INFORMATION REPORT INFORMATION REPORT

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SUBJECT Soviet English-Language Manuals on MIG-17 [FRESCO] and MIG-21 [FISHBED] Aircraft

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The two Soviet English-language manuals described below [redacted] No publishing data are shown on the manuals.

50X1-HUM

Att. No.	Title
1	Pilot's Instructions on Operation and Flying Technique of MIG-17 Aircraft and Its Modifications. [108 pages]. Pages 38 and 39 are missing from the text.
2	Maintenance of Airframe and Engine. Process Charts. Supplement to Ins[illegible]tion Guide No. 21. [389 pages]. Pages 112, 113, 15[illegible], 157, 184, and 185 are missing from the text.[1]

50X1-HUM

[redacted] Comment: No mention is made in the manual of an aircraft designation; however, the drawings in the manual show the MIG-21. A large number of parts designations begin with Ye6 and 72 [FISHBED C].

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INFORMATION REPORT INFORMATION REPORT

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50X1-HUM

PILOT'S INSTRUCTIONS ON OPERATION AND FLYING TECHNIQUE OF MIG-17 AIRCRAFT AND ITS MODIFICATIONS

SECRET

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PILOT'S INSTRUCTIONS ON OPERATION AND FLYING TECHNIQUE OF МиГ-17 AIRCRAFT AND ITS MODIFICATIONS

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P R E F A C E

The tactical fighter MiG-17 and its modifications MiG-17[illegible] ([illegible]), equipped with engine VK-1A (or VK-1F), are noted for their high performance, powerful armament and special equipment, which allow them to carry out their combat missions at all altitudes, up to the maximum ceiling, in standard and adverse weather conditions in the daytime and at night.

The present instructions are meant as a pilot's guide on the operation and piloting technique of the MiG-17 aircraft and its modifications.

I. PREPARATION FOR FLIGHT

1. Before the flight, the pilot should receive a report from the ground engineer on the readiness of the aircraft for the flight mission and on the amount and grade of fuel (T-1, TS-1 or T-2) filled into the fuel tanks.

INSPECTION OF AIRCRAFT

2. Examine the aircraft visually, acting with due care to avoid accidental firing of aircraft guns. While doing so, check to see that:

(a) no dents or any other damage is observed on the fuselage skin, wing and tail unit;

(b) the deflection of the nose and main landing gear wheel tyres is normal;

(c) the covers are removed from the guns and the pitot-static tube and no play is detected in the attachment bracket of the extension tube;

(d) the trim tabs of the elevator and ailerons are in the neutral position;

(e) the organic glass panels of the cockpit canopy have no cracks and are clean.

3. If drop fuel tanks are available, check them for proper attachment and tightness, and see if the tank synchronized automatic jettison selector switch, mounted under the left cantilever of the aircraft wing, is in the ON (TANKS) position.

4. With air bombs suspended from the aircraft, check whether:

(a) the caliber and type of air bombs comply with the bombing mission;

(b) the fuzes which the bombs are equipped with are adequate;

(c) the air bombs are properly suspended and attached to the bomb racks, and the bomb fuzes are properly locked;

(d) the tank synchronized automatic jettison selector switch is set in the OFF (BOMBS) position.

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INSPECTION OF COCKPIT

5. Examine the cockpit using a special lean-to ladder installed at the port side of the aircraft cockpit. While doing so, check to see that:

(a) no foreign objects are found inside the cockpit;

(b) no water (ice) or foreign objects are present on the cockpit floor under the seat;

(c) the seat harness is properly straightened; the harness straps should be engaged with the hooks on the cockpit walls;

(d) the fire control push-button of gun H-37 mounted on the aircraft control stick and the air bomb tactical release push-button are covered with safety guards;

(e) the safety red cap is fitted on the air bomb emergency release push-button (which is located on the bomb armament electric control panel);

(f) the canopy jettison levers (also used as the ejection seat firing mechanism) are tightly fitted to the seat arm rests;

(g) the ground locks are installed on the canopy jettison levers;

(h) the ground locks are installed into the ejection seat firing mechanism head;

(i) the flexible cord safety pin, connected with the sliding hood, is fitted into the firing mechanism head socket;

(j) the canopy jettison locks are securely fixed and the parts of the guiding beam locks, and the canopy rollers are free of dirt, ice crust or damage;

(k) the safety harness time release mechanism AH-3 is securely fastened on the right-hand seat belt and the mechanism pull cord is connected with the cord of the safety harness lock;

(l) the AH-3 time release mechanism is set for a time delay of 1.5 sec;

(m) the flexible pin of the AH-3 time release mechanism is locked and the flexible pin ripcord is fastened to the aircraft board;

(n) the control stick lock is released.

6. On aircraft mounting ejection seats with face screens the pilot should check to see that the ground safety lock is removed from the firing mechanism head in the rear section of the seat headrest, the air safety lock wire snap hook is connected to the canopy ring, and the safety lock is fitted into its seat.

PREPARATION OF ANTI-G SUIT ППК-I

7. The anti-G suit serves as a means for increasing the pilot's resistance to considerable G-loads, both in magnitude and time, arising during the flight.

8. Each fighter pilot should properly select the size of the ППК-I anti-G suit and fit it to suit his height (the sizes of the anti-G suits in relation to the pilot's height are given in the Operating Instructions on Anti-G Suit ППК-I). Depending on the season, the anti-G suit may be fitted both above the shirt, trousers and narrow-top high boots over the flying suit, and inside the fur or wide-top high boots.

The time required for fitting the suit must be about 5 to 8 minutes, and that necessary for putting on the fitted suit is 1 to 2 minutes.

9. While fitting or putting on the suit before the flight, check to see that the air bladder tightly fits the pilot's abdomen, the suit lacing is thoroughly tucked into the suit and the zippers on the trouser legs face inside. The anti-G suit should allow free movement on the ground and must not restrict the pilot's actions inside the cockpit when operating the aircraft fittings and when piloting the aircraft.

PREPARATION OF PARACHUTE

10. Before putting on the parachute, the pilot examines it and checks:

(a) the КАП-3 parachute release control unit for proper operation time adjustment (the unit altitude adjustment must ensure parachute opening at an altitude of minimum 1000 m above the overflown terrain);

(b) the flexible pin of the parachute release control unit for proper locking and the ripcord for proper packing;

(c) the parachute release control unit flexible hose for a sound condition and secure connection to the flexible hose of the parachute;

(d) the parachute release control unit flexible hose for proper connection to the bearing strip of the parachute pack flap;

(e) connection of the parachute release control unit cord to the parachute ripcord and proper locking of the ripcord pin.

Close the parachute pack flap, and put on the parachute.

11. It is allowed to lay the fitted parachute on the seat pan before the flight. In the latter case, the pilot or ground engineer attaches the parachute release control unit ripcord to the seat arm rest, before taking seat in the cockpit, and fastens the rip chain of the parachute oxygen apparatus to the ring on the left-hand control panel and connects the hoses of the parachute and aircraft apparatus.

Having taken his seat in the cockpit, the pilot should only put on and buckle the parachute harness. While doing so, he should make certain that the clothing and equipment items will not shift the canopy jettison lever in flight.

CHECKING OF AIRCRAFT EQUIPMENT AND FITTINGS AFTER ENTERING COCKPIT

12. Make sure the aircraft battery and all circuit breakers both on the right and left panels are cut off; pay special attention to the circuit breakers of aircraft armament.

13. Place the toes on the pedals under the straps and adjust the pedals according to the length of the legs.

14. Check height adjustment of the ejection seat (the eyes should be on a level with the sight reflector).

15. Check the fastening of the parachute release control unit flexible pin ripcord to the left arm rest of the ejection seat.

16. Release the shoulder harness, lifting the harness locking lever all the way up. After shifting the shoulder harness to the rearmost position, lock them by lowering the locking lever all the way down.

17. Lock the seat belt and shoulder harness, lean tightly against the back of the ejection seat and tighten up, first, the seat belt and, then, the shoulder harness. Check to see that the shoulder harness metal loops are properly aligned in the lock.

18. Give a command to the ground engineer to remove the ground safety lock pins from the ejection seat firing mechanism head and from the canopy jettison right-side handle.

Check if the ground safety lock pins are removed.

19. Check operation of the shoulder harness locking mechanism, for which purpose:

(a) lift the shoulder harness locking lever to the uppermost position;

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(b) leaning the body forward, check the tension of the shoulder harness springs;

(c) lean tightly against the back of the ejection seat, lower the shoulder harness locking lever all the way down and, tilting the body, check if the harness is locked.

20. Make sure the sliding hood is properly closed and can be easily opened.

21. Check the aircraft engine control lever for smooth travel;

22. Check to see that the reserve of compressed air in the air supply system is sufficient. Air pressure should be:

(a) in the main bottles - minimum 120 kg/sq.cm;

(b) in the landing gear emergency bottle - minimum 30 kg/sq.cm;

(c) in the flaps emergency bottle - minimum 120 kg/sq.cm.

23. Check the braking system for airtightness and the brakes for proper adjustment. With the brake lever pressed right home and the pedals in the neutral position, there must be no hissing of escaping air and the pressure gauge should read 11 ± 1 kg/sq.cm. The deflection of the pedal should be followed by a rapid pressure drop to zero in the braking system of the wheel which is opposite to the deflected pedal. During the braking cycle (at the end of travel of the brake first-step lever), the pressure gauge should read 8 kg/sq.cm.

24. Check the control stick and pedals for freedom of movement and the control surfaces for proper response.

25. Close the canopy and check the canopy locks for proper engagement; check the canopy pressurizing hose for condition, for this purpose, turn the pressurizing valve handle to the right, thereby filling the hose with air. While doing so, no hissing of the escaping air should be heard.

With the check over, set the pressurizing valve handle in the original position, thus releasing air from the hose, then, open the canopy.

Caution. Do not check the condition of the pressurizing hose with the canopy open, to avoid the break of the hose.

26. Check if the control knob of cockpit pressure controller PД-2ИМ is properly screwed.

27. Check the charging of aircraft battery under load, for which purpose cut in the battery and the radio set circuit breaker and press the voltammeter push-button (the battery voltage should be minimum 24 V). After checking, cut off the radio set.

28. Give a command CUT IN POWER SUPPLY and, on receiving the ground engineer's back report POWER SUPPLY ON, check by the voltammeter scale if external power supply is properly connected (the voltage should be minimum 24 V).

29. Cut in the gyro horizon circuit breaker and the ДГМК remote-reading gyromagnetic compass to prepare them for operation. The gyrounit of the АГИ-1 gyro horizon develops a speed ensuring normal operation of the gyro horizon three minutes after power supply has been cut in. The serviceability of the ДГМК remote-reading gyromagnetic compass is restored one minute after cutting in the circuit breaker.

Note. To provide for the minimum time space required to bring the АГИ gyro horizon to the operating condition, before cutting in the АГИ-1 gyro horizon, press the gyro horizon starting push-button as far as it will go; keep the button pressed for 3 - 4 seconds and then release it. When the temperature is below -30°C, keep the push-button pressed for 5 - 8 seconds.

30. Cut in the circuit breaker of the trim tabs and check operation of their electric actuators. If the elevator trim tab switch is pressed forward, the trim tab must deflect upward and if the switch is pressed back, the trim tab should deflect downward.

When pressing the aileron trim tab selector switch to the left, the trim tab should deflect downwards, and when pressing it to the right, the trim tab should deflect upwards.

Set the trim tabs neutral (the elevator trim tab is set by the white signal lamp).

31. Check the landing gear warning system for proper functioning.

With the warning system operating properly, three green warning lights should flash up and the landing gear strut position indicators on the wing and fuselage should be in the extended position. To check the condition of the landing gear UP position warning lights, press the check button; as a result, the red warning lights should flash up.

32. Cut in the instrument circuit breaker. While doing so, the pointers of the fuel and oil pressure gauges should be set at zero, the oil thermometer pointer should read the inlet oil temperature, and the fuel level gauge pointer should come against scale division 1050 litres.

33. Check the readings of the clock and wind it, if necessary.

34. Set the altimeter pointer at zero.

Caution. Before the flight, check the condition of the barometric altimeter, comparing the value of the surface pressure obtained from the meteorological station with the pressure read by the altimeter set at zero altitude.

35. Check the operation of the gyromagnetic compass, for which purpose, pressing the push-button slave the systems of the ДГМК remote-reading gyromagnetic compass. The compass index pointer should read the aircraft heading and, with the rack and pinion shifted to the left or to the right, the compass pointer should follow the turning scale.

36. Check the condition of the gyro horizon (for tilt of the instrument gyroscope). Then, cut off the instrument.

RADIO EQUIPMENT OPERATION CHECK

37. To check the operation of the radio set, proceed as follows:

(a) connect the detachable plug socket of the telephone cord;

(b) set the selector switch on the radio set control panel in the RECEPTION (ПРИЕМ) position;

(c) cut in the RADIO (РАДИО) circuit breaker;

(d) wait 1 or 2 minutes and, then, cut in the necessary radio channel by pressing the push-button on the control panel;

(e) press the transmitter switching button and call the ground radio station;

(f) using the volume regulator on the control panel, select the necessary volume of signals received;

(g) check the operation of the radio set on the other three channels after receiving the ground station clearance.

After checking the operation of the radio set, switch on the necessary radio channel and cut off the RADIO circuit breaker.

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AIRCRAFT TRANSPONDER CHECK

38. To check the operation of the aircraft transponder proceed as follows:

(a) cut in the APK-5 automatic radio compass and aircraft transponder circuit breaker, and the twin switch on the aircraft transponder control desk, as a result, the green signal lamp and, then (some seconds later), the yellow signal lamp mounted on the control desk should light up;

(b) set the required code on the aircraft transponder control desk;

(c) cut off the aircraft transponder.

APK AUTOMATIC RADIO COMPASS CHECK AND TUNING

39. Check the operation of the APK automatic radio compass in the following order:

(a) close the cockpit canopy (since the loop is located on the sliding hood);

(b) set the operating zone and frequency of the outer homing station on the control panel;

(c) set the remote radio compass range selector switch to the OUTER HOMING STATION ([illegible]) position, cut in the selector switch whose operating zone is within the frequency of the inner homing station;

(d) set the selector switch on the control panel of communication radio set [illegible] in the APK position;

(e) put the function switch on the radio compass control panel in the LOOP [illegible] position;

(f) cut in the APK - MARKER (APK - MAPKEP) circuit breaker and wait 1 - 2 minutes until the receiver lamps warm up;

(g) rotating the receiver tuning handle, see that the tuning indicator pointer is shifted to the right as far as possible;

(h) place the VOICE - KEY (ТЛФ - ТЛГ) selector switch on the compass control panel in the KEY position;

(i) listen to the call signs of the homing station and make sure it is properly tuned to the outer homing station; set the required volume, if necessary, by turning the VOLUME CONTROL (ГРОМКОСТЬ) knob;

(j) switch over the radio compass to the inner homing station, for which purpose set the INNER HOMING STATION - OUTER HOMING STATION (БЛИЖНЯЯ - ДАЛЬНЯЯ) selector switch to the INNER HOMING STATION position;

(k) listen to the call signs of the inner homing station and make sure the radio compass is properly tuned to it without additional trimming. If necessary, trim the radio compass to the inner homing station and, then, check tuning to the outer homing station;

(l) set the selector switch in the COMPASS (КОМПАС) position and by reference to the APK radio compass indicator make sure that the compass functions properly;

(m) put the selector switch in the LOOP (РАМКА) position and using the loop thumb lever, shift the indicator pointer 30 to 60° aside;

(n) set the selector switch in the COMPASS position and make sure the indicator pointer has returned to the initial position;

(o) cut off the radio compass circuit breaker.

PB-2 RADIO ALTIMETER OPERATION CHECK

40. To check the operation of the PB-2 radio altimeter, proceed as follows:

(a) cut in the PB-2 - MARKER (PB-2 - MAPKEP) circuit breaker;

(b) cut in the radio altimeter by turning the instrument handle, bearing the inscription ON, in the clockwise direction;

(c) set a range of 0 to 120 m by turning the RANGE (ДИАПАЗОН) handle to the left and wait 1 to 2 minutes until the transmitter-receiver valves are warmed up. With the radio altimeter functioning properly, the altitude indicator pointer should clear the lower stop and stop at the zero index-line, accurate within ±2 m;

(d) cut off the radio altimeter circuit breaker.

AIRCRAFT CHECK BEFORE GUN FIRING AND BOMBING MISSIONS

41. Receive a report from the armament mechanic on the readiness of the aircraft armament and camera gun for firing. This report should include the following data:

(a) the guns which are prepared for firing;

(b) the number of shells loaded per each gun;

(c) the colours of shells (in case of practice firing);

(d) the number of chargings required;

(e) the types of bombs suspended and their fuzes, and the value of time delay set.

42. Check if the sight reflector is clean.

43. Cut in the SIGHT HEATER (ОБОГРЕВ ПРИЦЕЛА), SIGHT (ПРИЦЕЛ), RADIO-RANGE FINDER (РАДАЛЬ) circuit breakers and check:

(a) the sight reticle lighting for smooth change;

(b) operation of radio-range finder by changing the range setting from 180 to 800 m, with the base line being equal to 15 m, and the base setting from 7 to 45 m. For this purpose, set the RADIO - OPTICS (РАДИО - ОПТИКА) change-over switch on the sight selector switch in the OPTICS position;

(c) gyroscope electric motor for proper operation and the reticle for clear display when the switch handle is set to the GYRO (ГИРО) position;

(d) operation of radio-range finder (whether the high voltage lamp burns). During this check, the sight selector switch should be set in the RADIO position.

44. Make sure there are two spare lamps for illuminating the sight in the cockpit.

45. Lock the sight gyroscope by setting the switch handle in the FIXED (НЕПОДВ.) position.

46. Check the bomb armament warning system, for which purpose put the ARMED - SAFE (ВЗРЫВ - НЕВЗРЫВ) change-over switch in the ARMED position. Cut in the air bomb tactical and emergency release circuit breakers and check:

(a) whether the two upper white warning lamps are lit up, indicating that air bombs are suspended from the bomb racks;

(b) if the lower red warning lamp burns, indicating that air bombs will be released at ARMED.

47. After checking the bomb armament warning system, cut off the air bomb tactical and emergency release circuit breakers. Cut off the sight circuit breakers in the reverse order, i.e. first, cut off the RADIO - RANGE FINDER circuit breaker and, then, the SIGHT and SIGHT HEATER circuit breakers.

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COCKPIT CHECK BEFORE HIGH-ALTITUDE FLIGHT

48. Before entering the aircraft, check:

(a) parachute oxygen apparatus and its hoses for exterior damage;

(b) oxygen pressure in the bottles of the parachute oxygen apparatus. The oxygen pressure indicator should read 150 kg/sq.cm;

(c) if the seal on the apparatus cover is intact;

(d) if the disconnector pin is locked.

49. Check the disconnector pins of the parachute oxygen apparatus for proper position and equal length, absence of bends at the pin ends and correct fitting into the safety ring.

50. On entering the cockpit, connect the pull chain to the ring on the left-hand panel and attach the hose of the inboard oxygen regulator with the intermediate hose of the parachute oxygen apparatus.

With the hose being shaken, oxygen should not leak from the parachute oxygen apparatus.

51. Check the condition of the oxygen apparatus, oxygen mask, hose, oxygen-flow indicator, and pressure gauge; make sure they are free of exterior damage.

52. Thoroughly fit the oxygen mask to the face and check the mask-to-face tightness, for which purpose clamp the corrugated hose and take a breath. If breathing proves impossible, the mask is airtight.

53. Check the connection of the oxygen hose to the apparatus and the attachment of the oxygen mask to the corrugated hose.

54. Check the airtightness of the oxygen low pressure system, for which purpose close the oxygen valve and the air-dilution switch and take a breath. If breathing proves impossible, the low pressure system is airtight.

After checking, set the air-dilution switch in the OPEN (OTKPЫTO) position.

55. Open the oxygen valve to capacity and make sure, by the pressure gauge readings, that the amount of oxygen available is sufficient.

56. Check the supply of oxygen by the indicator, taking two - three breathes. While doing so, the indicator blinker segments should get apart during inhalation and close in during exhalation.

57. Check the oxygen emergency supply system, opening the oxygen reducer emergency valve. With the emergency oxygen supply system functioning properly, the indicator blinker segments should get fully apart.

After checking, close the emergency valve of the oxygen reducer.

Caution. While checking the oxygen emergency supply system, do not hamper the flow of oxygen by bending over or compressing the corrugated hose of the oxygen mask.

AIRCRAFT CHECK BEFORE NIGHT FLIGHT

58. Prior to night flights, check the night lighting equipment, for which purpose:

(a) using the white lamp rheostat, set the required light brightness;

(b) set the landing gear warning lights blind in a position for a night flight;

(c) cut in the navigation lights circuit breaker and make sure the navigation lights are in a sound condition;

(d) using the ultraviolet light rheostats, light up the ultraviolet lamps and

after checking the lamps for proper condition, close the light filters and set the lamps approximately in the operating position;

(e) set the headlight circuit breaker and switch in the EXTENDED ([illegible]) position, make sure the headlight is in a sound condition and the light beam is properly directed, set the headlight switch in the RETRACTED ([illegible]) position and cut off the headlight circuit breaker;

(f) cut in the sight circuit breaker and adjust the brightness of the sight reticle to the required value;

(g) open the blinds on all warning lamps, make sure they are in a sound condition and, then, close the blinds to obtain the desired light brightness;

(h) adjust the illumination of the instrument scales on the radio compass control panel by rotating the ILLUMINATION ([illegible]) handle;

(i) check the condition and correctness of blind installation above the instrument panel for eliminating patches of light and reflection of instruments on the canopy glass;

(j) direct the port ultraviolet light on the flight instruments, and the starboard light - on the engine control instruments.

TOWING OF AIRCRAFT

59. The aircraft may be towed by a truck at a speed of 10 to 15 km/hr on a concrete taxiing strip and runway, and 5 to 6 km/hr, on an unpaved runway.

During the towing the pilot (or the ground engineer) should remain in the cockpit and keep his hand on the brake lever to brake the wheels, if necessary.

60. Aircraft towing at night should be performed with the navigation lights on.

ENGINE GROUND STARTING

61. The engine is started either from an external power source or from an aircraft power supply.

62. Before starting the engine, check to see that:

(a) the fire-fighting means are present nearby the aircraft;

(b) the wheel chokes are placed under the aircraft wheels;

(c) the aircraft battery and generator are cut in;

(d) the external power supply is cut in (when starting is performed from external power supply);

(e) the sight control handle is set in the FIXED position;

(f) the stopcock is closed (the stopcock lever is set in the UP (BBEPX) position;

(g) the GROUND - AIR (ЗЕМЛЯ - ВОЗДУХ) switch is set in the GROUND position (i.e. switched off).

63. Cut in the circuit breaker of the AГИ gyro horizon and the ДГМК remote-reading gyromagnetic compass and give the command REMOVE PLUGS, and on receiving the ground engineer's back report PLUGS REMOVED, prepare the equipment for starting the engine; to this end:

(a) cut in the power plant control instrument circuit breakers IGNITION, STARTING PUMP (ЗАЖИГАНИЕ, ПУСКОВОЙ НАСОС) and STARTING PANEL RELAY (РЕЛЕ ПУСКОВОЙ ПАНЕЛИ) (while doing so, the red signal lamp will light up);

(b) cut in the circuit breaker of the fuel booster pump; in so doing, the starting pump red signal lamp will go out, thus testifying to the normal operation of the pump.

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(c) cut in the circuit breaker of the fuel transfer pump which pumps fuel from the rear fuel tank. With the pump operating properly and fuel available in the tank, the green signal lamp will light up and go out immediately.

64. Before starting the engine call ALL CLEAR and on receiving assurance that all is clear start the engine; for this purpose:

(a) pull the engine control lever all the way back;

(b) press the engine starting push-button for 1 - 2 seconds. On receiving the signal FLAME HERE from the ground engineer, with the engine running at a speed of about 600 r.p.m., but not later than 10 - 12 seconds after pressing the starting push-button, shift the stopcock control lever to the starting (intermediate) position. At an ambient air temperature below -10°C, smoothly and quickly shift the stopcock control lever (after the engine has gained about 600 r.p.m.) to the fully open position (bypassing the intermediate position) and in 1.5 - 2 seconds move it to the starting (intermediate) position.

After the engine has reached a speed of 900 to 1200 r.p.m., remove the stopcock control lever from the starting (intermediate) stop and smoothly shifting it at a slow rate, put the lever in the fully open position within 1.5 - 2 seconds, checking the temperature of exhaust gases, which should not exceed 650°C or 690°C, when the ambient air temperature is below -10°C.

Notes: 1. The starting of the engine may involve surging which is normally accompanied by a specific "rumbling" noise.
2. In case of intensive "rumbling" followed by failure of engine to pick up speed and by excessive increase of exhaust gas temperature beyond the rated limits, cut off fuel supply, i.e. rapidly shift the stopcock control lever to the starting (intermediate) position and after the engine has stopped "rumbling", smoothly shift the lever within 1.5 - 2 seconds in the fully open position. If heavy "rumbling" is repeated with the stopcock in the open position, cut off fuel supply again.
3. In some engines "rumbling" may also take place with the stopcock lever in the starting (intermediate) position. If this is the case, cut off fuel supply by shifting the stopcock lever to the CLOSED (SAKPYTO) position, then, smoothly shift the lever to the OPEN (OTKPYTO) position.

Caution. If the engine control lever is pulled back incompletely, the engine will not start, since the power supply circuit microswitch is cut in only when the lever is pulled all the way back.

65. With the engine control lever pulled all the way back, the engine gains the idle rating, at which the engine speed should be 2400 to 2600 r.p.m., the temperature of gas in the tail pipe should not exceed 510°C, and the oil pressure should not be more than 0.2 kg/sq.cm. Run the engine at the above rating for 1 minute and, then, proceed to test the engine. If the engine is intended to be operated for long at idle rating, prior to its testing (but not later than 15 minutes after the starting moment), first smoothly bring the engine speed to 6000 - 7000 r.p.m., then, wait 3 - 4 seconds and gradually decrease speed down to the idle rating.

66. Should the temperature of gas in the tail pipe be in [illegible] of 650°C during the engine starting, stop starting the e[illegible] by closing the stopcock. Repeat the engine starting after setting the normal voltage of current fed for starting since, with the voltage value being insufficient, the electric starter rotates the turbine too slowly, which results in an increase of gas temperature.

67. Should unstable operation of the engine, followed by rumbling, be observed in starting the engine, slightly shut off the stopcock (until rumbling discontinues), wait 1 - 2 seconds, and, then, gradually open the stopcock again. While doing so, bear in mind that the engine starting cycle lasts 42 ± 3 seconds after which the starter is automatically cut off.

68. If during the engine starting, no ignition of fuel takes place, immediately close the stopcock, wait a little until the turbine stops rotating, scavenge (cold-start) the engine from the electric starter, with ignition cut off. Begin the repeated starting of the engine only after the end of scavenging (after the turbine has come to a standstill).

ENGINE GROUND TEST

69. After starting the engine and gaining steady idle rating (2400 - 2600 r.p.m.), give a signal for disconnecting the external power supply by waving the hand on the face level. Having made certain that [illegible] supply is cut off, switch on the aircraft battery and generator immediately. Gradually bring the engine speed to 4000 r.p.m., make certain the generator functions properly: the red signal lamp GENERATOR OFF should go out as the engine gains a speed of 3200 to 3700 r.p.m. The operation of the aircraft generator can also be checked at a speed of 6000 to 8000 r.p.m. by the voltammeter, with the aircraft battery cut off; the voltage value should be within 26.5 - 28.5 volts.

70. Check the operation of the isolating valve, for which purpose set the engine speed at 6500 - 7500 r.p.m., cut in the isolating valve circuit breaker (the isolating valve signal lamp should light up) and determine the engine speed change as compared with the initial speed.

Operation limit of the engine speed drop, with the isolating valve on, is 250 r.p.m. The engine speed growth is not limited.

If, with the isolating valve cut in, no change of engine speed has occurred, check the valve for proper functioning at other speed rates, without getting beyond the speed limits of 6500 to 7500 r.p.m. Constant engine speed or its drop by more than 250 r.p.m., with the isolating valve cut in, testifies to the valve unserviceability.

Cut off the isolating valve. As a result, the engine speed should resume the initial speed.

71. Warm up the engine at 8500 - 9000 r.p.m. within minimum 1 minute at an ambient air temperature above -10°C, and at least within 2 minutes when the temperature of an ambient air is -10°C and less.

Notes: 1. Take-off with a cold engine is allowed to be performed only in case of an alert take-off.
2. Do not run the engine at maximum speed, with oil pressure in the oil pump box above 3.5 kg/sq.cm.

72. Check the engine speed with the engine control lever set on the intermediate retainer. The engine speed should be 11,350 + 50 r.p.m.

73. Check the operation of the engine at the take-off rating. The rate of travel of the engine control lever, with the speed increased from the isolating valve check rating up to the take-off speed, equals 4 - 6 seconds. With the engine running at the maximum speed, cut in the isolating valve and check the value of the speed change. When the isolating valve is cut in at the take-off rating, the engine speed increase by not more than 50 r.p.m. or the engine speed drop by not more than 200 r.p.m. is allowed.

The readings of the engine control instruments during engine ground test at take-off rating are presented in Table 1.

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Table I

Readings of Engine Control Instruments during Engine Ground Test at Take-Off Rating

Parameters.	Instrument readings
Engine speed, r.p.m.	$11{,}560^{+40}_{-100}$
Gas temperature, °C	Maximum 690
Fuel pressure before burners (reduced), kg/sq.cm	45 ± 4
Fuel pressure (as read by pressure gauge), kg/sq.cm	Not more than 75
Oil pressure, kg/sq.cm	1.4 to 3.5
Oil temperature, °C	From −40 to +90

74. Check the operation of the APT-8B acceleration control unit from 5000 r.p.m. up to the maximum speed, for which purpose shift the engine control lever from the position corresponding to 5000 r.p.m. to the frontmost position within 1 – 2 seconds, wait until the engine starts running at a steady maximum rating, then, pull the engine control lever to the rearmost position.

With the acceleration control unit functioning normally, the engine should be accelerated from 5000 r.p.m. to the maximum speed within 11 – 15 seconds and short-time gas overtemperature should not exceed 770°C.

Short-time maximum overspeed caused by abrupt movement of the engine control lever, should not exceed 11,800 r.p.m.

75. In the course of the engine test run the pilot checks the cockpit pressurisation, for which purpose he will:

(a) close the cockpit canopy;

(b) pressurize the cockpit by turning the cockpit pressurizing valve to the right in the COCKPIT PRESSURIZED (КАБИНА ГЕРМЕТИЧНА.) position (up to the beginning of the coloured panel blue section). While doing so, a slight clicking sound should be heard.

Further turning of the pressurizing valve up to the next fixed position (at the end of the coloured panel blue section) will feed cold air into the cockpit, while turning the valve to the third fixed position (at the end of the coloured panel pink section) will feed warm air into the cockpit.

The cockpit tightness check is accomplished at engine take-off rating, with the pressurizing valve open completely.

The presence of smoke and oil or hydraulic fluid emulsion in the cockpit is not tolerated and indicates that the manifolds in the engine section or in the cockpit are faulty.

CHECK OF ANTI-G DEVICE ΠΠΚ-1

76. To check the ΠΠΚ-1 device with compressed air and the maximum G-load warning system, proceed as follows:

(a) connect the rubber hose of the ΠΠΚ-1 device (by means of a detachable coupling) to the aircraft supply line;

(b) run the aircraft engine at 7000 to 8000 r.p.m.;

(c) set the AД-5 automatic pressure controller and the [illegible] change-over switch in the MINIMUM (МИН.) position and, then, in the MAXIMUM (МАКС.) position; press the automatic pressure controller push-button in each of the above positions and make sure (by the pressure increase in the anti-G suit) that the controller functions properly.

HYDRAULIC SYSTEM OPERATION CHECK

77. While checking the engine, set the engine speed at 6000 r.p.m. and check the operation of the hydraulic system. The pressure readings of the hydraulic system gauge, with the valve in a neutral position, should be 60 to 140 kg/sq.cm. While doing so, the time interval between the shifts of the pressure relief valve should be minimum 2.5 minutes.

78. Move the flap control handle from the neutral to the take-off position, and after keeping it in this position for 1 – 2 seconds, send it to the flaps-down position (full down); the flaps should be fully extended within 2 – 3 seconds. The extension of flaps is checked by the light of the green signal lamp and by the complete protrusion of the mechanical indicator on the port wing. Synchronized extension of the right and left flaps is checked by the ground engineer.

79. To retract the flaps, shift the flap control handle to the flaps-up position (full up) without delaying in the take-off and neutral positions. While doing so the flap signal lamp should go out.

After the flap operation check is over, set the flap control handle to the neutral position.

80. To check the operation of the speed brakes, cut in the change-over switch on the aircraft port to the OPEN ([illegible]) position and make certain, by the light of the signal lamp, that the speed brakes are open. Retract the speed brakes, shifting the change-over switch to the CLOSED ([illegible]) position. Check the extension of the speed brakes by pressing the push-button on the aircraft control stick and ascertain their normal operation from the ground engineer's report.

At the time of the speed brakes retraction and extension, the pressure in the system may drop below 60 kg/sq.cm.

81. Check the operation of the [illegible]-I aileron control booster. The pressure in the system, with the hydraulic booster engaged, should be 4.5 – 6.0 kg/sq.cm. Apply pressure to the control stick and smoothly move it full left and full right 3 – 4 times. The control stick must move easily without binding or jerks. The movement of the control stick changes the pressure in the system within 10 – 15 kg/sq.cm limits; the pressure returns to normal when the control stick movement stops.

Open and close the aileron control booster valve two or three times. The valve must open and close easily without binding. With the aileron control booster cut off, check the control stick for jamming, stoppages or excessive aileron stick forces.

The time interval between the shifts of the automatic pressure relief valve, with the control stick in the neutral position and the aileron control booster cut in, should be minimum 40 seconds.

PREPARATION FOR TAXIING-OUT AND TAXIING PROCEDURE

82. Having ascertained that the engine, instruments and aircraft assemblies function properly, the canopy locks are properly engaged (the red matchmarks on the locks should align), and that the cockpit pressurisation operates properly, lock the safety harness, cut in the radio set circuit breaker, establish contact with the

flight control officer and request clearance for taxiing out. Slave the [illegible] remote-reading gyromagnetic compass. To prevent overheating of the [illegible] generator and retain the capacity of the battery, cut in the aircraft transponder, ARK-5 automatic radio compass, and the [illegible] radio-range finder sight before the flight. The above-indicated consumers may be cut in for a short time only.

83. Make certain the elevator trim tab is set in the NEUTRAL ([illegible]) position (to be checked by the signal lamp).

Move the control stick to the left and ascertain that the trim tab on the port aileron is neutral.

84. When taking off from a limited runway or with drop fuel tanks, extend the flaps by 20°; this will reduce the take-off run by about 100 m.

85. Give the signal [illegible] AWAY (by moving the hand palms to both sides on the head level) and brake the wheels.

86. Having made sure that the chokes are pulled away (the ground engineer signals it by touching the head-dress with his hand) and that no obstacles are observed ahead of the aircraft, check operation of the brakes. For this purpose, holding the aircraft in place by application of the brakes, move the engine control lever forward increasing engine speed to 10,000 r.p.m. Then, return the engine control lever to the idle cut-off position. The synchronized operation of the brakes is checked during taxiing by changing the taxiing direction.

87. Having made certain once more that no obstacles are ahead in the direction of intended taxiing, increase the engine speed to start moving. With drop tanks and full main tanks the taxiing speed must not exceed 30 km/hr on artificial runways and 15 km/hr on unpaved runways.

Change the direction of taxiing by applying the brakes.

Longitudinal rocking of the aircraft during taxiing should be eliminated by reducing the engine speed and by making use of the brakes.

88. The engine speed required for taxiing on paved runways is 3500 to 4500 r.p.m. and that on unpaved and rolled snow-covered runways is 5000 to 7000 r.p.m.

While taxiing over boggy ground, accelerate the engine slowly to avoid its overheating.

When several aircraft are taxiing on dusty airfields, take into account the direction of wind and the distance between the aircraft to ensure operation of engine outside dust cloud.

In winter time, the taxiway leading to the runway may be covered with ice crust, and taxiing proves rather difficult, especially when the wind exceeds 8 m/sec.

To avoid icing of the cockpit canopy and pitot-static tube, caused by precipitation of water dust formed by the aircraft taxiing in front, taxi the aircraft in winter time with due consideration of the wind direction. The heater of the main pitot static tube and emergency pitot tube [illegible]-156 should be cut in.

89. While approaching the runway, look around and make sure the runway is free and there is no aircraft approaching for landing, then, request clearance to line up.

90. On entering the runway, roll the aircraft 5 - 10 m ahead to align the nose wheel with the runway. Release the landing gear control handle and cut in the landing gear circuit breaker.

91. Before taking off in adverse weather conditions and at night, make sure that the gyro horizon and generator function properly and that the readings of the [illegible] remote-reading gyromagnetic compass are correct.

92. Cut in the aircraft transponder, ARK-5 automatic radio compass, CPI-I radio-range finder sight and the pitot-static tube heater.

Request take-off clearance.

II. TAKE-OFF AND CLIMBING

TAKE-OFF

93. Look around and make sure there are no obstacles ahead.

94. On obtaining clearance for take-off, perform take-off immediately to clear the runway.

95. Holding the aircraft in place by application of brakes, increase engine speed to 8000 - 9000 r.p.m. and after ascertaining that the instruments read normally, release the brake lever and start the take-off run; in the course of the take-off run increase the engine speed to attain take-off power setting.

On aircraft equipped with an intermediate retainer on the engine control lever, perform take-off at an engine speed of 11,350 + 50 r.p.m. The take-off procedure at engine speed of 11,560 is the same and differs in that the take-off run in the latter case increases by 5 - 7%.

Note. When taking-off or while in flight for intercepting an actual air target, and also in other unforeseen cases (take-off from a short runway or soft ground), the pilot is allowed to run the engine at a rating of 11,560 r.p.m.

Whenever necessary, it is allowed to begin taking off without holding the aircraft in place by application of brakes, and also immediately after entering the runway so as not to stop the movement of the aircraft.

96. At the beginning of take-off run, keep the control stick in the neutral position. If the aircraft tends to turn to either side, counteract the tendency by applying momentary pressure to the brake lever. With the aircraft translational speed increasing, maintain the take-off direction by deflecting the rudder.

In the process of the take-off run the aircraft is stable to maintain direction without any tendency to turn. A crosswind of 90° and up to 10 m/sec velocity does not practically affect directional control.

97. After the aircraft has gained a speed of 170 km/hr, smoothly apply back pressure to the control stick and raise the nose wheel off the runway, keep the aircraft in this attitude until unstick. At a speed of 220 to 230 km/hr the aircraft smoothly leaves the ground. It has no tendency to ballooning or stalling.

After unsticking, gradually gain altitude and simultaneously build up speed.

98. Retract the landing gear at an altitude of 10 to 15 m. During the retraction of the landing gear the speed of the aircraft should not exceed 400 km/hr. With the aircraft flying at a higher speed, the landing gear retraction time will increase and the landing gear may retract incompletely. The time normally required for retracting the landing gear is 6 to 8 seconds.

Check the retraction of the landing gear by the warning lights, mechanical indicators, and by the hydraulic system pressure, which must reach its full value.

Set the landing [illegible] control handle in the NEUTRAL ([illegible]) position.

If the landing [illegible] has failed to retract or has retracted incompletely, check if the landing gear electric switch is cut in. At an altitude of minimum 500 m, decrease the engine speed up to 350 km/hr by performing shallow climbing and set the landing gear control handle for retraction.

After retracting the landing gear, set the control handle in the NEUTRAL position.

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99. If take-off was made with flaps down, raise the flaps at an altitude of 100 m (after retracting the landing gear). Do not remove the hand from the flap control handle until retraction is completed; after this, set the flap control handle in the NEUTRAL position. While retracting the flaps, the pilot has almost no sinking sensation.

TAKE-OFF FROM UNPAVED AND SNOW-COVERED RUNWAYS

100. Take-off from unpaved and snow-covered runways with an even and a sufficiently firm surface does not differ much from that performed from concrete runways.

While taking off from unpaved runways having an uneven surface, the running aircraft experiences pitching and rolling, which cause heavy vibration to the control stick. With the speed increasing, the vibration of the control stick decreases and, then, disappears altogether without any interference on the part of the pilot.

The rolling and pitching of the aircraft during the take-off run make it difficult for the pilot to determine the nose wheel unstick, therefore the nose wheel should be raised somewhat later, i.e. after the aircraft has reached a speed of 180 - 190 km/hr.

Longitudinal and lateral separation between the aircraft during formation take-off from an unpaved runway must be not less than 50 m.

To avoid aircraft icing caused by precipitation of water dust in winter time, the aircraft must be staked on the runway at a distance of minimum 50 m.

CLIMBING

101. After retracting the landing gear and flaps, unlock the safety harness, use the elevator and aileron trim tabs to counteract the control forces and continue to climb at a gentle angle, simultaneously increasing the flying speed to attain the highest rate of climb speed at an altitude of 1000 m.

Caution. In aircraft equipped with irreversible hydraulic boosters in the elevator and aileron control system, do not use trim tabs in flight with the hydraulic boosters engaged.

102. Perform climbing at engine nominal rating (11,200 r.p.m.) and, whenever necessary to speed up climbing - at take-off (combat) rating (11,560 r.p.m.).

Caution. Continuous operation of the engine at take-off (combat) rating may be allowed in climbing for not more than 10 minutes. The duration of continuous engine operation at nominal rating should not exceed 1 hour.

103. To gain the maximum rate of climb, the pilot will perform climbing by maintaining the true airspeed (as read by the thin pointer) equal to 720 km/hr at engine nominal rating, and 750 km/hr at take-off (combat) rating. With the altitude gaining, the indicated airspeed (as read by the thick pointer) will decrease by 30 - 25 km/hr per each thousand of metres (Table 2).

Table 2

Vertical Climb Speed and Indicated Airspeed VS Flight Altitude and Climb Time (min)

Flight altitude, m	n = 11,560 r.p.m.			
	Optimum rate of rapid climb, km/hr		Vertical speed, m/sec	Climb time, min
	V_{IAS}, km/hr	V_{TAS}, km/hr		
1000	718	750	47.0	0.35
2000	686	750	44.0	0.7
3000	654	750	41.0	1.1
4000	624	750	36.0	1.5
5000	594	750	35.0	2.0
6000	564	750	32.0	2.5
7000	536	750	29.0	3.0
8000	509	750	26.0	3.6
9000	481	750	23.0	4.3
10,000	454	750	20.0	5.1
11,000	427	750	17.0	6.0
12,000	395	750	13.4	7.1
13,000	366	750	9.7	8.6
14,000	340	750	6.2	10.7
15,000	320	750	2.6	14.6

Notes: 1. The climb time given in Table 2 does not allow for the time space needed for take-off run and acceleration of the aircraft up to climb speed, with the engine running at 11,560 r.p.m. only for 10 minutes, from any initial altitude.

2. The required climb time, with the engine running at 11,350 r.p.m., increases on the average by 20 - 25%.

When climbing with the engine control lever kept constant on the intermediate retainer stop, the engine speed increases with the increase of altitude and may reach a value of 11,500 - 11,600 r.p.m. at altitudes of 4000 to 9000 m, depending on the flying speed value. Therefore, to keep the engine speed constant (11,350 r.p.m.), while climbing, the engine control lever should be gradually moved back.

104. During practice and training flights, when maximum rate of climb is not required, climb will be executed at an engine speed of 10,500 to [illegible] r.p.m.

105. Watch the readings of the engine control instruments, especially the temperature of gases, and see that the temperature of gases does not exceed [illegible]. With the gas temperature being in excess of the above value, decelerate the engine.

III. LEVEL FLIGHT

PERMISSIBLE SPEEDS

106. The maximum permissible flying speeds are:

(a) for altitudes below 3000 m - [illegible] km/hr IAS;

(b) for altitudes from 3000 to 7000 m - 1200 km/hr TAS;

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(c) For altitudes above 7000 m the speeds of the aircraft are unlimited.

Flying at maximum speed does not affect aircraft controllability.

107. If for some reasons the flying speed has become greater than the maximum permissible one, decrease it by extending the speed brakes and simultaneously changing the engine to the idle rating.

Speed brakes may be used at all speeds and altitudes.

While extending or retracting the speed brakes, the control forces on the control stick do not change at all permissible flight ratings.

108. With the indicated airspeed reduced down to 220 – 200 km/hr, the aircraft loses its stability and stalls, with the landing gear and flaps retracted and with the engine running at idle rating.

The minimum maneuvering speed at all altitudes equals 300 km/hr IAS. At this speed the aircraft is fairly stable and the controls are sufficiently effective.

While performing traffic pattern level flights for training purposes, the indicated airspeed should be 500 km/hr, with the landing gear retracted, and 450 km/hr, with the landing gear extended.

CHECK FLIGHT AND BALANCING OF AIRCRAFT NOT EQUIPPED

WITH HYDRAULIC BOOSTER IN ELEVATOR CONTROL SYSTEM

109. If the MiG-17 fighters have been delivered to military units ~~disassembled~~, carry out a check flight and a flight at maximum permissible speed after assembling the aircraft.

110. While carrying out a check flight, check the operation of engine, readings of instruments, flight control and navigation equipment, and other aircraft units, as well as the lateral and longitudinal balancing of the aircraft.

To check the lateral balancing of the aircraft in level flight at an altitude of 3000 to 4000 m, cut in the aileron hydraulic booster, increase indicated airspeed to 800 km/hr and use aileron trim tab to relieve the control stick of the aileron force. The longitudinal balancing check should be accomplished in the course of climbing immediately after the green warning lamp of the second fuel tank has lit up (with fuel remainder equal to 910 lit, and the C.G. location at 20.5% MAC).

With the elevator trim tab in the neutral position, the aircraft must balance (must have zero control force on the control stick) in climb from 3000 to 5000 m at engine nominal rating and at an indicated airspeed of 600 ± 50 km/hr.

After landing, check the position of the aileron trim tab. If the aileron trim tab is deflected by not more than ±10 mm and the longitudinal balancing corresponds to the specified value, and if no malfunction is detected in the operation of the engine and other units, then, after a repeated detailed examination, the aircraft is considered fit for a check flight at maximum permissible airspeed.

111. To check the correctness of aircraft adjustment which would ensure the operation of the aircraft at maximum permissible airspeeds, balance the aircraft longitudinally and laterally at an altitude of 3000 to 4000 m and an indicated airspeed of 800 km/hr, with the hydraulic booster engaged. Then, at an altitude of 3000 to 1500 m speed up the aircraft in level flight, with the engine running at a take-off (combat) rating (n = 11,560 r.p.m), up to an indicated speed of 1040 km/hr, under the above conditions the aircraft should not bank.

If necessary, the aircraft may be accelerated with a slight descent. During acceleration check the aircraft slipping (watch the turn-and-slip indica[illegible]ll).

If banking occurs at a speed of less than 1000 km/hr, check the bank [illegible]ting the control stick.

In case the deflection of the control stick by 1/3 of its full travel fails to check the bank, stop accelerating the aircraft, for which purpose cut down the engine speed to the idle rating, extend the speed brakes and, after the speed has decreased by 30 – 40 km/hr, smoothly assume climb attitude, stop further checking the aircraft adjustment and perform landing.

The aircraft developing banking at an indicated speed of less than 1060 km/hr, and requiring deflection of the control stick by more than 1/3 of its full travel to counteract the banking, will be not considered airworthy and are subjected to further adjustment by the Manufacturer.

Note. Building-up of positive G-load at altitudes from 0 to 5000 m intensifies banking, therefore, to stop banking, it is necessary, first, to decrease the aircraft speed by extending the speed brakes and cutting down the engine r.p.m., and, then, to send the aircraft into climb.

During flights intended for checking the adjustment of the aircraft at maximum permissible speed rates, the pilot should not exceed the indicated airspeed of 1060 km/hr and descend to an altitude of less than 800 m.

The results of aircraft adjustment check in flight will be entered by the pilot in the aircraft Service Log.

Caution. On aircraft equipped with irreversible hydraulic boosters in the elevator and aileron control system do not use trim tabs during flights, with the hydraulic boosters engaged.

112. If the stabilizer is set properly, the elevator control forces on the control stick, with the trim tab being neutral, in flights at altitudes from 3000 to 7000 m and at flying speeds from minimum maneuvering speed to the maximum one, change but slightly and, therefore, there is no need to use the trim tab even during execution of flight maneuvers.

At altitudes up to 3000 m and at speeds close to maximum ones, it is advisable to balance the aircraft by using the elevator trim tab at an indicated airspeed of 800 to 850 km/hr.

At altitudes of 10,000 m, the pilot is advised to balance the aircraft by using the elevator trim tab at an indicated airspeed of 400 km/hr.

BALANCING OF AIRCRAFT EQUIPPED WITH IRREVERSIBLE HYDRAULIC BOOSTERS IN ELEVATOR AND AILERON CONTROL SYSTEM

Lateral Balancing

113. To check the correctness of aircraft adjustment which ensures normal operation of aircraft at maximum permissible speeds, disengage the hydraulic booster at an altitude of 5000 – 4000 m and an indicated airspeed equal to 450 – 400 km/hr (as read by the thick pointer of the speed indicator).

Balance the aircraft, if necessary, at the above speed by the aerodynamic trim tab of the aileron so that the control force on the control stick equals zero. After that, the aileron aerodynamic trim tab should not be used. This done, engage the hydraulic booster and check the lateral balance of the aircraft throughout the speed range.

Permissible deflection of the control stick for removing the bank at maximum permissible speed is up to 1/3 of its full travel.

Note. The aileron control force on the control stick in a straight and level flight (without banking) at all speeds and altitudes, with the hydraulic

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booster engaged, should not exceed 3 - 5 kg. If the control force exceeds the above limits, decrease it by respectively deflecting the ground-adjustable trim tabs on the trailing edge of the wing (but not on the ailerons), when the aircraft is on the ground.

After carrying out the above-indicated lateral balancing, the position of the trim tab is considered balanced and the trim tab position should be checked before each next flight. The balanced position of the trim tab should be written down in red paint on the trim tab skin; the inscription should state the deflection value in millimeters.

Do not use the aerodynamic trim tab of the aileron when flying with the hydraulic booster engaged.

Longitudinal Balancing

114. With the aircraft flying at an altitude of 3000 to 4000 m at an indicated airspeed of 400 - 500 km/hr (as read by the thick pointer of the instrument), disengage the elevator hydraulic booster. Make sure the aircraft is changed to hand control. This done, speed up the aircraft (at engine nominal rating) using, if necessary, the elevator aerodynamic trim tab, to a true airspeed of 930 - 950 km/hr, at which the pressing force on the control stick should equal 5 - 7 kg.

Note. While performing a flight for aircraft balancing, the pilot should clearly keep in mind the standard diagram showing the change of the control force on the stick depending on the true airspeed.

Then, without using the trim tab, continue to accelerate the aircraft and determine the true airspeed corresponding to the lowest point of the force versus speed curve, which should be approximately within 1000 - 1100 km/hr.

Stop accelerating the aircraft after ascertaining, by the sharply increasing pressing control forces, that the aircraft has passed the lowest point of the force versus speed curve.

On finishing the acceleration, reduce the engine speed and dissipate speed down to the speed value corresponding to the lowest point of the force versus speed curve.

Balance the aircraft by the elevator trim tab at the above true airspeed in a straight and level flight (without G-load), so that the force on the control stick approximately equals zero (small pressing control force of 2 - 3 kg is tolerated).

After that, the elevator aerodynamic trim tab should not be used.

This done, dissipate flying speed down to indicated airspeed of 450 - 400 km/hr and engage the elevator hydraulic booster. With the above balancing performed, the position of the trim tab is considered balanced and the trim tab position should be checked before each next flight.

The balanced position of the trim tab should be put down in red paint on the trim tab skin; the inscription should state the deflection value in millimeters.

Notes: 1. If the hydraulic booster fails or cuts off, use may be made of the aerodynamic trim tab for decreasing the control force on the stick within the speed range from V_{ind} = 900 km/hr down to the landing speed.
2. At flying speeds exceeding V_{ind} = 900 km/hr, with the hydraulic booster disengaged, the aerodynamic trim tab should not be used.
3. One should bear in mind that excessive friction and play in the hydraulic system, with the hydraulic booster disengaged, hampers the aircraft control and may result in the aircraft pitching, especially during landing.

With the elevator hydraulic booster engaged and the trimming effect mechanism set in the neutral position, the aircraft should balance (the control force on the stick should equal zero) in climbing from an altitude of 3000 to 6000 m, with the engine running at nominal rating at an indicated airspeed of 600 ± 50 km/hr.

ENGINE CONTROL IN FLIGHT

115. Table 3 provides the main engine ratings in flight.

Table 3

Main Engine Ratings in Flight

Rating	Engine speed, r.p.m.	Gas temperature, °C	Continuous operation at given rating, min
Take-off (combat) rating up to H = 10,000 m (in level flight)	$11{,}560^{+60}_{-100}$	690	Not to exceed 5
Take-off (combat) rating above H = 10,000 m (in level flight)	$11{,}560^{+60}_{-110}$	690	Not to exceed 10
Take-off (combat) rating in climbing (at all altitudes)	$11{,}560^{+60}_{-100}$	690	Not to exceed 10
Normal rating	$11{,}200^{+60}_{-110}$	-	Not to exceed 1 hr
Idle rating	See Notes	-	Same

Notes: 1. The speed value corresponding to the position of the engine control lever on the idle rating stop, is variable and depends on the altitude and flying speed.
2. With the engine running at 10,870 r.p.m. and above, the oil pressure should be minimum 1.4 kg/sq.cm, but should not exceed 3.5 kg/sq.cm.
3. The oil temperature should be within -40 to +90°C.

116. With the flight altitude increasing, the temperature of exhaust gases increases too.

If the exhaust gas temperature exceeds 690°C, decrease the engine speed to return the gas temperature within the permissible limits.

117. In flight, the engine control lever may be advanced from idle to take-off (combat) rating within 2 seconds.

When carrying out any training exercise, do not allow sharp multiple movements of the engine control lever.

118. While in flight, do not exceed the engine speed of 11,350 + 50 r.p.m., except for cases of combat employment and correction of errors in carrying out ascending maneuvers.

The time of engine continuous run at 11,350 + 50 r.p.m. is the same as for the take-off (combat) rating.

Continuous flights at ratings of 10,800 - 11,100 r.p.m. are inadvisable for engines, models RK-1 and RK-1A, and should not be used unless necessitated by the flight conditions.

119. If a new aircraft is received or when the engine has been replaced, check the operation of the APT-6S acceleration control unit in flight, for which purposes

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(a) check the engine maximum speed at an altitude of 1000 - 1500 m and a maximum flying speed (this check may be performed simultaneously with the aircraft high-speed stalling check). Under these conditions the maximum engine speed should be within 11,460 to 11,620 r.p.m;

(b) at an altitude of 10,000 - 11,000 m set the indicated airspeed of 300 km/hr, with the engine control lever in the rearmost position. Then, move the engine control lever to the frontmost position within 1 - 2 seconds and wait until the engine runs steadily at maximum rating. If the acceleration control unit operates normally, the engine must attain take-off (combat) rating without surging (individual slight back fires are tolerated), and the steady maximum speed of the engine should be within 11,460 to 11,620 r.p.m.;

(c) at an altitude of 10,000 to 11,000 m set the maximum level flight speed by smoothly moving the engine control lever, and check the steady maximum speed of the engine, which, with the APT-5B acceleration control unit operating normally, should be within 11,460 - 11,620 r.p.m;

(d) at an altitude of 14,000 - 14,500 m repeat the procedure indicated in Item (b).

Cautions: 1. When checking the operation of the acceleration control unit, the short-time maximum overspeed should not exceed 1[illegible] r.p.m., and the short-time gas overtemperature should not exceed [illegible].
2. The APT-5B acceleration control unit check should be performed over the airfield in good weather conditions. Prior to checking, the pilot should refresh his memory on Section "Engine Starting in Flight"

OPERATION OF PRESSURIZED COCKPIT

120. Irrespective of the flight altitude the MиГ-17 aircraft should be flown with the cockpit pressurized.

Pressurize the cockpit on the ground before taxiing out to the runway.

121. Set the pressurization valve for feeding cold or hot air into the cockpit, depending on weather conditions and on the temperature of an ambient air.

122. In a warm season, when flying at an altitude of up to 5000 m in standard weather conditions, the pilot is advised to set the pressurization valve for feeding cold air into the cockpit.

123. While flying at altitudes above 5000 m as well as in a cold season, or when breaking clouds, the pilot is advised to set the pressurization valve for feeding hot air in order to avoid excessive cooling of the cockpit and dimming of the cockpit canopy.

124. When the cockpit canopy is dimmed, it is allowed to set the feed valve to the HOT (ГОРЯЧИЙ) position in all flight conditions.

125. Depending upon flight altitude cockpit pressure is automatically maintained by the PД-2M cockpit pressure controller.

The cockpit pressure is checked by the УВПД cockpit altitude and pressure differential gauge. Permissible pressure differential at altitudes above 5500 m, with the pressurized cockpit functioning normally, is within 0.26 to 0.32 kg/sq.cm.

To check the normal operation of the cockpit pressurizing system, the following rule should be used as a guide: the cockpit "altitude" should equal approximately half the aircraft flight altitude.

126. If the PД-2M cockpit pressure controller fails to operate normally and the cockpit pressure increases by more than 0.32 kg/sq.cm, set the fixed pressure differential by turning the knob (cockpit pressure manual adjustment knob) on the PД-2M cockpit pressure controller to the left.

127. Should smoke or unusual smell be detected in the pressurized cockpit during the flight at an altitude of up to 4000 m, immediately unpressurize the cockpit and cut in the velocity head ventilation.

If the flight is performed at an altitude of 4000 m, descend to 3000 m, since flying in an unpressurized cockpit will result in a negative pressure differential due to air suction, which increases with the increase of flying speed. The difference between the true altitude and the cockpit "altitude" (as read by the cockpit altitude-and-pressure differential gauge) amounts to 1000 m.

128. Gliding will be performed only with the pressurizing valve set in a position for delivery of hot air. If canopy dimming is detected when descending from a high altitude, proceed as follows:

(a) check to see that the pressurizing valve is set in a position corresponding to delivery of hot air into the cockpit;

(b) when at an altitude of 6000 to 7000 m, turn the knob on the PД-2M cockpit pressure controller all the way to the left.

If canopy dimming interferes with landing, increase engine speed up to nominal one for 3 - 4 min at an altitude of minimum 500 m. With the speed increasing 550 - 600 km/hr, extend speed brakes to prevent speed increase.

129. It is advisable to use the cockpit velocity head ventilation shutter at altitudes up to 2500 m in summer, when the temperature inside the cockpit is rather high.

USE OF OXYGEN IN FLIGHT

130. Fly the aircraft only with the parachute oxygen apparatus connected to the aircraft oxygen supply system. Put on the oxygen mask and cut in oxygen supply on the ground. When flying at altitudes above 8000 m, cut off the air-dilution switch and use pure oxygen.

131. When using the oxygen equipment in flight, watch the consumption of oxygen by the pressure gauge, and the oxygen supply by the indicator. If oxygen pressure in the bottle is less than 30 kg/sq.cm, descend to an altitude, where no oxygen supply is required.

132. In all cases of improper functioning of the aircraft oxygen apparatus, unpressurizing of cockpit, or when conducting an air battle, cut in the emergency oxygen supply.

133. If the oxygen supply system fails to operate properly (the indicator blinker segments are either still or respond weakly), pull out the disconnector pin, pass over to oxygen supply from the KП-23 parachute oxygen apparatus, and discontinue the high altitude flight.

134. On detecting smoke or unusual smell in the cockpit, close the air-dilution switch on the oxygen apparatus. When flying above 8000 m, descend to an altitude below 8000 m, unpressurize the cockpit gradually and open the velocity head ventilation shutter.

135. Cut off oxygen supply and remove the oxygen mask, after high-altitude flying, at an altitude of maximum 2000 m.

FLIGHT WITH DROP TANKS

136. The aircraft is designed to carry two drop fuel tanks of 400-lit capacity each.

137. Take-off with drop fuel tanks filled to capacity does not differ from that

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without drop fuel tanks, except for the increased length of take-off run, duration of take-off run and take-off speed. Before taking-off, make sure the circuit breaker on the right-hand electric panel bearing the inscription BOMBS (БОМБЫ), is set in the OFF (ВЫКЛЮЧЕНО) position. Cut in twin switch 2В-45, bearing the inscriptions TACTICAL RELEASE (ТАКТИЧЕСКИЙ СБРОС), ARMED (ВЗРЫВАТЕЛИ НА ВЗРЫВ), DROP TANKS (ПОДВЕСНЫЕ БАКИ) on the bomb control panel, and the circuit breaker with the inscriptions EMERGENCY BOMB RELEASE, JETTISONING OF TANKS (АВАРИЙНЫЙ СБРОС БОМБ, СБРОС БАКОВ) on the right-hand electric panel.

138. Flights with drop tanks are performed within the following maximum speed limits:

(a) from H = 0 to H = 4000 m - at an indicated airspeed of 900 km/hr;

(b) from H = 4000 m and above - at a true airspeed of 1000 km/hr.

Maximum permissible load factor with fuel tanks filled to capacity is not to exceed 4.5, and that with empty tanks - 6.5.

The behaviour of the aircraft in the above conditions is similar to that of the aircraft not carrying drop tanks.

139. Fuel consumption from the drop tanks is checked by means of a warning lamp which lights up when fuel is used up completely from the tanks.

Notes: 1. The drop tank warning lamp may light up when fuel in the drop tanks is used up incompletely, with the engine running at a speed less than 5000 r.p.m. If, with the engine speed exceeding 6000 r.p.m., the warning lamp does not go out, it means that fuel has been fully used up from the drop tanks.

2. During continuous flight at high indicated airspeeds and high altitudes, the rate of fuel consumption from the drop tanks is slowed down (with the engine running at combat and nominal ratings at H = 12,000 m, the fuel from the drop tanks will be consumed within 53 - 54 minutes).

140. The landing procedure of the aircraft with two empty fuel tanks of 400-lit capacity each does not differ from that without tanks. If fuel has not been used up from the drop tanks (owing to malfunction of aircraft equipment), it is allowed to perform landing with the filled fuel tanks at a gliding speed of 290 - 300 km/hr.

141. In case one of the drop fuel tanks has been swept off and the automatic tank jettison control unit (АБС) has failed to operate, take measures for jettisoning the other tank. If for some reason or other the second drop fuel tank could not be released, land the aircraft with one drop tank. Landing with one non-jettisoned fuel tank filled to capacity is hampered due to the considerable banking moment towards the non-jettisoned tank; therefore, such a landing requires special attention on the part of the pilot and proportionate deflection of the control stick to the side opposite to the bank (towards the jettisoned tank). The amount of control stick deflection to check the bank, during floating before landing, will increase with the landing speed drop.

142. Crosswind landing with one drop tank filled with fuel will be made into the wind or with the remaining tank being up the wind. When gliding for landing, maintain the following speeds:

(a) with the fuel tank filled with fuel to 50% - 290 km/hr, the landing pattern should be retained normal;

(b) with the tank filled to capacity - minimum 300 km/hr.

Floating and touchdown should be performed at a higher speed than normal.

143. Crosswind landing with the remaining tank being down the wind may be performed only when the fuel tank is filled to not more than 50% and the wind velocity does not exceed 5 m/sec. If this is the case, maintain the gliding speed of not less than 290 km/hr, perform floating and touchdown at a higher speed than normal.

144. Landing with one fuel tank filled to capacity, when a crosswind is blowing from the side of the jettisoned tank, is prohibited.

145. When making approach for landing with one remaining fuel tank, perform turns, if it is possible, to the side of the jettisoned tank at a bank not exceeding 40°.

Note. The amount of fuel left in the remaining tank can be approximately determined by the pilot before making approach for landing by the control stick deflection required for removing the bank. While gliding at an indicated airspeed of 350 km/hr, the amount of control stick movement will be about 1/3 of its full travel with the empty tank, and more than 2/3 of its full travel with the tank filled to capacity.

146. To jettison drop tanks, press the EMERGENCY BOMB RELEASE, JETTISONING OF TANKS (АВАРИЙНЫЙ СБРОС БОМБ, СБРОС БАКОВ) push-button. Fuel tanks may also be dropped by cutting in the tactical release push-button on the control stick, having first switched on the BOMBS (БОМБЫ) circuit breaker on the right-hand electric control panel. While doing so, the drop fuel tank warning lamps will light up. After the tanks are dropped, the warning lamps will go out. The drop of fuel tanks is checked visually.

Fuel tanks are jettisoned at the following indicated airspeeds:

(a) unitized tanks - from 350 to 900 km/hr;

(b) finless tanks - minimum 650 km/hr;

(c) finned tanks - minimum 400 km/hr.

Note. With the tanks dropped, immediately cut off the switches on the bomb control panel bearing the inscriptions TACTICAL RELEASE (ТАКТИЧЕСКИЙ СБРОС), ARMED (ВЗРЫВАТЕЛИ НА ВЗРЫВ), DROP FUEL TANKS (ПОДВЕСНЫЕ БАКИ) to avoid burning of the bomb rack drive solenoid winding.

FLIGHT WITH BOMB LOAD

147. The МиГ-17 aircraft mounts bombing equipment which allows the suspension of two 50-, 100-, and 250-kg air bombs from bomb racks Д4-50 and makes it possible to carry out dive, horizontal and toss (or loft) bombing.

148. The take-off in the МиГ-17 aircraft with suspended bombs does not differ from that performed without bombs. While in flight, the suspended air bombs do not have any noticeable effect on the behaviour and controllability of the aircraft.

149. The maximum permissible speeds of the МиГ-17 aircraft with suspended air bombs are set for conditions of zero vibration, which begins:

(a) at altitudes less than 3000 m - at 870 km/hr IAS;

(b) at an altitude of 4500 to 5000 m - at 935 to 945 km/hr TAS;

(c) at an altitude of 9500 to 10,000 m - at 955 to 965 km/hr TAS.

150. Should vibration appear on the aircraft flying with suspended air bombs at flying speeds less than the maximum permissible ones, stop increasing the airspeed and perform the flight at speeds at which no vibration is observed.

151. Flying the aircraft with one 100-kg air bomb does not practically differ from piloting with two suspended bombs. Piloting and landing with one 250-kg air bomb are similar to piloting and landing with non-expended fuel tanks.

152. Landing with two suspended 100-kg air bombs is no different from that without bombs; landing with 250-kg air bombs is performed in the same way as landing with non-expended fuel tanks.

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NIGHT FLIGHT

153. Start the engine and taxi out the aircraft at night in the usual way. While taxiing the pilot will switch on the taxiing light only for a short time when it is necessary to observe the ground ahead.

Prior to take-off switch off the utility lights. The port ultraviolet lights should be directed to the flight and navigation instruments and the starboard light to the engine control instruments.

154. The take-off procedure is the same as in the daytime. Maintain the direction of take-off run by referring to the light points of the runway. After breaking contact with the ground, increase the speed to 350 km/hr, gradually flying off the ground, and, then, assume climbing attitude.

155. The procedure of flying the aircraft at bright night does not differ considerably from the daytime flying procedure. If the natural horizon is not seen, perform instrument flying.

156. At dark night, the patches of light and the reflection of instruments on the cockpit canopy glass can be eliminated by adjusting the canopy lighting and by changing the position of the blind on the sight bracket inside the cockpit.

157. During approach for landing at night the base leg turn will be executed in the same way as in the daytime. The aircraft will be recovered from the final turn at an altitude of 250 - 300 m.

158. Judgement for landing at night is somewhat more complicated than in the daytime, since at night it is more difficult to determine the distance to the landing Tee by the light reference points.

The pilot should pay special attention to proper approach to the commencement of levelling-off. Levelling-off should be started in the sector lit by floodlights.

159. Landing at night on the runway lit by floodlights presents no particular difficulties; night landing procedure is similar to the daytime procedure.

The aircraft is equipped with a landing light which allows the pilots, well experienced in night flying, to land without ground floodlights. Aircraft landing with a landing light is more complicated and requires special attention and high accuracy of flying technique on the part of the pilot.

160. When landing at night with a landing light without ground floodlights, proceed as follows:

(a) cut in the landing light at an altitude of 100 to 150 m;

(b) maintain at least 9000 r.p.m. down to the levelling-off height, then, smoothly retard the engine control lever full back.

RANGE AND ENDURANCE

161. To increase the range and endurance, fly the aircraft at high altitudes (10,000 to 12,000 m).

162. To obtain a maximum range of flight, maintain the indicated airspeeds given in Table 4 (speeds are equal for cases of flying with drop tanks and without them).

163. Perform climbing at a speed of the highest rate of climb.

Table 4

Speeds and Flying Ranges at Different Altitudes

Flight altitude, m	Indicated airspeed corresponding to maximum range of flight, km/hr	Possible stage distance till emptied tanks (without drop tanks), km	Possible stage distance till emptied tanks (with drop tanks, 400-lit capacity each), km
5000	500 - 600	765	-
10,000	450 - 500	1185	1775 (without tank jettisoning)
12,000	400 - 460	1295	2010 (without tank jettisoning)
12,000	400 - 460	-	2150 (with tank jettisoning)

164. Perform gliding with a retracted landing gear and the engine control lever set on the idle rating stop, at the following indicated airspeeds (either without drop tanks or with them):

from an altitude of 12,000 down to 10,000 m, at 500 km/hr IAS;

from an altitude of 10,000 down to 5000 m, at 550 km/hr IAS;

from an altitude of 5000 down to 500 m, at 650 km/hr IAS.

165. To obtain a maximum endurance, carry out the flight at an indicated airspeed of 300 - 320 km/hr at altitudes indicated in Table 5.

Table 5.

Speeds and Endurance at Different Altitudes

Flight altitude, m	Indicated airspeed corresponding to maximum endurance, km/hr	Block time till emptied tanks (without drop tanks), min	Block time till emptied tanks (with drop tanks, 400-lit capacity each), min
5000	300	88	-
10,000	300	108	160
12,000	300	114	173

Note. When calculating the range and endurance, allowance has been made for fuel consumption, with the engine running on the ground for 5 minutes.

166. After the fuel from the rear tank has been fully used up and the green warning lamp of the fuel transfer pump has flashed up, cut off the circuit breaker of the transfer pump (the pump warning lamp should go out) and continue the flight, checking the remainder of fuel by the fuel quantity gauge.

167. When 300 litres of fuel remain in the front tank, the emergency fuel level red warning lamp will light up. If this is the case, discontinue the flight mission

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and land the aircraft, since the amount of fuel left will last for 10 – 15 minutes of flight with a speed of 500 – 550 km/hr at altitudes of 1000 to 5000 m.

Note. When filling the aircraft fuel tanks with fuel T-2 instead of T-1, the flight range and endurance will decrease by 8%.

ARMAMENT CONTROL PROCEDURE IN FLIGHT

168. Prepare the aircraft sight for firing in the following way:

(a) cut in the SIGHT HEATER (ОБОГРЕВ ПРИЦЕЛА) circuit breaker;

(b) switch on the SIGHT (ПРИЦЕЛ) circuit breaker;

(c) cut in the RADIO-RANGE FINDER (РАДАЛЬ) circuit breaker.

Caution. Do not cut in the radio-range finder until the sight circuit breaker has been switched on.

169. Prior to firing, proceed as follows:

(a) set the sight change-over switch lever in the GYRO (ГИРО) position;

(b) check the sight operation by executing shallow turns; the movable reticle should shift to the side opposite to the turn;

(c) check and adjust the sight reticle illumination.

170. Cut in the armament circuit breaker and the camera gun, and charge the guns, for which purpose press the charging push-buttons of the respective guns in due succession with a 2 to 3-second delay.

The readiness of aircraft weapons for firing is indicated by the red signal lamps located on the bomb armament electric control panel (on aircraft where these are installed).

171. Set the target base (wing span and overall dimensions of air or ground target) on the sight scale.

172. To fire the H-37, aircraft gun press the upper firing button, and for firing the HP-23 guns (or HR-23) press the front push-button by the hinged safety guard. To conduct salvo fire from all the guns, press simultaneously the upper and the front push-buttons (provided the aircraft is equipped with two-button firing control).

173. Provided the aircraft is equipped with one-button firing control, fire is conducted from guns HP-23 and H-37 by one front push-button. Whenever necessary to deliver separate fire (from guns HP-23 or H-37), cut off the respective circuit breaker.

174. Should any of the aircraft guns fail to fire, charge the inoperative gun by pressing the respective charging push-button, then, continue to fire.

If it is impossible to determine which of the port guns has failed, charge both guns.

Note. When conducting salvo fire from aircraft guns, the duration of fire bursts should be determined by gun H-37.

175. After the end of firing, charge the weapons, put the safety guard on the upper push-button, mounted on the control stick, cut off the armament circuit breaker and set the sight change-over lever in the FIXED position (thereby locking the gyroscope).

176. When flying at indicated airspeeds of 720 to 750 km/hr, the aircraft slightly oscillates round its vertical and fore-and-aft axes. These oscillations complicate gun sighting, especially during coordinated turns performed in case of inaccurate run-in. To stop oscillations, press the pedals tightly and change the flying speed, if possible.

177. Before bombing in flight, do the following:

(a) cut in the circuit breaker, as well as the tactical and emergency air bomb release circuit switch;

(b) throw back the bomb tactical release push-button safe guard and press the push button.

With the bomb release push-button pressed, make sure the air bombs have been released, for which purpose check if the warning lamps have gone out. If this is the case, cut off the circuit breakers of aircraft bomb armament.

178. Should the tactical release electric circuit fail to operate, throw back the safety cap of the emergency push-button and press the push-button.

179. Whenever necessary to immediately release air bombs over friendly territory, use the emergency release push-button. In the latter case, the bomb release circuit switch should be cut off (the air bombs will be released at SAFE).

IV. FLIGHT MANEUVERS

GENERAL

180. The MiG-17 aircraft is capable of performing all confidence and aerobatic maneuvers, and vertical maneuvers (half-rolls and diving), with the aircraft entering the half-rolls and diving at maximum level flight speeds from an altitude of 8000 m up to the service ceiling. While performing flight maneuvers, short-time negative G-loads are allowed.

Inverted flight in the MiG-17 aircraft mounting a tank with an inverted flight valve and hydraulic pump "Equipment 623", may be performed during not more than 15 seconds, provided the remainder of fuel in the fuel tanks is minimum 550 litres.

Ascending flight maneuvers should be performed at an engine speed of 11,350 + 50 r.p.m. up to an altitude of 6000 m. The procedure of execution of these maneuvers at an engine speed of 11,560 r.p.m. is the same.

To correct faults, it is allowed to accelerate the engine up to 11,560 r.p.m. in the process of executing of the above maneuvers.

181. To check the correct performance of flight maneuvers (especially above clouds and in conditions of poor visibility of the natural horizon), the pilot can make use of the АГИ-1 gyro horizon, which makes it possible to:

(a) exactly determine the values of the established banks, diving or pitching-up (slipping or climbing) angles, and check them during the flight;

(b) check the coordinated movements of the control surfaces when entering the flight maneuver, in the process of their execution, and when recovering the aircraft to level flight;

(c) determine the aircraft attitude in space relative to the natural horizon and recover the aircraft to level flight;

(d) determine the errors (banks, slipping, uncoordinated handling of controls), especially when carrying out vertical flight maneuvers.

Note. While performing an oblique loop or crossing the horizon line at a climbing or diving angle in excess of 80°, the spherical scale of the gyro horizon rotates through 180°. As a result, at the above angles the АГИ-1 gyro horizon cannot be used to check the bank.

182. Execute all flight maneuvers with the elevator trim tab in the neutral position. While performing the maneuvers, the pulling forces, as a rule, will be applied to the control stick, irrespective of the kind of maneuver executed.

183. While performing flight maneuvers at medium altitudes with high values of G-loads at high altitudes with comparatively small G-loads (3.5 to 4.5), the

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[redacted]

phenomena characteristic of critical angles of attack (wing-to-wing rolling and warning vibration before entering a spin), are likely to occur. If this is the case, release the pressure applied to the control stick until rolling and heavy vibration disappear (slight vibration can be tolerated, making full use of the aircraft maneuverability). While piloting on the verge of prestall vibration, the aircraft has a sufficient G-tolerance margin before entering a spin.

184. While carrying out half-rolls and dives at altitudes above 5000 m, with the aircraft entering the maneuver at maximum level flight speed, the speed limitations cannot be exceeded; therefore, the pilot may not watch the speed indicator readings but should watch the altimeter readings.

185. While performing descending vertical maneuvers (half-rolls and divings), the speed and altitude indicators mounted in the aircraft cockpit read the values of speed and altitude which are considerably higher than actual ones at the given moment of flight, owing to the delay in transmitting static pressure from the pitot-static tube to the instruments, and the error in measuring the amount of static pressure by the pitot-static tube. The delay in transmitting static pressure from the pitot-static tube normally takes place at a sufficiently high vertical speed.

The maximum delay values are obtained at the vertical section of half-rolls and dives entered at an altitude of 14,000 m when the difference between the instrument readings and the actual values can reach 80 to 120 km/hr (in TAS) and 800 to 1000 m (in altitude).

At close-to-sonic and sonic speeds the pressure in the pitot-static tube deviates from the actual value. The instrument reading correction involved by this error, i.e. the "wave correction", makes up 20 to 30 km/hr TAS.

If the speed indicator readings during descending vertical flight maneuvers equal or exceed the limitations specified for the given aircraft, it does not mean at all that the aircraft has reached or exceeded the speed limit.

Permissible increase of speed indicator readings as compared to the actual speed values of the aircraft for each of the vertical flight maneuvers are indicated in the description of the flying technique of these maneuvers.

186. To speed up the entry into the flight maneuver, accelerate or decelerate the aircraft not in level flight but in descent or climb, respectively, with speed brakes extended.

While performing flight maneuvers involving the descent of the aircraft (after the half-roll or during the second half of the loop, etc.), start increasing the engine speed at diving angles not in excess of 30° (depending on the diving speed), so as to enter the vertical maneuver from level flight, with sufficient speed available for carrying out the maneuver at the prescribed engine speed.

187. Pilots will be admitted to carry out flight maneuvers at high altitudes and high-speed half-rolls or dives, with the aircraft entering the half-roll or dive at maximum level flight speed, only after they have mastered flying maneuvers at normal speeds and medium altitudes.

188. While performing flight maneuvers with maximum speed at low, medium and high altitudes, bear in mind the specific features of the aircraft on which the flight maneuver is being executed (the speed of commencement of spontaneous banking).

189. The following flight maneuvers are not allowed to be performed in the MiG-[illegible] aircraft in accordance with the aircraft speed limitations:

(a) half-rolls and vertical dives, with the aircraft entering the half-roll or dive at maximum level flight speed at altitudes below 8000 m;

(b) diving with the engine running at combat rating when the aircraft is entered into a dive from a half-roll at a maximum level flight speed.

190. While recovering from vertical flight maneuvers (zooms or ascending rolls), with the amount of fuel in the fuel tanks being less than 500 - 900 litres and G-loads close to zero (from +0.1 to -0.5) acting during more than 1 second, the fuel system of the aircraft does not ensure reliable supply of fuel to the engine. Therefore, while recovering the aircraft from vertical flight maneuvers, avoid close-to-zero G-loads (from +0.1 to -0.5) of more than 1-sec duration.

BANKED TURN

191. To properly perform the banked turn, set the specified speed before entering the banked turn and, then, enter the maneuver by applying coordinated pressure to the control stick and pedals, simultaneously increasing the engine speed up to the maximum value.

Check the execution of the banked turn by the turn-and-slip, speed, and rate-of-climb indicators.

Recover the aircraft from the banked turn by coordinated movement of the control stick and pedals, simultaneously decreasing the engine speed so as to assume level flight attitude without changing the flying speed.

192. The aircraft is stable in the banked turn. In the process of the banked turn execution, considerable pulling forces (at a normal speed of balancing) appear on the control stick.

193. There is no difference in execution of the right-hand and left-hand banked turns.

194. High-altitude banked turns up to 30° can be executed at all speeds up to maximum one. The banked turn procedure at maximum speeds is the usual one, but in the latter case considerable elevator and rudder forces appear on the controls.

195. If excessive pressure is applied to the control stick during the banked turn, the aircraft begins to vibrate and, then, to roll. With further pulling of the control stick, the aircraft energetically recovers from the bank and performs a descending roll in the direction of the banked turn. Applic[illegible] of back stick pressure stops the rolling and rotation of the aircraft around the fore-and-aft axis and the aircraft enters a gentle diving.

If the aircraft starts rolling while performing the banked turn, decrease back pressure on the control stick, until the rolling stops.

196. Perform an optimum banked turn at a 65 to 70° bank, with the engine running at combat rating and the indicated airspeeds specified in Table 6 below.

Table 6

Indicated Airspeeds and Duration of Optimum Banked Turn (65 to 70° bank) at Different Altitudes

Altitude, m	Indicated airspeed, km/hr	Duration of banked turn, sec
2000	470 - 500	-
[illegible]	450 - 480	32 - 35
[illegible]	[illegible]	56 - 60

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When flying at altitudes above 10,000 m, perform banked turns at an indicated airspeed of minimum 350 km/hr.

FIGURE EIGHT

197. The procedure of execution of the figure eight is similar to that of the banked turn.

The change from one direction of banked turn to the other should be performed by continuous and coordinated movement of control stick and pedals, with the position of the engine control lever being unaltered. While changing from one turn to the other, watch the rate-of-climb indicator and altimeter to see that the flight altitude is properly maintained.

CHANDELLE

198. Carry out the chandelle at combat or normal rating of aircraft engine with flying speeds not in excess of the maximum permissible level flight speeds.

199. Before entering the chandelle, accelerate the engine up to the maximum (normal) rating, speed up the aircraft to the given speed and, then, by smoothly applying back pressure to the control stick in the direction of the chandelle and by simultaneously slightly pressing the pedal into the same direction, start climbing on upward spiral with an initial bank of 5 to 10°, taking care not to exceed 65 - 70° bank at the end of the second third of the chandelle.

After the aircraft has turned through 140 - 150°, the bank and climb angles should be gradually decreased by simultaneously moving the control stick forward and into the reversal of the turn, and pressing the pedal into the same direction, coordinating the movement of the controls in such a way as to recover the aircraft from the chandelle into a level flight at the heading which is exactly 180° from the original heading and at a speed of 350 km/hr.

200. Overcontrolling with the stick during the chandelle will result in vibration and wing-to-wing rolling of the aircraft which serves as a warning that the aircraft approaches critical angles of attack and may develop spin entry speed. If this is the case, stop the vibration of the aircraft and ease on the control stick until the rolling of the aircraft disappears.

201. While performing the chandelle, with the aircraft entering the maneuver at an altitude of 5000 m at maximum level flight speed and recovering from it at a speed of 350 km/hr, the aircraft gains 2500 to 3000 m of altitude.

202. If the chandelle is to be performed within minimum length of time, irrespective of the amount of altitude gain, bank the aircraft at 15 - 20° on reaching the given airspeed and, energetically moving the control stick backward, execute the first half of the oblique loop. At the top of the chandelle, when the aircraft attitude is close to the inverted one, which corresponds to the aircraft turn through 160 - 165° from the original direction of flight, and the aircraft nose is 10 - 15° above the horizon, start rolling the aircraft level, by applying coordinated control stick and pedal into the reversal of the turn. During the recovery, the aircraft will continue to turn and intercept the heading which is exactly 180° from the original heading.

When the aircraft assumes the level flight attitude, set the controls in the central position. The recovery speed should be at least 350 km/hr IAS.

HALF-ROLL

203. The half-roll can be performed at all altitudes from 2000 to 14,000 m. Depending on the altitude, the half-roll entry speed (IAS) must be:

- at altitudes from 2000 to 3000 m – 350 km/hr;
- at altitudes from 5000 to 8000 m – 300 to 600 km/hr;
- at altitudes from 5000 to 10,000 m – 300 to 500 km/hr;
- at altitudes from 10,000 to 12,000 m – 300 to 400 km/hr;
- at altitudes from 12,000 to 14,000 m – 300 to 350 km/hr.

Carry out the half-roll at the beginning of training in flying technique within the given flight zone at altitudes of 3000 to 5000 m, with the engine running at idle rating.

204. As the aircraft flies level, before entering the half-roll, set the original speed which corresponds to the altitude of flight, assume pitching angle of 10 - 15° by applying back pressure to the control stick, then, deflect the control stick and pedal into the desired half-roll so as to attain the wheels-up position within 2 - 3 seconds. With the aircraft turning to the wheels-up position, pull the engine control lever all the way back.

When the aircraft is in the wheels-up position, stop the aircraft rotation by coordinated movement of the control stick and pedal and, without fixing the aircraft in this position, smoothly apply back pressure to the control stick so as to recover the aircraft from the dive and to assume level flight attitude at an indicated airspeed of 550 - 650 km/hr.

During the recovery of the aircraft from the dive the control forces on the stick are always the pulling forces.

205. During the recovery of the aircraft from the dive, do not allow excessive or slow pulling of the control stick.

Overcontrolling with the stick results in vibration and, then, in wing-to-wing rolling of the aircraft. If this is the case, slow down the rate of the control stick backward movement until rolling stops and, then, smoothly pull the aircraft out to level flight. Recovering the aircraft from the half-roll under slight vibration conditions, especially at high altitudes, will decrease the loss of altitude and G-load and result in a lesser rate of speed increase.

A too slow rate of the control stick pull results in a rapid increase of speed, involving considerable growth of forces on the control stick and great loss of altitude. If this is the case, recover the aircraft by more energetic pulling of the control stick without allowing the aircraft to roll.

206. The altitude loss during the half-roll, when the aircraft enters the maneuver without application of the speed brakes at varying speeds and altitudes is given in Table 7.

Table 7

Altitude Loss during Half-Roll, when Aircraft Enters Maneuver without Application of Speed Brakes at Varying Speeds and Altitudes

Entry altitude, m	Entry speed (IAS), km/hr	Loss of altitude during half-roll, m	Recovery speed (IAS), km/hr	Maximum G-load during recovery
1	2	3	4	5
2000	350	1150	550	5.0 - 6.5

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1	2	3	4	5
3000 5000 5000 5000 5000 5000	350 350 450 500 550 600	1400 1500 1700 1900 2100 2300	540 600 650 700 750 800	5.0-6.5
8000 8000 8000 8000 8000 8000 8000	300 350 400 450 500 550 600	2200-2400 2300-2500 2400-2600 2500-2700 2600-2800 2700-2930 2800-3000	600 650 700 750 800 850 900	4.5-6.5
10,000 10,000 10,000 10,000 10,000	300 350 400 450 500	2500-2700 2700-2900 2900-3100 3100-3300 3300-3500	600 640 680 720 760	4.0-5.0
12,000 12,000 12,000	300 350 400	2800-3100 3000-3300 3200-3500	650 680 720	3.5-4.5

From an altitude of 8000 to 14,000 m the half-roll may be performed with speed brakes applied and the aircraft brought into the maneuver at maximum level flight speed. At altitudes from 10,000 to 14,000 m, with the aircraft entering the maneuver at maximum level flight speed, the half-roll may be performed without applying the speed brakes.

207. While performing the half-roll, with the aircraft entering the maneuver at maximum speed and the speed brakes applied, speed up the aircraft at the prescribed altitude (at minimum 8000 m) up to the maximum level flight speed, then, set the speed brakes change-over switch for extension. After the speed brakes extension signal lamp has lit up, perform the half-roll by deflecting the ailerons and rudder.

During the aircraft roll, pull the engine control lever all the way back.

At the moment the aircraft assumes the wheels-up position pull the control stick to recover the aircraft from the half-roll.

Depending on the altitude at which the aircraft enters the half-roll, the pilot should proceed as follows:

(1) When performing the half-roll from an altitude of 8000 m, pull the control stick with a force of 8 - 10 kg. While doing so, the aircraft reduces its speed in spite of the altitude loss and assumes a flight attitude involving considerable vibration at G-load of 4.0 - 4.5. The vibration discontinues at a negative diving angle of 45 to 50°, after which the pulling forces applied to the control stick should be increased up to 13 - 15 kg.

With the forces applied to the control stick retained, at the end of the pull-

out when the angle of dive is 25 to 30°, the aircraft experiences a slight vibration which increases with the decrease of the diving angle and flying speed. In the latter case, the forces applied to the control stick should be gradually decreased for recovering the aircraft on the verge of vibration.

If more energetic pull-out is required, the aircraft can be recovered from the half-roll with considerable vibration. When the pedals are in the neutral position, the vibration of the aircraft does not result in a stall.

The maximum speed during the recovery from the half-roll should not exceed the speed at which the aircraft enters the half-roll. The loss of altitude during the half-roll amounts to 3000 - 3500 m.

(2) While entering the half-roll from an altitude of 10,000 m, energetically move the control stick backward to about 1/3 of its full travel with a force of 10 - 15 kg. In this case, the aircraft starts vibrating as in case of a half-roll entered from 8000 m, but the G-load does not exceed 3.0 to 3.5.

After moving the control stick backward, the flying speed decreases but at a slower rate than in case of a half-roll entered from 8000 m. As the aircraft approaches the vertical section of the dive increase the pulling forces on the control stick up to 20 - 25 kg, and the vibration of the aircraft should stop. The aircraft flying speed at the dive vertical section increases reaching its maximum value 1100 - 1130 km/hr (as read by the narrow indicator pointer).

After passing the dive vertical section at angles of 70 to 60°, the value of G-load increases, and if the forces applied to the control stick are not decreased, the aircraft flying at a diving angle of 35 to 30° approaches the conditions of slight vibration.

Pull out the aircraft on the verge of vibration. The loss of altitude during the half-roll makes up 4000 - 4500 m.

(3) In carrying out the half-roll from 12,000 m, move the control stick backward by about 1/3 of its full travel with a force of 20 to 25 kg. The value of G-load at the beginning of the half-roll makes up 2.5 to 2.7.

With the diving angles close to 90°, the forces applied to the control stick should be increased up to 30 to 35 kg, thereby increasing the G-load up to 3.0 - 3.5.

After the aircraft has passed the vertical section, the G-load gradually increases even when the forces on the control stick are slightly decreased, and when the aircraft is 30 to 25° short of the level flight attitude, it starts slightly vibrating. The aircraft should also be recovered on the verge of vibration.

The maximum speed of the aircraft during the half-roll amounts to 1170 - 1180 km/hr (as read by the thin pointer) at an altitude of 9000 m. The loss of altitude during the half-roll makes up 4500 - 5000 m.

(4) While performing the half-roll from an altitude of 14,000 m, energetically move the control stick backward to about 1/3 of its travel. The forces on the control stick (after moving it back) increase at a lower rate than in half-rolls performed from lower altitudes.

As the aircraft approaches the half-roll vertical section, with the position of elevator being unaltered, the value of G-load makes up 2.0 - 2.4 and the forces on the control stick increase from 10 to 25 kg.

After passing the vertical section of the half-roll, the G-load increases even when the pulling forces on the control stick are decreased, and when the aircraft is 25 to 30° short of the level flight attitude, it starts slightly vibrating as in [illegible] other half-roll maneuvers. The maximum speed at an altitude of about 11,000 m [illegible] by the thin pointer). The actual speed while per-

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maneuver is performed at positive angles of attack, and the other – at negative angles of attack) and the pilot experiences varying G-load effects.

To perform the slow roll, establish level flight condition at 600 km/hr IAS, assume 15 – 20° nose-up attitude and, after fixing this attitude, smoothly applying the control stick into the roll, rotate the aircraft round its fore-and-aft axis, facilitating the rotation by pressing the pedal also into the roll. When the aircraft reaches 67° bank point, slightly push the control stick to prevent the aircraft from yawing and simultaneously ease on the pedal applied into the roll, at the same time holding the aircraft from nose-dropping by the reverse pedal.

On reaching the 90° point, keep moving the control stick backward so that, with the aircraft in the wheels-up position, the aircraft nose is 10 – 15° above the horizon; while doing so, gradually decrease pressure on the reverse pedal. With the aircraft in the wheels-up position, the pedals should be neutralized. On reaching the 225° point, press the pedal into the roll to prevent the aircraft from nose-dropping (the maximum pressure applied to the pedal should be at a bank of 90°), then, gradually ease on the pedal so as to set the pedals in a neutral position by the end of the roll.

After the aircraft has reached the 270° point, gradually move the control stick forward to prevent the aircraft from nose-dropping.

With the aircraft nearing the level flight attitude, set the controls for recovery and, after the aircraft has stopped rotating, set them neutral.

DOUBLE (MULTIPLE) HORIZONTAL ROLL

215. Double (multiple) horizontal rolls are a combination of two (or more) rolls. The MiG-17 aircraft may be used for carrying out both snap and slow controlled double (multiple) horizontal rolls. The speed at which the aircraft is brought into the double horizontal roll at medium flight altitudes should be at least 600 km/hr. The flying technique used in performing multiple horizontal rolls is similar to that used when executing single rolls.

LOOP

216. The loop is entered at a speed of 680 km/hr.

Before entering the loop, set the assigned speed and, then, apply back pressure to the control stick to assume climbing attitude and, without releasing back pressure on the control stick, keep the aircraft on the curved trajectory in the vertical plane (the control forces on the stick may be considerable).

Pull the control stick so as to ensure nearly constant rate of aircraft rotation (angular velocity) and a speed of 300 to 350 km/hr by the moment the aircraft assumes the wheels-up position. While executing the loop, check the aircraft bank, since the bank results in the loop being performed not in one plane.

At the top of the loop, when the aircraft nose reaches the horizon, smoothly decrease the engine speed down to the idle one; the procedure of diving and recovery of the aircraft to level flight is the same as during half-roll execution.

217. For training purposes, the loop must be performed at altitudes of 1500 to 6000 m. If the pilot is properly trained, the normal loop may be performed from an altitude of 7000 m, with the speed at the top of the loop being 300 km/hr.

218. While performing a loop at high altitudes, with the aircraft entering the maneuver at reduced speeds and the movement of the control stick during the first half of the loop being slow or too brisk, the aircraft may lose its speed 30 – 40° before reaching the top of the loop. In these cases, the pilot should [illegible] the control stick until the aircraft drops its nose and starts diving. Increase the engine speed only after the aircraft has dropped the nose through 20 – 30° below the horizon. Keep the pedals strictly neutral.

OBLIQUE LOOP

219. If before entering the normal loop the pilot establishes 40 to 45° bank relative to the horizon and performs the loop, maintaining the established bank throughout the maneuver, the aircraft will describe a closed curve in a plane inclined to the horizon. This maneuver is called the oblique loop.

220. The procedure of execution of the oblique loop is mainly the same as that of the normal loop, though during the execution of the former the pilot must be particularly accurate with the controls and maintain the established bank throughout the oblique loop.

It must be taken into consideration that the main problem consists in maintaining the established bank when the aircraft approaches the loop top and, especially, when the latter is being passed. With the aircraft in the wheels-up position, when the habitual idea of ground and horizon is reversed, the pilot should be able to determine and maintain the bank of the aircraft relative to the constant horizon line and, consequently, at the top of the loop the port wing of the aircraft should be dropped relative to the horizon during the left-hand bank (when the oblique loop was entered with the left bank), while the starboard wing should be raised.

After the aircraft has assumed diving attitude, press the pedal to the side opposite to the bank to retain the direction of flight during recovery. When returning the aircraft to level flight, remove the bank and, gradually decreasing the deflection of the pedals, set them neutral. During execution of the second half of the oblique loop, do not let the aircraft rotate round its fore-and-aft axis, especially in the direction of the bank increase, since this may result in the aircraft changing into the tight spiral.

221. During the initial execution of the oblique loop, the latter must be entered with a bank not exceeding 20°. The altitudes and speeds of the oblique loop entry are similar to those of normal loop entry.

If the pilot is not confident of correct execution of the first half of the oblique loop, he must remove the bank by deflecting the ailerons and perform the second half of the normal loop.

LOOP AND ROLL-OFF

222. Enter the loop and roll-off at a speed of 700 km/hr. The procedure of execution of the loop and roll-off first half is the same as that of the first half of the loop.

With the aircraft in the wheels-up position at the top of the loop and roll-off (the flying speed should be 300 – 350 km/hr), move the aircraft through 180° round its fore-and-aft axis (thereby performing the half-roll), for which purpose simultaneously apply the control stick and pedal into the desired roll.

The rate and amount of control stick movement should be such as to turn the aircraft within 2 – 3 seconds.

After the aircraft has reached the 90° point of the turn round the fore-and-aft axis move the control stick into the roll and at the same time somewhat forward to maintain directional control and decrease the angle of attack to prevent loss of speed.

The moment the aircraft returns to level flight, stop the rotation of the aircraft. After the rotation of the aircraft has stopped, decelerate the engine.

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223. If the speed is less than 300 km/hr, when the aircraft is in the wheels-up position, the pilot must perform the normal loop. In this case he should not attempt to execute the loop and roll-off as the aircraft may develop spin when the pedals are used at low speed.

224. When the loop and roll-off is performed from an altitude of 5000 m, the aircraft gains an altitude of 2000 - 2500 m.

225. For training purposes the initial altitude for execution of the loop and roll-off must not exceed 6000 m.

226. When the loop and roll-off is entered at a speed exceeding 700 km/hr, the pilot smoothly applies back pressure to the control stick at the beginning of the maneuver entry so that the aircraft speed at the top of the loop and roll-off is not more than 400 km/hr.

ZOOM

227. The zoom should be entered at a speed not exceeding the maximum level flight speed at the given altitude.

The zoom can be performed at various angles of climb including vertical climbing.

The pilot recovers the aircraft from the zoom by performing the turn. To recover the aircraft, establish a bank and, then, by applying coordinated pressure to the control stick and pedal enter the turn assuming noseheavy attitude. The aircraft can also be recovered by changing it to a banked turn.

228. The zoom recovery speed should be minimum 400 - 450 km/hr if the angles of climb are 60 to 80°, and 350 to 400 km/hr if the angles of climb are less than 60°.

229. The altitude gain in the zoom depends on the speed, angle of climb and zoom entry altitude.

HAMMERHEAD STALL

230. The zoom is entered at a speed not exceeding the maximum level flight speed at the given altitude.

To perform the hammerhead stall, apply back pressure to the control stick, and the aircraft to climb at an angle of 60 - 70° to the horizon and maintain this attitude until the speed decreases down to 450 km/hr. At this moment, apply smooth coordinated pressure to the pedal and control stick, without changing the angle of climb, enter the turn, i.e. press the pedal into the turn and at the same time apply pressure to the control stick to establish a bank into the turn. The bank should not exceed 20°.

With the movement of pedals increasing, deflect the control stick slightly back to keep the aircraft in the plane of turn. After the aircraft nose has dropped through the horizon, decelerate the engine, planning to obtain the minimum engine speed by the moment the aircraft starts diving. The aircraft must be brought into a dive at an angle equal to the angle of climb.

Pull out the aircraft at a speed of 400 km/hr.

Altitude loss from the top of the hammerhead stall to the moment the aircraft returns to level flight, makes up 700 to 900 m.

90° AND 180° ASCENDING AND DESCENDING ROLLS

231. Ascending and descending rolls of the aircraft are allowed at a flying speed up to the maximum permissible one and at all flight altitudes ensuring safety of aircraft recovery from the dive after performing the descending roll.

The mastery of aircraft rolls round the fore-and-aft axis should be started with practising 180° descending rolls, then, 90° rolls at diving angles of 60 to 70° and rolls in vertical diving. Having mastered the descending rolls, pass over to practising ascending rolls in the same sequence. During the first period of training in 90 and 180° rolls, practise diving after the half-roll or the second half of the loop, zoom, loop and loop and roll-off, with the aircraft brought into the above maneuvers at normal speeds. Then, perform ascending and descending rolls in combination with the other flight maneuvers at increased speeds and high altitudes.

To perform 180° or 90° roll in the dive, apply brisk forward pressure to the control stick, fix the given angle and roll the aircraft round its fore-and-aft axis through 180 or 90° by coordinated and energetic movements of the control stick and pedals into the desired roll and, when the aircraft is 10 to 15° short of the preset recovery reference point, stop rotating. Check the altitude and speed and recover the aircraft from the dive.

The flying technique of 180 and 90° rolls at climbing angles up to 90° is no different from that used in diving rolls. Rolls through 90° can be properly performed only on a vertical straight-line with an angle of turn equal to 90°. At the beginning of the roll, the flying speed should be minimum 550 km/hr. The aircraft may be recovered from the 180° or 90° roll to any flight attitude or maneuver, depending on the flying speed.

To ensure accurate performance of 180° and 90° rolls at climbing angles of up to 60 - 70°, the pilot should make use of typical ground reference points which must be clearly visible on the sky line (ground). To determine the amount of roll at climbing angles of 60 to 70°, the pilot should make use of the sun and separate clouds (if possible). He should also be able to determine the amount of aircraft roll by the rate of roll within a fixed time limit.

VERTICAL REVERSEMENT

232. The vertical reversement is executed at all altitudes from 2000 to 10,000 m. The speed at which the aircraft enters the vertical reversement may be from 600 km/hr up to the maximum permissible level flight speed.

For training purposes the vertical reversement will be entered from an altitude of 4000 to 6000 m with the zoom entry speed of 600 to 650 km/hr. Vertical reversements from an altitude below 4000 m or above 6000 m, with the zoom entry speed of more than 650 km/hr, are allowed to be performed only by those pilots who have mastered flying technique in the given type of aircraft to perfection.

Before entering the maneuver, the pilot sets the engine at normal rating, speeds up the aircraft in level flight up to the given speed and, by smoothly applying back pressure to the control stick, sends the aircraft into climb the angle of which depends on speed excess. Thus, with the aircraft entering the zoom at a speed of 600 to 650 km/hr, the angle of climb should be 40 to 45°.

Having gained a speed of 450 to 400 km/hr in the zoom smoothly apply the aircraft controls into the desired direction to roll the aircraft round its fore-and-aft axis through 180° (thereby making a half-roll) and after the aircraft nose has ap-

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reached the horizon, decelerate the engine r.p.m. to the minimum ones, send the aircraft into dive by applying back pressure to the control stick, and, then, return the aircraft to level flight.

If the zoom is entered at a speed close to the maximum permissible one, and the angle of climb equals 60 - 90°, the pilot should start 180° turn of the aircraft round its fore-and-aft axis at a speed of 550 to 500 km/hr and assume the wheels-up position planning to obtain a speed of not less than 300 km/hr at the top of the vertical reversement, when the aircraft nose is level with the horizon line.

540° ASCENDING ROLL

233. The 540° ascending roll is a combination of an ascending single roll with a half-roll performed for the subsequent inverted flight or for sending the aircraft into a dive.

Depending on the speed at which the aircraft enters the zoom, the 540° ascending rolls may be performed at angles of climb up to 60°. The ascending roll flying technique is the same as that of the controlled horizontal roll.

While mastering aerobatic maneuvers, perform 540° ascending rolls at angles of climb up to 45°. Before entering the flight maneuver, set the engine at nominal rating and assume climbing attitude at a speed of up to 700 km/hr and an altitude of minimum 1500 m.

As soon as the airspeed of 600 km/hr is reached at the preset climb angle, use short coordinated movement of the controls to perform the 540° roll. With the aircraft flying in the wheels-up position, stop the aircraft rotation and, at a speed of 380 km/hr apply back pressure to the control stick to recover the aircraft from the roll.

If, with the aircraft in the wheels-up position, the flying speed exceeds 300 km/hr, slow down the rate of control stick backward movement, decrease the engine speed and extend the speed brakes.

MULTIPLE ASCENDING ROLL

234. Multiple ascending rolls may be performed at climbing angles from 30 to 60° and at flying speeds up to the maximum permissible one. The larger the climbing angle, the higher should be the roll entry speed. The minimum roll entry speed should be not less than 700 km/hr, while the recovery speed must be minimum 400 km/hr.

The peculiarity of multiple ascending rolls consists in the fact that, with the increase of the angle of climb and, consequently, of the roll entry speed, the movement of the rudder should be less than in performing horizontal rolls; to retain a constant angle of climbing in the process of performing each of the series of rolls, it is necessary to apply forward pressure to the control stick, while in the wheels-up position, and move it back when recovering the aircraft from the roll.

After executing a series of ascending rolls, send the aircraft into a turn, banked turn, half-roll, etc., depending on the recovery speed.

VERTICAL FIGURE OF EIGHT

235. The vertical figure of eight is a combination of two loops combined by ascending and descending 180° aileron rolls.

While executing the vertical figure of eight, with the aircraft rolling round the fore-and-aft axis in the ascending maneuver, the speed at which the aircraft is brought into each loop should be 50 km/hr higher than the speed prescribed for

executing a normal loop, while the aileron roll should be performed at the end of the first quarter of each loop, i.e., when the aircraft is at a climbing angle of 80 to 90°.

When performing a vertical figure of eight, with the aircraft rolling in the descending maneuver, the speed at which the aircraft is brought into each loop should be normal, while the aileron roll must be executed at the end of the third quarter of each loop, i.e., when the aircraft is descending at a close-to-vertical diving angle.

HALF-LOOP AND ROLL

236. To perform the half-loop and roll, set an airspeed of 750 km/hr and send the aircraft into a climb as in executing the normal half-loop.

As the aircraft nose nears the top of the half-loop (15 to 20° short of the horizon), check the speed and, with the indicated airspeed of minimum 400 km/hr, roll the aircraft in the desired direction by coordinated movement of the control stick and pedal. After executing the half-loop perform a horizontal roll without changing the position of the controls. If, at the top of the half-loop, the speed is less than 400 km/hr, do not perform the roll but end the maneuver in normal half-loop.

ASCENDING DOUBLE CHANDELLE

237. The ascending double chandelle is a combination of the first half of a chandelle with the ascending half-roll performed in the same direction, and the second half of the chandelle performed in the opposite direction.

The aircraft may be brought into a double ascending chandelle at all altitudes and flying speeds up to the maximum permissible one.

Accelerate the aircraft at the given altitude to the required speed and send it into an ascending spiral, with an initial bank of 40°, by coordinated movement of the controls.

At the moment the aircraft has turned through 90° from the direction of the maneuver entry, stop the angular rotation of the aircraft without changing the angle of climb and, applying coordinated movement of the control stick and pedals, perform a controlled 180° roll into the back.

As soon as the aircraft reaches the opposite 50 to 60° bank, stop the aircraft rolling and continue the ascending turn up to 90° in the new direction. The recovery of the aircraft from the second half of the ascending chandelle should be finished at a speed of minimum 350 km/hr.

DIVE

238. Due to considerable loss of altitude and rapid increase of speed when pulling the aircraft out of the dive, maintain the following dive angles at altitudes above 2000 m:

(a) when the engine is running at minimum speed, with the speed brakes applied - up to 70°;

(b) with the engine running at minimum speed, without applying the speed brakes - 60°;

(c) with the engine running at increased speed (up to the normal rating) without applying the speed brakes - up to 50°.

239. Enter the dive from altitudes minimum 2000 m with the engine running at the minimum speed and dive angles not exceeding 45°.

240. The minimum dive entry altitude at an angle of 45° equals 1000 m.

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241. The dive may be entered from turn, half-roll or straight flight. The least altitude lose and speed growth during the entry will be obtained when the dive is entered from turn.

Do not enter the dive from a half-roll at altitudes less than 3000 m.

242. Enter the dive at an indicated airspeed of 350 km/hr.

243. When flying at altitudes above 5000 m, the aircraft may be brought into the dive at increased airspeeds:

(a) from an altitude of 5000 to 8000 m - at an indicated airspeed of up to 500 km/hr;

(b) at altitudes above 8000 m - at all level flight speeds up to the maximum one.

244. When diving, check the airspeed at altitudes above 5000 m by the altitude indicator readings, and at altitudes less than 5000 m - also by the speed indicator readings.

245. Start the dive recovery in such a way that the pull-out speed would not exceed the maximum permissible value.

246. Pull out the aircraft by energetic backward movement of the control stick, without allowing the aircraft to roll. If rolling is observed, slightly decrease the pulling forces on the control stick and continue to pull the aircraft out of the dive after the rolling has stopped.

247. During the dive, watch the horizon and the ground reference points to prevent the aircraft from rotating round its fore-and-aft axis.

248. Should the aircraft start rotating round its fore-and-aft axis during the diving maneuver, apply coordinated movement of the control stick and pedals to stop rotation, remove the bank and recover the aircraft from the dive.

249. If the rotation of the aircraft round its fore-and-aft axis has not been stopped when recovering the aircraft from the dive, the spiral bank and angular rotation will increase. This is normally accompanied by rapid buildup of speed and considerable loss of altitude.

250. In case of steep diving, with the aircraft rotating round its fore-and-aft axis, or when performing a tight spiral, start recovering the aircraft at an indicated airspeed not exceeding 900 km/hr, keeping in mind that the speed gain during the pullout may be up to 50 km/hr.

The dive recovery at speeds exceeding the above-indicated speed becomes more complicated due to the following reasons:

(a) reduced aileron efficiency, which calls for considerable deflection of ailerons and longer time for rotation stopping;

(b) effect of aircraft banking (when the aircraft rotates in the direction of the bank);

(c) necessity of applying considerable pressure to the control stick to build up G-load, which hampers energetic recovery, with simultaneous maximum use of ailerons for stopping the rotation of the aircraft.

251. When flying at altitudes above 11,000 m, in case of sudden unpressurizing of the cockpit or failure of the engine at an altitude of above 11,000 - 10,000 m, it is allowed to descend at maximum speed to reduce the descending time.

While doing so, bear in mind that a considerable rate of descend is gained during the dive with the engine running at low speed and the speed brakes applied. In emergency cases dive from high altitudes will be performed as follows:

(a) apply the speed brakes and bring the aircraft into the dive at an angle of 30 to 40°;

(b) shift the engine control lever to low speed;

(c) on reaching the given dive angle, keep it constant;

(d) after gaining an altitude of 11,000 - 10,000 m, smoothly move the control stick backward to pull the aircraft out without allowing it to bank. The efforts applied to the control stick during the pullout, may reach considerable values, however, the aircraft pulls out reliably.

VERTICAL DIVES

252. Vertical dives both with the speed brakes used and without them are allowed from altitudes of 12,000 m and above at all speeds up to the maximum level flight speed.

Bring the aircraft into the vertical dive at the maximum level flight speed by performing the half-roll. While rolling the aircraft over to the wheels-up position, pull the engine control lever all the way back. The behaviour of the aircraft, when approaching the vertical section of the dive is the same as in performing half-rolls.

253. To keep the aircraft in the vertical dive, move the control stick forward, checking the position of the aircraft by the horizon or by ground reference points.

254. The efforts required for holding the aircraft in vertical dive, with the speed brakes applied, increase with the increase of diving speed. When the dive is entered at maximum level flight speed at an altitude of 14,000 m, the speed of the aircraft at an altitude of about 10,000 m reaches its maximum value of 1240 to 1250 km/hr (as read by the thin pointer of the speed indicator), with the pressing forces on the control stick equal to 30 - 40 kg. If the above forces are retained on the control stick, the pilot is unable to keep the aircraft in the vertical dive. In spite of the large pressing forces on the control stick, the aircraft gradually decreases the diving angle down to 70 - 75° before it reaches an altitude of 8000 m and reduces the speed to 1220 km/hr (as read by the thin pointer).

255. Start the vertical dive recovery, with the speed brakes applied, at an altitude of 8000 m (as read by the altimeter). To recover the aircraft, energetically move the control stick back with an effort of 20 to 25 kg.

In this case, the aircraft pulls out at an altitude of above 5000 m without reaching the flight conditions at which banking is likely to be observed.

256. While at the vertical dive section of the manouver performed with the speed brakes applied, from an altitude of 14,000 m, with the aircraft brought into the dive at maximum level flight speed, the aircraft responds too slowly to longitudinal (pitch) control.

Though the pressing force on the control stick does not exceed 20 kg, the aircraft experiences load of 1.6 to 1.8 G for 10 - 8 seconds at the vertical section of the dive, while in performing the half-roll, without applying the speed brakes, from an altitude of 14,000 m with a pulling force of about 30 kg, the value of load at the vertical section of the trajectory amounts to 1.8 - 2.0 G.

The aircraft gains the maximum speed of 1340 to 1350 km/hr (as read by the thin pointer of the speed indicator) on the vertical dive section at altitudes of 9000 to 11,000 m, when entering the dive at an altitude of 14,000 m. In this case, the true airspeed of the aircraft does not exceed 1230 to 1250 km/hr

In spite of the value of pressing force on the control stick, amounting to 30 kg the dive angle and speed of the aircraft gradually decrease. On reaching an altitude of 8000 m (as read by the altimeter), the aircraft dive angle decreases down to 60° and the diving speed - to 1310 km/hr (as read by the thin pointer).

Inasmuch as the true airspeeds on the vertical section of the dive and half-roll, when entering the dive and half-roll at the maximum level flight speed, with the speed brakes retracted (and all the more with the speed brakes extended), do not exceed the permissible speeds specified for the aircraft, the pilot may not watch the speed indicator but should rather check the altimeter scale readings.

257. Start pulling the aircraft out of the vertical dive performed without applying the speed brakes also at an altitude of not less than 8000 m (as read by the altimeter). The control stick forces required for pulling out the aircraft make up 20 to 25 kg. The aircraft pulls out level at an altitude of about 5000 m.

Do not keep the aircraft diving at a close-to-90° angle at an altitude of less than 8000 m, with the aircraft brought into the dive at speeds close to the maximum level flight speed.

No vibration or any other phenomena interfering with aircraft piloting are observed in these cases.

The efforts to be applied for recovering the aircraft from the vertical dive, with the speed brakes applied at the beginning of the entry, are considerably decreased.

At the end of the pullout, the pilot has to keep the aircraft from changing to larger angles of attack and from vibration by pressing the control stick.

POWER DIVE WITH ENGINE RUNNING AT COMBAT RATING

258. Power dive with the engine running at combat rating, without applying the speed brakes, when the aircraft is brought into the dive from a straight and level flight may be performed at any flying speeds up to the maximum level flight speed.

Dive entry at altitudes of 12,000 - 14,000 m and below from a straight and level flight at maximum level flight speed at an angle of more than 50°, proves practically impossible owing to the rapidly increasing pressing forces on the control stick with the flying speed increase.

At lower altitudes, the maximum dive angle attained when entering the half-roll from a level flight, at maximum flight level speed, decreases and, with the dive entered at an altitude of 5000 m, cannot exceed 25 to 30°.

When performing the dive with the aircraft brought into the dive from a level flight, the pilot may not watch the speed indicator readings. With the flying speed increased, the aircraft itself starts recovering from the dive. The efforts to be applied for keeping the aircraft in the dive attitude amount to 30 - 50 kg before the aircraft gains the maximum permissible flying speed.

259. To bring the aircraft into the dive at an angle of 45 - 50° from a level flight, at the maximum level flight speed, energetically push the control stick with an effort of up to 15 - 20 kg to obtain a sufficiently large dive angle, before the aircraft gains a speed causing large pressing forces on the control stick.

If the aircraft is brought into the dive too slowly, it may result in pressing forces from 25 to 30 kg appearing on the control stick at small dive angles so that further increase of the dive angle will prove impossible.

260. To hold the aircraft on the rectilinear section of the dive, with the engine running at combat rating, apply pressing forces of up to 25 - 30 kg to the control stick. With the dive angle equal to 45 - 50° and the pressing forces on the control stick amounting to 50 kg, the aircraft gains a speed of 1240 km/hr (as read by the indicator thin pointer) at an altitude of 10,000 m, and 1220 km/hr - at an altitude of 5000 m.

However, the true airspeed at ...

261. Do not apply the elevator trim tab in the dive. The change of elevator trim tab position in the power dive with the engine running at combat rating does not have any considerable effect on the behaviour of the aircraft. The efforts to be applied for keeping the aircraft in the dive attitude rapidly increase in both extreme positions of the trim tab.

262. The varying location of the aircraft C.G. during power dives with the engine running at combat rating does not cause any considerable changes in the behaviour of the aircraft.

The forces to be applied for keeping the aircraft in the power dives, with the engine running at combat rating, rapidly increase with the increase of the flying speed at any location of aircraft C.G.

The speeds gained during the dive, at equal values of control stick pressing forces, on an aircraft with a forward C.G. location are higher than on an aircraft with a rear C.G. location. With the extreme forward C.G. position corresponding to 20.5% MAC, the speed developed at an altitude of 10,000 m, with the forces applied to the control stick equal to 30 - 35 kg, does not exceed 1240 km/hr, and that at an altitude of 5000 m - 1220 km/hr (as read by the thin pointer).

263. Recover the aircraft from the dive when the value of pulling forces on the control stick are up to 25 - 30 kg. The recovery of the aircraft does not result in any considerable G-loads due to worsening of aircraft controllability.

The forces required for building up a load of one G, when recovering the aircraft from the dive, sharply increase with the increase of flying speed and reach about 50 kg per G-unit at an altitude of 10,000 m and a speed of 1160 - 1210 km/hr (as read by the thin pointer). This means that the change of control stick force from pressing (25 kg) to pulling (25 kg), with the aircraft pulled out at an altitude of 10,000 m and a speed of 1160 to 1210 km/hr (as read by the thin pointer), builds up a load of about 2 G. In dive recovery, with the decrease of the flying speed, the G-load gradually increases, with the pressing forces being the same.

The extension of the speed brakes facilitates the recovery of the aircraft, since it results in a more rapid decrease of flying speed. Besides, the extended speed brakes involve a pitching moment which helps the pilot in recovering the aircraft from the dive.

264. Change the diving aircraft to the chandelle at maximum permissible flying speeds in the same way as at low speeds. When flying at close-to-maximum speed rates, the aircraft responds to the deflection of radar and ailerons too slowly and, therefore, the chandelle entry becomes somewhat lengthened.

The MiG-17 aircraft does not have any reverse bank effect to the deflection of the radar.

265. When diving at altitudes less than 3000 m, watch the speed indicator and see that the airspeed developed at the above altitudes does not exceed the indicated airspeed of 1050 km/hr (as read by the thick pointer of the indicator), since in some types of aircraft, the excessive flying speed may result in the aircraft banking.

When reaching the maximum permissible indicated airspeed of 1050 km/hr, the pressing forces on the control stick at the above altitudes decrease with the decrease of flight altitude and make up 5 to 8 kg at an altitude of 500 - 1000 m, with the trim tab in the neutral position.

At an altitude of about 5000 m the banking of the pulling out aircraft, with the positive G-load present, begins at an indicated airspeed of 950 to 960 km/hr.

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In rectilinear diving, the aircraft banking develops gradually and may be removed by the ailerons, and the flying speed may be increased by 10 – 20 km/hr before the ailerons lose their efficiency which involves full or partial deflection of the ailerons.

To stop banking in rectilinear diving, as well as in the level flight, decelerate the engine and extend the speed brakes, and only then start recovering the aircraft from the dive.

SPIRAL

266. The spiral is normally performed with a 45° bank at a speed of 500 km/hr, with the engine running at the minimum speed.

Before entering the spiral, assume gliding attitude at a speed of 450 – 500 km/hr and, then, enter the spiral with a bank of not more than 45° by coordinated movements of the control stick and pedal.

267. Decrease or increase flying speed during the spiral by respectively changing the aircraft fore-and-aft axis angle of inclination relative to the horizon (by raising or lowering the aircraft nose). In all other respects the spiral execution procedure is similar to that of the banked turn.

268. During one turn of the spiral entered at an altitude of 5000 m the aircraft loses about 1200 m of altitude. With the aircraft properly recovered from the spiral at an angle of 30 to 45°, and the flying speed before recovery increased to 600 – 570 km/hr IAS, at an altitude of about 2500 m, the loss of altitude during one turn makes up 500 to 1200 m.

When recovering the aircraft from more tight spirals, with the speed before the recovery increased to 960 – 1000 km/hr IAS, the loss of altitude is minimum 1500 – 2000 m.

269. With the landing gear and flaps extended, the spiral is performed at increased engine speed (8000 to 8500 r.p.m) at a flying speed of 350 km/hr.

270. The aircraft is recovered from the spiral by coordinated movements of the control stick and pedal, simultaneously increasing the speed while recovering to a level flight. The engine speed may be increased also after spiral recovery, during gliding.

271. While recovering from a tight spiral, with the aircraft fore-and-aft axis inclined to the horizon at an angle exceeding 30°, first, remove the bank and, then, recover the aircraft from the dive.

SLIP

272. Slip the aircraft, with the flaps and landing gear extended, at an indicated airspeed of 250 km/hr, with the engine running at idle rating.

273. To enter the slip, establish a bank, and simultaneously press the pedal in to the direction opposite to the bank to prevent the aircraft from turning.

The aircraft slips steadily with a bank of not more than 10° and the rudder fully deflected.

To recover the aircraft from the slip, remove the bank by the control stick and release the pedal in proportion with the value of the bank decrease, then, establish a normal gliding angle.

274. With the landing gear and flaps retracted, slip is normally performed at an indicated airspeed of 300 km/hr.

FLYING TECHNIQUE IN ANTI-G SUIT [illegible]-I

275. Carry out training flights with the [illegible]-I anti-G suit on in accordance with training exercises intended for mastering individual flying technique and air combat.

Carry out the first flight in the anti-G suit for determining G-tolerance at low (minimum) or high (maximum) pressure, since owing to the individual specific features of the pilot's organism, one and the same G-load can be easier tolerated by one part of flying personnel at low pressure, and by the other part – at high pressure.

Build up G-load not exceeding 3 – 4 during the first flights and increase it during the next flights to 6 – 7.5 by performing confidence and aerobatic maneuvers .. increased speeds.

Do not build up G-load exceeding 8, since it may lead to residual strains in the aircraft structure. The higher the flight altitude, the lesser the G-loads which may be attained. Thus, due to the aerodynamic properties of the aircraft, it is impossible to gain G-load equal to 8 at altitudes above 6000 m. The maximum G-load (8 G) can be obtained at altitudes down to 5000 m. In case an accelerometer is not installed in the aircraft, the maximum permissible G-load can be determined by the red warning lamp located to the left of the sight. If the warning lamp lights up, decrease the G-load until the lamp goes out.

The warning lamp, however, can light up within certain G-load limits owing to inaccurate operation of the AD-5 pressure control unit and СД-22А and СД-23А pressure warning units. It is worth noting, however, that on the [illegible]-17 aircraft, which is not equipped with a hydraulic booster in the elevator control system a G-load of 6 and above is practically impossible, when the aircraft C.G. location is properly adjusted, due to the large forces acting on the control stick and the large amount of elevator deflection.

A considerable pressure built up in the [illegible]-I anti-G suit serves as a warning signal indicating that a considerable G-load has been reached.

When recovering the aircraft from the dive, with the engine running at a speed less than 8000 r.p.m., the pressure in the engine compressor may be found less than 2 kg/sq.cm and, consequently, the pressure set up in the anti-G suit by the AD-5 pressure control unit may prove insufficient and does not conform with the value of G-load imposed. Therefore, while recovering the aircraft from the dive, the pilot should not let the engine run at a speed less than 8000 r.p.m. or should recover the aircraft more smoothly without building up high G-loads.

When G-loads are built up during the flight, the pressure supply into the suit should be smooth. Sudden change of pressure may result in unpleasant sensations and, with the AD-5 pressure control unit out of order, even in unhealthy symptoms.

Sudden buildup of pressure in the anti-G testifies to the AD-5 pressure control unit being defective. If this is the case, disconnect the suit hose from the aircraft air supply line and decrease G-load, if necessary.

Short-time pressure buildup in the [illegible]-I anti-G suit, by pressing the push-button on the AD-5 pressure control unit, may reduce the pilot's fatigue during a long-term flight.

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V. SPIN

276. The MiG-17 aircraft spins inadvertently only in those cases when the pilot commits blunders in flight technique.

The spin performed in the direction of the aircraft rotation is stable; as to the nature of rotation, spins may be regular and irregular.

If correct recovery procedure is used, the aircraft will be recovered from the spin within not more than one and a half turns.

AIRCRAFT BEHAVIOUR AT MINIMUM FLYING SPEED AND SPIN CHARACTERISTICS

277. When the aircraft loses stability, the minimum values of indicated airspeed with the engine running at idle rating, are as follows:

(a) with the landing gear and flaps retracted – 220 to 200 km/hr;

(b) with the landing gear and flaps extended – 200 to 150 km/hr.

When climbing at minimum engine rating, with the landing gear and flaps retracted, the minimum indicated airspeed equals 190 km/hr.

278. Flying with the landing gear and flaps up (with the speed brakes extended or retracted), when the value of flying speed is being decreased by gradually applying back pressure to the control stick, with the pedals in the neutral position (the engine control lever being shifted to the idle rating position), at a speed of 240 to 230 km/hr, may result in a warning vibration which increases with the further decrease of the airspeed. In this case, the efficiency of ailerons decreases but is still sufficient to prevent the aircraft from stalling.

Decreasing the flying speed down to 200 – 190 km/hr IAS will result in wing-to-wing rolling and, with the control stick deflected all the way back, the aircraft will drop its nose.

The moment the aircraft drops its nose the speed decreases to 180 – 170 km/hr IAS, and the aircraft wing-to-wing rolling becomes more energetic. In this case, the aircraft is prevented from stalling by deflecting the ailerons and rudder.

[illegible] the aircraft nose has dropped 30 – 40° below the horizon (with the control stick [illegible] full back), the aircraft speed increases up to 240 – 250 km/hr and wing-to-wing rolling disappears.

[illegible] slight forward pressure applied to the control stick at low flying speed [illegible] it immediately drops its nose, the flying speed increases and the wing-to-wing rolling and vibration discontinue.

[illegible] climbing at engine normal rating, the aircraft steadily maintains the flight attitude up to an indicated airspeed of 200 – 190 km/hr. In this case, the warning vibration starts at an indicated airspeed of 240 – 230 km/hr. The aircraft enters the spin only after the full pedal is pressed and the control stick is moved all the way back.

[illegible] when gliding with extended landing gear and flaps, with the engine running at idle rating, the aircraft steadily maintains the flight attitude up to the indicated airspeed of 200 – 190 km/hr.

The warning vibration of aircraft, before entering the spin, is less than with the retracted landing gear and flaps. In the latter case, the aircraft is more stable laterally at minimum flying speed and is prevented from spinning by the deflection of the ailerons.

With the pedal fully pressed and control stick moved all the way back, the aircraft stalls in the direction of the pressed pedal and enters the spin less energetically than in case when the landing gear and flaps are retracted.

The moment the aircraft enters the spin is indicative by considerable vibration and alternating loads (jerks) on the control stick and pedals.

281. Overcontrolling with the stick during the banked turn, chandelle and loop is accompanied by considerable vibration which warns the pilot well in advance about the coming spin.

In case of stick overcontrolling during the banked turn at a speed of 400 – 450 km/hr, the aircraft recovers energetically from the banked turn at considerable vibration and banks in the direction opposite to the banked turn and, then, into the banked turn, and makes a descending roll.

When performing a chandelle with stick overcontrolling at a speed of 400 to 450 km/hr, at the last quarter of the chandelle the aircraft stalls in the direction of the turn and makes a descending roll.

As the aircraft approaches the top of the loop, with the stick overcontrolled, the aircraft rolls through 180° round its fore-and-aft axis after which it stalls with considerable vibration and makes a descending roll.

282. If at the moment of vibration the pedal is pressed fully and the control stick is moved all the way back, the aircraft enters the spin in the direction of the pressed pedal.

283. In all cases of aircraft vibration during the performance of flight maneuvers, stop pulling the control stick or push it slightly until vibration discontinues.

284. While breaking into the spin, the deflection of ailerons into the spin (with a left-hand spin, the control stick is shifted to the left) or against the spin (with a left-hand spin, the control stick is shifted to the right) does not have any considerable effect on the nature of stall.

AIRCRAFT BEHAVIOUR IN SPIN

285. The behaviour of the MiG-17 aircraft in the spin, with the controls fully deflected into the spin (with the ailerons in the neutral position), slightly differs from that of other (unswept wing) fighters and is similar to the behaviour of the UTI MiG-15 aircraft in spin.

The spin of the MiG-17 aircraft is stable in the direction of rotation without spontaneous change of rotation direction in the process of the spin.

The rotation of the aircraft both in the left-hand and the right-hand spin, with the controls fully deflected into the spin and the ailerons in the neutral position, is, as a rule, irregular. In some cases, mostly in the right-hand spin, rotation can be regular.

286. In case of an irregular spin, the aircraft stops rotating every half or three quarters of a turn. In the process of the spin, the aircraft periodically raises and drops its nose and at the moment the rotation of the aircraft stops, it banks in the opposite direction. However, with the deflection of controls retained, the aircraft does not change to a reverse spin but keeps on rotating in the desired direction. After the rotation has stopped, the vibration of the aircraft increases and small alternating loads are felt on the control stick and pedals.

The angle of inclination of the fore-and-aft axis of the aircraft to the horizon varies during irregular spin from 20 to 70°. The duration of one turn is about 4 seconds, and the loss of altitude per turn makes up 400 – 450 m.

287. The rotation of the aircraft in the right-hand spin is, as a rule, more uniform than in the left-hand one. Uniform rotation is settled in the right-hand spin through one – two turns. In some types of aircraft the rotation in the left-hand

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When in the regular spin, the aircraft rotates continuously without stops or delays; the angle of inclination of the aircraft fore-and-aft axis to the horizon varies within 40 to 60° and the alternating loads on the control stick and pedals are less noticeable.

The duration of one regular spin turn is 3 seconds and the loss of altitude per one turn during the regular spin makes up 300 - 350 m.

288. The type of spin depends on the position of ailerons when performing the maneuver.

The deflection of the ailerons into the spin in the process of the maneuver execution (the control stick being shifted to the left in a left-hand spin, and to the right in a right-hand spin) increases the irregularity of the aircraft rotation. The aircraft stops rotating more frequently and for a longer time, raises its nose above the horizon, and the moment the rotation stops banks into the opposite side without entering the spin of another direction. Stops in the aircraft rotation result in considerable vibration and forces on the control stick and pedals, which tend to shift the controls to the neutral position.

With the ailerons deflected against the spin in the process of the maneuver execution, the rotation of the aircraft in the right-hand and the left-hand spins is uniform without slowing down(the angle of inclination of the aircraft fore-and-aft axis to the horizon being 40 - 60°) and with a very slight rise and drop of the aircraft nose. In this case, no alternating forces are felt on the control stick and pedals; the control stick is pulled full back.

Setting the ailerons in the neutral position, while performing the spin and keeping the controls applied into the spin, does not affect the nature of spin and the rotation of the aircraft remains regular.

289. With the control stick moved full back, the aircraft spin becomes steeper and more energetic.

The aircraft rotates energetically almost continuously with an inclination angle of 60 to 70° and the forces on the control stick and pedals are of a variable nature.

290. When the speed brakes are applied, the spin characteristics and its recovery procedure remain practically unaltered.

291. The change of aircraft C.G. location within the C.G. operating limits does not have any considerable effect on the spin characteristics and the recovery from it.

292. The G-loads during the spin are inconsiderable and are not practically felt by the pilot.

SPIN RECOVERY

293. Recover the aircraft from the spin in the following sequence:

(a) energetically apply full pedal against the spin, then, after a quarter or half a turn move the control stick full forward; with the control stick being moved forward and in the process of the spin recovery the ailerons should be held neutral;

(b) after the aircraft has stopped rotating, immediately set the pedals neutral and, on reaching 380 km/hr IAS, gradually pull the aircraft out of the dive.

If, after the pedal has been pressed for recovery, the rotation of the aircraft slows down before the aircraft has made a quarter or half a turn, the control stick must be moved correspondingly earlier, at the moment the aircraft rotation has stopped.

After shifting the control stick forward, the aircraft drops its nose in some cases more than by 90° with increase of rotational speed and stops rotating approximately after a quarter or half a turn.

294. In case of an irregular spin, the deflection of controls for recovery at the moment the rotation has stopped, results in immediate recovery from the spin without delay. In this case, to recover the aircraft, it is necessary to set the pedals neutral, move the control stick beyond the neutral position and when the flying speed of 380 km/hr is reached, pull the aircraft out of the dive.

With the controls deflected for recovery at the moment the aircraft rotation has stopped, the aircraft recovers from the spin after not more than one turn.

From a regular spin, the aircraft recovers after energetic and full deflection of controls for recovery in a proper sequence (first the pedal and, then, the control stick) within one and a half turns.

The forces to be applied to the controls to recover the aircraft from a regular spin, are somewhat higher than in recovering the aircraft from an irregular spin.

295. The deflection of the ailerons into the spin, with the control stick moved forward, does not affect the recovery of aircraft from the spin.

With the ailerons deflected against the spin, while pushing the control stick, the aircraft recovers from an irregular spin with much delay and fails to recover from a regular spin.

Therefore, when recovering the aircraft from the spin, do not apply the ailerons against the spin.

296. With the pressure on the pedals and control stick released in the process of an irregular spin, the pedals set in the neutral position, the control stick moves beyond the neutral position and the aircraft changes from the spin into a banked dive. The aircraft does not recover from a regular spin with the controls released.

297. If the sequence of deflection of the controls is not properly observed when recovering from an irregular spin (simultaneous application of the pedals and control stick; deflection of the control stick and, then, of the pedal; incomplete deflection of the controls for recovery from the spin), the aircraft recovers from the spin with a delay of up to one turn.

Inobservance of the proper sequence of deflection of the controls, as well as slow deflection of the controls when recovering from a regular spin, result in a recovery delay of up to two and even more turns, and may even lead to the failure of the aircraft to recover from the spin.

298. Loss of altitude after two spin turns with subsequent recovery to a level flight makes up 1800 to 2200 m.

299. If the aircraft fails to recover from the spin, apply the controls into the spin again, i.e. press full pedal into the direction of the aircraft rotation and apply back pressure to the control stick; half a turn later, repeat the recovery from the spin. While doing so, check to see that the ailerons are not applied against the spin.

300. If the aircraft fails to recover from the spin, the pilot must abandon the aircraft at an altitude of 2000 m.

INADVERTENT SPIN RECOVERY

301. If inadvertent spin occurs, bring the aircraft [illegible] before it has developed a steady spin by pressing the pedal in the [illegible] to the turn and applying forward pressure to the control stick, then, [illegible] aircraft to level flight.

302. If the pilot fails to keep the aircraft from [illegible] the latter enters the spin, he must proceed as follows:

(a) shift the engine control lever all the way back;

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(b) determine the direction of aircraft rotation;

(c) apply the controls into the spin and neutralise the ailerons;

(d) use the spin recovery procedure, discussed above.

INVERTED SPIN AND INVERTED SPIRAL

303. The MiG-17 aircraft can inadvertently enter the inverted spin or the inverted spiral only in case of flagrant errors in flying technique or in case of abrupt pushing of the pedal and control stick, with the controls being fixed for a long time in the deflected position:

(a) when performing flight manoeuvres at an indicated airspeed less than 250 km/h with the aircraft in the wheels-up position;

(b) in level flight when losing speed and dropping into a normal spin;

(c) when improperly handling the controls in recovering from a normal spin.

With the aircraft entering the inverted spin from the wheels-up position, it performs an irregular (with negative G-load) half-roll or a 540° roll, then, makes energetically a nose-down-wing-over, assumes the wheels-up position and enters the inverted spin.

Abrupt pushing of the pedal and control stick and their fixing in the above position in level flight, at the moment the aircraft drops into a normal spin, will make the aircraft energetically lower its nose, roll into the wheels-up position and enter the inverted spin.

If the ailerons are deflected against the spin, the aircraft performs an irregular roll with a descent in the direction of the deflected pedal, then, energetically makes nose-down-wing-over, assumes wheels-up position and, enters the inverted spin. With the ailerons deflected into the spin, the aircraft does not enter the inverted spin but changes to diving, slowly rotating in the direction of the pressed pedal.

When recovering from the normal spin, the aircraft may enter the inverted spin only when the position of the controls deflected for recovery is retained after discontinuing the rotation of the aircraft and changing the latter to negative angles, especially when the control stick is fully deflected forward and to the side opposite to the pressed pedal.

When entering the inverted spin, the pilot is subjected to alternating negative G-loads, while the control stick and pedals experience shock-type loads.

AIRCRAFT BEHAVIOUR IN INVERTED SPIN

304. After entering the inverted spin, the aircraft makes one or one and a half turns of an unsteady inverted spin which is characterized by:

(a) irregular rotation;

(b) considerable vibration of the aircraft nose in the vertical plane;

(c) alternating negative G-loads;

(d) alternating forces on the controls.

After one or one and a half turns of the unsteady spin, the aircraft changes to a steady inverted spin which is characterized by:

(a) regular rotation;

(b) lesser vibration of the aircraft nose in the vertical plane;

(c) more constant negative G-load;

(d) more constant forces on the controls.

When the aircraft is in a steady inverted spin, with the ailerons set in a neutral position, the angle of inclination of the aircraft fore-and-aft axis to the horizon makes up approximately 130 - 110°. With the ailerons deflected against the spin, the spin becomes shallower.

In a steady inverted spin, with the ailerons in the neutral position and as well as with the ailerons deflected against the spin, the pilot does not see the natural horizon. Owing to the inverted attitude of the aircraft, the invisibility of the natural horizon and the effect of negative G-loads, the orientation in space and the location of aircraft direction of rotation are hampered. In an inverted spin the aircraft always rotates in the direction of the pressed pedal. The duration of one turn is 2.5 to 3.0 seconds and the loss of altitude per turn is 300 to 400 m. The right- and left-hand spins differ but slightly.

AIRCRAFT BEHAVIOUR IN INVERTED SPIRAL

305. During the first one or one and a half turns it is practically difficult to distinguish the inverted spiral from the inverted spin by the behaviour of the aircraft. However, by the end of the second turn the pilot can easily determine that the aircraft is in the inverted spiral which is normally characterised by:

(a) increase of speed;

(b) lower rate of angular rotation than in an inverted spin;

(c) larger forces on the controls;

(d) larger negative G-loads which increase with the increase of speed.

RECOVERY FROM INVERTED SPIN AND INVERTED SPIRAL

306. To recover the aircraft from an inverted spin or spiral, proceed as follows:

(a) move the engine control lever backward;

(b) set the pedals and ailerons in the NEUTRAL position and simultaneously pull the control stick to slightly backward of neutral until rotation stops;

(c) after the aircraft rotation has stopped, pull the aircraft out of the dive.

In this case, the aircraft steadily recovers from the inverted spin within not more than one or one and a half turns.

The loss of altitude during the inverted spin recovery, beginning from the moment the pedals are set neutral and up to the moment the aircraft returns to level flight, makes up 1700 - 2000 m.

If, with the aircraft recovering from the inverted spin, the control stick is deflected backward and to the side opposite to aircraft rotation, the aircraft recovers from the spin with a greater delay (within one and a half or two turns).

If, during the inverted spin recovery, full pedal is pressed into the spin, the aircraft may fail to recover from the spin. In this case, the aircraft may change from inverted to normal spin if the control stick is deflected backward and to the side opposite to the pressed pedal. Releasing of the controls in the inverted spin results in the aircraft recovering with a delay of up to two or three turns. If the aircraft has not recovered from the inverted spin down to an altitude of 2000 m, the pilot should abandon the aircraft.

VI. FLIGHT IN ADVERSE WEATHER CONDITIONS, INSTRUMENT APPROACH AND LANDING USING OSP INSTRUMENT LANDING SYSTEM AND PSP-4 RADAR CONTROL LANDING SYSTEM

307. The safety of flying in adverse weather conditions, accurate instrument approach and landing using the OSP system and OSP with PSP-4 landing systems are ensured by:

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(a) good knowledge of operating instructions for flight instruments and aircraft radio navigation equipment;

(b) reliable operation of aircraft equipment and ground aids of the OCП and PCП-4 landing systems;

(c) proper maintenance of flight attitude at all stages of instrument approach and landing;

(d) correct and timely estimation of flight weather conditions;

(e) regular training of pilots in flying under adverse weather conditions, using the OCП instrument landing system.

308. Flights in adverse weather conditions at the weather minimum prescribed for the given airfield are performed with mandatory implementation of the aircraft and airfield radio and lighting equipment.

BEFORE FLIGHT

309. Before IMC flight, the pilot should make sure that gyro horizon AГИ-1, remote-reading gyromagnetic compass ДГМК, low-altitude radio altimeter PB-2, automatic radio compass APK and other flight instruments operate reliably. Whenever necessary, check the above instruments additionally for proper functioning. Make certain the aircraft is filled with de-icing fluid.

310. To prevent the aircraft starting out in a flight with a faulty gyro horizon, switch on gyro horizon AГИ-I at temperatures from +50 to -30°C not later than 3 minutes after the take-off, for which purpose, before switching on the instrument, press home the starting push-button on the right side of the instrument and, then, release it thus ensuring minimum (3 min) time of instrument readiness for operation. At temperatures below -30°C, cut in the instrument 4 minutes before the take-off.

311. Cut in the heater of the main pitot-static tube and emergency pitot tube TП-156.

312. It is not allowed to begin IMC flight if the pilot finds the aircraft equipment inoperative or radio communication equipment and airfield radio navigation aids operate irregularly.

IN FLIGHT

313. Normal flying in adverse weather conditions largely depends on the correctness of gyro horizon readings.

To avoid errors occuring in the gyro horizon readings, proceed as follows:

(a) perform turns at a bank of 20 to 45° when gyro horizon AГИ-I is switched on;

(b) switch on the gyro horizon in flight only when the aircraft is in the level flight. The gyro horizon readings will be correct 2 minutes after it has been cut in;

(c) periodically check the correctness of gyro horizon readings by comparing them with those of turn indicator ЭУП-46 (or ЭУП-53), rate-of-climb indicator, and remote-reading gyromagnetic compass ДГМК.

314. If the gyro horizon has failed, continue to fly by the readings of turn indicator ЭУП-46 (or ЭУП-53) operating in conjunction with other instruments (rate-of-climb indicator and compass ДГМК). Keep in mind that flights without a gyro horizon, by the readings of the turn indicator, require special attention and preliminary training.

UPWARD AND DOWNWARD CLOUD PENETRATION, INSTRUMENT APPROACH AND LANDING USING OCП INSTRUMENT LANDING SYSTEM AND PCП-4 RADAR CONTROL LANDING SYSTEM

315. After take-off, retract the landing gear and, at an altitude of minimum 100 m, check the readings of the gyro horizon against the actual attitude of the aircraft relative to the natural horizon, then, gradually increasing the climbing angle, change the aircraft to climbing, bringing the true airspeed up to 720 km/hr, with the engine running at normal rating. While doing so, with the aircraft climbing, the indicated airspeed and the readings of the rate-of-climb indicator will decrease. Climbing and cloud penetration during alarm flights or flights for air target interception are performed at take-off (combat) engine rating (11,560 r.p.m.) and a true airspeed of 750 km/hr.

316. Instrument approach and landing, with implementation of the OCП instrument landing system or the OCП system with the PCП-4 radar control landing system, may be performed by the straight-in approach procedure, two-180°-turn approach procedure or by the wide rectangular pattern approach procedure.

The main instrument approach and landing procedure used when landing approach is performed above clouds, is the straight-in approach procedure. If the approach to the runway is not accurate, or the pilot commits error in his judgement for landing, which requires go-around procedure, or if the visual landing approach by a small traffic pattern proves impossible, perform approach and landing using two-180°-turn approach procedure or the wide rectangular pattern approach procedure.

INSTRUMENT APPROACH AND LANDING USING STRAIGHT-IN APPROACH PROCEDURE

317. Approach the outer homing station at the assigned flight level or at 200 to 300 m above the cloud top from any direction, having first requested the flight control officer for instrument landing clearance and landing instructions.

318. After being cleared for an instrument approach and landing, set the value of ground pressure on the altimeter scale and the scale of the remote-reading gyromagnetic compass – at the landing course, having matched the landing course with the lubber line on the fixed section of the scale.

319. Check the entry of the outer marker zone of action by the flickering of the signal lamp MAРКЕР (MARKER) and by the audio signal (bell ringing) up to an altitude of about 5000 m, and at altitudes above 5000 m – only by the unstable readings of the automatic radio compass bearing indicator. Fix the time the aircraft passes the outer homing station by the change of readings on the automatic radio compass bearing indicator from 0° to 180°.

320. Fly from the homing station on the course which is the reciprocal of the final approach course and perform a maneuver above clouds to intercept the final approach course at an indicated airspeed of 500 km/hr.

321. On intercepting the landing course, extend the landing gear and deflect the flaps 20° down, set an indicated airspeed of 450 km/hr and change the aircraft to a descending flight.

322. Depending on the altitude, the rate of descent, when on the landing course, should be: down to an altitude of 2000 m – 30 m/sec, from an altitude of 2000 down to 1000 m – 15 m/sec, from an altitude of 1000 down to 600 m – 10 m/sec, and from an altitude of 600 down to 200 m – 5 to 3 m/sec.

323. At an altitude of 200 m, assume a level flight attitude and continue flying

at this altitude (in the clouds or under the cloud base) until entering the outer marker beacon zone, having decreased the flying speed down to 400 km/hr. The altitude of the aircraft when passing the outer marker is 200 m.

324. After entering the outer marker beacon zone, immediately shift the automatic radio compass range frequency band to the frequency of the inner marker beacon and, maintaining the radio station relative bearing equal to 0°, fly on the inner marker beacon. After passing the outer marker beacon, decrease the speed down to 300-320 km/hr, with the rate of descent equal to 2 - 3 m/sec, extend the flaps to the landing position and descend to an altitude of 400 m. The altitude of the aircraft when passing the inner marker beacon is 50 to 100 m.

325. Having passed the inner marker beacon, set a gliding speed of 260 km/hr, finalize the landing estimation and perform a visual landing.

326. If it is impossible to land the aircraft right after cloud penetration (speed is too high or the aircraft is not accurately aligned with the landing runway, etc.), make a go-around and request clearance to make visual approach for landing below clouds or, depending on the weather conditions and terrain, instrument approach in clouds or below clouds using two-180°-turn approach procedure or the wide rectangular pattern approach.

TWO-180°-TURN APPROACH PROCEDURE

327. In case of missed approach, when the pilot decides to make a two-180°-turn approach he should lock the time when the aircraft passes the inner marker beacon and climb to an altitude of 500 m at a vertical speed of 5 m/sec.

One minute after passing the inner marker beacon he makes 30° bank turn to intercept the course which is the reciprocal of the landing course.

When abeam the outer marker beacon, read the stop-watch readings, report the aircraft position over the radio and continue to fly at a speed of 500 km/hr, introducing a drift correction into the aircraft course. Two minutes after passing the outer marker beacon in level flight, report the aircraft position over the radio and make 30° bank turn to intercept the final approach course. In the second half of the turn, change the bank value to obtain simultaneous settling of the pointer of the ARK-5 automatic radio compass at zero relative bearing, and the pointer of the DGMK-3 remote-reading gyromagnetic compass, at the landing course. After the turn, perform level flight on the final approach heading for 30 seconds. Within the above time period, decrease speed down to 450 km/hr, extend the landing gear and deflect the flap 20° down, report the aircraft position over the radio and start descending with a vertical speed of 5 - 3 m/sec.

At an altitude of 200 m return the aircraft to level flight, decrease speed down to 400 km/hr and, without distracting attention to locate the runway or to identify the reference points, fly the aircraft by instruments until the outer marker beacon is reached, strictly maintaining an altitude of 200 m and zero relative bearing.

On recognizing the outer marker beacon passage, the pilot should switch the ARK-5 automatic radio compass over to the inner marker beacon, make a correction turn, if necessary, to obtain zero relative bearing, decelerate the engine and lower the flaps completely, send the aircraft into descent at 2 - 3 m/sec and report over the radio that the aircraft has passed the outer marker beacon.

On passing the inner marker beacon at an altitude of 8 to 100 m, make sure visually that the approach for landing is correct.

WIDE RECTANGULAR PATTERN APPROACH PROCEDURE

328. When going around for making a landing approach using the wide rectangular pattern procedure at a speed of 500 km/hr, climb the aircraft.

On the elapse of estimated time, after passing the inner marker beacon, turn to crosswind leg through 90° and continue to climb up to an altitude of 500 m with a vertical speed of 5 m/sec. Having gained the prescribed altitude, return the aircraft to level flight, maintaining a speed of 500 km/hr.

On reaching 2[illegible]° (1[illegible]°) relative bearing of the radio station, perform [illegible] leg turn with 30° bank to intercept the course, which is the reciprocal of the landing course.

Having reached 230° (130°) relative bearing of the radio station, make a base leg turn through 90°, and on reaching 285°(75°) relative bearing of the radio station perform final turn in a horizontal plane to intercept the landing course.

After intercepting the final approach course, while on the 30-sec level flight leg, decrease speed down to 450 km/hr, extend the landing gear and deflect the flaps 20° down, report over the radio and descend the aircraft at a vertical speed of 3 - 5 m/sec. At an altitude of 200 m return the aircraft to level flight and reduce the speed down to 400 km/hr.

329. Henceforth, the flight procedure is the same as in case of two-180°-turn approach procedure.

VII. [illegible]

PRE-TRAFFIC PATTERN CHECK

330. When approaching the airfield, check to see that:

(a) the circuit breakers of guns and bomb armament are cut off;

(b) the safety guards are locking the upper fire control push-button and the bomb release push-button located on the control stick;

(c) the main air system is under pressure, and if the value of pressure is insufficient, check the emergency system filling valve for ease of opening to ensure normal functioning of the brakes.

331. Decrease engine speed and, if necessary, apply the speed brakes to set a flying speed of 500 km/hr, then, enter the airfield traffic pattern at an altitude of 500 m.

LANDING GEAR EXTENSION

332. Extend the landing gear before making to base leg, turn at a flying speed of 450 km/hr, by shifting the landing gear lever down (EXTENSION). The normal duration of landing gear extension is 8 to 10 seconds.

333. The extension of landing gear is checked by the complete protrusion of mechanical indicators, by the flash of green warning lamps and by the full pressure value in the hydraulic system (120 to 140 kg/sq.cm). Set the landing gear lever in the [illegible] ([illegible]) position before taxiing out the aircraft to the parking place and stopping the engine.

334. After extending the landing gear, release the forces on the control stick by the elevator trim tab and lock the seat harness.

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APPROACH FOR LANDING

335. After extending the landing gear, fly the aircraft level and perform [illegible] leg turn at a speed of 400 km/hr. Glide on the base leg at a speed of 350 km/hr.

Before turning the aircraft to final leg, lower the flaps, first, in the take-off position (20° down) and, then, in the landing position, and check the extension of the flaps by the warning lights and the mechanical indicator located on the left wing.

Do not remove the hand from the flap control until the flaps are completely lowered.

336. The final turn should be executed at a speed of minimum 320 km/hr with in-creased engine speed. The aircraft must be recovered from the final turn at an altitude of minimum 200 m.

Having turned to final, set a speed of 260 to 250 km/hr and glide at the above speed up to the beginning of levelling-off.

The pilot will glide for landing reckoning on insignificant application of power and finalize the judgement by changing the engine speed.

337. In case of inaccurate approach which threatens the safety of aircraft landing, a missed approach procedure will be used.

338. The aircraft may initiate a missed approach procedure from any altitude down to the levelling-off altitude (6 – 7 m).

Having decided to go round, the pilot should accelerate the engine up to the take-off speed by shifting the engine control lever to the frontmost position within [illegible] to [illegible] seconds.

On gaining a speed of 300 km/hr, he will assume climbing attitude and gradually increase the flying speed.

At an altitude of [illegible] m and a speed of minimum 300 km/hr, retract the flaps and take another approach for landing.

Note. If, with the flaps lowered, the warning lamp [illegible] with celluloid [illegible] bearing the inscription [illegible] ([illegible]), lights up in the instrument panel, the pilot should immediately make a go-round and extend the landing gear, since the light signal indicates that the landing gear has not been extended or has been extended incompletely.

LANDING

339. At an altitude of 30 – 20 m shift the gaze towards the ground to the left and forward at 10 – 15° angle, and downward at an angle of 15 – 20°, to the point the aircraft is descending to.

Start levelling-off at an altitude of 7 – 6 m, smoothly pulling the control stick and decreasing the gliding angle in such a way as to bring the aircraft to the ground (stop descending) at an altitude of not more than 1 m.

340. Floating should be accomplished by gradual descent of the aircraft, for which purpose the pilot applies gentle back pressure to the control stick conforming the stick movements with the aircraft speed and establishes higher angles of attack at a rate ensuring touchdown on two main wheels with the nose wheel raised and preventing ballooning.

341. In the process of floating, the direction of vision towards the ground (10 – 15° to the left and 30 – 40 m ahead), must not be changed since it may lead to an error in determining the distance to the ground, and namely: nearing of vision focus to the wing edge may result in spontaneous ballooning while moving away of vision focus from the wing edge may lead to the nose wheel touching the ground first.

If during landing the pilot looks at the ground through the windshield of the cockpit canopy, then, with the aircraft ballooning (bouncing), the ground surface will be covered by the front section of the aircraft, creating a false impression of the height of ballooning. As a result, the pilot is likely to make other mistakes – excessive and energetic pushing of the control stick and, then, excessive and energetic pulling of the control stick, which may result in bad ballooning (bouncing) of the aircraft.

342. After two main wheels contact the ground, the pilot should not apply additional back pressure to the control stick but hold the control stick in the touch-down position until the nose wheel comes to touch the ground, the direction of pilot's vision being the same as during the floating procedure.

343. As soon as the nose wheel has lowered to the ground and the aircraft has started rolling on three wheels, the speed drops down to a value preventing the aircraft from lifting off the ground; the pilot must shift the gaze ahead and begin braking procedure.

The pilot brakes the wheels by smoothly applying pressure to the brake lever, i.e. by gradually increasing pressure so as to pull the lever to the first-stage stop by the end of the aircraft landing roll. Such a method of braking reduces the wear of tyres and wheel chocks to the minimum.

Whenever necessary to reduce the length of landing run to the minimum, press the brake lever in such a way as to pull the brake lever to the second-stage stop by the end of the landing roll.

344. Energetic braking at the end of landing roll may result in ground loop to either side. If this is the case, lower the brake lever to release the wheel, set the pedals in the neutral position and, then, gradually apply the wheel brakes again.

345. If no air pressure is available in the main air supply system during the landing of the aircraft, immediately open the brake system emergency supply valve on the cockpit starboard after the aircraft has begun steady landing roll. The wheel brakes, in this case, will operate even though the air system is not airtight.

346. On terminating the landing roll, clear the runway, retract the flaps and speed brakes (if the latter have been applied); if necessary, unpressurize the cockpit, open the canopy and cut off the aircraft transponder and the ARK automatic radio compass.

347. After a flight mission involving firing practice, taxi out the aircraft from the landing runway, place it in the direction safe for unloading the guns (removing the rocket shells) and, then, stop the engine.

Do not tow the aircraft after a flight involving firing practice, before unloading the guns (or removing the rocket shells).

348. If in the process of landing the aircraft balloons due to pilot's error in flying technique, the pilot, depending on the nature of the ballooning, must use one of the following procedures to rectify the error:

(a) when landing the aircraft on three wheels at an increased speed (200 to 225 km/hr), the pilot should stop pulling the control stick at the moment the aircraft brakes contact with the ground and prevent the aircraft from further ballooning by short and smooth pushing of the control stick; then, with the flying speed decreased and the aircraft approaching the ground, gradually pull the control stick and land the aircraft on two main wheels;

(b) with the aircraft landing on two main wheels at a normal or slightly increased speed (170 – 190 km/hr), the pilot, at the moment the aircraft leaves the ground, should stop pulling the control stick (at the same time preventing it from pushing),

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and eliminate the bank by energetic application of the pedal against the bank. As the aircraft nears the ground, land it on two main wheels by applying full back pressure to the control stick.

In case of high levelling-off (above 1 m), stop pulling the control stick and, then, with the landing speed decreasing and the aircraft nearing the ground, perform normal landing on two main wheels.

CROSSWIND LANDING

349. While landing in a crosswind, the pilot will correct the drift of the aircraft by carrying the upwind wing low.

Landing in crosswind at wind velocity up to 10 m/sec presents no special problems. However, at a higher velocity of the wind, the deflection of the rudder may prove insufficient to correct the drift, since with the rudder deflected completely and the ailerons applied, the aircraft bank while slipping before landing does not exceed 10°.

350. When landing with ammunition completely used up and an emergency fuel reserve, the forces on the control stick are rather small and during taxiing after landing the aircraft pitches more intensely and may strike against the ground with the fuselage fin. Landing in such conditions requires special attention on the part of the pilot.

LANDING ON UNPAVED RUNWAY

351. Landing on an even unpaved runway does not differ from that on a concrete runway.

When landing on uneven ground, do not allow early lowering of the nose wheel, since the aircraft possessing high progressive speed and while contacting rough ground may fly off the ground again and produce bouncing.

When landing on unpaved runway the brakes must be used gently: the pressure must be 1.5 – 2 kg/sq.cm, at first, and, then, up to 4 – 5 kg/sq.cm. Before clearing the runway, increase the engine speed slightly beforehand so as to prevent the aircraft from stopping and clear the landing runway as quickly as possible.

While taxiing on soft ground, check the gas temperature.

STOPPING ENGINE

352. If the engine was running on the ground at a take-off (combat) rating, it should be cooled down before stopping. For this purpose, run the engine at 5000 to 7500 r.p.m. for 1 min, set the engine control lever to the idle rating position and run the engine for 30 seconds, then, unpressurize the cockpit (if the latter has been pressurized).

353. With the engine control lever set to the idle rating position, close the fuel stopcock (lift the stopcock handle all the way up) and cut off all the circuit breakers, except for the circuit breaker of the aircraft battery and the fuel booster pump.

As soon as the engine turbine stops rotating, cut off the battery and booster pump circuit breakers by the signal of the ground engineer.

Set the landing gear control handle in the neutral position, having first shifted the latch to the right, and cut off the landing gear electric switch.

354. Before leaving the cockpit, the pilot should do the following:

(a) disconnect the hose of the parachute oxygen apparatus from the hose of the aircraft oxygen apparatus;

(b) disconnect the pull chain of the parachute oxygen apparatus from the cockpit wall;

(c) disconnect the hose of the PPK-1 anti-G suit;

(d) disconnect the cord of the parachute release control unit from the seat arm rest to avoid parachute opening.

To reduce the time necessary for preparing the pilot for the next flight, it is allowed to leave the parachute in the cockpit.

355. Give necessary instructions to the ground engineer for eliminating faults in aircraft equipment which have been detected in flight.

VIII. EMERGENCY PROCEDURE

PROCEDURE ON ENCOUNTERING ENGINE FAILURE IN FLIGHT

356. If the engine cuts off in flight under visual meteorological conditions, proceed as follows:

(a) immediately close the fuel stopcock;

(b) shift the engine control lever back to the idle rating position;

(c) advise ATC on the engine failure, altitude and position;

(d) cut off the GENERATOR and the circuit breaker of the aircraft transponder.

357. If the engine fails at an altitude below 2000 m, do not try to start it. Depending on the situation, proceed as follows:

(a) if the aircraft is in the vicinity of the airfield and the altitude of flight permits the aircraft to reach the airfield by gliding, extend the landing gear and perform a landing;

(b) if the flight is performed over even ground (meadow or ploughland), make a forced gear-up landing;

(c) if the flight is performed over the ground unsuitable for a forced gear-up landing, abandon the aircraft using the ejection seat.

358. In the event of engine failure at an altitude above 2000 m, attempt to start the engine. If the pilot has failed to start the engine before the altitude of 2000 m is reached, he should proceed as indicated above.

359. If the engine fails at an altitude above 11,000 m, descend at the maximum possible vertical speed down to an altitude of 11,000 – 10,000 m, checking the value of flying speed.

360. In case of engine failure in flight under adverse weather conditions, the pilot flying at an altitude of above 2000 m, should proceed as follows:

(a) close the fuel stopcock;

(b) change the aircraft to descending attitude;

(c) cut off the GENERATOR and the aircraft transponder;

(d) advise ATC on the engine failure;

(e) descend below the cloud base only in a straight line;

(f) when coming out of the clouds above 2000 m, start the engine and cut in the GENERATOR and the aircraft transponder.

361. If, while descending in the clouds with a failed engine, the aircraft has not come out of the clouds before an altitude of 2000 m is reached, or has come out of the clouds over the ground not suitable for safe forced landing, the pilot should abandon the aircraft using the ejection seat.

362. In all cases of engine failure, while flying in clouds at an altitude below 2000 m, the pilot should abandon the aircraft, using the ejection seat.

363. When the engine fails during a night flight at altitudes above 2000 m, the

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pilot should try to start it. If the engine has failed to start before an altitude of 2000 m is reached, and landing on the lighted runway of the home airfield proves impossible, the pilot should abandon the aircraft using the ejection seat.

ENGINE STARTING IN FLIGHT

364. After descending the aircraft to an altitude of 6000 m (or with the engine cut off at an altitude of less than 6000 m directly after its cutting-off), set the indicated flying speed at 300 - 320 km/hr and start the engine, for which purpose:

(a) cut in the starting ignition by setting the change-over switch to the IGNITION IN FLIGHT (ЗАЖИГАНИЕ В ВОЗДУХЕ) position (the red signal lamp in this case will light up);

(b) open the fuel stopcock 10 to 15 seconds after cutting in the ignition;

(c) watching the speed and temperature of engine gases, smoothly shift the engine control lever forward (at a rate of 15 sec) up to the maximum speed stop. If the engine fails to start, shift the engine control lever at the same rate in the opposite direction, selecting the optimum condition for starting the engine;

(d) as soon as the engine speed starts increasing, pull the engine control lever to the idle rating position to avoid excessive growth of the exhaust gas temperature;

(e) as the engine gains the steady speed corresponding to the engine control lever set in the idle rating position, cut off the starting ignition (the signal lamp should go out). Do not accelerate the engine to the steady rating (cruising, etc.), before the starting ignition is cut off;

(f) set the required engine rating and cut in all the previously switched off circuit breakers.

The entire process of engine starting in flight takes 40 - 45 sec.

Should the engine fail to start at the first attempt, close the stopcock and cut off the starting ignition, check if the engine control lever is set to the idle rating position. Start the engine again at a lower altitude but not earlier than 20 - 30 seconds after closing the stopcock.

Make the last attempt to start the engine at an altitude of 3000 m.

The reliability of engine starting increases with the decrease of altitude and flying speed.

The reliable starting limits of engine ВК-1 are characterized by the data presented in Table 8.

Reliable Starting Limits of Engine ВК-1 — Table 8

Altitude, m	Indicated speed, km/hr	Rotor speed of inoperative engine, min
5000	300-400	800-1150
4000	300-500	800-1230
3000	300-600	800-1350

Note. Do not start the engine in flight without closing the stopcock, since it may result in a sudden rise of gas temperature and a general increase of engine temperature.

PECULIARITIES OF STARTING ENGINE, MODEL ВК-1А, IN FLIGHT UNDER WINTER CONDITIONS

365. The altitude and flying speed at which reliable starting of engine ВК-1А is ensured under winter conditions, depend on the temperature of fuel in the aircraft fuel tanks.

With the temperature of fuel in the fuel tanks equal to -16°C (which is normally the case when the aircraft is parked for minimum 24 hours at a temperature of an ambient air down to -20°C), the reliable starting of engine ВК-1А in flight on aircraft МиГ-17 is ensured at altitudes and speeds specified for engine ВК-1.

Engine starting at altitudes from 5000 to 6000 m is unreliable and at altitudes above 6000 m does not start at all, therefore, do not start the engine at altitudes above 6000 m.

Reliable starting of the engine in flight at altitudes and speeds indicated in Table 8 is also provided for after gliding the aircraft with cut-off engine from altitudes of 10,000 to 11,000 m, since in this case no overcooling of the engine takes place.

When the temperature of fuel in the aircraft fuel tanks is -20°C and less (the fuel temperatures which may be observed when the aircraft is parked for about 24 hours at a temperature of an ambient air of approximately -30°C and less), the altitude and speed at which reliable starting of the engine can be ensured in flight reduce in due ratio with the temperature of fuel in the fuel tanks. In this case, start the engine at altitudes below 4500 m with flying speeds of 300 to 350 km/hr.

On aircraft МиГ-17 the engine may also be started in flight after a continuous gliding (up to 7 min) with cut-off engine and cut-in aircraft consumers necessary for carrying out a flight in adverse weather conditions.

In these cases it is advisable to start the engine at altitudes below 3000 m with indicated airspeeds of 300 km/hr.

The procedure to be taken by the pilot when starting the engine in flight under winter conditions is the same as in summer conditions. Reliable starting of the engine in flight at altitudes and speeds indicated in Table 8 is also provided for in cases when two attempts have been made to start the engine from the aircraft battery, prior to the flight.

In case of three or four attempts made to start the engine in flight, the parameters of the aircraft battery remain practically unaltered.

When starting the engine in flight under winter conditions, the ignition of fuel in the combustion chambers (which marks the increase of engine speed) takes place, as a rule, 10 to 15 seconds after complete opening of the stopcock without sudden rise of gas temperature behind the turbine beyond the maximum permissible value (69? °C).

A delay of fuel ignition of up to 25 sec may sometimes be observed. Therefore, to increase the reliability of starting of the ВК-1А engine in flight, keep the engine stopcock in the open position up to 25 sec. If the engine still fails to start, close the stopcock and make another attempt to start the engine at a lesser altitude and a lesser flying speed.

PROCEDURE ON ENCOUNTERING ENGINE LOGGY

366. When the engine is loggy, the engine speed does not increase with the engine control lever shifted forward, but remains unaltered slightly above the flight idle-rating speed. In this case the pressure of fuel is low but not less than 8 - 10 kg/sq.cm

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and the temperature of gases is low too. The engine may become loggy at an altitude of more than 7000 m.

367. If the engine is loggy, proceed as follows:

(a) put the engine control lever to the IDLE RATING position;

(b) cut in the isolating valve;

(c) slightly moving the engine control lever forward, set the required engine speed;

(d) if the engine speed and gas temperature cannot be restored, descend to an altitude of 6000 m;

(e) after eliminating the engine logging, cut off the isolating valve and head for the landing airfield.

Notes: 1. The loggy engine restores its normal operation without any interference on the part of the pilot with the aircraft descending down to an altitude of 6000 m.

2. One should bear in mind that a loggy and a spontaneously cut-off engine can sometimes be confused.

PROCEDURE ON ENCOUNTERING ENGINE SURGING

368. Engine surging can be detected by the change of usual sound produced during operation, the drop of engine speed, and rapid rise of gas temperature behind the turbine. Surging is mostly observed at transient engine ratings, when accelerating the engine from low to medium or maximum speed.

369. To recover the engine from surging, decrease fuel feed at transient rating by partially pulling the engine control lever until surging discontinues. With surging stopped, gain the required engine rating.

370. Engine surging may occur also when flying at a high altitude in climb, with the engine running at maximum speed.

In this case, to eliminate engine surging, decelerate the engine, speed up the aircraft and decrease the flight altitude.

PROCEDURE ON ENCOUNTERING RADIO COMMUNICATION FAILURE

371. In all cases of sudden failure of radio communication, proceed as follows:

(a) check the attachment of plug connector in the helmet adapter cord;

(b) check if the volume control knob is set at maximum audibility;

(c) check the radio communication on other channels.

If radio communication fails when flying under the cloud base, do not enter the clouds, discontinue the flight mission and land the aircraft.

372. Should radio communication fail when flying in clouds or above the cloud top, discontinue the flight mission, check if the aircraft transponder is cut in, switch on the distress signal, home on the airfield radio station, strictly maintaining the flight conditions, and, using the radio set as a transmitter, perform the landing approach.

373. If radio communication fails during a night flight, proceed in the same way as when flying in clouds, and fire a flare of any colour when turning final or after passing the outer marker beacon, so as to give a signal for switching on the landing floodlights.

Note. If the homing station is provided with additional equipment, the commands of the flight control officer can be received through the APK automatic radio compass receiver, for which purpose, with the transmitter functioning properly:

(a) advise the ground on switching-over to the APK automatic radio compass;

(b) set the RADIO COMPASS RECEIVER ([illegible] APK) change-over switch in the RADIO COMPASS (APK) position;

(c) put the function switch on the radio compass control panel in the LOOP (ANTENNA) position, and the change-over switch KEY - VOICE ([illegible]) - in the VOICE position.

On receiving the orders from the flight control officer, set the function switch periodically in the COMPASS ([illegible]) position, otherwise, the course indicator will not show the direction to the homing radio station.

PROCEDURE ON ENCOUNTERING GYRO HORIZON FAILURE

374. Failure or incorrect readings of the gyro horizon in flight is determined in any flight attitude (level flight, climbing, descent or banked turn) only by comparing the readings of the whole group of flight instruments taken jointly.

375. If the gyro horizon is faulty, pass over to piloting the aircraft by the turn-and-slip indicator in conjunction with the speed indicator, rate of climb indicator, altimeter, and ГИК remote-reading gyromagnetic compass.

Maintain the flight attitude checking the roll control with the turn-and-slip indicator, pitch control - with the speed indicator, altimeter and rate-of-climb indicator, and directional control - by the turn indicator with additional check by the gyromagnetic and automatic radio compasses.

PROCEDURE ON ENCOUNTERING SPEED INDICATOR FAILURE
(total-pressure line defective)

376. The failure of speed indicator may occur not immediately but gradually. Therefore, first make sure that the speed indicator has failed. For this purpose, without changing the engine speed, smoothly change the aircraft to descent or climb checking the attitude by gyro horizon АГИ-1 and by the rate-of-climb indicator.

If the speed readings do not comply with the flight attitude, while the other instruments function normally, it means that total-pressure line has failed.

377. Should the speed indicator fail to operate, first check the switching of the pitot-static tube heater and change the supply of impact pressure from the main pitot-static tube to emergency pitot tube ПД-156.

Check the flight attitude by the readings of the gyro horizon, engine speed indicator, rate-of-climb indicator and altimeter.

In case the speed indicator fails to operate, it is advisable to maintain the engine speeds indicated in Table 9 at various flight attitudes and during a straight-in approach for landing.

Table 9

Flight attitude	Indicated airspeed, km/hr	Vertical speed, m/sec	Engine speed, r.p.m.	Pitch angle by АГИ-1, deg	Notes
1	2	3	4	5	6
Climb	500	15	10,500	5	Landing gear and flaps retracted
Level flight at altitude below 6000 m	500	0	9500	0	Same
Maximum endurance conditions					
at altitude 3000 m		0	7700	0	Same
at altitude 5000 m		0	8300	0	Same

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1	2	3	4	5	6
Glides:					
to altitude 2000 m	450	30	7500	12	Landing gear extended, flaps deflected 20° down
from 2000 to 1000 m	450	15	8000 - 8500	5	Same
from 1000 to 600 m	450	10	9200	3	Same
from 600 to 200 m	450	5 - 3	9600	2	Same
Level flight at altitude of 200 m	400	0	9500-10,000	0	Same

Note. When flying with drop fuel tanks, maintain the engine speed by 200 r.p.m. higher than the speeds given in the table.

PROCEDURE ON ENCOUNTERING SPEED INDICATOR, RATE-OF-CLIMB INDICATOR AND ALTIMETER FAILURE (pitot-static tube line defective)

378. Simultaneous failure of speed indicator, rate-of-climb indicator and altimeter (pitot-static tube line faulty) is first detected by the behaviour of the rate-of-climb indicator whose pointer settles abruptly in the zero position or slowly responds to the deflection of the controls, and also by the readings of the altimeter which remain unaltered with the aircraft assuming the climbing or descending attitude.

The main instrument ensuring piloting of the aircraft in adverse weather conditions with the pitot-static tube line defective, is the AГИ-1 gyro horizon, operating in conjunction with the engine speed indicator.

When flying above 2000 m the flight altitude is determined by the readings of the УВПД cockpit altitude and pressure differential gauge (with the cockpit pressurizing valve open to capacity, the cockpit "altitude" equals approximately half the aircraft flight altitude).

At altitudes below 2000 m, it is practically impossible to determine the flight altitude by the УВПД cockpit altitude and pressure differential gauge.

From an altitude of 1200 m down to the ground surface, the flight altitude is determined by the readings of the PB-2 radio altimeter.

379. Perform approach for landing when flying over the cloud top. Intercept the landing course above the cloud top as accurate as possible. After extending the landing gear and flaps, set the necessary rate of descent and without changing it enter the clouds.

Avoid turning when descending in clouds on the landing course.

While descending, maintain the flight conditions indicated in Table 10.

Table 10

Altitude	Pitch angle read on gyro horizon, approx., deg	Engine speed, r.p.m.	Special notes
1	2	3	4
Up to 4000 m (cockpit altitude equals 2000 m)	10	7500	The readings of the ДГМК remote gyromagnetic compass conform to the landing course and

1	2	3	4
			the APK automatic radio compass reads zero
From 4000 down to 1200 m	5	8500	Keep the readings of the ДГМК remote gyromagnetic compass and APK automatic radio compass unaltered
From 1200 down to 200 m	0	9500-10,000	

With the aircraft coming out below the cloud base, fly it by the engine speed and the pitch angle, thoroughly checking the altitude by the PB-2 radio altimeter and by commands from the ground.

380. If the instruments have failed under weather conditions allowing the piloting of the aircraft in pair, and the pilot has been trained in downward cloud penetration in close pair formation join the aircraft sent by the flight control officer, when flying over the outer homing station and perform an approach for landing in pair.

381. If the thickness of clouds is very large and the altitude of the cloud base is too low (below 200 m), or in case of poor visibility under the cloud base and insufficient training of the pilot in downward clouds penetration by the readings of the gyro horizon pitch angle in conjunction with the engine speed value, the pilot should take a decision to abandon the aircraft by ejection on the permission of the flight control officer.

PROCEDURE ON ENCOUNTERING ДГМК REMOTE-READING GYROMAGNETIC COMPASS FAILURE

382. The failure of the remote-reading gyromagnetic compass is determined by the following indications:

(a) the compass readings to not correspond to the actual aircraft heading;

(b) the compass course indicator oscillates to both sides or remains stationary;

(c) when executing a banked turn, the compass course indicator fails to read the change of aircraft heading or the change of the compass readings is jerky.

383. If the compass fails to operate, first make certain the compass circuit breaker is cut in. Report the matter to the flight control officer. Approach the homing station by the radio compass, periodically checking the direction of flight by calling the radio direction finder.

In adverse weather conditions and at night the landing approach should be performed with the help of the radio compass in conjunction with the radio direction finder data, and by the commands received from the flight control officer.

PROCEDURE ON ENCOUNTERING APK-5 AUTOMATIC RADIO COMPASS FAILURE

384. The APK automatic radio compass failure is determined by the stationary position of compass pointer, with the direction of flight changed, and by the continuous rotation or oscillation of the radio compass pointer.

If the radio compass fails, make sure the radio compass circuit breaker is cut in and the function switch mounted on the radio compass control panel is set in the COMPASS (КОМПАС) position. Request the flight control officer on the operation of the homing station and check the adjustment of the APK-5 radio compass. Maintain the flight attitude by the gyromagnetic compass when approaching the flight zone.

Periodically check the correctness of approach to the airfield by requesting the

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radio bearing and by interrogating the landing airfield control post. Should the radio compass fail when flying in clouds or above the cloud top, perform a landing approach with the help of the gyromagnetic compass, by requesting the radio bearing and by commands of the flight control officer.

Note. If the pilot is in doubt as to the correctness of the radio compass readings, it is normal practice to listen to the call signs of the homing station operating in the RADIO COMPASS LAMP (ANTENNA) mode. Having adjusted the radio compass by maximum deflection of the adjustment indicator pointer, change the radio compass mode to COMPASS. Check the direction of flight by the gyromagnetic compass and by requesting the radio bearing.

PROCEDURE ON ENCOUNTERING LIGHTING EQUIPMENT FAILURE DURING NIGHT FLIGHT

385. If the navigation lights fail to operate, act with due care, especially when approaching the airfield, and report the position of the aircraft to the flight control officer. With the headlight in a sound condition, periodically cut in the headlight for marking the position of the aircraft.

Note. The headlight may be used at a flying speed not in excess of [illegible] km/hr IAS. Should the ultra-violet lamps fail, use the cockpit white-light lamp for illuminating the instrument scales.
If the light filter has fallen out of the ultra-violet lamp, thus resulting in blinding the pilot, immediately cut off the lamp rheostat.

FORCED LANDING PROCEDURE

386. In case of power-off forced landing the pilot will make approach for landing with retracted landing gear and flaps at a glide speed of 350 km/hr. He should extend the landing gear and flaps using the emergency procedure only if he is absolutely sure that his judgement for landing on the airfield has been done correctly. With the landing gear and flaps extended, the speed in glide should be 260 to 270 km/hr.

387. Perform forced landing outside the airfield only with the landing gear retracted, the flaps lowered by means of emergency procedure, and the suspended loads released. The gliding speed in this case should be kept at 270 to 280 km/hr.

Cautions: 1. Perform forced landing with the landing gear retracted only on natural ground. Fuselage landing on a concrete or metal runway leads to fire owing to the breakdown of fuel tanks and pipings.
2. Before gear-up landing, at an altitude of minimum 100 m, the pilot should open the sliding hood and cut off the aircraft battery, and before touchdown, remove the toes from the pedals and place the feet nearer to the seat pan.

388. In case of forced landing on unfriendly territory, the pilot should destroy the transmitter receiver of the aircraft transponder, for which purpose he should press the destruction button (the red lamp on the destruction control panel will come on) and take necessary measures for destroying the aircraft.

LANDING GEAR AND FLAPS EMERGENCY EXTENSION PROCEDURE

389. If the main extension system fails to extend the landing gear, the pilot will resort to the gear emergency extension procedure, for which purpose he should proceed as follows:

(a) put the landing gear control lever in the neutral position;

(b) pull the right-hand clip for emergency disengagement of the nosewheel and starboard wheel strut locks;

(c) pull the left-hand clip for disengagement of the port wheel strut lock;

(d) check if the struts have come off the locks (the warning lamps should go out and the mechanical indicators should come out slightly;

(e) set the landing gear control lever for extension;

(f) open the landing gear emergency air bottle valve on the cockpit right-hand panel;

(g) check the landing gear extension and struts locking by the warning lamps and the mechanical indicator;

(h) close the emergency system valve after accomplishing the flight and cutting off the engine.

Caution. Do not retract the landing gear in flight after emergency extension of landing gear.

Should the main and emergency extension systems fail to extend landing gear, land the aircraft only on an auxiliary unpaved runway.

390. For emergency extension of flaps, proceed as follows:

(a) shift the flap control lever all the way down (55°);

(b) open the flaps emergency air bottle valve on the right-hand panel of the cockpit;

(c) check the extension of flaps (by the warning lamp on the left-hand panel and by the mechanical indicator on the left-hand wing);

(d) close the flap extension emergency valve after accomplishing the flight and cutting off the engine.

PROCEDURE ON ENCOUNTERING FUEL PRESSURE DROP AFTER FIRST TANK PUMP

391. If the lamp of the fuel pressure warning unit has flashed up during the flight, check if the circuit breaker of the booster electric pump is cut in.

If the booster pump is cut off, switch on its circuit breaker when flying at an altitude of less than 9000 m, without changing the engine rating, and while flying at an altitude of 9000 m and above, first set the engine speed at 10,000 r.p.m. and, then, cut in the circuit breaker of the booster pump.

392. Do not fly the aircraft at altitudes above 9000 m with the fuel pressure warning unit lamp burning.

PROCEDURE ON ENCOUNTERING ENGINE FIRE

393. The indications of fire in the engine zone are:

(a) burning of the red warning lamp on the left-hand panel;

(b) smoke strip behind the aircraft tail, which can be easily detected during the banked turn;

(c) probable increase of exhaust gas temperature and presence of smoke inside the cockpit.

394. To extinguish fire, proceed as follows:

(a) close the stopcock and move the engine control lever full back;

(b) cut off the fuel booster and transfer pumps;

(c) decrease the flying speed down to 300 - 350 km/hr, using the speed excess for climbing;

(d) press the extinguisher starting button.

395. Should smoke get into the cockpit, close air dilution on the oxygen regulator, unpressurise the cockpit and cut in the ventilation.

396. After the fire has been stopped, do not start the engine in flight and land the aircraft with the engine cut off.

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PROCEDURE ON ENCOUNTERING GENERATOR FAILURE

397. The failure of generator in flight can be detected by the burning of red warning lamp and by the ammeter readings: the instrument pointer reads zero.

398. If the generator fails when flying in clouds or during a night flight, do the followings:

(a) when flying at altitudes below 9000 m, switch on the radio station receiver, gyro horizon, remote gyromagnetic compass, turn-and-slip indicator, the engine rating control instruments, pitot-static tube heater, ultra-violet and navigation lights (the last two only in night flight). Cut in the radio compass, the radio station transmitter, and aircraft transponder intermittently, in due succession, if necessary;

(b) when flying at altitudes above 9000 m, engage the booster fuel pump in addition to the consumers indicated above. The pump should be cut off after the aircraft has descended below 9000 m;

(c) with the APK-5 radio compass or the aircraft transponder cut in intermittently in a night flight, when the ultra-violet lamps go out and light up again in 1 - 2 minutes, and the visibility of control instruments is impaired, make use of the white lamp.

399. With the generator failing and the consumers fed from the aircraft battery in accordance with the procedure discussed in Item 398, the safe flying time of the aircraft makes up 18 to 22 minutes for day and night flights.

Note. The above safe flight limits are given for battery 12 CAM-28 having 75-per cent capacity, provided the battery has been used for one engine starting.

If, with the generator failing in flight, all the power supply consumers are cut in, the flight time within which the aircraft battery ensures flying safety makes up 5 to 6 minutes (on the average).

400. The indications of battery complete discharge are the failure of radio station to operate in the daytime and that of the ultra-violet lights during night flight (in this case, the AГИ-1 gyro horizon and the ДГМК-5 remote-reading gyromagnetic compass continue to operate).

401. When the flight is performed under instrument meteorological conditions and the pilot is obliged to make instrument approach for landing using instrument landing system, he must use the radio compass, marker receiver and radio altimeter PB-2 in the following way: cut in PB-2, MARKER (PB-2, MAPKEP) and APK, MARKER (APK, MAPKEP) circuit breakers 4 - 5 sec before reaching the homing station of the main or alternate airfield and home to the station by the APK radio compass.

402. On determining the moment of the homing station passage, cut off the PB-2, MARKER and APK, MARKER circuit breakers and using the gyromagnetic compass maneuver the aircraft into the final approach course line. When turning final and 30 - 60° before intercepting the final approach course, cut off the MPП-48 marker receiver, PB-2 radio altimeter and APK radio compass and keep them ON until the aircraft is landed.

PROCEDURE ON ENCOUNTERING ENGINE SPEED DROP IN FLIGHT

403. With the engine decelerating during take-off (in the process of the take-off run), the pilot should discontinue the take-off and take measures to rapidly stop the aircraft.

404. If the engine speed drops in flight at an altitude of up to 3000 m, cut in the isolating valve without changing the engine rating. At altitudes above 3000 m shift the engine control lever to the idling rating position, before cutting off the isolating valve. With the isolating valve cut in, set the required engine rating by smooth and slow movement of the engine control lever.

Note. When flying at high altitudes, with the isolating valve cut in, the engine speed rates are likely to exceed the permissible limits; therefore, watch the engine speed and, if necessary, decelerate the engine by retarding the engine control lever.

405. Engine speed drop, involving switching-on of the isolating valve, testifies to a serious defect in the fuel pumps. If this is the case, discontinue the flight and land the aircraft on the main or alternate airfield.

Cut off the isolating valve circuit breaker only after landing.

PROCEDURE ON ENCOUNTERING AILERON BOOSTER FAILURE

406. The aileron booster failure is recognized by great aileron forces on the control stick and by booster system pressure gauge readings(the pressure drops to zero).

If the aileron booster fails to operate, cut it off with the help of the control valve.

Level flight with the aileron booster cut off is safe. However, the landing of aircraft with the aileron booster cut off requires higher attention on the part of the pilot to aircraft flying due to considerable growth of aileron forces on the control stick.

Caution. Do not practice confidence and aerobatic maneuvers if the aileron booster is unserviceable.

PROCEDURE ON ENCOUNTERING ICE FORMATION

407. In all cases of ice formation the pilot should check whether the heater of the main pitot-static tube and emergency pitot tube TП-156 is cut in and should make proper use of the aircraft anti-icing system. In case of ice formation during upward cloud penetration, cut in the anti-icing system in level flight after taking the aircraft above the cloud top. During downward cloud penetration, do not change the flight attitude, use the anti-icing system down to an altitude of 1000 m and finally remove the ice crust from the canopy windshield in level flight after the aircraft has come below the cloud base.

If the windshield is covered with ice when penetrating clouds by a group of aircraft, remove the ice crust before the group assembly. If a group of aircraft gets into the icing zone, the group leader should take necessary measures to leave the icing zone and, with the anti-icing devices used by the pilots, he must separate the group laterally at safe intervals to ensure safety of flight.

Cut in the anti-icing device intermittently by 3 to 5-seconds pulses at 10 to 15-second intervals, with minimum consumption of fluid before encountering the enemy and prior to landing the aircraft after accomplishing the flight mission.

For better removal of ice crust, increase, if possible, the indicated airspeed to 700 km/hr at medium altitudes, and the true airspeed up to 600 km/hr at high altitudes.

CANOPY JETTISON AND EJECTION PROCEDURE

408. The ejection procedure is the most reliable method to abandon the aircraft in emergency. The ejection is safe both at high flying speeds and at various attitudes of the aircraft in space.

409. All the movements and actions of the pilot should be practised on the ground

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to perfection. The pilot should be able to find by finger feel the ejection system firing mechanism lever (face screen).

410. To abandon the aircraft equipped with the ejection seat, whose firing mechanism is actuated only from the levers located on the seat arm rests, proceed as follows:

(a) change the aircraft to level flight, if possible, and reduce the speed;

(b) take the toes off the pedals and put the feet on the seat foot rests;

(c) lean tightly against the seat back, press the head against the head plate and lock the seat harness;

(d) jettison the canopy, for which purpose shift the canopy jettison lever all the way forward; the canopy jettison mechanism makes it possible to jettison the canopy only from the front (closed) position: both with the pressurized and the unpressurized cockpit at any speed;

Note. If the canopy failed to jettison after pushing the canopy jettison lever, the pilot can drop it by pressing with the thumbs of both hands against the tail sections of the lock control levers, having first unpressurized the cockpit.

(e) make sure the canopy is jettisoned, rest the feet against the seat foot rests, and the hands - against the seat arm rests, without bending the arms in the elbows, then, press the hands tightly to the body, without lifting the lower back from the parachute pack, strain muscles and close the eyes and mouth;

(f) without changing the posture, press the firing lever with the fingers of the right hand.

411. If, with the above measures taken, the canopy still fails to jettison, the pilot can abandon the aircraft through the canopy. While doing so, proceed as follows:

(a) pull the red "bulb" fastened to the canopy above the pilot's head and remove the safety pin from the socket of the firing mechanism head which is connected with the sliding hood;

(b) assume the necessary posture in the seat, and eject the seat by pressing the levers on the seat arm rests.

While abandoning the aircraft, keep the assumed posture.

412. To leave the aircraft equipped with a face-screen ejection seat, the pilot should proceed as follows:

(a) tightly press the back against the seat;

(b) lock the seat harness;

(c) put the feet on the foot rests;

(d) rest the feet against the foot rests, straighten the back and press it against the seat back, press the head tightly against the head rest;

(e) take the face screen with both hands, close the mouth and eyes tightly, strain the muscles of the whole body and energetically pull the screen down. Shifting the screen during the first half of its travel will jettison the sliding hood and pull out the firing mechanism safety lock of the ejection system, the ejection (firing) being accomplished during the second half of screen travel.

Retain the assumed posture at the moment the ejection seat clears the aircraft.

If the face screen has stopped short of the chin level, the cockpit canopy may fail to jettison. In the latter case, without changing the assumed posture drop the cockpit canopy by the emergency method, i.e. by turning the canopy jettison handle all the way back, and eject using the arm rest levers or the face screen.

Bear in mind that after canopy emergency jettisoning by turning the handle, the ejection seat face screen may be thrown by the air stream behind the head plate.

Should the canopy fail to jettison, pull out the safety pin from the socket of the firing mechanism head which is connected with the sliding hood, for which purpose pull the hook (ring) located on the left side of the head rest plate and eject through the canopy using the face screen or the arm rest levers.

413. After the ejection, proceed as follows:

(a) free yourself from the seat 1.5 seconds after the ejection by pushing the seat away with the hands and feet, having first made sure that the seat harness is unlocked by the AД-3 mechanism;

(b) if the seat harness lock has not been released by the AД-3 mechanism, open the lock manually 1.5 - 2 seconds after the ejection and clear the seat.

414. When the ejection takes place at altitudes below 500 m, immediately open the parachute after clearing the seat by pulling the parachute rip cord.

While ejecting at altitudes above 500 m (up to the service ceiling of the aircraft) keep falling until the parachute is released by the KAП-3 parachute release control unit, which takes place as soon as the altitude set on the instrument is reached, or 2 seconds after clearing the seat when ejecting at a flight altitude below that set on the instrument.

If the parachute does not open from the KAП-3 parachute release control unit, open the parachute by pulling out the ring at an altitude of minimum 500 m above the ground surface.

415. Whenever necessary to open the parachute at an altitude exceeding the altitude set on the KAП-3 parachute release control unit (intensive rotation while falling, sharp ear pain, abandoning the aircraft over high ground), open the parachute 5 seconds after clearing the seat but at an altitude of not more than 9000 m.

416. When ejecting at altitudes above 9000 m, open the parachute only after a 10-second delay for each thousand metres of elevation above 9000 m (Table 11).

Table 11

Ejection altitude, m	10,000	11,000	12,000	13,000	14,000
Parachute opening delay, sec	10	20	30	40	50

417. When ejecting in condition of poor ground visibility (night flight in clouds), open the parachute manually in accordance with the instructions laid down in Items 414, 415.

PROCEDURE ON ENCOUNTERING COCKPIT UNPRESSURIZING AT HIGH ALTITUDES

418. Unpressurizing the cockpit will result in a typical "clap" and pressure in the ears; the VDPA cockpit altitude and pressure differential gauge shows a sharp increase of cockpit "altitude" and the pressure differential drops.

If the cockpit has been unpressurized by reasons other than the breakdown of canopy glass panels or the tear-down of sliding hood, open the emergency oxygen supply valve, decrease the flight altitude, then, report the failure to the flight control officer and discontinue the flight mission.

419. Should the canopy glass be broken or the canopy sliding hood torn off, immediately lower the goggles onto the eyes, lean forward towards the instrument panel, cut in emergency oxygen supply, decrease the altitude and reduce flying speed to 350 km/hr, report the mishap to the flight control officer and discontinue the flight mission.

IX. PECULIARITIES OF OPERATION AND FLYING TECHNIQUE OF MiG-17 AIRCRAFT EQUIPPED WITH IRREVERSIBLE HYDRAULIC BOOSTERS IN ELEVATOR AND AILERON CONTROL SYSTEM

GENERAL

420. To reduce the forces on the control stick, the latest-make fighter MiG-17 is equipped with irreversible hydraulic boosters БУ-1М (operating on the irreversible cycle) in the elevator and aileron control system.

The installation of an irreversible hydraulic booster in the elevator control system has considerably improved the longitudinal controllability of the aircraft at high flying speeds (especially at high altitudes), but has simultaneously increased the elevator stick forces at low flying speeds, as compared to those on the MiG-17 aircraft not equipped with irreversible hydraulic boosters.

The employment of irreversible hydraulic booster БУ-1М in the aileron control system has improved the lateral controllability of the aircraft (at high speeds) but slightly.

421. On aircraft equipped with irreversible hydraulic boosters in the elevator and aileron control system, all the aerodynamic loads caused by the elevator and ailerons are carried by the hydraulic boosters. The imitation of forces on the control stick is accomplished by means of special spring-feel mechanisms in which the springs are compressed in due ratio to the deflection of the control stick and consequently of the control surfaces, and forces are also set up by the balance tab in case of G-loads.

The greater the deflection of the control stick, the larger the force to be applied to the stick. With maximum deflection (forward or backward) of the control stick, the force values (as checked on the ground) amount to 9 - 10 kg. When G-loads are built up in flight due to the presence of a balance tab in the elevator control system, it is necessary to apply additional forces to the control stick proportional to the change of G-load (0.8 kg per G-load unit change). With the control stick moved all the way to the right or to the left, the forces caused by the aileron spring-feel mechanism make up 5 kg.

One should bear in mind that the power of the elevator booster is sufficient for taking off aerodynamic loads from the elevator in almost any flight attitude, whereas the power of the aileron booster in conditions of supersonic flying speeds (at an altitude of 5000 m and below) proves insufficient, which results in an intensive increase of forces required for deflecting the ailerons in the above flight attitudes.

Due to the presence of a spring-feel mechanism in the elevator control system, the control stick is fixed longitudinally in a preset position, with the hydraulic system operating and the hydraulic booster cut in, and can be deflected from this position only by applying some effort to it. This position of the control stick can be changed by switching on the trimming effect electric mechanism which forms the specific feature of the MiG-17 aircraft equipped with irreversible hydraulic boosters.

The forces applied to the control stick by the spring of the elevator spring-feel mechanisms can be trimmed in flight by the trimming effect electric mechanism which is controlled by a pressure change-over switch (as the elevator trim tab on the MiG-17 aircraft not equipped with irreversible hydraulic boosters). In this case, the aileron and elevator trim tab circuit breaker on the right-hand cockpit electric panel should be switched on.

The forces applied to the control stick can be completely removed by the trimming effect electric mechanism in a flight attitude corresponding to elevator deflection of maximum ±5°.

With the trimming effect electric mechanism set at zero, the control stick is fixed by the spring-feel mechanism in the neutral position, and the elevator trim tab warning lamp lights up.

422. The piloting of the aircraft with irreversible hydraulic boosters in the elevator control system, at low altitudes and high indicated airspeeds, beginning with 800 km/hr and above, requires of the pilot smooth movement of the elevator control and firm habits in piloting technique, since owing to the high efficiency of the control surfaces at high indicated airspeeds, short but energetic pulling of the control stick, leads to sharp increase of the angle of attack and subsequent slight but brisk pushing of the control stick results in considerable negative G-loads.

Flying the aircraft at high indicated airspeeds by feeling the force on the control stick may result in excessively high positive or negative G-load and wing-to-wing rolling.

423. With the aircraft pitching, the pilot should fix the control stick in the position at which the pitching has started, decrease the speed and assume the required flight attitude.

424. Cut off the elevator booster by the change-over switch located on the left-hand control panel of the cockpit.

425. If the booster hydraulic system fails to operate, or if the elevator booster is cut off by the change-over switch located on the left-hand control panel, the spring-feel mechanism gets automatically switched off and the elevator aerodynamic trim tab is switched on instead, the latter being controlled by the pressure change-over switch of the elevator trim tab. In this case, the circuit breaker of the aileron and elevator trim tabs on the right-hand control panel of the cockpit should also be cut in.

PRE-FLIGHT CHECK OF HYDRAULIC BOOSTERS

426. After starting the engine, check pressure in the booster hydraulic system, which should be from 60 - 65 to 80 - 85 kg/sq.cm.

427. Check the aileron control (with the hydraulic booster switched on or off) in the same order as on the MiG-17 aircraft not equipped with irreversible boosters.

428. Cut in the aileron and elevator trim tab circuit breaker on the right-hand electric panel of the cockpit; set the aileron trim tab in the NEUTRAL (НЕЙТРАЛЬНО) position as on the MiG-17 aircraft not equipped with irreversible hydraulic boosters. Cut off the elevator booster by the change-over switch located on the cockpit left-hand panel and use the pressure change-over switch to set the elevator aerodynamic trim tab in the NEUTRAL position after which the signal lamp should light up.

429. Check the elevator control with the hydraulic booster cut off (the change-over switch on the cockpit left-hand panel is cut off). At the moment the control stick is moved forward or backward, the pilot should feel only the forces caused by friction in the joints of the control system and by the load set up in the system, since in this case, the spring-feel mechanism is automatically cut off from the control system.

Considerable forces on the control stick during the check testify to the spring-feel mechanism engaging and disengaging cylinder being defective or to the ГА-74 booster cut-off hydraulic valve being out of order.

430. Cut in the elevator booster by the change-over switch mounted on the cockpit left-hand panel and check ease and smoothness of the elevator control. With the control stick deflected forward or backward, the pilot should feel inconsiderable forces. When released, the control stick should return to the neutral position.

431. Check the operation of the trimming effect electric mechanism, with the

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elevator booster cut in (the circuit breaker of the aileron and elevator trim tabs is switched on), in the following sequence:

(a) set the elevator trim tab pressure change-over switch in the PITCHUP (KABPUPOBAHИE) position until the trimming effect electric mechanism is cut in completely; as a result, the control stick should move backward (the elevator should deflect 5° up);

(b) set the pressure change-over switch in the PITCHDOWN (ПИКИРОВАНИЕ) position until the trimming effect electric mechanism is cut in completely. As a result, the control stick should move forward (the elevator should deflect 5° down);

(c) use the elevator trim tab pressure change-over switch to set the control stick (and consequently the elevator) in the neutral position, after which the elevator trim tab lamp should light up.

TAKE-OFF

432. Take-off in the МиГ-17 aircraft equipped with irreversible hydraulic boosters does not differ from that performed in the МиГ-17 aircraft without irreversible hydraulic boosters, except for the fact that the pilot feels more considerable pulling forces on the control stick. To raise the nose wheel, the pilot should pull the control stick with an effort of about 6 to 8 kg (since the deflection of elevator during the take-off makes up about 3/4 of its full upward deflection).

These forces remain practically unaltered until the aircraft clears the ground.

CLIMB

433. The climbing attitude of the aircraft equipped with hydraulic boosters is the same as on the aircraft without hydraulic boosters. After unsticking, when accelerating the aircraft with the trimming effect electric mechanism in the neutral position (the signal lamp burns), the pulling forces decrease with the increase of speed, and equal zero at a speed of 600 ± 50 km/hr.

Climb at optimum speed rating results in pulling forces on the control stick owing to the increase of the elevator deflections required with the altitude increase.

The arising forces can be trimmed with the help of the trimming effect electric mechanism by pulling the elevator trim tab change-over switch. However, to remove the force from the control stick in climbing, the pilot will have to resort to the change-over switch more frequently (approximately every 1000 - 1500 m) than to the trim tab change-over switch in the МиГ-17 aircraft not equipped with irreversible hydraulic boosters.

Climbing can also be accomplished without changing the position of the trimming effect electric mechanism, but in the latter case the pulling forces on the control stick will gradually increase and amount to about 6 - 8 kg at an altitude of 14,000 - 15,000 m.

STRAIGHT FLIGHT

434. In a straight flight (level or descending), the forces on the control stick, with the trimming effect electric mechanism in the neutral position, increase with the increase of the flying speed in excess of 650 km/hr.

However, at sonic and supersonic flying speeds the control stick forces in the aircraft equipped with irreversible hydraulic boosters grow smoother than in the aircraft without hydraulic boosters. At maximum flying speeds gained during straight flight the value of the pressing forces does not exceed 10 kg.

When flying level, the forces on the control stick may be trimmed by the trimming effect electric mechanism practically throughout the speed and altitude range.

FLIGHT MANEUVERS

435. In aircraft equipped with irreversible hydraulic boosters flight maneuvers are performed with the trimming effect electric mechanism in the neutral position (the elevator trim tab signal lamp burns).

The peculiarity of flying technique in the МиГ-17 aircraft equipped with irreversible hydraulic boosters is the increase of pulling forces on the control stick with the decrease of the flying speed in the process of executing flight maneuvers.

Irregular change of forces on the control stick, dependent on the characteristic of the spring of the spring-feel mechanism, slightly complicates piloting as compared to the МиГ-17 aircraft (not equipped with irreversible hydraulic boosters.

BANKED TURN AND SPIRAL

436. The flying technique of the banked turn and spiral in the aircraft equipped with irreversible hydraulic boosters has practically remained unaltered, except for the fact that lesser forces are required for building up G-load.

The presence of an irreversible elevator booster makes it possible to obtain the maximum permissible G-load (before the vibration starts) at altitudes above 6000 m, by deflecting the control stick with 6 - 12 kg pulling forces, and the maximum operating G-load (8 G) at altitudes below 6000 m with 10 - 14 kg pulling forces.

When flying at altitudes above 6000 m at supersonic speeds (the flying speed, as read by the indicator thin pointer, exceeds 1100 km/hr), the elevator efficiency reduces, which results in an increase of the control stick deflection required for performing the flight maneuver. The increase of the control stick deflection may be accompanied by an increase of forces on the control stick up to 20 - 30 kg, owing to insufficient power of the elevator booster at the above ratings.

CHANDELLE

437. With the aircraft energetically brought into the chandelle at any possible flying speed, the pulling forces on the control stick are less than in the aircraft not equipped with irreversible hydraulic boosters (the forces do not exceed 10 - 14 kg). As the flying speed is being reduced, the control stick pulling forces slightly decrease. However, at the end of the chandelle they slightly increase again to 6 - 8 kg due to the fact that the deflection of the elevator increases, when nearing the top of the flight maneuver, thus causing a respective increase of forces as a result of the compression of the spring in the spring-feel mechanism.

NORMAL LOOP AND HALF-LOOP

438. When performing a normal loop and half-loop in the МиГ-17 aircraft equipped with irreversible hydraulic boosters, the pulling forces to be applied to the control stick, when approaching the top of the maneuver, gradually increase up to 7 - 10 kg, since, with the speed decreased, the elevator deflection angles should be accordingly increased.

If the pulling forces on the control stick are insufficient, it may result in a loss of speed when nearing the top of the flight maneuver.

HALF-ROLL

439. The flying technique of half-rolls in the MиГ-17 aircraft equipped with irreversible hydraulic boosters is the same as in the MиГ-17 aircraft not provided with the above boosters. The forces on the control stick, when recovering from the half-roll, do not exceed 6 - 12 kg.

440. The half-roll, with the aircraft brought into the manouver at maximum level flight speed, is allowed at all altitudes specified for the MиГ-17 aircraft not equipped with irreversible hydraulic boosters. The aircraft gains practically the same flying speeds as the MиГ-17 aircraft not equipped with irreversible hydraulic boosters.

The pulling forces on the control stick, while executing half-rolls, do not exceed 12 kg.

VERTICAL DIVE

441. The vertical dive in the MиГ-17 aircraft mounting irreversible hydraulic boosters, with the aircraft brought into the dive from maximum level flight speed, is allowed from the same altitudes as in the MиГ-17 aircraft not equipped with irreversible hydraulic boosters.

Bring the aircraft into the vertical dive from maximum level flight speed by executing the half-roll. While rolling the aircraft to the wheels-up position, pull the engine control lever all the way back.

After the aircraft has reached a diving angle of 90°, move the control stick full forward.

When an altitude of 10,000 - 9000 m is gained, with the control stick moved full forward, the aircraft has a tendency to change the dive angle towards negative diving, and with further decrease of altitude it tends to pull out, while the pressing forces on the control stick increase at the vertical dive section and may amount to 10 kg.

Start recovering the aircraft at an altitude of minimum 8000 m (as read by the altimeter) in such a way as to pull it out level at an altitude of about 4500 to 5000 m. While recovering the aircraft from the vertical dive, the pulling forces on the control stick do not exceed 10 - 12 kg.

In case of late recovery from the vertical dive with the speed brakes retracted, when the aircraft banking is likely to arise at high indicated airspeeds at altitudes below 5000 m, immediately apply the speed brakes to decrease the airspeed.

The maximum speed (as read by the thin pointer) of 1340 - 1350 km/hr is gained on the vertical section of the dive at an altitude of 9000 to 6000 m, when the aircraft is brought into the dive at the maximum level flight speed from an altitude of 14,000 m with the speed brakes retracted. In this case, the actual flying speed does not exceed 1230 - 1250 km/hr with further diving the speed starts decreasing.

POWER-ON DIVE WITH ENGINE RUNNING AT COMBAT RATING

442. The power-on dive of the aircraft with the engine running at combat rating and the speed brakes retracted, when the aircraft is brought into the dive from a straight flight, may be performed at any speed up to the maximum level flight speed. When entering the dive at the maximum level flight speed, the control stick may be moved all the way forward (up to the stop).

With the stick moved all the way forward, when entering the dive at the maximum level flight speed from an altitude of 12,000 to 14,000 m, the aircraft reaches a certain dive angle not in excess of 50° relative to the horizon. While diving from lower altitudes, the dive angle value decreases and makes up 25 to 30° when the dive is entered at an altitude of 5000 m.

When bringing the aircraft into the dive, smoothly move the control stick forward. Energetic push of the control stick may result in negative G-load, and if the pilot is inadequately tied to the seat, he may strike his head against the cockpit canopy.

443. In the process of the dive execution, the pressing forces on the control stick, with the latter pushed all the way forward, do not exceed 10 kg. However, when diving from an altitude of 12,000 to 14,000 m, the forces on the control stick increase up to 20 - 25 kg at an altitude of 5000 to 6000 m due to insufficient power of the elevator booster.

In this case, the deflection of elevator is decreased and the aircraft itself gradually decreases the dive angle.

444. When diving with the engine running at combat rating, the aircraft gains the maximum speed when the dive is entered from a straight flight at a maximum level flight speed from an altitude of 14,000 m.

In the latter case, the flying speed (as read by the thin pointer) reaches 1300 - 1330 km/hr at an altitude of 9000 to 5000 m due to delay in transmitting static pressure to the speed indicator.

The actual speed of the aircraft, in this case, does not exceed the maximum permissible one.

Since the flying speed in diving at 50° and lesser dive angles, with the aircraft brought into the dive from a straight flight at maximum level flight speed, does not exceed the permissible speeds specified for the aircraft, the pilot flying at altitudes above 3000 m may not watch the speed indicator but will only check the altimeter readings.

445. While diving at altitudes below 3000 m, the pilot should watch the speed indicator as in case of the MиГ-17 Aircraft not equipped with irreversible hydraulic boosters, and should not exceed the maximum permissible indicated airspeed of 1060 km/hr (as read by the indicator thick pointer), specified for these altitudes.

FLYING WITH HYDRAULIC BOOSTERS CUT-OFF

446. Flying (take-off, landing and piloting) with a cut-off elevator booster differs from that in the MиГ-17 aircraft not provided with irreversible hydraulic boosters by slightly increased forces on the control stick in all flight attitudes, which are due to friction in the booster piston and in the elevator control system joints. Besides, in flights involving G-loads, it is necessary to apply additional forces to the control stick, proportionate to the change of G-load (0.8 kg per G-unit), owing to the presence of a balance tab in the elevator control system.

With the aileron irreversible booster cut off, the controllability of the aircraft does not differ from that of the MиГ-17 aircraft with cut off reversible hydraulic booster.

FLIGHT WITH HYDRAULIC BOOSTER SYSTEM FAILED

447. If the hydraulic booster system fails, cut off the boosters (using the change-over switch on the left-hand panel for cutting off the elevator, and the valve for cutting off the ailerons).

The aircraft should be balanced by the elevator and aileron aerodynamic trim tabs as in case of the MиГ-17 aircraft not equipped with irreversible hydraulic booster.

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LANDING

448. The specific feature of the aircraft in landing is the increased pulling forces on the control stick, which amount to 6 - 7 kg, since the upward movement of the elevator increases with the speed decrease, along with the proportionate increase of the forces imposed by the compression of the spring in the spring-feel mechanism.

X. PECULIARITIES OF OPERATION AND FLYING TECHNIQUE OF AIRCRAFT MиГ-17П

449. The MиГ-17П aircraft is a modification of the production aircraft MиГ-17 and differs from it mainly in that the MиГ-17П aircraft mounts a radar sight which ensures the performance of tactical missions in the daytime in adverse weather conditions and at night in standard and adverse weather conditions.

450. Check the aircraft and engine before flight in the sequence laid down for the MиГ-17 aircraft. Besides, examine the attachment units and check the fairings of the radar set scanner and sighting aerials for cracks.

PRE-FLIGHT CHECK OF RADAR SIGHT

451. The pilot checks the operation of the radar sight on the ground in the following cases:

(a) after elimination of faults detected in the sight during the previous flight;

(b) when the flight has been preceded by 100-hour scheduled maintenance involving the removal of the sight main units from the aircraft.

In all other cases, the pilot checks the sight units by visual inspection.

452. Before checking the radar sight on the ground, do the following:

(a) make sure the DAY - NIGHT (ДЕНЬ - НОЧЬ) change-over switch located on the cable box of the fuselage nose upper bay is set to the respective position;

(b) make sure the external power unit is connected to the aircraft mains;

(c) make certain the STATION-OFF (СТАНЦИЯ - ВЫКЛ.) change-over switch located on the control desk is placed in the OFF (ВЫКЛ.) position, and the BRIGHTNESS (ЯРК.) handle arranged in the right-hand lower corner of the indicator housing is placed in the extreme left-hand position (brightness is cut).

453. To check the radar sight for proper functioning, the pilot should proceed as follows:

(a) switch on the sight; two - three minutes after switching, a raster, background noises and lines of the electronic gyro horizon appear on the indicator scope;

(b) adjust the BRIGHTNESS (ЯРК.) and FOCUS (ФОК.) handles to obtain a weak but clear background on the scope with a gap in noise brightness within a zone from 2 to 5 - 6 km. The background noise should start at a range of 0.2 km and its upper boundary should be located at a distance of 12 km and above. The azimuth background noises should be restricted by a zone of 60° on both sides of the azimuth zero line. With the sight switched on, the instrument pointer on the control desk should first oscillate within 0 - 200 and 3 - 4 minutes after switching it on should settle in position between scale divisions 60 - 220, the pointer oscillation being not in excess of 10 scale divisions; in radar sights employing an automatic frequency control system, the instrument pointer should settle without oscillation between scale divisions 50 - 300 in 3 - 4 minutes;

(c) check the first crystal current and pressure in the waveguide system, for which purpose set the 1st CRYSTAL CURRENT - PRESSURE (ТОК I КРИСТ. - ДАВЛЕНИЕ) change-over switch in the 1st CRYSTAL CURRENT position with the first crystal current being normal, the instrument pointer should be located between scale divisions 60 - 220. Then, shift the 1st CRYSTAL CURRENT - PRESSURE change-over switch to the PRESSURE position. In this case, the instrument pointer should be located between scale divisions 60 - 140;

(d) check the operation of the radar sight sighting unit by pressing the CHECK (КОНТРОЛЬ) push-button. With the sighting unit functioning properly, the following should be observed:

- a target pip having the shape of a horizontal index-line, with a lock-on trace under it in the shape of a bright line, appear on the indicator scope at a range of 600 m; the target pip moves smoothly to the right and stops at the right boundary of the sighting zone square;

- a light artificial target image whose brightness increases with its movement right upwards from the initial position, appears on the data translation unit reflector. The dimensions of the artificial target image increase to a size corresponding to a range of 600 m;

- after releasing the CHECK push-button, the artificial target image retains its dimensions and brightness within one second and, then, returns to the initial position, decreasing its size and brightness.

Having made sure that the radar sight functions properly, set it in the OFF position.

OPERATING OF RADAR SIGHT IN FLIGHT

454. The radar sight is switched on and checked in flight in the same sequence as on the ground.

Three - four minutes after switching on the radar sight ground interference blips in the shape of index-lines and pips should appear on the indicator scope at a range corresponding to the flight altitude. Ground interferences decrease with the increase of the flight altitude and disappear completely at an altitude of 7000 m.

When flying at altitudes below 3000 m, it is difficult to observe the target pips against the interference background; therefore, the combat employment of the radar sight is limited by a minimum altitude equal to 2000 m.

Five - six minutes after switching on the sight in a level flight, check the reference point line of the electronic gyro horizon relative to the line of banks and, if necessary, adjust their relative layout. While doing so, check the level flight attitude by the flight instruments. Make sure by slight manoeuvering that the electronic gyro horizon functions properly.

455. Permanent check of radar sight operation in flight is accomplished by the presence of noises on the scanning indicator and by the readings of the first crystal current. The radar sight is cut off before landing.

456. After the radar sight is switched off, push the sliding section of the indicator tube all the way forward.

PECULIARITIES OF FLYING TECHNIQUE

457. All the flight elements are performed in the MиГ-17П aircraft according to the requirements of the present Instructions, with allowance made for the specific features, which are characterized by:

(a) increased flying weight of the MиГ-17П aircraft (by 220 kg) as compared to that of the MиГ-17П aircraft;

(b) poor field of vision through the front hemisphere owing to the installation of the sight units on it;

(c) necessity to pay attention not only to instrument flying but also to operating the radar sight;

(d) need for watching the scope face of the sight scanning indicator through the obscuring tube when flying in the daytime;

(e) change in layout of flight instruments on the instrument panel and of some units in the cockpit;

(f) installation of landing gear wheels with more efficient wheel brakes.

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458. The peculiarity of take-off in the MiG-17R aircraft is the poor field of vision through the front windshield of the cockpit canopy frame. Besides, due to the increase of aircraft flying weight, the nose wheel should be raised during the take-off run at a speed of 190 - 200 km/hr with a slight increase of the unstick speed and, consequently, of the take-off run and distance. The flying technique of the MiG-17R aircraft is no different from that of the MiG-17 aircraft.

If the take-off is performed with the flaps lowered to the take-off position, they will be retracted at an altitude of minimum 70 to 100 m.

459. The climbing in the MiG-17 aircraft is accomplished at the same speeds and engine ratings as in the MiG-17 aircraft. The time required for climbing the MiG-17R aircraft is slightly increased as compared to that of production aircraft MiG-17 (comparative data are laid down in the Appendix). The service ceiling of the aircraft is 14,500 m.

460. The piloting technique in level flight has no peculiar features. The maximum permissible speed limitations at all altitudes are the same as for the MiG-17 aircraft, while the maximum level flight speeds are somewhat less (the speed values are presented in the Appendix).

461. The time required to speed up the aircraft, with the engine running at 11,560 r.p.m., is characterized by the data given in Table 12.

Table 12

Time (in seconds) Required to Accelerate Aircraft with Engine Running at 11,560 r.p.m.

True airspeed range, km/hr	Altitude, m		
	1000	5000	10,000
From 600 to 700	10	21	-
From 700 to 800	10.5	22	36
From 800 to 900	11.5	23	39
From 900 to 1000	-	-	42

462. Aircraft deceleration, by only decreasing the engine speed to idle rating or by decreasing the engine speed down to the idling rating with simultaneous extension of the speed brakes, is characterized by the data indicated in Table 13.

Table 13

Time (in seconds) Required to Decelerate Aircraft by Decreasing Engine Speed Down to Idle Rating with Speed Brakes Extended or Retracted

True airspeed range, km/hr	Altitude, m					
	1000		5000		10,000	
	with speed reduced	with speed reduced and speed brakes applied	with speed reduced	with speed reduced and speed brakes applied	with speed reduced	with speed reduced and speed brakes applied
1	2	3	4	5	6	7
From 1000 to 900	-	-	-	-	[illegible]	[illegible]
From 900 to 800	9	4	14	6	27	12
From 800 to 700	16	6	19	8	34	17
From 700 to 600	20	8	24	12	-	-

463. As to the performance of flight maneuvers, the MiG-17R aircraft [illegible] differ from production aircraft MiG-17.

464. The peculiarity of performing flight maneuvers in the MiG-17R [illegible] the impairment of orientation in space due to the inadequate field of [illegible] the front hemisphere caused by the installation of additional sight and [illegible] presence of windshield heater metal wires in some models of aircraft.

465. While executing ascending flight maneuvers the respective speed [illegible] which the aircraft is brought into the maneuver, specified for the MiG-17 [illegible] should be increased by 20 - 30 km/hr. The indicated airspeed in the upper [illegible] the ascending flight maneuvers should be minimum 350 km/hr. The descending [illegible] maneuver entry speed should also be minimum 350 km/hr.

466. With the elevator trim tab in the neutral position, pulling forces arise on the control stick in all flight maneuvers; the value of these forces is considerably higher than in the MiG-17 aircraft. While flying at high altitudes, the deterioration of the aircraft maneuverability is more noticeable as compared to the MiG-17 aircraft.

467. The minimum flying speeds of the MiG-17R aircraft exceed the minimum flying speeds of the MiG-17 aircraft by 5 - 10 km/hr IAS.

468. The behaviour of the MiG-17R aircraft at minimum flying speeds, its stall characteristics, and the conditions in which the aircraft enters both the normal and the inverted spin, as well as the nature of the spin proper and the recovery procedure, are the same as in the MiG-17 aircraft.

469. When approaching the airfield for landing, cut off the radar sight.

470. The glide on the base leg and the turn to final leg will be performed at a speed of 350 km/hr. Perform gliding after turning to final leg, prior to levelling-off, at a speed of 330 km/hr.

471. While descending through clouds and making a straight-in approach for landing, or when approaching for landing using two-180°-turn or the wide rectangular pattern approach procedure, before reaching the outer marker, maintain an indicated airspeed of minimum 450 km/hr.

472. Due to poor vision through the front hemisphere, the pilot should give special attention to finalizing the direction of landing, determining the time of levelling-off and distributing attention during landing.

473. In the process of floating and at the moment of touchdown, look at the ground through the side glass panel of the cockpit canopy frame (10 - 15° to the left and 30 - 40 m ahead).

474. The normal touchdown speed of the aircraft (with the fuel remainder equal to 300 - 450 lit) is 230 to 220 km/hr. After landing, the MiG-17R aircraft drops its nose more energetically as compared to the MiG-17 aircraft.

475. Apply the wheel brakes during the landing roll more smoothly, gradually increasing pressure in the brakes from 1.5 - 2.0 kg/sq.cm at the beginning of the roll (after lowering the nose wheel) to 5 - 6 kg/sq.cm at the end of the landing roll.

EMERGENCY PROCEDURES ON ENCOUNTERING FORCED LANDING

476. In case of forced landing on natural ground, in addition to the procedure normally used in the MiG-17 aircraft, the pilot should extend the nose wheel, for which purpose:

(a) disengage the landing gear nose wheel [illegible] cockpit floor, to the right of the aircraft [illegible] [illegible]lling the shackle on the [illegible];

(b) check by the mechanical indicator and [illegible] [illegible] if the nose wheel has come off from the lock.

PECULIARITIES OF PILOTING [illegible]

477. The peculiarities of piloting the MiG-[illegible] [illegible] searching, approaching or attacking the target, or while operating [illegible], as well as the safety measures to be observed in combat flights, are [illegible] [illegible] Training Aid for Flying Personnel of MiG-17П Fighter-Interceptors.

XI. PECULIARITIES OF [illegible] TECHNIQUE OF AIRCRAFT [illegible] EQUIPPED WITH ENGINE [illegible] [illegible]-17ПФ

INSPECTION OF AIRCRAFT

478. Examine the aircraft in the sequence laid down for the MiG-17 aircraft. Besides that, the pilot should:

(a) make sure that no foreign matter, damage or accumulation of fuel is observed in the nozzle and afterburner;

Note. When turning the engine rotor from the electric starter, with the booster fuel pump engaged, or checking the operation of the afterburner, as well as during long-term parking of the aircraft, minor leakage of fuel through the afterburner jets is tolerated.

(b) examine the retractable cone and flaps of the engine adjustable nozzle for dents and deformation.

While examining the aircraft, the retractable cone of the engine jet nozzle may be in the rear or in the front position.

It can remain in the rear position after the pre-flight check of the afterburner ignition system owing to insufficient pressure in the hydraulic accumulator.

When starting the engine, with pressure set up in the hydraulic system, the retractable nozzle cone should be in the front position.

479. On entering the cockpit, check to see that:

(a) the ENGINE AFTERBURNER ([illegible]) circuit breaker is cut in;

(b) the AFTERBURNER EMERGENCY CUT-OFF ([illegible]) circuit breaker is switched on (the change-over switch being set in the front position);

(c) the adjustable nozzle control change-over switch should be in the CLOSED (ЗАКРЫТО) position (rear position);

With the power supply cut off, check the ease of movement of the engine control lever to the combat and augmented rating stops (when the control lever is moved forward beyond the combat rating speed limiter, an audible click of the microswitch should be heard).

ENGINE STARTING AND TESTING

480. The starting and testing procedure of engine, model ВК-1Ф, is similar to that of engine, model ВК-1.

481. Before starting the engine, check the operation of the afterburner ignition system units with zero pressure in the aircraft hydraulic system, for which purpose switch on the ENGINE AFTERBURNER circuit breaker, shift the engine control lever by pressing the lever button to the frontmost position beyond the full augmented rating stop, thereby starting the afterburner ignition for 4 – [illegible] seconds (without feeding fuel to the burners). Sparking between the electrodes of the afterburner spark plug, visible through the adjustable nozzle, testifies to the proper condition of the afterburner ignition system.

Simultaneously a clicking sound of the adjustable nozzle door control electromagnetic valve should be heard, indicating that the valve is in a proper condition.

Note. The afterburner system may be checked for proper functioning also at a pressure of more than 75 kg/sq.cm in the hydraulic system. A pressure of less than 75 kg/sq.cm may result in deformation of the adjustable nozzle cone due to oblique setting. Therefore, if the value of pressure in the hydraulic system is less than 75 kg/sq.cm, release pressure down to zero and, then, proceed to check the operation of afterburner ignition system units.

482. Check the afterburner emergency cut-off circuit breaker for proper functioning, for which purpose switch on the AFTERBURNER EMERGENCY CUT-OFF circuit breaker and check by ear whether a clicking sound is heard when operating the afterburner emergency cut-off solenoid located on the lower fuel pump (ПН-14А) of the afterburner system. Checking over, set the AFTERBURNER EMERGENCY CUT-OFF circuit breaker in the OFF position.

483. Before starting the engine, cut in the engine afterburner circuit breaker on the left-hand electric panel and keep it switched on during the whole flight, irrespective of whether the afterburner is turned on or off.

484. The AFTERBURNER EMERGENCY CUT-OFF circuit breaker should be switched on.

Cautions: 1. Do not shift the engine control lever before the engine gains the idle rating.

2. If, with the engine started, a heavy flame comes off the afterburner nozzle all over the cross-section of the nozzle, it indicates that the АРТ-14А afterburner fuel distributor slide-valve is open for some reason or other.

If this is the case, immediately switch on the afterburner emergency cut-off system, by shifting the AFTERBURNER EMERGENCY CUT-OFF and ENGINE AFTERBURNER circuit breaker to the rear position and, without stopping the engine, continue to start it. After starting the engine, gain 6000 r.p.m., then, decelerate the engine and stop it by closing the stop-cock, matching the setting notches on the МР-2 mechanism of the АРТ-14А valve or closing the shut-off fuel valve when the setting notches are mismatched.

After stopping the engine, start it only after locating the cause of the non-opening of the АРТ-14А valve and eliminating the fault.

Do not scavenge the engine with fuel burning down in the afterburner when starting the engine with the АРТ-14А valve open, since scavenging will only intensify the flame.

485. After starting the engine, with a pressure in the aircraft hydraulic system being minimum 75 kg/sq.cm and the engine running at 7000 to 6000 r.p.m., check the operation of the adjustable nozzle by cutting in or out the NOZZLE OPEN (СОПЛО ОТКРЫТО) change-over switch.

After cutting off the NOZZLE OPEN change-over switch, make sure the adjustable nozzle is in the CLOSED (ЗАКРЫТО) position.

OPERATING OF ENGINE ON GROUND

486. On the ground the afterburner may be turned on only when it is necessary to check the operation of the afterburner after replacing the afterburner or one of its units. In this case, the time of engine operation at augmented rating should not exceed 10 seconds and the pressure of afterburner fuel should be not in excess of 11[illegible] kg/sq.cm.

Before testing the afterburner, check whether the chocks are properly placed under the aircraft wheels, since, with the afterburner turned on, the engine thrust on the ground increases by 25%.

487. With the temperature of an ambient air being below –10°C, and the engine run-

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ning at maximum speed, the gas temperature behind the turbine may increase beyond the permissible value (720°C).

In the latter case, the engine rating is limited by the gas temperature and, to obtain the permissible gas temperature, it is necessary to decelerate the engine.

488. To avoid overheating of the fuselage structure elements, the duration of engine continuous run on the ground, with the adjustable nozzle flaps closed, should not exceed 3 minutes.

If more continuous engine operation on the ground is required, open the adjustable nozzle flaps, for which purpose set the NOZZLE OPEN change-over switch in the OPEN position. The temperature of gases in this case will drop by 80 - 100° and the engine thrust will be below the rated value.

489. It is unadvisable to run the engine on the ground at maximum speed for more than 1 minute.

490. Continuous engine run at idle rating should not exceed 10 minutes and the temperature of exhaust gases in this case should be not over 540°C.

491. The maximum permissible rate of engine control lever movement from the idle to the combat rating stop (without turning on the afterburner) should not exceed 1 - 2 seconds. While doing so, short-time overspeed by 250 r.p.m. and gas overtemperature behind the turbine by not more than 50°C are allowed.

The time required to accelerate the engine to maximum speed should not exceed 15 seconds.

The reverse movement of the engine control lever from the combat to the idle rating position may be effected within not less than 1.5 - 2 seconds.

492. At an air temperature above +15°C, the engine acceleration ground test may be accomplished from a speed of not less than 5600 r.p.m.

PECULIARITIES OF OPERATING ENGINE, MODEL RD-10, IN AIR WITHOUT AFTERBURNER TURNING-ON

493. When shifting the engine control lever on the ground or at low altitudes, the change-over from manual control of the HH-6MA pump to automatic control takes place unnoticed (the engine control lever idle run is missing).

Increasing the flight altitude, when passing over from manual control of the HH-6MA pump to automatic control, will result in an idle run section of the engine control lever, i.e., with the engine control lever shifted, the engine speed on the change-over section remains unaltered. At an altitude of about 10,000 m, the idle run section of the engine control lever amounts to 1/5 of the total travel and is located between the idle rating position and the position of the engine control lever corresponding to a ground speed of 9000 ± 200 r.p.m.

494. While descending from any altitude, with the position of the engine control lever over the manual control section of the HH-6MA pump being constant (from the idle rating to 9000 ± 200 r.p.m.), the engine speed will decrease.

PROCEDURE OF AFTERBURNER TURNING-ON AND -OFF IN FLIGHT

495. The afterburner will be turned on in flight at the engine maximum speed by shifting the engine control lever forward beyond the combat rating stop, thereby cutting in automatically all the units ensuring the starting and operation of the afterburner.

The afterburner is turned off by shifting the engine control lever in the reverse direction.

Note. Turning the afterburner on or off may result in short-time changes of the engine speed and gas temperature behind the turbine.

496. The afterburner can be turned on up to an altitude of 15,000 m.

497. With the afterburner turned on, the engine thrust increases, causing an increase of vertical climbing speeds, maximum level flight speeds and service ceiling, and improving the manoeuvrability of the aircraft.

498. To turn on the afterburner, proceed as follows:

(a) set the indicated airspeed of minimum 300 km/hr;

(b) accelerate the engine to the maximum speed (11,560 r.p.m.);

(c) press the button on the engine control lever and shift the lever beyond the combat rating stop so as to latch it in this position.

499. It is allowed to turn on the afterburner at the maximum cruising rating (10,870 r.p.m.) by continuous movement of the engine control lever with a rate of minimum 1.5 seconds.

500. The afterburner starts operating 3 to 5 seconds after turning it on. The time required for increasing the engine thrust when turning on the afterburner, should not exceed 6 seconds.

Turning on the afterburner at altitudes below 10,000 m will result in pops with energetic acceleration of the aircraft. The temperature of the exhaust gases increases by 10 to 40°C; at altitudes above 10,000 m especially at low flying speeds, the turning-on of the afterburner is accompanied for a short time by intensive pops and the acceleration of the aircraft is considerably less.

501. The turning-on and operation of the afterburner should be checked by the temperature of the exhaust gases and by the acceleration of the aircraft.

The maximum temperature of the gases behind the turbine, when flying at augmented rating, should not exceed 720°C up to an altitude of 14,000 m and 745°C - above 14,000 m.

The maximum temperature of gases at take-off (combat) rating, with the afterburner turned off should not exceed 720°C at all flight altitudes.

If the fuel fails to ignite in the afterburner after turning it on, the gas temperature behind the turbine drops by 30 - 40°C and the flying speed decreases.

502. Continuous operation of the engine at augmented rating in climbing and level flight at altitudes up to 7000 m is allowed for not more than 3 min, and at altitudes above 7000 m - for maximum 10 min.

When climbing the aircraft at the maximum rate-of-climb speed immediately after take-off or from an altitude below 7000 m, the afterburner may remain turned on from the moment of take-off during 10 min continuously, since the altitude of 7000 m will be reached within less than 3 min. When in flight, the afterburner may be turned on several times whenever necessary. Repeated switching of the afterburner is allowed only after cooling the afterburner, for 3 minutes with the engine running at 11,200 r.p.m.

The values of engine rating limitations are given in Table 14.

Table 14

Engine Rating Limitations

Engine rating	Engine speed, r.p.m.	Gas temperature behind turbine, °C	Oil		Time of continuous operation
			pressure, kg/sq.cm	temperature, °C	
1	2	3	4	5	6
Combat, with afterburner on	$11{,}560^{+50}_{-100}$	720, at altitudes		From -30 to +90	At altitudes up to 7000 m - maximum

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1	2	3	4	5	6
		above 14,000 m - 745		From -40 to +90	3 minutes; at altitudes above 7000 m - maximum 10 minutes
Combat, with afterburner off	$11,560^{+60}_{-100}$	720	1.4-3.5		In level flight at altitudes up to 10,000 m - maximum 6 minutes; at altitudes above 10,000 m - maximum 10 minutes; in climbing - 10 minutes
Nominal	11,200				60 minutes
Maximum cruising	10,870				Unlimited
Idle rating on the ground	2500 ± 100	540	Minimum 0.2		Maximum 10 minutes

503. With the increase of flight altitude, the fuel pressure in the afterburner considerably drops. Thus, at an altitude of 3000 m, the fuel pressure in the afterburner equals 60 to 80 kg/sq.cm; at an altitude of 10,000 m the pressure of fuel in the afterburner equals 10 to 15 kg/sq.cm; and at an altitude of 14,000 m the pressure of afterburner fuel equals 2 to 5 kg/sq.cm.

504. To change the engine thrust at augmented rating in aircraft mounting engines with strengthened afterburners, provision is made for a throttling system which ensures the change of the engine speed without turning off the afterburner. The change of the engine speed, with the engine running at augmented rating, is effected by shifting the engine control lever from the combat rating stop to a special throttling stop set in a position corresponding to the engine speed of 10,870 - 70 r.p.m.

To turn off the afterburner, shift the engine control lever backward through the throttling stop. While doing so, the afterburner gets turned off at the engine speed of 10,550 + 50 r.p.m.

It is allowed to shift the engine control lever to the required engine speed only after making certain that the afterburner has been turned off (pressure in front of the afterburner jets drops down to zero).

505. In aircraft mounting engines with non-strengthened afterburners the throttling system is not provided and the throttling stop is not installed. The above aircraft have intermediate stops adjusted to the engine speed of 8600 r.p.m., which are intended for limiting the movement of the engine control levers in order to protect the afterburners from crumpling when turning off the engine afterburners at flying speeds above 800 km/hr.

To turn off the afterburner in these aircraft, shift the engine control lever back beyond the combat rating stop.

To repeatedly turn on the afterburner, set the engine control lever at the intermediate stop or cut in or out the afterburner circuit breaker.

Shift the engine control lever beyond the combat rating stop only after carrying out the above operations. This is normal procedure to prepare the electric circuit for repeated turning on of the afterburner.

506. To prevent spontaneous cutting-off or logging of the engine at altitudes above 15,000 m with an indicated airspeed of less than 300 km/hr, operate the engine only at combat or augmented rating. When throttling the engine at these altitudes, gain the combat rating at altitudes of less than 15,000 m and an indicated airspeed of above 300 km/hr.

To prevent spontaneous cutting-off of [illegible] engine, model ВК-1Ф, at altitudes above 16,000 m, the engine afterburner may be turned off at flying speeds of more than 300 km/hr IAS.

TAKE-OFF WITHOUT TURNING-ON AFTERBURNER

507. Before taking-off, the pilot should make sure that the NOZZLE OPEN (ОТКРЫТО) change-over switch is in the CLOSED (ЗАКРЫТО) position.

Caution. When taking off with the nozzle open, the length of take-off run is almost twice as much owing to the decrease of the engine thrust.

508. The take-off technique in the МиГ-17Ф and МиГ-17ПФ aircraft, with the afterburner turned off, does not practically differ from that in the МиГ-17 aircraft. The take-off run length is somewhat greater than that of the МиГ-17 aircraft. The unstick speed of the МиГ-17ПФ aircraft, as compared to that of the МиГ-17 aircraft, is increased by 10 - 20 km/hr.

TAKE-OFF WITH AFTERBURNER TURNED ON ON THE GROUND

509. Whenever necessary to reduce the length of the take-off run and take-off path, it is allowed to take off with the afterburner turned on.

510. While taking off with the afterburner turned on, the aircraft rapidly gains speed both during the take-off run and after the unstick, which considerably reduces the length of the take off run of the МиГ-17Ф aircraft down to 350 - 400 m, and the climbing time.

511. When taking off with turning on the afterburner for subsequent flying at low altitudes, the pilot should carefully watch the fuel [illegible], since the use of the afterburner at low altitudes involves considerable consumption of fuel.

Turn off the afterburner after take-off at an altitude of 150 - 200 m.

512. While flying the landing pattern, turn to base leg at a speed of 400 km/hr, glide on the base leg at a speed of [illegible] - 370 km/hr and perform the final leg turn at a speed of minimum [illegible] km/hr. After turning final, maintain the gliding speed of [illegible] - [illegible] km/hr.

513. While gliding, with the engine running at idle rating, bear in mind that engine acceleration time (time required to pick up speed from idle to take-off rating) makes up 15 seconds, therefore, the decision to add power or to go-around should be taken in due time.

514. The flying technique of the МиГ-17Ф and МиГ-17ПФ aircraft, with the afterburner turned off, does not practically differ from that of the МиГ-17 aircraft.

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Table 15

Rate of Climb of Single Aircraft МиГ-17Ф with Afterburner Turned on or off

Altitude, m	With afterburner turned off			With afterburner turned on		
	true speed (read by thin pointer) during climbing, km/hr	vertical speed, m/sec	climbing time, min	true airspeed (read by thin pointer) during climbing, km/hr	vertical speed, m/sec	climbing time, min
1000	750	39.6	0.4	-	-	-
2000	750	36.4	0.9	-	-	-
3000	750	33.9	1.3	1000	75.8	1.7
4000	750	31.3	1.9	1000	70.4	1.9
5000	750	26.8	2.4	1000	65.0	2.1
6000	750	26.2	3.0	1000	59.7	2.4
7000	750	23.6	3.7	1000	54.4	2.7
8000	750	21.0	4.5	1000	49.0	3.0
9000	750	18.4	5.3	1000	43.8	3.3
10,000	750	16.0	6.2	1000	38.4	3.7
11,000	750	13.4	7.3	970	33.0	4.2
12,000	750	10.0	8.8	970	28.0	4.7
13,000	750	7.0	10.0	970	22.5	5.4
14,000	750	3.9	14.0	970	17.2	6.3
15,000	750	0.8	22.0	940	11.8	7.4
16,000	750	-	-	910	6.7	9.2

Note. The climbing time at augmented rating is given for conditions of climbing flight up to 3000 m at engine combat rating, with the afterburner turned off.

515. Climb the aircraft, with the afterburner turned off, at the following speeds:

(a) in the МиГ-17Ф aircraft – at true airspeed of 750 km/hr (as read by the thin pointer);

(b) in the МиГ-17ПФ aircraft – at a true airspeed of 730 km/hr (as read by the thin pointer).

516. Climbing at augmented rating should be performed:

(a) in the МиГ-17Ф aircraft: up to an altitude of 10,000 m – at a true airspeed of 1000 km/hr; from an altitude of 11,000 to 14,000 m – at a true airspeed of 950 km/hr, and up to 16,000 m – at a true airspeed of 900 km/hr. The forces applied to the control stick, when climbing the aircraft at augmented rating up to 10,000 m, are pressing forces and amount to 5 – 7 kg. At altitudes of 10,000 m and above, the forces on the control stick change into pulling forces and have an average value of up to 5 kg; with the trim tab applied, the control stick forces are reduced;

(b) in the МиГ-17ПФ aircraft: up to an altitude of 10,000 m – at a true airspeed of 960 km/hr; when climbing to altitudes above 10,000 m, reduce the true airspeed by 20 km/hr per each 1000 m.

517. Climb to altitudes above 16,000 m only in aircraft equipped with special high-altitude equipment.

Table 16

Rate of Climb of Single Aircraft МиГ-17ПФ with Afterburner Turned on or off

Altitude, m	With afterburner turned off			With afterburner turned on		
	true airspeed (read by thin pointer) during climbing, km/hr	vertical speed, m/sec	climbing time, min	true airspeed (read by thin pointer) during climbing, km/hr	vertical speed, m/sec	climbing time, min
0	780	33.8	0	990	-	-
1000	780	31.8	0.5	930	-	-
2000	780	29.8	1.0	990	-	-
3000	790	27.8	1.6	990	-	-
4000	780	25.8	2.2	990	59.5	-
5000	780	23.8	2.9	990	55.0	2.5
6000	780	21.8	3.7	990	50.5	2.9
7000	780	19.8	4.5	930	46.0	3.2
8000	750	17.8	5.3	990	41.3	3.6
9000	780	15.8	6.4	990	36.8	4.0
10,000	780	13.7	7.6	990	32.3	4.5
11,000	780	11.7	8.9	9[illegible]0	28.0	5.1
12,000	780	8.4	10.5	9[illegible]0	22.8	5.7
13,000	780	5.0	13.1	9[illegible]0	16.5	6.6
14,000	780	1.6	18.5	920	11.1	7.8
15,000	-	-	-	[illegible]	5.6	9.3

Note. The climbing time at augmented rating is given for conditions of climbing flight up to 4000 m at engine combat rating, with the afterburner turned off.

518. While climbing at maximum speed to an altitude of 5000 – 7000 m, with the afterburner turned on, the consumption of fuel for climbing to an altitude above 10,000 m is less than that for climbing to the same altitude with the afterburner turned off.

LEVEL FLIGHT

519. The maximum level flight speeds (read by the thin pointer) of the МиГ-17ПФ and МиГ-17Ф aircraft, with the engine running at augmented rating, increase as compared to the flying speeds with the engine running at combat rating. The speed values (in kilometres per hour) are specified in Table 17.

Table 17

Aircraft	Altitude, m		
	5000	10,000	12,000
МиГ-17Ф	1130	1071	1054
МиГ-17ПФ	1165	1052	1038

520. While flying level at the maximum speed, with the afterburner turned on at an altitude of less than 10,000 m (for aircraft МиГ-17Ф), the pilot experiences pressing forces on the control stick (the aircraft flies nose up). Thus, at an altitude of 5000 m with an indicated airspeed of 900 km/hr, the pressing forces on the control stick make up 35 – 40 kg. In this case, the elevator trim tab proves ineffective to remove the above forces.

521. The maximum permissible flying speeds (in kilometres per hour) of the МиГ-17Ф and МиГ-17ПФ aircraft at various altitudes equal respectively to the values given in Table 18.

T a b l e 18

Aircraft	Altitude, m		
	up to 3000	up to 7000	above 7000
МиГ-17Ф and МиГ-17ПФ	1060 (read by the instrument)	1150 (read by the thin pointer)	Up to the service ceiling flying speed should not exceed 1100 km/hr (as read by thin pointer)

AIRCRAFT BALANCING

522. The trim speed of the МиГ-17Ф and МиГ-17ПФ aircraft (with zero forces on the control stick) at a climbing attitude, with the engine running at nominal rating at a speed of 11,200 r.p.m., at an altitude of 3000 - 5000 m (the elevator trim tab being in the neutral position), should make up 600 + 50 km/hr.

FLIGHT MANEUVERS

523. The flying technique of the МиГ-17Ф and МиГ-17ПФ aircraft with the afterburner turned on differs but slightly from that with the afterburner turned off.

524. While performing vertical maneuvers at augmented rating, with the same G-loads as in flying with the afterburner turned off, the flight maneuvers become extended in altitude and the time required for performing them increases.

The performance of banked turns at augmented rating may involve greater G-loads than in flying with the afterburner turned off; owing to greater G-loads the maneuvering time decreases.

The characteristics of optimum steady banked turns performed in the МиГ-17Ф and МиГ-17ПФ aircraft at an altitude of 10,000 m are presented in Table 19.

T a b l e 19

Characteristics of Optimum Steady Banked Turns Performed at Altitude of 10,000 m

Banked turn characteristics	МиГ-17Ф		МиГ-17ПФ	
	with afterburner off, n=11,560 r.p.m.	with afterburner on, n=11,560 r.p.m.	with afterburner off, n=11,560 r.p.m.	with afterburner on, n=11,560 r.p.m.
Speed, km/hr	-	-	440	450
Time, sec	64.4	54.2	85	62
Radius, m	-	-	2850	2050

Note. For the МиГ-17ПФ aircraft the steady banked turn characteristics are reduced to a weight of 5238 kg.

525. Flying at augmented rating has increased the flight maneuver altitudes as follows:

(a) banked turns of up to 45° may be performed at altitudes up to 12,000 m;

(b) 30° banked turns may be executed at an altitude of 15,000 m;

(c) the normal loop and half-loop may be entered at an altitude of 8000 m.

526. Inverted flight at combat rating, with the afterburner turned off, is allowed for not more than 15 seconds, while that with the afterburner turned on may be performed for not more than 5 seconds, provided the remainder of fuel is minimum 550 litres.

Caution. Recover the aircraft from vertical maneuvers at augmented rating, when the aircraft is subject to positive G-load (above +0.1), since the overhead flight tank cell capacity is insufficient.

526. The spin characteristics of the МиГ-17Ф and МиГ-17ПФ aircraft are similar to those of the МиГ-17 aircraft; therefore, these aircraft are recovered from the spin in the same way as the МиГ-17 aircraft.

RANGE AND ENDURANCE

528. To gain the maximum range and endurance in the МиГ-17ПФ aircraft, maintain the indicated airspeeds given in Table 20.

T a b l e 20

Indicated Airspeeds Corresponding to Maximum Range and Endurance

Flight altitude, m	Indicated airspeed corresponding to maximum range, km/hr	Indicated airspeed corresponding to maximum endurance, km/hr
5000	470-570	300-320
10,000	400-480	300-320
12,000	390-440	300-320

529. Glide the МиГ-17Ф and МиГ-17ПФ aircraft with a retracted landing gear and the engine control lever set in the idle rating position, at the speeds indicated for the МиГ-17 aircraft.

EMERGENCY PROCEDURES

AFTERBURNER FAILS TO TURN OFF

530. In case the afterburner fails to turn off when actuated by the engine control lever, turn off the afterburner using the emergency procedure, for which purpose shift the AFTERBURNER EMERGENCY TURN-OFF (АВАРИЙНОЕ ВЫКЛЮЧЕНИЕ ФОРСАЖА) circuit breaker in the rear position. In addition, cut off the ENGINE AFTERBURNER (ФОРСАЖ ДВИГАТЕЛЯ) circuit breaker by shifting the switch to the rear position.

When turning off the afterburner using the emergency procedure, the АРТ-14А valve and the engine jet nozzle flaps may remain in the OPEN (ОТКРЫТО) position, which will result in the engine thrust drop with the afterburner turned off, and to additional consumption of fuel by the engine (about 400 lit/hr) through the АРТ-14А valve.

After the afterburner has been turned off by the emergency procedure, discontinue the flight mission since the engine will run at a decreased thrust with an increased fuel consumption. In this case, the pilot can return to the home airfield and land the aircraft.

If the afterburner has been turned off by the emergency procedure, stop the engine after landing only by the command of the ground engineer (unless absolutely necessary). The ground engineer should immediately check the position of setting the notches on

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the KT-2 mechanism of the APT-1-A valve. If the notches are aligned, stop the engine using the normal procedure, i.e., by closing the stopcock. However, if the notches on the KT-2 mechanism are misaligned, stop the engine by closing the fuel shut-off valve, to avoid ignition of fuel in the afterburner and damage to the aircraft.

Do not fly the aircraft before the afterburner turn-off trouble has been found and eliminated.

PROCEDURE ON ENCOUNTERING FIRE

531. Should a fire occur in flight with the engine running at augmented rating, turn off the afterburner using the emergency procedure and, then, proceed in the same way as in case of fire in the MiG-17 aircraft.

PROCEDURE ON ENCOUNTERING FORCED LANDING

532. In case of forced landing of the MiG-17Ф and MiG-17ПФ aircraft on the ground, in addition to the operations performed in the MiG-17 aircraft, extend the landing gear nose leg using the emergency procedure for which purpose pull the emergency control handle located on the lower console of the instrument panel all the way back. This done, check by the mechanical indicator and warning lights if the landing gear nose leg has come off from the lock.

PROCEDURE ON ENCOUNTERING AFTERBURNER
SPONTANEOUS TURN-OFF

533. Spontaneous turn-off of the afterburner 4 – 6 seconds after its switching-on, testifies to the operation of the interlock system due to the jet nozzle flaps failure to open. Spontaneous turn-off may involve short-time increase of the exhaust gas temperature up to 800°C and the appearance of pops, which, however, do not interfere with the normal operation of the engine. If this is the case, do not turn on the afterburner for the second time, discontinue the flight mission and return to the home airfield.

APPENDIX

Aircraft Performance Reference Table for МиГ-17 Aircraft and Its Modifications

Data	МиГ-17	МиГ-17П	МиГ-17Ф	МиГ-17ПФ	Notes
1	2	3	4	5	6
Engines: type / thrust, kg	ВК-1 / ВК-1А / 2700	ВК-1А / 2700	ВК-1Ф / 2600 / 3380	ВК-1Ф / 2600 / 3380	With afterburner off / With afterburner on
Fuel reserve, lit: without drop fuel tanks / with drop fuel tanks	1435 / 2235	1430 / 2260	1410 / 2210	1395 / 2195	Capacity of drop fuel tanks, 2 x 400 lit
Flying weight, kg: normal / maximum (with drop fuel tanks)	5340 / 6072	5550 / 6280	5354	5620 / [illegible]	
Unstick speed, km/hr	220-230	255	235	246	Flaps retracted. Without drop fuel tanks; afterburner turned off
Length, m: take-off run / take-off path	550 / 1300	805 / 1400	530 / 1350	730-930 / 1475	Same
Optimum climbing speed (as read by thin pointer), km/hr: at take off (combat) engine rating	750	750	750	780	With afterburner turned on for МиГ-17Ф aircraft at an altitude of [illegible] m; for МиГ-17ПФ aircraft at an altitude of 4000 m
at normal engine rating	720	720	720	750	
at augmented rating up to an altitude of 10,000 m	-	-	1000	990	From an altitude of 10,000 m, decrease the climbing speed by 20 km/hr per each 1000 m of altitude for МиГ-17ПФ aircraft
at augmented rating from 11,000 to 14,000 m	-	-	970	-	
at augmented rating from 14,000 to 16,000 m	-	-	940	-	
Maximum rate of climb with engine running at take-off (combat) rating, m/sec:					For МиГ-17Ф aircraft flying at augmented rating at an altitude of 3000 m, and for МиГ-17ПФ at an altitude of 4000 m
at an altitude of 1000 m	47.0	36.7	-	-	

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1	2	3	4	5	6
at an altitude of 5000 m	35.0	27.0	65.0	55.0	
at an altitude of 10,000 m	20.0	15.0	38.4	32.3	
at an altitude of 15,000 m	2.6	-	11.8	5.6	
at an altitude of 16,000 m	-	-	6.7	-	
Minimum climbing time at engine take-off (combat) rating, min:					For МиГ-17Ф aircraft flying at augmented rating at an altitude of 5000 m, and for МиГ-17ПФ aircraft at an altitude of 4000 m
1000 m	0.35	0.4	0.4	0.5	
5000 m	2.0	2.5	2.1	2.5	
10,000 m	5.1	6.6	3.7	4.5	
15,000 m	14.6	-	7.4	9.8	
16,000 m	-	-	9.2	-	
Service ceiling, m: with afterburner turned off	15,500	14,500	15,100	14,450	No climbing has been practised above 16,470 m
with afterburner turned on	-	-	16,470	16,300	
Maximum speed at various altitudes, km/hr:					
at an altitude of 1000 m	1110	-	-	-	
at an altitude of 5000 m	1098	1085	1130	1123	
at an altitude of 10,000 m	1048	1033	1071	1060	
at an altitude of 12,000 m	1030	1006	1054	1038	
Maximum permissible flying speeds:					
up to an altitude of 3000 m	1060	1060	1060	1060	IAS
from 3000 to 7000 m	1200	1200	1150	1150	TAS
above 7000 m	no limits	1100	1100	1100	TAS
G-load: maximum operating / breaking	8/12	8/12	8/12	8/12	
Minimum manoeuvering speed at all altitudes, km/hr IAS	300	340	300	340	

1	2	3	4	5	6
Minimum flying speed at which the aircraft loses stability, km/hr	200–220	210–230	200–220	210–230	The landing gear and flaps are retracted (idle rating)
Speed corresponding to maximum range for an altitude of 10,000 m, km/hr	480	480	480	480	At other altitudes the specified speed is increased by 20 km/hr per each 1000 m of altitude decrease, and decreased by 20 km/hr per each 1000 m of altitude increase, as compared to the altitude of 10,000 m
Speed corresponding to maximum endurance, km/hr	300–320	300–320	300–320	300–320	For all altitudes (IAS)
Maximum range (stage), kms at an altitude of 1000 m	-	-	400/730	470/740	Numerator indicates flight range without drop tanks;
at an altitude of 5000 m	765/-	780/1140	670/1040	690/1070	
at an altitude of 10,000 m	1185/1775	-	990/1520	1000/1530	Denominator indicates flight range with drop fuel tanks
at an altitude of 12,000 m	1295/2150	1220/1900	1080/1670	1100/1730	
Maximum endurance (block), min:					Numerator indicates endurance without drop fuel tanks, denominator indicates endurance with drop fuel tanks
at an altitude of 1000 m	-	-	71/109	72/107	
at an altitude of 5000 m	88/-	94/130	91/124	86/128	
at an altitude of 10,000 m	108/163	-	97/147	101/149	
at an altitude of 12,000 m	114/173	113/162	101/152	97/159	

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1	2	3	4	5	6
Maximum aerodynamic quality:					
with flaps and landing gear retracted	13.6	13.6	13.6	13.6	
with flaps and landing gear extended	5.6	5.6	5.6	5.6	
Glide landing speed with inoperative engine, km/hr:					
with landing gear and flaps retracted	320–350	325–355	320–350	325–355	
with landing gear and flaps extended	260–270	270–280	260–270	270–280	
Optimum gliding speed (IAS), km/hr:					With or without drop fuel tanks
from an altitude of 12,000 to 10,000 m	500	500	500	500	
from an altitude of 10,000 to 5000 m	550	550	550	550	
from an altitude of 5000 to 500 m	650	650	650	650	
Glide landing speed (before levelling-off), km/hr	260–270	270–280	260–270	270–280	
Landing speed, km/hr	170–190	180–200	170–190	180–200	
Length, m: landing run / landing path	820–850 / 1470–1500	885 / 1640	820–850 / 1450–1500	885 / 1640	Without drop fuel tanks, flaps in landing position

Notes: With the maximum engine speed decreased from 11,560 to 11,350 + 50 r.p.m., the aircraft performances change as follows:

(a) maximum level flight speed (TAS) decreases by 20 – 30 km/hr, at altitudes up to 5000 m, and by 10 – 20 km/hr at altitudes above 5000 m;

(b) the service ceiling decreases approximately by 500 m;

(c) take-off run increases by 8%;

(d) climbing time increases by 20 – 25%;

(e) time of take-off run increases by 15 – 20% at low altitudes, and by 30 – 35% at high altitudes (about 10,000 m).

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MAINTENANCE OF AIRFRAME AND ENGINE PROCESS CHARTS

SUPPLEMENT TO INSPECTION GUIDE No. 21

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GROUP 1
Excluded from automatic downgrading and declassification

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SECRET

MAINTENANCE OF AIRFRAME AND ENGINE

PROCESS CHARTS

SUPPLEMENT TO INSPECTION GUIDE No. 21

PREFACE

The present Process Charts are used as instructive documents during scheduled maintenance operations on the airframe and engine which are listed in the Inspection Guide No.21.

All the assemblies, mechanisms and units of the airframe and engine indicated in the present book are subject to inspection and check-out even in case their operation has been faultless. The reason is that the purpose of inspections and scheduled maintenance operations consists mainly in prevention of troubles rather than in correction of faults.

Indicated in the Process Charts are:

- the scope of the operations performed during scheduled maintenance;
- the technical requirements for the units and systems of the airframe and engine;
- the operations carried out to correct faults in units and systems which fail to meet the existing technical requirements;
- the approximate time quotas (in man-hours) for each operation.

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TECHNOLOGICAL SUCCESSION OF MAINTENANCE OPERATIONS ON AIRPLANE AND ENGINE

IN TERMS DEPENDING ON AIRCRAFT FLYING HOURS

(indicated in the columns are the numbers of Process Charts which deal with the corresponding maintenance operations)

After first 5±2 hours of engine operation	After first 10±2 flying hours	After first 25±3 flying hours	After every 25±5 flying hours	after every 50±5 flying hours	After every 100±10 flying hours	After every 6 months of operation	After every 12±1 months of operation	Note
64	2,25	13,18	11, 13, 14, 18, 19, 20, 21, 22, 28, 32, 33, 37, 41, 50, 57, 59, 64	1, 2, 3, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 26, 29, 30, 32, 33, 34, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 57, 58, 59, 60, 61, 62, 63[2] 64, 65, 66, 67, 68, 69, 70[3], 72	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70[3], 72	55	53, 56	1. Process Chart No.31. AMG-10 hydraulic fluid is changed in L.G. shock struts every 3 years of operation 2. Airtightness checks of de-icer system (Point 1 of Process Chart No.63) are carried out once every 100 flying hours 3. Process Chart No.70. Operations are performed during engine replacement and in case fuselage is disjointed 4. Process Chart No.71. Operations are performed during corrosion-preventive treatment of engine

Note. The terms of maintenance operations are given in strict conformity with those indicated in the Inspection Guide No.21, Second Edition.

G E N E R A L

1. Scheduled maintenance operations on the aircraft should be performed in compliance with the Inspection Guide No.21, the present Process Charts, aircraft service manuals and Manufacturer's Bulletins.

2. Scheduled maintenance operations on the airframe, engine and equipment systems of the aircraft should be carried out in terms which depend upon the number of aircraft flying hours: i.e. after the first 5±1, 10±2 and [illegible] flying hours and after every 25±5, 50±5 and 100±10 flying hours, as well as after every 6 and 12±1 months of operation.

3. If the engine or any other unit has been replaced on the aircraft, maintenance operations on these are performed in terms depending on the number of flying hours, i.e. after 25±5, 50±5 and 100±10 flying hours.

4. To ensure trouble-free operation of the aircraft equipment in diverse climatic conditions (high humidity, dust contamination of air, etc.), or when specific missions impose heavier loads on particular units of the aircraft (the landing gear is subjected to strenuous use and the like), ahead-of-schedule maintenance operations on all or separate aircraft (or units) may be authorized for performance during engine replacement work or when the aircraft is withdrawn from flying missions for a long period of time. These non-scheduled operations should be carried out in compliance with the Inspection Guide No.21.

5. Prior to forwarding the aircraft to maintenance teams it is necessary to discharge the seat ejection gun, the canopy [illegible] gun and the drop tank jettison system, as well as the aircraft [illegible], rocket launcher systems and the [illegible] signal flare launcher, type [illegible]. When [illegible], all the necessary safety precautions should be taken. The next step is the inspection in the scope of the post-flight inspection procedure, with recording of all the faults detected. The troubles revealed during the inspection should be entered in the appropriate Service Logs and then eliminated (but for those which can be remedied only in the course of special maintenance procedures).

6. Before the beginning of the scheduled maintenance operations the aircraft should be inspected in the scope of the post-flight inspection procedure.

7. Special preparations should be carried out at the maintenance site in the following sequence:

(a) select and arrange conveniently the tools, fixtures and accessories which are required for maintenance operations. The tools should be contained in special tool boxes or in bags which bear identification inscriptions;

(b) remove the canvas covers from the aircraft;

(c) attach the walks on the wing;

(d) open the necessary access hole panels on the wing and fuselage.

8. All maintenance operations should be performed with serviceable and marked tools and accessories attached to the airframe and engine.

Prior to, and after maintenance operations on the aircraft, it is necessary to checklist all the tools in order to make sure that not a single tool has been lost or left in the aircraft.

9. When carrying out inspections and maintenance operations the external surfaces of the units of the airframe, armament items, flight control and navigating equipment, the radio and radar equipment, as well as their connecting lines and wires should be cleaned from dirt, dust and old lubricant.

[illegible]. Never remove dirt with air-kerosene mixture.

10. Remove dirt from the aircraft skin with water making use of a hair brush or clean rags.

11. Remove ice and hoar-frost from the aircraft skin

with warm air fed from a heater. The surfaces cleaned from ice should be dried with warm air. The air temperature should be not over 70 - 80°C.

WARNING. Never attempt to tear frost-stuck canvases from aircraft skin since otherwise the varnish coating of skin will be damaged.
Use warm air to unfreeze canvases before removing them from aircraft.

12. All the holes in units, pipelines and all the plug connectors which are opened during maintenance operations on the aircraft should be sealed with plugs or PVC film immediately upon completion of the operations.

WARNING. It is forbidden to wipe and stop the ends of pipelines with cotton wool, hemp and the like when disconnecting pipelines of systems. Only clean rags should be used for cleaning operations.

13. At parking the canopy glazing and the cockpit pressurization rubber tube should be protected against effect of sun rays; for this purpose the canopy should be canvased.

14. All the maintenance operations and cases of fault correction should be recorded in the airframe and engine Service Logs and in the Aircraft Pre-Flight Inspection Log.

15. The aircraft technician superintends all the operations concerning repair, adjustment and correction of faults which were detected during aircraft inspections before the scheduled maintenance operations.

Safety Precautions

16. Before beginning inspection and maintenance [illegible] on the aircraft take all the necessary precautions to prevent accidental firing, drop tank jettisoning, [illegible] landing gear retraction and spontaneous engagement of electric units since these may result in grave accidents and failure of aircraft equipment.

To obviate these undesirable cases open the canopy, install the ground safety lockpins in the operating [illegible] of the canopy remover guns and, without climbing into the cockpit, make sure that:

- the seat ejection gun and the canopy remover gun are discharged;

- the ground safety pins are installed in the 215[illegible] drogue gun and in the 215[illegible] canopy remover gun actuating roller; safety covers are fitted over the seat arm-rests;

- the ground safety pin is inserted in the canopy autonomous jettison lever and the lever is locked; the lever of the duplicating canopy unlock system is locked;

- the drop tank emergency jettison control button on the instrument panel is capped and the drop tank jettison gun is discharged;

- the landing gear control handle is latched in the neutral position;

- all the switches and automatic circuit-breakers of the electric equipment in the cockpit (with the exception of those which are locked) are in the OFF ([illegible]) position (the automatic circuit-breakers located under the right-hand transparent panel may be left ON but for the ARMED - SAFE ([illegible]) circuit-breaker);

- the IFF unit destruction circuit is OFF, i.e. safety pin in the cockpit is installed, and the switch on the IFF destructor control panel in the nose accessory compartment is in the OFF ([illegible]) position.

17. When mounting the drop tank on the aircraft do not switch on the storage battery before completion of drop tank mounting operations.

18. Before inspecting the front air brakes or the armament systems open the cross-feed cock (located in the wall of the right L.G. leg) and lock it with a flagged

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safety pin; then manually open the air brakes. Prior to opening the cross-feed cock reduce the pressure in the hydraulic system to zero.

WARNING: 1. It is forbidden to extend the air brakes for inspection by pressing the air brake control push button located on the pilot's control stick.

2. It is forbidden to stay in the cockpit when the cells of the landing gear, flaps and air brakes are being inspected with the hydraulic system under pressure.

3. It is forbidden to extend the air brakes with the aid of the live hydraulic system (for operations in the well of the air brakes).

19. Before working in the well of the rear air brake disconnect the hydraulic cylinder operating rod from the air brake with the pressure in the main hydraulic system reduced to zero.

20. Upon termination of inspection and maintenance operations in the air brake wells close the cross-feed cock.

It is forbidden to fly the aircraft with the cross-feed cock open.

21. Only ordnance specialists are authorized to load and unload the seat ejection gun, the canopy remover guns and the drop tank jettison guns, to check the control of the drop tank jettison gun firing group, to test-fire the explosive charge-actuated mechanisms with special primers and to check the charge-actuated mechanisms for proper functioning.

The mechanical control lines of the explosive charge firing mechanisms of the seat ejection gun and canopy jettison [illegible] should be adjusted by specialists included in the [illegible] maintenance team.

22. All the maintenance, preparation and adjusting operations on the seat ejection gun, canopy remover gun, and drop tank jettison gun should be carried out with the explosive charges removed.

23. It is forbidden to demount the canopy from the aircraft together with the interlock cable.

24. During loading and unloading operations of the aircraft armament systems it is necessary to place a red flag (or a red lantern when dark) at a distance of 3 to 5 metres fore of the aircraft nose. In addition a red flag (lantern) should be also placed behind the tail section of the aircraft when special units (pods) are being attached. The flag (lantern) indicates that staying or passing in front of or behind the aircraft is prohibited.

25. When fuelling the aircraft it is forbidden to stay under the aircraft or to work from a service ladder at the fuselage tail section since otherwise sudden setting-down of the aircraft under the gravity of the tank-filling fuel may result in grave injuries to the personnel.

26. It is forbidden to fuel the aircraft which is within the reach of gas streams from other taxiing aircraft or in close downwind proximity to the aircraft with running engines.

27. During maintenance operations on the aircraft never place foreign objects on the parts, assemblies and units of the airframe and engine. Upon completion of maintenance operations make certain that no foreign objects are left in the access holes, compartment, and on the units and accessories of the airframe and engine.

28. Before the first starting of the engine, as well as after every disconnection of fuel and hydraulic system lines of the engine or airframe for units replacement, pump the systems through to eliminate air locks, especially if there are indications of such locks.

29. If oil has been drained from the engine oil system, prior to starting the engine charge oil to the normal level (measure with the aid of the dip stick) the

level should be 11 ± 0.5 litres). Then start the engine and make it run at 93% normal rating during 30 seconds. After the engine is stopped check the oil level and add oil into the tank till the required level.

NEVER FILL OIL OVER CAPACITY.

30. It is forbidden to add oil into the engine oil system with the engine running since otherwise undesirable splash-out of oil may happen.

31. After scheduled maintenance operations and upon elimination of troubles the engine should be started and tested only at grounds specially assigned and equipped for this purpose.

32. Never start the engine unless brake chocks are placed under the landing gear wheels. Before starting the engine for testing at augmented rating moor the aircraft by means of cables.

33. Before ground check-running of the engine install protective screens on the additional air intake shutter ports and remove these screens before taxiing to the take-off position. At parking, plug the additional air intake shutter ports.

34. During the first starting and check-running of the engine after the scheduled maintenance operations check (with the engine running idle and with the engine compartment access hole covers open) for leakage of fuel and oil from the joints of pipelines and units. Only after this check it is allowed to carry out engine checking at higher power ratings.

35. In the course of the entire service life or storage of the engine on the aircraft the engine system should be filled with fuel. In case the fuel system of the engine is emptied it is necessary to subject the system to internal corrosion-preventive treatment no later than in twenty four hours after fuel drainage.

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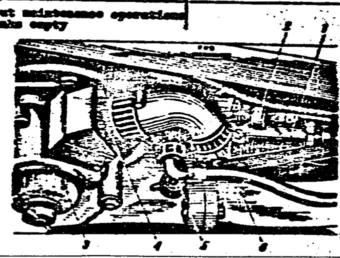
Supplement to Inspection Guide No.21	PROCESS CHART No.1		In 2 sheets Sheet 1
FUEL SYSTEM	WASHING FILTER IN SPECIAL VALVE CONTROL PRESSURE LINE OF FUEL SYSTEM		Man-hours required – 2,30
Procedure	**Technical requirements**	**Fault correction**	
1. Remove drop fuel tank and drop tank pylon 2. Disconnect hydraulic cylinder operating rod from left L.G. door and lift door 3. Open panel of access hole leading to pump of tank 3 (on fuselage port side, between frames Nos 16 and 20). (see Fig.1) 4. Remove filter from special valve control pressure line. To this end, remove control pressure pipe: screw off two nuts, disconnect electric connector from unit 495-A2, remove non-return valve, remove Tee-connection, screw off nut from filter body and release clamp 5. Disassemble filter and wash it in clean (unleaded) gasoline, blow with compressed air and inspect	Note. Carry out maintenance operations with tanks empty  FIG. 1. INSTALLING FILTER IN SPECIAL VALVE CONTROL PRESSURE LINE OF FUEL SYSTEM 1 – filter, 2 – non-return valve, 3 – pump [illegible], 4 – [illegible] connection; 5 – Tee-connection and control pressure system pipe, 6 – fuel system pipe-line. Filter should be clean; filter ports should not be clogged with dirt and should be viewed through unobstructedly. No mechanical damage to filter shall be tolerated	Mechanically damaged filter should be replaced	

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Supplement to Inspection Guide No. [illegible]	PROGRESS CHART No. 1	In 2 sheets Sheet 2
FUEL SYSTEM	WASHING FILTER IN SPECIAL VALVE CONTROL PRESSURE LINE OF FUEL SYSTEM	Man-hours required - 2.30

Procedure	Technical requirements	Fault correction
6. Re-install filter in special valve control pressure line of fuel system; screw it in as far as it will go and safety with locking wire KO-0.8 7. Fuel all tanks, engage pumps and check system for airtightness 8. Close access hole panel and lock it		

Accessories	Tools
	Wrenches, 14 x 17; 24 x 27 and 30 x 32 Multi-purpose flat-nose pliers Screwdriver Screwdriver for cross-slitted screws

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Supplement to Inspection Guide No.21	PROCESS CHART No. 2	In 3 sheets Sheet 1
FUEL SYSTEM	WASHING AND INSPECTING GASOLINE SYSTEM FILTER	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
1. Open gasoline tank access hole panel on fuselage port side and remove filler neck cover 2. Open panel of access hole leading to fire extinguishing cylinder and hydraulic accessories (on right bottom side of fuselage). Filter 9 is installed between tank and pump UNF10-96 (Fig.2) 3. Drain gasoline from tank into clean container by pressing upon drain cock 1 (Fig.3) 4. Unlock filter 5. Screw off pipe nuts and remove filter 2. Demount filter together with Tee-connection 4	Protect disconnected pipe ends with plugs or cellophane	
6. Wash filter in pure gasoline and blow with compressed air	Filter gauze and soldering places should be free from damage and deformation	In case of deteriorated filter gauze or soldering, repair or replace filter

Supplement to Inspection Guide No. 21	PROCESS CHART No. 2	In 3 sheets Sheet 2

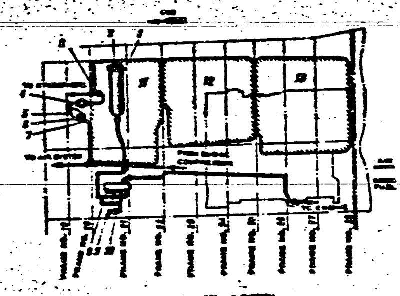

FIG. 2. DIAGRAM OF GASOLINE SYSTEM
1 – gasoline tank; 2 – gasoline tank filler neck; 3 – safety valve; 4 – reducing valve; 5 – receiver; 6 – [illegible] valve; 7 – filter; 8 – gasoline pump [illegible]; 9 – gasoline filter; 10 – gasoline drain cock; 11, 12 and 13 – fuel tanks Nos 4, 5 and 6.

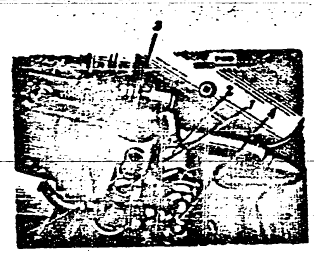

FIG. 3. INSTALLING GASOLINE PUMP [illegible] AND GASOLINE-SYSTEM FILTER
1 – gasoline drain cock; 2 – filter; 3 – pump [illegible]; 4 – Tee-connection.

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Supp[illegible] to Inspection [illegible]	PROCESS CHART No. 2	In 3 sheets Sheet 3
FUEL SYSTEM	WASHING AND INSPECTING GASOLINE SYSTEM FILTER	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
7. Inspect filter gauze and soldering pieces 8. Re-mount filter, tighten nuts and lock them 9. Fill tank with gasoline 10. Inspect filter connections and make sure there is no gasoline leakage 11. Close access hole panel and lock it	Filter should be clean	

Accessories	Tools
Gasoline Hair brush	Pliers Screwdriver Wrench, 19 x 22 Wrench, 32 x 36

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Supplement to Inspection Guide No.[illegible]	PROCESS CHART No.3	In [illegible] sheets Sheet [illegible]
FUEL SYSTEM	WASHING WING TANK FILTERS	Man-hours required - 0.35

Procedure	Technical requirements	Fault correction
1. Remove cover of access hole leading to [illegible]-1B pump located on wing undersurface at most sections of ribs 13 - 14 (before doing this demount special rack, if any) 2. Remove screws which attach electric connections of pods and move these away from filter cover to ensure free removal of filter cover (Fig.4) 3. Unlock and unscrew filter cover 4. Withdraw filter element from body 5. Re-mount filter cover on filter body to close filter opening		
6. Wash filter element in clean gasoline, blow with compressed air and inspect	Filter gauze should be clean and free from damage or crumpling. Soldered joints should be intact	Filter elements with damaged gauze or soldered joints should be replaced
7. Remove cover and insert filter element in filter body 8. Screw in filter cover and secure it with locking wire KZ-0.8 9. Attach and fasten in place electric connections of special racks 10. On aircraft beginning with Serial No.[illegible] open panel of access hole leading to accessories located between		

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Supplement to Inspection Guide No.21	PROCESS CHART No.3		In 3 sheets Sheet 2
FUEL SYSTEM	WASHING WING TANK FILTERS		Man-hours required – 0.30
Procedure	Technical requirements	Fault correction	
frames Nos 16 and 16a on fuselage port side (gauze filter is housed in body connected with non-return valves of wing fuel compartments) 11. Remove pipe assembly which is coupled to non-return valves of wing fuel compartments, drop tank and special valve of tank 2 12. Undo coupling flange bolts of non-return valves body and filter body and remove filter 13. Wash filter in clean gasoline and inspect it. Filter gauze should not be damaged mechanically 14. Re-install filter and connect bodies reversing the disassembly procedure			

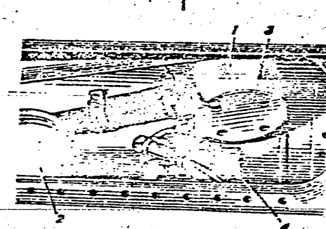

FIG. 4. INSTALLING WING TANK FILTER
1 – filter body; 2 – fuel transfer pump [illegible]; 3 – filter cover; 4 – electric connector [illegible]

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 3	In 3 sheets Sheet 3
FUEL SYSTEM	WASHING WING TANK FILTERS	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
15. Re-mount complete assembly on aircraft, attach and lock pipes 16. Refuel tanks, engage pumps and check system for airtightness 17. Re-install access hole cover and make it fast with screws		

Accessories	Tools
	Screwdriver for cross-slitted screws, 72-7804-98 Special wrench for fuel system Flat-nose pliers

Supplement to Inspection Guide No.21	PROCESS CHART No. 4	In 3 sheets Sheet 1
FUEL SYSTEM	INSPECTION OF DROP FUEL TANK GAUZE FILTER	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction
1. Drain fuel from drop tank (Fig.5) into clean container or refueller 2. Unlock and screw plug out of drop tank drain hole	WARNING. Screw out plug with special wrench; never use additional lever for unscrewing since otherwise welded joint of tank filler neck is likely to get damaged. If plug of drain hole fails to be screwed out with wrench, remove upper plug of tank, fill tank with 5 litres of clean kerosene and rinse tank. Inspect gauze filter through tank upper filler neck and make sure it is intact	
3. Wash gauze filter with clean gasoline and blow with compressed air	Filter should be clean, its filtering gauze and soldered joint should be free from damage	Replace filter with damaged filtering gauze or soldered joint

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Supplement to Inspection Guide No.22	PROCESS CHART No. 4	In 3 sheets Sheet 2

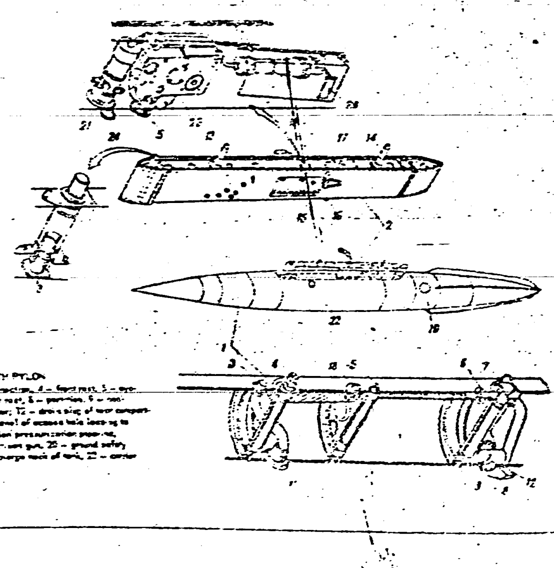

FIG. 5. DROP TANK WITH PYLON

1 – drop tank; 2 – pylon; 3 – [illegible] pipe connection; 4 – front rest; 5 – [illegible]; 6 – pressurization system [illegible], 7 – rear rest, 8 – partition, 9 – [illegible] valve, 10 – filler neck, 11 – [illegible] filter; 12 – drain plug of rear compartment, 13 and 14 – front and rear [illegible]; 15 – panel of access hole leading to tank jettison gun, 16 – limit switch, 17 – pylon pressurization [illegible], 18 – [illegible], 19 – tank jettison gun, 20 – ground safety pin, 21 – tank [illegible] gun, 22 – ground discharge neck of tank, 23 – [illegible]; 24 – [illegible] pin.

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Supplement to Inspection Guide No.21	PROCESS CHART No.4	In 3 sheets Sheet 3
FUEL SYSTEM	INSPECTION OF DROP FUEL TANK GAUZE FILTER	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction
4. Inspect filter 5. Make sure that tank bottom and area around drain hole are free from dirt and sediment 6. Re-install filter, screw in plug and secure it with locking wire KOK-0.8		

Accessories	Tools
	Special wrench, 72-7804-380 Flat-nose pliers

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Supplement to Inspection Guide No.21	PROCESS CHART No. 8	In 3 sheets Sheet 1
FUEL SYSTEM	INSPECTION OF NEGATIVE-G VALVE AND INTERIOR OF FUEL TANK No.3	Man-hours required – 4.00

Procedure	Technical requirements	Fault correction
1. Remove drop fuel tank and drop tank pylon 2. Disconnect hydraulic cylinder rod from left air brake and lift air brake 3. Open cover of access hole leading to pump of tank No.3 (on fuselage port side between frames Nos 16 and 20) 4. Unlock and disconnect electric connection of pump 495A2 (Ref. No.2 in Fig.6) 5. Disconnect fuel pipeline running from pump 495A2 to engine; to this end unlock and screw off four nuts and remove bolts 6. Disconnect two drain pipes from Tee-connection 4 mounted on connection pipe of pump 495A2 7. Disconnect fuel pipe and electric connection from warning unit CД-3, screw out fastening bolt of bracket 2 (Fig.7) of warning unit and remove warning unit 1 together with bracket 8. Unlock and screw out bolts 4 which attach plate 3 of negative-G valve	Note. Carry out maintenance operations with tanks empty	

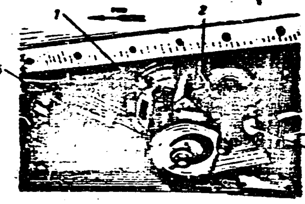

FIG. 6. GENERAL VIEW OF FUEL PUMP 495A
1 – pump 495A2; 2 – electric connection of pump; 3 – engine fuel supply pipeline; 4 – Tee-connection; 5 – pressure warning unit, type CД-3.

FIG. 7. ATTACHMENT OF PRESSURE WARNING UNIT CД-3
1 – pressure warning unit CД-3; 2 – warning unit mounting bracket; 3 – negative-G valve plate; 4 – bolts attaching valve plate to tank edging.

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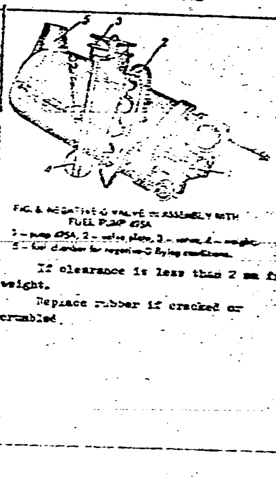
Supplement to Inspection Guide No. 23	PROCESS CHART No. 5	In 3 sheets Sheet 2
FUEL SYSTEM	INSPECTION OF NEGATIVE-G VALVE AND INTERIOR OF FUEL TANK No.3	Man-hours required – 1.00

Procedure	Technical requirements	Fault correction
9. Rock slightly pipe union of pump 495A2 to carefully lower plate with negative-G valve (Fig.8) 10. Using extension lamp inspect (through inspection hole in tank No.3 of negative-G valve) tank interior and make sure that tank walls are neither swollen nor laminated and that there is no sediment on tank bottom. When through with inspection of tank interior close access hole with cover cut out of thin duralumin sheet to match negative-G valve plate. Attach cover with four screws	**Note.** Perform operations with fuel drained off tanks Tank walls should be even (but for glued joints); there should be neither spot [illegible] nor lamination of walls. Tank [illegible] should be free from sediment (lumps of solidified fluid or metal dust)	 FIG. 8. NEGATIVE-G VALVE ASSEMBLY WITH FUEL PUMP 495A 1 – pump 495A, 2 – valve plate, 3 – [illegible], 4 – weight, 5 – fuel chamber for negative-G flying conditions.
11. Inspect to make sure that elements and locking fittings of negative-G valve assemblies are intact and that inner space is clean. Check sealing rubber in valve seat (Fig.8) for condition. Inspect point at which weight [illegible] against valve body [illegible] operation of negative-G [illegible] this end turn valve [illegible] assembly over by 180° to [illegible] inverted flight of aircraft	Clearance between weight and valve body in normal (non-inverted) position should be not smaller than 2 mm. Sealing rubber should be intact; no crumbling of rubber shall be tolerated. At weight bumping points no metal separation should be present. In inverted position valve [illegible] should tightly close inlet opening at seat. Valve should move smoothly in its guides, without jamming	If clearance is less than 2 mm file weight. Replace rubber if cracked or crumbled.

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Supplement to Inspection Guide No.21	PROCESS CHART No. 6	In 3 sheets Sheet 3
FUEL SYSTEM	INSPECTION OF NEGATIVE-G VALVE AND INTERIOR OF FUEL TANK No.3	Man-hours required - 4.00

Procedure	Technical requirements	Fault correction
13. Check drain cock on negative-G valve plate 14. Check airtightness at valve seat in inverted position (valve closed by gravity) at air pressure of 0.2 kg/cm^2 inside valve body during 5 minutes 15. Install plate with negative-G valve in tank. Before installation, inspect tank walls in area of valve weight travel for absence of corrugation since corrugation may result in valve binding. No corrugation in this area shall be tolerated	Valve should be absolutely airtight Note. Clearance between pump shroud (hood) and valve body should be not smaller than 1 mm	

Accessories	Tools
	Wrenches, 5 x 7; 9 x 11; 14 x 17; 9 x 11 (socket wrench) Flat-nose pliers Screwdrivers: ordinary and for cross-slitted screws

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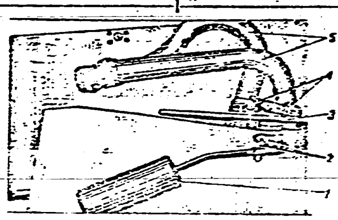
Supplement to Inspection Guide No.21	PROCESS CHART No. 6	In 3 sheets Sheet 1
FUEL SYSTEM	INSPECTION OF FLOAT VALVES OF TANKS NOS 1 AND 3	Man-hours required – 3.00
Procedure	**Technical requirements**	**Fault correction**
1. Drive out screws and demount canopy rear section to obtain access to float valve plate of tank No.1 2. Open cover of fuel tank No.3 (on fuselage port side) 3. Unlock and disconnect control and vent pipelines from tanks Nos 1 and 3 4. Unlock and screw out bolts which attach float valve plates of tanks Nos 1 and 3 5. Carefully rocking pipe unions remove valve plates of tanks Nos 1 and 3 (Fig.9)	 FIG. 9 FLOAT VALVE OF TANK [illegible] COMPLETE WITH PLATE (PLATE REMOVED FROM TANK) 1 – float, 2 – plungers of fuel valve, 3 – plate, 4 – plugged connections of control pressure pipelines (pipes are plugged immediately upon their disconnection), 5 – vent pipelines	
6. Inspect parts of float valves to make sure that they are free from corrosion and mechanical damage 7. Check float valve for airtightness. To this end: (a) shut off one of valve pipe unions and supply air pressure to other union [illegible];	Corroded and damaged parts will not be tolerated When air is supplied to valve at pressure of 0 to 1.8 kg/cm^2, no air bubbles are allowed	Replace valves with corroded and damaged parts

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Supplement to Inspection Guide No.21	PROCESS CHART No. 6	In 3 sheets Sheet 2
FUEL SYSTEM	INSPECTION OF FLOAT VALVES OF TANKS NOS 1 AND 3	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
(b) Immerse valve into water and, holding float in lower position (ball valves are closed), build up air pressure of 0 to 1.8 kg/cm^2 In case of bubbling check valve additionally for airtightness by fuel; to this end fill kerosene into valve body and build up pressure of 0 to 1.8 kg/cm^2	If bubbles are detected, test valve additionally When air is supplied during 1 minute at 0 to 1.8 kg/cm^2 to kerosene-filled valve, the valve under test is considered airtight if its leakage is not heavier than 10 drops per minute	In case of poor airtightness of valve demount it and transfer to repair workshop

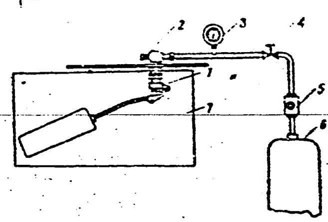

FIG. 10. CHECKING FLOAT VALVE FOR AIRTIGHTNESS
1 - Test valve; 2 - plug; 3 - pressure gauge; 4 - cutout valve; 5 - reducing valve; 6 - compressed air [illegible]; 7 - [illegible] water.

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Supplement to Inspection Guide No.21	PROCESS CHART No. 6	In 3 sheets Sheet 3
FUEL SYSTEM	INSPECTION OF FLOAT VALVES OF TANKS NOS 1 AND 3	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
8. Using extension lamp, inspect (through plate hole) tank walls for condition and make sure that tanks are free from foreign objects 9. Re-install plates of float valves, tighten and lock bolts 10. Connect and lock pipelines		

Accessories	Tools
Extension lamp Devices for air supply at 0 to 1.6 kg/cm^2 to float valve (see Diagram in Fig.2)	Screwdriver for cross-slitted bolts and ordinary screwdriver, 200 mm Socket wrench, 9 x 11, and nut wrenches, 14 x 17; 19 x 22; 24 x 27 and 32 x 36 Flat-nose pliers Wrench for round nuts 3106-46

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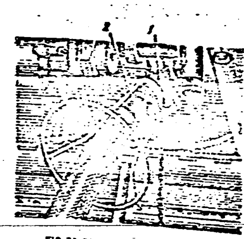
Supplement to Inspection Guide No.21	PROCESS CHART No. 7	In 2 sheets Sheet 1
FUEL SYSTEM	DRAINAGE OF SEDIMENT AND NON-EXPENDABLE FUEL REMAIN FROM WING FUEL COMPARTMENTS	Man-hours required - 1.00

Procedure	Technical requirements	Fault correction
1. Drain fuel from wing compartments through drain cock of main fuel line. To this end: (a) ground aircraft and containers into which fuel is being drained; (b) open filler neck of tank No.2; (c) open left access panel of engine to obtain access to drain cock, connect fuel drain hose to drain cock, stretch hose towards container for drainage and open cock (Fig.11); (d) switch on ground electric supply source and engage pump II of service tank group and wing fuel compartment pump 2. Drain sediment and non-expendable fuel remain from wing tanks; to do this, the following operations should be performed in turn on each wing: (a) unlock drain plug; (b) screw special device for wing fuel tank drain plugs into plug seat (Fig.12); (c) jack up wing opposite to that which is fitted with drain plug device (lift wing by 200 mm);	 FIG. 11. DRAINING FUEL FROM TANKS 1 – drain cock; 2 – fuel drain hose.	

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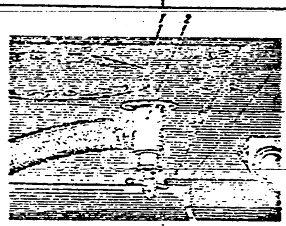
Supplement to Inspection Guide No.21	PROCESS-CHART No. 7	In 2 sheets Sheet 2
FUEL SYSTEM	DRAINAGE OF SEDIMENT AND NON-EXPENDABLE FUEL REMAIN FROM WING FUEL COMPARTMENTS	Man-hours required – 1.00

Procedure	Technical requirements	Fault correction
(d) using device screw out plug and drain fuel remain into specially prepared container Note. Before carrying out operation under Item 2 open filler neck of tank No.2 and ground drainage container and aircraft as in Item 1	FIG. 12. DRAINING SEDIMENT AND NON-EXPENDABLE FUEL REMAIN FROM WING TANKS 1 – cover of drain plug, 2 – device for wing fuel tank drain plugs.	

Accessories	Tools
Fuel drain hose (72-7804-320) Device for drain plugs of wing fuel compartments (72-7804-370)	Wrench, 24 x 27 Screwdriver, 200 mm Flat-nose pliers

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Supplement to Inspection Guide No. 2	PROCESS CHART No. 8	In 2 sheets Sheet 1
FUEL SYSTEM	INSPECTION OF BAG FUEL TANKS AND LOWER SECTION OF FUEL SERVICE TANK FOR PROPER CONDITION AND RELIABLE ATTACHMENT	Man-hours required-1.30

Procedure	Technical requirements	Fault correction
1. Turn out screws attaching panels of access holes which lead to tank attachment studs at fuselage port and starboard sides and in superstructure section; then open access panels (Figs 15 and 14)		

Note. To demount fuel tanks act as follows:
(a) turn out access panel attachment screws of fuel tanks at spars and frames at fuselage port and starboard sides (Fig.15);
(b) withdraw attachment rods of fuel tank access panels (Fig.15).

WARNING.

Do not open access panels of tanks Nos 4, 5 and 6 until attachment rods are removed since otherwise access panel hinge loops will be sheared

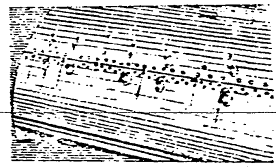

FIG. 15 LAYOUT OF FUSELAGE STARBOARD SIDE ACCESS HOLES LEADING TO [illegible] ATTACHMENT [illegible] OF FUEL TANK ACCESS HOLE PANEL ATTACHMENT SCREWS

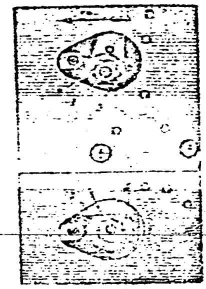

FIG. 14 GENERAL VIEW OF FUEL TANK ATTACHMENT [illegible] (FUSELAGE PORT SIDE)
[illegible] 2 – [illegible] 3 – [illegible]

2. Remove access panels of tanks Nos 4, 5 and 6

Procedure	Technical requirements	Fault correction
3. Check to see if nuts are [illegible] tight on tank attachment studs	Nuts should be tightly seated and reliably locked on studs as shown in Fig. 14	

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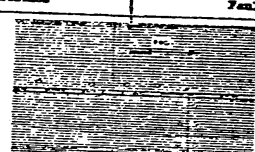
Supplement to Inspection Guide No. 21	PROCESS CHART No. 6	In 2 sheets Sheet 2
FUEL SYSTEM	INSPECTION OF BAG FUEL TANKS AND LOWER SECTION OF FUEL SERVICE TANK FOR PROPER CONDITION AND RELIABLE ATTACHMENT	Man-hours required-1.50

Procedure	Technical requirements	Fault correction
4. Check safety fittings on nuts for condition 5. Re-install panels of access holes leading to attachment studs and secure them with screws 6. Turn out screws which attach access panel of fuel service tank lower section (from fuselage port side, in landing gear leg well) 7. Looking through access hole check condition of service fuel tank lower section 8. Re-install and secure with screws access hole cover	 FIG. 15. LAYOUT OF FUEL TANK COVER ATTACHMENT RODS Inner walls of fuel tank should be free from cracks, spots of attrition, as well as from lamination and swelling of rubber	Should cracked surface, attrition resulting in exposure of fabric, lamination or swelling of rubber be detected, demount faulty tank and install new one

Accessories	Tools
	Screwdriver for cross-slitted screws Multi-purpose flat-nose pliers Wrench, 9 x 11 Screwdriver

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 9		In 2 sheets Sheet 1
FUEL SYSTEM	DEMOUNTING GASOLINE SYSTEM PRESSURIZATION UNIT AND DUST FILTER		Man-hours required-1.00
Procedure	**Technical requirements**	**Fault correction**	
1. Unlock and turn two nuts off gasoline system pressurization pipelines	Note. Gasoline system pressurization unit is installed on rear wall of right L.G. leg well where it is attached by means of two yokes		
2. Screw two nuts off bolts which fasten pressurization unit yokes			
3. Carefully bring yokes apart and remove pressurization unit from yokes Note. In case of failure to demount pressurization unit remove reducing valve at the left side			
4. Remove spring ring and withdraw dust filter from pressurization unit			
5. Wash filter in clean gasoline and dry			
6. Drain condensate from pressurization unit cylinder			

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 9	In 2 sheets Sheet 2
FUEL SYSTEM	DEMOUNTING GASOLINE SYSTEM PRESSURIZATION UNIT AND DUST FILTER	Man-hours required-1.00

Procedure	Technical requirements	Fault correction
7. Insert filter in cylinder and install spring ring 8. Install pressurization unit back in place (the arrow on cylinder should be directed upward), fasten it in position with screws, connect pipes and secure pipe nuts		

Accessories	Tools
	Wrenches, 14 x 17; 19 x 22 and 9 x 11 Flat-nose pliers

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 10	In 4 sheets Sheet 1
FUEL SYSTEM	CHECKING FUEL SYSTEM, GASOLINE SYSTEM AND HYDRAULIC RESERVOIR PRESSURIZATION SYSTEM PIPELINE FOR AIRTIGHTNESS	Man-hours required-1.00

Procedure	Technical requirements	Fault correction
Checking Airtightness of Fuel System 1. Operate through lower access hole (at left, between frames Nos 25 -26) to close cut-off valve of fuel system 2. On starboard side of fuselage tail section (above flap), in metal screen-protected recess, demount two valves of main tanks pressurization system; plug disconnected ends 3. Use rubber plug to shut off end of pipe which runs from sealed box of drop tank pressurization system safety valves over fuselage skin on port side, fore of engine oil filler neck 4. Operating through access hole on fuselage port side between frames Nos 25 - 23, disconnect hydraulic system pressurization pipe and engine air intake pipe from four-way connection; plug pipe unions	Fuel system should be checked for airtightness: (a) with fuel tanks filled to capacity; (b) with excessive air pressure in pressurization system of 0.3 kg/cm^2; excessive air pressure is built up with the aid of special device; (c) with drop tank and pylon removed. Fuel pipeline of air pressurization system on fuselage should be closed with special plugs	

Supplement to Inspection Guide No. 21	PROCESS CHART No. 19	In 4 sheets Sheet 2
FUEL SYSTEM	CHECKING FUEL SYSTEM, GASOLINE SYSTEM AND HYDRAULIC RESERVOIR PRESSURIZATION SYSTEM PIPELINE FOR AIRTIGHTNESS	Man-hours required-1.00

Procedure	Technical requirements	Fault correction
5. Using rubber plug close drain pipe which runs from drain (circular) pipeline over fuselage skin, down at frame No. 29		
6. All drain cocks of pumps and system should be closed		
7. Connect pipeline with rubber plug (running from ground installation) to fuel system vent connection pipe located to the left on superstructure section aft of frame No. 28A		
8. Insert rubber plug of device E6-9820-00 in pressure head air intake connecting pipe		
9. Build up air pressure of [illegible] kg/cm^2 in system and maintain this pressure during 15 minutes	Air pressure drop and kerosene leakage shall not be tolerated	
<u>Checking Airtightness of Gasoline System and Hydraulic Reservoir Pressurization Pipeline</u>		
1. Fill tank with gasoline and install special pressure gauge-fitted cover on tank filler neck		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 10	In 4 sheets Sheet 3
FUEL SYSTEM	CHECKING FUEL SYSTEM, GASOLINE SYSTEM AND HYDRAULIC RESERVOIR PRESSURIZATION SYSTEM PIPELINE FOR AIRTIGHTNESS	Man-hours required - 1.8

Procedure	Technical requirements	Fault correction
2. Remove hydraulic reservoir filler neck cover from hydraulic booster chamber (at fuselage port side) and install new cover provided with pressure gage; before doing this, check level of hydraulic fluid AMT-10 in reservoir 3. Operating through left-hand engine access hole (down, at frame No. 27), disconnect pressurization pipe running to gasoline tank and hydraulic reservoir from four-way connection. Connect hose with adapter together with wheel tube inflation device to tube **Note.** If it is only gasoline system which is being checked for airtightness, it is necessary to operate through access hole down at fuselage port side (at frame No. 20) to disconnect from Tee-connection that pipe which is used for hydraulic reservoir pressurization; then the corresponding end of Tee-connection should be plugged 4. Connect air-charged ground bottle to device, open bottle valve with reducing valve remaining closed, and, slowly		

Supplement to Inspection Guide No. 21	PROCESS CHART No. 10	In 4 sheets Sheet 4
FUEL SYSTEM	CHECKING FUEL SYSTEM, GASOLINE SYSTEM AND HYDRAULIC RESERVOIR PRESSURIZATION SYSTEM PIPELINE FOR AIRTIGHTNESS	Man-hours required – 1.00

Procedure	Technical requirements	Fault correction
opening reducing valve, build up 10 kg/cm² pressure		
5. Make sure that gasoline tank pressure gauge reads $0.4^{+0.05}$ kg/cm², and hydraulic reservoir pressure gauge indicates 1.6 to 2.45 kg/cm²; then close reducing valve and maintain this pressure in system during 15 min	Neither decrease in pressure indications nor gasoline leakage at pipe joints shall be tolerated	
6. Restore initial pressure in system		
7. Open fuel cut-off cock and lock it with KOK-0.8 wire		
8. With engine control lever in CUT-OFF ([illegible]) position, engage all fuel system pumps for 5 to 10 minutes	Leakage of kerosene from pipeline joints and vent system is not permissible	

Accessories	Tools
Plug for fuel pipeline used when pylon is removed (D6-6100-2825) Airtightness test fixture for cockpit and fuel system (D6-9520-00)	Screwdriver for cross-slitted screws Wrenches, 27; 19 x 22; 14 x 17 and 46 Flat-nose pliers

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 11	In 3 sheets Sheet 1
FUEL SYSTEM	CHECKING PRESSURIZATION VALVES IN FUEL, GASOLINE AND HYDRAULIC SYSTEMS WITH ENGINE RUNNING. CHECKING AMOUNT OF PRESSURIZATION IN WING FUEL COMPARTMENTS OF AIRCRAFT BEGINNING WITH SERIAL No. 0815	Man-hours required - 6.[illegible]

Procedure	Technical requirements	Fault correction
1. Open covers of access holes and filler necks of fuel (kerosene and gasoline) tanks and hydraulic reservoir and fill them with fuel (kerosene and gasoline) and AMG-10 hydraulic fluid	During pressurization valve checks fuel [illegible] (both kerosene and gasoline) should be filled to capacity: - fuel level in fuselage and drop fuel tanks should be below lower edge of filler necks by 20 to 30 mm in summer and 10 to 20 mm in winter; fuel level in gasoline tank should be below lower edge of filler neck by 40 mm in winter and in summer; - hydraulic system reservoir (its both sections) should be fully charged (within the limits of dip stick or gauge glass divisions)	
2. Tightly close filler neck covers of fuel tanks and hydraulic reservoir (with the exception of covers specified in Item 3 below)		
3. Install special caps with pressure gauges (see Figs 16 and 17) in place of caps of filler neck of fuel tank No. 4, filler neck of gasoline tank, filler neck of drop tank and filler neck of hydraulic booster chamber (at the left side) or of hydraulic reservoir main		FIG. 16. INSTALLING PRESSURE GAUGES IN PLACE OF FILLER NECK COVERS IN GASOLINE AND KEROSENE TANKS

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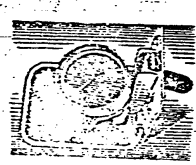
Supplement to Inspection Guide No. 21	PROCESS CHART No. 11		In 3 sheets Sheet 2
FUEL SYSTEM	CHECKING PRESSURIZATION VALUE IN FUEL, GASOLINE AND HYDRAULIC SYSTEMS WITH ENGINE RUNNING. CHECKING AMOUNT OF PRESSURIZATION IN WING FUEL COMPARTMENTS OF AIRCRAFT BEGINNING WITH SERIAL No. 0615		Man-hours required - 0.30
Procedure	**Technical requirements**	**Fault correction**	
system (at the right side) 4. Start engine and make it run at 70 - 80% normal rating. At this rating drop tank fuel consumption indicator light should go out 5. Check pressurization value by pressure gauges installed in tank filler necks	Pressurization air pressure should be : - in tank No.4 - 0.21-0.23 kg/cm² - in gasoline tank - $0.4^{+0.05}$ kg/cm² - in drop tank 0.81 - 0.83 kg/cm² - in hydraulic reservoir - 1.60 - 2.45 kg/cm²  FIG. 17. INSTALLING PRESSURE GAUGE IN PLACE OF HYDRAULIC RESERVOIR RIGHT FILLER NECK COVER	If tank pressurization value is lower than specified, act as follows: - detect point of air leakage from system by application of soapy water at pipeline connections and murally - correct fault by tightening nuts (before doing this bleed air from system by gradually screwing off filler neck caps)	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 11	In 3 sheets Sheet 3
FUEL SYSTEM	CHECKING PRESSURIZATION VALUE IN FUEL, GASOLINE AND HYDRAULIC SYSTEMS WITH ENGINE RUNNING. CHECKING [illegible] OF [illegible]PRESSURIZATION IN WING FUEL COMPARTMENTS ON AIRCRAFT BEGINNING WITH SERIAL No. 0815	Man-hours required = 0.5

Procedure	Technical requirements	Fault correction
6. Reduce engine speed to idling rating and run it at this rating for 1 min.	Pressure should drop to not lower than: (a) 0.17 kg/cm^2 in tank No. 4; (b) 0.41 - 0.43 kg/cm^2 in wing fuel compartments (for aircraft beginning with Serial No. 0815)	
7. Stop engine. Fifteen minutes after engine stoppage, check air pressure in gasoline tank and hydraulic reservoir	In 15 minutes after engine stoppage, air pressure should be: (a) $0.4^{+0.05}$ kg/cm^2 in gasoline tank; (b) 1.6 to 2.45 kg/cm^2 in hydraulic reservoir. If the above requirements are observed, pressurization system is considered operative and airtight	It is not advisable to tighten nuts of pipeline connections with system pressurized

Accessories	Tools
Fixture for checking pressurization of main and drop fuel tanks, and of hydraulic system reservoir (CH-98199-00, 36-9062-00) Drop tank trolley	Pliers, flat-nose

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Supplement to Inspection Guide No. 21	PROCESS-CHART No. 12	In 3 sheets Sheet 1
FIRE-FIGHTING SYSTEM	CHECKING FIRE-FIGHTING SYSTEM UNITS AND PIPELINES FOR CONDITION AND ATTACHMENT	Man-hours required - 0.1[illegible]

Procedure	Technical requirements	Fault correction
1. Check the following units and pipelines of fire-fighting system for proper condition and attachment: (a) fire extinguisher cylinder attached between frames Nos 21 and 22; (b) discharge ring (if engine is removed, check orifices for cleanness); (c) pipelines running from fire extinguisher cylinder to discharge ring; (d) fire detectors (thermocouples).	Once used (in fire fighting or accidentally), fire extinguisher should be removed from aircraft and transferred for recharging. When replacing fire extinguisher (no matter charged or discharged) from aircraft, screw cap with holes onto operating connection. Fit cap over connection immediately upon disconnection of pipeline; this done, demount fire extinguisher from bracket. Fire cylinder surface should be clean and properly painted. Pipelines should have no frayed spots deeper than 0.2 mm. Cylinder mounting bracket should be free from cracks	
2. Check continuity of electric circuit between fire extinguisher operating button and fire extinguisher cylinder discharge squib (carry out the check [illegible]ively with electrical equipment [illegible] specialists); to this end: (a) in cockpit: close STORAGE BATTERY, [illegible] (АККУМУЛЯТОР БОРТОВОЙ,		

Supplement to Inspection Guide No. 21	PROCESS CHART No. 12	In 3 sheets Sheet 2
FIRE-FIGHTING SYSTEM	CHECKING FIRE-FIGHTING SYSTEM UNITS AND PIPELINES FOR CONDITION AND ATTACHMENT	Man-hours required – 0.[illegible]

Procedure	Technical requirements	Fault correction
АЭРОПРОМ.) circuit-breaker on right-hand console and FIRE-FIGHTING EQUIPMENT. CANOPY DEICER. CUTOFF VALVE (ПОЖАР. ОБ. ПРОТИВОБОЛЕЗН. ФОНАРЯ, ПЕР. КРАН) circuit-breaker on left-hand front control board; (b) insert 2 – 3 megohms resistor between pipe (fire detector) and air-frame: this should result in operation of EC-2 electronic amplifier, and in illumination of FIRE (ПОЖАР) indicator light. When resistor of 5 megohms is introduced, EC-2 amplifier does not operate		

Supplement to Inspection Guide No. [illegible]	PROCESS CHART No. 12	In 3 sheets Sheet 3
FIRE-FIGHTING SYSTEM	CHECKING FIRE-FIGHTING SYSTEM UNITS AND PIPELINES FOR CONDITION AND ATTACHMENT	Man-hours required – 0.10

Procedure	Technical requirements	Fault correction
3. Remove and check fire extinguisher cylinders for proper charging by weighing them at charging station 4. Re-install fire extinguisher cylinders and connect electric wires and pipelines from discharge ring to them	Cylinder pressure should be as specified below:	

°C	-55	-45	-35	-25	-15	-5	0	+5	+15	+25	+35	+45
kg/cm^2	30	35	40	45	50	55	60	65	70	80	90	100

Accessories	Tools
	Multi-purpose flat-nose pliers Screwdriver

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 15	In 20 sheets Sheet 1
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required - 3.[illegible]

Procedure	Technical requirements	Fault correction
	Hydraulic fluid in hydraulic systems should be changed for the first time after first 25 ± 5 flying hours, without demounting and washing of hydraulic reservoir Subsequent changing of hydraulic fluid in hydraulic systems which involves demounting and washing of hydraulic reservoir should be carried out after every 200 flying hours (2 years of operation)	
<u>Draining AMG-10 Fluid from Hydraulic Systems</u>		
1. Jack aircraft up so as to obtain clearance not smaller than 50 mm between ground and wheels 2. Connect ground electric power supply source 3. In cockpit: close circuit-breakers of landing gear, flaps, air brakes and aileron hydraulic boosters		

Supplement to Inspection Guide No. 21	PROCEDURE CHART No. 13	In 20 sheets. Sheet 2
HYDRAULIC SYSTEM	CHANGING AMT-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.10

Procedure	Technical requirements	Fault correction
4. Connect ground hydraulic pump to main hydraulic system and build up pressure of 200 – 210 kg/cm^2 WARNING. Before retracting landing gear and extending air brakes and flaps make sure that there is nobody staying near landing gear, air brakes and flaps. As a measure of precaution, give order: KEEP AWAY FROM LANDING GEAR (KEEP AWAY FROM AIR BRAKES, KEEP AWAY FROM FLAPS); start retraction procedure only after the order has been acknowledged	Note. Following dirt prevention measures should be taken: (a) before connecting ground pump wash aircraft connections and hose tips with clean gasoline; (b) upon completion of ground pump operation, thoroughly wipe aircraft connections and hose tips, and close them with their respective plugs	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS, REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	

Procedure	Technical requirements	Fault correction
5. Retract landing gear, extend air brakes and flaps, and disengage ground hydraulic pump (for more effective cleaning of system repeat this procedure several times)		
6. Reduce pressure in main hydraulic system to zero by moving aircraft control stick forward and backward		
7. Disconnect hoses of ground hydraulic pump from aircraft connections		
8. Connect hydraulic fluid drain fixture to suction connection of aircraft hydraulic system and drain hydraulic fluid from hydraulic reservoir		
9. Place landing gear control to [illegible] ([illegible]) and extend landing gear with the aid of emergency pneumatic system by slowly opening cock valve		
10. Evacuate air from landing gear hydraulic cylinders; to this end disconnect pipes between cylinder and hydraulic lock		
11. Open filler necks of hydraulic reservoir		

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[illegible]pplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 4
HYDRAULIC SYSTEM	CHANGING AMT-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required - 3.10

Procedure	Technical requirements	Fault correction
[illegible]. Place air brake and flaps control [illegible] to RETRACTED (УБРАНО) and retract [illegible] brakes and flaps manually; as a [illegible] of this action, AMT-10 hydraulic fluid should be forced from cylinders [illegible] hydraulic reservoir [illegible]. Drain AMT-10 hydraulic fluid [illegible] hydraulic reservoir of hydraulic booster system		
<u>[illegible]moval and Washing of Hydraulic [illegible]servoirs of Hydraulic Systems</u> 1. In order to prevent contamination [illegible] hydraulic systems wash all connections [illegible] clean gasoline. Remove locking ar[illegible]ments and screw off nuts which [illegible] pipes to hydraulic reservoir [illegible], fit plugs over open ends of [illegible] connections of hydraulic [illegible] or cover open ends with PTC [illegible] order to prevent penetration of [illegible] into pipes and hydraulic reservoir	<u>WARNINGS:</u> 1. Demount and wash hydraulic reservoir only after every 200 flying hours (2 years of operation) 2. Never bend disconnected pipes since otherwise they are likely to get damaged. Bending of pipes may also result in mounting stresses after re-installation of pipes If pipe fits connection tightly, release nut on opposite end of pipe or release pipe attachment fitting	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In [illegible] Sheet 3
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	[illegible] required [illegible]

Procedure	Technical requirements	Fault correction
	so as to make it possible to move pipe away from connection without exerting undue effort	
2. Unlock and screw off nut of hydraulic reservoir fastening yoke; screw off nuts and remove bolts on hydraulic reservoir mounting brackets (see Fig.18)	 FIG. 18. ATTACHMENT OF HYDRAULIC RESERVOIR ON FUSELAGE FRAME No. [illegible]	
3. Demount hydraulic reservoir from aircraft and wash it with clean (unleaded) gasoline, blow with compressed air and inspect. When inspecting hydraulic reservoir pay special attention to cleanness of inner surfaces and condi-	Interior of hydraulic reservoir should be clean. Cracks in hydraulic reservoir shall not be tolerated	Weld up cracks

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...pplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 5
HYDRAULIC SYSTEM	CHANGING AMT-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.10

Procedure	Technical requirements	Fault correction
... of welded joints; make sure that ... are no cracks at areas where ...rvoir mounting brackets are fitted 4. Re-install hydraulic reservoir, ...it fast on brackets by means of ...and lock in place 5. Remove plugs from reservoir pipes ...nnections, and connect pipes to ...rvoir		
...ment of Fine Filtering Elements ...Filters in Hydraulic Systems. ...ing of Coarse Filters 1. Remove cover of access hole lead... units of hydraulic systems (at ...ge starboard and port sides between ...Fes 25 and 27), see Figs 19 and ... filter cup and pipe connections ...ent contamination of system ...lock and screw out filter sleeve ...(2)	Notes: 1. First replacement of fine filtering elements of 11ГО-4 filter of НП-34-2Т pump outer circulation line in main hydraulic system should be performed after first 10 ± 2 flying hours 2. Further replacements of fine filtering elements in 11ГО-4 (ОП-31) filters of main hydraulic system should be carried out	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 13	In 20 sheets Sheet 7

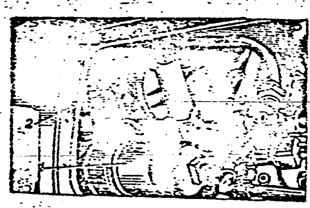

FIG. 19. POSITION OF 6T-11 PRESSURE LINE FILTER (REF. No. 1) AND 13-T4-8 DRAIN LINE FILTER (REF. No. 2) AS VIEWED FROM FUSELAGE STARBOARD SIDE (FILTER 6T-11 INSTEAD OF 13-T4-8 ON AIRCRAFT OF EARLIER MAKES)

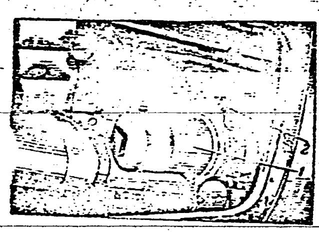

FIG. 20. POSITION OF PRESSURE LINE FILTER 6T-11 (REF. No. 1) AND HYDRAULIC BOOSTER SYSTEM GAUZE FILTER (REF. No. 2) AS VIEWED FROM FUSELAGE PORT SIDE

Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 8
HYDRAULIC SYSTEM	CHANGING AMT-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.10

Procedure	Technical requirements	Fault correction
Note. When replacing fine filtering elements in filters of straight-through type it is necessary to demount complete filter assembly having previously washed filter and pipe connections externally. Open ends of pipes should be plugged	after every 25 ± 5 flying hours, while in filters of hydraulic booster system – once every 50 ± 5 flying hours. Simultaneously, coarse filters should be cleaned and checked for secure attachment. Fine filters are located as follows: (a) in pressure line of main hydraulic system: filter ФГ-11, fuselage starboard side, between frames Nos 25 – 27; filter 11ГФ-4 (ФГ-31 on aircraft of earlier makes), in fin, before БУ-51М hydraulic booster – in return line of main hydraulic system: filter ФГ-11, fuselage starboard side, between frames Nos 25 – 27; filter 11ГФ-4 in forward part of superstructure, see Fig.22; (b) in pressure line of hydraulic booster system: filter ФГ-11, fuselage port side, between	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 23	In 20 sheets Sheet 5
5. HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF WIRE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required - [illegible]

Procedure	Technical requirements	Fault correction
	frames Nos 25 - 27 (see Fig. 20, Ref. No. 1); filter 11T6-4 in fin, before BU-51M hydraulic booster (Fig.23); - in return line of hydraulic booster system: gauze filter 2 (see Fig. 20)	
3. Remove fine filtering element from filter (Fig. 21) 4. Wash coarse filtering element and filter cup with clean gasoline and blow with compressed air		
5. Inspect coarse filter and filter cup; make sure that gauze is clean and soldered joints are intact 6. Install new filtering element and screw in filter sleeve 7. Lock filter with KO-0.8 wire and wipe filter externally	Coarse filtering element should be clean and free from dents and deterioration of soldered joints. When removing coarse filter be careful not to damage it	If dirt remains in filter cup, remove and re-wash it

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Supplement to Inspection Guide No.[illegible]	PROCESS CHART-No. [illegible]	In [illegible] sheets Sheet [illegible]

FIG. 21. REMOVAL OF FINE FILTERING ELEMENT
(a) view of filter before removal of fine filtering element; the arrow shows the direction in which the filter should be shifted for removal; (b) view of filter after removal of filtering element; the arrow shows the coarse filter.

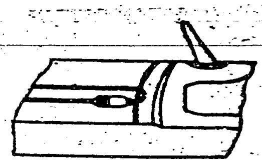

FIG. 22. POSITION OF OUTER CIRCULATION LINE FILTER [illegible] OF MAIN HYDRAULIC SYSTEM PUMP [illegible]

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Supplement to Inspection Guide No.21	PROCESS CHART No. 13	In 20 sheets Sheet 11

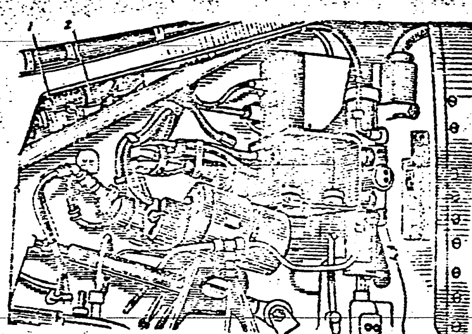

FIG. 22. POSITION OF MAIN HYDRAULIC SYSTEM PRESSURE LINE FILTER [illegible] FILTER ON AIRCRAFT OF EARLIER MAKES (REF. No. 1) AND [illegible] FILTER OF HYDRAULIC BOOSTER SYSTEM PRESSURE LINE

1 — main hydraulic system pressure line filter, 2 — hydraulic booster system pressure line filter.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 12
HYDRAULIC SYSTEM	CHANGING AMT-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.10

Procedure	Technical requirements	Fault correction
Removing and Washing Gauge Filter in Return Line of Hydraulic Booster System 1. Wash filter and pipe connections 2. Unlock and demount filter (see Fig.20). Close pipe ends with clean plugs 3. Disassemble filter, wash it in clean gasoline and blow with compressed air	Note. First removal and washing of gauze filter should be carried out after first 10 ± 2 flying hours	
4. Inspect filter gauze and soldered joints	Filter gauze and soldered joints should be intact	
Washing Throttles of Anti-Surge Shutters 1. Remove throttles of anti-surge shutter and intake cone lines, installed in nosewheel L.G. strut well 2. Wash throttles in clean gasoline, blow with compressed air and inspect	Note. Successive washing of throttles should be carried out after every 50 ± 5 and 100 ± 10 flying hours	
Washing Hydraulic System 1. Install washing filter in place of removed operating filters ФГ-11, ... and gauze filter of return line of hydraulic booster line	WARNING. Hydraulic system is subject to washing during scheduled changing of AMT-10 hydraulic fluid after 200 flying hours or ahead	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13		In 20 sheets Sheet 13
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS		Man-hours required - 1[illegible]
Procedure	**Technical requirements**	**Fault correction**	
2. Install through connections in place of removed throttles in anti-surge shutter control lines 3. Prepare engine jet nozzle flap control system for ground operation with engine inoperative in accordance with the operating instructions 4. Charge hydraulic systems with fresh or filtered fluid 5. Connect ground pump to aircraft connections of main hydraulic system 6. Connect ground electric power supply source, turn on STORAGE BATTERY (AKKUMULYATOR) switch and all circuit-breakers of takeoff and landing equipment 7. Engage ground hydraulic pump and pump fluid through main hydraulic system. To this end: (a) retract and extend landing gear, flaps, air brakes and anti-surge shutters 10 to 12 times	of schedule in case mechanical impurities have been detected in hydraulic fluid Notes: The following equipment should be used for washing hydraulic systems: 1. Set of washing filters 6I-11, 11T0-4 and gauze filter of return line in hydraulic booster system (these are taken from maintenance kit). Washing filters differ from operating ones (with the exception of gauze filter) in that their safety valves are plugged 2. Set of through connections used in place of throttles in control lines of anti-surge shutters and landing gear WARNING. Washing filters and through connections should be painted red, and caution flags should be attached to them		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 14
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.10

Procedure	Technical requirements	Fault correction
(b) set engine jet nozzle flaps 10 to 12 times in succession at FLAPS CLOSED ([illegible]), MINIMUM AUGMENTED ([illegible] ФОРСАЖ) and MAXIMUM AUGMENTED ([illegible] ФОРСАЖ) positions; (c) retract landing gear and flaps, extend air brakes and anti-surge shutters; (d) disengage ground hydraulic pump; (e) turn on circuit-breaker and change-over switch BOOSTER SYSTEM DISCONNECTION ([illegible]) and move control stick forward and backward to reduce main system pressure to zero; (f) turn off storage battery and circuit-breaker 8. Connect ground hydraulic pump to aircraft connections of hydraulic booster system 9. Turn on STORAGE BATTERY ([illegible]) change-over switch and circuit-breaker of stabilizer and aileron hydraulic booster control system	WARNING. When retracting and extending landing gear, flaps, etc., take all precautions recommended in Item 4 of Section "Draining AMG-10 fluid from hydraulic systems"	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 15	In 20 sheets Sheet 15
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS, REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required - 1[illegible]

Procedure	Technical requirements	Fault correction
10. Engage ground hydraulic pump 11. Turn on BOOSTER SYSTEM DISCONNECTING change-over switch and pump fluid through aileron hydraulic booster lines during 5 to 6 minutes manipulating aileron control stick over entire operating range. Move aileron control stick right and left at a rate of 25 to 30 full-range resettings per one minute 12. Pump hydraulic fluid through stabiliser hydraulic booster line in the course of 5 to 6 minutes by operating stabiliser control handle. Move stabiliser control handle forward and backward at a rate of 10 to 12 full-range resettings per one minute. During these manipulations APF-33 automatic transmission ratio controller should be set at its bigger arm 13. Disengage ground hydraulic pump 14. Reduce pressure to zero by operating stabilizer and aileron control stick		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 16
HYDRAULIC SYSTEM	CHANGING AMT-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required - 3.10

Procedure	Technical requirements	Fault correction
15. Turn off change-over switches, circuit-breakers and electric supply 16. Drain AMT-10 hydraulic fluid in accordance with Item 7 through 13 of Section "Draining AMT-10 fluid from hydraulic systems" 17. Demount washing filters, disassemble them and inspect for cleanness 18. Re-install operating filters 0Г-11, 11ГФ-4 and gauze filter of hydraulic booster system return line. Safety connections with locking wire, type КОК-0.8 19. Remove washing through connections and re-install throttles of anti-... shutters and intake cone control ...nes. Safety connections with КОК-0.8 locking wire	WARNING. Should dirt, sand or other foreign matter be detected in filtering elements of 0Г-11 and 11ГФ-4 filters or gauze filter of hydraulic booster system return line, wash dirty filters, re-install them and re-wash the given hydraulic system	
Charging Hydraulic Systems with AMT-10 Fluid 1. Check amount of nitrogen, and, if ...ary, fill hydraulic accumulators ... nitrogen to capacity	Nitrogen pressure in spherical and cylindrical hydraulic accumulators should be equal to 50^{+5} kg/cm^2.	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 17
HYDRAULIC SYSTEM	CHANGING AMT-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.10

Procedure	Technical requirements	Fault correction
2. Open covers (on fuselage) of access holes leading to hydraulic reservoir filler necks and, if reservoir has not been demounted and washed, wipe cap and reservoir filler neck with clean cloth (for hydraulic reservoirs with open-type filling of AMT-10 hydraulic fluid) 3. Fill both sections of hydraulic reservoir with AMT-10 hydraulic fluid (fill approximately 2.5 litres into main system section, and approximately 6.5 litres of hydraulic fluid into hydraulic booster system section; use dip stick for measurements) Total amount of hydraulic fluid in both systems and hydraulic reservoir is about 36 litres 4. Connect ground electric power supply source. In cockpit: turn on STORAGE BATTERY change-over switch and circuit-breakers of landing gear, flaps, air brakes, anti-surge shutters, cone, engine nozzle flaps and hydraulic boosters	When charging hydraulic systems observe the following requirements for dirt prevention: (a) AMT-10 fluid to be used in hydraulic system should be kept in special sealed containers; (b) prior to filling charging cart with AMT-10 fluid from special containers, thoroughly wipe filler necks of charging cart and special containers with clean cloth: make absolutely sure that no traces of dirt remain on them; (c) fill AMT-10 fluid into charging cart in closed location taking all dust preventive precautions; (d) before opening hydraulic reservoir thoroughly wipe filler neck and cap and wash charging gun tip in clean gasoline; (e) hydraulic reservoir should remain open only during recharging operations. When filled with AMT-10 fluid, hydraulic reservoir should be immediately closed, and its cap and	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 18
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.35

Procedure	Technical requirements	Fault correction
5. Place landing gear control valve handle to RETRACTION (УБРАНО) and press LANDING (ПОСАДКА) button at flap control panel of left-hand horizontal console 6. Connect ground pump to aircraft connections of both hydraulic systems 7. Engage ground hydraulic pump and build up service (operating) pressure in system. Reduce pressure to zero by operating aircraft control stick 8. Open (in turn) filler necks of hydraulic reservoir and add AMG-10 hydraulic fluid into reservoir 9. Pump fluid through main hydraulic system and hydraulic booster system. To this end: (a) initiate 10 or 12 retraction-extension cycles of landing gear, air brakes, flaps, anti-surge shutters and engine nozzle flaps; (b) move aircraft control stick 15 to 20 times over entire operating ranges forward and backward and from right to left.	filler neck – wiped	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 19
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required - 3.10

Procedure	Technical requirements	Fault correction
Leave landing gear in extended position, and flaps, air brakes, cone, anti-surge shutters and engine jet nozzle flaps - in retracted position 10. Pump fluid through nosewheel turning mechanism (if any). To this end: (a) reduce pressure in nosewheel shock strut to 5 - 7 kg/cm^2; (b) engage nosewheel turning mechanism; (c) apply foot bars 10 to 12 times Charge strut with nitrogen and disengage nosewheel turning mechanism		
11. Disengage ground hydraulic pump and reduce pressure in systems by operating aircraft control stick	Reduction of pressure in hydraulic booster system to 165 $^{+10}_{-5}$ kg/cm^2 should be indicated by illumination of BOOSTER (БУСТЕРНАЯ) indicator light and should result in automatic engagement of НП-27 pump (pump engagement will be audible)	
12. Engage PUMP UNIT (НАСОСНАЯ СТАНЦИЯ) circuit-breaker on right-hand vertical console		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 13	In 20 sheets Sheet 20
HYDRAULIC SYSTEM	CHANGING AMG-10 HYDRAULIC FLUID IN HYDRAULIC SYSTEMS. REPLACEMENT OF FINE FILTERING ELEMENTS IN HYDRAULIC SYSTEM FILTERS	Man-hours required – 3.10

Procedure	Technical requirements	Fault correction
13. Disengage pump unit circuit-breaker and reduce pressure in system to zero by moving aircraft control stick from one extreme position over to the other		
14. Check fluid level in hydraulic reservoir using cap-mounted dip sticks or glass gauges on reservoir of closed filling type	With landing gear extended and air brakes, flaps and cone retracted, fluid level should be within reference marks on dip sticks	If fluid level is lower or higher than specified, add or drain AMG-10 fluid through suction valves for ground pump; before level adjustment operations it is necessary to open filler necks of reservoir
15. Close filler neck caps of hydraulic reservoir and wipe them with clean cloth		

Accessories	Tools
Ground hydraulic pump unit	Wrenches, 19 x 22 and 24 x 27 Special wrench, 19 mm Flat-nose pliers Screwdriver for cross-slitted screws

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 14	In 2 sheets Sheet 1
HYDRAULIC SYSTEM	CHECKING INNER CHAMBERS OF CYLINDRICAL HYDRAULIC ACCUMULATORS FOR AIRTIGHTNESS	Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
1. At fuselage port side (near fin) open cover of access hole leading to cylindrical hydraulic accumulators		
2. Unlock and disconnect pipelines from hydraulic accumulators of hydraulic systems. Plug open ends of pipes and connections of hydraulic accumulator		
3. Demount hydraulic accumulators from aircraft (if hydraulic accumulators bear no identification marks as to which system they belong to, make such marks)		
4. Turn hydraulic accumulators with air chamber connections down and drain leaked-in AMG-10 hydraulic fluid from both chambers	If more than 100 cu.cm. of AMG-10 fluid is found accumulated in air chamber this testifies to intolerably poor airtightness of sealing cups; in this case hydraulic accumulator is subject to replacement	
5. Re-install hydraulic accumulators on aircraft, attach them with yokes and lock in position Note. Re-install hydraulic accumulators strictly in accordance with their former positions	Mounted at the right should be hydraulic accumulator of main hydraulic system, and at the left - hydraulic accumulator of hydraulic booster system	

Supplement to Inspection Guide No.21	PROCESS CHART No. 14	In 2 sheets Sheet 2
HYDRAULIC SYSTEM	CHECKING INNER CHAMBERS OF CYLINDRICAL HYDRAULIC ACCUMULATORS FOR AIRTIGHTNESS	Man-hours required – 1.30

Procedure	Technical requirements	Fault correction
6. Connect pipelines to hydraulic accumulators and secure them in position with locking fittings 7. Build up working (service) pressure in hydraulic systems and make sure that there is no leakage of AMT-10 hydraulic fluid from pipeline connections and joints		

Accessories	Tools
	Screwdriver for cross-slitted screws Flat-nose pliers Wrenches, 14 x 17; 19; 24 x 27; 19 x 22

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Supplement to Inspection Guide No.21	PROCESS CHART No. 15		In 2 sheets Sheet 1
HYDRAULIC SYSTEM	INSPECTION AND WASHING OF GAUZE FILTERS INSTALLED IN HYDRAULIC BOOSTER INLET CONNECTIONS		Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
1. On port side of fin screw out screws and remove cover of access hole leading to EY-51M hydraulic booster of stabiliser 2. Unlock inlet connections of main hydraulic system and of hydraulic booster system, and screw out connections 3. Withdraw gauze filters and inspect them. Make sure that soldered joints of filters are intact	Filters should be clean and intact	Should metal particles or chips be detected in filter, remove hydraulic booster and transfer it to repair workshop for disassembly and checking Filter with damaged gauze or deteriorated soldered joints should be replaced
4. On undersurface of right and left outer wing panels turn out screws and remove covers of access holes which lead to BJ-45 hydraulic boosters of ailerons 5. Unlock inlet connections of hydraulic boosters and screw out those connections 6. Remove and inspect gauze filters 7. Re-install filters, screw connections right home and lock them		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 15	In 2 sheets Sheet 2
HYDRAULIC SYSTEM	INSPECTION AND WASHING OF GAUZE FILTERS INSTALLED IN HYDRAULIC BOOSTER INLET CONNECTIONS	Man-hours required — 1.30

Procedure	Technical requirements	Fault correction
8. Re-install access hole panels and fasten them in position with screws		

Accessories	Tools
	Screwdriver for cross-slitted screws Flat-nose pliers Wrenches, 14 x 17; 19 x 22

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Supplement to Inspection Guide No.21	PROCESS CHART No. 16	In 2 sheets Sheet 1
HYDRAULIC SYSTEM	DEMOUNTING AND RE-MOUNTING PRESSURIZATION UNIT OF HYDRAULIC SYSTEMS	Man-hours required - 1.2

Procedure	Technical requirements	Fault correction
1. Unlock union nuts of pipes coupled to unit and unscrew these nuts (pipe running from pressure regulator to unit should be disconnected at pressure regulator end, and unit should be demounted complete with this pipe) 2. Screw off two nuts of bolts which couple unit fastening yokes 3. Carefully bring yokes apart and remove unit 4. Remove spring ring and withdraw dust filter from unit 5. Wash filter in clean gasoline and dry it 6. Drain condensate from unit bottle 7. Re-install filter in bottle and fit spring ring right in place . 8. Re-install unit (arrow on bottle should be directed upward), make it fast in yokes, connect pipes and lock union nuts of pipes	Note. Hydraulic system pressurization unit is mounted on rear wall of left L.G. wheel well with the aid of two yokes	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 16	In 2 sheets Sheet 2
HYDRAULIC SYSTEM	DEMOUNTING AND RE-MOUNTING PRESSURIZATION UNIT OF HYDRAULIC SYSTEMS	Man-hours required – 1.20

Procedure	Technical requirements	Fault correction

Accessories	Tools
	Wrench, 9 x 11 Multi-purpose flat-nose pliers Wrench, 14 x 17 Wrench, 19 x 22 Round-nose pliers

Supplement to Inspection Guide No.21	PROCESS CHART No. 17	In 7 sheets Sheet 1
HYDRAULIC SYSTEM	CHECKING HYDRAULIC SYSTEM FOR INTERNAL AND EXTERNAL AIRTIGHTNESS	Man-hours required - 0,[illegible]

Procedure	Technical requirements	Fault correction
1. Jack up aircraft until wheels clear ground		
2. Check level of AMG-10 fluid in hydraulic reservoir sections of systems (if systems were not filled or replenished with AMG-10 hydraulic fluid right before maintenance operations)	During internal airtightness check of main hydraulic system hydraulic pressure in hydraulic booster system should be zero Level of AMG-10 fluid in hydraulic reservoir sections should be within reference graduations on dip stick	Add hydraulic fluid if its level is below reference graduation marks
3. Check nitrogen pressure in spherical hydraulic accumulators with the aid of special fixture (if this check was not performed during previous scheduled inspection)	Nitrogen pressure should be at least 50 ± 5 kg/cm^2	
4. Check position of cross-feed cock	Cross-feed cock should be closed (ground safety lock B6-9544-00 should be removed)	
<u>Internal Airtightness Check of Main Hydraulic System</u> 5. Demount non-return valve installed in delivery line before spherical hydraulic accumulator (on fuselage starboard side between frames Nos 26 and 27:	In aircraft of latest series (beginning with Serial No.[illegible]) main hydraulic system has no pressure drop limiting valve which is replaced with non-return valve installed before spherical hydraulic accumulator. This	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 17	In 7 sheets Sheet 2
HYDRAULIC SYSTEM	CHECKING HYDRAULIC SYSTEMS FOR INTERNAL AND EXTERNAL AIRTIGHTNESS	Man-hours required – 3.40

Procedure	Technical requirements	Fault correction
6. Install special maintenance adapter No.74-7801-1050 in place of demounted non-return valve.	valve isolates hydraulic accumulator from all consumers but hydraulic boosters and engine jet nozzle flaps control system Pressure gauge transmitter of main hydraulic system is installed after non-return valve and therefore after engine stoppage or disconnection of ground hydraulic pump pressure in main hydraulic system is not indicated by cabin-mounted pressure gauge. With this arrangement it is possible to relieve pressure in main system only with the aid of hydraulic boosters. Therefore internal airtightness check of main hydraulic system calls for substitution of maintenance adapter No.74-7801-1050 for non-return valve (as instructed in Items 5 and 6 above)	
7. Connect ground hydraulic supply [illegible] to aircraft connections of [illegible] system (on fuselage star-[illegible] side)		

Supplement to Inspection Guide No.21	PROCESS CHART No. 17	In 7 sheets Sheet 3
HYDRAULIC SYSTEM	CHECKING HYDRAULIC SYSTEMS FOR INTERNAL AND EXTERNAL AIRTIGHTNESS	Man-hours required – 0.40

Procedure	Technical requirements	Fault correction
8. Open the following circuit-breakers on vertical panel of right-hand console: L.G. indication, air brakes, hydraulic booster system disengagement, hydraulic system indication and L.G. flaps		
9. With working hydraulic fluid in main system under pressure inspect all joints to make sure that system is airtight externally 10. To warm up working fluid (in cold weather) and to evacuate air from hydraulic system operate units of hydraulic system as follows: (a) retract and extend landing gear, flaps, air brakes, cone, anti-surge shutters and engine jet nozzle flaps 10 – 12 times; (b) move aircraft control stick forward and backward at maximum possible rate 20 – 30 times; (c) turn L.G. nosewheel strut with turning mechanism engaged (on aircraft equipped with turning mechanism) 15 – 16 times	Working fluid pressure should be equal to $210 ^{+5}_{-10}$ kg/cm^2. Leakage of AMG-10 fluid from joints to pipelines and units shall not be tolerated WARNINGS: 1. Before taking seat in aircraft cockpit to perform extension and retraction cycles of hydraulically operated units make sure that nobody works in close proximity of landing gear, flaps and air brakes 2. During actuation of hydraulic units, an inspector should be standing at aircraft wing to watch retraction-extension procedure 3. During operation of nosewheel strut turning mechanism nitrogen pressure in shock strut should be relieved to 5 – 7 kg/cm^2	In case of poor airtightness reduce pressure to zero and tighten union nut of faulty joint

Supplement to Inspection Guide No.21	PROCESS CHART No. 12	In 7 sheets Sheet 4
HYDRAULIC SYSTEM	CHECKING HYDRAULIC SYSTEMS FOR INTERNAL AND EXTERNAL AIRTIGHTNESS	Man-hours required - 0.40

Procedure	Technical requirements	Fault correction
11. Build up working pressure in hydraulic system and place unit control cocks in cockpit to following positions: (a) aileron hydraulic booster cock - to OFF ([illegible]); (b) nosewheel strut turning mechanism control cock (if any) - to OFF ([illegible]); (c) L.G. cock - to NEUTRAL ([illegible]); (d) flap control cock - to RETRACTED ([illegible]); (e) anti-surge shutter control cock - to CLOSED ([illegible])		
12. Maintain working pressure in main hydraulic system for 1 to 2 minutes and disengage hydraulic pump of ground supply kit	Aircraft control stick should be fixed in neutral position. Pressure in hydraulic booster system should be equal to zero	
13. Determine time of pressure drop from 180 to 150 kg/cm^2 in main hydraulic system by pressure gauge installed in [illegible]	Time of pressure drop from 180 to 150 kg/cm^2 in main hydraulic system should be not less than 10 seconds	
[illegible] internal airtightness [illegible] placed in other operat[illegible] as indicated under Point 11		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 17	In 7 sheets Sheet 5
HYDRAULIC SYSTEM	CHECKING HYDRAULIC SYSTEMS FOR INTERNAL AND EXTERNAL AIRTIGHTNESS	Man-hours required = 0.4

Procedure	Technical requirements	Fault correction
(with the exception of aileron hydraulic booster control cock which should be OFF)		
15. With main hydraulic system under working pressure, return cocks to positions indicated in Point 11, and engage aileron hydraulic booster control cock		
16. Operate aircraft control cock over entire operating range from right to left and back again; accomplish 20 to 30 full cycles at maximum possible rate		
17. Disengage ground hydraulic pump and measure time during which pressure in system drops from 180 to 150 kg/cm^2 with aileron hydraulic boosters engaged	Time during which main hydraulic system pressure drops from 180 to 150 kg/cm^2 should be at least 5 sec	
18. Operate aircraft control stick to reduce pressure in hydraulic system to zero and disconnect ground hydraulic pump		
19. When through with check, remove maintenance adapter and re-install non-return valve Note. When re-installing non-return valve be sure to position it with arrow on valve body directed towards spherical hydraulic accumulator		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 17	In 7 sheets Sheet 6
HYDRAULIC SYSTEM	CHECKING HYDRAULIC SYSTEMS FOR INTERNAL AND EXTERNAL AIRTIGHTNESS	Man-hours required – 0.40

Procedure	Technical requirements	Fault correction
20. Check all non-return valve-to-pipeline connections for airtightness		
Airtightness Check of Hydraulic Booster System		
1. Connect hoses from ground hydraulic pump to hydraulic booster system connections on fuselage port side		
2. Build up working pressure in system and examine connections and joints for external airtightness	Pressure in hydraulic booster system should be $210 ^{+5}_{-10}$ kg/cm^2. No leakage of AMG-10 fluid at connections and joints of pipelines and units shall be tolerated	
3. Operating from cockpit, engage aileron boosters and move aircraft control stick forward and backward and from left to right at maximum possible rate during 2 minutes	Pressure in main hydraulic system should be zero	
4. Place aircraft control stick to [illegible] position and disengage ground [illegible]	**Note.** The following amounts of AMG-10 fluid are allowed to be squeezed out at moving surfaces during operation of BU-45 and BU-51M hydraulic boosters: (a) BU-51M booster- 2 cu.cm per one operating hour	At parking tolerated leakage is up to 2 cu.cm per 24 hours for BU-51M

Supplement to Inspection Guide No.21	PROCESS CHART No. 17	In 7 sheets Sheet 7
HYDRAULIC SYSTEM	CHECKING HYDRAULIC SYSTEMS FOR INTERNAL AND EXTERNAL AIRTIGHTNESS	Man-hours required - 0.40

Procedure	Technical requirements	Fault correction
	(b) EY-45 booster: 4 cu.cm per one operating hour (or two drops per minute).	booster and up to 1 cu.cm for EY-45 booster
5. Measure time required for system pressure to drop from 180 to 150 kg/cm^2	Pressure in system should drop from 180 to 150 kg/cm^2 during not shorter than 10 seconds	
6. Build up working pressure in system and disengage aileron hydraulic boosters		
7. Disengage ground hydraulic pump and measure time during which hydraulic system pressure drops from 180 to 150 kg/cm^2	With aileron hydraulic boosters disengaged, time of pressure drop from 180 to 150 kg/cm^2 should be at least 35 sec	
8. Relieve pressure in system to zero. Disconnect ground hydraulic pump		

Accessories	Tools
Fixture for testing nitrogen pressure in hydraulic accumulators Ground hydraulic installation	Flat-nose pliers Screwdriver

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Supplement to Inspection Guide No.21	PROCESS CHART No. 18	In 4 sheets Sheet 1
HYDRAULIC SYSTEM	CHECKING EMERGENCY PUMP UNIT НП-27 FOR RELIABLE OPERATION	Man-hours required – 0.2

Procedure	Technical requirements	Fault correction
1. Connect ground electric power supply source to aircraft 2. Connect ground hydraulic pump to aircraft connections of hydraulic booster system 3. Operating from cockpit, turn on circuit-breakers bearing inscriptions DISENGAGEMENT OF BOOSTER SYSTEM. HYDRAULIC SYSTEM INDICATION (ОТКЛЮЧ. БУСТ. СИСТ. СИГН. ГИДР.) and LIGHT CONTROL. LIGHT INDICATION PANEL. FUEL REMAIN. TRIMMING EFFECT MECHANISM INDICATION (КОНТРОЛЬ ЛАМП. ТАБЛО. ОСТ. ТОПЛ. СИГН. ТРИМ. ЭФФ.)		
4. Operating from cockpit, turn on toggle switch bearing inscription STORAGE BATTERY AIRCRAFT-GROUND (АККУМУЛЯТОР БОРТОВОЙ АЭРОДРОМНЫЙ) 5. Engage ground hydraulic pump and build up working pressure in hydraulic booster system	This action should result in illumination of two indicator lights: BOOSTER (БУСТЕРНАЯ) and MAIN (ОСНОВНАЯ) on instrument panel As fluid pressure in system reaches 195 kg/cm^2, BOOSTER indicator light should go out, MAIN light remaining on	
6. In cockpit turn on circuit-breaker with inscription PUMP UNIT (НАСОСНАЯ СТАНЦИЯ)		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 18	In 4 sheets Sheet 2
HYDRAULIC SYSTEM	CHECKING EMERGENCY PUMP UNIT NS-27 FOR RELIABLE OPERATION	Man-hours required – 0.1

Procedure	Technical requirements	Fault correction
7. Disengage ground hydraulic pump and smoothly move aircraft control stick backward and forward to check beginning of automatic operation of NS-27 pump unit	As soon as working pressure of hydraulic fluid in system drops to 165 $^{+10}_{-5}$ kg/cm² BOOSTER light should come on, and pump unit should engage automatically Engagement of NS-27 pump unit shall be ascertained aurally, by noise of electric motor and pump	
8. Disengage pump unit and aileron hydraulic boosters, and operate aircraft control stick to reduce pressure in hydraulic booster system to 130 kg/cm²		
9. Set aircraft control stick neutral and, holding it fixed, engage pump unit. Note time during which pressure built up by NS-27 unit increases from 130 to 170 kg/cm² 10. Run pump unit for 30 seconds	With aircraft control stick in fixed position and aileron hydraulic boosters disengaged pressure in hydraulic booster system should increase from 130 to 170 kg/cm² during not longer than 7 seconds If in the course of 30-sec. operation of pump unit pressure of working fluid in hydraulic booster system remains stable at 160 $_{-5}$ kg/cm² this means that safety valve installed in pump unit line and pump unit NS-27 proper function normally	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 18	In 4 sheets Sheet 3
HYDRAULIC SYSTEM	CHECKING EMERGENCY PUMP UNIT EN-27 FOR RELIABLE OPERATION	Man-hours required – 0.1

Procedure	Technical requirements	Fault correction
11. Having checked EN-27 pump unit engage aileron hydraulic boosters 12. Without disengaging pump unit check its automatic disconnection from aircraft electric mains. To this end: (a) engage ground hydraulic pump; (b) build up working pressure in hydraulic booster system **Notes:** 1. In order to extend service life of electric motor of EN-27 pump unit it is advisable that during ground checks of pump unit it is engaged for continuous operation for not longer than 3 minutes 2. Remember that with EN-34 pump inoperative, EN-27 pump unit cannot be disengaged automatically; therefore, during ground checks EN-27 unit should be disengaged (in case of necessity) manually, by opening PUMP UNIT circuit-breaker 3. Emergency pump units which were operated in flight for about 13 minutes are subject to replacement	At the moment hydraulic booster system pressure reaches 195 kg/cm^2 pump unit should be automatically disengaged (disengagement shall be determined by discontinuation of pump unit noise) Difference between EN-27 pump unit engaging and disengaging pressures should be not less than 12 kg/cm^2	WARNING. To ensure normal operation of EN-27 pump unit and proper indication of pressure drop in hydraulic systems it is necessary to select pressure relays PA-135 (in case of replacement) which would be rated for engaging pressure of 165 $^{+10}_{-5}$ kg/cm^2 and disengaging pressure of not over 195 kg/cm^2 For relay characteristics refer to Certificates of relays used

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Supplement to Inspection Guide No.21	PROCESS CHART No. 18	In [illegible] sheets Sheet 4
HYDRAULIC SYSTEM	CHECKING EMERGENCY PUMP UNIT ED-27 FOR RELIABLE OPERATION	Man-hours required: 0.1

Procedure	Technical requirements	Fault correction

Accessories	Tools
Ground hydraulic installation Ground electric power supply source	Screwdriver Multi-purpose flat-nose pliers

Supplement to Inspection Guide No.21	PROCESS CHART No. 19	In 6 sheets Sheet 1
HYDRAULIC SYSTEM	CHECKING [illegible] HYDRAULIC PUMPS, AILERON HYDRAULIC BOOSTERS AND STABILIZER HYDRAULIC BOOSTERS FOR [illegible] OPERATION	Man-hours required – 0.40

Procedure	Technical requirements	Fault correction
1. Check nitrogen pressure in spherical hydraulic accumulators (if it has not been checked before) and cylindrical hydraulic accumulators with the aid of pressure gauges installed at fuselage port side		
2. Check air brakes for tight fitting to fuselage skin		
3. In order to prevent "sticking" of hydraulic booster control valve slide blocks in intermediate positions make sure before starting engine that aileron hydraulic boosters are engaged	With zero pressure in both hydraulic systems, pressure in cylindrical and spherical hydraulic accumulators should be 50^{+5} kg/cm^2. Air brake panels should be tightly pressed to fuselage skin Cross-feed cock should be closed	If air brake panels do not fit tightly to fuselage skin open cross-feed cock, manually press air brakes to fuselage skin and install screw clamps; close cross-feed cock
4. Start engine. When pressure appears in hydraulic systems (this moment is indicated by pressure gauge pointers which will begin their travel from zero points) turn off AILERON BOOSTERS ([illegible]) switch in order to prevent hydraulic fluid flow through hydraulic boosters during check-out of [illegible]		
5. [illegible] pressure gauges check [illegible] of pressure increase in hydraulic [illegible]	When H.P. rotor reaches 25% rating, pressure in both hydraulic sys-	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 29	In 6 sheets Sheet 2
HYDRAULIC SYSTEM	CHECKING [illegible] HYDRAULIC PUMPS, AILERON HYDRAULIC BOOSTERS AND STABILIZER HYDRAULIC BOOSTERS FOR RELIABLE OPERATION	Man-hours required - [illegible]

Procedure	Technical requirements	Fault correction
	zone (as indicated by pressure gauges) should rise from 0 to 210 $^{+5}_{-10}$ kg/cm^2 (keep aircraft control stick motionless during pressure rise)	
6. Check operation of [illegible] pump of hydraulic booster system; to this end: at 50% r.p.m. of engine turn on AILERON BOOSTERS switch and several times move aircraft control stick diagonally at maximum possible rate	Pressure in hydraulic booster system should not fall below 150 kg/cm^2. If it is so, [illegible] pump of hydraulic booster system is sound. Aircraft control stick should move smoothly, without [illegible] or jerking. Efforts from artificial feel loading mechanisms should be perceptible	If pressure in hydraulic booster system drops below 180 kg/cm^2, replace [illegible] pump with new one
7. Check operation of ЕШ-34 pump of main hydraulic system. To this end: (a) at engine r.p.m. of 50% normal rating press DISENGAGEMENT OF BOOSTER SYSTEM button at right-hand console; keep it in depressed position and move aircraft control stick several times diagonally at maximum possible rate. While doing this, check operation of hydraulic boosters from main hydraulic system and pressure in main hydraulic system	Pressure in main hydraulic system should not drop below 180 kg/cm^2. If so, hydraulic pump of main hydraulic system should be considered sound	If pressure in main hydraulic system drops below 180 kg/cm^2, replace ЕШ-34 pump

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Supplement to Inspection Guide No. 2)	PROCESS CHART No. 39	In 5 sheets Sheet 3
HYDRAULIC SYSTEM	CHECKING [illegible] HYDRAULIC PUMPS, AILERON HYDRAULIC BOOSTERS AND STABILIZER HYDRAULIC BOOSTERS FOR RELIABLE OPERATION	Man-hours required — 0.40

Procedure	Technical requirements	Fault correction
WARNINGS: 1. Continuous ground running time of engine at H.P. rotor r.p.m. lower than 50% in icing conditions (at temperatures of 0 to minus 10°C) should not exceed 5 minutes 2. Never operate aileron hydraulic booster switch with electric supply on and no pressure in hydraulic systems unless this is extremely urgent. This is general rule that aileron hydraulic booster switch should be always ON		
External Airtightness Check of Pipe-lines and Units of Hydraulic Systems (a) Hydraulic Booster System 1. On fuselage port side and wing covers of access holes leading to [illegible] pipelines of hydraulic booster		

Supplement to Inspection Guide No. 21	PROCESS CHART No. 19	In 6 sheets Sheet 4
HYDRAULIC SYSTEM	CHECKING НШ-34 HYDRAULIC PUMPS, AILERON HYDRAULIC BOOSTERS AND STABILIZER HYDRAULIC BOOSTERS FOR RELIABLE OPERATION	Man-hours required – 0.4

Procedure	Technical requirements	Fault correction
2. Build up working pressure in hydraulic booster system from ground hydraulic pump 3. Maintain pressure in system during at least 10 minutes 4. Observing through open access holes inspect externally pipeline and unit connections and joints (in sections: pump-hydraulic boosters) for leakage of AMT-10 fluid	Leakage of AMT-10 fluid in connections and seals shall not be tolerated. When inspecting pipelines make sure that bent sections of pipelines are round (out-of-roundness should not exceed 5%). Pipes are allowed to be worn down by not more than 0.2 mm deep	Should out-of-roundness be over 5% replace pipeline
5. Relieve pressure in system by operation of aircraft control stick	During pipeline mounting see to it that pipes are not stressed. With pipe disconnected, separation of pipe from connection should be not over 1 mm. Be absolutely sure that pipe centre line is co-centric with centre line of connection	
6. Close access holes with respective covers and secure them with screws or locks		

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Supplement to Inspection Guide No. 21	PROGRESS CHART No. 39	In 6 sheets Sheet 5
HYDRAULIC SYSTEM	CHECKING [illegible]-34 HYDRAULIC PUMPS, AILERON HYDRAULIC BOOSTERS AND STABILIZER HYDRAULIC BOOSTERS FOR RELIABLE OPERATION	Man-hours required – 5.40

Procedure	Technical requirements	Fault correction
(b) Main Hydraulic System 1. On fuselage starboard side and wing open covers of access holes leading to accessories (units) of main hydraulic system 2. Build up working pressure in main hydraulic system from ground hydraulic pump		
3. Observing through open access holes examine pipeline and unit joints for external airtightness in the following sections of main hydraulic system: (a) L.G. retraction and extension systems, in three positions of L.G. control cock: NEUTRAL (НЕЙТРАЛЬНО), RETRACTION (УБОРКА), and EXTENSION (ВЫПУСК); (b) flap control system, with control cock in two positions: RETRACTED (УБРАНО) and LANDING (ПОСАДКА); (c) air brake system, with control cock in two positions: EXTENDED (ВЫПУЩЕНО) and RETRACTED (УБРАНО) (d) system of anti-surge shutters, with control cock in two positions: OPEN (ОТКРЫТО) and CLOSED (ЗАКРЫТО);	Pressure should be maintained in hydraulic system for each position of control cocks during at least 10 minutes. Check by outer inspection in lines: pump-cocks; cocks-cylinders; pump-hydraulic boosters of delivery and return lines. Check above mentioned sections of hydraulic system simultaneously. Make sure that joints and connections of system pipelines and units show no traces of fluid leakage	

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Supplement to Inspection Guide No. 22	PROCESS CHART No. 19		In 6 sheets Sheet 6
HYDRAULIC SYSTEM	CHECKING RU-3A HYDRAULIC PUMPS, AILERON HYDRAULIC BOOSTERS AND STABILIZER HYDRAULIC BOOSTERS FOR RELIABLE OPERATION		Man-hours required – 0.[illegible]
Procedure	**Technical requirements**	**Fault correction**	
(e) movable cone system, in three positions: RETRACTED ([illegible]), EXTENSION I ([illegible] I) and EXTENSION II ([illegible] II); (f) jet nozzle flaps system, with control cock in two positions; (g) nosewheel turning mechanism, with control cock in position ENGAGED ([illegible]); (h) supply line of aileron and stabilizer hydraulic boosters 4. Re-install access hole covers and fasten them in place with screws or locks 5. Lower aircraft to ground by jacks			

Accessories	Tools
Ground hydraulic installation Ground electric power supply source	Screwdriver for cross-slitted screws Multi-purpose flat-nose pliers

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Supplement to Inspection Guide No.21	PROCESS CHART No. 20	In 2 sheets Sheet 1
HYDRAULIC SYSTEM	CHECKING NITROGEN PRESSURE IN SPHERICAL HYDRAULIC ACCUMULATORS OF HYDRAULIC SYSTEMS	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
1. Open left- and right-side covers of access holes leading to spherical hydraulic accumulators installed between frames Nos 22 and 25 2. Unlock and screw off caps from connections of hydraulic accumulator charging valves		
3. Screw nitrogen pressure gauge fixture onto hydraulic accumulator valve connection and check nitrogen pressure in hydraulic accumulators by pressure gauge indications (Fig.24)	Nitrogen pressure in spherical hydraulic accumulators (at zero pressure in hydraulic systems) should amount to 50 kg/cm^2	

Accessories	Tools
Fixture for charging L.G. shock struts and hydraulic accumulators with nitrogen and for checking nitrogen pressure in them (72-7804-256) Ground nitrogen bottle	Screwdriver Wrench, 14 x 17

Supplement to Inspection Guide No. 21	PROCESS CHART No. 20	In 2 sheets Sheet 2

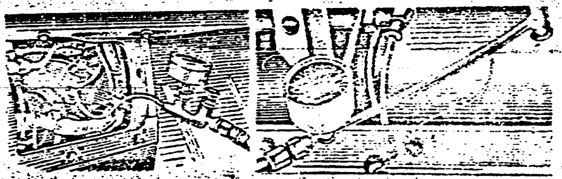

FIG. 24. SPECIAL DEVICE FOR CHECKING SPHERICAL HYDRAULIC ACCUMULATOR FOR NITROGEN CHARGE PRESSURE

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Supplement to Inspection Guide No. 21	PROCEDURE CHART No. 21	In 5 sheets Sheet 2
HYDRAULIC SYSTEM	CHECKING CONDITION OF L.G. MAIN AND NOSEWHEEL SHOCK STRUTS AND PRESSURE-CHARGING OF STRUT HINGE GREASE FITTINGS WITH LUBRICANT, GRADE TSIATIM-201	Man-hours required - 2.30

Procedure	Technical requirements	Fault correction
1. Lift aircraft until its wheels clear ground; do this with the aid of hydraulic jacks installed under wings and nose	Having lifted aircraft fix operating rods of hydraulic jacks with the aid of locking sleeves	
2. Wash joints of main and nosewheel L.G. struts with gasoline and blow them with compressed air (Figs 25 and 26)	Joints and parts of main and nosewheel L.G. struts should be clean, especially at welded joints and couplings	
3. Using magnifier glass examine parts of main and nosewheel L.G. struts and of main L.G. strut turning mechanism for cracks. Pay special attention to the following places: (a) welded joints of parts; (b) pass-over areas; (c) axle shaft of main L.G. strut, rear plug of wheel shaft turning mechanism lever	Cracks in joints and parts of struts shall not be tolerated. Replace struts and assemblies if they are cracked	Should cracks be suspected, remove paint from examined area with solvent and check with paint method. Should this method prove ineffective remove strut or part and test it with magna-flux method
4. Press-charge L.G. strut hinge grease fittings with TSIATIM-201 lubricant [illegible] Note. [illegible] fitting in hubs of main [illegible] strut mounting shafts lo-	Joints shall be considered sufficiently lubricated if fresh lubricant appears in clearances of joint being lubricated	If no fresh lubricant appears in clearances between assembly elements, disassemble faulty group of parts, wash lubrication holes in parts with gasoline

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Supplement to Inspection Guide No 21	PROCESS CHART No. 21	In 5 sheets Sheet 2

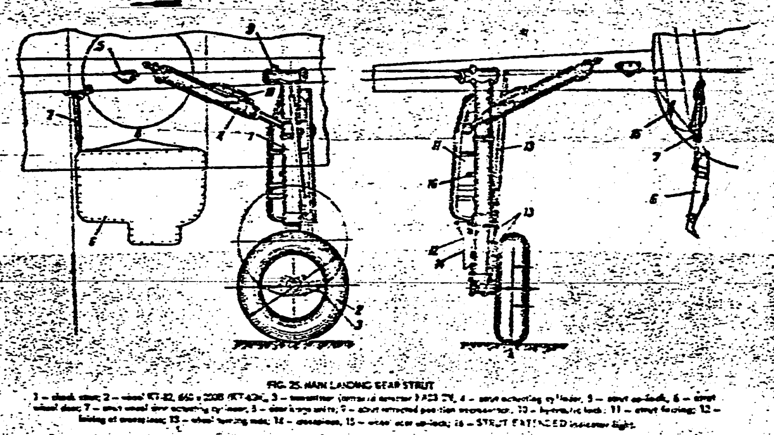

FIG. 25. MAIN LANDING GEAR STRUT

1 – shock strut; 2 – wheel KT-82, 660 x 200B (KT-63K); 3 – [illegible]; 4 – strut actuating cylinder; 5 – strut up-lock; 6 – strut wheel door; 7 – strut wheel door actuating cylinder; 8 – [illegible]; 9 – strut retracted position [illegible]; 10 – hydraulic lock; 11 – strut facing; 12 – [illegible]; 13 – wheel turning [illegible]; 14 – [illegible]; 15 – [illegible] up-lock; 16 – STRUT EXTENDED indicator light.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 21	In 5 sheets Sheet 3

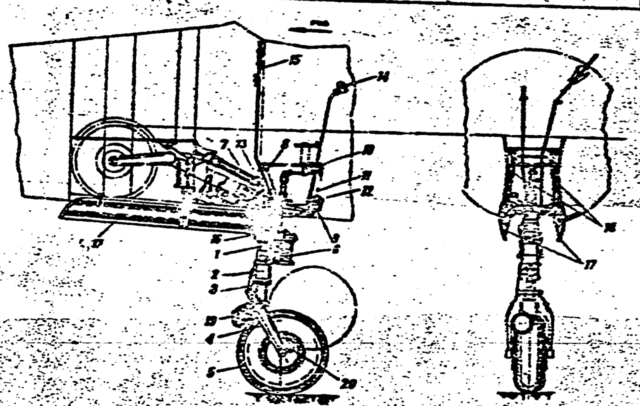

FIG. 26. LANDING GEAR NOSEWHEEL STRUT

1 – strut outer tube; 2 – lever assembly; 3 – universal joint; 4 – fork; 5 – wheel KT-32 (500 x 180A); 6 – shimmy damper with nosewheel turning mechanism; 7 – strut actuating cylinder; 8 – strut extended position stop; 9 – strut up-lock; 10 – nosewheel strut control mechanism drive; 11 – No. 7A frame [illegible]; 12 – strut retracted position microswitch; 13 – strut extended position microswitch; 14 – nosewheel strut emergency unlock handle; 15 – STRUT EXTENDED mechanical indicator; 16 – STRUT EXTENDED indicator light; 17 – L.G. nosewheel strut doors; 18 – nosewheel strut doors extension mechanism; 19 – towing lug; 20 – transmitter (antiskid detector) YA24/2.

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Supplement to Inspection Guide No. 21	PROCESS CHART No.21	In 5 sheets Sheet 4

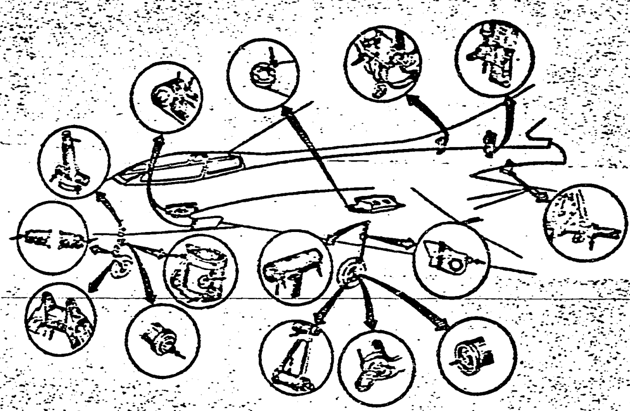

Fig 37. Layout of grease fittings

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 21	In 5 sheets Sheet 5
HYDRAULIC SYSTEM	CHECKING CONDITION OF L.G. [illegible] AND [illegible] SHOCK STRUTS AND PRESSURE-CHARGING OF [illegible] GREASE FITTINGS WITH LUBRICANT, GRADE [illegible]-201	Man-hours required – 2.30

Procedure	Technical requirements	Fault correction
[illegible]ated closer to wing front spar should be lubricated with L.G. struts half-retracted 5. Lower aircraft to ground with the aid of jacks installed under wings and aircraft nose	Only [illegible]-201 lubricant should be used for all L.G. assemblies. NEVER use other lubricants. Before lowering aircraft act as follows: (a) build up counterpressure in hydraulic jacks; (b) release locking sleeves of jacks; (c) smoothly open by-pass valve	and re-assemble the group. Repeat lubrication procedure If these requirements are not met, it may occur that upon opening of valve operating rods of hydraulic jacks, under gravity of aircraft, may start abruptly downward which will result in aircraft falling down from hydraulic jacks

Accessories	Tools
Hydraulic jack for wing, 9200-00Б (two jacks) Hydraulic jack for fuselage nose section (9200-0CБ) Syringe [illegible]-37C Tray [illegible]-9997-[illegible] Bucket, zinc-plated [illegible], painter's [illegible] glass, X10. State Standard ГОСТ 7594-55 [illegible] for examination of hard-to-get-at places, [illegible]4-55 Grease cup 72-7804-140	

Supplement to Inspection Guide No.21	PROCESS CHART No. 22	In 3 sheets Sheet 1
LANDING GEAR	CHECKING TOTAL PLAYS OF L.G. STRUTS, DOORS AND FAIRINGS	Man-hours required – 1.1

Procedure	Technical requirements	Fault correction
1. Use hydraulic jacks to lift aircraft until its wheels clear ground 2. Prepare special fixture for measuring plays of L.G. struts and install it near L.G. strut wheel 3. Check total plays in longitudinal and lateral directions in main and nosewheel struts (Fig.28) For measuring total play it is necessary to use dynamometer to move strut in one direction (forward), to bring moving graduated horizontal pin (set at zero) to wheel and to move wheel through dynamometer in opposite direction; while doing this read total play value by graduations on measuring fixture pin (See Fig.28)	Prior to measuring total plays in L.G. struts make sure that working fluid pressure in main hydraulic system equals zero. Then an effort of up to 20 kg is gradually applied to wheel axle (in both directions), total play in main L.G. strut should be: (a) not over 8 mm in longitudinal direction; (b) not over 10 mm in lateral direction. Total play of nosewheel strut in both longitudinal and lateral directions should not exceed 5 mm	If total play exceeds maximum specified values locate joint assembly which is worn most heavily, and replace parts of this joint or complete strut
4. Check plays in doors and fairings of main and nosewheel L.G. struts	Play of doors and fairings is measured at lower edges	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 22	In 3 Sheets Sheet 2

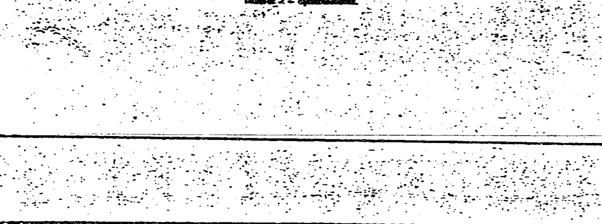

FIG. 28. MEASURING TOTAL PLAY OF MAIN L.G. STRUT WITH SPECIAL FIXTURE
(a) measuring lateral play; (b) – measuring longitudinal play; 1 – total play measuring fixture; 2 – dynamometer.

Supplement to Inspection Guide No.21	PROCESS CHART No.22	In 3 sheets Sheet 3
LANDING GEAR	CHECKING TOTAL PLAYS OF L.G. STRUTS, DOORS AND FAIRINGS	Man-hours required - 1.15

Procedure	Technical requirements	Fault correction
5. Operate hydraulic jacks to lower aircraft to ground	Main L.G. strut wheel door should play by not more than 12 mm. Nosewheel door should play by not over 7 mm. No play shall be tolerated in strut fairings and crosspieces. Efforts applied to doors and fairings during play check-out should be within 2 to 3 kg	

Accessories	Tools
Special fixture for measuring total plays in L.G. struts, 35-9835-00	Dynamometer rated for up to 20 kg

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Supplement to Inspection Guide No.21	PROCESS CHART No. 23	In 2 sheets Sheet 1
LANDING GEAR	CHECKING CLEARANCE BETWEEN STOP ON FRAME No.6 AND UPPER ARM OF NOSEWHEEL STRUT	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
1. Jack aircraft up until wheels clear ground. 2. Use feeler gauge to measure clearance between stop on frame No.6 and upper arm of L.G. nosewheel strut (Fig.29)	When hand effort of up to 20 kg is applied to strut wheel axle in direction of flight, and with landing gear control cock in neutral position, checked clearance should be not over 0.45 mm. When adjusting clearance be extremely careful and attentive since absence of clearance will result in poor aligment of hydraulic booster operating rod and ball lock. On the other hand, excessive clearance will result in impact loads on joint	If clearance is greater or smaller than specified adjust it as follows: (a) unlock and disconnect from strut L.G. nosewheel strut actuating cylinder rod eyebolt; (b) to increase clearance turn eyebolt out, and vice versa

FIG. 29. MEASURING CLEARANCE BETWEEN STOP ON FRAME No. 6 AND NOSEWHEEL STRUT UPPER ARM (BOTTOM VIEW)

1 – upper arm of nosewheel strut, 2 – stop on frame No. 6, 3 – operating rod of nosewheel strut actuating cylinder, 4 – set of feeler blades; 5 – frame No. 6, 6 – cable of strut position mechanical indicator; 7 – [illegible].

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Supplement to Inspection Guide No.21	PROCESS CHART No.23		In 2 sheets Sheet 2
LANDING GEAR	CHECKING CLEARANCE BETWEEN STOP ON FRAME No.6 AND UPPER ARM OF NOSEWHEEL STRUT		Man-hours required – 0.[illegible]
Procedure	**Technical requirements**	**Fault correction**	
3. Relieve nitrogen pressure in shock strut to 4 – 6 kg/cm^2 4. Engage strut turning mechanism and, with main hydraulic system under pressure, several times move foot control bar in cockpit from one extreme side position to the other 5. With turning mechanism disengaged, turn nosewheel manually in both directions as far as it will go 6. With control mechanism engaged, extend flaps 7. Retract flaps and half-retract landing gear (full retraction is forbidden since otherwise nosewheel strut fairing may get damaged) 8. Charge shock strut with nitrogen 9. Operate hydraulic jacks to lower aircraft to ground.	Nosewheel should turn by $45^{+5°}_{-3}$. Travel margin of turning lever should be at least 1° (linear equivalent – – 2.5 mm by lug of lever) Mechanism should become disengaged	Should eyebolt adjustment fail to correct fault, place plate of required thickness (0.3 – 0.5 mm) under stop on frame No.6	

Accessories	Tools
Special fixture for measuring nosewheel turn angle	Set of feeler blades, 0.05–2 mm, State Standard ГОСТ 882-41

Supplement to Inspection Guide No.21	PROCESS CHART No.24		In 2 sheets Sheet [illegible]
LANDING GEAR	CHECKING CONDITION OF CONTROL CABLES RUNNING FROM MAIN L.G. STRUT LOCKS TO L.G. DOOR LOCKS		Man-hours required – 0.15
Procedure	**Technical requirements**	**Fault correction**	
1. Wipe control cables running from main L.G. strut locks to L.G. door locks with rags soaked in gasoline 2. Inspect cables externally and move hand over them to make sure that cables are neither rusted nor rugged 3. Check cable termination in and lugs for condition 4. Coat cables with grade ЦИАТИМ-201 lubricant 5. Remove and inspect bolts which couple three-arm lever 4 (Fig.30) with strut and wing door up-locks. Replace bolts if they are worn out by more than 0.2 mm deep Coat bolts with grade ЦИАТИМ-201 lubricant and re-install	Cable should be free from corrosion and ruggedness	In case of rust traces wipe affected section with rags soaked in kerosene, then wipe it dry and coat with grade ЦИАТИМ-201 lubricant. If cable is rugged (seperate strands are broken) replace cable. Cables with strand projecting at termination should be replaced	
Accessories	**Tools**		
	Screwdriver, ordinary Flat-nose pliers Wrenches, 5 x 7 and 9 x 11		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 80	In 2 sheets Sheet 2

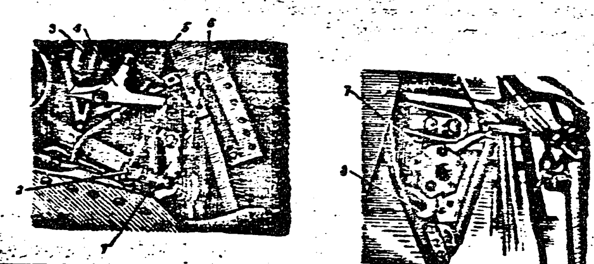

FIG. 28. POSITION OF CABLE LINKAGE AT MAIN L.G. STRUT (LEFT ILLUSTRATION) AND AT L.G. DOOR LOCK (RIGHT ILLUSTRATION)

1 – main L.G. strut up-lock; 2 – main L.G. strut up-lock opening cylinder; 3 – lock opening pneumatic cylinder for emergency L.G. extension; 4 – three-arm lever; 5 – cable running to main L.G. strut wheel door up-lock; 6 – main L.G. strut up-lock hook; 7 – main L.G. strut wheel door up-lock; 8 – lock hook.

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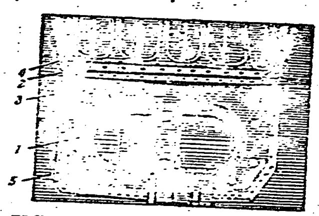
Supplement to Inspection Guide No.2	PROCESS CHART No.25	In 2 sheets Sheet 1
LANDING GEAR	WASHING, INSPECTION AND LUBRICATION OF WHEEL DOORS ATTACHMENT JOINTS AND OF WHEEL TURNING MECHANISM CONTROL ROD HINGE JOINTS	Man-hours required - 0.25

Procedure	Technical requirements	Fault correction
1. Disconnect L.G. door operating cylinder rod from door; to this end, remove locking fittings and screw out bolt (Fig.32) 2. Remove pins and wash L.G. wheel door attachment joints (Fig.31) and hinge joints of wheel turning mechanism control rods with clean gasoline; then blow with compressed air (Fig.32)	 FIG. 31. GENERAL VIEW OF MAIN L.G. STRUT WHEEL DOOR 1 – door; 2 – strut attachment points; 3 – door actuating cylinder operating rod attachment joint; 4 – door actuating cylinder operating rod; 5 – holding pin of L.G. door in retracted position.	
3. Inspect pins and attachment joints of wheel doors for cracks and corrosion 4. Inspect hinge joints of wheel turning mechanism control rods and make certain that nuts are locked securely	Wheel door should rotate about its hinge freely, without jamming. If pin head rotates with opposite end remaining motionless, the pin in question is surely broken	If door turns with difficulty and if pin is found broken, demount wheel door, wash joints with clean gasoline and repair (if necessary). Should traces of corrosion be detected, clean them off with polishing paper No.200 In case of heavy corrosion (result-

Supplement to Inspection Guide No.21	PROCESS CHART No.25	In 2 sheets Sheet 2
LANDING GEAR	WASHING, INSPECTION AND LUBRICATION OF WHEEL DOORS ATTACHMENT JOINTS AND OF WHEEL TURNING MECHANISM CONTROL ROD HINGE JOINTS	Man-hours required – 0.25

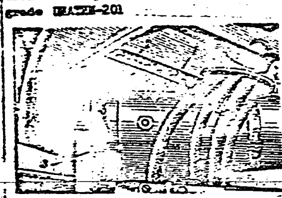
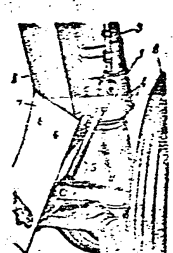
Procedure	Technical requirements	Fault correction
5. Coat pins, wheel door attachment joints and wheel turning mechanism control rod hinge joints with lubricant, grade TsIATIM-201 		ing in pitting) replace faulty joint (assembly) or pin

FIG. 32. HINGE JOINTS OF WHEEL TURNING MECHANISM
1 – main L.G. strut, 2 – wheel turning mechanism rod attachment point in wing; 3 – wheel turning mechanism control rod, 4 – lower control rods of wheel turning mechanism; 5 – crosspiece, 6 – strut fairing; 7 – crosspiece fairing; 8 – wheel.

Accessories	Tools
Bottle with compressed air Lubricant, grade TsIATIM-201 Grease cup	Syringe Brush Wrench, 14 x 17

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Supplement to Inspection Guide No.21	PROCESS CHART No.26	In 4 sheets Sheet 1
LANDING GEAR	REMOVAL, WASHING AND LUBRICATION OF BOLTS OF NOSEWHEEL SHOCK STRUT UNIVERSAL JOINT AND MAIN L.G. STRUT CROSSPIECES	Man-hours required — 4.10

Procedure	Technical requirements	Fault correcting
1. Use hydraulic jacks to lift aircraft so that wheels clear ground (if aircraft is not jacked up)		
2. Uncotterpin and screw nuts off bolts of L.G. nosewheel universal joints (Fig.33)	Inner lubrication spaces of bolts and universal joints should be clean.	
3. Remove bolts and universal joints, wash them in clean gasoline and blow with compressed air	Ball socket of upper universal joint should rotate freely, without jamming	In case of stiff rotation of ball socket obtain easy rotation by repeated gasoline washing with the aid of syringe
4. Inspect surfaces of bolts and universal joints for corrosion, cracks and scores	No corrosion, cracks and scores are allowed on surfaces of bolts and universal joint	If corrosion has been detected on ball socket replace universal joint. Bolts with surface cracks and scores should be replaced
5. Coat surfaces of bolts and openings of universal joints with thin layer of grade ЦИАТИМ-201 lubricant		
6. Re-install universal joints, screw nuts onto bolts and lock them		
7. Use syringe to grease universal joint bolts with grade ЦИАТИМ-201 lubricant	Appearance of lubricant in assembly clearances indicates sufficient lubrication	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 26	In 4 sheets Sheet 2

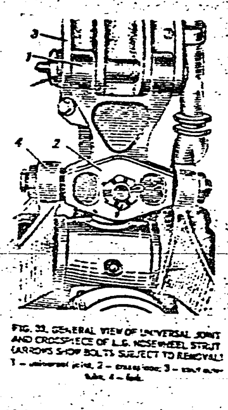

FIG. 33. GENERAL VIEW OF UNIVERSAL JOINT AND CROSSPIECE OF L.G. NOSEWHEEL STRUT (ARROWS SHOW BOLTS SUBJECT TO REMOVAL)
1 – universal joint, 2 – crosspiece; 3 – strut outer tube, 4 – fork.

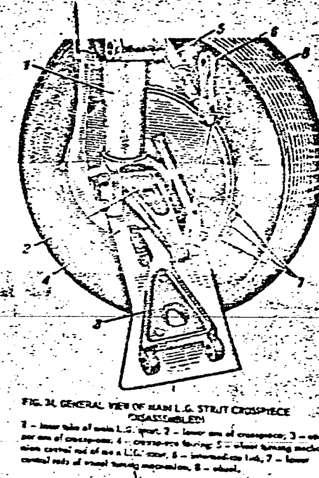

FIG. 34. GENERAL VIEW OF MAIN L.G. STRUT CROSSPIECE (DISASSEMBLED)
1 – lower tube of main L.G. strut, 2 – lower arm of crosspiece, 3 – upper arm of crosspiece, 4 – crosspiece fairing, 5 – wheel turning mechanism control rod of main L.G. strut, 6 – intermediate link, 7 – lower control rods of wheel turning mechanism, 8 – wheel.

Supplement to Inspection Guide No. 21	PROCESS CHART No. 46	In 4 sheets Sheet 3
LANDING GEAR	REMOVAL, WASHING AND LUBRICATION OF BOLTS OF NOSEWHEEL SHOCK STRUT UNIVERSAL JOINT AND MAIN L.G. STRUT CROSSPIECES	Man-hours required – 4,10

Procedure	Technical requirements	Fault correction
8. Uncotterpin and screw nuts off bolts of crosspiece of right and left main L.G. struts (upper, middle and lower bolts, see Fig.34)		
9. Remove crosspieces and bolts; wash them in clean gasoline and blow with compressed air	Inner lubrication spaces of bolts and crosspieces should be clean	
10. Examine bolts and crosspieces for corrosion, cracks and scores	Corrosion, cracking and scoring of bolts and crosspieces shall not be tolerated	Bolts with surface cracks or scores should be replaced In case of minor surface corrosion of bolts remove rust with cloth and re-install clean bolts
11. Coat surfaces of bolts and crosspiece openings with thin layer of grade TsIATIM-201 lubricant		
12. Re-install crosspieces and bolts; screw on nuts and lock them with cotter pins		
13. Use syringe to grease bolts and crosspieces with lubricant, grade TsIATIM-201	Appearance of lubricant in assembly clearances is indicative of sufficient lubrication	Heavily corroded (pitted) bolts should be replaced

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 26	In 4 sheets Sheet 4
LANDING GEAR	REMOVAL, WASHING AND LUBRICATION OF BOLTS OF NOSEWHEEL SHOCK STRUT UNIVERSAL JOINT AND MAIN L.G. STRUT CROSSPIECES	Man-hours required ...

Procedure	Technical requirements	Fault correction

Accessories	Tools
Grease cup	Wrenches, 22 x 24; 5 x 7; 24 x 27 and 32 x 36 Flat-nose pliers Hammer Drift pin, duralumin or copper Screwdriver, ordinary

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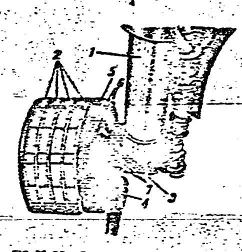
Supplement to Inspection Guide No.21	PROCESS CHART No.27	In 14 sheets Sheet 1
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION	Man-hours required – 2.05

Procedure	Technical requirements	Fault correction
1. Use hydraulic jacks to lift aircraft until its wheels clear ground 2. Demount KT-82 or KT-82M wheels of main landing gear struts and disassemble them (Fig.35); to this end: (a) disconnect brake control pneumatic line from connection on wheel; (b) disconnect electric wires and remove JA23/2M antiskid detector (transmitter) 4 from wheel; (c) release locking ring and remove wheel cover; (d) unlock and screw nut off wheel axle; (e) remove outer roller bearing, wheel, second roller bearing and gland from wheel axle; (f) release bolt joint by unscrewing nuts 7 of brake (on wheel axle flange); (g) remove wheel brake from wheel axle; (h) disassemble wheel brake (Fig.36)	 FIG. 35. BRAKE OF KT-82 WHEEL (WHEEL REMOVED): 1 – shock strut inner tube; 2 – stationary brake discs; 3 – wheel axle shaft; 4 – transmitter (antiskid detector) UA23; 5 – brake cylinder assembly; 6 – brake disc-to-cylinder assembly attachment bolts; 7 – wheel brake-to-axle shaft flange attachment bolts. Wheel brake and cylinder assembly should be disassembled with the aid of special fixtures (Figs 37 and 38)	

Supplement to Inspection Guide No. 21	PROCESS CHART No. 27	In 1t [illegible] Sheet 2

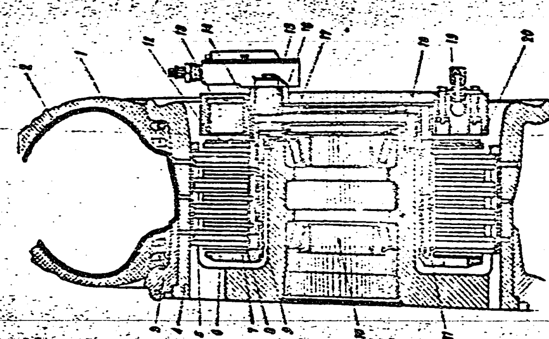


FIG. 20. WHEEL KT-?? OF MAIN L.G. STRUT (CROSS-SECTIONAL VIEW)
1 = tyre; 2 = tube; 3 = detachable flange; 4 = wheel drum; 5 = rotating disc guide; 6 = rotating disc; 7 = brake frame; 8 = stationary disc; 9 = stationary disc guide; 10 = roller bearing; 11 = pressure disc pull-back spring; 12 = brake cylinder assembly; 13 = brake cylinder piston; 14 = felt ring; 15 = [illegible] (fusible detector) [illegible]; 16 = gear; 17 = felt packing ring; 18 = wheel gear; 19 = brake connection; 20 = pressure disc.

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Supplement to Inspection Guide No.21	PROCESS CHART No. 27	In 24 sheets Sheet 3

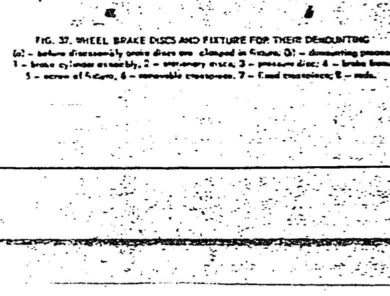

FIG. 37. WHEEL BRAKE DISCS AND FIXTURE FOR THEIR DEMOUNTING
(a) – before disassembly once discs are clamped in fixture; (b) – dismounting process
1 – brake cylinder assembly; 2 – stationary discs; 3 – pressure disc; 4 – brake frame; 5 – screw of fixture; 6 – removable crosspiece; 7 – fixed crosspiece; 8 – rods.

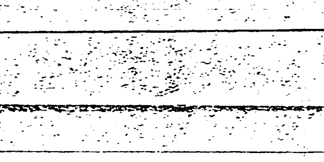

FIG. 38. BRAKE CYLINDER ASSEMBLY AND FIXTURE FOR PRESSING OUT BRAKE CYLINDER PISTONS
1 – cylinder assembly; 2 – brake cylinder piston; 3 – removable ring; 4 – fixed ring; 5 – posts; 6 – wing nut.

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Supplement to Inspection Guide No.21	PROCESS CHART No.27	In 14 sheets Sheet 4
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION	Man-hours required – [illegible]

Procedure	Technical requirements	Fault correction
	Wheels, type КТ-82, use brake discs made from powder metal, grade ФМК-8, with friction coefficient M = = 0.25 to 0.18. Wheels, type КТ-82М, use brake discs made from powder metal, grade ФМК-11, with friction coefficient M = = 0.20 to 0.22	
3. Wash parts with clean gasoline. Check condition of brake and powder metal discs, brake system cylinder assembly, roller bearings and other parts of main landing gear wheel	Any number of minor cracks in cast iron portion, as well as annular scores not deeper than 0.5 mm are allowed on working surfaces of bimetallic sectors of brake discs. Open cracks running across entire width of sector and spreading over entire depth of cast iron portion down to steel frame shall not be tolerated.	If heavier-than-tolerated cracks have been detected on at least one sector replace faulty brake disc
	Powder metal discs, pressure disc and powder metal facing of frame butt end may be affected with any number of cracks in powder metal portion. Cracks running through powder metal portion and steel frame are not permissible. Warpage of bimetallic	If cracks affect powder metal portion and extend through steel frame, replace disc Discs with warpage which cause braking of wheel with brake released should be replaced

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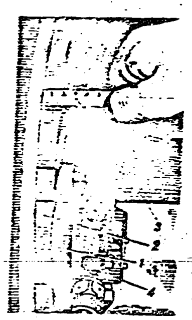
Supplement to Inspection Guide No.21	PROCESS CHART No.27	In 14 sheets Sheet 5
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION	Man-hours required – 2.05

Procedure	Technical requirements	Fault correction
 FIG. 39. MEASURING TOTAL PLAY OF PRESSURE DISC 1 – wheel flange, 2 – brake cylinder assembly; 3 – measuring rule; 4 – [illegible]	and powder metal discs shall be tolerated if this defect does not cause braking of wheel with brake released. Intermediate and pressure discs and support flange are allowed to have crumbling of powder metal at sector edges all along contour over 12 mm of the width of chipped edge. Powder metal discs may be worn down to thickness of 6 mm. and bimetallic discs – to level of links which interconnect the discs. Total wear of bimetallic and metal discs should ensure that pressure disc displaces from butt end of cylinder assembly by 25 mm (Fig.39). It is forbidden to use wheels with pressure discs travelling by 25 or more than 25 mm when pressure is supplied to cylinders	Discs with powder metal chipped over more than 12 mm should be replaced Powder metal discs narrower than 6 mm, as well as bimetallic discs worn down to below link level should be replaced. In case of heavier displacement replace pressure discs which have been worn down most severely
4. Lubricate roller bearings with HK-50 grease (both in winter and summer).	Return springs should be intact and their surfaces should be free from corrosion	

Supplement to Inspection Guide No.21	PROCESS CHART No.27	In 14 sheets Sheet 6
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION	Man-hours required - 2.[illegible]

Procedure	Technical requirements	Fault correction
and brake cylinder pistons - with grade TSIATIM-201 lubricant 5. Re-assemble main L.G. leg brakes and wheels in the order reverse to disassembly, and mount them onto strut axles Inflate wheels using special inflation device	Inflation pressure in wheels of main L.G. struts should be: (a) $8^{+0.5}$ kg/cm² for normal take-off weight; b) $10^{+0.5}$ kg/cm² for maximum take-off weight	
6. Demount and disassemble L.G. nosewheel (Fig.40). To this end: (a) disconnect wheel brakes control pneumatic line from two connections; (b) disconnect electric wires from YA-24/2 antiskid detector (transmitter) (do not remove detector); (c) unlock and screw nut off wheel axle; (d) withdraw wheel axle from strut fork and from wheel with the aid of special puller and disassemble wheel	Brake lining is fit for operation irrespective of number of minor cracks provided these cracks do not extend across entire thickness of cast iron portion, and irrespective of annular scores on working surface of lining If working surface of bimetallic brake lining is cracked through entire thickness of cast iron portion and	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 27		In 14 sheets Sheet 7
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION		Man-hours required – 2.0?
Procedure	Technical requirements	Fault correction	
	cracks extend across entire thickness of cast iron portion to outer end, replace brake lining or wheel		
7. Wash parts with clean gasoline and check condition of brake linings, shoes, chambers, gears, roller bearings and other parts of wheel.	Brake shoes are serviceable when their thickness is not smaller than 8 mm	If brake shoe thickness is smaller than 8 mm, replace faulty shoe	
When inspecting parts for condition, pay special attention to the following: (a) integrity of teeth of driven gear, intermediate shaft gear and transmitter gear; make sure there are no cracks at teeth roots;	Gear teeth should be intact and free from cracks	In case of broken or cracked teeth replace drive	
(b) absence of corrosion and cracks on races and rollers of bearings;	Corrosion and cracks on rollers and races shall not be tolerated.	In case of corrosion or cracks replace faulty bearing.	
(c) ball bearings of transmitter intermediate shaft	Intermediate shaft of [illegible]-24/2 transmitter drive system should rotate in bearings freely, without crunch and jamming	In case of stiff rotation of shaft as well as in case of crunch wash ball bearings with clean gasoline (wash several times if necessary), blow with compressed air and lubricate. If the above actions fail to correct faults, replace drive	
8. Lubricate roller bearings with [illegible]-50 grease (both in winter and in summer), and drive gears with ball bearings with grade [illegible]-201 lubricant			

Supplement to Inspection Guide No. 21	PROCESS CHART No. 27	In 14 [illegible] Sheet [illegible]
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION	Man-hours required - [illegible]

Procedure	Technical requirements	Fault correction
11. Check pressure of air supplied to brakes of each wheel. To do this: (a) connect type KB-30 or KB-60 pressure gauge to brake system hose: (b) operating from cockpit press brake control lever on aircraft control stick as far as it will go; (c) open emergency brake control valve. Check right and left wheels in succession. Upon completion of check, reconnect tubes (hoses)	Pressure gauge should read 16 ± 0.5 kg/cm^2. With emergency brake control valve open, pressure gauge should read 16^{+4}_{-1} kg/cm^2. When brake control lever on aircraft control stick is pressed, two-pointer pressure gauge KB-12 should indicate 6 ± 0.5 kg/cm^2 pressure in system. Difference between indications of left and right pointers of pressure gauge should not exceed 0.5 kg/cm^2. In aircraft equipped with type [illegible]-03/1 deboosters instead of type [illegible]-24-00-2 deboosters, the [illegible]-7 valve should be adjusted for 5.5 ± 0.5 kg/cm^2 pressure, and KB-12 pressure gauge should read 5.5 ± 0.5 kg/cm^2, same-value air pressure being applied to brake of nosewheel. Air loss per one braking cycle is equivalent to pressure loss of 50 to 60 kg/cm^2	In case hoses are serviceable [illegible] pipelines by disconnecting and blowing them with air successively; trace place of clogging and eliminate defect

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 27		In 34 sheets Sheet 21
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION		Man-hours required — 2.05
Procedure	Technical requirements	Fault correction	
	Type JU-24-00-2 deboosters with 1:15 ratio are installed in brake system of KT-82M wheels. The check should show the following pressure values in brakes: (a) 16 ± 0.5 kg/cm² in main wheel brakes; (b) 10.5 ± 0.5 kg/cm² in nose-wheel brakes. Wheels, type KT-82M, feature reduced idle volume of brake cylinders. Therefore air consumption per one braking cycle equals 25 to 30 kg/cm². Both right and left main L.G. struts should be equipped with KT-82M wheels if this type is used		
12. Connect hoses to wheel pipe [illegible]ions and check airtightness of main and [em]ergency brake control systems: (a) check airtightness of main pneu[m]atic system; (b) check airtightness of emergency [pn]eumatic system. To this end, close emer[ge]ncy extension control and emergency [illegible] charging valves;	Main pneumatic system should be checked for airtightness with reference to main system pressure gauge 2M-150. Main hydraulic system, when fully charged to 110 - 130 kg/cm² is considered airtight if pressure reduction does not exceed 5 kg/cm² in the course of 2 hours (system from main air bottles to pressure consumer)		

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Supplement to Inspection Guide No.21	PROCESS CHART No.27	In 14 sheets Sheet 12
LANDING GEAR	CHECKING WHEELS, BEARINGS AND BRAKE SYSTEM FOR CONDITION	Man-hours required = 2.5

Procedure	Technical requirements	Fault correction
(c) check airtightness of brake system (Fig.41). To this end: with valves closed and nosewheel braked press brake control lever on aircraft control stick and keep it engaged until $8^{+0.5}$ kg/cm^2 pressure is obtained in brake system (as read by two-pointer pressure gauge M5-12); this being done, ПУ-8 valve should be in one of extreme positions (check in succession, by applying pedals to right or left);	Check with reference to 2M-150 pressure gauge of emergency system. Air pressure is allowed to drop by up to 2.5 kg/cm^2 during 30 minutes (for right and left positions of pedals, separately). Check pressure by 2M-150 pressure gauge of main system	
(d) check airtightness of emergency brake system; to do this, open emergency brake control valve and keep it open for braking during 30 minutes	In the course of these 30 minutes pressure in emergency brake system is allowed to drop by not more than 30 kg/cm^2. Check through reference to 2M-150 pressure gauge of emergency brake control system	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 27	In 14 sheets Sheet 13

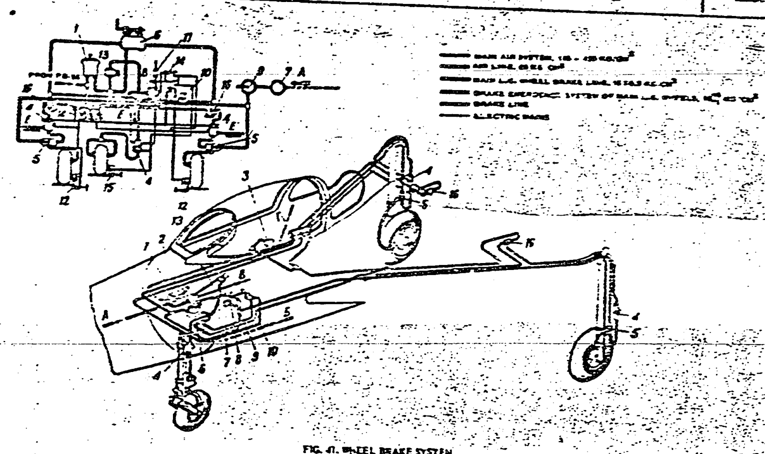

FIG. 41. WHEEL BRAKE SYSTEM

1 – reducing valve; 2 – wheel brake cylinder, retraction system; 3 – reducing valve PB-50[illegible]; 4 – solenoid-operated servo valve [illegible]; 5 – emergency valve 563609; 6 – differential valve [illegible]; 7 – reducing valve No. 62250[illegible]; 8 – switch [illegible]; 9 – emergency brake control valve 62500 A; 10 – pressure gauge MB-12; 11 – automatic circuit-breaker; 12 – [illegible] detector [illegible]; 13 – nosewheel brake control valve; 14 – valve [illegible]; 15 – [illegible] detector [illegible]; 16 – [illegible]

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Supplement to Inspection Guide No.21	PROCESS CHART No.28		In 5 sheets Sheet 1
LANDING GEAR	INSPECTION OF TAPER BUSHING AND CHEEK SURFACE OF MAIN L.G. STRUT INNER TUBE		Man-hours required – 0.30
Procedure	**Technical requirements**	**Fault correction**	
1. Demount wheel of main L.G. strut without removing brake disc; to do this, open access hole in wheel leading to wheel nut, unlock and screw off nut 2. Disconnect main L.G. wheel turning mechanism control rod (Fig.42) 3. Press lower bellcrank of wheel turning mechanism retaining brake discs by hand, and smoothly turn wheel axle vertically (if necessary, jack up aircraft) 4. Inspect pin (its taper portion), taper bushing and cheek surface of main L.G. strut inner tube (Fig.43); for inspection, remove wheel axle complete with brake discs	If traces of wear or scoring are detected on cheek surface of inner tube at cheek-to-pin contact points work affected area with emery cloth No.200, thoroughly wash it with gasoline and coat with grade ЦИАТИМ-201 lubricant. Do not pack lubricant into bushing especially in cold seasons otherwise pin will fail to enter bushing. If bushing is worn down by more than 0.3 mm replace it. Make a pattern for measuring wear depth. If no spare bushings are available, use old bushing turned by 180° (as an exception)		

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Supplement to Inspection Manual Guide No.21	PROCESS CHART No.26	In 5 sheets Sheet 2

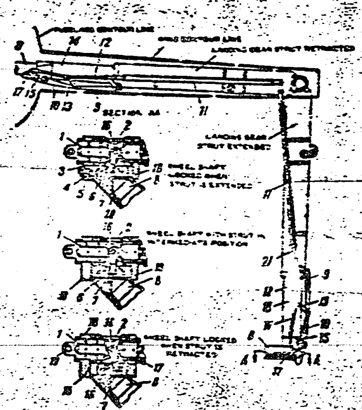

FIG. 42. MAIN L.G. WHEEL AXLE SHAFT TURNING MECHANISM (ON AIRCRAFT UP TO SERIAL No. 815)
1 – shaft; 2 – plug; 3 – nut; 4 – stop; 5 – bushing; 6 – pin; 7 – lever; 8 – axle shaft; 9 – crosspiece upper arm; 10 – crosspiece lower arm; 11 – rod; 12 – rod; 13 – link; 14 – rod; 15 – [illegible]; 16 – [illegible]; 17 – [illegible]; 18 – [illegible] tube; 19 – pin of [illegible] strut attachment [illegible]; 20 – [illegible] bolt pin; 21 – threaded bushing.

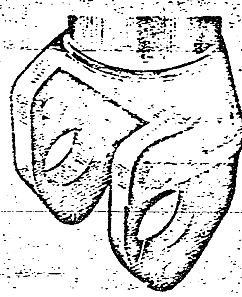

FIG. 43. LOWER PART OF MAIN L.G. STRUT INNER TUBE (THE ARROW POINTS AT THE TAPER BUSHING)

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Supplement to Inspection Guide No.21	PROCESS CHART No.28	In 5 sheets Sheet 5
LANDING GEAR	INSPECTION OF TAPER BUSHING AND CHECK SURFACE OF MAIN L.G. STRUT INNER TUBE	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction
5. Upon replacement of taper bushing act as follows: (a) place strut axle horizontally lifting it by brake discs and lowering turning mechanism lever; (b) re-mount wheel;		
(c) check clearance between strut inner tube and stop on strut axle. If necessary, adjust clearance as instructed in Process Chart No.33 6. Retract and extend L.G. struts three times to make sure that pin securely locks wheel axle in extended and retracted positions 7. Check functioning of axle shaft turning mechanism and of kinematic lock which fixes axle shaft of main L.G. strut:	Note. Aircraft beginning with Serial No.740815 use main L.G. struts fitted with wheel turning mechanism of new design: the mechanism is provided with kinematic lock which fixes wheel axle shaft in both retracted and extended positions (Fig.44)	
(a) check closed position of axle shaft lock with strut extended; to this end, insert feeler pin, 3 mm in diameter, in check hole located on kinematic link	When lock is closed completely feeler pin should enter freely by length of 21 - 23 mm. If feeler pin fails to enter in	Full closing of lock is ensured by adjusting control rod length by means of adjusting bushing (Fig.44, Ref. No.5, Joint 1)

Supplement to Inspection Guide No.21	PROCESS CHART No.28		In 5 sheets Sheet 4
LANDING GEAR	INSPECTION OF TAPER BUSHING AND CHECK SURFACE OF MAIN L.G. STRUT INNER TUBE		Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
of lock (Fig.44, Ref. Nos 10 and 11); (b) when sure that axle shaft lock is fully closed check clearance between strut inner tube and head of thrust bolt on axle shaft (Fig.44, Ref. Nos 7 and 8). For convenience's sake in measuring this clearance it is allowed to disconnect brake hose from wheel and electric wires – from wheel brake transmitters (antiskid detectors)	check hole this means that holes in kinematic links are misaligned and lock is not closed With lock fully closed, clearance between head of thrust bolt and strut inner tube (on jacked-up aircraft) should be within 0.03 to 0.25 mm	If clearance exceeds 0.25 mm replace thrust bolt When installing new thrust bolt use deposite welding on bolt head to obtain 0.03 – 0.1 mm clearance (see Fig.44) between bolt head and strut inner tube. Make sure that bolt head-to-axle shaft contact surface covers not more than 75% of entire thrust surface (check and adjust by paint pattern)

Accessories	Tools
Clearance gauge with set of feeler blades Feeler pin, dia. 3 mm	Wrench for wheel nut Flat-nose pliers Screwdriver

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Supplement to Inspection Guide No.2	PROCESS CHART No.25	In 5 sheets Sheet 5

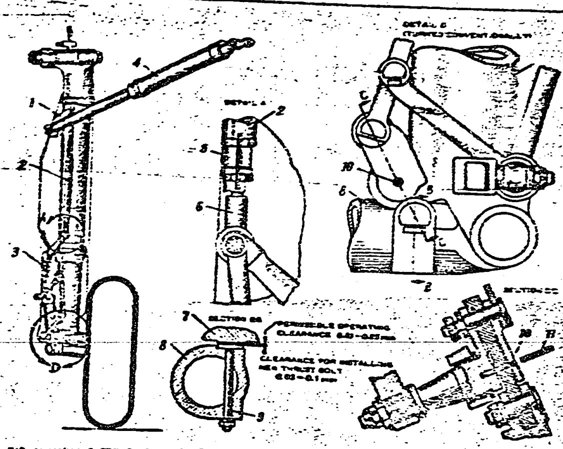

FIG. 44. MAIN L.G. STRUT WITH KINEMATIC LOCK FOR FIXING WHEEL TURNING MECHANISM AXLE SHAFT (ON AIRCRAFT BEGINNING FROM SERIAL No. 2319)

1 – bolt of brace with wheel turning mechanism lever, 2 – adjusting rod of wheel turning mechanism, 3 – wheel turning mechanism, 4 – strut actuating cylinder, 5 – length adjusting bushing of wheel turning mechanism rod 2, 6 – eyebolt (lug of rod 2), 7 – L.G. strut inner tube, 8 – strut axle shaft, 9 – thrust bolt, 10 – check hole in axle shaft fixing kinematic lock; 11 – feeler gauge, dia. 2 mm.

Supplement to Inspection Guide No.21	PROCESS CHART No.29		In 5 sheets Sheet 1
LANDING GEAR	CHECKING L.G. EMERGENCY EXTENSION SYSTEM FOR PROPER FUNCTIONING AND AIRTIGHTNESS		Man-hours required - 1.X
Procedure	**Technical requirements**	**Fault correction**	
1. Use cabin pressure gauge to check pressure in emergency pneumatic system	Air pressure in emergency pneumatic system should be not lower than 110 kg/cm^2	If pressure is lower than 110 kg/cm^2 charge system additionally	
2. Accomplish the following connections: (a) connect ground hydraulic installation to aircraft pipe unions and build up pressure in system; (b) connect electric power supply source and turn on all circuit-breakers			
3. Command maintenance personnel to clear landing gear; upon receiving acknowledgement of command, throw lock up and reset landing gear control cock from neutral to RETRACTED (УБРАНО) position (up)	If landing gear retracts and becomes locked in retracted position normally, red indicator lights L.G. RETRACTED (ШАССИ УБРАНО) on light indication panel No.6 and three red lights on L.G. indication panel should illuminate. Keep L.G. control cock in retraction position during 10 to 15 seconds, and then set it neutral. This done, L.G. RETRACTED indicator lights should be still on		

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Supplement to Inspection Guide No.21	PROCESS CHART No.29	In 3 sheets Sheet 2
LANDING GEAR	CHECKING L.G. EMERGENCY EXTENSION SYSTEM FOR PROPER FUNCTIONING AND AIRTIGHTNESS	Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
4. Relieve pressure in main hydraulic system to zero by moving aircraft control stick backward and forward	In one minute after L.G. retraction disengage ground hydraulic pump without disconnecting supply hoses from aircraft pipe unions	
5. Place L.G. control cock to EXTRACTION (НА ВЫПУСК) 6. Open valve of L.G. emergency extension pneumatic system. Landing gear extended, observe light and mechanical indicators to make sure that landing gear struts are locked; make 1-min. pause and close air valve of emergency extension pneumatic system	Landing gear should extend completely and become fixed by ball locks of hydraulic cylinders. Green lights L.G. EXTENDED (ШАССИ ВЫПУЩЕНО) on light indication panel No.6 should flash up and mechanical indicator in fuselage nose section should go out completely	In the course of emergency extension of landing gear, ejection of АМГ-10 hydraulic fluid from inner space of hydraulic reservoir of main hydraulic system (right-hand section of hydraulic reservoir, as viewed in direction of flight) should not be considered abnormal. Tray should be placed under fuselage to collect ejected fluid
7. Expell air from main L.G. strut actuating hydraulic cylinder; to this end, screw off union nut of strut extension line pipe (running from hydraulic cylinder of main L.G. strut). Evacuate air from hydraulic cylinder of L.G. nosewheel strut; to this end, screw off nut of hydraulic cylinder pipe (in cylinder bottom portion)		

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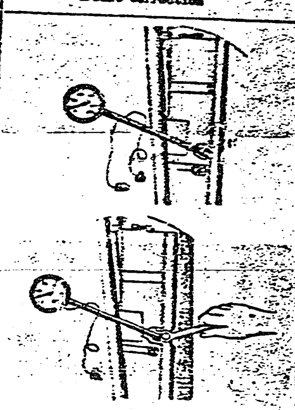
Supplement to Inspection Guide No.21	PROCESS CHART No.29		In 3 sheets Sheet 3
LANDING GEAR	CHECKING L.G. EMERGENCY EXTENSION SYSTEM FOR PROPER FUNCTIONING AND AIRTIGHTNESS		Man-hours required – 1.p
Procedure	**Technical requirements**	**Fault correction**	
8. Engage ground hydraulic installation and pump AMΓ-10 hydraulic fluid through main hydraulic system; when pumping, fulfil 10 to 12 retraction-extension cycles of landing gear 9. Charge emergency pneumatic system additionally to 110 – 130 kg/cm^2, and add AMΓ-10 hydraulic fluid to hydraulic reservoir to capacity 10. Disconnect ground hydraulic installation from aircraft pipe unions 11. Disconnect ground electric power supply source			

Accessories	Tools
Ground hydraulic installation Ground electric power supply source	Wrenches, 14 x 17 and 19 x 22 Flat-nose pliers

Supplement to Inspection Guide No.21	PROCESS CHART No.30	In 7 sheets Sheet 1
LANDING GEAR	CHECKING AMG-10 HYDRAULIC FLUID LEVEL IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required - 2,50

Procedure	Technical requirements	Fault correction
1. Lift aircraft by means of jacks until wheels clear ground. This should be done if maintenance operations on landing gear are carried out before disjointing of fuselage		 FIG. 45. SPECIAL DEVICE FOR GAUGING NITROGEN PRESSURE IN MAIN L.G. SHOCK STRUT
2. Remove plugs from charging valves and screw on fixtures for charging L.G. shock struts and hydraulic accumulators with nitrogen; check pressure in shock struts and hydraulic accumulators, and, using special fixture, relieve nitrogen pressure from shock struts (Fig.45)		
3. Screw out charging valve and drain hole plug from shock strut of L.G. nosewheel	Screw out charging valve first. If hissing sound of escaping nitrogen is audible when charging valve is being unscrewed, discontinue valve unscrewing until nitrogen escapes completely	
4. Use syringe to fill shock strut (through holes in charging valve) with 100 cu.cm of AMG-10 hydraulic fluid	Charge totals of shock struts are: (a) 2400 cu.cm for main L.G. strut; (b) 650 cu.cm for nosewheel strut	

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Supplement to Inspection Guide No.21	PROCESS CHART No.30	In 7 sheets Sheet 2
LANDING GEAR	CHECKING AMT-10 HYDRAULIC FLUID LEVEL IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required - 2.5

Procedure	Technical requirements	Fault correction
5. Gradually lower aircraft nose to obtain full compression of nosewheel shock strut and keep aircraft in this position during at least 20 minutes until excessive AMT-10 fluid is fully drained	Strut should be in vertical position Excess of AMT-10 fluid will be drained from compressed shock struts through charging valve hole	If no fluid escapes from shock strut, add hydraulic fluid to shock strut to 100 cu.cm and then drain fluid excess
6. Turn in charging valve and drain hole plug, raise aircraft nose until wheels clear ground and charge nosewheel shock strut with technical nitrogen		
7. Screw out charging valves of main L.G. shock struts and, operating through holes in struts, fill each shock strut with 100 cu.cm of AMT-10 hydraulic fluid (use syringe for charging)		
8. Gradually lower aircraft (by means of wing jacks) to obtain full compression of main L.G. shock struts and keep aircraft in this position during 20 minutes	Adjust jacks to obtain vertical position of struts with shock struts fully compressed	If hydraulic fluid fails to be drained, add fluid into shock struts and drain excessive fluid
9. Screw in charging valves and operate wing jacks to lift aircraft until wheels clear ground		If it is necessary to charge L.G. shock struts with fresh AMT-10 fluid, L.G. struts should be demounted

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Supplement to Inspection Guide No.21	PROCESS CHART No.30		In 7 sheets Sheet 3
LANDING GEAR	CHECKING AMT-10 HYDRAULIC FLUID LEVEL IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER		Man-hours required – 2.50
Procedure	Technical requirements	Fault correction	
10. Use special fixture to charge shock struts with compressed technical nitrogen	Nitrogen pressure in shock struts should be: (a) 30 ± 1 kg/cm² in main L.G. shock struts; (b) 34 ± 1 kg/cm² in nosewheel shock strut. If in cold seasons shock struts are being charged in heated rooms, it should be taken into consideration that ambient air temperature decrease results in reduced pressure in shock struts. In this case it is necessary to increase pressure in shock struts by 1.2 kg/cm² per every 10°C difference between temperature in charging room and outdoor ambient air temperature		

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Supplement to Inspection Guide No.21	PROCESS CHART No.30	In 7 sheets Sheet 4
LANDING GEAR	CHECKING AMГ-10 HYDRAULIC FLUID LEVEL IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required – 2.5

Procedure	Technical requirements	Fault correction

Basic Technical Data of Landing Gear

Characteristics	Main strut	Nosewheel strut
1	2	3
Type of shock strut	Hydraulic-nitrogen	Hydraulic-nitrogen
Operating fluid used in shock struts	AMГ-10 (ГОСТ 6794-53)	AMГ-10 (ГОСТ 6794-53)
Shock strut full travel	280^{+2}_{-3} mm	90^{+2}_{-1} mm
Wheel type and dimensions	660 x 200Б (КТ-82)	500 x 180А (КТ-38)
Initial pressure in shock struts:		
(a) at nominal take-off weight;	30 ± 1 kg/cm^2	34 ± 1 kg/cm^2
(b) at maximum take-off weight	30 ± 1 kg/cm^2	34 ± 1 kg/cm^2
Wheel tire inflation pressure:		
(a) at nominal take-off weight;	$8^{+0.5}$ kg/cm^2	$6^{+0.5}$ kg/cm^2
(b) at maximum take-off weight	$10^{+0.5}$ kg/cm^2	$6^{+0.5}$ kg/cm^2

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Supplement to Inspection Guide No.21	PROCESS CHART No.30	In 7 sheets Sheet 5
LANDING GEAR	CHECKING AMT-10 HYDRAULIC FLUID LEVEL IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required – 2.50

Procedure	Technical requirements	Fault correction

1	2	3
Ground compression (closure):		
(a) at normal take-off weight;	140^{+5}_{-8} mm	54.5 ± 3 mm
(b) at maximum take-off weight	117^{+5}_{-8} mm	34 ± 3 mm
Ground tire deflection:		
(a) at normal take-off weight;	40 mm	25 mm
(b) at maximum take-off weight	45 mm	30 mm

Notes: 1. The normal take-off weight is the weight of the aircraft with full load of fuel, oil, ammunition, less the drop tank and special external loads
2. The maximum take-off weight is the weight of the aircraft with full load of fuel, oil, ammunition, fuelled drop tank, and external loads
3. The ground compression (closure) of a shock strut is the distance between shock strut outer tube end and rim of inner tube head (Figs 46 and 47)

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Supplement to Inspection Guide No.22	PROCESS CHART No.30	In 7 sheets Sheet 5
LANDING GEAR	CHECKING AMT-10 HYDRAULIC FLUID LEVEL IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required – 2.5

Procedure	Technical requirements	Fault correction
11. Check amount of AMT-10 hydraulic fluid in nosewheel shimmy damper (carry out the checks on struts with wheel turning mechanism removed): (a) if red reference mark on rod is not seen or is located at a distance of not less than 7 mm above cover, add AMT-10 fluid into shimmy damper; (b) if white reference mark on rod coincides with cover surface or stands somewhat above it (by 1 – 2 mm maximum), as well as in case white reference mark is not seen while red mark is located at a distance greater than 7 mm, no additional charging of shimmy damper chamber is needed. In cold seasons shimmy damper should be removed and transferred to heated room for warming	If there are no reference marks on rods, take into consideration the following standard dimensions of rod extension: (a) with compensation chamber filled normally at 20 ± 5°C temperature rod should be out by 16.5 mm from top of filler neck cap to chamber cover; (b) minimum operational extension of rod cap top to chamber cover amounts to 10 mm	Add AMT-10 fluid into compensation chamber as follows: (a) fix shimmy damper in operating position and screw filler neck cap from compensator rod (carry out these operations at 20 ± 5°C); (b) screw adapter into rod and couple adapter to syringe head for pressure filling of AMT-10 hydraulic fluid; (c) supply AMT-10 fluid under pressure and watch movement of rod. Supply pressure until rod extends by 24 mm; (d) disconnect syringe and screw adapter out of rod; (e) using duralumin rod, intermittently press ball of non-return valve and simultaneously watch lowering of rod making sure not to miss moment when white reference mark on rod coincides with surface of upper cover of chamber body. In

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Supplement to Inspection Guide No.21	PROCESS-CHART No.30	In 7 sheets Sheet 7
LANDING GEAR	CHECKING AMT-10 HYDRAULIC FLUID LEVEL IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required - 2.50

Procedure	Technical requirements	Fault correction
12. Operate jacks to lower aircraft to ground		this position AMT-10 fluid will flow from rod hole. Screw in filler neck cap and lock it with type KhK-0.8 wire; (f) re-mount shimmy damper on strut

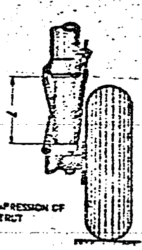

FIG. 46. GROUND COMPRESSION OF MAIN L.G. STRUT

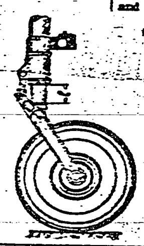

FIG. 47. GROUND COMPRESSION OF NOSEWHEEL STRUT

Accessories	Tools
Fixture for charging shock struts and hydraulic accumulators and checking pressure in them, 72-7804-250	Wrench, 14 x 17 Syringe Flat-nose pliers

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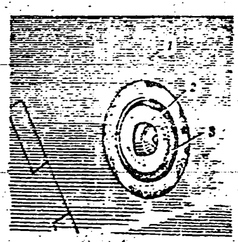
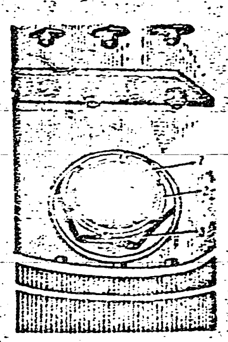
Supplement to Inspection Guide No.21	PROCESS CHART No.11	In 7 sheets Sheet 1
LANDING GEAR	CHANGING AMT-10 HYDRAULIC FLUID IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required – 2.5

Procedure	Technical requirements	Fault correction
1. Lift aircraft by means of jacks until wheels clear ground 2. Demount main L.G. struts in the following order: (a) drain fuel from wing tanks into clean vessels or refueller; to this end, screw out drain plug from wing tanks drain holes and install special fixture in place of them (Fig.48); (b) drive out screws and remove access panels on wing; (c) remove fuel transfer pump [illegible]1-[illegible] of wing tanks; (d) remove electric accessory box; (e) remove main L.G. strut EXTENDED limit switch; (f) demount wheel and brake discs from wheel axle shaft; (g) demount strut and crosspiece fairings; (h) screw off nut and unjoint control rod of wheel turning mechanism at upper arm of crosspiece (i) screw off union nuts of three air hoses;	 FIG. 48. PLUG OF WING TANK DRAIN HOLE 1 – wing [illegible] skin, 2 – drain plug, 3 – [illegible]	 FIG. 49. LOCK FITTINGS OF MAIN L.G. STRUT SHAFT ATTACHMENT NUT 1 – main strut shaft, 2 – nut, 3 – lock fitting.

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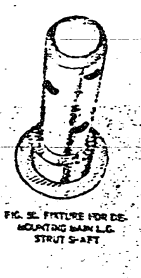
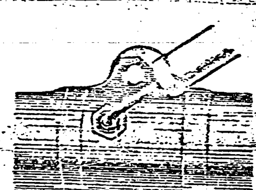
Supplement to Inspection Guide No.21	PROCESS CHART No.31	In 7 sheets Sheet 2
LANDING GEAR	CHANGING AMG-10 HYDRAULIC FLUID IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required – 2.50

Procedure	Technical requirements	Fault correction
(j) unscrew nut and disjoint hydraulic cylinder rod and floating bolt of strut; (k) unscrew nut and remove fixing bolt of main L.G. strut axle; (l) unlock and screw off nut which secures main L.G. strut axle in attachment joints (Fig.49); (m) screw special fixture into strut mounting axle (Fig.50) and rotate fixture to remove axle. During this operation strut should be supported by two men. For easier removal it is recommended to rock axle in direction of flight 3. Screw cap off strut charging valve, screw on special fixture and reduce nitrogen pressure in main L.G. shock strut to zero 4. Screw out charging valve, place strut horizontally with connection down and drain AMG-10 fluid. For more effective drainage it is recommended to rock strut 5. Place strut horizontally but a little inclined with axle shaft down and,	 FIG. 50. FIXTURE FOR DE-MOUNTING MAIN L.G. STRUT SHAFT	 FIG. 51. CHARGING MAIN L.G. SHOCK STRUT

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Supplement to Inspection Guide No.21	PROCESS CHART No.31		In [illegible] sheets Sheet [illegible]
LANDING GEAR	CHANGING AMG-10 HYDRAULIC FLUID IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER		Man-hours required = 2[illegible]
Procedure	**Technical requirements**	**Fault correction**	
using syringe (Fig.51), fill strut with 400 cu. cm of AMG-10 fluid To re-mount strut on aircraft reverse demounting procedure 6. Demount nosewheel strut as follows: (a) unlock and screw off nut and disconnect hydraulic cylinder rod from strut; (b) demount wheel; (c) remove panel (with antenna) of access hole leading to nosewheel strut and disconnect strut position mechanical indicator from strut; (d) disconnect nosewheel turning mechanism control rod; (e) open covers of access holes leading to L.G. nosewheel axle; (f) unlock and screw off strut shaft mounting nut (use special wrench for this purpose); (g) disconnect strut-mounted hydraulic system pipes running to wheel turning mechanism; (h) disconnect air supply pipes running to wheel brakes.			

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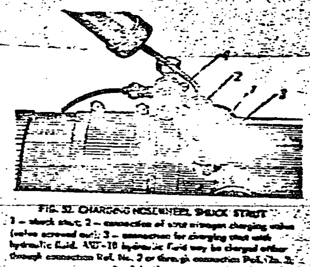
Supplement to Inspection Guide No.21	P R O C E S S C H A R T No.31	In 7 sheets Sheet 4
LANDING GEAR	CHARGING AMT-10 HYDRAULIC FLUID IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required - 2.50

Procedure	Technical requirements	Fault correction
(i) disconnect electric connector from ЯА24/2 transmitter (antiskid detector); (j) collapse struts: do this by pressing landing gear downlock downwards by means of handle bar; (k) remove strut mounting axle; during this operation strut should be supported by two men 7. Screw special fixture onto strut, relieve nitrogen pressure to zero and drain AMT-10 fluid from L.G. nosewheel 8. Fill 650 cu.cm of AMT-10 hydraulic fluid into L.G. nosewheel strut (Fig.52)	 FIG. 52. CHARGING NOSEWHEEL SHOCK STRUT 1 – shock strut; 2 – connection of [illegible] nitrogen charging valve (valve screwed out); 3 – connection for charging strut with hydraulic fluid. AMT-10 hydraulic fluid may be charged either through connection Ref. No. 2 or through connection Ref. No. 3; 4 – injection gun.	
9. Re-mount nosewheel strut on aircraft in the order reverse to demounting 10. Charge main and nosewheel L.G. struts with nitrogen from ground nitrogen bottle 11. Remove wheel shimmy damper from nosewheel strut 12. Clean shimmy damper from dirt and wipe it with clean cloth or blow with compressed air		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 31	In 7 sheets Sheet 5
LANDING GEAR	CHANGING AMT-10 HYDRAULIC FLUID IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required - 2.5

Procedure	Technical requirements	Fault correction
13. Screw compensator from shimmy damper body, screw out filler hole plugs and thoroughly drain old AMT-10 hydraulic fluid from shimmy damper		
14. Using clean fresh AMT-10 fluid wash inner spaces of operating chambers, central chamber of shimmy damper and compensation chamber of compensator. Drain washing fluid from shimmy damper		
15. Place shimmy damper horizontally, with bellcrank down. Operating through filler holes, fill operating chambers with clean AMT-10 hydraulic fluid to level of body top edge	Working fluid temperature should be 20 ± 5°C	
16. Screw compensator into shimmy damper body. Before doing this, check condition of sealing ring. When screwing in compensator be sure not to damage sealing elements		
17. Screw plug out of compensator rod, screw adapter into rod and connect syringe for filling AMT-10 hydraulic fluid		

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Supplement to Inspection Guide No.21	PROCESS CHART No.31	In 7 sheets Sheet 6
LANDING GEAR	CHANGING AMT-10 HYDRAULIC FLUID IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required – 2.50

Procedure	Technical requirements	Fault correction
18. Using syringe, charge AMT-10 fluid until fluid begins to pour out in clean air bubble-free jets from filler holes of operating chambers 19. Screw plugs into filler holes of operating chambers and effect three or four full turns of bellcrank arm from one extreme position to the other 20. Set arm neutral and again screw plugs out of filler holes of operating chambers 21. Once more pump AMT-10 fluid with syringe into shimmy damper until it is ejected from filler holes of operating chambers in clean jets, after which stop fluid pumping 22. Screw plugs into filler holes of operating chambers and lock them 23. Using syringe, fill compensation chamber with AMT-10 hydraulic fluid. Charge compensation chamber until compensator rod extends by 24 mm. Keep shimmy damper in this position during 1 hour; no leakage of fluid at body joints shall be tolerated		

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Supplement to Inspection Guide No.21	PROCESS CHART No.31	In 7 shee. Sheet 7
LANDING GEAR	CHANGING AMG-10 HYDRAULIC FLUID IN L.G. SHOCK STRUTS AND NOSEWHEEL SHIMMY DAMPER	Man-hours required – 2.5

Procedure	Technical requirements	Fault correction
24. Using duralumin rod, intermittently press ball of compensator rod non-return valve to drain hydraulic fluid from compensator. This being done, compensator rod will travel down. Discontinue fluid drainage as soon as white reference mark on rod becomes aligned with compensator cover surface		
25. Screw plug into filler hole of compensator rod and lock it. Lock compensator to shimmy damper body		
26. Re-mount shimmy damper on strut and lock nuts of attachment bolts and hinge joints of shimmy damper bellcrank		

Accessories	Tools
Fixture for drain plugs of wing fuel tanks, 72-7804-370 Bucket Syringe	Wrench for nut of main L.G. strut shaft, 72-7804-30 Wrench for demounting L.G. nosewheel strut, 72-7804-55 Wrenches, 9 x 11; 14 x 17 and 19 x 22 Screwdriver for cross-slitted screws Screwdriver, ordinary Flat-nose pliers

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Supplement to Inspection Guide No.21	PROCESS CHART No.32	In 6 sheets Sheet 1
LANDING GEAR	CHECK RETRACTION AND EXTENSION OF LANDING GEAR	Man-hours required – 0.50

Procedure	Technical requirements	Fault correction
1. Lift aircraft by means of hydraulic jacks until its wheels clear ground		
2. Make sure that main hydraulic system is charged with AMT-10 hydraulic fluid; to check, open filler neck cap of main system section reservoir and check amount of AMT-10 fluid by means of dip stick	Fluid level in hydraulic reservoir should be between upper and lower reference marks on dip stick	If fluid level is below lower reference mark on dip stick, add AMT-10 fluid into reservoir
3. Check position of L.G. control valve change-over switch handle in cockpit	Handle of L.G. control valve change-over switch should be fixed in NEUTRAL (НЕЙТРАЛЬНО) position	
4. Connect hoses from ground hydraulic pump to aircraft connections of main (Fig.53) hydraulic system of aircraft: these connections are located at fuselage starboard side; connect ground electric power supply source to terminals of aircraft electric mains (Fig.54)		
5. In cockpit: turn on circuit-breakers bearing inscriptions L.G.(ШАССИ) and FLAPS (ЗАКРЫЛКИ)		
6. Engage ground hydraulic pump and build up pressure in main hydraulic system	Pressure in main hydraulic system (as read by pressure gauge) should be 210^{+5}_{-10} kg/cm^2	

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Supplement to Inspection Guide No.21	PROCESS CHART No.32	In 8 sheets Sheet 2

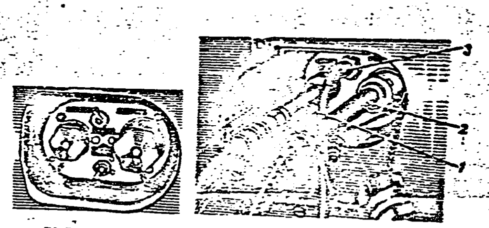

FIG. 53. CONNECTING GROUND HYDRAULIC INSTALLATION TO HYDRAULIC SYSTEM
1 — delivery line hose, 2 — [illegible] line hose, 3 — [illegible]

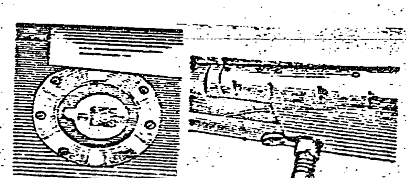

FIG. 54. CONNECTING GROUND ELECTRIC POWER SUPPLY SOURCE

Supplement to Inspection Guide No.21	PROCESS CHART No.32	In 8 sheets Sheet 3
LANDING GEAR	CHECK RETRACTION AND EXTENSION OF LANDING GEAR	Man-hours required — 0.50
Procedure	**Technical requirements**	**Fault correction**
7. Command: CLEAR LANDING GEAR! (ОТ ШАССИ). Upon return of LANDING GEAR CLEARED (ЕСТЬ ОТ ШАССИ) acknowledgement reset L.G. control valve change-over switch handle to RETRACTED (УБРАНО). In the course of landing gear retraction check the following: (a) synchronism in retraction of main and nosewheel landing gear struts and retraction time; (b) operating reliability of strut turning mechanism; (c) sound operation of sequence valves; (d) sound engagement of struts and wheel doors by up-locks;	Nosewheel and main L.G. struts, as well as wheel doors should retract and get engaged by their respective up-locks with specific clicks; this should be accompanied by illumination of three red indicator lights on L.G. indication board in instrument panel and by illumination of red lights LANDING GEAR RETRACTED (ШАССИ УБРАНО) on light indication panel No.6	
(e) clearance between main L.G. strut fairing and wing skin; clearances between wheel doors and fuselage skin and clearances between nosewheel strut fairing and fuselage skin (Fig.55);	When retracted, L.G. doors and fairings should conform to contours of wing and fuselage. Clearances between fairings and wing skin should be as specified in Fig.55	
(f) operating reliability of automatic wheel braking system at retraction	Two-pointer pressure gauge МВ-12 installed in cockpit should read 4 kg/cm^2	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 32	In 8 sheets Sheet 4

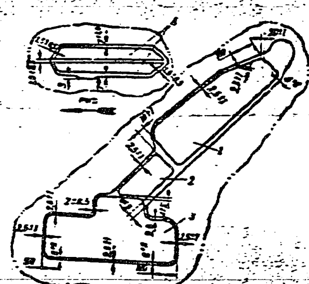

FIG. 55. CLEARANCES OF L.G. DOORS AND FAIRINGS
1 – strut fairing; 2 – cross-piece fairing; 3 – wheel door; 4 – [illegible] strut fairings.

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Supplement to Inspection Guide No.21	PROCESS CHART No.32	In 8 sheets Sheet 5
LANDING GEAR	CHECK RETRACTION AND EXTENSION OF LANDING GEAR	Man-hours required - 0.5?

Procedure	Technical requirements	Fault correction
Ten to fifteen seconds after flashing up of red indicator lights place landing gear control valve change-over handle to NEUTRAL and fix it in this position; (g) extend flaps and check functioning of EXTEND LANDING GEAR ([illegible]) light indication on landing gear indication board and aircraft instrument panel. Retract flaps 8. Extend landing gear: give command: CLEAR LANDING GEAR and, upon receiving LANDING GEAR CLEAR answer, place landing gear control valve change-over handle to EXTENDED ([illegible]) position	Nosewheel and main L.G. struts should extend and get fixed by ball locks in landing gear actuating cylinders; - L.G. EXTENDED green indicator lights should illuminate on landing gear indication board; - nosewheel strut position mechanical indicator should go out from its pocket	

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Supplement to Inspection Guide No.21	PROCESS CHART No.32	In 8 sheets Sheet 6
LANDING GEAR	CHECK RETRACTION AND EXTENSION OF LANDING GEAR	Man-hours required - 0.50

Procedure	Technical requirements	Fault correction
Ten to fifteen seconds after illumination of green L.G. indicator lights place landing gear control valve change-over handle to NEUTRAL and fix it in this position		
9. Check operation of automatic wheel braking system; to this end:		
(a) disconnect electric connector of ЈА-23 transmitter (antiskid detector) (on right or left main L.G. wheel);	This operation should be carried out collectively with electrical equipment specialists **Note.** Aircraft beginning with Serial No.7[illegible]315 use KT-62M brake wheels with braking discs made from powder metal, grade ФМК-11, with friction coefficient of 0.2 to 0.22; brake system employs УП24/1 valve with 1:1.5 reduction ratio	
(b) in cockpit: turn on circuit-breaker of wheel automatic braking system;		
(c) operate cock to engage УП33/1 valve of KT-38 nosewheel brake system;		
(d) press brake control lever and build up 4 - 5 kg/cm^2 pressure in brake system;		

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Supplement to inspection Guide No.21	PROCESS CHART No.32	In 8 sheets Sheet 4
LANDING GEAR	CHECK RETRACTION AND EXTENSION OF LANDING GEAR	Man-hours required – 0.50

Procedure	Technical requirements	Fault correction
(e) close terminals of YA-23 transmitter (antiskid detector) connectors on right or left KT-82 main L.G. wheel;	Closing of terminals should result in operation of two YE53/1 valves of main L.G. strut wheel and nosewheel being checked YE53/1 valves relieve air pressure, and wheels become unbraked. Opening of terminals should result in braking of wheels	Note. Carry out checks on right and left wheels in succession. Check system for proper functioning by hand-trying of brake and released wheels and by sound produced by air escaping from YE53/1 valves
(f) couple electric connector of YA-23 transmitter of main L.G. wheel under test and uncouple electric connector of YA-24 transmitter of nosewheel;	This should result in operation of YE53/1 valve of nosewheel, and nosewheel should become released (meanwhile main L.G. wheels remain braked). Opening of terminals should result in braking of nosewheel	
(g) couple electric connector of YA-24 transmitter		
10. Check all three L.G. wheels for synchronous braking and releasing; check braking time: this should be 2 seconds maximum		

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Supplement to Inspection Guide No.21	PROCESS CHART No.32	In 8 sheets Sheet 8
LANDING GEAR	CHECK RETRACTION AND EXTENSION OF LANDING GEAR	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction
11. Operate hydraulic jacks to lower aircraft to ground		

Accessories	Tools
Ground hydraulic installation	Wrench, 14 x 17, for connection of hydraulic reservoir pressurization pipe Wrench, 36 x 46, for connecting hoses to aircraft pipe unions

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Supplement to Inspection Guide No.21	PROCESS CHART No.33	In 2 sheets Sheet 1
LANDING GEAR	CHECKING CLEARANCES BETWEEN STOP ON WHEEL AXLE SHAFT AND BOTTOM OF MAIN L.G. SHOCK STRUT INNER TUBE	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
1. Use hydraulic jacks to lift aircraft until its wheels clear ground 2. With main L.G. struts extended and mechanic locks of axle shafts closed check clearance between stop on wheel axle shaft and inner tube bottom (Figs 56 and 57). For checking, lift wheel as far as it will go 3. Operate hydraulic jacks to lower aircraft	Clearance between stop on wheel axle shaft and inner tube bottom should be within 0.03 to 0.25 mm	If clearance between stop and inner tube bottom is smaller or greater than specified, adjust clearance by screwing intermediate bushings of wheel turning mechanism control rod. Having adjusted clearance, lock end lugs of control rod and check control rod tension. Control rod should freely turn under hand effort about its axis in ball supports. It is absolutely forbidden to file down head of stop (bolt) on wheel axle shaft with a view to increasing clearance

Accessories	Tools
	Set of feeler blades (0.01 to 1 mm)

[redacted]

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Supplement to Inspection Guide No.21	PROCESS CHART No.33	In 2 sheets Sheet 2

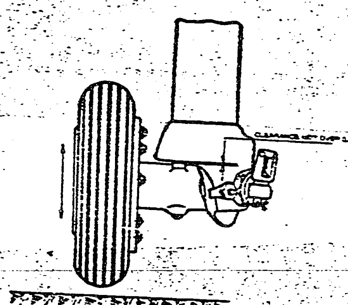

FIG. 56. MEASURING CLEARANCE BETWEEN STOP ON STRUT AXLE SHAFT AND SHOCK STRUT INNER TUBE BOTTOM (REAR VIEW OF AXLE SHAFT)

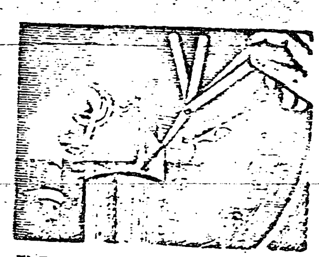

FIG. 57. MEASURING CLEARANCE BETWEEN STOP ON STRUT AXLE SHAFT AND SHOCK STRUT INNER TUBE BOTTOM

Supplement to Inspection Guide No.21	PROCESS CHART No.3[illegible]	In 7 sheets Sheet 1
WING	INSPECTION AND LUBRICATION OF WING ATTACHMENT JOINTS. CHECKING CONDITION OF PIPELINES AND ELECTRIC WIRING HARNESS	Man-hours required - 0.40 (6.45 when wing joining bolts are removed)

Procedure	Technical requirements	Fault correction
1. Remove fairings (fillets) in front and middle parts of wing panel	Wing panel is attached to fuselage by means of five attachment joints at frames Nos 13, 16, 22, 25 and 28 (Fig.58)	
2. Extend flaps to gain access to wing-to-frame No.28 attachment joint (Fig.59) 3. Wash wing-to-fuselage attachment joints with clean (unleaded) gasoline and blow them with compressed air	Front fairing fastening screws should be driven out only by means of special screwdrivers provided with pinned blade since otherwise screw locking arrangements will be damaged	
4. Inspect attachment joints for cracks (use magnifier glass for inspection). When examining attachment joints pay special attention to areas of sharply bent elements (fillets). Make sure that bolt nuts and wing-to-frame No.28 attachment bolt head are securely locked. When faults or fault traces are detected (such as shearing of nut locking fittings, loose fitting of bolt heads or nuts to attachment joint structure, etc.) remove bolts of all attachment joints	It is prohibited to shear locking cotter pin by nut rotation. When examining attachment joints and bolts for cracks pay special attention to areas where bolt heads end and bolt	If cracking is suspected test part concerned with magnaflux inspection method

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Supplement to Inspection Guide No.21	PROCESS CHART No. 34	In 7 sheets Sheet 2

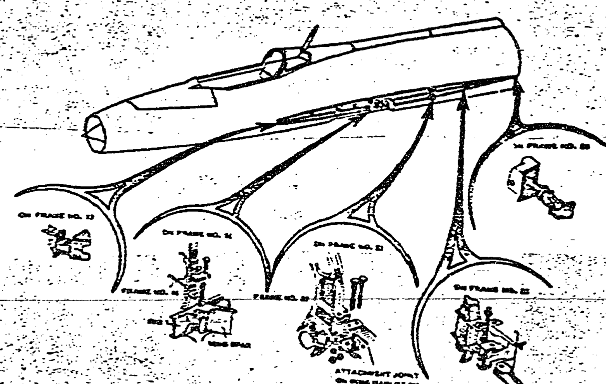
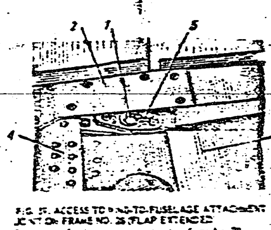


FIG. 52. WING ATTACHMENT JOINTS

Supplement to Inspection Guide No.21	PROCESS CHART No.34	In 7 sheets Sheet 3
WING	INSPECTION AND LUBRICATION OF WING ATTACHMENT JOINTS. CHECKING CONDITION OF PIPELINES AND ELECTRIC WIRING HARNESS	Man-hours required – 0.40 (6.45 when wing jointing bolts are removed)

Procedure	Technical requirements	Fault correction
and unjoint wing panel as instructed below Unjoint wing panel from fuselage as follows: (a) extend flap to clear access to attachment joint on frame No.28; (b) reduce pressure in hydraulic systems to zero by operating aircraft control stick; (c) reduce pressure in oxygen system to zero; (d) reduce pressure in pneumatic systems (main and emergency) to zero; (e) lift aircraft by means of hydraulic jacks until its wheels clear ground and install trestles (jack horses) under frames Nos 22 and 28;	shanks begin, as well as to areas of sharp structural angling in attachment joints. In case bolt shank is work-hardened or stepped, replace faulty bolt WARNING. It is forbidden to eliminate work-hardening, scores and "stepping" on outer surfaces of bolts by filing or grinding  FIG. [illegible]. ACCESS TO WING-TO-FUSELAGE ATTACHMENT JOINT ON FRAME NO. 28 (FLAP EXTENDED) 1 – wing-to-fuselage attachment joint on frame No. 28. 2 – wing fillet; 3 – flap; 4 – wing; 5 – locking fittings of bolt.	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 34	In 7 sheets Sheet 4
WING	INSPECTION AND LUBRICATION OF WING ATTACHMENT JOINTS. CHECKING CONDITION OF PIPELINES AND ELECTRIC WIRING HARNESS	Man-hours required – 0.4 (6.45 when wing jointing bolts are removed)

Procedure	Technical requirements	Fault correction
(f) lower aircraft to jack horses under frames Nos 22 and 28; (g) bring trolleys to under wing panels and adjust them in height;	Trolley should be installed under its respective wing; ball socket of wing should fit tightly over ball projection of trolley, while arc-shaped support of trolley should fit tightly to wing leading edge	
(h) remove fairings and fillets from wing leading edge and middle sections; (i) remove covers of access holes in wing leading edge section at fuselage; (j) disconnect aileron control rod from bellcrank at wing attachment joint; (k) disconnect L.G. strut mounting axle lock emergency opening cable;		
(l) disconnect pipelines of hydraulic and pneumatic systems at wing attachment joint; (m) disconnect fuel system pipelines running from wing fuel compartment; (n) disconnect pipelines of oxygen system; (o) disconnect electric and radio connectors;	To prevent penetration of dirt and foreign objects into pipelines of fuel, hydraulic, pneumatic and oxygen systems after their disconnection it is necessary to plug open ends or wrap them with PVC film. Electric and radio connection terminals should be	

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Supplement to Inspection Guide No.21	PROCESS CHART No.34	In 7 sheets Sheet 5
WING	INSPECTION AND LUBRICATION OF WING ATTACHMENT JOINTS. CHECKING CONDITION OF PIPELINES AND ELECTRIC WIRING HARNESS	[illegible] required – 6.40 (6.45 when wing jointing bolts are removed)

Procedure	Technical requirements	Fault correction
(p) uncotterpin and screw off nuts of wing jointing bolts at frames Nos 13, 16, 22, 25 and 28; (q) using special puller (Fig.60) remove bolts of wing-to-fuselage attachment joints. On attachment joint at frame No.16: remove lower bolt first, then – horizontal bolt, and next remove upper bolt using special wrench. The last to be removed is bolt of attachment joint at frame No.13; (r) carefully rocking wing panel by tip, move trolley-mounted wing away from fuselage. To re-joint wing panel reverse unjointing procedure. Having jointed wing panel to fuselage and having coupled pipelines of hydraulic, pneumatic and fuel systems and electric and radio connections, check operation of aileron, flap, landing gear and special equipment controls	wrapped in clean cloth or PVC film	

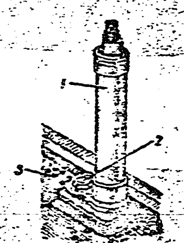

FIG. 60. PULLER FOR WING-TO-FUSELAGE JOINTING BOLTS
1 – puller; 2 – wing attachment joint on frame No. 22; 3 – wing.

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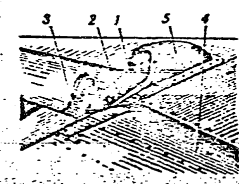
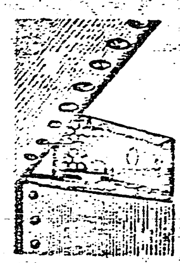
Supplement to Inspection Guide No.21	PROCESS CHART No.35	In 2 sheets Sheet 1
WING	INSPECTION AND LUBRICATION OF AILERON ATTACHMENT JOINTS. CHECKING WEIGHT BALANCE BOLTS FOR SECURE LOCKING	Man-hours required - 2.40

Procedure	Technical requirements	Fault correction
1. Screw out attachment screws of aileron bellcrank fairing and remove fairing (Fig.61) 2. Uncotterpin and screw off nut; remove bolt which couples aileron control rod with aileron-mounted bellcrank 3. Move aileron down, uncotterpin and screw nuts off bolts of attachment joints in aileron root portion, and remove bolts (Fig.62) 4. Moving aileron down, remove from its middle attachment joint two bolts (Fig.63) which connect aileron link (shackle) with wing bracket 5. Lower aileron until middle attachment joint link comes out of wing bracket. Bring aileron close to fuselage, release cantilever (rod hinge) attachment elements of aileron and demount aileron by moving it down 6. Wash attachment joints and open bearings with clean (unleaded) gasoline and inspect them for cracks and corrosion. Make sure that bearings rotate freely, without jamming	Note. The Process Chart envisages removal of aileron  FIG. 61. AILERON CONTROL BELLCRANK (FAIRING REMOVED) 1 - bellcrank; 2 - control rod; 3 - aileron bellcrank; 4 - aileron; 5 - fairing	 FIG. 62. AILERON ROOT SECTION ATTACHMENT JOINT

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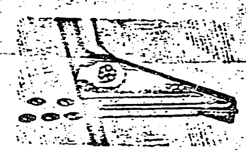
Supplement to Inspection Guide No.21	PROCESS CHART No.35	In 2 sheets Sheet 2
WING	INSPECTION AND LUBRICATION OF AILERON ATTACHMENT JOINTS. CHECKING WEIGHT BALANCE BOLTS FOR SECURE LOCKING	Man-hours required – 2.40

Procedure	Technical requirements	Fault correction
7. Check aileron weight balance bolts for secure locking 8. Lubricate attachment joints and bearings with grade TSIATIM-201 lubricant and re-mount ailerons on wing (if they have been demounted) reversing demounting procedure	 FIG. 63 AILERON-TO-WING MIDDLE ATTACHMENT JOINT (BOTTOM VIEW)	

Accessories	Tools
Syringe Magnifier glass, X10 Brush Bucket, zinc Tray	Socket wrenches, 14 and 17 Screwdriver for cross-slitted screws Flat-nose pliers

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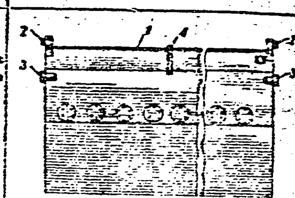
Supplement to Inspection Guide No.21	PROCESS CHART No.36	In 3 sheets Sheet 1
WING	INSPECTION AND LUBRICATION OF FLAP CARRIAGES	Man-hours required - 0.50

Procedure	Technical requirements	Fault correction
1. Drive out screws and remove fairing at end of outer guiding rail 2. On aircraft of earlier makes: remove clamp from end of inner guiding rails. To this end, withdraw cotter pins and remove two locking pins 3. Remove flap (Fig.64) 4. Unlock and screw off nut, and disconnect hydraulic cylinder operating rod from flap attachment joint (Fig.65) 5. Roll flap backward until carriages clear guiding rails (Fig.66)	Flaps can be hinged by 24°30. Deflection angle is determined by measuring distance between flap root rib and wing: this distance should be 358 ± 8 mm (this distance is mean standard; it may differ for each individual aircraft, and is indicated in Levelling Diagram supplemented to each aircraft Service Log). Difference in distances for right and left flaps should not exceed 2 mm. Width of gap between wing skin and flap as measured at rib No.2 with flap extended, should be equal to 52 ± 4 mm	 FIG. 64. GENERAL VIEW OF FLAP 1 – flap; 2 – front carriage; 3 – rear carriage; 4 – attachment joint of flap control cylinder operating rod
6. Remove carriage bearings and wash them in clean gasoline 7. Inspect carriages and bearings for cracks and dirt	Carriage bearings should rotate smoothly, without jamming or squeak Outer races should be securely held in bearing and should be free from cracks. Cages and balls should be intact	If bearings run with binding or squeak, replace them
8. Lubricate bearings with grade [illegible]-201 lubricant 9. Wash guiding rails with clean gasoline, inspect them and coat with grade [illegible]-201 lubricant	Guiding rails should be free from scoring and dents. Grooving caused by side ball supports shall be tolerated	

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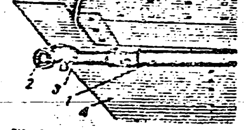
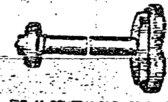
Supplement to Inspection Guide No.21	PROCESS CHART No.36	In 3 sheets Sheet 2
WING	INSPECTION AND LUBRICATION OF FLAP CARRIAGES	Man-hours required - 0.50

Procedure	Technical requirements	Fault correction
10. Remount flap on wing reversing demounting procedure  FIG. 65. FLAP HYDRAULIC CYLINDER OPERATING ROD (FLAP REMOVED) 1 – operating rod of flap control hydraulic cylinder; 2 – eyeing; 3 – locknut; 4 – wing.	Due to the fact that flowmeters are removed from flap control hydraulic system, it may occur that during flap extension and retraction checks on ground their full extension travel will be non-synchronous, i.e. one flap just starts to move while the other has been already extended through full travel range. In this case it is necessary to disconnect hydraulic cylinder operating rod from lagging flap and to check flap for easy movement on guiding rails by applying tractive effort of not over 5 kg at middle part of flap trailing edge. Flap should go out completely; if this is the case this means that flap is not jammed in guiding rails. Non-synchronism will not be present in flight due to action of dynamic pressure upon flaps	 FIG. 66. GENERAL VIEW OF FLAP CARRIAGES

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Supplement to Inspection Guide No.21	PROCESS CHART No.36	In 3 sheets Sheet 3
WING	INSPECTION AND LUBRICATION OF FLAP CARRIAGES	Man-hours required – 0.50

Procedure	Technical requirements	Fault correction
11. Check flap play at trailing edge 12. Check flaps for proper adjustment and synchronous extension from ground hydraulic installation	Adjust extension and retraction motions of flap by means of eyelug of hydraulic cylinder operating rod: eyelug should be screwed in or out (see Fig.62) Play of extended flap should be 11 mm, and that of retracted flap – – 2 mm Lateral play of flap should be within 0.5 to 4 mm	

Accessories	Tools
	Screwdriver for cross-slitted screws Flat-nose pliers Wrenches, 14 x 17 and 19 x 22

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Supplement to Inspection Guide No.21	PROCESS CHART No.37	In 3 sheets. Sheet 1
WING	INSPECTION OF GUIDING RAILS AND ROLLERS OF FLAPS. CHECKING FLAPS FOR SYNCHRONOUS EXTENSION AND RETRACTION	Man-hours required – 0.50

Procedure	Technical requirements	Fault correction
1. Command from cockpit: CLEAR FLAPS! Upon receiving FLAPS CLEAR acknowledgement, extend flaps by placing FLAPS (ЗАКРЫЛКИ) controls to EXTENSION	Flaps should go down synchronously and through full travel range; guide rollers should assume extreme rear position in guiding rails	
2. Wash guiding rails 2 (Figs 67 and 68) with clean (unleaded) gasoline **Note.** It is forbidden to carry out maintenance operations in cockpit when maintenance operations in flap wells are being done		
3. Inspect guiding rails and their attachment joints to make sure that locking fittings of attachment joint bolts are intact and guiding rails are free from scores	Guiding rails should be clean. Rail races should be free from scoring. Up to 0.5 mm deep grooving on rail webs caused by support balls shall be tolerated. Attachment joints of guiding rails should be securely fastened	
4. Check flap actuating hydraulic cylinder for secure fastening to attachment joint on wing, and rod – for reliable attachment to flap: make sure that locking fittings are intact and attachment joint nuts are tightened	Nuts of hydraulic cylinder-to-wing attachment joint bolts should be screwed fully on and locked. Hydraulic cylinder operating rod should be fastened to attachment joint on flap and locked in position	
5. Coat guiding rails and bearings of flap carriages with grade ЦИАТИМ-201 lubricant	Apply ЦИАТИМ-201 lubricant to guiding rails and ball bearings sparingly	

Supplement to Inspection Guide No.22	PROCESS CHART No.37	In 3 sheets Sheet 2
[illegible]	INSPECTION OF GUIDING RAILS AND ROLLERS OF FLAPS. CHECKING FLAPS FOR SYNCHRONOUS EXTENSION AND RETRACTION	Man-hours required - 0.50

Procedure	Technical requirements	Fault correction
6. Retract and extend flaps, and check them for synchronous movement 7. Check flap actuating hydraulic cylinders for leakage of AMT-10 hydraulic fluid. Inspect from the side of operating rod and from the side of hydraulic cylinder cover	Flaps should be retracted and extended in synchronism during not longer than 2 seconds	If flaps movement is out of synchronism or if their extension or retraction time exceeds 2 seconds inspect associated units and flap control system pipeline connections for external air-tightness (examine for leakage of AMT-10 hydraulic fluid). If leakage of AMT-10 fluid has been detected, remove faulty unit and eliminate leakage or, in case of failure to do this, replace unit. If hydraulic fluid leakage has been detected in pipeline connection, screw off nut and examine pipeline at beading for cracks and quality of beading. When through with checking pipeline tighten nut by turning it on as far as it will go. See to it that neither misalignment nor overtightening is involved when pipeline is being coupled to connection

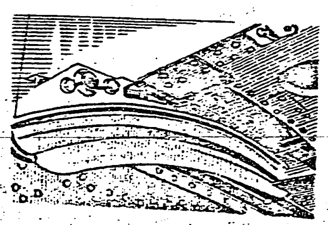

FIG. 67. [illegible] GUIDING RAIL OF FLAP (ART. 7)

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Supplement to Inspection Guide No.21	PROCESS CHART No.37	In 3 sheets Sheet 3
WING	INSPECTION OF GUIDING RAILS AND ROLLERS OF FLAPS. CHECKING FLAPS FOR SYNCHRONOUS EXTENSION AND RETRACTION	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction

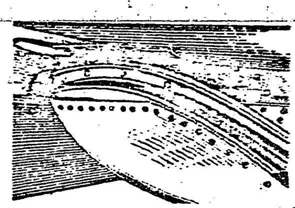

FIG. [illegible] OUTER GUIDING RAIL OF FLAP (ART. 72)

Accessories	Tools
Syringe	Flat-nose pliers Wrench

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Supplement to Inspection Guide No.21	PROCESS CHART No.38	In 10 sheets Sheet 1
FUSELAGE	FUSELAGE DISJOINTING AND RE-JOINTING	Man-hours required – 8 for unjointing and demounting; 12 – for re-jointing and remounting

Procedure	Technical requirements	Fault correction
1. Place aircraft on level ground to obviate breakage of units and pipelines of engine and airframe during unjointing of fuselage tail section. Relieve working fluid pressure in main hydraulic system and hydraulic booster system to zero 2. Operate hydraulic jacks to lift aircraft until its wheels clear ground 3. Open covers of access holes leading to fuselage tail section-to-fuselage nose section attachment joints on frame No.25 (Fig.69) and screw off four nuts of lower fuselage jointing bolts to provide installation of trolley 4. Bring special trolley to under fuselage tail section and fasten fuselage tail section on it; place tray under fuselage in area of frame No.28 (Figs 70 and 71) 5. Open covers of access holes leading to aircraft controls and disconnect control rods (Fig.72). Remove impact pressure intake duct arrangements and uncouple electric connector.	 FIG. 69. LOCATION OF JOINTING BOLTS OF FUSELAGE NOSE AND TAIL SECTIONS ON FRAME NO. 25. (a) access cover closed; (b) access cover open.	

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Supplement to Inspection Guide No.21	PROCESS CHART No.38	In 10 sheets Sheet 2
FUSELAGE	FUSELAGE DIS-JOINTING AND RE-JOINING	Man-hours required – 8 for unjointing and demounting; 12 – for re-jointing and remounting.

Procedure	Technical requirements	Fault correction
6. Deflect stabilizer leading edge section down (Fig.73)		
7. Screw out attachment screws, remove vent pipe (Fig.74) and demount tail fairing. Open access holes on top at frame No.36 and disconnect bolts which fasten hydraulic cylinder cooling branch pipes		
8. On fuselage top, starboard, open cover of access hole leading to stabilizer controls and uncouple synchronization (sieving) transmitter electric connector. Disconnect six attachment joints of afterburner removable section control rods (Fig.75)		
9. Disconnect two hydraulic system pipes which run to jet nozzle flaps control cylinder (Fig.76)		
10. Remove front ring with nozzle flap control hydraulic cylinders (Fig.77)		
11. Remove drag chute with container and demount drag chute container screen and thermocouple		

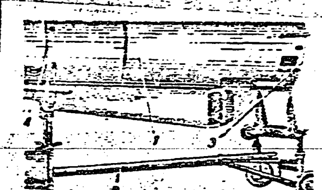

FIG. 70. POSITION OF SPECIAL TROLLEY UNDER FUSELAGE TAIL SECTION

1 – fuselage tail section, 2 – special trolley placed under fuselage tail section, 3 – frame No. 25, 4 – frame No. 35.

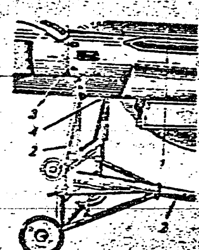

FIG. 71. MOUNTING FUSELAGE TAIL SECTION ON SPECIAL TROLLEY AT FRAME No.28a

1 – fuselage tail section, 2 – trolley, 3 – fuselage joint, 4 – trolley-to-frame No. 28a attachment screw.

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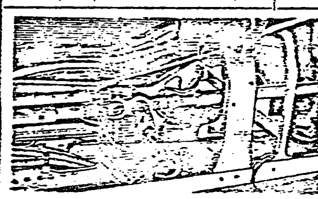
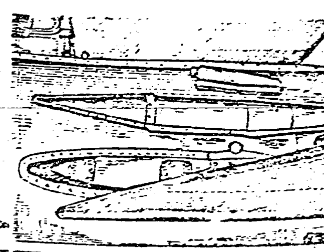
Supplement to Inspection Guide No.21	PROCESS CHART No.38	In 30 sheets Sheet 3
FUSELAGE	FUSELAGE DISJOINTING AND RE-JOINTING	Man-hours required – 8 for unjointing and demounting; 12 – for re-jointing and remounting

Procedure	Technical requirements	Fault correction
12. Disconnect vent pipeline of afterburner (Fig.78) and vent pipeline accessible through hole behind frame No.28 13. Remove on starboard side loop of MPG-56 II marker receiver to obtain access to thermocouples (Fig.79) 14. Disconnect and remove from connections four thermocouple transmitters (Fig.80) 15. Disconnect wires from engine afterburner ignition plug (Fig.81) and remove adapter 16. Disconnect main fuel tank pressurization pipeline (Fig.82): access – from fuselage port side 17. Disconnect four connections of hydraulic pipes (Fig.83) at quick-disconnect valves (pressure in hydraulic systems should be zero) 18. Disconnect air system pipe (at zero pressure in air system) 19. Disconnect fuel system pipelines in fuselage superstructure	 FIG. 72 INSTALLING STABILIZER AND RUDDER CONTROL BELLCRANKS (THE ARROWS SHOW CONTROL ROD CONNECTION JOINTS)  FIG. 73 POSITION OF STABILIZER L.E. SECTION BEFORE FUSELAGE UNJOINTING	

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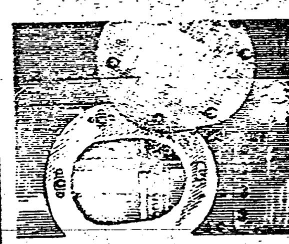
Supplement to Inspection Guide No.21	PROCESS CHART No.38	In 10 sheets Sheet 4
FUSELAGE	FUSELAGE DISJOINTING AND RE-JOINTING	Man-hours required - 8 for unjointing and demounting; 12 - for re-jointing and remounting

Procedure	Technical requirements	Fault correction
20. Disconnect twelve electric and radio connectors (perform this operation collectively with electric and radio equipment specialists). Uncouple connectors with due care since they are not attached to airframe structure 21. Unlock attachment fittings (rollers) of engine tailpipe at frame No.36 (Fig.[illegible]) 22. Screw off eighteen nuts of jointing bolts on frame No.28 23. Insert drift bars in access holes along reference line of aircraft both at starboard and port sides and, using drift bars as levers and gradually moving trolley off, carefully move fuselage tail section away from fuselage. As fuselage tail section is being moved, make sure that there is no catching of parts inside fuselage	To obviate damage when rolling out fuselage tail section see to it that fuselage structural members do not touch engine parts As soon as fuselage tail section is separated from fuselage by about 200 mm backward and tailpipe rollers clear rails it is necessary to screw rollers out to ensure that fuselage tail section passes through nozzle flaps	 FIG. 74. CONNECTION OF FUEL SYSTEM VENT PIPE

Supplement to Inspection Guide No.21	PROCESS CHART No.38	In 16 sheets Sheet 5
FUSELAGE	FUSELAGE DISJOINTING AND RE-JOINTING	Man-hours required - 8 for unjointing and desmounting, [illegible] - for re-jointing and remounting

Procedure	Technical requirements	Fault correction
24. Screw tailpipe rollers out as required (Fig.85)		Left roller should be driven out by 4.7 mm distance from bushing end, and right roller - by 0.5 mm
25. Re-joint tail and nose sections of fuselage reversing unjointing procedure	Tighten jointing bolt nuts at frame No.25 uniformly, screwing on diametrally opposite nuts in succession	
26. Upon re-jointing of fuselage carry out external inspection to make sure that all parts, units and locking fittings are in their proper places. This done, close access hole covers which have been removed 27. After inspecting parts and units for proper installation it is absolutely necessary to check fuel system, aircraft controls and units located in fuselage tail section for proper functioning		

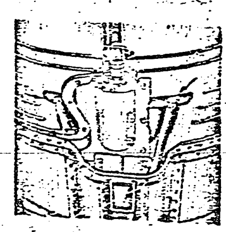


FIG. 75 LOWER ATTACHMENT JOINT OF AFTERBURNER REMOVABLE SECTION (THE ARROWS SHOW CONTROL ROD CONNECTION JOINTS)

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Supplement to Inspection Guide No.21	PROCESS CHART No.38	In 10 sheets Sheet 6
FUSELAGE	FUSELAGE DISJOINTING AND RE-JOINTING	Man-hours required – 8 for unjointing and demounting; 12 – for re-jointing and re-mounting

Procedure	Technical requirements	Fault correction

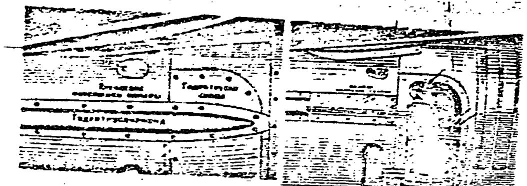

FIG. 76 GENERAL ARRANGEMENT OF PIPELINES ON FUSELAGE PORT SIDE

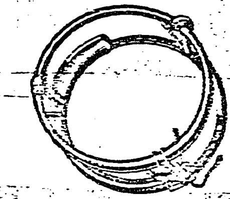

FIG. 77. FRONT RING WITH NOZZLE FLAP CONTROL HYDRAULIC CYLINDERS

Accessories	Tools
Tray Hydraulic jacks (1 set) Trolley for fuselage tail section, [illegible]	Screwdriver, 150 and 200 mm Screwdriver for cross-slitted screws Flat-nose pliers Wrench, 36, E2-7804-95 Wrench for quick-disconnect valve of main hydraulic system, 72-7804-45 Wrench for thermocouple, E2-7804-66 Wrench, E2-7804-105 Wrench, socket, 24, for engine tailpipe, E2-7804-103

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Supplement to Inspection Guide No.21	PROCESS CHART No. 38	In 10 sheets Sheet 7

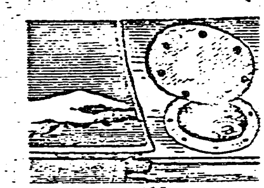


FIG. 78. CONNECTING VENT PIPE OF TELESCOPIC COUPLING

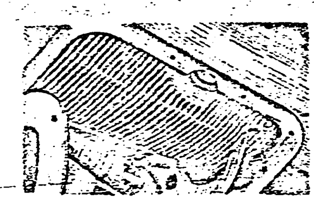


FIG. 79. VIEW OF COMPARTMENT WITH MRP-56 MARKER RADIO RECEIVER LOOP REMOVED

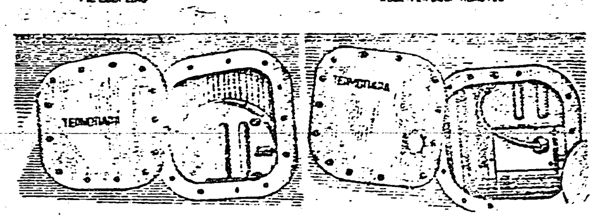


FIG. 80. ACCESS HOLE LEADING TO THERMOCOUPLE TRANSMITTERS (ON FUSELAGE RIGHT UPPER PART)

Supplement to Inspection Guide No.21	PROCESS CHART No. 38	In 10 sheets Sheet 8

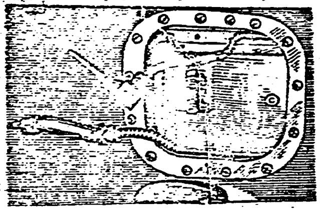
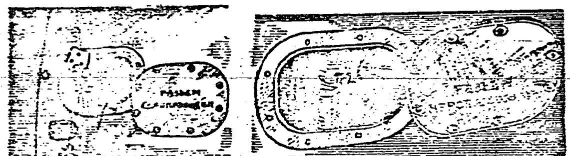


FIG. 81. VIEW OF THERMOCOUPLE TRANSMITTER AND WIRE FROM ENGINE AFTERBURNER IGNITION PLUGS (ON FUSELAGE UPPER LEFT SIDE)



a

b

FIG. 82. CONNECTION OF FUEL TANK PRESSURIZATION SYSTEM PIPELINES
a — left view; b — right view (connection points are shown by arrows)

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Supplement to Inspection Guide No.21	PROCESS CHART No. 38.	In 10 sheets Sheet 9

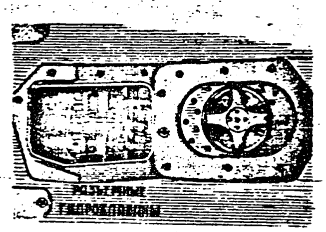

FIG. 83. VIEW OF QUICK-DISCONNECT HYDRAULIC VALVES

FIG. 84. LOCKING FITTINGS OF ENGINE TAILPIPE COLLARS

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Supplement to Inspection Guide No.21	PROCESS SHEET No. 38	In 10 sheets Sheet 10

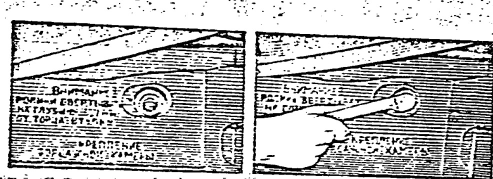

FIG. 85. TURNING OUT ROLLERS OF ENGINE TAILPIPE

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Supplement to Inspection Guide No.21	PROCESS CHART No. 39	In 3 sheets Sheet 1
Fuselage	INSPECTION OF FUSELAGE INNER SKIN; INSPECTION AND CHECKING CONDITION OF PIPELINE ATTACHMENT FITTINGS, SEALING RUBBER, DISC VALVES AND ACCESSORIES (UNITS) LOCATED IN ENGINE COMPARTMENT AND FUSELAGE TAIL SECTION	Man-hours required - 1

Procedure	Technical requirements	Fault correction
1. Unjoint fuselage tail section from nose section		
2. Inspect fuselage inner skin and make sure that it is free from deformation (warpage), burnt through spots and cracks		
3. Inspect pipelines and accessories (units) for leakage of AMT-10 hydraulic fluid and fuel; pay special attention to connections and joints; make sure that pipelines and electric harness are attached securely, that there are no worn down spots and that pipes and electric wires do not touch adjacent parts; make certain that locking fittings are in their right places and intact	Pipes and bunched electric conductors should not touch adjacent parts and should be securely attached Maintain at least 3-mm clearances between fixed parts and 5-mm clearances between moving parts	In case pipes bear traces of rubbing with worn down spots deeper than 0.2 mm, replace faulty pipes
4. Inspect tailpipe attachment rollers for condition. Check rollers for free rotation by hand	Rollers should rotate freely, without jamming	If rollers fail to rotate, remove them and wash in gasoline. Replace rollers if washing fails to correct trouble
5. If engine is removed, examine rubber sealing of engine nose cone and air intake: make sure that rubber is neither deteriorated nor swollen and that rubber ring does not project from its seating recess (Fig.86); check condition	Rubber sealing should lie even in recess and should be free from bulging and deterioration Limit ends of valves controlling air flow should be bent out by 8 mm from air cooler shell	Replace bulged or deteriorated rubber sealing

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Supplement to Inspection Guide No.21	PROCESS CHART No. 39	In 5 sheets Sheet 2

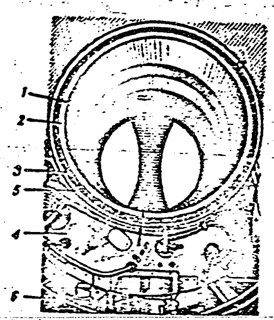

FIG. 86. GENERAL VIEW OF RUBBER SEALING ON ENGINE NOSE CONE AND ARRANGEMENT OF AIR COOLER PLATE VALVES

1 – air cooler; 2 – rubber sealing ring; 3 – plate valve of air cooler; 4 – frame No. 22; 5 – discharge ring of fire fighting system; 6 – frame No. 23.

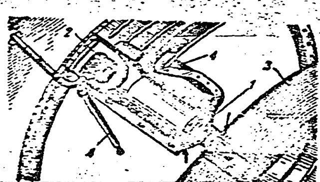

FIG. 87. ATTACHMENT OF ENGINE NOZZLE FLAP CONTROL HYDRAULIC CYLINDER

1 – operating rod of jet nozzle flap control cylinder; 2 – cylinder; 3 – jet nozzle flap control yoke; 4 – hydraulic unit attachment rods.

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Supplement to Inspection Guide No.21	PROCESS CHART No. 39	In 3 sheets Sheet 3
FUSELAGE	INSPECTION OF FUSELAGE INNER SKIN; INSPECTION AND CHECKING CONDITION OF FUSELAGE ATTACHMENT FITTINGS, SEALING RUBBER, DISC VALVES AND ACCESSORIES (UNITS) LOCATED IN ENGINE COMPARTMENT AND FUSELAGE TAIL SECTION	Man-hours required - 1

Procedure	Technical requirements	Fault correction
of air cooler plate valve (make sure that they are intact) 6. Check rubber sealing at frame No.28 for condition 7. Check condition of jet nozzle flap control hydraulic cylinder, attachment rods of removable ring and skin; make certain that these elements are intact (Fig.87)		

Accessories	Tools
Inspectoscope (adjustable mirror for inspection of hard-to-get-at places) Extension lamp KL-36	Screwdriver

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Supplement to Inspection Guide No.21	PROCESS CHART No.30	In 16 sheets Sheet 1
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required- 1.50

Procedure	Technical requirements	Fault correction
1. Extend cone manually to forward position		
2. Turn out cone attachment screws (along the periphery) and demount cone. Remove cone with utmost care so as not to damage actuating system		
3. Demount radio and radar antennas. (This job should be performed by radio equipment specialists)		
4. Drive out antenna-mounting ring fastening screws and remove ring		
5. Disconnect hydraulic cylinder operating rod from cone moving tube assembly, and remove cone moving tube		
6. Wash cone mechanism (inner fixed and outer moving tubes, cone control cylinder-to-outer tube attachment joint) with clean unleaded gasoline, and inspect indicated parts and assemblies	When inspecting, make sure that fixed tube surface is perfectly (mirror-like) clean; it should be free from cracks, scores and corrosion. Moving tube should displace freely, without jamming	
7. Inspect de-icer tank for proper attachment	De-icer tank is attached to wall of fixed cone by means of three yokes	

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Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 2
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.50

Procedure	Technical requirements	Fault correction
	Fastening screws of yokes should be tightened up and locked with KOK-1 wire. There should be felt pads under yokes	
8. Check condition of limit switch and cone control mechanism Wash and examine fixed cone surface	Surface of fixed cone should be even and free from spots of scoring or attrition	
9. Apply thin layer of grade ШЕАТИ-201 lubricant to surface of fixed cone and cone control cylinder operating rod	Apply lubricant to surface of fixed cone with cotton wool wad. When doing so shift movable tube from one extreme position to the other	
10. Re-mount radio antenna and cone reversing demounting procedure		
11. Extend anti-surge shutters by manual control		
12. Wash control rods, attachment joints and hinge connections of bell-cranks and anti-surge shutter control rods with gasoline and blow them with compressed air (Fig.68)		
13. Inspect control rods, attachment joints, hinge connections of bellcranks and rods, and attachment fittings of hy-		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 40	In 16 sheets Sheet 3

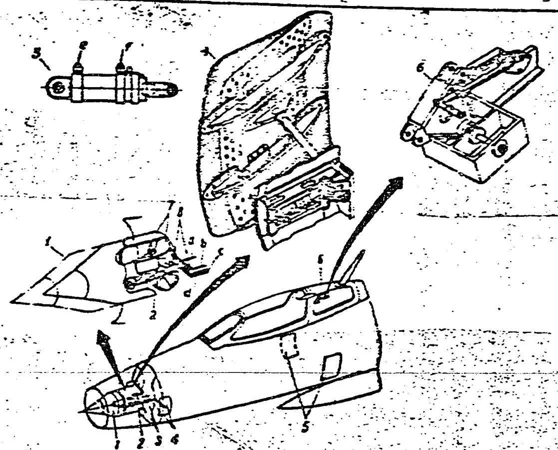

FIG. [illegible] CONE AND ANTI-SURGE SHUTTER CONTROL SYSTEM

1 – movable cone; 2 – cone control cylinder; 3 – shutter control cylinders; 4 – anti-surge shutters, 5 – take-off shutters, 6 – [illegible] point of bellcrank [illegible] frame No. 22; 7 – fixed cone, 8 – pivot joint, a – extension, position II, b – extension, position I, c – retraction, position II; d – retraction, position I; e – shutter retraction, f – shutter extension.

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Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 4
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.50

Procedure	Technical requirements	Fault correction
draulic cylinders and pipes for corrosion, cracks and other faults; examine locking fittings for integrity and proper installation 14. Lubricate all attachment joints and hinge joints of anti-surge shutters with ЦИАТИМ-201 lubricant 15. Retract anti-surge shutters		
<u>Checking Cone Control Mechanism and Anti-Surge Shutters for Proper Operation (Check of Automatic Controls)</u> 1. Connect ground electric power supply source to aircraft. Perform the following on right-hand console in cockpit: turn on circuit-breakers CONE (КОНУС), ENGINE CONTROL LEVER INTERLOCK (БЛОКИРОВКА РУД), DISENGAGEMENT OF BOOSTERS, HYDRAULIC SYSTEM INDICATION (СИГНАЛИЗ. БУ, СИСТЕМ ОТКЛ. ГИДР.) and FUEL REMAIN LIGHT PANEL LAMP TEST, [illegible] EFFECT INDICATION (КОНТРОЛЬ ЛАМП ТАБЛО ОСТ. ТОПЛ. И СИГНАЛ ТРЯН. [illegible]); on left-hand console:	Check operation of cone and anti-surge shutters collectively with aircraft equipment specialists	

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Supplement to Inspection Guide No.21	PROCESS CHART No.40		In 16 sheets Sheet 5
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS		Man-hours required – 1.50
Procedure	**Technical requirements**	**Fault correction**	
turn on cone and anti-surge shutter operating change-over switches, select AUTO (АВТОМАТ) position, and turn on circuit-breaker MAXIMUM AUGMENTED (ФОРСАЖ МАКСИМАЛ.) Turn on STORAGE BATTERY, AIRCRAFT-GROUND (АККУМУЛЯТОР БОРТОВОЙ, АЭРОДРОМНЫЙ) switch on starboard side Place ENGINE PROCESSING (КОНСЕРВАЦИЯ ДВИГАТЕЛЯ) switch in engine processing box (located down on starboard side in area of fuselage frame No.16) to "K" position 2. Connect KAY-3 tester to dynamic and static pressure holes of pitot-static tube 3. Connect ground hydraulic installation to aircraft connections of main hydraulic system and build up working pressure in system. Disengage electric interlock of [illegible] and [illegible] limit switches in KAF-13A afterburner control box by turning screw "B" to DISENGAGED ([illegible]) position (KAF-13A box is mounted down on star-			

Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 8
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.50

Procedure	Technical requirements	Fault correction
12. Move aircraft control stick forward towards neutral position (deflect stabilizer leading edge section up)	As stabilizer leading edge section is deflected to angle smaller than -20°, anti-surge shutters should close. This should result in engagement of afterburner, AUGMENTED (ФОР-САЖ) light should go out and anti-surge shutters should open	
13. Reset engine control lever from MINIMUM AUGMENTED to MAXIMUM AUGMENTED stop		
<u>Checking Operation of Air Intake Duct Cone</u>		
14. Raise pressure in dynamic pressure line of pitot-static tube to obtain pressure corresponding to second extended position of cone	This action should result in cone extension to second position	When checking cone extension relative to Mach numbers, take into consideration errors of Mach relay and Mach meter as stated in Certificates of these instruments
15. Apply hand effort of 40 to 50 kg to cone in retraction direction	Cone should not retract: this testifies to sound operation of hydraulic locks	
16. Reduce pressure in dynamic line of pitot-static tube by 0.2 to 0.3 kg/cm² with respect to pressure of second extended position of cone	Under this pressure the cone should retract to first position	
17. Reduce pressure in pitot-static tube dynamic pressure line to value corresponding to first position of cone	As a result of this action cone should be retracted to initial retracted position;	

Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 9
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.50

Procedure	Technical requirements	Fault correction
	anti-surge shutters should get retracted; blocking system should get disengaged; CONE EXTENDED ([illegible]) indicator light should go out	
1A. Shift engine control lever backward to CUT-OFF position and set screw "[illegible]" on [illegible]-13[illegible] afterburner control box to initial position	As engine control lever passes MAXIMUM AUGMENTED stop anti-surge shutters should remain closed. Automatic stop should not hamper full retraction of engine control lever	
<u>Checking Air Intake Duct Cone and Anti-surge Shutter Manual Controls</u>		
1. Reduce pressure in dynamic and static lines of pitot-static system to zero		
2. Place movable cone operating mode selector switch to MANUAL ([illegible]) position, and anti-surge shutters control change-over switch – to CLOSED ([illegible]) position		
3. Place movable cone operating mode selector switch to first extended position	This should result in flashing up of CONE EXTENDED indicator light on [illegible]-4 light indication panel, and in extension of cone to first position	

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Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 10
[illegible] FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.5

Procedure	Technical requirements	Fault correction
4. Place switch to second extended position	This should result in cone extension to second position	
5. Place switch back to first extended position	Cone should go back to first extended position	
6. Place switch to RETRACTION (УБОРКА) position	Cone should begin its retraction movement; CONE EXTENDED light should go out upon complete retraction of cone	
7. Reset anti-surge shutter control change-over switch from CLOSED to OPEN (ОТКРЫТ) position	This should result in synchronous opening of anti-surge shutters	
8. Reset anti-surge shutter control change-over switch from OPEN to CLOSED position	This should result in synchronous closing of anti-surge shutters	
9. Place anti-surge shutters control change-over switch and cone operating mode selector switch to AUTO (АВТОМАТ) and lock them with brass wire, 0.25 mm in diameter. Reset ENGINE PROCESSING (НОН-[illegible]) switch from "Х" to OPERATION (РАБОТА)		
10. Disengage ground hydraulic installation, generator and turn off all circuit-breakers		

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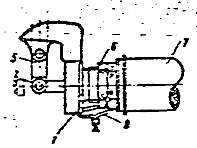
Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 11
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.50

Procedure	Technical requirements	Fault correction
<u>Checking System for Blocking Engine Control Lever by Mach Number</u> 1. Turn out screws and remove access hole cover from casing under throttle control in cockpit 2. Check presence and correct attachment of locking fittings (with seals) which couple ЭМО2/2 electromagnet with locking nut and throttle control bracket (Fig.89)	 FIG. 89. ARRANGEMENT OF SOLENOID LOCKING FITTINGS 1 – flange on throttle control bracket; 2, 3 and 4 – pin, washer and cotter pin; 5 – bellcrank; 6 – [illegible]; 7 – solenoid (electromagnet) ЭМО-2/2; 8 – locking wire КСК-1.	If for some reason or other locking fittings are missing, call for electric equipment specialist to check ЭМО2/2 electromagnets. Upon completion of check re-mount electromagnet and attach new locking fittings and seal
3. Check two-cycle operation of stop versus Mach number limitations from energised ЭМО2/2 electromagnet. Check in the following succession: (a) with operating rod of ЭМО2/2 electromagnet extended, stop flag should be raised and pin on engine control lever should pass under it with clearance not smaller than 1 mm, as shown in Figs 90 and 91:		A 1-mm displacement up or down from pin axis shall be tolerated. Fig. 91 shows stop blocking backward movement of engine control lever. In case of faulty operation (untimely tripping) of electromagnet or clearances other than those indicated in Figs 90 and 91 act as follows: – demount throttle control – disconnect ЭМО2/2 electromagnet.

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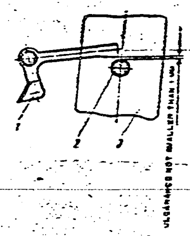
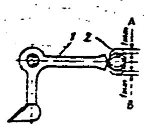
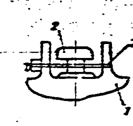
Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 12
FUSELAGE	INSPECTION OF COWL AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required - 1.50

Procedure	Technical requirements	Fault correction
(b) with operating rod of 3M02/2 electromagnet retracted, stop flag should be lowered and bear along axis of pin on engine control lever		from bellcrank installed before electromagnet 3MO - unlock and remove electromagnet 3M02/2 Examine space before operating rod of 3M02/2 for absence of foreign objects. Install electromagnet on throttle control in accordance with Fig.89 maintaining 9-mm distance between flange and nut of 3M02/2 electromagnet. Check operation of stop versus Mach number limitation (see text above). If above mentioned clearance cannot be obtained in re-mounting, adjust it with the aid of adjustable threaded end tip (lug) of spring-loaded rod; adjustment over, safety rod with locknut and check as instructed under first three Points of this Article
FIG. 90. POSITION OF PARTS FOR CHECKING BLOCKING SYSTEM 1 – stop lug; 2 – pin on engine control lever; 3 – engine control lever.		
4. Check lifting of stop flag from emergency control button on throttle control	Stop flag should rise and pin on engine control lever should pass with not smaller than 1-mm clearance as shown in Fig.90. Stop flag is lifted as a result of compression of	

Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 13
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.50

Procedure	Technical requirements	Fault correction
Check as follows: (a) retract operating rod of 3МО2/2 electromagnet; (b) de-energise 3МО2/2 electromagnet; (c) attach bellcrank before 3МО2/2 electromagnet so that it would be immovable when operating rod of 3МО2/2 electromagnet is retracted; (d) press emergency control button on throttle control 5. Having completed check lift emergency control button to fixed upper position, lock it with wire and seal as shown in Fig.92	spring-loaded control rod which links 3МО2/2 electromagnet with stop flag  FIG. 91. POSITION OF STOP LUG FOR CHECKING ENGINE CONTROL LEVER BLOCKING 1 – stop lug; 2 – pin on engine control lever. A – upward travel tolerance, B – downward travel tolerance.	 FIG. 92. POSITION OF EMERGENCY CONTROL BUTTON LOCKING FITTINGS 1 – bracket; 2 – emergency control button; 3 – locking wire, type [illegible]
<u>Checking Air Intake Duct Cone for Correct Position</u> 1. Connect ground hydraulic installation to aircraft connection of main hydraulic system and build up working pressure in system	Position of air intake duct cone should correspond to data indicated in Levelling Diagram available in aircraft Service Log	If measured positions of cone differ from corresponding data indicated in Levelling Diagram by more than ±2 mm, problem of whether to consider newly obtained position of cone as serviceable

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Supplement to Inspection Guide No.21	PROCESS CHART, No.40	In 16 sheets Sheet 16
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required - 1.50

Procedure	Technical requirements	Fault correction
		or to correct Levelling Diagram with a view to eliminating present discrepancy should be solved in each particular case jointly with Manufacturer
2. Place cone operating mode selector switch to MANUAL (РУЧНОЕ). Operating cone position selector switch perform 5 or 6 retraction-extension cycles of cone, with its fixation in three positions (retracted, extended to first position and extended to second position)	If cone operates properly, deviations within ±2 mm in cone positions as compared to data indicated in Levelling Diagram shall be tolerated	
3. Install special fixture (Fig.93) on cone to check cone extension travel with reference to fuselage nose cone seeing to it that inner surface of fixture fits tightly to movable cone surface	If movable cone or hydraulic control cylinder has been replaced, as well as after all other operations which involve cone adjustments, obtain those dimensions of cone positions which are indicated in Levelling Diagram	
4. Operate selector switch to place cone to RETRACTED position and measure dimension "Г" with the aid of ruler	Dimension "Г" is distance between reference point "1a" on aircraft nose cone and point "24" on movable	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 40	In 16 sheets Sheet 13

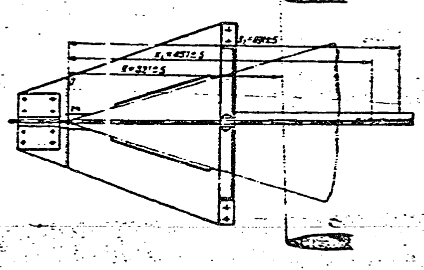

FIG. 93. CHECKING AIR INTAKE CONE FOR CORRECT POSITION

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Supplement to Inspection Guide No.21	PROCESS CHART No.40	In 16 sheets Sheet 16
FUSELAGE	INSPECTION OF CONE AND ANTI-SURGE SHUTTER CONTROL MECHANISMS	Man-hours required – 1.50

Procedure	Technical requirements	Fault correction
5. Extend cone to first position and measure dimension "X1" by means of ruler 6. Extend cone to second position and use ruler to measure dimension "X2". Cone extension dimensions should be measured three times 7. Remove fixture from cone. Place cone to fully retracted position and reset cone operating mode selector switch to AUTO (ABTOMAT) 8. Disconnect ground installation from aircraft	cone. This dimension should correspond to data indicated for given aircraft in its Levelling Diagram and should be within 321 ± 5 mm Dimension "X1" should meet specification of Levelling Diagram (451±5 mm) Dimension "X2" should be as specified in Levelling Diagram (491±5 mm)	

Accessories	Tools
Fixture 74-9871-850 for checking position of air intake duct cone Tester KIJ-3 Ground hydraulic installation Ground electric power supply source	Screwdriver, ordinary Screwdriver for cross-slitted screws Flat-nose pliers

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 41	In 5 sheets Sheet 1
FUSELAGE	CHECKING OPERATION OF DRAG CHUTE SYSTEM	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
Checking of drag chute system (Fig. 94) should be carried out after re-jointing of fuselage 1. Place clean canvas under chute compartment of fuselage to protect chute from fouling 2. Take seat in cockpit and make sure that pressure in pneumatic system is not lower than 50 kg/cm^2 3. Turn on circuit-breaker bearing inscription DRAG CHUTE (ТОРМОЗНОЙ ПАРАШЮТ)		
4. Press button on instrument panel bearing inscription CHUTE RELEASE (ВЫПУСК ПАРАШЮТА)	Pressing CHUTE RELEASE button actuates electropneumatic valve which supplies air to chute doors opening cylinder. Doors should go open, and drag chute should drop under gravity from chute compartment container. Notes: 1. Chute doors can be opened by turning hexagon of lock on outer door (index mark on look hexagon should be placed to OPEN (ОТКРЫТО) 2. When opening chute doors keep them with hands and be careful not to injure hands at	

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Supplement to Inspection Guide No.21	PROCESS CHART No.41	In 5 sheets Sheet 2

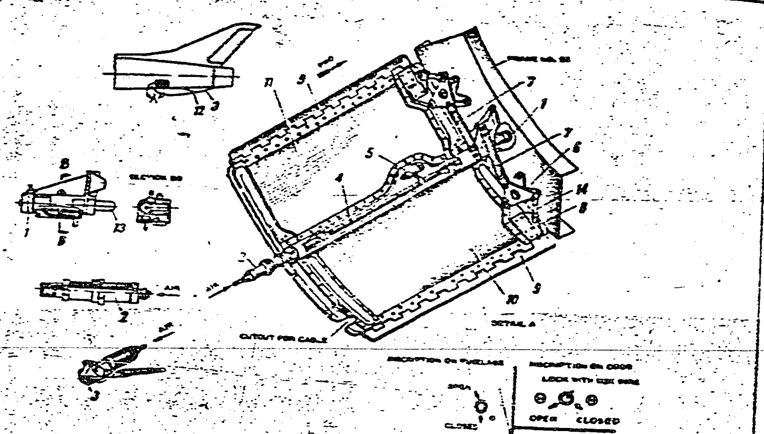

FIG. 94. DOORS OF DRAG CHUTE CONTAINER

1 – lock, 2 – air cylinder, 3 – attachment lock, 4 – control rod, 5 – door lock, 6 – bellcrank, 7 – guide cylinder with spring, 8 – bracket, 9 – [illegible]-type hinge joint, 10 – right door, 11 – left door, 12 – clamp, 13 – shaft of lock, 14 – control rod.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 41	In 5 sheets Sheet 3
FUSELAGE	CHECKING OPERATION OF DRAG CHUTE SYSTEM	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
	chute doors opening moment (doors are spring-loaded and go open in brisk manner) 3. When opened, doors should remain in this position	
5. Pull chute cable from clamps and apply 5 to 15-kg effort to it. Press push-button (on cockpit port side) bearing inscription CHUTE JETTISON (СБРОС ПАРАШЮТА) 6. Return system to initial position and safety chute compartment doors lock	Pressing chute jettison button should open attachment lock to release cable	
7. Build up 30 kg/cm^2 pressure in pneumatic system and repeat check of drag chute system operation as instructed under Points 2 through 5 above 8. Wash chute door hinges with clean gasoline and coat them with [illegible]-20 lubricant 9. Wash drag chute lock with clean gasoline. Inspect drag chute cable attachment hook and eliminate burrs if any	At 30 kg/cm^2 pressure in pneumatic system chute system should function as properly as at 50 kg/cm^2 pressure	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 41		In 5 sheets Sheet 4
FUSELAGE	CHECKING OPERATION OF DRAG CHUTE SYSTEM		Man-hours required - 0.30
Procedure	Technical requirements	Fault correction	
10. Check flaps on containers for integrity; in case of ruptures repair flaps 11. Place chute in container and mount container in chute compartment of fuselage. To this end: (a) fit chute cable ring into lock and close lock so that locking cylinder, acted upon by its spring, would return to initial position; (b) fit chute cable in clamps on fuselage; (c) arrange container with chute in fuselage compartment. Flap with rip cable (cord) loop should be at bottom; (d) cover drag chute with flaps; (e) close chute compartment doors (closed first should be door closest to ventral fin, and then - upper door), and drive cable fitted with safety pin and flag through doors;			

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 41	In 5 sheets Sheet 5
FUSELAGE	CHECKING OPERATION OF DRAG CHUTE SYSTEM	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction
(f) close doors first with rear lock, and then with front lock by pressing lock heads. index marks on both hexagons should be in closed position; (g) use type KK-1 wire to secure rear lock (hexagon head) to chute door skin Cable fitted with safety pin and warning flag should be withdrawn before flight		

Accessories	Tools
	Combination tool (wrench) 72-7804-435/A Screwdriver, 150 mm Combined multi-purpose pliers, State Standard (ГОСТ) 6547-52

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Supplement to Inspection Guide No. F1	PROCESS CHART No. 42		In 1 sheet Sheet 1
FUSELAGE	CHECKING ATTACHMENT LOCKS AND SCREWS OF FUSELAGE MAINTENANCE ACCESS COVERS		Man-hours required - 3½
Procedure	**Technical requirements**	**Fault correction**	
1. Check condition of locks and special screws which attach maintenance access hole covers to fuselage (both on port and starboard sides). When screwing special screws in or out make use of special screwdriver intended for operations on cross-slitted or curved-slit screws	Note. Carry out inspection of locks and screws after finishing all maintenance operations on fuselage and wing Access cover attachment locks should be intact and closed. When lock is closed, outer end of lock and pin should be flush with skin. Make two red marks on skin opposite lock slit as reference of closed position of lock	If lock pin is depressed (sinks), this means that lock is not closed	
2. Check attachment screws of fuselage access hole covers for tightness	Special screws shall be considered locked correctly if screw cores come out to bear flush with screw heads	If special screw core fails to come out, turn out screw and either repair faulty screw or replace it	

Accessories	Tools
	Screwdriver, special Screwdriver, ordinary Screwdriver for cross-slitted screws

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 43	In 5 sheets. Sheet 1
FUSELAGE	CHECKING ATTACHMENT OF HYDRAULIC CYLINDERS AND HINGE JOINTS OF AIR BRAKES	Man-hours required – 40

Procedure	Technical requirements	Fault correction
1. In cockpit: read pressure gauge indication to make sure the hydraulic fluid pressure in main system is zero	WARNING. To obviate accidents during operations in wells of side (front) air brakes it is forbidden to extend air brakes by working pressure of main hydraulic system (Fig. 95)	
2. Open cross-feed cock in right wheel well; to do this pull cock operating handle and fix it in new position with the aid of special safety lock fitted with red warning flag (Fig. 96) 3. Open (manually) both side (forward) air brakes (Fig. 97)		
4. Open clamp lock on rear air brake and disconnect hydraulic cylinder rod from air brake (Figs 98 and 99, Ref. Nos 1, 2, 3 and 4) 5. Secure air brake in open position by means of wire cord and transverse pin with rubber gasket (Fig. 99, Ref. No. 5) 6. Wash air brake hinge joints, as well as hydraulic cylinder-to-fuselage and hydraulic cylinder rod-to-air brake	WARNING. NEVER lower disconnected rear air brake fully down since otherwise belly skin of fuselage and air brake skin will be damaged	

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Supplement to Inspection Guide No.21	PROCESS CHART No.69	In 5 sheets Sheet 2

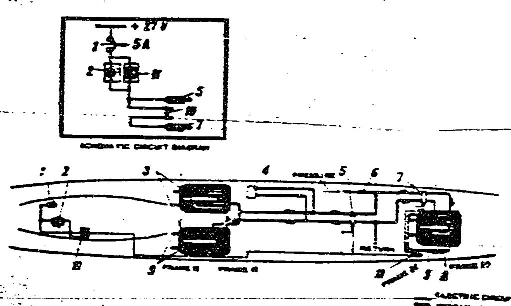

FIG. 95. AIR BRAKE CONTROL SYSTEM

1 – circuit-breaker A3C-5; 2 – [illegible] control button [illegible] on aircraft control stick; 3 – [illegible]; 4 – cross-feed cock; 5 – [illegible] control valve ГА-[illegible]; 6 – [illegible]; 7 – valve ГА-154 [illegible]; 8 – [illegible]; 9 – [illegible]; 10 – [illegible] switch КВ-[illegible] [illegible]; 11 – switch КВ-6 on throttle control lever.

FIG. 96. CROSS-FEED COCK WITH SAFETY LOCK INSTALLED

1 – cross-feed cock; 2 – [illegible]; 3 – [illegible]; 4 – air charging connection.

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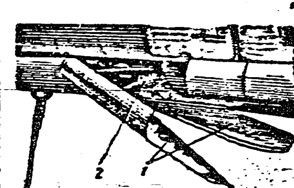
Supplement to Inspection Guide No. 21	PROCESS CHART No. 45	In 5 sheets Sheet 3
FUSELAGE	CHECKING ATTACHMENT OF HYDRAULIC CYLINDERS AND HINGE JOINTS OF AIR BRAKES	Man-hours required – 40

Procedure	Technical requirements	Fault correction
attachment joints with clean gasoline (Figs 100 and 102) 7. Using electric illumination, inspect air brake hinge joints and hydraulic cylinder-to-fuselage and cylinder rod-to-air brake attachment joints to make sure that nuts are reliably tightened, nut locking arrangements and bonding elements are intact and attachment joints are free from cracks 8. Press-charge TSIATIM-201 lubricant into grease fittings of hinge joints and attachment joints of operating rods of front and rear air brakes. Wash and lubricate ball sockets of universal joints which attach cylinders of side air brakes. Access to ball sockets is obtained by removing fairings and armament items. Wash ball sockets with gasoline, use syringe to charge them with MK-8 oil, and coat with TSIATIM-201 lubricant. 9. Having completed all maintenance operations: (a) connect hydraulic cylinder rod to rear air brake and close clamp lock (the order reverse to disassembly);	Cracked parts are not serviceable. Fastening nuts of attachment joints should be screwed right home and locked. Bonding elements should be intact and should neither get into attachment joints nor rub against adjacent parts. WARNING. Upon completion of all operations in air brake wells make sure that cross-feed cock is shut off	In case cracks are suspected remove dubious attachment joint from aircraft and examine it either with magnaflux inspection or paint method. Faulty bonding elements should be replaced  FIG. 97. FRONT (SIDE) AIR BRAKES in EXTENDED POSITION 1 – air brakes; 2 – air brake actuating cylinders.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 43	In 5 sheets Sheet 4
FUSELAGE	CHECKING ATTACHMENT OF HYDRAULIC CYLINDERS AND HINGE JOINTS OF AIR BRAKES	Man-hours required – 40

Procedure	Technical requirements	Fault correction
(b) press air brakes to fuselage; (c) close cross-feed cock in right wheel well; to this end: push valve stem forward and remove safety lock with red warning flag. Acted upon by its spring, valve stem should sink		

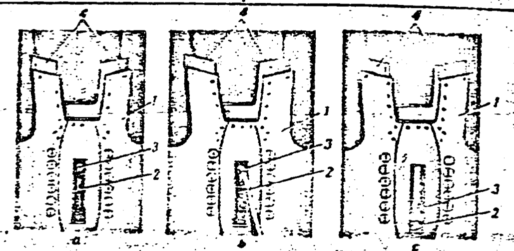

Fig. 88. Rear air brake clamp opening procedure (air brake extended):
a – lock closed; b – lock open; c – clamp with lock opened; 1 – rear air brake; 2 – clamp; 3 – lock; 4 – air brake attachment points.

Accessories	Tools
Inspectoscope (moving mirror for inspection of hard-to-get-at places) Grease cup Syringe Extension lamp ПЛ-36 Safety lock for stem of cross-feed cock of air brake, Б6-2844-ОС	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 43	In 5 sheets Sheet 5

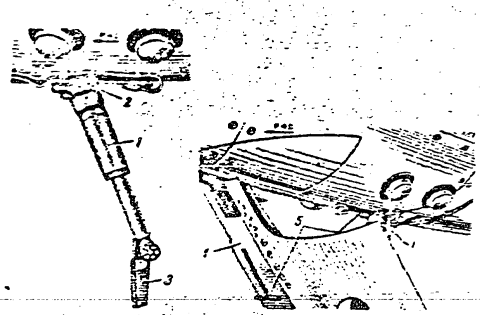

FIG. 99. HYDRAULIC CYLINDER AND REAR AIR BRAKE IN EXTENDED AND FIXED POSITIONS
1 – air brake actuating cylinder, 2 – cylinder attachment joint, 3 – clamp, 4 – air brake, 5 – [illegible] for securing air brake in extended position.

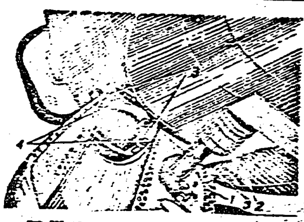

FIG. 100. ATTACHMENT JOINTS OF SIDE AIR BRAKE
1 – air brake, 2 – cylinder, 3 – air brake attachment [illegible], 4 – grease fittings.

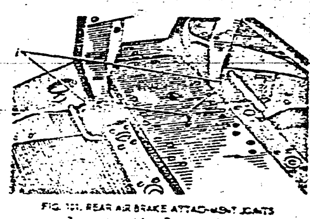

FIG. 101. REAR AIR BRAKE ATTACHMENT JOINTS
1 – attachment joints, 2 – grease fittings.

Supplement to Inspection Guide No. 21	PROCESS CHART No. 44	In 13 sheets Sheet 1
AIRCRAFT CONTROLS	CHECKING CONDITION AND LUBRICATION OF AIRCRAFT CONTROL RODS, BELLCRANKS AND THEIR ATTACHMENT JOINTS, CHECKING БУ-51М (БУ-51МС) and БУ-45 HYDRAULIC BOOSTERS FOR PROPER ATTACHMENT	Man-hours required - 5

Procedure	Technical requirements	Fault correction
1. Turn out screws and remove covers of access holes leading to aircraft control assemblies located in fuselage superstructure, in wing (Fig. 104, Ref. Nos 1, 6, 10 and 12, and Figs 105, 106, 107 and 108) and in fuselage port side (Figs 109 and 110). Turn out screws and remove fairing from АРУ-3В automatic transmission ratio controller (Fig. 111), cover of access hole leading to trimming effect mechanism (Fig. 112) and cover of access hole leading to hydraulic booster БУ-51М (БУ-51МС), see Fig. 113, if they are still on	Note. Stabiliser hydraulic boosters БУ-51М and БУ-51МС are interchangeable. When БУ-51МС booster is installed in place of БУ-51М booster, no friction sleeve is mounted on stabiliser beam	
2. Wash hinge joints of aircraft controls with clean gasoline 3. Inspect control rods, ball bearings of control rods and bellcranks, bellcranks, support rollers of stabiliser, rudder and aileron control systems located in aircraft cockpit, fuselage superstructure, fin, wing and fuselage	Ball bearings of closed type should not be washed with gasoline. These should be wiped externally with clean cloth and sparingly coated with grade ЦИАТИМ-221 lubricant	Should there be no lubricant in closed ball bearing or should binding or crunch be present in rotating bearing, press-charge (by means of syringe) fresh ЦИАТИМ-221 lubricant into ball bearing

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Supplement to Inspection Guide No.21	PROCESS CHART No. 44	In 13 sheets Sheet 2

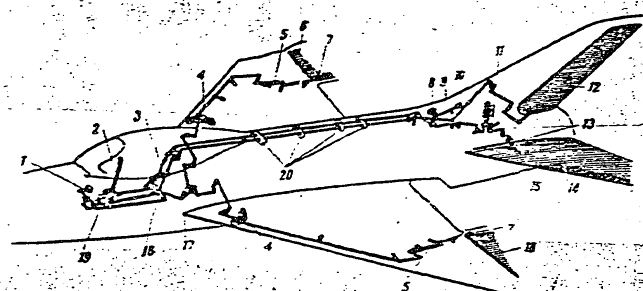

FIG. 102. AIRCRAFT CONTROL SYSTEM
1 – foot control bars; 2 – aircraft control stick; 3 – artificial feel mechanism of aileron control system; 4 – aileron non-linear control mechanism; 5 – aileron hydraulic booster [illegible]; 6 – right aileron; 7 – bellcrank [illegible]; 8 – automatic [illegible] ratio controller [illegible]; 9 – artificial feel mechanism; 10 – trimming effect mechanism; 11 – hydraulic booster [illegible]; 12 – rudder; 13 – stabilizer control bellcrank; 14 – stabilizer; 15 – [illegible]; 16 – left aileron; 17 – fuselage-mounted aileron control system bellcrank; 18 – [illegible]-mounted bellcrank assembly; 19 – aircraft control [illegible] assembly.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 44		In 13 sheets Sheet 3
AIRCRAFT CONTROLS	CHECKING CONDITION AND LUBRICATION OF AIRCRAFT CONTROL RODS, BELLCRANKS AND THEIR ATTACHMENT JOINTS. CHECKING БУ-51М (БУ-51МС) AND БУ-45 HYDRAULIC BOOSTERS FOR PROPER ATTACHMENT		Man-hours required - 3
Procedure	**Technical requirements**	**Fault correction**	
(Figs 102 through 113) During inspection make sure that control rods and bellcranks bear no traces of attrition caused by adjacent bonding elements and aircraft structural members; see to it that locking fittings are intact. Check clearances between stabilizer and rudder control rods and support rollers; make sure roller pins are properly locked	No rubbing of control rods and bellcranks against adjacent parts shall be tolerated. Clearance between control rods and aircraft parts should be not smaller than 5 mm. Eyebolts (end lugs) of control rods should be screwed into control rods up to reference (check) hole in control rod (check this by inserting wire in check hole of control rod. Wire end should, in case of correct position, thrust against eyebolt Support rollers should rotate freely, without jamming. Clearance between rods and rollers should be 0.05 to 0.3 mm	If wire end freely passes through control rod this means that eyebolt (end lug) has been ~~screwed~~ into rod through insufficient depth. In this case remove control rod, measure position of screwed-in eyebolt, release locking nut and screw eyebolt out. If threaded portion of eyebolt is short of check (reference) hole when screwed in, replace faulty eyebolt (end lug). When length adjustments are involved, check general adjustment of corresponding control system. If clearance is smaller or greater than specified, adjust as follows: - unlock eccentric (tetrahedron-headed) bolt on support; - rotate this bolt to obtain required clearance with the aid of clearance gauge	
4. Use grade ЦИАТИМ-221 lubricant to lubricate ball bearings of control rods bellcranks and support rollers of aircraft control systems (Figs 114 and 115)	Elements effected by high temperatures should be greased with grade ЦИАТИМ-221 lubricant		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 44	13 sheets Sheet 4

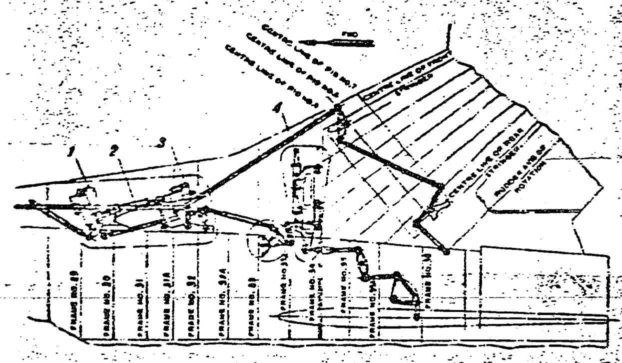

FIG. [illegible]. SCHEMATIC DIAGRAM OF AIRCRAFT CONTROL SYSTEM HOUSED IN FUSELAGE TAIL SECTION

1 – automatic transmission ratio controller APS-28; 2 – artificial feel mechanism; 3 – trimming effect mechanism; 4 – hydraulic booster BU-51M (BU-51MC).

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Supplement to Inspection Guide No.21	PROCESS CHART No. 44	In 35 sheets Sheet 5

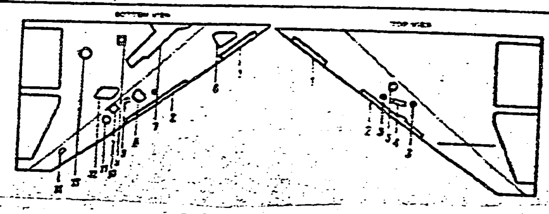

FIG. 154. LAYOUT OF ACCESS HOLES IN WING

1 – non-linear transmission mechanism and aileron bellcrank, 2 – electric supply line of … equipment, 3 – external load attachment fittings, 4 – pressure … unit, 5 – … [illegible] …, 6 – non-linear transmission mechanism; 7 – main L.G. … well, 8 – … [illegible] …, 9 – … [illegible] …; 10 – aileron control bellcrank, 11 – … [illegible] …; 12 – … hydraulic booster … [illegible] …, 13 – flap operating cylinder; 14 – special … [illegible]

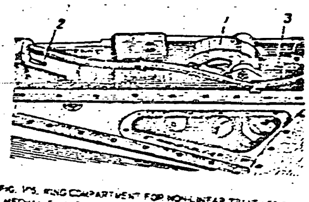

FIG. 155. WING COMPARTMENT FOR NON-LINEAR TRANSMISSION MECHANISM AND AILERON CONTROL BELLCRANK (BOTTOM VIEW)

1 – non-linear transmission mechanism; 2 – aileron control bellcrank; 3 – aileron control rod.

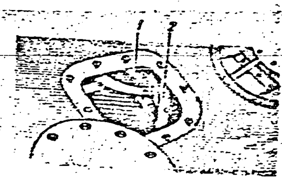

FIG. 156. AILERON CONTROL BELLCRANK (REF. No.1) AND ROD (REF. No.2) IN WING (AS VIEWED THROUGH UNDERSURFACE ACCESS HOLE IN WING PANEL)

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Supplement to Inspection Guide No.21	PROCESS CHART No. 44	In 23 sheets Sheet 6

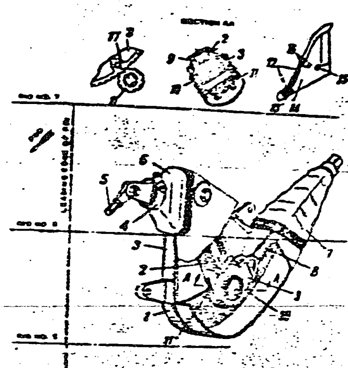

FIG. 107. NON-LINEAR TRANSMISSION MECHANISM OF RUDDER CONTROL SYSTEM

1 – [illegible], 2 – bellcrank; 3 – bracket with toothed sector; 4 – yoke; 5 – control rod [illegible]; 6 – sealing boot; 7 – sealing boot; 8 – control rod; 9 – [illegible]; 10 – eccentric; 11 – gear; 12 – [illegible]; 13 – [illegible] automatic [illegible] controller [illegible]; 14 – [illegible] non-linear transmission mechanism [illegible]; 15 – access [illegible] to rudder control bellcrank; 16 – non-linear transmission mechanism frame attachment bolts; 17 – and [illegible] marks on sectors and gears used during mechanism assembling operations

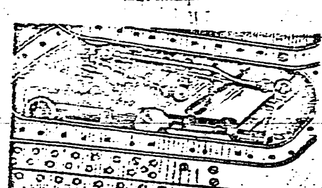

FIG. 108. WING COMPARTMENT FOR БУ-45 HYDRAULIC BOOSTER AND PIPELINES OF AILERON CONTROL HYDRAULIC SYSTEM (BOTTOM VIEW)

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 44	In 15 sheets Sheet 7
AIRCRAFT CONTROLS	CHECKING CONDITION AND LUBRICATION OF AIRCRAFT CONTROL RODS, BELLCRANKS AND THEIR ATTACHMENT JOINTS. CHECKING BY-51M (BY-51MC) AND BY-45 HYDRAULIC BOOSTERS FOR PROPER ATTACHMENT	Man-hours required - 3

Procedure	Technical requirements	Fault correction
<u>Checking APY-3B Automatic Transmission Ratio Controller System During Airspeed and Altitude Function Adjustments</u> (this work should be performed by special equipment specialists collectively with airframe specialists)		
1. In cockpit: turn on AUTOMATIC TRANSMISSION RATIO CONTROLLER (АВТОМАТ ПЕР. АРУ) circuit-breaker on right-hand console and make sure that APY operating mode selector switch on left-hand console is in AUTO (АВТОМАТ) position	1. Check functioning of automatic transmission ratio controller system with aircraft control stick released	
2. Disconnect static line from MPE-106 transmitters to this end, uncouple U-shaped pipe bearing inscription "MPE-106" from connections on starboard side and connect transmitter through adapter No. 72-7702-170 to hose of KIY-3 tester	2. When APY controller operating rod is reset from LOW SPEED (МАЛАЯ СКОРОСТЬ) to HIGH SPEED (БОЛЬШАЯ СКОРОСТЬ) and back, stabilizer leading edge will slightly deflect downward or upward, respectively; this will be accompanied by deflection of aircraft control stick	
3. Connect one KIY-3 tester to dynamic opening of pitot-static tube, and another KIY-3 tester - to static openings of pitot-static tube	3. Remember that APY automatic control system is calibrated at standard atmospheric conditions; readings of APY indicator pointer	

Supplement to Inspection Guide No. 21	PROCESS CHART No. 44	In 13 sheets Sheet 8
AIRCRAFT CONTROLS	CHECKING CONDITION AND LUBRICATION OF AIRCRAFT CONTROL RODS, BELLCRANKS AND THEIR ATTACHMENT JOINTS. CHECKING BY-51M (BY-51MC) AND BY-45 HYDRAULIC BOOSTERS FOR PROPER ATTACHMENT	Man-hours required – 3

Procedure	Technical requirements	Fault correction
4. In cockpit: set dynamic line selector cock of pitot-static tube ПВД and pitot tube ТП-156 on left-hand console to OPERATING (РАБОЧ.) position 5. Operating from right-hand console in cockpit turn on STORAGE BATTERY, AIRCRAFT-GROUND circuit-breaker: this should result in illumination of STABILIZER FOR LANDING (СТАБИЛ. НА ПОСАД.) indicator light on T-4 light indication panel 6. Engage ground hydraulic pump and build up working pressure in hydraulic booster system	will differ from those of aircraft altimeter pointer As soon as APY indicator pointer in its clockwise movement reaches 650 km/hr IAS, indicator light at T-4 indication panel should go out.	 FIG. [illegible]. MOUNTING POSITION OF AILERON CONTROL BELLCRANKS IN FUSELAGE BETWEEN FRAMES Nos [illegible] AND [illegible] (AT FUSELAGE PORT SIDE) 1 – aileron control rod; 2, 3 and 4 – aileron control bellcranks; 5 – [illegible] valve of cockpit pressurization system.
7. Build up gauge (excessive) pressure in dynamic line and gradually increase it to a value corresponding to 1010 km/hr IAS 8. Create vacuum in static line by gradually decreasing pressure to a value corresponding to 10,000 m altitude; then increase pressure to a value corresponding to 5000 m altitude	Operating rod of APY controller should assume HIGH SPEED position In position corresponding to 10,000 m altitude APY controller rod should assume LOW SPEED position. At value corresponding to 5000 m altitude APY operating rod should assume HIGH SPEED position	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 44	In 13 sheets Sheet 9

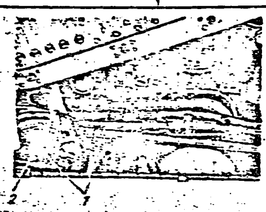

FIG. [illegible] POSITION OF ENGINE CONTROL BELLCRANK IN FUSELAGE
1 – engine control rod; 2 – bellcrank.

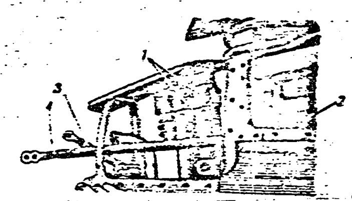

FIG. [illegible] POSITION OF [illegible] AUTOMATIC TRANSMISSION RATIO CONTROLLER
1 – [illegible] controller, 2 – [illegible] feel mechanism, 3 – [illegible] control rod, 4 – rudder control rod.

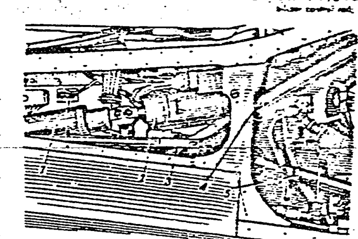

FIG. [illegible] POSITION OF TRIMMING EFFECT MECHANISM
1 – [illegible] feel mechanism, 2 – [illegible] effect mechanism; 3 and 4 – rudder control rods, 5 – [illegible] control rod.

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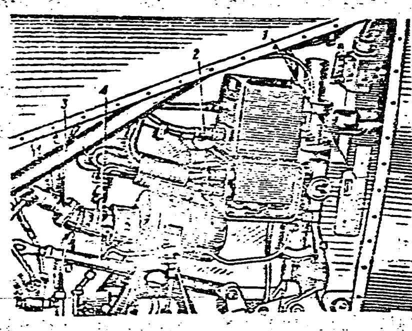

FIG. [illegible]. POSITION OF [illegible] HYDRAULIC BOOSTER AND [illegible] PUMP STATION
1 — hydraulic booster [illegible]; 2 — pump unit [illegible]; 3 — rudder control rod; 4 — stabilizer control rod.

Supplement to Inspection Guide No.21	PROCESS CHART No. 44	In 13 sheets Sheet 11

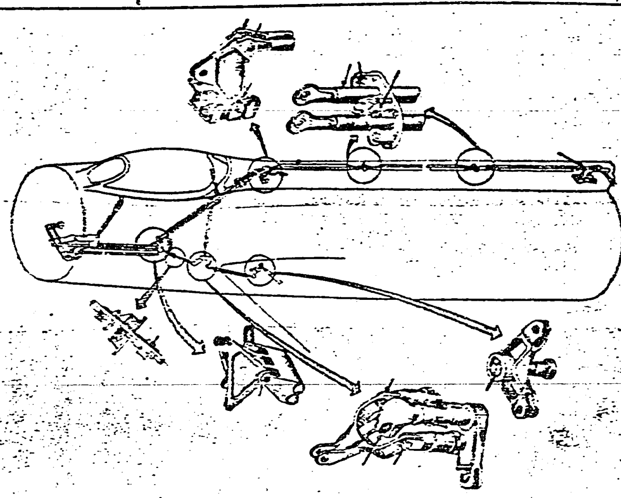

FIG. 114. LUBRICATION POINTS OF AIRCRAFT CONTROL SYSTEM JOINTS IN FUSELAGE NOSE SECTION SHOWN BY ARROWS.

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Supplement to Inspection Guide No.21	PROCESS CHART No. 44	In 23 sheets Sheet 12

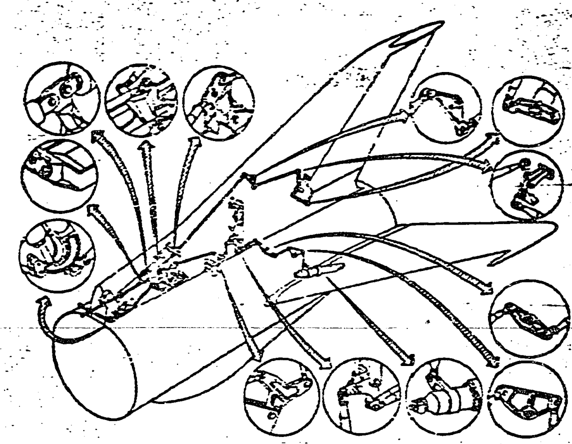

FIG. 115 LUBRICATION POINTS OF AIRCRAFT CONTROL SYSTEM JOINTS IN FUSELAGE TAIL SECTION SHOWN BY ARROWS

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 44	In 23 sheets Sheet 13
AIRCRAFT CONTROLS	CHECKING CONDITION AND LUBRICATION OF AIRCRAFT CONTROL RODS, BELLCRANKS AND THEIR ATTACHMENT JOINTS. CHECKING BU-51M (BU-51MC) AND BU-45 HYDRAULIC BOOSTERS FOR PROPER ATTACHMENT	Man-hours required - 3

Procedure	Technical requirements	Fault correction
Make sure that APY indicator readings are correct (by altitude scale)		
9. Check full resetting of operating rod (from one extreme position to the other)	Time of full resetting of operating rod should not exceed 22 sec	
10. Unplug connections and connect U-shaped pipe to connections		
11. Coat APY automatic transmission ratio controller operating rod with thin layer of CKS-122-7 lubricant		
12. Re-install covers of access holes and fasten them in place with screws		

Accessories	Tools
Syringe Grease cup Clearance gauge with set of feeler blades	Screwdriver for cross-slitted screws Screwdriver, ordinary Pliers, multi-purpose

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 45	In 2 sheets Sheet 1
AIRCRAFT CONTROLS	CHECKING PLAY IN RUDDER, STABILIZER AND AILERON CONTROLS	Man-hours required - 0.15

Procedure	Technical requirements	Fault correction
1. Fix aircraft control stick in neutral position 2. Shake aileron by its trailing edge section and check aurally to make sure that there are no knock-accompanied plays in aileron control assemblies and that control rods and bellcranks are not caught by elements of wing (check with aileron hydraulic booster БУ-45 engaged) 3. Shake rudder by its trailing edge section and check aurally to make sure that there are no knock-accompanied plays in rudder control assemblies and that control rods and bellcranks are not caught by elements of wing	Absence of plays in control rod and bellcrank hinges will be determined by absence of knocking sound in control assemblies when ailerons (or rudder) are energetically hand-moved by their trailing edge. No knocking in hinges shall be tolerated	In case of knocking sound locate faulty assembly and replace bolt or bellcrank

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 45	In 2 sheets Sheet 2
AIRCRAFT CONTROLS	CHECKING PLAY IN RUDDER, STABILIZER AND AILERON CONTROLS	Man-hours required - 0.[illegible]

Procedure	Technical requirements	Fault correction
4. Moving aircraft control stick forward and backward and checking aurally make sure that there are no knock-accompanied plays in stabiliser control assemblies and that control rods and bellcranks are not caught by elements of fuselage		

Accessories	Tools
	Flat-nose pliers Screwdriver Screwdriver for cross-slitted screws

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 45	In 1 sheet Sheet 1
AIRCRAFT CONTROLS	CHECKING WEIGHT BALANCERS OF STABILIZER AND RUDDER FOR PROPER ATTACHMENT	Man-hours required – 5

Procedure	Technical requirements	Fault correction
1. Rock (manually) end portion of stabilizer weight balancers to check them for proper attachment to stabilizer 2. Rock (manually) end portion of rudder weight balancer to check it for proper attachment to rudder	Secure attachment of balancers should be determined by condition of rivets which fasten balancer skin to stabilizer (or rudder) skin Noticeable sinking of rivets, as well as their loose seating in skin shall not be tolerated	

Accessories	Tools
	Screwdriver for cross-slitted screws Screwdriver, ordinary

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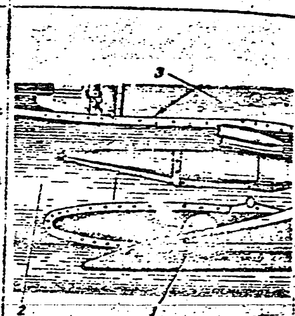
Supplement to Inspection Guide No. 21	PROCESS CHART No. 47	In 4 sheets Sheet 1
AIRCRAFT CONTROLS	LUBRICATION OF STABILISER BEAM BEARINGS AND CHECKING STABILISER FRICTION MOMENT	Man-hours required – 1.5

Procedure	Technical requirements	Fault correction
1. Lower stabiliser with leading edge down 2. Open cover of access hole leading to bearing (Fig. 116) 3. Force [illegible]-201 lubricant into outer and inner bearings of stabiliser with the aid of syringe (Fig. 117) 4. Remove fairings located under stabiliser to obtain access to stabiliser control rods and bellcranks (Fig. 118) 5. Disconnect control rods from bellcranks, and bonding elements – from stabiliser control rod (Fig. 119) 6. Fasten special screw clamp on one of stabiliser sections (halves) (Figs 120 and 121) 7. Deflect trailing edge of one stabiliser section to extreme upper position (leading edge down) 8. Hook dynamometer to screw clamp and lower stabiliser section by 50 to 70 mm, and then pull dynamometer handle down in direction normal to stabiliser chord	When lubricating bearings see to it that [illegible]-201 lubricant does not get into friction damper Remember that: (a) at low temperatures friction in stabiliser joints is increased and therefore greater effort is required to deflect stabiliser; after engine warm-up stabiliser-deflecting effort is back to normal; (b) indicated in Certificate of damper is friction moment obtained during stand trials of individual friction damper; (c) in the course of aircraft operation, as flying hours are accumulated, friction force moment of damper may increase to 12 kg-m;	 FIG. 1?? POSITION OF STABILIZER DURING PRESSURE LUBRICATION OF BEAM BEARINGS 1 – [illegible]; 2 – [illegible]; 3 – [illegible]

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Supplement to Inspection Guide No.21	PROCESS CHART No. 47	In 4 sheets Sheet 2

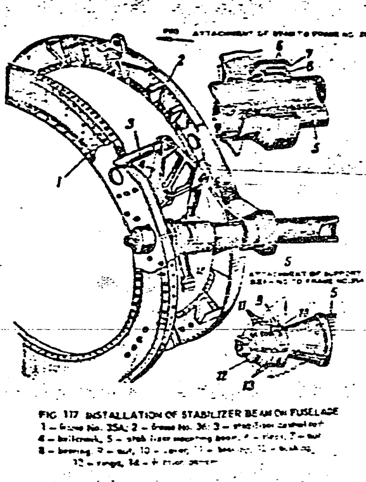

FIG. 117 INSTALLATION OF STABILIZER BEAM ON FUSELAGE
1 – frame No. 35A; 2 – frame No. 36; 3 – [illegible] control rod; 4 – bellcrank; 5 – stabilizer mounting beam; [illegible]; 7 – nut; 8 – bearing; [illegible] – nut; 10 – [illegible]; [illegible]; 13 – [illegible]; 14 – [illegible]

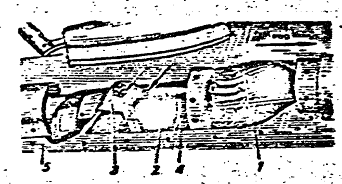

FIG. 118. STABILIZER CONTROL BELLCRANKS AND RODS AS SEEN WITH FAIRING REMOVED
1 – bellcrank; 2 – control rod; 3 – bellcrank; 4 – frame No. 35A; 5 – frame No. 36.

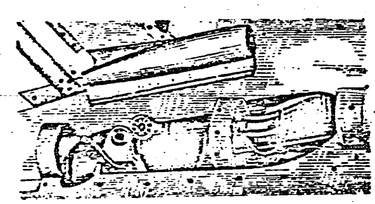

FIG. 119. POSITION OF CONTROL ROD DISCONNECTED FROM BELLCRANK AND OF BONDING ELEMENT DISCONNECTED FROM CONTROL ROD

Supplement to Inspection Guide No.21	PROCESS CHART No. 47	In 4 sheets Sheet 3

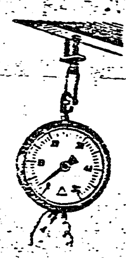

FIG. 120. POSITION OF DYNAMOMETER DURING STABILIZER FRICTION MOMENT TEST

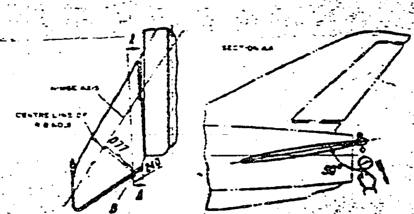

FIG. 121. MOUNTING TESTING FIXTURE ON AIRCRAFT

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 47	In 4 sheets Sheet 4
AIRCRAFT CONTROLS	LUBRICATION OF STABILIZER BEAM BEARINGS AND CHECKING STABILIZER FRICTION MOMENT	Man-hours required – 3.45

Procedure	Technical requirements	Fault correction
9. Note reading of dynamometer at which stabilizer trailing edge begins to deflect down 10. Connect control rods with stabilizer control bellcranks and safety with cotter pins (see Fig. 118) 11. Re-mount fairing and access hole panels, and fasten them with screws	(d) trailing edge of stabilizer should be started into downward movement by effort of 13 to 21 kg as stabilizer moves. Stabilizer movement starting moment is not taken into consideration; (e) friction moment less than 10 kg-m should not be tolerated	

Accessories	Tools
Grease cup 72-7804/1A0 Friction moment test fixture (screw clamp), 86-9872-00 Syringe Dynamometer	Screwdriver for cross-slitted screws

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 1
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required – 1.3

Procedure	Technical requirements	Fault correction
Checking Operation of Diaphragm Valve and Remover Gun of Canopy Emergency Jettison System **From Ejection Seat Face Blind** 1. Open canopy, unload remover gun and charge it with two dummy cartridges (charges) fitted with primer caps 2. Relieve air pressure from main air system and from canopy lifting bottle to zero. Bleed air with the aid of special fixture (fixture for testing pressure in canopy lifting bottle through connection located in nosewheel leg well. Check air pressure by cockpit-mounted pressure gauges and by pressure gauge installed on device (Figs 122 and 123)	WARNING. During all operations in cockpit with seat demounted always have safety flooring laid. Unload and charge gun collectively with ordnance specialist	
3. Charge canopy lifting bottle with compressed air using the same device	Air pressure in canopy lifting bottle should be within 50 to 60 kg/cm^2. Pressure in main air system should be zero. If these requirements are met, this means that non-return valve operates normally	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 48	In 20 sheets Sheet 2

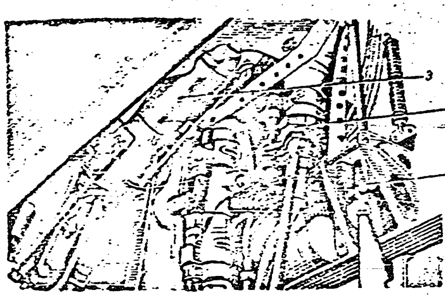

FIG. 122. CONNECTIONS IN NOSEWHEEL STRUT WELL USED FOR COCKPIT AIRTIGHTNESS CHECKS
1 – connection for cockpit airtightness check; 2 – nosewheel doors extension and retraction control assembly; 3 – L.G. nosewheel [illegible] actuating cylinder

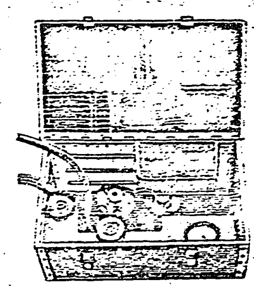

FIG. 123. COCKPIT AIRTIGHTNESS TEST DEVICE

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 3
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required – 9.30

Procedure	Technical requirements	Fault correction
4. Take seat in cockpit and lock canopy. Withdraw ground safety lock from autonomous canopy jettison handle so that it would not hamper checkout operations		
5. Briskly pull seat blind and check aurally that diaphragm valve and dummy charges of remover gun are actuated; make certain that locking wire on these and on trigger is broken loose	Pulling blind should initiate air supply through punctured diaphragm of valve to pneumatic lifting cylinders to build up canopy removing (tossing) pressure Canopy locks should go open after blind is pulled through 115 to 140 mm, and explosive charge-actuated mechanism should be operated after 255^{+30}_{-10} mm travel of blind; total travel of blind should be 336^{+20}_{-10} mm.	
6. Relieve air from canopy pneumatic lifting cylinders and remover (tossing) system with the aid of fixture for testing pressure in canopy pneumatic lifting bottle	Effort applied to blind at explosive charge-actuated mechanism operation moment should not exceed 30 kg	
7. Open canopy manually; to this end: (a) turn canopy controls (Fig.124) backward (having retained control handle in STOP (СТОП) position);	WARNING. Never open canopy before air pressure in canopy pneumatic lifting cylinders is relieved	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48		In 26 sheets Sheet 4
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM		Man-hours required – 9.30
Procedure	**Technical requirements**	**Fault correction**	
(b) the man sitting in cockpit should lift manually rear part of canopy and the man operating from outside should lift canopy to required position. Install ground safety locks in operating rods of canopy lifting cylinders			
2. Remove diaphragm assembly; act as follows: (a) demount right-hand side screen (panel) and move right-hand section of instrument panel aside; (b) screw off nut of valve inlet connection and remove pipe with filter;			
(c) remove two valve attachment bolts and valve; (d) screw out inlet connection (from diaphragm side). Make sure that valve diaphragm is smashed and that primer caps of dummy charges are punctured (Figs 125 and 126)	Diaphragm should be broken over an area not smaller than 50% of pipeline section area		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 48	In 20 sheets Sheet 5

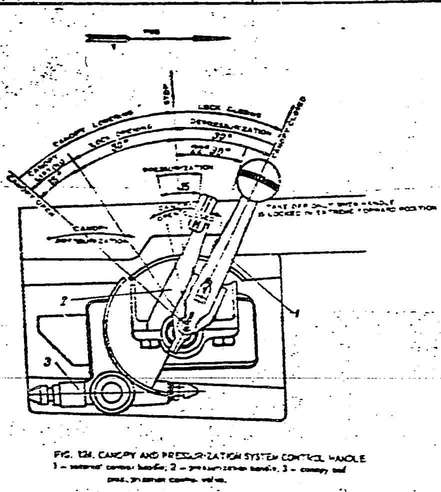

FIG. 124. CANOPY AND PRESSURIZATION SYSTEM CONTROL HANDLE
1 – [illegible] control handle; 2 – pressurization handle; 3 – canopy and pressurization control valve.

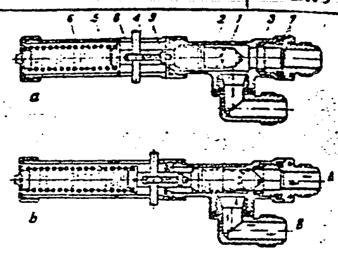

FIG. 125. DIAPHRAGM VALVE OF CANOPY LIFTING (TOSSING) SYSTEM
1 – valve body; 2 – striker; 3 – [illegible]; 4 – pin; 5 – tube; 6 – spring; 7 – sealing gaskets; 8 – roller; 9 – [illegible]; A – to lifting cylinders; B – from emergency bottle P = 110–130 kg/cm²

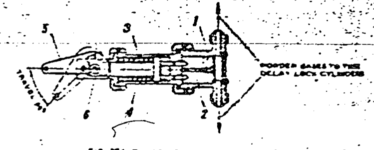

FIG. 126. CANOPY EMERGENCY REMOVER GUN
1 – body with two connections; 2 – explosive charge [illegible]-1; 3 – striker; 4 – operating spring. 5 – trigger lever; 6 – pin.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 6
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required - 9.30

Procedure	Technical requirements	Fault correction
9. Clean diaphragm valve and filter from particles of broken diaphragm with compressed air, install new diaphragm in valve and screw on connection 10. Set diaphragm valve at operating position and safety it with MIK-0.5 locking wire	When replacing diaphragm in valve remember that bushing which carries diaphragm should be set with its taper portion inside valve; this is done to prevent breaking of diaphragm by sharp (taper) edges of body during assembly	
11. Return canopy emergency jettison system to initial position and lock it From Canopy Autonomous Jettison Handle 12. Unload remover gun, load it with dummy charges and lock with MIK-0.5 wire		
13. Charge additionally bottle of canopy lifting system with compressed air using special fixture for this purpose.	Air pressure in canopy lifting (tossing) system bottle should be 50 to 60 kg/cm^2	
14. Check operation of diaphragm valve and remover gun from canopy emergency jettison handle; to this end: (a) withdraw ground safety pins from operating rods of canopy lifting pneumatic cylinders; (b) lock canopy;		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48		In 20 sheets Sheet 7
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM		Man-hours required - 1.5
Procedure	**Technical requirements**	**Fault correction**	
(c) turn canopy emergency jettison handle fully down (to horizontal position); this should result in breakage of locking wire on handle and diaphragm valve, and in operation of diaphragm valve (diaphragm valve operates when handle is turned down by 45°);			
(d) slowly pull canopy emergency jettison handle backward as far as it will go: this should result in breakage of trigger locking wire	Moving handle through 25 to 30 mm will result in puncturing of primer caps of remover gun dummy charges; further movement of handle by 35 to 40 mm unblocks seat ejection gun. Travel margin of handle in this case should be at least 5 mm.		
15. Bleed air from canopy lifting cylinders and lifting system using special fixture for checking charging pressure of canopy lifting system bottle			
16. Manually open canopy acting as follows:			
- turn canopy control handle backward (having retained handle in STOP position)			

Supplement to Inspection Guide No. 21	PROCESS CHART No. 48		In 20 sheets Sheet 8
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM		Man-hours required – 9.30
Procedure	**Technical requirements**	**Fault correction**	
– the man sitting in cockpit should lift rear part of canopy and the man operating from outside of cockpit should lift canopy farther upward to required position			
Re-install ground safety pins into operating rods of canopy lifting cylinders 17. Carry out operations described under Points 8, 9, 10 and 11 of present Process Chart <u>Checking Operation of Emergency Lock Opening System</u> <u>From explosive charge-actuated system</u> 1. Remove canopy movable section as follows: (a) open cover of fuselage upper front access (hatch); (b) disconnect rubber hose of de-icer system manifold and remove manifold from front glass panel of canopy;			

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 9
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required - 9.30

Procedure	Technical requirements	Fault correction
(c) open canopy, detach spring hook of seat ejection gun blocking system and make sure that ground safety pins are installed in seat ejection gun and canopy remover gun; (d) retaining canopy with hands withdraw pins from operating rods of canopy lifting cylinders and remove ground safety pins from operating rods; (e) operating from cockpit close canopy by placing control handle to STOP position; (f) remove two bolts of front hinge locks of canopy; (g) operator sitting in cockpit should lift alternately front and then rear part of canopy; meanwhile two operators should demount canopy from aircraft. Canopy mounting is the reverse of demounting		
2. Place canopy on special trestles with provision for access to lock loops	NEVER place canopy to rest on lock loops	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 10
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required - 9.30

Procedure	Technical requirements	Fault correction
Suspend 5 to 10 kg weight (equal for each lock) to each lock loop as shown in Fig.127		
3. Remove fairing from time delay locks. Remove AMtsT-1.6 locking wire and clean thiocol compound from locks		
4. Screw locking plunger from remover gun and connect special fixture for checking canopy lock operation to remover gun body (Fig. 128). Couple ground air bottle to fixture	Air fed to cylinder should operate lock emergency opening system, lock loops should clear locks, front hinge locks should go open, and rods of time delay locks should move to LOCKS CLOSED position which will be determined by extension of operating rods from pneumatic cylinders (see Fig.128, Ref. No. 4)	
5. Open bottle valve and, using pressure regulator, build up 6 kg/cm^2 pressure: this should result in breakage of locking wire on locks opening cylinders		
6. Close side locks of canopy (Fig.129); to do this: (a) fit loop 2 into each side lock, turn arm 6 down and move down locking	WARNING. Protect lock loops from denting and other damage when they drop.	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 42	In 20 sheets Sheet 21

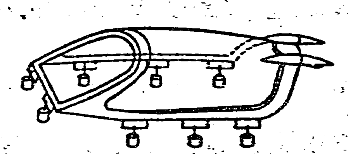

FIG. 127. SUSPENDING WEIGHTS FROM CANOPY LOCK LOOPS

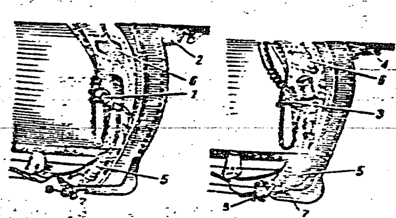

FIG. 128. CHECKING CANOPY EMERGENCY JETTISON SYSTEM
1 and 2 – canopy emergency remover gun; 2 and 4 – time delay lock; 5 – lock emergency opening cylinder; 6 – Tee-connection; 7 – cable running to canopy emergency jettison control handle; 8 – loop of right rear lock No. 6.
Left illustration shows position of ... remover gun.
Right illustration shows device 3 attached to remover gun body; emergency automatic unlock system operates after air supply, lock loops separate from canopy and time delay lock operating rods move toward LOCKS CLOSED position as is seen from illustration (operating rods have extended from cylinders, Ref. No. 4).

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Supplement to Inspection Guide No.21	PROCESS CHART No. 48	In 20 sheets. Sheet 12

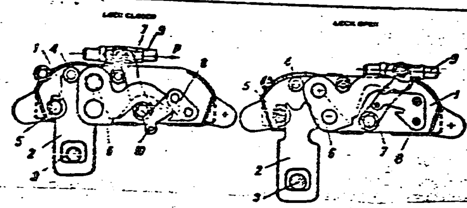

FIG. 129. SIDE EMERGENCY LOCK AND POSITION OF SPRING-LOADED CATCH
1 – lock body; 2 – lever; 3 – pin; 4 – lock housing; 5 – lock pin; 6 – arm; 7 – [illegible]crank; 8 – locking lever; 9 – emergency unlock (canopy jettison) system control rod; 10 – attachment hole for weight or spring-loaded catch.

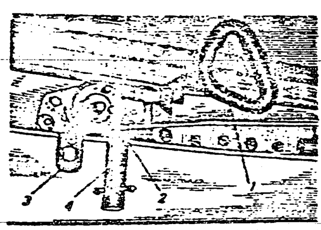

FIG. 130. DUPLICATING CANOPY EMERGENCY JETTISON SYSTEM MECHANISM WITH COVER REMOVED
1 – handle, 2 – roller; 3 – lock stop; 4 – spring-loaded catch.

Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 13
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required – 9.X

Procedure	Technical requirements	Fault correction
lever 6 by pulling it out with the aid of thin (0.8 to 1 mm) wire (attach wire end to hole 10 in lever); (b) install spring-loaded catches with spring tension of 3 to 5 kg hooking them by lever attachment lug (see Fig.129). Next close front hinge locks (Fig.131) as follows: – move bigger hook 2 and locking lever 4 backward and force both bell-cranks 7 forward simultaneously. As a result, system of control rods and bell-cranks moves forward and locks become closed	Numbers of loops should correspond to numbers of locks: Right side (towards aircraft nose): (a) front side No. 2; (b) middle side No. 4; (c) rear side No. 6 Left side (towards aircraft nose): (a) front side No. 1; (b) middle side No. 3; (c) rear side No. 5	If numbers are missing on locks, make them in red paint on lock undersurfaces in accordance with loop number
7. Close time delay locks (Fig.132); to this end: using screwdriver sink rods 2 of time delay locks, align locking holes and safety elements with	Check closing of side and front locks: (a) loops 2 (see Fig. 129) of side locks should not slip out; (b) arm 6 (see Fig.129) should not rotate	If loops slip out or arms rotate, check lock closing procedure again

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 1A
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required- 9.30

Procedure	Technical requirements	Fault correction
type AMR-1.6 locking wire (Ref. No. 8). Fill hook holes with thiocol compound, grade JB. Install fairings on locks		
From Handle of Duplicating Canopy Emergency Jettison System 8. Suspend 5 to 10-kg weights from loops of canopy emergency locks as instructed in Point 2 above		
9. Grip handle of duplicating canopy emergency system and energetically pull it; this action should result in breakage of locking wire (Fig. 130)	When energetically pulled, duplicating system control handle should go loose and separate from canopy. Under gravity of weights loops leave lock seats, front hinge locks go open	
10. Return emergency lock opening system to initial position and close side and front locks of canopy as instructed in Point 6 above		
11. Remove cover from duplicating canopy emergency jettison control system, install handle in mechanism and attach it to roller (see Fig. 130). Close mechanism cover and safety it in place	4-mm dia. holes in handle body and in roller inside body should be aligned and cable ball should fit into recess	

Supplement to Inspection Guide No.21	PROCESS CHART No. 48	In 20 sheets Sheet 15

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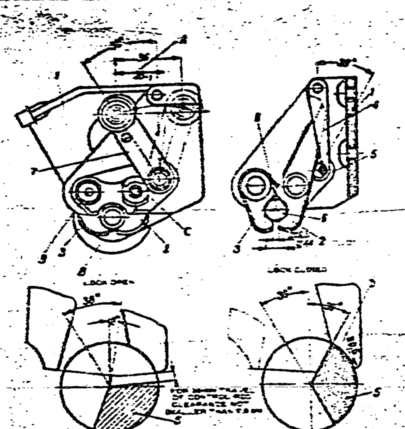

FIG. [illegible] FRONT HINGE LOCK OF CANOPY.

1 – bracket; 2 – [illegible] hook; 3 – [illegible] hook; 4 – [illegible] lever; 5 – shaft; 6 – [illegible] of canopy-carrying panel; 7 – [illegible]; 8 – guide collars; 9 – [illegible].

A – [illegible] travel of rod. Position in which lock should be open. [illegible] B – no clearance is allowed. Check for [illegible] C – during [illegible] [illegible]

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 16
CANOPY AND COCKPIT	[illegible] OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required - 9.30

Procedure	Technical requirements	Fault correction
12. Again suspend the same weights (5 to 10 kg) from lock loops as has been instructed above		
13. Grip handle and slowly pull it; as soon as all locks go open, discontinue handle pulling and make reference mark on handle cable; then pull handle until it completely separates from roller	Travel margin of handle cable should be 5 mm	
14. Set system to initial position (close locks as instructed in Point 6 of present Process Chart)		
15. Wash and lubricate parts of canopy locks and of canopy emergency jettison mechanism on fuselage and canopy	Upon completion of all checks on canopy removal system and after lock opening checks charge canopy remover gun with two live charges. When charging remover gun make sure that big nut is screwed right home but is at least 0.5 mm short of fastening yoke butt end. Otherwise striker will have a clearance which will cause misfiring	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 48	In 20 sheets Sheet 17

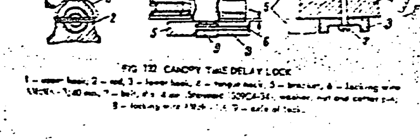

FIG 132 CANOPY TIME DELAY LOCK

1 – upper hook, 2 – rod, 3 – lower hook, [illegible] – tongue hook, 5 – bracket, [illegible] – locking wire [illegible] 40 mm, [illegible] – bolt, [illegible] washer, nut and cotter pin; [illegible] – locking wire [illegible] – axle of lock.

Supplement to Inspection Guide No.21	PROCESS CHART No. 6[illegible]	In 20 sheets Sheet 18

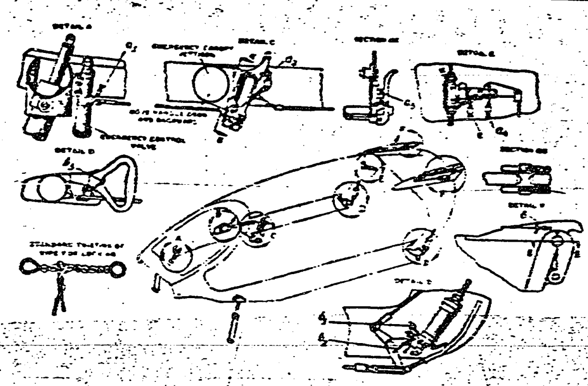

FIG. 1[illegible]. LOCKING FITTINGS OF CANOPY EMERGENCY SYSTEMS (COCKPITS WITH B[illegible]-ACTUATED EJECTION SEATS) [illegible]

Note. [illegible]

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Supplement to Inspection Guide No.21	PROCESS CHART No. 48	In 20 sheets Sheet 19

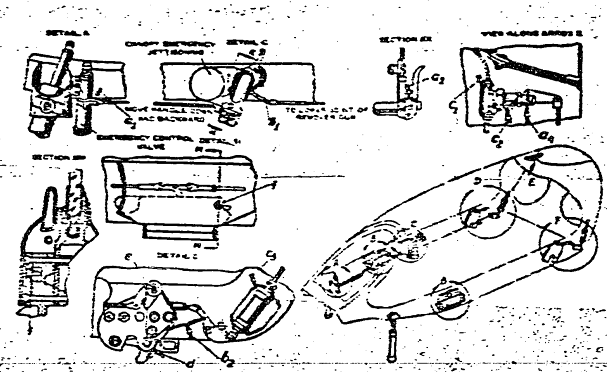

FIG. 134. LOCKING FITTINGS OF CANOPY EMERGENCY SYSTEMS (COCKPITS WITH TYPE [illegible] EJECTION SEATS)

a_1, a_2 and a_3 – secure with locking wire [illegible]; b_1 and b_2 – secure with locking wire KCK-0.5; c_1 and c_3 – secure with locking wire KCK-0.8, 150 mm long; c_2 – secure with locking wire KCK-0.8, [illegible] mm long; [illegible] – secure with locking wire KCK-1, 150 mm long; [illegible] – secure with locking screw [illegible], [illegible]; [illegible] – secure with screw E6-[illegible], [illegible] screw [illegible] pigment paste [illegible].

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 48	In 20 sheets Sheet 20
CANOPY AND COCKPIT	CHECKING OPERATION OF CANOPY EMERGENCY JETTISON SYSTEM	Man-hours required - 9.30

Procedure	Technical requirements	Fault correction
16. Safety system of locks and lock control mechanisms (Figs 133 and 134)	Lockwire following parts: (a) rear lock bellcranks; (b) remover gun; (c) diaphragm valve of canopy emergency jettison system; (d) duplicating canopy emergency jettison control handle; (e) canopy emergency jettison control handle; (f) time delay lock	

Accessories	Tools
Fixture for checking canopy emergency jettison system, CH7/2-98208-00 Fixture for checking canopy opening locks, 74-9826-00	Pliers, multi-purpose Wrenches: 14 x 17, 5 x 7 and 19 x 22 Screwdriver

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49	In 8 sheets Sheet 1
CANOPY AND COCKPIT	REMOVAL OF BLIND-ACTUATED EJECTION SEAT FROM AIRCRAFT, WASHING, INSPECTION AND LUBRICATION OF MECHANISM MOVING PARTS AND CABLES	Man-hours required - 0.45

Procedure	Technical requirements	Fault correction
<u>Precautionary Measures</u> Make sure that ejection gun of seat is unloaded (if no firing has been made) 1. If canopy has not been removed, lift it and move engine control lever forward	[illegible]. Ejection seat may be removed from aircraft after ejection gun has been operated by armament specialist	
2. Remove blocking ball out of funnel of ejection gun cylinder (Fig.135, Ref.19) 3. Disconnect safety pin of ejection gun from rod of ejection control cable 4. Unfasten snaphook of pull cord for AD-3 time release mechanism from yoke on frame		
5. Disconnect cable running to diaphragm valve		
6. Install tightening clamp on ejection seat stabilizing [illegible] to prevent flaps from opening when removing seat from aircraft. 7. Withdraw inserts which fasten upper shackle of headrest to ejection gun journals		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49	In 8 sheets Sheet 2
CANOPY AND COCKPIT	REMOVAL OF [illegible]-ACTUATED EJECTION SEAT FROM AIRCRAFT, WASHING, INSPECTION AND LUBRICATION OF MECHANISM MOVING PARTS AND CABLES	Man-hours required - 0.45

Procedure	Technical requirements	Fault correction
8. Remove ejection seat from aircraft. When lifting seat along guide rails, make sure that OPK-2 common connector (Fig.135, Ref.13) can be easily disconnected. Install ejection seat on special bench		
9. Wash all hinged connections of seat mechanisms with clean gasoline and blow them off with compressed air		
10. Inspect seat frame, particularly its welded seams for cracks; examine hinges and cables for condition, corrosion and broken strands of cable (Fig. 135)	If cracks are found in seat frame, seat should be withdrawn from service. Hinged joints should rotate without binding. All strands of cables should be sound	Cables with broken strands should be replaced with new ones
11. On seat examine shoulder and waist belt restraint mechanisms 4 and 14 and foot grip release mechanism 9	Harness belts should have no ruptures. Cable strands of harness lock should be sound and securely attached to harness unlock mechanism handle	
12. Check operation of harness belts restraint mechanisms and AD-3 time release mechanism foot-grip release system as follows:		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49	In 8 sheets Sheet 3
CANOPY AND COCKPIT	REMOVAL OF BLIND-ACTUATED EJECTION SEAT FROM AIRCRAFT, WASHING, INSPECTION AND LUBRICATION OF MECHANISM MOVING PARTS AND CABLES	Man-hours required - 0.4[illegible]

Procedure	Technical requirements	Fault correction
(a) cock AD-3 time release mechanism and lock it with flexible pin (Fig.135); (b) cock middle plunger of spring mechanism and fix it in position with rod (Fig. 136);	AD-3 time release mechanism should be set to operate in 1.5 sec	
(c) cock extreme and plungers of spring mechanism and lock them in position with rods; (d) install lock sleeve connected with AD-3 time release mechanism; (e) remove rods locking in position spring mechanism plungers;	Extreme plungers and lock sleeve should be installed flush with wall of spring mechanism	
(f) occupy ejection seat with flying suit and parachute on, smooth out straps and close harness lock; (g) lock foot grips 9 by pressing step bearing of foot rests; (h) withdrew flexible pin of AD-3 time release mechanism	Foot grips and harness straps lock should open quickly and without jamming	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49	In 6 sheets Sheet 6

FIG. [illegible] EJECTION SEAT [illegible]
1 – [illegible]; 2 – [illegible]; 3 – [illegible]; 4 – [illegible]; 5 – [illegible]; 6 – [illegible]; 7 – [illegible]; 8 – [illegible]; 9 – [illegible]; 10 – [illegible]; 11 – [illegible]; 12 – [illegible]; 13 – [illegible], type OPK-2; 14 – [illegible]; 15 – [illegible]; 16 – [illegible]; 17 – [illegible]; 18 – [illegible]; 19 – [illegible]

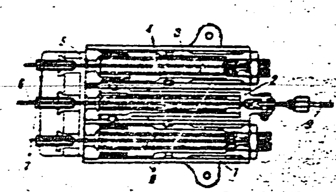

FIG. 13a SPRING MECHANISM OF FOOT GRIPS AND SAFETY HARNESS LOCK CONTROL SYSTEM
1 – frame; 2 – inner cylinder; 3 – outer cylinder; 4 – ball locks of outer cylinder; 5 – ball lock of inner cylinder; 6 – cable to safety harness lock; 7 – cables to foot grips; 8 – [illegible] springs; 9 – cable to [illegible]

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49		In 8 sheets Sheet 5
CANOPY AND COCKPIT	REMOVAL OF BLIND-ACTUATED EJECTION SEAT FROM AIRCRAFT, WASHING, INSPECTION AND LUBRICATION OF MECHANISM MOVING PARTS AND CABLES		Man-hours required – 0.6
Procedure	**Technical requirements**	**Fault correction**	
Repeat checking operation of harness straps restraint mechanisms and foot-grip release system. Check over, place whole system to operating position. Note. Should foot grips close accidentally, open them by moving back shafts of grips coming out of ports in inner walls of foot rests. Lock flexible pin of AD-3 time release mechanism with special thread 13. Examine dampers of ejection seat foot rests and check them for proper operation. To this end: (a) remove bolts fastening rods of left-side and right-side dampers to arm rests; (b) lower foot rests and bring dampers out of casings; (c) make external inspection of dampers, wash hinged joints in gasoline and lubricate with grease TsIATIM-201; (d) pull rods out of dampers and make sure that they are free of dents, nicks and bends;	For locking use twisted cord thread from core of shroud line K-6		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49	In 6 sheets Sheet 6
CANOPY AND COCKPIT	REMOVAL OF BLIND-ACTUATED EJECTION SEAT FROM AIRCRAFT, WASHING, INSPECTION AND LUBRICATION OF MECHANISM MOVING PARTS AND CABLES	Man-hours required – 0.45

Procedure	Technical requirements	Fault correction
(e) move rods into cylinders, insert dampers into casings and secure dampers to arm rests; (f) check dampers for proper operation by pulling out rods and applying load to foot rests. Coat with grease TSIATIM-201 all hinged joints and cables	Movement of foot rests should be uniform without any warping or jamming. When 1 kg load is applied to foot rests their lowering should take 3 - 5 sec. Folding of foot rests under load of 40 kg should take place within 5 - 10 sec.	If lowering or folding of foot rests takes more or less time than required, it indicates that dampers contain insufficient amount of oil. Check dampers for quantity of AMG-10 oil If required, add oil to dampers as follows: (a) remove damper from seat; (b) compress it fully; (c) screw plug off filler connection and fill cylinder with oil AMG-10 to capacity, after which drain 1.5 cu.cm of oil; (d) screw plug on filler connection and lock it with wire KO-0.5; (e) mount damper on ejection seat and check it again for proper operation
14. Check shoulder belt restraint mechanism lock for proper operation. To this end:		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49	In 8 sheets Sheet 7
CANOPY AND COCKPIT	REMOVAL OF BLIND-ACTUATED EJECTION SEAT FROM AIRCRAFT, WASHING, INSPECTION AND LUBRICATION OF MECHANISM MOVING PARTS AND CABLES	Man-hours required - 0.6

Procedure	Technical requirements	Fault correction
(a) place parachute on seat pan, take seat and fasten shoulder belts; (b) release shoulder belts and make sure that shoulder belt restraint mechanism operates properly; (c) lock belts successively in all points and make certain that shoulder belt restraint mechanism is engaged and that pilot can not lean forward. Pay particular attention to proper locking of belts in position required for ejection 15. Check stabilizing flaps mechanism for proper operation. For this purpose: (a) remove tightening clamp from stabilizing flaps; (b) check manually flaps for easy rotation; (c) lower flaps; this done, flaps should open fully and get locked in open position; (d) close flaps by pressing block through hole in horizontal flap of strut		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 49	In 8 sheets Sheet 8
CANOPY AND COCKPIT	REMOVAL OF BLIND-ACTUATED EJECTION SEAT FROM AIRCRAFT, WASHING, INSPECTION AND LUBRICATION OF MECHANISM MOVING PARTS AND CABLES	Man-hours required — 0.45

Procedure	Technical requirements	Fault correction
and lower flap by pressing off wire latch; further movement of both flaps should be done simultaneously. Press flaps to head rest and mount tightening clamp on them	After mounting ejection seat on aircraft remove tightening clamp as flaps are held from opening by guide rails	
16. Mount ejection seat on aircraft in reverse order	When mounting ejection seat on aircraft, make sure that canopy emergency jettison handle engages forked rod of transmission mechanism of canopy jettison system	

Accessories	Tools
Lubricating gun Device for removing canopy by means of crane Device for checking ejection seat Device for removing ejection seat by means of crane Clamp for tightening flaps of ejection seat (72-7804-220) Rod for loading spring mechanism of ejection seat (144C49-4-110)	Wrench, 12 x 14 Pliers Wrench (CK7804-794) for tightening nut of firing mechanism striker Wrench (E2-7804-113) for cocking striker of firing mechanism

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 50	In 4 sheets Sheet 1
CANOPY AND COCKPIT	CHECKING CONDITION OF CANOPY FRAME. LUBRICATION OF MECHANISM FOR CANOPY INSIDE AND OUTSIDE CONTROL HANDLES	Man-hours required - 0.5

Procedure	Technical requirements	Fault correction
1. Check canopy frame for cracks, broken seal and damaged protective coating 2. Examine canopy glass for cracks, silvery areas and dimming (poor transparency). When examining, pay particular attention to places where glass panels are built into canopy frame (in top and rear portion of canopy) 3. Inspect canopy units made of magnesium alloy for corrosion	Canopy with cracks and silvery areas (hairline cracks) is not fit for further use and should be withdrawn from service. When performing scheduled maintenance operations observe the following: (a) canopy should be covered with canvas (when on ground) to protect it from adverse effects of sunrays, dust, rain, snow and from mechanical damage; (b) should organic glass be fouled, clean it as follows: - wipe glass with clean soft cloth wetted with water and wrung; - wipe glass dry with soft cloth; - if any fat stains are found, remove fat by rubbing glass with dry soft cloth and some paste BHAN-2 If no paste BHAN-2 is available, wipe glass with soft cloth soaked in soapy water (3-5%-solution) and wrung out	Canopy with cracks or silvery areas on glass panels should be replaced by new one If any hairline scratches or scores are found on glass panels of canopy, polish glass with paste BHAN-2. Polishing should be made manually with water-absorbing cotton and small amount of paste. When polishing, rub glass first along scratch, then across it and finally rub area in circular movements without stopping to avoid heating of glass Polishing may be performed over entire surface of glass. Never try to eliminate scratches and scores (irrespective of their location) by means of emery paper.

Supplement to Inspection Guide No. 21	PROCESS CHART No. 50	In [illegible] sheets Sheet 2
CANOPY AND COCKPIT	CHECKING CONDITION OF CANOPY FRAME. LUBRICATION OF MECHANISM FOR CANOPY INSIDE AND OUTSIDE CONTROL HANDLES	Man-hours required - 0.25

Procedure	Technical requirements	Fault correction
	Organic glass may contain the following minor defects: (a) separate hairline scratches; (b) shallow scratches or scores not longer than 30 mm scattered over wide surface of glass Note. When wiping glass, it is forbidden to use woolen or silk cloth that can induce electrical charge in organic glass as in this case surface of glass will attract dust particles	It is strictly forbidden to eliminate silvery areas by means of emery paper or by cleaning, polishing, grinding or local heating
4. Wash canopy outside and inside control handle mechanism (Fig.137) in clean gasoline and blow it through with compressed air		

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Supplement to Inspection Guide No.22	PROCESS CHART No. 90	In 6 sheets Sheet 3

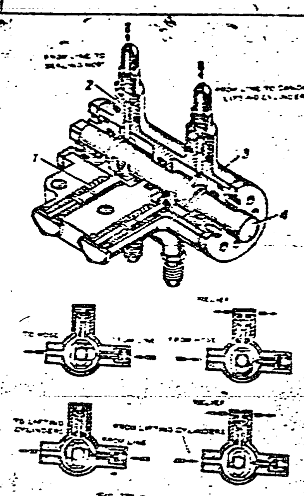

FIG. [illegible]. CANOPY CONTROL VALVE
[illegible]

Supplement to Inspection Guide No. 21	PROCESS CHART No. 50		In 4 sheets Sheet 4
CANOPY AND COCKPIT	CHECKING CONDITION OF CANOPY FRAME, LUBRICATION OF MECHANISM FOR CANOPY INSIDE AND OUTSIDE CONTROL HANDLES		Man-hours required – 0.25
Procedure	**Technical requirements**	**Fault correction**	
5. Check screw fastening toothed wheel of canopy control lever for secure attachment. To this end, remove switchboard at left side of cockpit 6. Coat with grease canopy control handle mechanism			

Accessories	Tools
Lubricating gun Brush	Screwdriver Pliers

Supplement to Inspection Guide No. 21	PROCESS CHART No. 51	In 2 sheets Sheet 1
CANOPY AND COCKPIT	CHECKING CABLE FOR MECHANICAL OPENING OF LANDING GEAR NOSE STRUT INDEPENDENT EXTENSION LOCK. CHECKING CABLE'S RUBBER SEALING BOOT FOR CONDITION	Man-hours required - 0.50

Procedure	Technical requirements	Fault correction
1. Wipe the cable at cockpit side with cotton waste soaked in gasoline	Note. If possible, perform operations on checking cable for mechanical opening of landing gear nose strut independent extension lock and on checking condition of rubber boot only after ejection seat and cover of cockpit floor have been removed. In view of this such operations are included in Section "Canopy and Cockpit"	
2. Inspect cable for mechanical opening of landing gear nose strut independent extension lock. Make particularly thorough inspection of cable-to-handle connection in cockpit and of cable termination near lock lever. Broken cable wires can be detected by passing bare hand over entire cable length		Replace cables

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 51	In 2 sheets Sheet 2
CANOPY AND COCKPIT	CHECKING CABLE FOR MECHANICAL OPENING OF LANDING GEAR NOSE STRUT INDEPENDENT EXTENSION LOCK. CHECKING CABLE RUBBER SEALING BOOT FOR CONDITION	Man-hours required – 0.50

Procedure	Technical requirements	Fault correction
3. Remove cable sealing boot and check it for condition. Remove dirt from boot 4. Coat cable with thin layer of grease TSIATIM-201	If cracks are discovered on sealing boot of cable, replace defective boot by new one	

Accessories	Tools
Grease TSIATIM-201	Pliers Screwdriver

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Supplement to Inspection Guide No. 23	PROCESS CHART No. 52	In 2 sheets Sheet 1
CANOPY AND COCKPIT	CHECKING CONDITION OF HOT LINE THERMAL INSULATION AND JOINT BETWEEN COCKPIT SUPPLY SYSTEM CONNECTING PIPE AND CANOPY AIR BLOW MANIFOLD	Man-hours required - 0.15

Procedure	Technical requirements	Fault correction
1. Remove ejection seat from aircraft 2. Check in pilot's cockpit thermal insulation of hot line for cockpit pressurization system (Fig. 138) 3. Inspect joint between cockpit pressurization system connecting pipe and canopy air blow manifold 4. Inspect cockpit air supply valve (Fig.135), its attachment fittings and control cables. Coat cable with [illegible]-201 lubricant 5. Inspect pressure regulator [illegible]-57B, temperature regulator TPTBK-45M, make sure that they are securely attached; check pipelines for secure fastening	Wearing and breaking of pipeline thermal insulation are not allowed Nuts in joint between connecting pipe and canopy air blow manifold should be securely tightened and locked	If any wear or damage to thermal insulation is discovered, it should be eliminated If connection appears to be loose, tighten nuts or replace locking wire

Accessories	Tools
Lubricating gun Grease [illegible]-201	Special wrench (72-7804-1390) Multi-purpose pliers Screwdriver

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Supplement to Inspection Guide No.21	PROCESS CHART No. 32	In 2 sheets Sheet 2

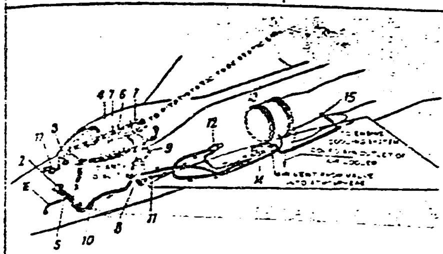

FIG. 138. COCKPIT PRESSURIZATION SYSTEM
1 – pressure regulator type [illegible]; 2 – [illegible] safety valve; 3 – [illegible]; 4 – canopy [illegible]; 5 – [illegible]; 6 – [illegible]; 7 – cockpit air supply valve control [illegible]; 8 – cockpit air supply valve; 9 – cabin temperature regulator type [illegible]; 10 – [illegible] air supply [illegible]; 11 – [illegible] valve [illegible]; 12 – turbo-cooler [illegible]; 13 – air cooler; 14 – [illegible] valve; 15 – air intake from engine; 16 – [illegible]; 17 – pressure regulator valve [illegible].

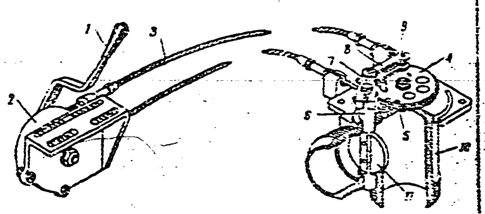

FIG. 139. COCKPIT AIR SUPPLY VALVE
1 – valve control handle; 2 – control sector; 3 – cable in flexible sheathing; 4 – roller; 5 – pin; 6 – shaft; 7 – actuator arm; 8 – control rod; 9 – spring; 10 – shutoff valve; 11 – baffle.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 53	In 3 sheets Sheet 1
CANOPY AND COCKPIT	INSPECTION OF FAIRLEADS FOR AIRCRAFT CONTROL RODS AND OF COCKPIT SEALING HOSE	Man-hours required – 0.15

Procedure	Technical requirements	Fault correction
1. Inspect sealing boot for aileron control rod installed in cockpit rear bottom portion to make sure that it is sound	Sealing boot should be sound and without any ruptures	If any cracks or ruptures are discovered, replace boot
2. Remove tail portion of canopy (fairing) located behind cockpit, for which purpose turn out screws and disconnect wiring of antenna		
3. Examine rubber fairleads for rudder and stabilizer control rods; make sure that they are securely attached to fuselage connecting pipes		
4. Check control rods of stabilizer, rudder and ailerons for condition (rods are located under auxiliary floor of cockpit). Check clearances between rods and cockpit structural elements. Wipe with clean waste control rods of ailerons, rudder and stabilizer; coat connections with thin layer of TSIATIM-221 lubricant	Clearance should be at least 4 mm	
5. Inspect fairleads for control rods of engine, rudder, stabilizer and ailerons. Coat ends of rods and fairleads with TSIATIM-221 lubricant		

Supplement to Inspection Guide No. 21	PROCESS CHART No. 53	In 3 sheets Sheet 2
CANOPY AND COCKPIT	INSPECTION OF FAIRLEADS FOR AIRCRAFT CONTROL RODS AND OF COCKPIT SEALING HOSE	Man-hours required – 0.15

Procedure	Technical requirements	Fault correction
6. Inspect canopy sealing hose for wear and damage to ozone resistant coating (of black colour)	Sealing hose should be provided with ozone resistant coating over its entire surface. Sealing hose should be free from deep chafing (of light colour) and cracks. When sticking sealing hose, use cement No. 88 and apply it only to bottom of hose, leaving sides of hose free of cement. It is allowed to use cement No.88 for sticking gaskets not more than 2 mm thick made of material P2671. Sealing hose is allowed to project in curvilinear zone of cockpit outline by not more than 1.5 mm; in remaining areas – not more than 1 mm; sinking of hose at any point over its entire length should not exceed 0.5 mm	If hose is not protected with ozone resistant coating, be sure to restore it. To this end, cover bare areas with ozone resistant varnish 23CA (TO 752). If deep chafing or cracks are detected, replace hose by new one Replacing Sealing Hose 1. Disconnect hose connecting pipe from air supply system, for which purpose, screw off check nut and nut in cockpit 2. Remove hose from chute 3. Clean chute from old cement making use of wash-out solution 4. Remove oil from surface of chute and from bottom of sealing hose making use of clean unleaded gasoline

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 53	In 3 sheets Sheet 3
CANOPY AND COCKPIT	INSPECTION OF FAIRLEADS FOR AIRCRAFT CONTROL RODS AND OF COCKPIT SEALING HOSE	Man-hours required - 0.15

Procedure	Technical requirements	Fault correction
		5. Apply thin layer of cement No. 88 to horizontal surface of chute and to bottom of hose and wait for 10 min

Accessories	Tools
	Screwdriver Wrench, 12 x 14

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 54	In 2 sheets Sheet 1
CANOPY AND COCKPIT	MOUNTING EJECTION SEAT ON AIRCRAFT, MOUNTING CANOPY AND CHECKING IT FOR PROPER OPENING AND CLOSING	Man-hours required - 2.00

Procedure	Technical requirements	Fault correction
1. Mount face blind actuated ejection seat on aircraft reversing dismantling procedure. To this end: (a) install tightening clamps on stabilizing flaps; (b) connect lifting device cable to seat; (c) lift ejection seat and lower it into guide rails; (d) install inserts fastening upper clamp of seat headrest to journals of ejection gun; (e) connect cable running to diaphragm valve; (f) connect snap hook of pull cord for AR-3 time release mechanism to clamp on frame; (g) load ejection gun and connect blocking cables 2. Mounting canopy on aircraft is the reverse of dismantling		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 54	In 2 sheets Sheet 2
CANOPY AND COCKPIT	MOUNTING EJECTION SEAT ON AIRCRAFT, MOUNTING CANOPY AND CHECKING IT FOR PROPER OPENING AND CLOSING	Man-hours required – 2.00

Procedure	Technical requirements	Fault correction
3. Charge air to aircraft air system through charging connection located in right-side well of landing gear main strut wheel 4. Perform check opening and closing of canopy by operating inside and outside canopy control handles. Check canopy emergency jettison system	Canopy should open and close easily and smoothly, without jerks when operated by inside or outside handles	

Accessories	Tools
Hose for charging air into aircraft air system Tightening clamp Device for checking cockpit for tightness	Special wrench Pliers Wrench, 14 x 17 (2 pieces)

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 55	In 8 sheets Sheet 1
CANOPY AND COCKPIT	REMOVING AND MOUNTING EJECTION SEAT	Man-hours required – 1.30

Procedure	Technical requirements	Fault correction
Removal of Ejection Seat 1. Open canopy 2. Make sure that all ground safety pins are installed	Ground safety pins should be installed in the following points (Fig. 140): (a) in head of ejection gun SGK 2500-38; (b) in canopy emergency jettison handle; (c) in plungers of firing mechanisms 215F and 2150 (in two cylinders); (d) in hinged supports brackets; (e) in armrests of ejection seat (armrests should be closed with metal covers); (f) in roller of four-link mechanism for control of firing mechanisms 2150; (g) in foot rests when in top position; (h) in firing mechanism 215F	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 55	In 8 sheets Sheet 2
CANOPY AND COCKPIT	REMOVING AND MOUNTING EJECTION SEAT	Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
3. Unload the following firing mechanisms: (a) seat ejection gun TCH-2500-38 (to be performed by the armament man); (b) firing mechanism 215Ш of drogue chute (one cylinder); (c) firing mechanism 215Ф for disengaging and separating canopy from seat (two cylinders); (d) firing mechanism 215P for unlocking pilot's safety harness (one cylinder) 4. Disconnect cable of pin for drogue chute firing mechanism 215Ш from attachment fitting on aircraft 5. Disconnect control cable from pin of firing mechanism TCH-2500-38 6. Disconnect cable of AD-3 (?) time release mechanism from aircraft attachment fitting 7. Disconnect cable for opening hinged supports (for canopy) from bracket on cockpit floor		**Note.** Firing mechanisms TCH-2500-38 and 215Ш should be loaded and unloaded with ejection seat installed on aircraft Firing mechanisms 215P and 215Ф should be loaded and unloaded with ejection seat removed from aircraft

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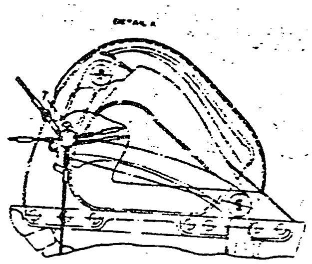
Supplement to Inspection Guide No.21	PROCESS CHART No. 55	In 8 sheets Sheet 3



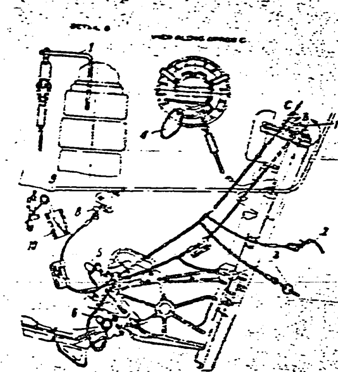


FIG. 140. GROUND SAFETY LOCKS SCHEMATIC ARRANGEMENT
1 – TO4-2500-38 seat ejection gun head lock (one piece); 2 – head lock of 21SP shoulder belt restraint gun (one assy); 3 – head lock of 21SB canopy remover gun (two pieces); 4 – head lock of 21SG [illegible] gun (one piece); 5 – lock of canopy hinged supports (two pieces); 6 – [illegible] lock (two pieces); 7 – lock of ejection trigger on hand-grip (two pieces); 8 – lock of canopy emergency jettison control handle (one piece); 9 – lock of canopy diaphragm valve (one piece).

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 55	In 8 sheets Sheet 4
CANOPY AND COCKPIT	REMOVING AND MOUNTING EJECTION SEAT	Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
8. Remove lower block of common connector CPK-2 and close it with cover 9. Screw off thrust screws of hooks locking journals of firing mechanism in attachment units on beam CK-5102-500 10. Secure hoist (crane) on ejection seat journals and lift seat slowly. Uncouple plug connector of supply conductor for electric motor MV-100AT used for adjusting ejection seat to pilot's height. Two persons should watch the seat coming out of cockpit (on both sides of cockpit) 11. Install ejection seat on special pyramid __Mounting Ejection Seat on Aircraft__ 1. Load firing mechanism 215B for disengagement and separation of canopy from ejection seat and firing mechanism 215P for unlocking pilot's harness, after which insert ground safety pins in plungers of firing mechanisms 2. Insert ground safety pins into holes of brackets on hingel and foot	When removing seat, move engine control lever forward or rearward as required	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 55	In 8 sheets Sheet 5
CANOPY AND COCKPIT	REMOVAL AND MOUNTING EJECTION SEAT	Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
supports and in arm rests of ejection seat. Close arm rests with metal covers 3. Install ejection gun TCN-2500-38 on aircraft attachment beam (provided ejection gun has been removed from aircraft). To this end: (a) turn off screws out of ejection gun journals; (b) deflect one of attachment rods (see Dwg.96-9100-173/1) and connect rod to journal; (c) deflect second elastic rod sideway and connect it to journal; (d) turn screws with washers into journals (install screws on zinc white) 4. Turn off thrust screws of locking hooks in joints of ejection seat attachment beam if they have been installed (see dwg. CK-9102-533) 5. Lift ejection seat by means of hoist (or crane) and move upper rollers into seat guide profiles 6. Lower seat slowly inside cockpit, then make stop to couple power supply	When lowering seat, make sure that side pins of foot rests have entered guides in cockpit floor and that foot grips remain opened.	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 55		In 8 sheets Sheet 6
CANOPY AND COCKPIT	REMOVAL AND MOUNTING EJECTION SEAT		Man-hours required - 1.30
Procedure	**Technical requirements**	**Fault correction**	
bunched conductor connector of electric motor for adjusting seat to pilot's height. This done, lower seat until upper journals of ejection gun bear against seat catches 7. Turn home thrust screws of hooks in ejection seat attachment beam joints (dwg.CK-5103-533), locking thereby journals of ejection gun TCM-2500-38 in attachment joints 8. Connect to special lugs in cockpit the following elements: (a) cable from pin of drogue chute firing mechanism 2152; (b) cable of time release mechanism AD-3; (c) cable for opening canopy hinged supports (i.e. cable running from cross shaft which locks hinged supports) 9. Connect lower block of common connector CPK-2 with cable to middle block of seat 10. Remove ground safety pins from plungers of firing mechanism 2150 and	When lowering seat, be careful not to damage throttle control lever, for which purpose, move throttle control lever forward and rearward while lowering seat		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 55	In 8 sheets Sheet 7
CANOPY AND COCKPIT	REMOVAL AND MOUNTING EJECTION SEAT	Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
from brackets of foot grip hinged supports 11. Load firing mechanisms [illegible]-2500-38 and 215[illegible], install ground safety pins and connect them to ground safety pin cable of ejection seat		
<u>[illegible] Drogue Chute on Ejection Seat</u> 1. Install container plates into shape of plunger of firing mechanism 215[illegible] by aligning container plate holes containing primer caps with holes in shape 2. Making use of lock pins fasten shape of plunger together with container plates and harness belt ring, having previously placed belt ring between plates of container at its right side 3. Lock pins with locking wire [illegible]-0.5 4. Remove wire with seals from [illegible] of container plates, otherwise [illegible] will not release drogue chute in case of bailing out		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 55	In 8 sheets Sheet 8
CANOPY AND COCKPIT	REMOVAL AND MOUNTING EJECTION SEAT	Man-hours required - 1.30

Procedure	Technical requirements	Fault correction
5. Fasten snap hook of shroud lines cover to lug in right-side box of headrest. For removing drogue chute reverse installation procedure. Prior to removing container seal it through end holes of its plates		

Accessories	Tools
Device for removing seat from cockpit (cable) Crane	Screwdriver Pliers

Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 1
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
1. Unload firing mechanisms TCM-2500-38 and 215П (Fig.141) 2. Remove ejection seat from aircraft 3. Unload firing mechanisms 215P and 215Ø 4. After armament specialist has performed check of firing mechanisms for proper striking of primer caps and has cleaned mechanisms, perform checking of seat.	Firing mechanisms are to be unloaded by armament specialist WARNING. When accomplishing scheduled maintenance operations on ejection seat, it is forbidden to make any adjustments, since all mechanisms have been adjusted at manufacturing plant	
Inspect and check the following control cables for burrs and proper fastening in cable shoes: (a) cable running from seat arm rests release lever to cross shaft of seat pan; (b) cable running from plunger lever of firing mechanism 215P to pin of firing mechanism TCM-2500-38; (c) cable running from shoulder lock reel via roller of firing mechanism 215P to attachment point on seat frame;	Cables should be free from broken wires (or burrs). Cables are to be checked visually and by hand-feeling them (at accessible places)	If broken wires are found, defective cable should be replaced

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Supplement to Inspection Guide 21	PROCESS CHART No. 56	In 26 sheets Sheet 2

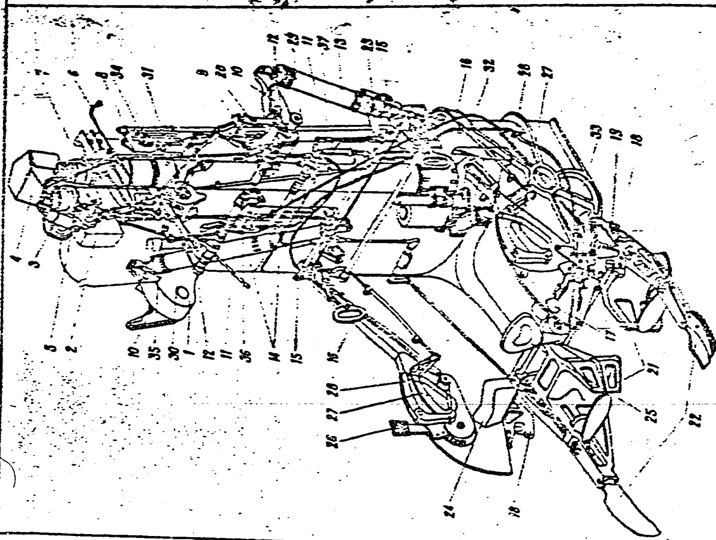

FIG. 141. EJECTION SEAT, TYPE CK

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 96	In 26 sheets Sheet 3
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
(d) shoulder lock reel locking cable running from the ratchet pawl lever to shoulder harness control lever on left-side arm rest; (e) cables (one rightside and one left-side) for waist belt restraint mechanism, running from handle on right-side arm rest to locks on rear side of seat pan; (f) cable running from seat ejection handle to roller of firing mechanism 2158 for separation of canopy from seat; (g) cable running from pins fastening container of drogue chute to head of firing mechanism 2153; (h) cable running from pin of firing mechanism 2153 to aircraft structure; (i) side supports opening cable running from rocker of lock sectors cross shaft to lug (bracket) on cockpit floor. Checking of cables over, coat them with [illegible]-201 lubricant		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 8
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
5. Inspect seat cables and parts for corrosion paying particular attention on parts made of electron and painted green		
6. Coat with TsIATIM-201 lubricant all hinged joints of seat cables and bearings of all shafts; see that they are lavishly lubricated		
7. Check adjustable section of control cables for intact sealing and locking		
8. Remove cover from case of transfer roller and coat it with TsIATIM-201 lubricant		
9. Remove jacket from ejection seat lifting screw for adjusting seat by pilot's height and coat screw liberally with TsIATIM-201 lubricant		
10. Coat with TsIATIM-201 lubricant guide rails of seat		
11. Replace grease in housing of electric motor MV-100-AM reduction gear in the following manner:		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 5
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
(a) screw off plug provided in bottom of electric motor reduction gear housing; (b) wash reduction gear compartment with clean gasoline and blow off with compressed air; (c) put fresh lubricant ЦИАТИМ-201 into reduction gear housing 12. Put lubricant ЦИАТИМ-201 into reduction gear housing of worm wheel of seat pan lifting screw. To this end: (a) unscrew bearing cover of vertical shaft which rotates seat screw; (b) remove bearing with seat and pack lubricant into housing. Re-install bearing with seat and close it with cover 13. Check electric wiring of seat lifting mechanism for condition 14. Check ejection seat controls for proper operation; check all firing mechanisms for striking primer caps		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 6
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
<u>Checking Firing Mechanisms 215P and TCM-2500-38 for Striking Primer Caps</u> Attach firing mechanism (ejection gun) TCM-2500-38 to seat. Load firing mechanisms TCM-2500-38 and 215P with special cartridges which do not contaminate firing mechanisms during checking (checking procedure should be done by armament specialist). Connect controls to firing mechanisms.	Checking seat units should be done with ejection seat installed on pyramid 76-9631-300	
By slowly compressing release lever with protecting yoke actuate first mechanism 215P and then mechanism TCM-2500-38. Unload firing mechanisms TCM-2500-38 and 215P. Make certain primer caps have operated. Place locking plungers of firing mechanisms to initial position	The moment firing mechanism 215P operates, pin of ejection seat firing mechanism TCM-2500-38 should remain stationary	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 7
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
Checking Harness System Restraint Mechanism for Proper Functioning After parachute leg straps of harness system have been passed through loops of harness side straps, engage them with buckles to connect waist belt restraint mechanism. Press from outside handle on left-hand arm rest (Fig. 141, Ref.17) and deflect it rearward. While holding handle in this position, pull out fastening cable of shoulder restraint lock, as far as it will go. Make certain fastening cable is locked in pulled out position. Note. On late ejection seats unlocking and locking of cable is performed manually Pull waist restraint buckles 16 with pulleys having placed waist belt restraint handle 26 on right arm rest to extreme forward position	In the course of locking cable makes return movement by 25 – 30 mm	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 8
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 1.0

Procedure	Technical requirements	Fault correction
Take seat and connect fastening cable of shoulder harness lock 30 to aft connecting strap of parachute harness. Pass leg straps of parachute harness through waist restraint buckles and secure them in central lock. Make waist belt restraint system operate by moving its handle on right arm rest fore and aft. Actuate shoulder belt restraint mechanism. To this end, lean forward, pull out fully fastening cable of shoulder lock and then lean back against seat back. In this case spring of firing mechanism 215P should retract fastening cable into shoulder lock and secure it in this position. Unlock shoulder belt system by pulling handle 17 on left-side arm rest and by leaning forward pull shoulder lock cable as far as it will go		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 9
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
Perform this procedure three times, then unlock shoulder belt system and disconnect soft connecting link of parachute harness system from shoulder lock cable. Pull out waist belt system cables by placing waist belt restraint handle on right-side arm rest to extreme forward position. Disconnect leg straps of parachute harness system from waist belt restraint buckles. Check amount of extension of shoulder lock cable	The extension of shoulder lock cable should amount to 100 mm __Note.__ By cable extension is meant distance between centre of lug, locked with cable in extended position, and top edge of hole in lock body minus distance from top edge of hole to centre of lug with cable in retracted position	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 10
CANOPY AND COCKPIT	CHECKING ON EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
<u>Checking Firing Mechanism 2150 for Proper Striking</u> 1. Load firing mechanism 2150 with special explosive charge (to be performed by armament specialist) 2. Set time release mechanism AD-3 (Ref.2), for which purpose: (a) disconnect cable of AD-3 mechanism from cross shaft lever by removing axle; (b) cock time release mechanism by pulling out fully time release mechanism cable by means of ring with hook (supplied with time release mechanism); (c) inset flexible pin into time release mechanism AD-3 and lock it; (d) connect cable to lever of cross shaft; (e) lock spring intensifier for opening harness restraint locks 3. Remove flexible pin which will cause time release mechanism to operate and turn cross shaft that controlls through rods locking plunger levers of		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 11
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT [illegible] AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
firing mechanisms 2150; as a result, firing mechanisms will operate. Check firing intensifier for proper engagement 4. Unload firing mechanisms and check whether primer caps have operated 5. Cock locking plunger of firing mechanisms 2150 6. Cock time release mechanism AD-3 or lock pin with thick thread 7. Turn cross shaft controlling firing mechanisms into initial position 8. Place locking plungers to their initial positions Locking System for Emergency Opening of Restraint Locks and Foot Grips Lock spring intensifier. By operating handle on right-side armrest actuate waist belt restraint system. Actuate shoulder restraint system. Turn locking screws out of firing mechanism 2150, out of attachment clamp of firing mechanism 2150, out of rods for opening 2150 mechanism clamp after		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 12
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.0

Procedure	Technical requirements	Fault correction
which bend off locking plate of rods of firing mechanism 215? clamp. Put feet into foot grips and lock them. Fit special extension pieces on journals of cross beam in order to turn canopy jettison levers. Through the use of extension pieces turn gradually canopy jettison levers 10 until they come in touch with levers 12 on cross shaft under beam; keep turning levers further and make certain that attachment clamp of firing mechanism 2157 has opened and that foot grips 22 have opened first or simultaneously (to release feet), then shoulder belt lock 31 and only then waist belt locks. Set whole system to initial position and cock shoulder belt lock, waist belt locks, and foot grip locks	After waist belt locks have opened, levers should be free to travel 10 mm more	

Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 13
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
Cocking Shoulder Belt Lock Disconnect rod connecting lever of cross shaft with lever on upper cross beam provided with journals. For this purpose remove lock pin used for attachment of rod to lever 12. Insert harness cable (strap) 30 into hole of shoulder belt lock and move it inside lock as far as it will go. Pawl 31 should rotate in this case. Gaining access through hole in lock body, press pawl tongue with screw driver and bring pawl lug into strap loop, which will correspond to LOCKED (ЗАКРЫТО) position. While holding pawl with roller in this position by means of screwdriver, move plunger inside lock	Pull harness strap to make sure that lock is closed	If lock fails to get closed, repeat cocking procedure
Cocking Waist Belt Locks and Foot Grip Locks Turn levers with rockers running to foot grips so as to bring stops into engagement with rachets		

Supplement to Inspection Guide No. 21	PROCESS CHART No.56	In 26 sheets Sheet 1A
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.[illegible]

Procedure	Technical requirements	Fault correction
Turn cross shaft of beam up by its levers until right-side lever (as viewed from aircraft rear) of vertical shaft touches with its lower slot rod pin connecting levers of waist belt locks. In this case rod running to control shaft for waist belt locks will travel to left and through leverage system will turn foot grip control shaft levers and bring them to foot grip levers. Put ends of waist belt restraint cables into locks. Close belt restraint locks. Move rod connecting levers of waist belt locks to left (as viewed from aircraft rear) so that lugs on lock lever which close grips prevent waist belt lock grips from coming out. Pull waist restraint cables to make sure that they are locked. Turn beam cross shaft by lifting its end levers so that right-side end of slot in lever of lower vertical shaft	Cross shaft levers should be placed so that their bolt heads and those on control rockers of foot grips coincide	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 15
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
reaches pin of rod connecting levers of waist belt locks. As a result, control rocker of foot grips will be locked through system of rods and levers Checking Operation of Canopy Hinged Supports and Determining Effort Required for Their Folding 1. Make sure that safety pins are installed in hinged supports 2. Turn shear locking screw out of left-side sector of control shaft for collapsible supports 3. Remove ground safety pins from each support in turn having taken necessary precautions 4. After taking necessary precautions turn control shaft 5. Turn shear screw out of stops which lock moving spring pin in slot of support, strike stop with rods of 10-mm diameter. Check in this manner each support	Precautionary Measures When turning hinged supports control shaft be sure that nobody is present close to supports. Supports should get opened (get turned through 90°) and locked by spring pins	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56		In 26 sheets Sheet 16
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION		Man-hours required - 3.00
Procedure	**Technical requirements**	**Fault correction**	
6. Sink spring pins and lock them with stops by turning in shear screws	Spring finger should extend		
7. Connect dynamometer to each support in turn and measure initial efforts required to fold supports. Connect dynamometer to arm of support. When doing so unlock support by pressing pin with rod inserted through hole on top of bracket, after which bring rod back from hole	Effort for folding supports should be at least 18 kg	Replace spring if effort is less than 18 kg	
8. Fold hinged supports using reverse procedure and install ground safety pins			
<u>Removal of Drogue Chute and Checking It for Proper Folding</u>			
1. Disconnect thimble of chute shroud lines from swivel of locking plunger of firing mechanism 2150 2. Unfasten snap hook of chute shroud lines cover from lug in right-side recess of ejection seat head rest 3. Seal drogue chute container through and holes in its plates	Checking and folding of drogue chute should be made in accordance with relevant Instructions <u>WARNING</u>. It is forbidden to take off with drogue chute container sealed as container will fail to release drogue chute at ejection		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 25 sheets Sheet 17
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CANOPIES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
4. Unlock and remove pins from plates of container 5. Remove plates of container from cups of locking plunger of firing mechanism 2150 and remove drogue chute. Installation of drogue chute is the reverse of removal		
Checking Safety Belt Locks for Proper Opening from Emergency Handle 1. Remove roller cover and mark position of roller in slot. Mark recess which accommodates lug of cable running to [illegible]-link reel in order to place lug of cable in the same recess should it become necessary to disconnect this cable 2. Arrange personnel parachute with harness in seat pan and connect it to locks of shoulder and waist belt restraint systems 3. Occupy seat, put on harness, fasten central lock of harness, operate shoulder and waist belt restraint mechanisms and close foot grips	Perform checking with spring intensifier locked and unlocked. Locking plungers of firing mechanisms 2150 should operate. All locks and foot grips should open	

Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 14
CANOPY AND COCKPIT.	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required = 3.00

Procedure	Technical requirements	Fault correction
4. Pull slowly handle 25 located on front side of seat pan.	After waist belt locks have opened handgrip should be free to travel for at least 6 mm before disconnection	
Return whole system to initial position, for which purpose proceed as follows:		
(a) pass handle cable with lug through connecting pipe of roller body;	Handle with cable should remain in hand	
(b) bring recess for cable lug in roller to outlet of cable from roller body;		
(c) insert lug of cable running from handle into recess in roller;		
(d) secure cover on roller body;		
(e) disconnect rods from release levers of firing mechanisms 2150;		
(f) rotate cross shaft which controls firing mechanisms 2150, having lowered shaft levers;	Rotation of cross shaft should cause turning of roller connected to shaft, while handle cable should return to initial position	
(g) move up levers of cross shaft as high as free travel of vertical shaft lever permits;		
(h) check control lever of four-link piece for proper locking		

Supplement to Inspection Guide No. 2A	P R O C E S S C H A R T No. 56	In 26 sheets Sheet 19
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	Fault correction
<u>Checking Operation of System for Dropping Drogue Chute Bag</u> Perform checking in the following sequence: (a) uncouple from cross shaft all connections which control units; (b) remove locks from levers for attachment of shackle connected with canopy control lever; (c) turn out safety screws of lock which closes split yoke; (d) turn safety screws out of firing mechanism 2150; (e) lower canopy control levers [illegible] as far as they will go; (f) make sure that lock of split yoke connecting upper and lower portions of firing mechanism 2153 outer [illegible] released yoke and the latter [illegible] be [illegible] and that shackles have [illegible] of levers; (g) [illegible] system to initial position;		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56		In 26 sheets Sheet 20
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION		Man-hours required - 1.0
Procedure	**Technical requirements**	**Fault correction**	
(h) turn safety screws into lock of split yoke and install new locking plates; (i) lock shackles on pins of levers; (j) turn safety screws into firing mechanisms 2150 <u>Checking Explosive Charge of Firing Mechanism 2150 for Proper Operation</u> 1. Load firing mechanism 2150 with special dummy cartridge provided with primer caps 2. Connect cable to pin of firing mechanism locking plunger 3. Pull briskly pin out of locking plunger, which will result in operation of firing mechanism 4. Unload firing mechanism and make sure that primer caps have been struck 5. Cock and reinstall locking plunger of firing mechanism and reconnect cable			

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 21
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
<u>Installing and Checking Condition of Special Safety Screws Which Lock Separate Units</u> For checking use the following procedure: (a) check screw of split yoke lock of firing mechanism 215D; (b) check screw of firing mechanism 215D; (c) check screw of beam drop control lever located on cross beam with journals; (d) check screw of pin fastening retainer on firing mechanism 215D; (e) check screw of cross shaft which controls canopy hinged supports; (f) check screw of firing mechanism 215D; (g) check locking device of cross shaft which opens safety harness locks; (h) check locking device of firing mechanism 215D drive; (i) check locking plate of rods which open yoke of firing mechanism 215D	After installation safety screws should be turned right home. Locking plates (one at each side of lock) should fit closely to plate rods, and tabs of plates should be bent on rods. <u>WARNING</u>. Locking plates of yoke for attachment of firing mechanism 215D should be used only once. Therefore, it is not allowed to bend tabs of locking plates twice. When performing scheduled or some other maintenance operations which require bending of plate tabs, replace plates with new ones	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 22
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
<u>Checking Ejection Seat Units and Canopy for Joint Operation</u> (seat removal) 1. Open canopy and unload firing mechanisms TMC 2500-38 and 215T 2. Install ground safety pins in firing mechanisms 2150 and 215P and in sectors of foot grip rods 3. Remove at 4. Unload ring mechanisms 2150 and 215P 5. Remove firing mechanism TCM 2500-38 from aircraft 6. Install on aircraft special actuating cylinder filled with AMG-10 oil and provided with hose and cock. Connect to rear portion of canopy lifting device for providing starting effort of 150-200 kg 7. Turn off special shear screws from the following units: from canopy front grip locks, from upper bushings of canopy rear grip locks,	This kind of check should be made in the following cases: (a) when replacing seat or canopy; (b) after removing or replacing armour plate; (c) when repairing cockpit or making any modifications that may affect operation of seat mechanisms or prevent seat from coming out of cockpit. Removal of ejection seat from cockpit should be made only when cockpit is fully fitted with standard equipment. To avoid damaging engine control lever during removal of ejection seat move engine control lever fore and aft	

Supplement to Inspection Guide No. 22	PROCESS CHART No. 56	In 26 sheets Sheet 23
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required – 3.00

Procedure	Technical requirements	Fault correction
from left sector of control shaft for fixed supports and from stops locking spring pins on supports for the canopy front grip locks 8. Install seat on aircraft 9. Lower seat pan into extreme lower position		
10. Close canopy and check clearance between journal and lower surface of hook of canopy rear grip lock. Do not pressurize cockpit 11. Pass hoses from ground installation through connecting pipe for cockpit air conditioning and connect them to sock. Then one of inspectors should occupy ejection seat and take hold of hydraulic actuating cylinder control valve 12. Install two auxiliary bolts in canopy rear arch (instead of two operating bolts that have been screwed off) and connect to them dynamometer through cable. Connect other end of dynamometer	Clearance between journal and the lower surface of canopy lock hook should be at least 2 mm (greater size is not limited) Clearance between bosses of journals and canopy carrying panel should be not over 0.2 mm. Right-side and left-side journals are allowed to press canopy locks with up to 2 mm difference	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56		In 40 sheets Sheet 24
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION		Man-hours required - 3.0
Procedure	**Technical requirements**	**Fault correction**	
to hook of crane and apply 180-200 kg effort preliminarily on canopy as read by dynamometer 13. Raise slowly seat until its journals come into nests for canopy locks and make certain that canopy locks have operated 14. Continue raising seat and make sure that: (a) pin of firing mechanism 215 has been pulled out properly; (b) as soon as surface of canopy supports reaches lower level of canopy-carrying panel, levers holding canopy supports start turning and supports open 15. Check operation of common connector CPK-2 and make sure that tightening of cable and uncoupling of lower block of plug connector do not cause stresses in aircraft hoses KB-26 and in anti-G suit hose 16. Continue raising seat until lower ends of seat guides reach middle rollers	The pin should be pulled out of firing mechanism 215 after seat travels approximately 30-50 mm Half-opened supports slide along canopy-carrying panel, then they open completely after passing panel and remain under canopy rib		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 25
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT [illegible] AND CABLES FOR PROPER OPERATION	Man-hours required = 5.00

Procedure	Technical requirements	Fault correction
17. Lower seat and start removing it again from position when seat pan is in uppermost position 18. Remove seat and install it together with canopy on pyramid; check clearance between stops in two-arm levers of ejection seat and levers on rear grip locks of canopy 19. Open manually front and rear grip locks of canopy and separate canopy from ejection seat; place canopy lock system and seat lock system to initial position	After replacing canopy or seat, check clearance between insert of front lock and side of seat support. Clearance should be at least 3 mm	
20. Turn safety screws into front and rear grip locks and place shear aluminum rivet 3520A-2-6 in front lock of time delay mechanism	Turn into front grip lock safety screw 56-0605-916 made of material Al-1. Turn into rear grip lock safety screw 56-0605-801 made of material Al-1	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 56	In 26 sheets Sheet 26
CANOPY AND COCKPIT	CHECKING OF EJECTION SEAT UNITS AND CABLES FOR PROPER OPERATION	Man-hours required - 3.00

Procedure	Technical requirements	FAULT CORRECTION
	Install screws on zinc white (prepared on natural drying oil)	

Accessories	Tools
Device for removing canopy by crane Device for checking ejection seat Device for removing ejection seat by crane	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 57	In 2 sheets Sheet 1
CANOPY AND COCKPIT	CHECKING COCKPIT FOR [illegible]	Man-hours required - 25

Procedure	Technical requirements	Fault correction
1. Place valve of pressure regulator APD-57B to OFF ([illegible]) position		
2. Close cockpit air supply valve		
3. Connect hoses of ground device 465-78/50-060 to cockpit pipe unions located in landing gear nose strut well		
4. Connect ground air bottle to ground device		
5. Close canopy and pressurize cockpit from outside		
6. Open valves of ground air bottle and device and watch readings of [illegible]-20 instrument	Cockpit pressure rise ratio should not exceed 0.1 kg/cm^2 during 1 min.	
7. Build up pressure in cockpit as high as 230-235 mm Hg, after which stop air supply to cockpit by closing valves of ground air bottle and ground device		
8. Measure time during which cockpit pressure drops from 230 to 210 mm Hg. Perform this operation 2 or 3 times	For calculating cockpit pressure drop time refer to Chart No.1 77-E24-76-1. Cockpit is considered tight if air leakage is not over 10 kg/hr	In case cockpit air leaks through APD-57B regulator with valve in OFF ([illegible]) position, plug outlet pipe of regulator APD-57B. If air leakage exceeds 10 kg/hr, it is necessary to trace place of leak-

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Supplement to Inspection Guide No. 22-[illegible]	PROCESS CHART No. 57	In 2 sheets Sheet 2
CANOPY AND COCKPIT	CHECKING COCKPIT FOR TIGHTNESS	Man-hours required - 25

Procedure	Technical requirements	Fault correction
9. Depressurize cockpit and open canopy by operating outside arm 10. Set valve of regulator АРД-57В to ОВ (ВЫКЛЮЧЕНО) position and lock with wire КТ-0.8 11. Disconnect hose of ground device from cockpit pipe unions, plug and seal pipe unions		age aurally (by hissing sound) or with the help of soapy water. Fairleads of rods and cables should be checked first

Accessories	Tools
Device for measuring amount of cockpit pressurization Ground bottle with compressed air	Wrench for cockpit pressurization system pipe unions

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Supplement to Inspection Guide No.21	PROCESS CHART No. 58	In 3 sheets Sheet 1
CANOPY AND COCKPIT	REMOVING FILTER OF AK-6 PRESSURE CONTROLLER, CLEANING FILTER AND CHECKING PRESSURE	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
1. Screw off cover and remove filter of pressure controller AK-6. Clean filter with soft hair brush and check filtering element for condition	Clean filter carefully so as not to damage filtering element. Check to see that no hairs remain on filtering element. Torn paper inside corrugations and in outer ribs, deep dents on paper, expansion of individual corrugations in excess of 4 mm and shrinkage of other corrugations, twisting and sharp bends of corrugations are not allowed	If filtering element has any of the above indicated defects, replace it
2. Reinstall cover 3. Connect hose of 4 lit. bottle provided with pressure gauge (instead of pressure suit) to hose of ППК-1 anti-G suit (on upper block of ОРК-1М common connector) 4. Close cockpit air supply valve Note. Testing is allowed with cockpit air supply valve open. But in this case cockpit should be pressurized		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 58	In 3 sheets Sheet 2
CANOPY AND COCKPIT	REMOVING FILTER OF AK-5 PRESSURE CONTROLLER, CLEANING FILTER AND CHECKING PRESSURE	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction
5. Install special device with weight on head of AK-5 pressure controller 6. Start engine and accelerate it to 65 % normal rating 7. Using device create required effort on button of pressure controller AK-5 and read pressure value off pressure gauge of device produced by pressure controller AK-5	Output pressure should be as follows:	If required output pressure can not be obtained by adjusting pressure controller AK-5, replace the latter
8. After adjusting or replacing pressure controller AK-5 check system	There should be no air leaks through connections of pressure controller AK-5	In case of leakage, tighten connection or replace gasket

Effort, P, on button of AK-5 controller, gr	Output pressure produced by AK-5 controller, mm Hg, kg/cm²
351	17-33 up to 0.04
1,053	165-205 up to 0.27
1,755	325-365 up to 0.48
2,457	450-475 up to 0.62

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Supplement to Inspection Guide No.21	PROCESS CHART No. 58	In 3 sheets Sheet 3
CANOPY AND COCKPIT	REMOVING FILTER OF AR-8 PRESSURE CONTROLLER, CLEANING FILTER AND CHECKING PRESSURE	Man-hours required - 0,30

Procedure	Technical requirements	Fault correction
for tightness with the help of soapy water		

Accessories	Tools
Bottle (4-lit. capacity) with pressure gauge Special device with weight Brush	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 54		In 1 sheet Sheet 1
CANOPY AND COCKPIT	CHECKING FLEXIBLE CASING OF CONTROL CABLE OF VALVE EV-7 AND VALVES EV-7 AND EV-8 FOR CONDITION AND ATTACHMENT		Man-hours required – 0.50
Procedure	**Technical requirements**	**Fault correction**	
1. Wash with clean gasoline joint between cable and EV-7 valve control lever on aircraft control stick 2. Check condition and attachment of flexible casing and control cable of EV-7 valve for wear and burrs. To find burrs, hand-feel cable over its entire length. When examining cable pay particular attention to its sharp bends, to places where cable protrudes from flexible casing, and to its lug	Control cable of EV-7 valve should be free from any wear and broken wires (burrs). Flexible casing and cable should be laid without any sharp bends which may result in excessive friction of cable. Flexible casing and EV-7 and EV-8 valves should be securely attached	Replace cable if it has broken wires or is chafed	
3. Check EV-7 and EV-8 valves, bell crank and their control rod for attachment; wash them in gasoline and blow off with compressed air 4. Lubricate EV-7 valve control cable with oil EI-8 (transformer oil); lubricate cable-to-control lever joint, connections between cable and bell crank and EV-8 valve control rod			

Accessories	Tools

Supplement to Inspection Guide No.21	PROCESS CHART No. 60	In 2 sheets Sheet 1
FUSELAGE	REPLENISHING OIL IN TURBO-COOLER BEARINGS	Man-hours required - 0.25

Procedure	Technical requirements	Fault correction
1. Open cover of turbo-cooler hatch in fuselage right side between frames No.15 and No.18)		
2. Remove locking wire from plugs (three pieces) of turbo-cooler (Fig.142)		
3. Screw off one oil filler plug (located at right upper side) of turbo-cooler bearings and fill [illegible]-122-14 oil into hole		
4. Rotate manually turbo-cooler fan	Easy running of rotor indicates that turbo-cooler is sound	If fan of turbo-cooler rotates with difficulty or fails to rotate at all, replace turbo-cooler
5. Screw in plug and lock it with wire [illegible]-0.8		

Accessories	Tools
	Screwdriver Pliers Wrench, 14 x 16

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Supplement to Inspection Guide No. [illegible]	PROCESS CHART No. 60	In 2 sheets Sheet 2

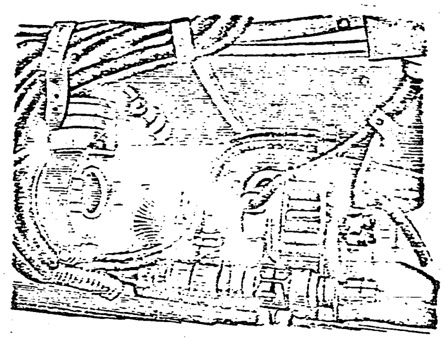

FIG. [illegible] GENERAL VIEW OF TURBO-COOLER (THE ARROWS SHOW THE CHARGING HOLE PLUG AND THE LOCKING WIRE)

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50X1-HUM

Pursuant to Inspection Guide No.27	PROCESS CHART No. 61	In 1 sheet Sheet 1
AIR AND DE-ICING SYSTEMS	WASHING AND INSPECTION OF AIR SYSTEM STRAINER	Man-hours required – 0.30

Procedure	Technical requirements	Fault correction
1. Unlock nuts of strainer pipe unions (strainer is installed in fuselage well for right-side wheel of main landing gear strut) 2. Holding strainer body turn off union nuts, release strainer attachment clip and remove the strainer. Plug disconnected pipes or tie them with PVC film 3. Disassemble strainer 4. Wash the filtering element of strainer (washers) in clear gasoline and blow with compressed air 5. Wash all metal parts of strainer in gasoline and blow them with compressed air 6. Inspect parts of strainer 7. Assemble and reinstall filter	Remove corrosion off parts When mounting strainer see that arrows are directed along airflow	Removal of corrosion should be made by cleaning parts with grinding cloth No.180-220 Replace all damaged rubber gaskets Restore stripped thread on pipe unions and strainer body. Replace individual parts of strainer or whole strainer

Accessories	Tools
	Pliers Wrenches, 14 x 17; 9 x 11; 32 x 36

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Supplement to Inspection Guide No.7[illegible]	PROCESS CHART No. 62	In 3 sheets Sheet 1
AIR AND DE-ICING SYSTEMS	CHECKING AIR SYSTEM BOTTLES FOR SECURE ATTACHMENT AND BOTH SYSTEMS FOR TIGHTNESS	Man-hours required - 1.0

Procedure	Technical requirements	Fault correction
1. Make external inspection of air bottles; make sure that they have proper paint coating 2. Inspect attachment fittings of air bottles 3. Charge main and emergency air systems with air (Fig.143) 4. Check main and emergency air systems for tightness	When checking systems for tightness observe the following sequence: A. Check section of air system between main air bottles and consuming units To this end: (a) charge main air system with air to obtain pressure of 110 - 130 kg/cm^2; (b) close all valves; (c) wait for 2 hours; (d) air leakage from system should not exceed 5 kg/cm^2. Checking should be made through the use of pressure gauge 2M-150 of main air system B. Check landing gear emergency air system To this end: (a) charge system (landing gear emergency air bottles) to a pressure of 110-130 kg/cm^2; (b) close valves for emergency discharging and charging of air system;	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 62	In 3 sheets Sheet 2

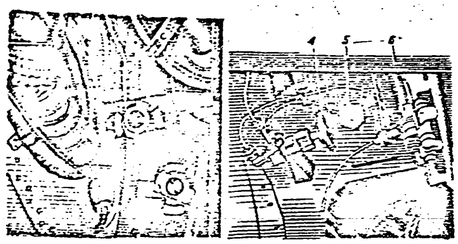

FIG. 143. AIR SYSTEM CHARGING CONNECTION, MAIN LINE CHARGING VALVE AND EMERGENCY LINE CHARGING VALVE

1 – charging connection; 2 – charging valve plug; 3 – plate lock of plug; 4 – main air system charging valve; 5 – emergency air system charging valve; 6 – L.G. emergency extension control valve.

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 62	In 3 sheets Sheet 3
AIR AND DE-ICING SYSTEMS	CHECKING AIR SYSTEM BOTTLES FOR SECURE ATTACHMENT AND BOTH SYSTEMS FOR TIGHTNESS	Man-hours required – 1.0

Procedure	Technical requirements	Fault correction
	(c) air pressure drop in section between emergency air bottles and valves is not allowed in the course of two hours. This check should be performed with pressure gauge 2M-150 of emergency air system	

Accessories	Tools
Ground air bottle	Wrench Screwdriver Pliers

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[illegible] to Inspection Guide No. 21	PROCESS CHART No. 63	In 2 sheets Sheet 1
AIR AND DE-ICING SYSTEMS	CHECKING DE-ICING SYSTEM FOR SPRAYING ALCOHOL THROUGH MANIFOLD	Man-hours required - 0.20

Procedure	Technical requirements	Fault correction
1. Check de-icing system for [illegible]. To this end, disconnect [illegible] with non-return valve from [illegible] (Fig.144); plug disconnected and pipeline; fill system with air by [illegible] lever of valve ЗК-48 2. Inspect manifold and clean its [illegible] with soft wire 0.5 mm in diameter (Fig.144) 3. Take seat in cockpit and switch [illegible]. CANOPY DE-ICER. SHUT-OFF [illegible] circuit breaker ([illegible] sure preliminarily that ground [illegible] source is connected to aircraft). [illegible] circuit breaker is located on [illegible] side upper control [illegible]	Check system for tightness with 3 kg/cm^2 operating air pressure. No air leaks through pipeline connections are allowed	
4. Press CANOPY DE-ICER ([illegible]) button on left side of instrument [illegible], check alcohol spraying from [illegible] and then quickly release button 5. Replenish alcohol tank with [illegible] through filler neck located [illegible] nose compartment	Alcohol should be sprayed uniformly and continuously. De-icing system tank should be filled only with rectified alcohol (2.3 lit.)	If spraying is non-uniform or intermittent, clean holes in manifold once more and repeat spray checking

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Supplement to Inspection Guide No.21	PROCESS CHART No. 63	In 2 sheets Sheet 2
AIR AND DE-ICING SYSTEMS	CHECKING DE-ICING SYSTEM FOR SPRAYING ALCOHOL THROUGH MANIFOLD	Man-hours required - 0.20

Procedure	Technical requirements	Fault correction
6. Close tightly filler neck cap, lock it and seal		

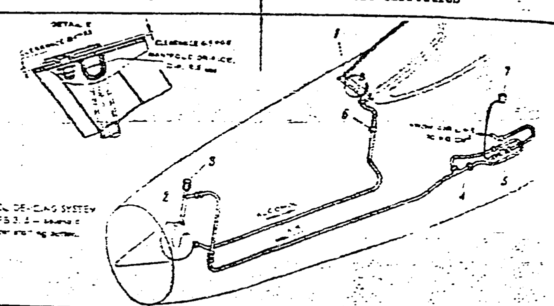

FIG. 144. SCHEMATIC ARRANGEMENT DIAGRAM OF CANOPY ALCOHOL DE-ICING SYSTEM
1 — manifold, 2 — alcohol tank, [illegible], type [illegible], 6 — [illegible]; 7 — [illegible]

Accessories	Tools
Wire, 0.5 mm	Pliers

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Supplement to Inspection Guide No.73	PROCESS CHART No. 6a	In 3 sheets Sheet 1
POWER PLANT	REMOVAL, INSPECTION AND WASHING OF OIL UNIT FILTER	Man-hours required – 1.00

Procedure	Technical requirements	Fault correction
1. Lift up access panel at fuselage starboard side marked "ENGINE AND [illegible] SYSTEM ACCESSORIES" ([illegible])		
2. Remove strap from breather connections; remove connections (Fig.145)	Strap and connections should be free of cracks and deformation	Replace connections, if cracks or deformation is detected Weld up cracks developed on strap
3. Make external inspection of oil filter cover and housing for defects	Oil filter cover handle bar should be locked with 1 mm dia. safety wire. Surfaces of oil filter cover and oil unit housing should be clean	Wipe contaminated surfaces with waste cloth soaked in gasoline
4. Unlock and turn off nut with handle bar by turning it counter-clockwise	Handle bar is not to bind, when rotated	
5. Remove filter Immediately stop filter with rubber plug C31-131		
6. Fit plug E37-317 into oil unit housing instead of oil filter cover		
7. Remove rubber sealing ring from cover groove and inspect it for condition	Rubber sealing ring should be elastic and free of bites, contraction, swelling or deformation	Replace rubber sealing ring, if defective (part D253031)
8. Inspect filtering unit	Filtering unit should be clean; no metal chips or any other foreign matter is allowed on gauze discs	In case metal chips are detected on filtering unit consult representative of manufacturing plant or repair organization as to further use of filter

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Supplement to Inspection Guide No.21	PROCESS CHART No. 6a	In 3 sheets Sheet 2
POWER PLANT	REMOVAL, INSPECTION AND WASHING OF OIL UNIT FILTER	Man-hours required - 1.00

Procedure	Technical requirements	Fault correction
9. Wash filtering unit surface in gasoline bath	Damage to filtering unit gauze is not allowed	Replace filtering unit, if any damage is detected on gauze
10. Dry filtering unit	Do not blow filtering unit with compressed air. When drying filtering unit, take care to see that no dust, dirt, or any other foreign matter gets on filtering unit surface	
11. Inspect filtering unit	Filtering unit must be clean	
12. Remove plugs from oil unit housing (6Z37-317) and from filter housing (C31-231).		
13. Insert filter into oil unit housing after fitting rubber sealing ring into cover groove		
14. Screw up nut with handle bar by turning it clockwise. See that rubber sealing ring is installed properly	Biting of rubber sealing ring or its projection from under filter cover flange is not allowed	If ring biting or projection is detected, remove cover and inspect rubber sealing ring for condition. Replace ring, if necessary
15. Make external inspection of oil filter cover and housing	Surfaces of oil filter cover and housing should be clean	Clean contaminated surfaces with clean waste cloth soaked in gasoline
16. Lock oil filter cover handle bar with 1 mm dia. safety wire	Wire should prevent oil filter cover handle bar from working loose	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 64	In 3 sheets Sheet 3
POWER PLANT.	REMOVAL, INSPECTION AND WASHING OF OIL UNIT FILTER	Man-hours required – 1.00

Procedure	Technical requirements	Fault correction
17. Install connections and tighten them		
18. Check oil unit for tightness, when starting engine	No leakage is allowed	Replace seal, if leakage is detected
19. Close access panel "ENGINE AND HYDRAULIC SYSTEM ACCESSORIES" and fasten with screws		

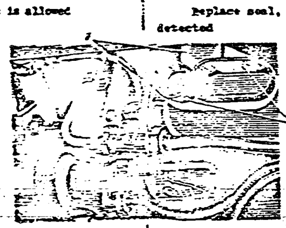

FIG. 145 ENGINE BREATHER CONNECTIONS
1 – breather connection [illegible], 2 – breather connection

Accessories	Tools
Container for small-size parts [illegible] for gasoline Tray [illegible] C31-139 Clean gasoline B-70 [illegible] wire, dia. 1-[illegible] State Standard ГОСТ [illegible]-50 Clean waste cloth [illegible] [illegible]37-317; C31-131	Screwdriver Wrenches [illegible]27-07-9Х11, 2 pieces Pliers C31-226

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Supplement to Inspection Guide No.21	PROCESS CHART No. 65	In 2 sheets Sheet 1
POWER PLANT	INSPECTION OF ENGINE CONTROLS	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction
1. Lift up access panel CONTROLS, ENGINE ACCESSORIES ([illegible]) and remove access panel HYDRAULIC UNITS ([illegible])		
2. Wash links and inspect them for condition, including attachment points	Use gasoline for washing. Links and their attachment points should be free of chafing, cracks, deformation, contacts with other components, or other defects. Nuts of coupling bolts, pump levers, and [illegible] control panel should be properly locked	Eliminate defects. If locking devices are damaged, replace them
3. Shift engine control lever throughout entire range from CUT-OFF ([illegible]) stop to FULL AUGMENTED ([illegible]) stop, to see that control lever moves smoothly and that there is no play, where links and engine control bell cranks are connected	Engine should be easily controlled. No binding is allowed throughout engine control lever travel	Detect cause of binding or excessive play and correct fault
4. Coat link and bell crank joints with [illegible]-221 lubricant	Apply lubricant [illegible]-221 in thin layer	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 65	In 2 sheets Sheet 2
POWER PLANT	INSPECTION OF ENGINE CONTROLS	Man-hours required - 0.30

Procedure	Technical requirements	Fault correction

Accessories	Tools
Bath for gasoline Brush for washing Clean gasoline B-70: [illegible]-221 lubricant Binding wire, 0.8-[illegible], State Standard ГОСТ 1066-50 Cotter pins 194X51-1.5x15 Clean waste cloth Inspection lamp Mirror CM-7804-55 Lens X4	Screwdriver Pliers C31-226

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Supplement to Inspection Guide No.71	PROCESS CHART No. 66	In 4 sheets Sheet 1
POWER PLANT	CHECKING ENGINE CONTROL LEVER FOR PROPER LOCKING AT ALL STOPS; CHECKING CONTROL LEVER POSITIONS FOR PROPER AGREEMENT WITH POSITIONS OF HP-210 REGULATING FUEL PUMP LEVERS AND ПУРТ-10 CONTROL PANEL LEVERS	Man-hours required - 0.25

Procedure	Technical requirements	Fault correction
1. Check to see that positions of engine control lever in cockpit at main ratings (Fig.146) agree with positions of HP-210 regulating fuel pump and ПУРТ-10 control panel levers on engines (Fig.147), for which purpose: (a) set engine control lever at CUT-OFF (СТОП) stop;	Engine control lever should be locked in this position. Clearance between CUT-OFF stop and engine control lever should amount to 1.5-2 mm. Lug of regulating fuel pump should tightly fit to pump CUT-OFF adjusting screw stop. Zero notch on ПУРТ-10 control panel dial should line up with notch on control panel body	Adjust engine controls
(b) set engine control lever at IDLING RATING (МАЛЫЙ ГАЗ) stop;	Notch on lug of HP-210 regulating fuel pump should be between notches limiting IDLING RATING sector on pump dial (first and third notches as from CUT-OFF stop). Figures 11-15° on ПУРТ-10 control panel dial should coincide with notch on panel body	If necessary, adjust positions of locking elements and stops

... to Inspection Guide No.21	PROCESS CHART No. 66	In 4 sheets Sheet 2
POWER PLANT	CHECKING ENGINE CONTROL LEVER FOR PROPER LOCKING AT ALL STOPS; CHECKING CONTROL LEVER POSITION ... AGREEMENT WITH POSITIONS OF HP-219 REGULATING FUEL PUMP LEVERS AND ... CONTROL PANEL LEVERS	Man-hours required - 0.25

Procedure	Technical requirements	Fault correction
(e) set engine control lever in ... (...) rating position;	Engine control lever should be locked in this position. Dial of HP-216 regulating fuel pump should set at fifth notch	
(f) set engine control lever at ... (...) stop;	Notch provided on lug of HP-219 regulating fuel pump should set behind sixth notch on pump dial. Figures 67-68 on ... control panel dial should line up with notch provided on panel body	
(g) set engine control lever in ... (...) position;	When pulled back, engine control lever should come up against MINIMUM AUGMENTED stop, if retainer is released. Notch on lug of HP-219 regulating fuel pump should set behind seventh notch on pump dial. Figures 72-73 on ... control panel dial should line up with notch provided on panel body	
(h) set engine control lever at ... (...) stop	Engine control lever should be locked in this position. Clearance between FULL AUGMENTED STOP and engine control lever should be equal to 1.5-2 mm	

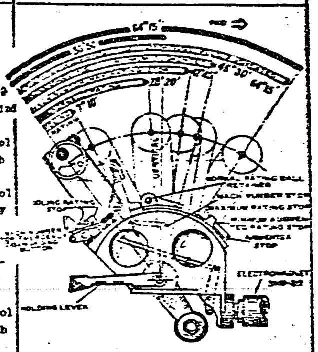

FIG. 144. POSITIONS OF ENGINE CONTROL LEVER

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Supplement to Inspection Guide No.21	PROCESS CHART No. 66	In 4 sheets Sheet 3

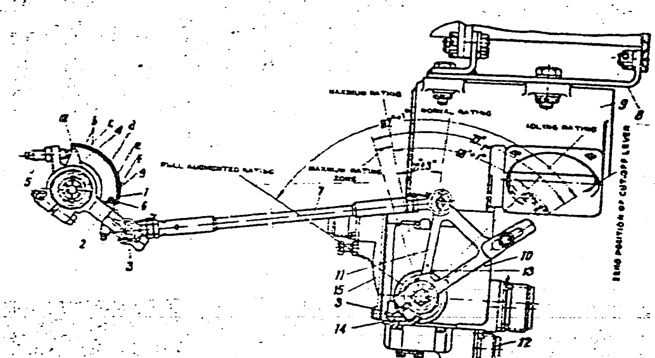

FIG. 207. POSITION OF HP-21Φ PUMP AND IDPT-1Φ PANEL LEVERS

1 – HP-21Φ pump dial; 2 – HP-21Φ pump lever; 3 – rod attachment bolt; 4 – index lug of HP-21Φ pump; 5 – CUT-OFF stop; 6 – AUGMENTED rating stop; 7 – control rod; 8 – bracket; 9 – plug connector box; 10 – IDPT-1Φ panel; 11 – lever of IDPT-1Φ panel; 12 – P-1 [illegible]; 13 – index lug of IDPT-1Φ panel; 14 – FULL AUGMENTED stop; 15 – [illegible]-2A transmitter; a – notch on index lug; b – 1st and 3rd notches limiting IDLING RATING zone; c – IDLING RATING; d – 4th notch denoting speed at which automatic regulation begins; e – 5th notch – NORMAL rating; f – 6th notch – MAXIMUM rating; g – 7th notch.

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Supplement to Inspection Guide No.21	PROCESS CHART No. 56		In 4 sheets Sheet 4
POWER PLANT	CHECKING ENGINE CONTROL LEVER FOR PROPER LOCKING AT ALL STOPS; CHECKING CONTROL LEVER POSITIONS FOR PROPER AGREEMENT WITH POSITIONS OF HP-21Ф REGULATING FUEL PUMP LEVERS AND ШУРТ-1Ф CONTROL PANEL LEVERS		Man-hours required – 0.25
Procedure	Technical requirements	Fault correction	
	Notch on HP-21Ф regulating fuel pump lug should set behind seventh notch on pump dial. Clearance between HP-21Ф pump lug and AUGMENTATION (ФСРСАН) justing screw stop should be at least 2 mm. ШУРТ-1Ф control panel lever should tightly fit to FULL AUGMENTED stop, whereas figure 1/2 on ШУРТ-1Ф control panel dial must line up with notch provided on panel body		

Accessories	Tools
Inspection lamp Mirror CS-7804-55	

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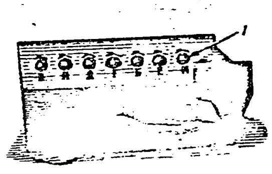
Supplement to Inspection Guide No.21	PROCESS CHART No. 67	In 3 sheets Sheet 1
POWER PLANT	CHECKING OPERATION OF JET NOZZLE FLAPS CONTROL SYSTEM	Man-hours required - 2

Procedure	Technical requirements	Fault correction
1. Connect ground power supply source 2. Turn on following switches and circuit breakers: MASTER SWITCH ([illegible]) AFTERBURNER ([illegible]), PROCESSING ([illegible]) (this switch should be set in [illegible] position) 3. Switch off afterburner blocking system [illegible] by turning screw [illegible] on afterburner control unit [illegible] in BLOCKING OFF ([illegible]) position (Fig.148) 4. Connect ground hydraulic unit (at fuselage starboard side)	Voltage in aircraft mains should not be below 25_{-2} V Pressure in hydraulic system should be within 210_{-10} kg/cm^2 Note. During hydraulic system operation, take care to see that there is no leakage in hydraulic cylinders and in hydraulic system piping joints	 FIG. 148. AFTERBURNER CONTROL UNIT, TYPE KA9-13[illegible] (Arrow shows screw "[illegible]" which engages cam of [illegible] blocking system when the slit is directed vertically and disengages [illegible] system cam when the slit is set horizontal)
5. Move engine control lever from MAXIMUM to FULL AUGMENTED stop and check time within which flaps shift from MAXIMUM to FULL AUGMENTED position	It should take [illegible]1.5 sec. to shift flaps from MAXIMUM to FULL AUGMENTED position. Move engine control lever at a rate of 1.5 to 2 sec. Check flaps shifting by observing control ring	If flaps shifting time fails to agree with specified value, perform adjustment of synchronizing valves by manipulating respective flow restrictors (Fig.149)

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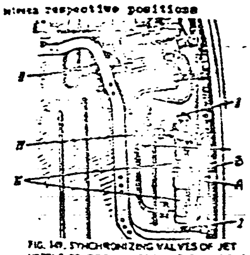
Supplement to Inspection Guide No.21	PROCESS CHART No. 67	In 3 sheets Sheet 2
POWER PLANT	CHECKING OPERATION OF JET-NOZZLE FLAPS CONTROL SYSTEM	Man-hours required – 2

Procedure	Technical requirements	Fault correction
6. Move engine control lever from FULL AUGMENTED stop to MAXIMUM stop and check time required for flaps to shift between respective positions  FIG. 149. SYNCHRONIZING VALVES OF JET NOZZLE CONTROL HYDRAULIC CYLINDERS I – actuating cylinder; II – hydraulic unit attachment rods; III – synchronizing valves; IV – [illegible] valve 1, 2 and 3 – flow restrictors for flaps [illegible]; A and B – operating rod travel synchronization adjusting screws.	Flaps should shift from MAXIMUM to FULL AUGMENTED position within 5.5 ± 1.5 sec. To determine flaps shifting time, operate shutters at least three times	Increase in capacity of synchronizing valve flow restrictor I will cause reduction of time required for rods to shift to MAXIMUM position, and vice versa. Increase in capacity of synchronizing valve flow restrictor II will reduce time required for rods to shift to AUGMENTED position, and vice versa. Having finally adjusted rod shifting time, select auxiliary valve flow restrictor III in accordance with graph (Fig.150).
	Check all three actuating rods for synchronous travel. Check is carried out as follows: with actuating rods moving to MAXIMUM position, measure distance between shanks of two other rods and hydraulic cylinder stops, as soon as one of the rods comes up against stop. Distance measured should not exceed 7 mm	If necessary, adjust actuating rod travel by manipulating screws of synchronizing valves springs, after loosening coupling nuts. Turning screw A in will increase rate of rod movement for opening flaps. Turning screw B in will increase rate of rod travel for closing flaps
7. Set screw 2 on KAO-133 afterburner control unit in LOCKING ON		

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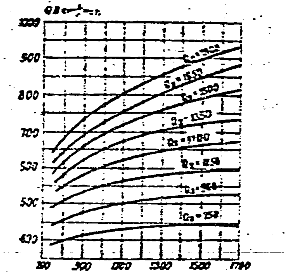
Supplement to Inspection Guide No.21	PROCESS CHART No. 67	In 3 sheets Sheet 3
POWER PLANT	CHECKING OPERATION OF JET NOZZLE FLAPS CONTROL SYSTEM	Man-hours required - 2

Procedure	Technical requirements	Fault correction
(SIONKPOBKA [illegible]) position 8. Turn off following switches and circuit breakers: MASTER SWITCH, AFTER-BURNER; set switch PROCESSING in initial position 9. Disconnect ground power supply source from aircraft mains 10. Disconnect ground hydraulic unit 11. Wipe areas stained with AMT-10 oil	Oil stains should be removed with cloth soaked in gasoline B-70 FIG. 152 GRAPH FOR SELECTING CAPACITY OF ADDITIONAL VALVE FLOW RESTRICTOR	

Accessories	Tools
Ground power supply source Tray Gasoline B-70 Clean cloth Flow restrictors Ground hydraulic unit	Screwdriver

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Supplement to Inspection Guide No.71	PROCESS CHART No. 68	In 12 sheets Sheet 2
POWER PLANT	ADJUSTMENT OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA	Man-hours required - [illegible]

Procedure	Technical requirements	Fault correction
1. Prior to disjointing fuselage, measure clearance B between adjustable jet nozzle and afterburner diffuser (Fig.151)	Local increase in clearance B is allowed to 4.5 mm (on arc not exceeding 300 mm)	Use feeler gauge to measure clearance B in telescopic joint. Where clearance B is maximum, make notch with pencil on fuselage diffuser. Remove telescopic ring and measure height of diffuser collar with slide gauge (dimension E). Difference between dimensions B and E must not be less than 1 mm. If difference is less than 1 mm, find out which of parts (diffuser or jet nozzle) is deformed. For this, turn jet nozzle through 180° and measure clearance B, where difference is less than 1 mm (where notch is made on afterburner diffuser) and in diametrically opposite point. If maximum clearance B also turnes through 180°, adjustable jet nozzle is deformed. If point where clearance B is maximum remains unchanged after turning of jet nozzle, then diffuser flange is considered deformed

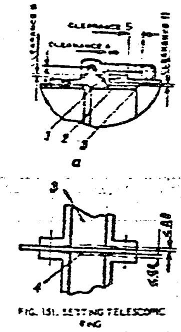

FIG. 151. SETTING TELESCOPIC RING
1 – afterburner diffuser, 2 – variable-area nozzle, 3 – telescopic ring, 4 – gasket

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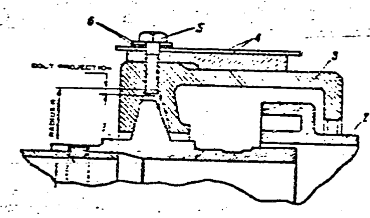
Supplement to Inspection Guide No.21	PROCESS CHART No.68	In 12 sheets Sheet 2
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA	Man-hours required - 2.00

Procedure	Technical requirements	Fault correction.
 FIG. 152. MEASURING PROJECTION OF BOLTS 1 – afterburner diffuser; 2 – variable-area nozzle; 3 – telescopic ring; 4 – fuel collector; 5 – bolt 0203080; 6 – washer 0243130		Straighten deformed flange with the aid of wooden tool (mall and dolly) **Notes:** 1. Nicks on flanges are not allowed 2. In case difference between dimensions E and B exceeds 1 mm, see that maximum clearance D does not increase (as compared to original clearance), when making subsequent inspections. If clearance is found to be increased, perform operations, detailed above. Prior to installing telescopic ring, check bolts 0203080 for projection beyond radius B (Fig.152). If projection value exceeds 0.3 mm, fit third washer 0243130 under bolt, or file bolt face (at thread end) so that projection value does not exceed 0.3 mm. When installing telescopic joint, proceed as follows: 1. Fit adjustable jet nozzle flange onto rear flange of afterburner diffuser, so that clearance A between flanges is within 2 to 10 mm (Fig.151). Do not use any levers, likely to cause

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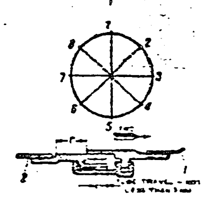
Supplement to Inspection Guide No.71	PROCESS CHART No. 68		In 12 sheets Sheet 3
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA		Man-hours required – 2.00
Procedure	Technical requirements	Fault correction	
 FIG. 153 MEASURING END CLEARANCE BETWEEN VARIABLE-AREA NOZZLE AND DIFFUSER		deformation of above components. Perform measurements by feeler gauge in four points along circumference. Difference in clearances must not exceed 1 mm 2. Fit telescopic ring in place 3. See that telescopic ring is installed properly by inspecting it thoroughly on circumference 4. Fit in bolts securing telescopic ring joint; install gasket without shield and tighten up nuts. Check clearance (see Fig.151) between ring face and gasket, which should amount to 0.8 mm (at each side). If clearance exceeds 0.8 mm, replace telescopic ring by new one 5. Remove telescopic ring coupling bolts and reinstall them along with shield; tighten up bolts and lock them	
2. Bring mounting trolley under adjustable jet nozzle and secure nozzle on trolley 3. Make external inspection of telescopic ring to see that it is installed properly	Narrow (front) groove of telescopic ring should accommodate diffuser rear flange, whereas wide		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 68	In 12 sheets Sheet 4
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS TRAVEL AGAINST SERVICE LOG DATA	Man-hours required – 2.00

Procedure	Technical requirements	Fault correction
	(rear) groove must receive adjustable jet nozzle flange	
4. Check free travel of adjustable jet nozzle in telescopic joint Carry out check on jointed aircraft	Free travel along clearance Б (Fig.253) should not be less than 6 mm	
5. After jointing aircraft measure size Г inside afterburner, in eight points (Fig.253), with tail pipe in extreme rear position	Difference in size Г measured in two diametrically opposite points should not exceed 5 mm; in horizontal plane size Г in 3rd point should exceed that in 7th point by 2 to 5 mm	If sizes Г in horizontal plane differ by more than 5 mm or less than 2 mm, adjust afterburner position with the aid of rollers. After adjustment, determine sizes A, Б, B and clearances between engine and aircraft inner skin in tail cone jointing plane, which should be within values indicated in Fig.154; measure size Г once again
	Maximum size Г should amount to about 22 mm	If size Г exceeds 22 mm, check telescopic joint clamp for proper installation
6. Refer to Service Log to set proper jet nozzle flap diameter values at the following ratings: (a) full augmented; (b) minimum augmented; (c) maximum rating		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 68		Of 12 sheets Sheet 5
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA		Man-hours required - 2.00
Procedure	**Technical requirements**	**Fault correction**	
7. Use device No.6360/44 (contained in set for 20 aircraft), to determine actual diameter value of jet nozzle flaps and compare obtained results with Service Log data	Obtained jet nozzle diameter value must not differ from that indicated in Service Log by more than 3 mm	If actual diameter value differs from that indicated in Service Log by more than 3 mm, adjust jet nozzle flaps diameter to specified value; permissible error is not to exceed ±2 mm. Adjustment of jet nozzle diameter should be started from FULL AUGMENTED rating since changing of flaps diameter at FULL AUGMENTED rating will entail changing of flaps diameter at [illegible] AUGMENTED rating Adjustment of Jet Nozzle [illegible] Diameter at FULL AUGMENTED Rating 1. Set engine control lever at FULL AUGMENTED stop; turn on following switches and circuit breakers: MASTER SWITCH, AFTERBURNER; set switch PROCESSING in I position. Switch off blocking system [illegible] by turning screw H on [illegible] afterburner control unit in BLOCKING OFF position 2. Relieve pressure in hydraulic system	

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Supplement to Inspection Guide No.22	PROCESS CHART No. 68	In 12 sheets Sheet 6
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA	Man-hours required - 2.00

Procedure	Technical requirements	Fault correction

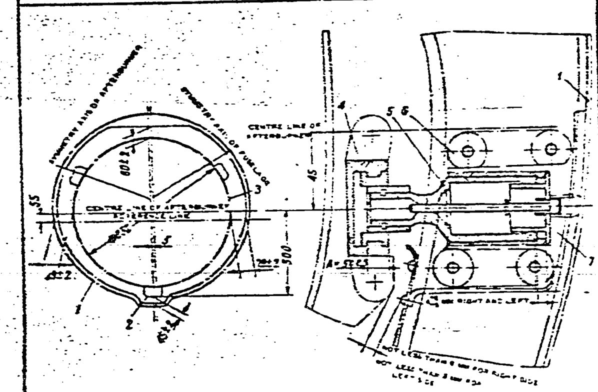

FIG. 234. MEASURING CLEARANCES BETWEEN AFTERBURNER AND FUSELAGE [illegible]
1 – fuselage outer contour; 2 – casing of hydraulic cylinder; 3 – outer contour of afterburner casing; 4 – afterburner guide [illegible]; 5 – roller body; 6 – fuselage attachment [illegible]; 7 – bolt with locking cap.

Fault correction

3. Slacken hydraulic cylinder shank locking bolts

4. Turn hydraulic cylinder rods to obtain required nozzle flaps diameter. Turning of hydraulic cylinder rod clockwise (looking forward) will increase flaps diameter, and vice versa. One turn of rod will change flaps diameter by approximately 2 to 3 mm. To avoid cocking of ring, turning of rods of all three hydraulic cylinders should be performed to the same angle. Adjustment completed, tighten up and lock bolts: turn off switches and circuit breakers

5. Check hydraulic cylinder rods for full extension at the beginning of FULL AUGMENTED sector, for which purpose set engine control lever in position at which figures 107-109 on HYPT-1Ø control panel dial line up with notch provided on control panel body. Turn screw E on KAΦ-13A afterburner control unit in BLOCKING OFF position and turn on following switches and circuit breakers: MASTER SWITCH, AFTERBURNER; set switch

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Supplement to Inspection Guide No.71	PROCESS SHEET No. 68		In 22 sheets Sheet 7
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA		Man-hours required - 2.00
Procedure	Technical requirements	Fault correction	
		PROCESSING in K position. With engine control lever set in this position, hydraulic cylinder rods should come up against mechanical stop (a) In case actuating rods come up against mechanical stop before engine control lever is set in this position, turn screw 19 on rheostat P-1 clockwise to adjust actuating rods so that they come up against mechanical stop, when engine control lever is set in above position (b) Should actuating rods stop when engine control lever is being set in above position, turn on switch EMERGENCY ENGAGEMENT OF TWO-POSITION JET NOZZLE (АВАРИЙНОЕ ВКЛЮЧЕНИЕ 2-ПОЗИЦИОННОГО СОПЛА). Extension of actuating rods should not change after above switch is turned on. If extension of actuating rods do change after switch has been manipulated (rods were not set against mechanical stop), turn screw 19 on rheostat P-1 counterclockwise to adjust full extension of	

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Supplement to Inspection Guide No.??	PROCESS CHART No. 68	In 12 sheets Sheet 8
POWER PLANT	[illegible] OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR [illegible] INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA	Man-hours required – 2.00

Procedure	Technical requirements	Fault correction

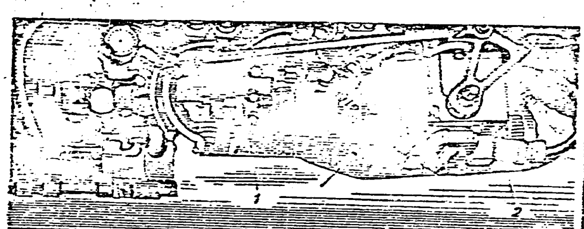

FIG. 155. ENGINE ACCESSORIES
1 – fuel pump [illegible]; 2 – panel [illegible] (ARROW SHOWS ADJUSTING SCREW OF [illegible] TRANSMITTER)

actuating rods with engine control lever set in specified position. Turn off switch EMERGENCY ENGAGEMENT OF TWO-POSITION JET NOZZLE.

After checking and adjusting full extension of actuating rods, turn screw 10 counter-clockwise through 3 to 4° and check to see that actuating rods remain stationary while engine control lever is moved within FULL AUGMENTED sector

Adjustment of Flaps Diameter at MINIMUM AUGMENTED Rating

1. Set switch [illegible] in [illegible] position, turn screw [illegible] on KAO-13A afterburner control unit in BLOCKING OFF position, and turn on following switches and circuit breakers: MASTER SWITCH, AFTERBURNER. Set engine control lever at MINIMUM AUGMENTED stop

2. Adjust flaps diameter to required value by turning adjustment screw of transmitter ДР-3А (Fig.155). Turning of screw clockwise will cause increase in jet nozzle flaps diameter

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Supplement to Inspection Guide No.21	PROCESS CHART No. 68	In 12 sheets Sheet 9
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR ENGINE INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER [illegible]	Man-hours required - 2.00

Procedure	Technical requirements	Fault correction
		and vice versa. When adjusting flaps diameter, see that axial displacement of adjustment screw does not exceed 2 mm to either side, as from initial dimension H (screw projection), indicated in Certificate of transmitter ДР-3А. Should it be impossible to adjust flaps diameter by displacing screw within specified range, adjustment of flaps diameter should be performed in the following manner: (a) set adjustment screw of transmitter ДР-3А in initial position H; (b) turn screw M9 on rheostat P-1 to obtain required flaps diameter WARNING. After adjusting shutter diameter with the aid of screw M9, be sure to check hydraulic cylinder rods for full extension, as detailed in Point 5 (see page 332) with subsequent checking and readjustment of flaps diameter at [illegible]

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Supplement to Inspection Guide No.21	PROCESS CHART No. 68	In 12 sheets Sheet 10
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA	Man-hours required - 2.00

Procedure	Technical requirements	Fault correction
		AUGMENTED rating with the aid of screw incorporated in transmitter ДР-3А. __Adjustment of Flaps Diameter at MAXIMUM Rating__ 1. Set engine control lever at MAXIMUM stop. Turn on MASTER SWITCH 2. Manipulate cylinder nuts to obtain required diameter value. Turning of nut clockwise will reduce flaps diameter, and vice versa. One revolution of nut will change flaps diameter by 2 to 3 mm. To avoid cocking of ring, turn nuts of all three cylinders through the same angle. Adjustment completed, disconnect ground hydraulic unit and power supply source from aircraft mains, set switches MASTER SWITCH, AFTERBURNER, PROCESSING in initial position, set screw Н on afterburner control unit КЮ-13Л in BLOCKING ON position, and take off device for measuring flaps diameter (No.6360/AA)

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Supplement to Inspection Guide No.21	PROCESS CHART No. 58		In 12 sheets Sheet 11
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA		Man-hours required - 2.00
Procedure	Technical requirements	Fault correction	
		In the case with engines furnished with non-adjustable jet nozzles, adjust flaps diameter as follows: (a) at AUGMENTED rating - in accordance with Points 2, 3, 4 of Section I; (b) at MAXIMUM rating - in accordance with Section III Having completed adjustment of flaps diameter, fit in pressure gauges for checking P_2^1 and P_4; run engine at MAXIMUM rating and check instrument indications; pressure P_4 should not exceed pressure P_2^1 by more than 0.02 kg/cm^2, whereas exhaust gas temperature must not exceed temperature value obtained at the beginning of engine operation by more than 20°C. Should pressure P_4 be in excess of specified value, readjust flaps diameter	

Supplement to Inspection Guide No.71	PROCESS CHART No. 68	In 12 sheets Sheet 12
POWER PLANT	INSPECTION OF JET NOZZLE AND ITS TELESCOPIC JOINT FOR PROPER INSTALLATION; CHECKING OF JET NOZZLE FLAPS DIAMETER AGAINST SERVICE LOG DATA	Man-hours required - 2.00

Procedure	Technical requirements	Fault correction

Accessories	Tools
Device for measuring flaps diameter (No.636C/44, contained in set for 20 aircraft) Washer 5243130 Pressure gauge with division value of 0.02 kg/cm² Compressed air cylinder Hydraulic unit	Feeler gauge set EA-19/1 Maul Dolly File Slide gauge

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Supplement to Inspection Guide No.2[illegible]	PROCESS CHART No. 69	In 2 sheets Sheet 1
POWER PLANT	INSPECTION OF ENGINE ATTACHMENT UNITS	Man-hours required - 0.2[illegible]

Procedure	Technical requirements	Fault correction
1. Lift up access panels [illegible] ([illegible], ENGINE [illegible] AND HYDRAULIC UNITS, [illegible] ACCESSORIES on fuselage starboard and port side		
2. Inspect engine attachment brackets and bolt heads for condition through access port ENGINE ATTACHMENT	Attachment brackets and bolt heads must be free of cracks or any other defects	If cracks are detected on bracket or on bolt head, replace respective parts
3. Inspect engine-to-airframe attachment links for condition	No cracks, dents, or any other defects are allowed on links. Bolt nuts must be locked. Use wrench to check nuts for proper tightening	Replace link; when proceeding so, take care to see that lenght of newly installed link is equal to length of link replaced. Tighten link locking nuts and apply marks with red paint to link, locking nut, and link tip (opposite to each other)
	Check marks applied with red paint to locking nut, tip, and link must be strictly aligned	
4. Lubricate link articulated joint ([illegible] replacing engine)		

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Supplement to Inspection Guide No.21	PROCESS CHART No.69	In 2 sheets Sheet 2
POWER PLANT	INSPECTION OF ENGINE ATTACHMENT UNITS	Man-hours required – 0.25

Procedure	Technical requirements	Fault correction

Accessories	Tools
Paint brush Nitro-enamel, red Lubricant, [illegible]-201 Clean waste cloth Inspection lamp Mirror CH-7806-55 Lens, X4	Screwdriver (for cross slits) Screwdriver

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Supplement to Inspection Guide No.21	PROCESS CHART No. 73	In 17 Sheets Sheet 1
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required – 48.00

Procedure	Technical requirements	Fault correction
1. Engine dismantling Prior to dismantling engine, perform normal processing of engine in accordance with recommended procedure Remove engine in the following sequence: 1. Close fuel shut-off valve 2. Remove tail cone		
3. Remove hydraulic control unit from adjustable jet nozzle, for which purpose: (a) detach hydraulic pipelines from hydraulic control unit; detach feed-back transmitter plug connector; (b) unlock and remove six pins holding links 3 to adjustable jet nozzle ring (Fig.156); (c) remove links 3 from lugs and dismantle hydraulic control unit (three cylinders complete with cooling shrouds, outer control ring 10, and load carrying ring 4 complete with six links 3) 4. Disjoint fuselage tail section in accordance with Process Chart No.38 5. Bring trolley under adjustable jet nozzle	Prior to detaching pipelines operating under pressure, make sure there is no pressure in system. When turning off pipeline nuts, make use of another wrench, to avoid deforming pipelines and loosening unions	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 2

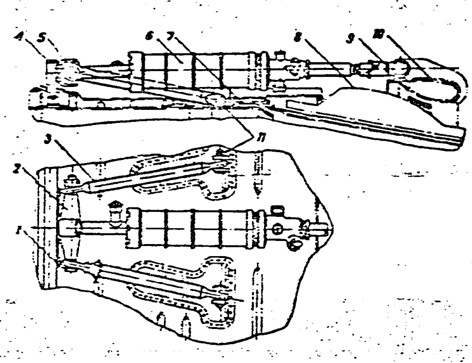

FIG. 156. LOAD-CARRYING ELEMENTS OF NOZZLE CONTROL SYSTEM
1 – [illegible]; 2 – bracket; 3 – link; 4 – [illegible] attachment load-carrying ring; 5 – link attachment plug; 6 – cylinder; 7 – flap mounting flange; 8 – flap; 9 – link tip; 10 – flap ring; 11 – pin.

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70		
POWER PLANT	REPLACEMENT OF ENGINE		In 17 sheets Sheet 3
Procedure	Technical requirements	Fault correction	Man-hours required – 48.00
6. Remove telescopic ring and detach jet nozzle from afterburner diffuser. Wrap jet nozzle in two layers of paraffin paper and bind with twine	After removing adjustable jet nozzle, install hydraulic control unit on jet nozzle; prior to this process external surfaces of flaps and hydraulic control unit		
7. Fit lifting device belts under adjustable jet nozzle, bring it up and place into shipping case after preparing attachment fittings			
8. Secure adjustable jet nozzle	Secure adjustable jet nozzle to supports in two planes: (a) first attachment zone is represented by front flange of adjustable jet nozzle, whose collar engages half-ring of case support and is secured by detachable half-ring with the aid of two hinged bolts; (b) second zone comprises slides for securing of afterburner, which hold afterburner on two T-shaped pins of case support		
9. Couple case with bottom	Case is held to bottom by four bolts		
10. Disconnect all aircraft pipelines and wires from engine, as instructed in respective list (Appendix 1)	Prior to disconnecting pipelines operating under pressure, make sure there is no pressure in system		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 4

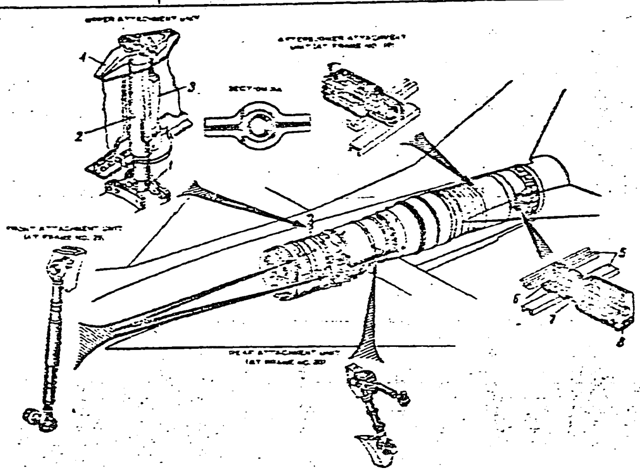

FIG. 137 ENGINE-TO-AIRFRAME ATTACHMENT UNITS
1 – attachment unit, 2 – pin, 3 – wedge, 4 – … attachment unit, 5 – rails, 6 – roller, 7 – shaft, 8 – locking cap

Supplement to Inspection Guide No.21	PROCESS CHART No. 70		In 17 sheets Sheet 5
POWER PLANT	REPLACEMENT OF ENGINE		Man-hours required – 48.00
Procedure	Technical requirements	Fault correction	
11. Bring trolley under engine 12. Disconnect engine attachment pins (Fig.157) from airframe attachment units, for which purpose: (a) remove superstructure cover on ..., near frame No.25, extract bolt ... engine upper attachment unit pin ... fuselage attachment unit; unlock and extract pin; (b) secure engine to trolley; (c) unlock and disconnect from attachment units on frame No.28 two links ... side and one link at starboard ... for additional attachment of engine; disconnect links located on frame No.28	When removing nuts, make use of another wrench to prevent deforming of pipelines and loosening of unions To provide for reinstallation of engine without subsequent levelling, do not change length of side attachment unit links, when dismantling engine from aircraft		
13. Move away engine NOTE. Engine should be fastened to trolley in front zone before engine rollers leave aircraft fuselage guide rails	When moving away engine, take care to see that fuel-cooled oil cooler passes by frame No.25 with due clearance; see that proper clearances are provided between fuselage structure components and engine (on top and below)		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 6
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required - 48.00

Procedure	Technical requirements	Fault correction
	Take away engine with due care to avoid brushing of engine accessories against fuselage structure units components or against engine mount; if necessary, change engine position by manipulating trolley adjustment elements	
14. Remove the following accessories and units from engine: (a) two hydraulic pumps [illegible]-34; (b) two tachometer generators [illegible]-1; (c) thermo-couple set [illegible]-112; (d) oil pressure transmitter [illegible]-8T; (e) two connections with gauze, for air discharge from unloading chambers; (f) oil system centrifuge connection (reinstall after mounting engine into fuselage); (g) connection for air supply into cockpit; (h) fuel system pressurization pipe with non-return valve; (i) connection with drain cock for fuel supply into booster pump; (j) fuel system vent pipes; (k) ring on engine inlet flange	When hoisting and installing engine, take care to avoid damaging	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 7
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required – 48.00

Procedure	Technical requirements	Fault correction
	engine pipelines and accessories by lifting device cables	
15. Fit special blanking covers and [illegible] into all pipelines, air intake [illegible], engine accessory unit flanges; [illegible] engine intake and exhaust ducts		
16. Fasten lifting device to engine shipping case support		
17. Perform processing of engine [illegible] surfaces in accordance with [illegible] Chart No.71		
18. Secure engine to support	Engine attachment is accomplished in two planes; (a) at aircraft load-carrying attachment fitting (compressor rear housing) – to two side brackets; (b) at front flange of turbine first stage nozzle assembly casing – to brackets arranged in centre part of engine	
19. Secure package containing spare [illegible] set for one engine and aircraft [illegible] tools kit to case support	For reliable attachment of engine to case support, see that support bolts, coupling it to case bottom are securely tightened, and that pins supporting engine are locked	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 8
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required – 48.00

Procedure	Technical requirements	Fault correction
20. Put case cover over support, fit in place face wall of case, secure them with bolts to support and apply seals to shipping case	Cover is held to case by four bolts	
<u>B. Engine Installation</u> 1. Unpack engine in the following order: (a) remove four bolts holding cover to bottom; (b) detach and remove cover wall; take cover off case bottom; (c) take out spare parts set and aircraft-carried tools kit. Check to see that seals are intact; (d) remove cover from engine; (e) secure lifting device to bolts and brackets; (f) release attachment fittings securing engine to case support; (g) hoist engine and place it on trolley, fitting bolts and brackets in position	When hoisting and mounting engine on trolley, take care to see that engine pipelines and wires are not damaged; see that lifting device cables do not touch engine components or units. It will be remembered, that	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 9
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required - 48.00

Procedure	Technical requirements	Fault correction
	centre of gravity is located at a distance of 165 mm from rear housing joint (towards adjustable jet nozzle)	
2. Unpack adjustable jet nozzle as follows: (a) remove jet nozzle hydraulic control unit; (b) release attachment fittings securing adjustable jet nozzle to case support; (c) bring lifting arm belts under jet nozzle casing, hoist jet nozzle and place it on trolley;		
3. Deprocess external surfaces of engine in accordance with Process chart No.71		
4. Make external inspection of engine directing particular attention to the following points: (a) attachment of engine units and assemblies;	All units should be securely fastened and locked	
(b) attachment of engine fuel, oil, and air lines	Pipelines must be reliably secured and locked. Clearances between pipelines should amount to not less than 3 mm. Where rigid joints are	

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 70	In 17 sheets Sheet 10
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required - 48.00

Procedure	Technical requirements	Fault correction
	provided, (casing, brackets, flanges, etc.), clearance must be equal to not less than 1 mm	
(c) attachment and condition of engine electric wires;	Electric wires should be securely fastened and locked; plug connectors should be kept clean	
(d) presence of plugs in unions for measuring instruments;	Unions serving for taking measurements on ground should be fitted with plugs. Unions for connection of engine instruments taking measurements during engine operation should be fitted with accessory plugs coated with red paint	
(e) presence of seals on adjustable elements	Should any defects be detected on engine, draw up statement to the effect and hand it over to Manufacturer	
Remove accessory plugs from engine and fit engine with units and assemblies referred to in Item 14, Section A of present Process Chart	Removal of accessory plugs from engine units and assemblies should be done just before installing units or pipelines connected	
5. Check to see whether engine compartment has been properly prepared for engine installation	Engine compartment should be cleaned of dust, dirt, traces of oil or fuel and foreign objects	
6. Check intake duct surfaces for cleanliness and condition		
7. Install engine in the reverse order of dismantling	Oxygen supply system must be filled with nitrogen. Prior to connecting	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 11
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required – 48.00

Procedure	Technical requirements	Fault correction
	aircraft pipelines to engine, see that supply pipes and hoses are free of foreign objects or dirt inside and outside	
8. Bring adjustable jet nozzle mounted on trolley to engine fastened in fuselage	Adjustable jet nozzle attachment rollers should be turned out as indicated on access panel	
9. Fit adjustable jet nozzle flange onto rear flange of afterburner diffuser, so that clearance A (see Fig.181) in afterburner diffuser flange-to-adjustable jet nozzle flange joint should be within 2 to 10 mm	When measuring clearance, do not employ any levers, which are likely to cause deformation either to afterburner diffuser flange or to adjustable jet nozzle flange. Measurement should be carried out with the aid of feeler gauge applied in four points spaced around circumference. Difference in measurements must not exceed 1 mm	
10. Install easy-detachable telescopic coupling ring holding adjustable jet nozzle to diffuser, for which purpose: (a) fit telescopic ring onto joint;	Secure telescopic ring at left-hand side (looking forward). Narrow groove provided in telescopic ring receives diffuser flange collar; collar of adjustable jet nozzle ~~engages~~ wide groove in ring	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 12
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required - 48.00

Procedure	Technical requirements	Fault correction
(b) check to see that telescopic ring has been installed properly;	Telescopic ring should connect by hand effort	If clearance amounts to more than 0.8 mm, replace telescopic ring by new one
(c) fit in bolts securing telescopic ring joint, install gasket without screen and tighten up nuts;	After bolts are fitted in, clearance of 0.8 mm is allowed between ring face and gasket (at both sides, see Fig. 151)	
(d) remove bolts; reinstall them along with screen; tighten and lock bolts		
11. After installing telescopic ring, check axial displacement of adjustable jet nozzle in telescopic joint (with fuselage nose section joined)	Axial displacement of adjustable jet nozzle must not be less than 6 mm (with regard to clearance "B"), (see Fig.153)	
12. Connect oxygen supply pipeline to engine non-return valve		
13. Perform joining of aircraft as laid down in Process Chart No.38. After completing aircraft joining, measure clearance "B" between adjustable jet nozzle and afterburner diffuser (see Fig.151)	Should it be necessary to check engine and afterburner operation, it is allowed to check engine fitted with adjustable jet nozzle on ground, provided jet nozzle is secured to truss	
14. Perform flushing of pipeline for removal of air locks, as follows: <u>Main Fuel System</u> (a) connect ground power supply source	Prior to starting flushing procedure, fill aircraft main and starting fuel tanks Drain processing compound from	

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Supplement to Inspection Guide No.21	PROCESS CHART No. [illegible]	In 17 sheets Sheet 13
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required - 48.00

Procedure	Technical requirements	Fault correction
to aircraft mains; (b) remove screw cap from air release union on unit 357C and connect air discharge device BN-838; (c) open fuel shut-off valve and start booster pumps; (d) after completing flushing, switch off booster pumps and reinstall screw cap after replacing rubber sealing ring; (e) use the same procedure for flushing regulating fuel pump HP-21Ф by connecting device BN-838 to relief valve Pipeline Supplying Starting Fuel to Starting Electro-Magnetic Valve (a) set switch AIRCRAFT GROUND STORAGE BATTERY (АККУМУЛЯТОР БОРТОВОЙ АЭРОДРОМНЫЙ) in ON ([illegible]) position; (b) set switch PROCESSING ([illegible]) (BK) in K position; (c) turn on switch STARTING UNITS ([illegible]) (АПС-25);	fuel pipelines through fuel drain union on unit 357C Discontinue flushing procedure as soon as stream of fuel flowing from hose does not contain air bubbles, but only after 8 to 10 lit. of fuel has been drained	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 14
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required - 48.00

Procedure	Technical requirements	Fault correction
(d) turn on switch STARTING IN AIR ([illegible]) (3B); (e) discontinue flushing procedure as soon as stream of starting fuel (issuing from aircraft drain valve) contains no more air bubbles; (f) after flushing main and starting fuel pipelines, set switch STARTING IN AIR in initial position; (g) rub areas splashed with fuel by cloth	Oxygen cut-off valve should be closed	
Hydraulic System (a) connect ground hydraulic unit; (b) switch off interlocking systems [illegible] and [illegible] system by turning screw [illegible] on afterburner control unit [illegible] in BLOCKING OFF position; (c) turn on switch AFTERBURNER; (d) shift engine control lever 3 to 5 times from [illegible] stop to FULL AUGMENTED stop and back While doing so, observe movement of flaps ring. Properly aligned ring will indicate that there are no air locks in hydraulic system;	Misalignment of flaps ring must not exceed 7 mm. Any difference in hydraulic cylinder rod projection is not allowed	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 70	In 17 sheets Sheet 15
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required - 48.00

Procedure	Technical requirements	Fault correction
(e) check time period required for cylinder rods to shift from one position to another in compliance with Process Chart No.67	Ring misalignment should be checked as follows: as soon as one of rods sets against stop (with rods moving to MAXIMUM position), measure distance between shanks of two other rods and stops of respective cylinders. Values obtained will indicate degree of misalignment	
(f) set all switches and circuit breakers in initial position after flushing of pipelines is completed 15. Deprocess internal surfaces of engine in compliance with Process Chart No.71 16. Check operation of adjustable jet nozzle hydraulic control system as instructed in Process Chart No.67 17. Set time lag value on afterburner control unit KAG-13K, with regard to fuel and adjustable jet nozzle flaps in compliance with data presented in engine Service Log 18. Check main flame igniter oxygen supply system, proceeding as follows:		

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Supplement to Inspection Guide No. 2)	PROCESS CHART No. 70	In 17 sheets Sheet 16
POWER PLANT	REPLACEMENT OF ENGINE	Man-hours required – 48.00

Procedure	Technical requirements	Fault correction
(a) fill aircraft oxygen bottle with gaseous commercial nitrogen;	Filling should be carried out via charging union until pressure is brought to 150 kg/cm^2 (using felt filter)	
(b) fit in pressure gauge calibrated from 0 to 10 kg/cm^2, for measuring oxygen pressure downstream of non-return valve;		
(c) make sure ground power supply source is connected to aircraft mains;		
(d) open oxygen supply bottle shut-off valve;		
(e) turn on MASTER SWITCH, as well as switch STARTING UNITS (ASC-25);		
(f) set switch OXYGEN ([illegible]) ([illegible]) in CHECKING ([illegible]) position and measure oxygen pressure downstream of non-return valve;	Nitrogen pressure downstream of non-return valve must amount to 6.5 – 8.5 kg/cm^2	
(g) remove pressure gauge and fit in substitute plug;		
(h) treat non-return oxygen valve-to-aircraft pipeline joint, as well as plug fitted into union for measuring oxygen pressure, with neutral soap foam for checking tightness of joints;		

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Supplement to Inspection Guide No. 21	PROCESS CHART No. 70		In 17 sheets Sheet 17
POWER PLANT	REPLACEMENT OF ENGINE		man-hours required – 42.00
Procedure	Technical requirements	Fault correction	
(i) set switch OXYGEN ([illegible]) in CHECKING position and release nitrogen; (j) set switches and circuit breakers in initial positions, detach ground power supply source; (k) charge oxygen bottle	When releasing nitrogen, check above joints for tightness. When charging oxygen bottle, observe due care: hands should be clean; take measures to prevent contact with oil	If bubbles are formed on soap foam, tighten up or recondition joint	
39. Start engine and check its operation	Checking should be done on site allotted for the purpose		

Accessories	Tools

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Supplement to Inspection Guide No.21	PROCESS CHART No. 71	In 11 sheets Sheet 1
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required - 6

Procedure	Technical requirements	Fault correction
I. Internal Processing		
1. Perform starting and checking of engine at all ratings including augmented rating	Engine starting and checking should be performed on site allotted for the purpose, with aircraft securely fastened	
2. Process internal surfaces of engine as follows: (a) check to see that processing oil has been tested in laboratory;	Respective certificate will be valid for not more than 7 days from date of issue	
(b) fill tank for internal processing with oil (Fig.258);	For internal processing of fuel and oil systems, employ oil MK-8, State Standard ГОСТ 6457-53. Oil properties should comply with requirements of State Standard ГОСТ Specifications. It is strictly prohibited to utilize oil containing traces of water, or reclaimed, or used oil. Insert oil into tank through silk filter. See that no dust, dirt, or foreign particles find their way into tank. Processing oil tank must be fitted with booster pump equipped with reducing valve and filter ФТ-1 or ФТ-2 at the outlet	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 71	In 11 sheets Sheet 2
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required – 6

Procedure	Technical requirements	Fault correction
(c) drain oil from engine oil system via oil tank and accessory gear box drain cocks; (d) fill oil tank with fresh oil after checking respective Certificate;	No draining of oil is required, if engine operation amounts to not more than 10 hours Oil tank should contain 11±0.5 lit. of oil, as measured by dip stick	
(e) close fuel shut-off valve; (f) drain fuel via fuel-oil unit drain cock; discharge fuel from drain tank by removing plug; (g) pour at least 3 lit. of oil into starting fuel tank;	Oil pressure at inlet to booster pump ДЦН-13ДТ must be equal to 1.07–1.7 kg/cm^2	
(h) connect hose running from internal processing tank (Fig.158) to processing union located on pipe supplying fuel to booster pump ДЦН-13ДТ	Prior to connecting processing pipeline, flush it with oil Hose tips should be clean	Wash in clean kerosene
(i) use hose of device БК57-535 to connect unions for measuring afterburner fuel pressure with union serving for measuring fuel pressure in pilot fuel manifolds; (j) supply nitrogen under pressure of 2 to 4 kg/cm^2 (via filter) to union for measuring oxygen pressure; blow		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 71	In 11 sheets Sheet 3

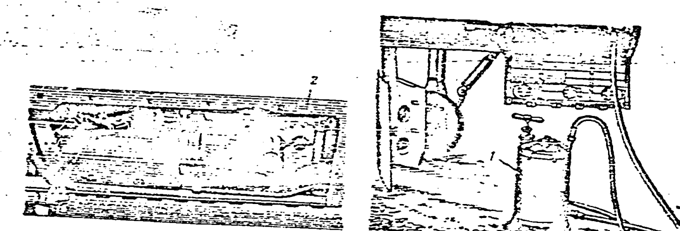

FIG. 158. DEVICE FOR ENGINE INTERNAL PROCESSING
1 – tank with hose, 2 – connection for cooling hose.

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Supplement to Inspection Guide No.71	PROCESS CHART No.71	In 11 sheets Sheet 4
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required - 6

Procedure	Technical requirements	Fault correction
oxygen system with nitrogen during processing 3. Carry out engine cranking, for which purpose proceed as follows: (a) connect ground power supply source to aircraft mains; (b) turn on following switches and circuit breakers: STORAGE BATTERY, AIRCRAFT, GROUND (n_2) (set it in ON position); STARTING UNITS (ASC-25); AFTERBURNER (ASC-15); DAMPING VALVE (EC) on engines of 5th series; PROCESSING (BK) (set it in K position); CRANKING (BD) (set it in CRANKING position); (c) disconnect blocking systems YS and B40 by turning screw H located on afterburner control unit KAO-15K; (d) set engine control lever in FULL AUGMENTED position, press button STARTING ON GROUND and keep it pressed for 1 to 2 sec.;	Switch STARTING IN AIR (ASC-10) must be set in OFF position. Switch OXYGEN (BKD) should be set in OPERATING position Depressing of button STARTING ON GROUND will cause generator to spin engine rotor. Rotors should spin smoothly, without knocking or binding. 24 V supply system is employed for	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 71	In 11 sheets Sheet 5
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required - 6

Procedure	Technical requirements	Fault correction
(e) crank engine 4 to 5 times to accomplish processing of internal surfaces	engine cranking; neither power supply sources, nor starting unit supply line is switched from 24 to 48 V. After cranking engine 5 times in succession, allow starter to cool down for not less than 30 min. before cranking engine again. While cranking engine, shift engine control lever 2 to 3 times from IDLING rating stop to MAXIMUM stop. After final cranking of engine, oil should issue from drain pipes of main and afterburner combustion chambers in full stream	
4. Set internal processing tank switch in ON position (this should be done, when depressing button STARTING ON GROUND)		
B. External Processing 1. Stop all open unions with special plugs or plugs made of cellophane film	External processing or operations on removal of surface corrosion must not be performed during rain or snowfall	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 71	In 11 sheets Sheet 6
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required – 6

Procedure	Technical requirements	Fault correction
2. Wipe external surface of engine and afterburner with cloth soaked in clean gasoline. Dry surfaces subject to processing	When proceeding so, take care to see that gasoline or processing compound does not get on electric wiring, relief jet of starting fuel control unit incorporated in fuel regulating pump НР-21Ф, generator ГСР-СТ-12000ВТ, booster coil КЕА-11А, or adjusting needles.	
	If corroded spots are detected on engine external parts, remove corrosion	Clean corroded spots with fine emery cloth treated with oil, polish with paste ГОИ, wash with clean gasoline and coat with processing compound
3. Treat external surfaces of metal components void of paint coatings with thin layer of processing compound, including internal surfaces of afterburner	For external processing of engine non-painted metal parts use neutral petrolatum, State Standard ГОСТ 782-53 Petrolatum may be substituted by aviation oils МС-20 or МК-22, State Standard ГОСТ 1013-49, with addition of 4 to 10% ceresine, State Standard ГОСТ 2488-47. Processing compound should meet requirements of respective State	

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Supplement to Inspection Guide No.21	PROCESS CHART No. 71	In 11 sheets Sheet 7
POWER PLANT	PROCESSING AND DEPROCESSING ENGINE	Man-hours required - 6

Procedure	Technical requirements	Fault correction
4. Arrange 30 silica gel bags on engine. From this number 6 bags must be arranged in diffuser, and 8 - in front housing. Remaining 16 bags should be arranged as follows: (a) in the vicinity of engine accessories - 8 bags; (b) on compressor front housing - 6 bags; (c) on compressor rear housing - 2 bags;	Standard ГОСТ Specifications so far as its properties are concerned. Use of processing compound is allowed only in case moisture content is equal to zero. It is strictly prohibited to utilize reclaimed or used processing compound. Use brush or atomizer for carrying out processing procedure. For liquifying processing compound, petrolatum should be preheated to 80-90°C, and aviation oil and ceresine mixture - to 60-70°C Bags should be fastened at both ends. Take care to prevent greasing of bags (place bags on top of paraffined paper). Silica gel should be freshly dried and its moisture content should not exceed 2%	Remove moisture from processing compound by heating it to temperature of 110-120°C, until no froth is visible on heated oil surface

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Supplement to Inspection Guide No.71	PROCESS CHART No. 71	In 11 sheets Sheet 8
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required – 6

Procedure	Technical requirements	Fault correction
(d) on turbine housing – 2 bags 5. Put blanking cover on diffuser. Fit canvas cover or painted plywood blanking cover onto front housing 6. Wrap engine in two layers of paraffine paper and bind it with twine		
7. Place 10 silica gel bags on top of paraffine paper (distributing them uniformly on entire engine surface), provide two humidity indicators 8. Put cover of film onto engine	Arrange humidity indicators on engine so that they can be observed through cover film and through case ports Carefully press cover to engine to remove any air	
9. Apply tag to packed engine; following data should be indicated on tag: engine No., date of processing and storage expiration date, number of silica gel bags, signatures of person in charge of processing and that of inspector 10. Enter date of processing and storage expiration date in engine Service Log C. Deprocessing of External Surfaces 1. Wash external parts of engine coated with processing compound with clean gasoline, using brush		

Supplement to Inspection Guide No.[illegible]	P R O C E S S C H A R T No. 71	In 11 sheets Sheet 9
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required - 6

Procedure	Technical requirements	Fault correction
2. Thoroughly wipe washed areas with dry cloth	Do not allow gasoline or oil to get on electric equipment components, when deprocessing engine. Thick processing compound may be removed with the aid of transformer oil heated to temperature of 80-90°C. Exposure of painted surface to gasoline or solvents for more than 2 min. is not allowed	
D. Deprocessing of Internal Surfaces 1. Drain processing oil from engine accessory gear box and engine tank 2. Pour fresh oil into engine tank 3. Connect ground power supply source to aircraft mains 4. Turn on following switches and circuit breakers: (a) STORAGE BATTERY (B); (b) STARTING UNITS (ABC-25); (c) AFTERBURNER (AZC-[illegible]); (d) [illegible] VALVE ([illegible]) - for engines of 5th series; (e) CRANKING (EC) (set it in CRANKING position);		

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Supplement to Inspection Guide No.71	PROCESS CHART No. 71	In 11 sheets Sheet 10
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required - 6

Procedure	Technical requirements	Fault correction
(f) PROCESSING (ПН) (set it in П position) 5. Use hose of device ПЗ7-535 to connect unions for measuring pressure of afterburner fuel with union for measuring fuel pressure in pilot manifold 6. Disconnect blocking systems П3 and П40 by turning screw B on afterburner control unit КАО-131 7. Open fuel shut-off valve 8. Start main fuel booster pumps 9. Set engine control lever at FULL AUGMENTED stop, press button STARTING ON GROUND and keep it pressed for 1 to 2 sec.	As soon as button is depressed, generator should start cranking engine. Rotor spinning should not involve any knocks or binding. Deprocessing will be accomplished in 3 to 4 engine crankings. After cranking engine 5 times in succession, allow starter to cool down within not less than 30 min., before cranking engine again	If any defects are found during cranking, immediately discontinue cranking by turning off circuit breaker STARTING UNITS. Do not crank engine again unless defect is eliminated
10. Stop main fuel booster pumps and perform engine cranking		

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Supplement to Inspection Guide No.21	PROCESS CHART No. 71	In 11 sheets Sheet 11
POWER PLANT	PROCESSING AND DEPROCESSING OF ENGINE	Man-hours required - 6

Procedure	Technical requirements	Fault correction
111. Set switches, circuit breakers and screw [illegible] on [illegible] unit in initial positions		

Accessories	Tools

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Supplement to Inspection Guide No.21	PROCEDURE CHART No. 72	In 1 sheet Sheet 1
POWER PLANT	ENGINE TRIALS; CHECKING OF INSTRUMENTS AND UNITS FOR PROPER OPERATION; CHECKING OF SYSTEMS FOR TIGHTNESS	Man-hours required - 2

Procedure	Technical requirement	Fault correction
1. Start and subject engine to trials, with afterburner turned on	Engine performance characteristics should comply with Specifications	In the course of engine operation it is allowed to carry out adjustments (see Appendix No.2)
2. With engine running, check fuel, oil, and hydraulic systems for condition, by observing them through respective access panels on fuselage	Systems should be airtight	Recondition systems, if not tight

Accessories	Tools

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APPENDIX 1

DETACHABLE CONNECTING LINES OF ENGINE

Description	Type of connection	Description	Type of connection
Oil System		Return line of hydraulic fluid from nozzle flap control hydraulic cylinders	Nipple
Engine breathing line	Rubberized canvas hose	**Flame Igniter Oxygen Feeding System**	
Main and Starting Fuel System		Supply line of low-pressure oxygen to non-return valve	Nipple
Main fuel supply line to booster pump, type ЦБ-13ИТ	Flange	**Electric System of Engine**	
Starting fuel supply line to solenoid-operated valve	Nipple	Connection 2НР6Ш45НЕ2	
Engine Air Bleed System and Pressure Balance Chamber Pressure Relief System		Connection 2РТ20Ш45НЕ2 of ДОС-1А transmitter	
Air bleed for aircraft hot air needs (at two points)	Nipple Flange	Connection of wires to starter-generator	Bolt
Air bleed from pressure balance chamber manifold (at two points)	Flange	Starter-generator cooling line	Flange
Air bleed for shaft blowing	Telescopic	**Drain System**	
Hydraulic System		Drain lines from two hydraulic pumps НШ-34	Nipple
Hydraulic fluid supply line to nozzle flap control hydraulic cylinders	Nipple	Fuel drain line from ЦБ-13ИТ pump drive	Nipple

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Description	Type of connection	Type of connection	Description
Fuel drain line from electric contactor of KP-22 unit	Nipple	Fuel drain line from glands of KP-21 and KP-22 unit drives	Nipple
Fuel drain line from combustion chamber housing	Nipple	Oil drain line from two-speed gear box	Nipple
Fuel drain line from collector of afterburner diffuser	Nipple	Fuel drain line from starting fuel control unit, electric contactor and regulator drive gland of KP-210 unit	Nipple
Fuel drain line from fuel collector of nozzle diaphragm assembly diffuser	Nipple		

Note. All the drain lines with the exception of the fuel drain line from the fuel collector of the afterburner diffuser are connected into a single common leadout pipe.

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APPENDIX 2

ADJUSTMENT OF ENGINE

In the course of engine operation the following adjustments are allowed:

1. Adjustment of engine starting.
2. Adjustment of idling r.p.m.
3. Adjustment of low-pressure rotor maximum r.p.m.
4. Adjustment of oil pressure.
5. Adjustment of the limit switch incorporated in the hydraulic decelerator of regulating fuel pump HP-21Б.
6. Adjustment of control unit.
7. Adjustment of high-pressure rotor maximum r.p.m.
8. Adjustment of time delays of afterburner control unit [illegible]-132.
9. Adjustment of acceleration.

All the adjusting devices of the engine delivered by the Manufacturer should be properly locked.

WARNINGS: 1. Prior to carrying out engine adjustment, see to it that the readings of the measuring instruments are precise.

2. To ensure that the adjustment results are stable, change the positions of the adjusting devices by turning them in. Should it be necessary to turn an adjusting device out through some angle, first turn it out by the desired angle plus 180°, and then turn it in through 180°.

If the adjusting device has several fixed positions (indicated by clicks, etc.), reserve the basic margin by moving the adjusting device through the number of clicks equivalent to an angle of 180°. Upon completion of the adjusting procedure lock the respective adjusting devices and apply seals.

In the course of engine operation it is allowed to change the position of the following adjusting elements:

(a) the adjusting screw of the maximum r.p.m. limiter incorporated in regulating fuel pump HP-21Б;

(b) the HP-21Б regulating fuel pump maximum r.p.m. stop;

(c) the flow restrictor of the hydraulic decelerator of regulating fuel pump HP-21Б;

(d) the pressure increase limiter flow restrictors of the 1st and 2nd branches of regulating fuel pump HP-22Б

(e) the stop of the HP-21Б regulating fuel pump lever in the AFTERBURNER (ФОРСАЖ) position:

(f) the adjustment screw of the HP-22Б regulating fuel pump electrohydraulic contactor;

(g) the screw of the starting control unit of regulating fuel pump HP-21Б;

(h) the air jet of the starting control unit;

(i) the flow restrictor of the afterburner valve of the HP-22Б regulating fuel pump;

(j) the reducing valve of the oil unit;

(k) the screws of the limit switches of boosters ЭЦ-4Б (ЭЦ-2ТК);

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(l) regulating needle P_2;

(m) altitude corrector needle P_2^{*};

(n) screws №9 and 10 of the P-1 rheostat.

The positions of other adjustment elements can be adjusted only by the manufacturer's representative.

All the adjustments performed should be duly registered in the engine Service Log.

Adjustment of Engine Starting

The engine starting system is adjusted with the use of the ground power supply source.

The adjusting elements of the engine starting system are:

1. The screw of the spring incorporated in the starting fuel control unit which controls the first stage of the starting procedure (up to speed n_2 = 18 to 21%).

When the screw is turned out the engine accelerates at the first stage of the starting procedure slowly (the temperature of gases after the turbine decreases), and vice versa.

2. The jet serving for bleeding air from the diaphragm chamber of the starting fuel control unit, which controls the 2nd stage of the starting procedure (the engine develops speed n_2 in excess of 18 - 21%).

An increase in the jet orifice diameter causes the engine to accelerate in the second stage of the starting procedure at a slower rate (the temperature of gases after the turbine decreases), and vice versa.

In case the engine characteristics (the time period required for starting, temperature of gases after the turbine) displayed in the course of the starting procedure come out of the specified performance limits, adjust the starting system in the following manner:

1. Make sure that when the engine control lever is set in IDLING RATING (МАЛЫЙ ГАЗ) position the index lug of the НР-21Ф regulating fuel pump lever is located between the notches limiting the idling rating zone on the pump dial.

2. Connect the pressure gauge and check the fuel pressure in the starting manifold. The starting fuel pressure should be within 2.0 ± 0.2 kg/cm^2 (without pressurization of the starting fuel tank, and with the voltage in the aircraft storage battery amounting to 25_{-2}V). If the actual pressure does not agree with the specified value, carry out the necessary adjustment with the aid of the screw accommodated in the reducing valve of the starting fuel pump. When the screw is turned in, the pressure increases, and vice versa.

3. Mount the pressure gauge (with the scale range from 0 to 100 kg/cm^2) for measuring fuel pressure in the primary fuel manifold.

4. Start the engine after ascertaining that the electric control equipment and the power supply source function properly.

Note. It is allowed to start the engine with manual control of the fuel supply.

5. Warm up the engine for 1 to 2 min. at a speed amounting to 88 - 90% of the normal rating.

6. Check the idling r.p.m.: these should be equal to the speed (see Fig.159) specified for the given barometric pressure.

Adjust the idling r.p.m. if necessary.

7. Check and, whenever necessary, adjust the fuel pressure in the primary fuel manifold with the engine running at idling rating; the pressure should amount to 21 ± 1 kg/cm^2 for engines fitted with the НР-21Ф pumps (beginning with series Д). The adjustment procedure is carried out by the representative of the manufacturer; to accomplish adjustment, the screw of the distributing

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valve (PK) should be turned by not more than a quarter of a turn relative to the initial position.

Turning the screw in will cause an increase in the fuel pressure.

8. Stop the engine, remove the air jet, and disconnect the solenoid-operated valve which controls the additional fuel supply at starting; to measure the fuel pressure in the primary fuel manifold mount a pressure gauge (scale range from 0 to 10 kg/cm^2).

9. Without fitting in place the air jet of the starting fuel control unit and with additional fuel supply disconnected, start the engine; when the engine becomes logy (fails to accelerate despite the movement of the throttle control lever), manipulate the starting fuel control unit screw to adjust the fuel pressure in the primary manifold. This pressure should equal 4 to 5 kg/cm^2.

Note. Determine the position of the starting fuel control unit adjusting screw by turning it in as far as it will go and noting the number of full revolutions.

10. Fit in the starting fuel control unit air jet ($1.9^{-0.3}_{-0.4}$ to $2.0^{-0.2}_{-0.5}$ mm in diameter), and connect the solenoid-operated valve controlling the additional fuel supply at starting (if provided). Make sure that the primary fuel manifold is fitted with a pressure gauge (scale range from 0 to 100 kg/cm^2).

11. Start the engine 2 or 3 times.

Notes: 1. The engine should start without becoming logy and without excessive rise of gas temperature.
If the engine fails to accelerate after the high-pressure rotor develops a speed amounting to 18 - 21% of the normal rating, as well as in case a flame torch appears after the turbine, the starting fuel control unit screw should be turned out. If the engine fails to accelerate after the high-pressure rotor develops a speed amounting to 25 - 27% of the normal rating, reduce the diameter of the starting fuel control unit air jet.
2. If surging is experienced at high-pressure rotor speed of about 32% of the normal rating, increase the diameter of the starting fuel control unit air jet.
3. A reduction in the engine acceleration rate is allowed within the high-pressure rotor speed range of approximately 24 to 28% of the normal rating; in this case the total engine starting period (when using the ground power supply source) should not be in excess of 60 sec.

12. Check to see that there is a certain interval between the moment when the engine fails to accelerate without temperature rise and the moment of the engine becoming logy with temperature rise (this interval should be equivalent to not less than three turns of the starting fuel control unit adjusting screw).

Note. In case of failure to adjust the engine starting system properly, as well as in case the starting fuel control unit screw can be turned through less than 3 turns, show the starting unit to the Manufacturer's representative.

When through with the adjusting procedure, disconnect the pressure gauges, plug the gauge connections and start the engine 2 or 3 times in succession.

13. In the case with engines furnished with equipment for autonomous starting, proceed as follows: having adjusted the engine starting system with the use of the ground power supply source, check the starting fuel control unit screw for the number of revolutions through which it can be turned additionally from the initial

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position, using fully charged aircraft storage batteries (or some other power supply source which ensures engine spinning to n_2 = 9 to 11% of the normal rating); the screw should turn through not less than 3/4 of a turn to either side. The checkout procedure is as follows:

(a) turn in the starting fuel control unit screw through 3/4 of a turn from the initial position and check the engine starting;

(b) turn out the starting fuel control unit screw through 1.5 of a turn from the last position and repeat the engine starting check.

If the engine fails to start with the screw set in one of the above positions, as well as in case the starting procedure takes more than 100 seconds after the screw has been turned out through 1.5 of a revolution, readjust the starting system as instructed in the Note to Point 11 of the present Section. After the readjustment check the starting fuel control unit screw again, with the use of the aircraft storage batteries.

The check completed, set the starting fuel control unit screw in the intermediate position.

Adjusting the Idling R.P.M.

Prior to checking and adjusting the idling r.p.m., see that when the engine control lever is in the IDLING RATING position the index lug of the HP-21Б regulating fuel pump lever is located between the notches which limit the idling rating zone on the pump dial; these are the first and third notches, as counted from the CUT-OFF (CTOП) position.

Checkout and adjustment of the idling r.p.m. should be carried out after the engine has been warmed up during 2 minutes at a speed of at least 88% of the normal rating. Prior to performing the adjustment, check the idling rating zone by moving the engine control lever in either direction between the first and third notches (as counted from the CUT-OFF position) provided on the HP-21Б regulating fuel pump dial. If the idling rating zone upper limit r.p.m. differ from the lower limit r.p.m. by more than 1.5%, consult the Manufacturer's representative as to the further use of the HP-21Б pump.

To adjust the idling r.p.m. it is necessary to turn the adjusting head through several clicks, so that the idling r.p.m. become equal to the r.p.m. value indicated in the Chart for the given barometric air pressure.

Rotation of the adjusting head clockwise causes the idling r.p.m. to decrease, and vice versa. One turn of the adjusting head results in the change of the idling r.p.m. by about 2%.

Adjustment of the idling r.p.m. should be accomplished with the ЭЦ-34-2Т pump and ГСР-СТ-12000ВТ starter-generator running.

Adjustment of Low-Pressure Rotor Maximum R.P.M.

1. In case the maximum speed of the low-pressure rotor on the properly warmed up engine differs from the specified value of 100 ± 0.5% it is necessary to carry out appropriate adjustments.

Note. When adjusting the maximum r.p.m. of the low-pressure rotor make use of an attachment tachometer which reads accurate to ±0.2% within the 90 - 105% range. If no attachment tachometer is available the aircraft tachometer may be employed; in this case the r.p.m. value at which the adjustment procedure is being carried out should not exceed 100.5%, with due consideration of the actual correction to the instrument readings.

2. Prior to starting the engine, check the elements of the control unit for proper position:

(a) figure 68 should be indicated at control panel KYPT-34;

(b) the notch on the index lug of regulating fuel pump HP-21Ф should bear over the sixth notch on the dial.

The maximum r.p.m. should be adjusted by resetting the hydraulic decelerator screw. Turning the screw in causes a reduction in the r.p.m., and vice versa. One revolution of the screw changes the r.p.m. by about 2.2 to 2.7%.

Having completed the adjusting procedure, check the maximum r.p.m. of the engine; to this end set the engine control lever at MAXIMUM (MAKSIMAL) stop from the 90% r.p.m. position. Repeat this procedure two or three times.

3. Check to see that regulating fuel pump HP-21Ф does not cause the maximum r.p.m. to exceed the specified value as a result of changes in the fuel flow into the engine; to check, act as follows:

(a) detach for some time the plug connectors from the solenoid-operated valve and from the limit switch of the afterburner valve incorporated in the HP-22Ф pump;

(b) check the difference between the maximum r.p.m. when setting the engine control lever at the MAXIMUM stop and the FULL AUGMENTED (FORSAZH [illegible]) stop.

The difference between the maximum r.p.m. values for the two settings should not exceed 0.5%.

Note. The maximum r.p.m. values in either case should not exceed 100.5%.

If the difference between the maximum r.p.m. values for the two settings is found to be in excess of 0.5%, replace the feed-back flow restrictor with a new flow restrictor whose capacity is greater by 20 to 30 cu.cm/min.

Notes: 1. The maximum permissible capacity of the feed-back flow restrictor is 300 cu.cm/min.
2. After replacement of the feed-back flow restrictor, check the engine acceleration from the idling rating to the maximum rating and variations in the engine r.p.m. at engine ratings amounting to 88 - 100% normal rating; the r.p.m. variations should be within ±0.3%.
3. If turning of the hydraulic decelerator adjusting screw through 2 turns (when carrying out the adjustment procedure discussed in Point 2) fails to bring the maximum r.p.m. (n_1) to the proper value of 100 ± 0.5%, regulating fuel pump HP-21Ф should be replaced.

Adjustment of Oil Pressure

In case the oil pressure value turns to be beyond the specified range it must be adjusted by means of the rotating shank of the reducing valve incorporated in the oil unit.

If the oil pressure is in excess of the specified value, the shank should be turned out. If the oil pressure is lower than specified, the shank should be turned in. One turn of the adjusting screw changes the pressure by 1 kg/cm^2.

Note. If the oil pressure drops by more than 0.5 kg/cm^2 below the minimum pressure value, consult the Manufacturer's representative as to the possibility of further use of the oil unit.

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Adjustment of Limit Switch Incorporated in Hydraulic Decelerator of Regulating Fuel Pump HP-21Ф

Check the hydraulic decelerator operating r.p.m. in the following succession:

1. Detach the electric plug connector of the hydraulic decelerator of the HP-21Ф pump and connect it to the engine via console No.356 taken from the maintenance kit for 20 aircraft.

2. While smoothly moving the engine control lever in the range between 90% to maximum r.p.m., watch the illumination of the indicator light in console No.356; the light comes on to indicate that the limit switch of the hydraulic decelerator of the HP-21Ф regulating fuel pump operates as soon as the speed reaches 98 ± 1% normal rating.

If the actual r.p.m. are not within the specified r.p.m. range, operate the adjusting screw of the hydraulic decelerator switch to bring the limit switch operating r.p.m. within the specified range; turning the screw in will increase the r.p.m. at which the limit switch operates and vice versa. One turn of the screw changes these r.p.m. by 3.6%.

When through with the adjustment procedure, disconnect console No.356 and fit the HP-21Ф pump hydraulic decelerator connector back in place.

Adjustment of Control Unit

The control unit (Fig.147) is adjusted with the following methods:

(a) by changing the length of control rod 7;

[illegible]. When adjusting the length of control rod 7, see to it that the holes of the first row (counting from the shackle) are not open;

(b) by rearranging the shackle of control rod 7 in the slot of lever 2 of the HP-21Ф pump.

Notes: 1. When adjusting the length of control rod 7 and the position of the rod shackle in the slot of lever 2, set arm 11 of control panel ДУРТ-1Ф and the lever of regulating fuel pump HP-21Ф in the CUT-OFF (STOP) position.
2. The original distance between the centre of bolt 3 which attaches rod 7 to the HP-21Ф pump lever and the centre of the HP-21Ф pump shaft should be equal to 55 mm.

When adjusting the control unit, see that the following is provided with regard to the positions of arm 11 of the ДУРТ-1Ф control panel and lever 2 of the HP-21Ф regulating fuel pump:

(a) when index lug 4 of the HP-21Ф regulating fuel pump is set at the CUT-OFF stop, the zero division of the ДУРТ-1Ф control panel dial should line up with the notch on the control panel body;

(b) when figures 67 and 68 on the ДУРТ-1Ф control panel dial are matched with the notch provided on the control panel body, the notch on the HP-21Ф regulating fuel pump index lug should bear against the sixth notch on the HP-21Ф regulating fuel pump dial;

(c) when figures 72 and 73 on the ДУРТ-1Ф control panel dial are aligned with the notch on the control panel body, the notch on the HP-21Ф regulating fuel pump index lug should be beyond the seventh notch on the HP-21Ф regulating fuel pump dial;

(d) with the ДУРТ-1Ф control panel index lug 13 set against the FULL AUGMENTED stop, the notch on the HP-21Ф regulating fuel pump index lug should be located beyond the seventh notch on the HP-21Ф regulating fuel pump dial.

When through with the adjusting procedure, check the following:

1. The limit switches of the ИУРТ-1Б control panel for proper operation (making use of oscaole No.356, without the engine at standstill), when performing the check see to it that:

(a) when figures 67 - 68 on the ИУРТ-1Б control panel dial are matched with the notch on the control panel body, cam EK should operate;

(b) alignment of figures 72 - 73 on the ИУРТ-1Б control panel dial with the notch on the control panel body initiates operation of cam БКС;

(c) as soon as figures 99 - 102 on the ИУРТ-1Б control panel dial become matched with the notch on the control panel body operation of cam "a" should take place.

Notes: 1. The above mentioned positions of the ИУРТ-1Б control panel arm and НР-21Б regulating fuel pump lever relate to the engines of the 5th series.
2. When checking positions of the ИУРТ-1Б control panel arm and the НР-21Б regulating fuel pump lever on engines of other series, refer to the appropriate Instructions for the given series and supplementary bulletins.

Adjustment of High-Pressure Rotor Maximum R.P.M.

In case the maximum r.p.m. value of the high-pressure rotor in flight exceeds the specified value and reaches more than 103.5%, it is necessary to readjust the maximum r.p.m. limiter so as to obtain the value of $103.3_{-0.9}$%.

The adjusting procedure should be carried out as follows:

1. Unlock and turn off the cap fitted over the screw of regulating fuel pump НР-22Б.

2. Adjust the r.p.m. to the specified value by operating the adjusting screw. Turning the screw in increases the maximum r.p.m. of the high-pressure rotor, and vice versa.

Note. One turn of the adjusting screw changes the maximum r.p.m. value of the high-pressure rotor by 1.7%.

This may result in decrease of the low-pressure rotor r.p.m.; therefore, determination and adjustment of the low-pressure rotor maximum r.p.m. on the ground should be performed with the jet nozzle flaps fully opened (in the FULL AUGMENTED position); act as follows:

(a) detach the plug connectors of the solenoid-operated valve serving for engaging the afterburner, and of the electrical contactor incorporated in regulating fuel pump НР-22Б;

(b) move the engine control lever to the FULL AUGMENTED stop to check the maximum r.p.m. of the low-pressure rotor; if necessary, adjust the r.p.m. to 100 ± 0.5%.

The above adjusting procedure over, attach the plug connectors and make sure that the afterburner becomes engaged properly.

Adjustment of Time Delays of Afterburner Control Box КАФ-1ЗИ

Provision is made in the afterburner control box operation for time delays (with regard to the position of the jet nozzle flaps and the rate of fuel supply).

To ensure proper time delays it is necessary to set the slotted screws of the КАФ-13И afterburner control box in the respective positions. To slow down the rate of gas temperature drop after the turbine, the time delay

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with regard to the jet nozzle flaps position should be increased, whereas the time delay with regard to the fuel supply rate must be decreased, and vice versa.

Notes: 1. Time delays should be changed in succession.
2. In case impediment to afterburner starting occurs resulting in a double pop, decrease the time delay with regard to the flaps position or increase the time delay with regard to the fuel supply rate.

Adjustment of Engine Acceleration

If the engine performance fails to meet the specifications carry out the necessary adjustments:

1. Connect a pressure gauge (with the scale range from 0 to 100 kg/cm²) to the respective connection provided on the primary fuel manifold.

2. Measure the fuel pressure in the primary manifold, with the engine running at idling rating; the fuel pressure should amount to 21 ± 1 kg/cm² (for regulating fuel pumps HP-21Φ of X and subsequent series). If the pressure turns to be beyond the specified level, adjust it by means of screw ПК incorporated in the distributing valve; the screw should be turned by not more than 1/4 of a turn from the initial position. When the screw is being turned in, the fuel pressure increases (the adjustment procedure in question should be accomplished after consulting the manufacturer's representative, with subsequent checkout of the fuel pressure in the primary fuel manifold during engine starting).

3. Check the time period required for the fuel pressure in the primary fuel manifold (with regard to the first branch of the pressure increase limiter) to increase from $P_{p.f.m.} = 22$ kg/cm² to $P_{p.f.m.} = 26$ kg/cm²; the time period should be equal to not less than 3.0 seconds.

Notes: 1. The time period within which the pressure increase takes place should be measured (after setting the engine control lever below the idling rating stop) to pressure $P_{p.f.m.} = 19 \pm 0.5$ kg/cm².
2. The flow restrictor of the first branch pressure increase limiter must be characterized by a capacity not smaller than 40 cu.cm/min. The capacities of flow restrictors used must range within 40 to 100 cu.cm/min.
3. The initial fuel pressure increase in the primary fuel manifold should not exceed 2.5 kg/cm².
4. The time required for pressure increase to take place should be measured with the following method:
(a) slowly move the engine control lever to the CUT-OFF stop to reduce the fuel pressure in the primary fuel manifold to 19 ± 0.5 kg/cm²;
(b) smoothly move the engine control lever to the MAXIMUM position and check the period required for pressure increase in the first branch of the pressure increase limiter.

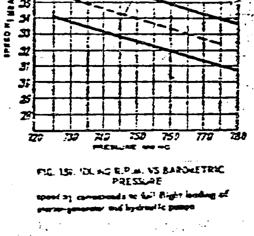

FIG. 156. IDLING R.P.M. VS BAROMETRIC PRESSURE

speed ... corresponds to full flight loading of generator and hydraulic pumps

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4. Check the time period within which the engine accelerates from the idling r.p.m. to the 100% r.p.m.; this period should meet the limitations set forth in the Chart of Fig.160. The stopwatch should be arrested at n_1 = 99%.

WARNING. If the acceleration time for the first branch is within the specified limits, whereas the full acceleration time is other than specified, adjust the acceleration time by selecting proper flow restrictors for the second branch of the pressure increase limiter or proper feed-back flow restrictors.

5. Check the time period required for the fuel pressure in the primary fuel manifold to increase, as regards the second branch of the pressure increase limiter, from $P_{p.f.m.}$ = 25 kg/cm^2 to $P_{p.f.m.}$ = 40 kg/cm^2; this time period should be within 4.8 ± 0.6 sec. and at least 5.5 sec. for the engines not provided with autonomous starting system.

Notes: 1. Change-over from the first branch of the pressure increase limiter to the second branch takes place at the primary manifold pressure of 27 ± 1 kg/cm^2. To determine the change-over pressure, insert a flow restrictor of the capacity amounting to 280 - 300 cu.cm/min. in the second branch. Having determined the change-over pressure value, reinstall the old flow restrictor. The capacity values of the second-branch flow restrictors used, range from 70 to 350 cu.cm/min., the recommended indicated range being 100 to 150 cu.cm/min.
2. If the engine acceleration time by the first and second branches of the pressure increase limiter is within the specified range but the total acceleration time does not meet the Specifications, adjust the acceleration time value by replacing the feed-back flow restrictor with a new one to correct the fault.

3. When adjusting the engine acceleration time with regard to the pressure increase limiter, install temporarily a flow-restrictor of 250 to 300 cu.cm/min capacity which is capable of cutting off the pressure increase limiter. Upon completion of the adjusting procedure, re-install the old flow restrictor. Use should be made of hydraulic decelerator flow restrictors with the capacity range of 50 to 90 cu.cm/min.

6. Check the engine acceleration from the r.p.m. amounting to 85% normal rating to the normal rating or 100%; while checking, measure the acceleration time to 99% normal rating. This time period should be equal to 7 - 10 seconds. If the acceleration time fails to meet the specified value, re-adjust the acceleration time by selecting the proper flow restrictor of the hydraulic decelerator.

WARNINGS. 1. The capacity values of the feed-back flow restrictors should be within 150 to 300 cu.cm/min.

2. When replacing the feed-back flow restrictor with a flow restrictor of lower capacity check the engine maximum r.p.m. as instructed in point 3 of Section "Adjustment of Low-Pressure Rotor Maximum R.P.M.".

7. When through with the adjusting procedure, check the engine acceleration:

(a) from idling r.p.m. to maximum r.p.m.;

(b) from n_1 = 85% normal rating to maximum r.p.m.

Note. Upon replacement of flow restrictors during acceleration adjusting operations flush regulating fuel pump HP-21Ф with fuel to eliminate probable air locks.

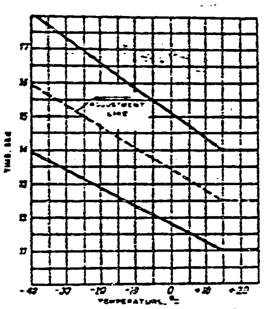

FIG. 160. ACCELERATION TIME VS AMBIENT AIR TEMPERATURE

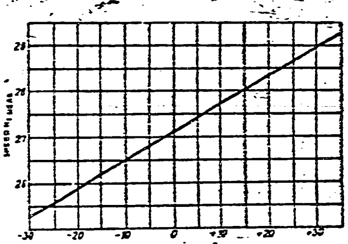

FIG. 161. STABLE ENGINE OPERATION AT MINIMUM R.P.M., AS FUNCTION OF AMBIENT AIR TEMPERATURE (FOR ENGINES FURNISHED WITH TYPE 53-45 CONTROL UNITS)

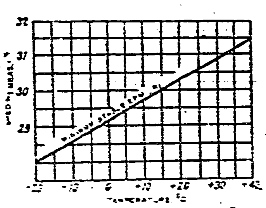

FIG. 162. STABLE ENGINE OPERATION AT MINIMUM R.P.M., AS FUNCTION OF AMBIENT AIR TEMPERATURE (FOR ENGINES NOT EQUIPPED WITH ...-45 CONTROL UNITS)

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8. Check the acceleration margin by the following method:

(a) accelerate the engine to the maximum r.p.m. and run it at this speed during 1 minute;

(b) reduce the engine r.p.m. to the idling rating and run it at this speed during 1 minute;

(c) smoothly accelerate the engine to 85% normal rating and check the engine acceleration time to the maximum rating.

The acceleration time measured during the above checking procedure should differ from that measured during the operations under Point 7 (b) by not more than 2 seconds. Should the acceleration time difference be in excess of 2 seconds, consult the Manufacturer's representative as to the possibility of further use of the HP-21Ф regulating fuel pump.

Notes: 1. During the engine acceleration margin check, the acceleration time is allowed to differ from that measured under Point 7 (b) above by more than 2 sec. provided it remains within the specified range.

2. Should the engine acceleration in any of the above cases involve an excessive increase in gas temperature after the turbine or surging, discontinue the engine acceleration by placing the engine control lever at the CUT-OFF stop; then locate and eliminate the fault.

9. Move the engine control lever below the idling r.p.m. zone until the lever reaches the border of the minimum stable r.p.m. zone (determined from the Charts presented in Figs 161 and 162) with flight load applied to booster pump ЭЦ-3А and to starter-generator ГСР-СТ-12000ВТ; then accelerate the engine from this r.p.m. value. If the engine fails to come up to speed from the reduced r.p.m. (this results in unstable operation), re-adjust the distributing valve incorporated in regulating fuel pump HP-21Ф, as instructed above (see Point 2 of the present Section).

If the adjustment proves ineffective, replace type HP-21Ф regulating fuel pump.

10. Disconnect the pressure gauge which has been installed for measuring fuel pressure in the primary fuel manifold, and obtain the original positions of the pipelines and connections.

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