600	10950 to 11900*

NOTES: 1. * It is recommended to maintain a stepped flight profile upon authorization of the ATC service: occupy flight level 390 after the gross weight drops down to 91000 kg provided the distance to go to the destination point is not less than 400 km.

2. It is allowed to occupy a flight level higher than that derived from the Table the outside air temperature and the gross weight so allow and the maximum altitude limits are observed.

3.1.4. Calculation of Required Fuel Supply

(1) The fuel supply required for a flight (PS) must be not less than

$$PS = NWP + WCF + TF + RF$$

where NWP - fuel used since takeoff up to landing in no-wind conditions;

WCF - correction accounting for enroute wind (positive in case of headwind);

TF - fuel used for starting and warming up the engines and taxiing to lineup position (assumed to be equal to 500 kg and in excess of the maximum allowable takeoff weight);

RF - regulatory fuel reserve determined from the formula below:
 $RF = FR + CF$, where

FR - fuel reserve required for reaching the alternate aerodrome from the route estimated point with fuel required for holding for the selected period of time included;

(cont'd)

Climb:

For other weights, regime and tempratures refer to the Syrian Airlines Manual

Table 3.1.9.7

Time, Distance Covered, Fuel Used and True Airspeed in Enroute Climb

THREE ENGINES OPERATING AT MAXIMUM CONTINUOUS

ISA-10°

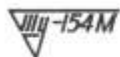
BEST-RANGE CRUISE

Altitude, m	9450 and below	Above 9450
IAS, km/hr	550	-
Mach number	-	0.8

AIRPLANE WEIGHT AT LINEUP POSITION - 100000 kg

Pressure altitude		Time, min	Distance, km	Fuel, kg	TAS, km/hr
ft	m				
1500	450	2	0	600	551
10000	3050	4	23	1163	621
12000	3650	5	30	1294	639
14000	4250	6	36	1426	658
16000	4900	6	45	1570	678
18000	5500	7	53	1706	699
19000	5800	7	57	1774	709
20000	6100	8	62	1844	719
21000	6400	8	67	1914	730
22000	6700	9	72	1986	741
23000	7000	9	78	2059	751
24000	7300	10	84	2133	763
25000	7600	10	90	2209	774
26000	7900	11	96	2286	785
27000	8250	11	105	2379	799
28000	8550	12	112	2461	812
29000	8850	12	120	2546	824
30000	9150	13	129	2636	836
31000	9450	14	139	2726	848
32000	9750	14	146	2797	845
33000	10050	15	155	2874	842
34000	10350	15	163	2948	839
35000	10650	16	173	3027	835
36000	10950	17	183	3111	831
37000	11300	18	198	3221	830
38000	11600	19	212	3326	830
39000	11900	20	229	3447	830
40000	12200	22	253	3605	831
41000	12500	24	287	3817	831
42000	12800	28	339	4130	831

(cont'd)



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PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.9.21

Time, Distance Covered, Fuel Used and True Airspeed in Enroute Climb

THREE ENGINES OPERATING AT MAXIMUM CONTINUOUS

ISA +10°

BSST-RANGE CRUISE

Altitude, m	9450 and below	Above 9450
IAS, km/hr	550	-
Mach number	-	0.8

AIRPLANE WEIGHT AT LINEUP POSITION - 100000 kg

Pressure altitude		Time, min	Distance, km	Fuel, kg	TAS, km/hr
ft	m				
1500	450	2	0	600	571
10000	3050	5	35	1294	645
12000	3650	6	45	1459	664
14000	4250	7	56	1627	684
16000	4900	8	69	1812	705
18000	5500	10	82	1990	727
19000	5800	10	90	2080	738
20000	6100	11	97	2172	749
21000	6400	11	105	2266	760
22000	6700	12	114	2362	771
23000	7000	13	123	2461	783
24000	7300	14	133	2563	795
25000	7600	14	143	2668	807
26000	7900	15	154	2776	819
27000	8250	16	168	2907	834
28000	8550	17	181	3024	847
29000	8850	18	195	3148	860
30000	9150	19	212	3282	873
31000	9450	20	229	3418	887
32000	9750	21	243	3532	884
33000	10050	22	257	3638	881
34000	10350	23	271	3747	878
35000	10650	24	287	3861	874
36000	10950	26	304	3981	870
37000	11300	27	328	4143	870
38000	11600	29	354	4313	870
39000	11900	31	390	4532	870
40000	12200	36	453	4905	870

(cont'd)



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PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.9.42

Time, Distance Covered, Fuel Used and True Airspeed in Enroute Climb

THREE ENGINES OPERATING AT MAXIMUM CONTINUOUS

ISA

HIGH-SPEED CRUISE

Altitude, m	9750 and below	Above 9750
IAS, km/hr	575	-
Mach number	-	0.85

AIRPLANE WEIGHT AT LINESUP POSITION - 10000 kg

Pressure altitude		Time, min	Distance, km	Fuel, kg	TAS, km/hr
ft	m				
1500	450	2	0	600	587
10000	3050	5	30	1227	662
12000	3650	6	39	1375	681
14000	4250	6	48	1524	700
16000	4900	7	58	1688	722
18000	5500	8	69	1844	744
19000	5800	9	75	1922	755
20000	6100	9	81	2003	766
21000	6400	10	87	2084	777
22000	6700	10	94	2168	789
23000	7000	11	101	2253	800
24000	7300	11	109	2340	812
25000	7600	12	117	2430	824
26000	7900	13	126	2521	836
27000	8250	13	137	2631	851
28000	8550	14	147	2729	864
29000	8850	15	157	2829	877
30000	9150	16	169	2934	890
31000	9450	16	182	3045	904
32000	9750	17	196	3163	918
33000	10050	18	208	3262	916
34000	10350	19	220	3360	912
35000	10650	20	234	3463	908
36000	10950	21	249	3574	904
37000	11300	22	269	3721	903
38000	11600	24	292	3873	903
39000	11900	26	323	4071	903
40000	12200	29	369	4357	903

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Table 3.1.9.64

Time, Fuel Used and Distance Covered in Descent

BEST-RANGE CRUISE

THREE ENGINES OPERATING AT IDLE

MODE

Altitude, m	Above 10750	10750 and below
Mach number	0.8	-
IAS, km/hr	-	500

MIDWING SPOILERS RETRACTED

Pressure altitude		Time, min	Fuel, kg	Distance, km
ft	m			
41000	12500	23	830	268
39000	11900	22	800	258
37000	11300	21	770	243
35000	10650	20	720	226
33000	10050	19	670	208
31000	9450	18	630	190
29000	8850	16	580	173
27000	8250	15	540	156
25000	7600	14	490	140
23000	7000	13	450	126
20000	6100	11	380	105
15000	4550	8	280	70
10000	3050	5	180	45
5000	1500	2	70	17
1500	450	0	0	0

NOTE: Time and fuel for landing are not included.

(cont'd)

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PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.9.65

Time, Fuel Used and Distance Covered in Descent

HIGH - SPEED CRUISE

THREE ENGINES OPERATING AT IDLE

MODE

Altitude, m	Above 9750	9750 and below
Mach number	0.85	-
IAS, km/hr	-	575

MIDWING SPOILER

Altitude, m	7000	7000 to 3000	3000
Spoiler setting angle	0°	45°	0°

Pressure altitude		Time, min	Fuel, kg	Distance, km
ft	m			
41000	12500	14	490	178
39000	11900	13	470	168
37000	11300	12	440	155
35000	10650	11	410	142
33000	10050	10	380	130
31000	9450	10	350	120
29000	8850	9	320	110
27000	8250	8	290	92
25000	7600	7	260	80
23000	7000	6	230	68
20000	6100	6	200	60
15000	4550	5	160	50
10000	3050	4	120	37
5000	1500	2	60	24
1500	450	0	0	0

NOTE: Time and fuel for landing are not included.

(cont'd)



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PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.6.3

Maximum Allowable Landing Weight for Factored Landing Distance
Available, Aerodrome Temperature and Altitude

DESTINATION AERODROME

FLAPS 36°

Factored landing distance available, m		2100	2300	2500	2700	2900 and more		
Aerodrome conditions		Maximum allowable landing weight, 1000 kg						
Aerodrome altitude, m	0	Aerodrome temperature, °C	0	70	74.4	78.8	80	80
			5	69.4	73.9	78.3	80	80
			10	68.8	73.4	77.8	80	80
			15	68.2	72.9	77.3	80	80
			20	67.6	72.1	76.7	80	80
			25	67.0	71.5	76.1	79.5	80
			30	66.4	70.9	75.5	79	80
			35	65.8	70.3	74.9	78.5	80
			40	65.2	69.7	74.3	78.0	80
			45	64.6	69.1	73.7	77.5	80
	100		0	69.5	74	78.2	80	80
			5	68.9	73.4	77.7	80	80
			10	68.3	72.8	77.2	80	80
			15	67.7	72.2	76.7	80	80
			20	67.1	71.6	76.2	80	80
			25	66.5	71.0	75.6	79.4	80
			30	65.9	70.4	75.0	78.8	80
			35	65.3	69.8	74.4	78.2	80
			40	64.7	69.2	73.8	77.6	80
			45	64	68.6	73.2	77	80
	200		0	69	73.5	77.7	80	80
			5	68.4	72.9	77.2	80	80
			10	67.8	72.3	76.7	80	80
			15	67.2	71.7	76.2	80	80
			20	66.6	71.1	75.7	79.5	80
			25	66.0	70.5	75.1	78.9	80
			30	65.4	69.9	74.5	78.3	80
			35	64.8	69.3	73.9	77.7	80
			40	64.1	68.7	73.3	77.1	80
			45	63.4	68.1	72.7	76.5	80

(cont'd)

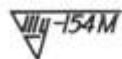
Table 3.1.6.3. cont'd

Factored landing distance available, m				2100	2300	2500	2700	2900	3100 and more
Aerodrome conditions				Maximum allowable landing weight, 1000 kg					
Aerodrome altitude, m	400	Aerodrome temperature, °C	0	68.5	73.0	77.2	80	80	80
			5	67.9	72.4	76.7	80	80	80
			10	67.3	71.8	76.2	80	80	80
			15	66.7	71.2	75.7	79.5	80	80
			20	66.1	70.6	75.2	79	80	80
			25	65.5	70.0	74.6	78.4	80	80
			30	64.9	69.4	74.0	77.8	80	80
			35	64.3	68.8	73.4	77.2	80	80
			40	63.6	68.2	72.8	76.6	80	80
			45	62.9	67.6	72.2	76	79.5	80
	600		-5	68.5	73.0	77.2	80	80	80
			0	67.9	72.4	76.7	80	80	80
			5	67.3	71.8	76.2	80	80	80
			10	66.7	71.2	75.7	79.5	80	80
			15	66.1	70.6	75.2	79	80	80
			20	65.5	70.0	74.6	78.4	80	80
			25	64.9	69.4	74.0	77.8	80	80
			30	64.3	68.8	73.4	77.2	80	80
			35	63.6	68.2	72.8	76.6	80	80
			40	62.9	67.6	72.2	76	79.5	80
	800		-5	67.8	72.3	76.5	80	80	80
			0	67.2	71.7	76.0	79.8	80	80
			5	66.2	71.1	75.5	79.3	80	80
			10	66.0	70.5	75.0	78.8	80	80
			15	65.4	69.9	74.5	78.3	80	80
			20	64.8	69.3	73.9	77.7	80	80
			25	64.2	68.7	73.3	77.1	80	80
			30	63.5	68.1	72.7	76.5	80	80
35		62.8	67.5	72.1	75.9	79.4	80		
40		62.1	66.9	71.5	75.3	78.8	80		

(cont'd)

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FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.6.3, cont'd

Factored landing distance available, m		2300	2500	2700	2900	3100	3300 and more		
Aerodrome conditions		Maximum allowable landing weight, 1000 kg							
Aerodrome altitude, m	1000	Aerodrome temperature, °C	-5	71.5	75.7	79.2	80	80	80
			0	70.9	75.2	78.7	80	80	80
			5	70.3	74.7	78.2	80	80	80
			10	69.7	74.2	77.7	80	80	80
			15	69.1	73.7	77.2	80	80	80
			20	68.5	73.1	76.7	80	80	80
			25	67.9	72.5	76.2	79.5	80	80
			30	67.3	71.9	75.7	79.0	80	80
			35	66.7	71.3	75.1	78.5	80	80
			40	66.1	70.7	74.5	78	80	80
	1500		-10	70	74.2	77.7	80	80	80
			-5	69.5	73.7	77.2	80	80	80
			0	68.9	73.2	76.2	80	80	80
			5	68.3	72.7	76.2	79.5	80	80
			10	67.7	72.2	75.7	79	80	80
			15	67.1	71.7	75.2	78.5	80	80
			20	66.5	71.1	74.7	78	80	80
			25	65.9	70.4	74.1	77.4	80	80
			30	65.2	69.8	73.5	76.8	80	80
			35	64.5	69.1	72.9	76.3	79.5	80
	2000		-10	68	72.2	75.7	79.2	80	80
			-5	67.5	71.7	75.2	78.6	80	80
			0	66.9	71.2	74.7	78	80	80
			5	66.3	70.7	74.2	77.5	80	80
			10	65.7	70.2	73.7	77.0	80	80
			15	65.1	69.7	73.2	76.5	79.5	80
			20	64.5	69.1	72.7	76	79	80
			25	63.8	68.3	70.0	75.3	78.4	80
			30	63.0	67.6	71.3	74.6	77.8	80
			35	62.2	66.8	70.6	74.0	77.2	80

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.6.5

Maximum Allowable Landing Weight for Factored Landing
Distance Available, Aerodrome Temperature and Altitude

DESTINATION AERODROME

Flaps 45°

Factored landing distance available, m				2100	2300	2500	2700 and more
Aerodrome conditions				Maximum allowable landing weight, 1000 kg			
Aerodrome altitude, m	0	Aerodrome temperature, °C	0	73	78.3	80	80
			5	72.4	77.7	80	80
			10	71.8	77.1	80	80
			15	71.2	76.5	80	80
			20	70.6	75.8	79.8	80
			25	70	75.1	79.2	80
			30	69.4	74.4	78.6	80
			35	68.8	73.7	78	80
			40	68.2	73	77.3	80
			45	67.5	72.3	76.6	80
	100		0	72.6	77.9	80	80
			5	72.0	77.3	80	80
			10	71.4	76.7	80	80
			15	70.8	76	79.8	80
			20	70.2	75.3	79.2	80
			25	69.6	74.6	78.6	80
			30	69	73.9	78	80
			35	68.4	73.2	77.4	80
			40	67.7	72.5	76.8	80
			45	67	71.8	76.1	80
	200		0	72.2	77.1	80	80
			5	71.6	76.5	80	80
			10	71	75.9	80	80
			15	70.4	75.3	79.5	80
			20	69.8	74.7	78.9	80
			25	69.2	74.1	78.3	80
			30	68.6	73.4	77.7	80
			35	67.9	72.7	77	80
			40	67.2	72	76.3	80
			45	66.5	71.3	75.6	79.6-80

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.6.5, cont'd

Factored landing distance available, m				2300	2500	2700	2900 and more
Aerodrome conditions				Maximum allowable landing weight, 1000 kg			
Aerodrome altitude, m	400	Aerodrome temperature, °C	0	76.4	80	80	80
			5	75.8	80	80	80
			10	75.2	79.5	80	80
			15	74.6	78.9	80	80
			20	74	78.3	80	80
			25	73.3	77.6	80	80
			30	72.6	76.9	80	80
			35	71.9	76.2	80	80
			40	71.2	75.5	79.5	80
			45	70.5	74.8	76	80
	600		-5	76.8	80	80	80
			0	75.6	80	80	80
			5	75	79.4	80	80
			10	74.4	78.8	80	80
			15	73.8	78.2	80	80
			20	73.2	77.5	80	80
			25	72.5	76.5	80	80
			30	71.8	76.1	79.5	80
			35	71.1	75.4	79.1	80
			40	70.4	74.7	78.7	80
	800		-5	75.4	79.8	80	80
			0	74.8	79.2	80	80
			5	74.2	78.6	80	80
			10	73.5	78	80	80
			15	72.8	77.3	80	80
			20	72.1	76.6	80	80
			25	71.4	75.9	79.5	80
			30	70.4	75.2	79	80
			35	70	74.5	78.4	80
			40	69.3	73.8	77.8	80

(cont'd)



FLIGHT MANUAL

PREPARATION FOR FLIGHT - Calculation of Flight Data

Table 3.1.6.5, cont'd

Factored landing distance available, m				2300	2500	2700	2900	3000 and more
Aerodrome conditions				Maximum allowable landing weight, 1000 kg				
Aerodrome altitude, m	1000	Aerodrome temperature, °C	-5	74.2	78.8	80	80	80
			0	73.8	78.1	80	80	80
			5	73.2	77.5	80	80	80
			10	72.6	76.9	80	80	80
			15	71.9	76.3	80	80	80
			20	71.2	75.7	79.5	80	80
			25	70.5	75.1	78.9	80	80
			30	69.8	74.4	78.3	80	80
			35	69.1	73.7	77.6	80	80
			40	68.4	72.9	76.9	80	80
	1500		-10	73.5	77.8	80	80	80
			-5	72.2	76.8	80	80	80
			0	71.6	76.2	80	80	80
			5	71	75.6	79.5	80	80
			10	70.3	74.9	78.8	80	80
			15	69.6	74.2	78.1	80	80
			20	68.9	73.5	77.4	80	80
			25	68.2	72.8	76.7	80	80
			30	67.5	72.1	76	79.4	80
			35	66.8	71.4	75.3	78.8	80
	2000		-10	71.3	75.6	79.5	80	80
			-5	70	74.6	78.9	80	80
			0	69.4	74	78.2	80	80
			5	68.7	73.4	77.5	80	80
			10	68	72.8	76.8	80	80
			15	67.3	72.2	76.1	79.4	80
			20	66.6	71.6	75.4	78.8	80
			25	65.9	71	74.6	78.1	80
			30	65.2	70.3	73.8	77.3	80
			35	64.5	69.6	73	76.5	79.6-80

(cont'd)

Conversion of Barometric Pressure in mm Hg into Millibars (Table 3.1.12.6)

Table 3.1.12.6

mm Hg	mb	mm Hg	mb	mm Hg	mb	mm Hg	mb	mm Hg	mb
684	912	711	948	741	988	771	1028	801	1067
685	913	712	949	742	989	772	1029	802	1069
686	914	713	950	743	990	773	1030	803	1070
687	916	714	952	744	992	774	1032	804	1071
688	917	715	953	745	993	775	1033	805	1073
689	918	716	954	746	994	776	1034	806	1074
690	920	717	955	747	996	777	1036	807	1075
691	921	718	957	748	997	778	1037	808	1077
692	922	719	958	749	998	779	1038	809	1078
693	923	720	960	750	1000	780	1040		
694	925	721	961	751	1001	781	1041		
695	926	722	962	752	1002	782	1042		
696	928	723	964	753	1004	783	1044		
697	929	724	965	754	1005	784	1045		
698	930	725	966	755	1006	785	1046		
699	932	726	968	756	1008	786	1048		
700	933	727	969	757	1009	787	1049		
701	934	728	970	758	1010	788	1050		
702	936	729	972	759	1012	789	1052		
703	937	730	973	760	1013	790	1053		
704	938	731	974	761	1014	791	1054		
705	940	732	976	762	1016	792	1056		
706	941	733	977	763	1017	793	1057		
707	942	734	978	764	1018	794	1058		
708	944	735	980	765	1020	795	1060		
709	945	736	981	766	1021	796	1061		
710	946	737	982	767	1022	797	1062		
		738	984	768	1024	798	1064		
		739	985	769	1025	799	1065		
		740	986	770	1026	800	1066		