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INSPECTION GUIDE No. II

ELECTRIC EQUIPMENT ROUTINE MAINTENANCE

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ADDENDA

GENERAL

1. Routine maintenance of aircraft electric equipment is carried out at intervals specified by Inspection Guide No.11 (second edition).

2. The present instructions on maintenance procedure are worked out on the basis of experience accumulated by air force units in servicing aircraft electric systems. They should serve as a guide for engineers and technicians in routine maintenance of electric equipment within the scope established by Maintenance Instructions No. 11 (second edition).

3. When accepting an aircraft for routine maintenance, check the condition of the aircraft electric equipment by inspecting and checking it within the scope of preliminary preparation. Minor faults detected at this time should be corrected by specialists assigned to service the aircraft.

Elimination of more faults may be timed to the routine maintenance procedure provided the routine maintenance closely follows a post-flight inspection.

4. All maintenance operations on an aircraft must be performed with serviceable standard tools and fixtures.

Before and after the work on the aircraft check over the tools against the inventory list so as not to lose or leave them inside the aircraft.

5. Routine maintenance must be performed with the aircraft mains de-energized; do not connect aircraft and ground power sources to the aircraft mains

until all works in electric panels, distributing devices and other electric units are finished.

6. When performing routine maintenance, wipe dirt, dust and old grease off the external surfaces of electric units.

7. The routine maintenance is so developed that only a minimum amount of special tools and check instruments are required to carry out inspections and maintenance operations. Special tools, fixtures, and instruments necessary for maintenance operations are listed in Appendix 1.

SAFETY PRECAUTIONS

1. Before starting any inspections or routine maintenance take all necessary precautions to prevent accidental firing of weapons and ejection gun , as well as jettisoning of tanks, retraction of the landing gear and inadvertent operation of electric units.

For this purpose open the cockpit and without entering it make sure that:

the firing mechanism of the seat and the ejection gun are locked by main and ground safety pins, while the handle of the face screen and the firing controls located on the arm rests, as well as the levers of the spring mechanism are wire-locked;

the handle for independent jettisoning of the canopy is set in the CLOSED (ЗАКРЫТО) position and is wire-locked;

buttons for emergency dropping of bombs are closed with protective caps and clips;

the changeover switch of the landing gear control is in the neutral position and latched;

the storage battery and all electric switches are off (circuit-breakers situated under the right-hand panel of organic glass may be left on, except circuit-breakers ARMED-SAFE (ВЗРЫВ-НЕВЗРЫВ);

the bomb firing circuit is open (the safety pin is inserted).

2. When installing drop tanks in the aircraft, do not switch on the battery and ground power supply until the installation is completed.

3. When performing some work in the engine compartment (with installed engines):

see that all tools are tied;

take care that removed units and fastenings do not drop into the section; for this purpose, lay down a clean piece of cloth around the unit being serviced;

close air by-pass bands when assembly and disassembly are carried out.

4. All openings in units and tubing which are opened during disassembly should be closed with plugs or polyvinyl chloride tape.

5. While the engine is running, keep away from the air intake duct at a distance of over 15 metres.

6. Do not perform any work, while the engine is running, except for checks of units and instruments of aircraft equipment.

7. Never make a repeated starting or cold cranking of the engine until the engine rotor comes to a complete standstill.

8. On aircraft provided with a controllable stabilizer before switching on variable ratio automatic boost control unit АРУ-2А, first switch on hydraulic booster БУ-14МС or electric actuator АПС-4.

STARTER-GENERATOR

Operations	Possible faults	Remedy (Specifications)
1. Removal of Starter-Generator To remove the starter-generator: unlock and turn out bolts which fasten the flanges of starter-generator inlet pipe and pipe of cooling air feed; disconnect conductors from the starter-generator; unlock and, supporting the starter-generator, turn out two bolts of the generator's easily detachable connection ring; in doing so, first turn out the internal bolt, then the external one; remove the starter-generator from the splines, remove the pyronite spacer and, with the inlet pipe down, take out the generator.		SPECIFICATIONS 1. Rated voltage ..... 28.5 V 2. Rated load current..... 200 A 3. Speed (range of revolutions)..... 4000-9000 r.p.m. 4. Duty ..... continuous 5. Permissible maximum load current with the starter-generator operating from cold state for 30 min. - without forced cooling at 3400 r.p.m. and 28.5 V ..... 60 A 6. Permissible maximum load current for 20 min. at 3050 r.p.m. and 25 V ..... 100 A 7. Grade of brushes..... No.7(MTC-7) 8. Total number of brushes... 12

Operations	Possible faults	Remedy (Specifications)
		9. Number of brushes per holder stud ..... 2 10. Size of brushes ..... 7.2x17.5x x25.5 mm
2. External Inspection of Starter-Generator Wipe dust, dirt, and moisture off the body, inspect externally and check for corrosion and damage on starter-generator parts. Check for dents on the protective case located inside the starter-generator body on drive side; dents may cause rubbing of the fan against case, when armature rotates.	Nicks at end of splined shaft. Loose bolts of terminals.	Send starter-generator for repairs. Tighten bolt fastening nuts.

Operations	Possible faults	Remedy
3. Check of Commutator Condition Remove the protective band. Check the commutator condition by external inspection. When the starter-generator is operated normally, the commutator surface acquires a glossy film with a dark shade, but without traces of burning or contamination.	Contamination of commutator.	In case of contamination (fatty dull black film) rub commutator with clean cotton cloth slightly moistened in gasoline B-70 and blow with compressed air.
Examine the terminal block, make sure that the starter-generator contains no oil inside.	Burning of commutator bars.	If contamination cannot be removed by cloth, use sand paper No.180 or 220 (never use emery cloth for this purpose).
Remove brush dust from starter-generator parts by blowing with compressed air (pressure 1.5-2 kg/sq.cm.).		When cleaning, rotate starter-generator armature and press against commutator surface strip of sand paper pulled over a sharpened

Operations	Possible faults	Remedy
		wooden plank. Slide plank together with sand paper along entire commutator. Before cleaning commutator remove brushes from brush holders. After cleaning, groove commutator bars with wooden stick, wipe with cotton cloth moistened in gasoline B-70, blow with compressed air (pressure 1.5-2 kg/sq.cm) and install brushes into brush holders. In the event of bad burning or wear of commutator, send starter-generator for repairs. Replace starter-generator.
4. Check of Spring Pressure on Brushes Using a dynamometer with measurement range of 0-1000 gr, check pressure of	Tin molten out of commutator lugs	The accuracy of readings of spring dynamometers with measurement range up to 1 kg is considerably affected

Operations	Possible faults	Remedy
spring-loaded levers on the brushes which should be within 575 - 700 gr.		by weight of moving parts. Dynamometer reads most accurately when its position in checking spring pressure corresponds to position during its calibration. Dynamometers with cylindrical springs are calibrated in vertical position. In checking spring pressure on brushes, position starter-generator so that axis of brush in question is located vertically. The dynamometer axis should be in line with brush axis. In this case dynamometer reads spring pressure the moment spring-loaded lever separates with brush.
5. Check of Condition of Brushes and Their Seating See that brushes are	Wear or	Brushes worn down to 17 mm height

Cperations	Possible faults	Remedy
correctly installed and easily move (without jamming or rocking), measure the height of brushes with calipers or a ruler, make sure that brush pig tails are safe, especially at points of their joint with brushes and cable lugs. Brushes height should be not less than 17 mm.	damage of brushes.	or damaged should be replaced with new ones from individual set of spare parts. Measurement of brush height should be made along greater side as shown in Fig.1. Seat new brushes and ground them to fit commutator. When measuring brush height, take into consideration degree of their wear during previous operation. If, for example, height of brush decreased for 50 hours of operation from 25 mm to 19 - 20 mm, remove such set of brushes and replace it, as during subsequent 50 hours brush may wear away to less than 17 mm which may cause a starter-generator failure. In high-altitude flying allowable wear of brushes for 50 hours of operation is not more than 3.5 mm.

Operations	Possible faults	Remedy
	Brushes jam in brush holders.	If brush jams in brush holder, pull it out and carefully dress point of jamming (it has a shiny glossy appearance) with sand paper No.180. A ground-in brush should easily move in brush holder. Permissible gap between brush and brush holder is within 0.2 - 0.4 mm for both sides, increase in gap will make brush loose in brush holder, which deteriorates operation of commutator unit.
6. Seating of Brushes To seat brushes, follow the procedure below: Wrap a strip of sand paper No. 180-220 around the commutator with the sanded side outwards. The width of the strip should be		

Operations	Possible faults	Remedy
equal to the commutator length. Install the brushes to be seated into brush holders, carefully set the springs onto the brushes, and rotate the armature shaft protruding end by hand in the direction of the starter-generator rotation until the brushes make uniform fit circumferentially. Before seating of new brushes, those brushes which are not to be replaced or seated, should be removed from brush holders. In the course of seating brush height should not decrease by more than 0.5 - 0.6 mm as decrease in the height of brushes shortens their life. When seating process is over, take brushes out of brush holders and remove brush dust from the starter-generator by blowing with		

Operations	Possible faults	Remedy
compressed clean air through ports in frame. Brushes should be ground during operation of the starter-generator under generating duties at 50 - 70 A load or idle for 1 - 2 hours. Seating is considered completed if at least 70 - 80 per cent of the brush surface fits well to the commutator and brushes acquire an even glossy surface without noticeable deep scores which, practically, ensures sparkless operation of starter-generator. 7. Check of Smooth Rotation of Starter-Generator Armature Remove brushes and see that the armature moves freely when being rotated by hand. After inspection of the commutator and brushes, install the protective band and relock the bolts with soft steel wire protected from corrosion by tin or zinc-plating.		

Operations	Possible faults	Remedy
8. Check of Bolt Tightening Make sure that bolts of electrical contacts are tight, the air duct hose is securely fastened to the cap. See that the commutator side shield and cap are secure; when checking, use calibrated wrench (calibrated for 90 - 110 kg-cm) to avoid overtightening of bolts.	Loose bolts of electrical contacts. Loose bolts fastening blow-through cap and shield.	Tighten up bolt fastening nuts. Tighten bolts.
9. Installation of Starter-Generator To install starter-generator, reverse procedure for removal. When installing, be sure to connect electrical conductors correctly, in accordance with marks on conductors and terminal block. When installing the starter-generator, position the connection ring so that the joint is in the horizontal plane.		

Operations	Possible faults	Remedy
Connect the starter-generator to the aircraft mains. Cable lugs on contact screws should be secured by nuts and locknuts. The tightening should ensure perfect electric contact. Put rubber caps on terminals and cable lugs, close the terminals with the cover and secure it by three bolts placing ordinary and spring washers under their heads. Join the air duct pipe to inlet pipe of the cap through the intermediate flange. The intermediate flange is fastened to the inlet pipe by bolts which should be securely locked. After joining the air duct, make sure that the cap is securely attached to the shield. The outside bead of the cap should enter groove in the	Loose nuts of contact screws. Damaged soldering or damage to cable lugs.	Tighten up nuts. Resolder or replace lugs.

Operations	Possible faults	Remedy
shield all the way in along the entire surface and be securely bolted to the shield.		
10. Checking Starter-Generator for Operation under Starting Duties		
When starting aircraft engine, check operation of starter-generator used as starter.	When cut in, starter-generator fails to operate due to:	If in measurement of resistance avometer TT-1 reads infinity, remove starter-generator and send it for repairs.
(a) Cold Cranking of Engine In cold cranking the engine is rotated by the starter-generator without fuel feed and ignition.	Breakage of busbar of series exciting winding. Malfunction of starter-generator power supply or control circuits.	Check to see that power supply is well connected to aircraft mains. In the event of imperfect contact, correct it.

Operations	Possible faults	Remedy
To perform cold cranking of the engine, follow the procedure below:		Check tightening of contact screw nuts of starting panel and starter-generator. Nuts should be tightened up securely.
Check position of the engine control lever, see that it is in the STOP (СТОП) position; Close automatic circuit-breakers: A3C-5 of PUMP OF 1ST TANK (НАСОС 1-го БАКА) and A3C-25 of STARTING UNITS (АГРЕГАТЫ ЗАПУСКА).	Starter-generator fails to develop required speed of armature.	Check supply voltage and, if it is less than 21 V with starter-generator on, increase voltage or replace power supply.
Depress button START (ЗАПУСК), release it in 1 - 2 sec. and simultaneously start stop-watch. At the end of the starting cycle measure the current consumed by the starter-generator, the speed of engine	Starter-generator develops an excessive speed of armature.	If voltage with starter-generator on exceeds 21 V, decrease voltage. If supply voltage is normal, check resistance of exciting windings; if total resistance of shunt winding is

Operations	Possible faults	Remedy
shaft, and starting cycle time against stop-watch which should be started precisely at the end of the starting cycle. Speed of the engine shaft should be measured against aircraft tachometer and must fall within 800 - 1100 r.p.m. Load current should not exceed 230 V at supply voltage of 21 V. Duration of the starting cycle should be within 42^{+3} sec.		less than 2.033 ohms or total resistance of series winding is less than 0.00252 ohm, remove starter-generator and send it for repairs.
(b) Starting of Engine		
Engine is started in a way similar to cold cranking. When starting the engine, set the engine control	Excessive sparking under brushes with resultant burning of commutator bars.	See that brushes smoothly move in brush holders. Remove brushes which cannot be readily pulled out or do not fit well to commutator

Operations	Possible faults	Remedy
lever to the LOW SPEED (МАЛЫЙ ГАЗ) stop. The speed of the engine shaft at which the starting cycle of the starter-generator ends is of 1400-2400 r.p.m. provided engine is normally started from the aircraft battery. When started from more powerful (external) source, the starter-generator may get disengaged at 2500 r.p.m. Disengagement of the starter-generator is indicated by the extinction of the [illegible] (ЗАЖИГАНИЕ) pilot lamp. Note: Operations outlined in Para.10 are to be performed by the aircraft mechanic together with an electrician.		due to jamming and slightly dress their side surfaces with sand paper No.180 or 220. Brushes with rough spots exceeding 30 per cent of entire surface should be seated and ground, as above. To remove black film on commutator surface, rub commutator with cotton cloth slightly moistened in gasoline B-70 and then blow with compressed air. If sparking under brushes does not diminish, clean grooves between commutator bars. If fault persists, send starter-generator for repairs.

Operations	Possible faults	Remedy
		Excessive burning of one or more bars shows up wire breaks in armature winding. Starter-generator with wire breaks in armature winding should be sent for repairs.
11. Checking Starter-Generator Operation under Generating Duties In testing the engine check operation of the generator, carbon-pile voltage regulator and differential minimum relay. To check the operation of the starter-generator and control equipment, use portable test desk. For the electrical diagram of the test desk see Fig.2.	Starter-generator fails to supply voltage due to the following: б/с in excitation winding;	If in checking resistance of excitation winding by avometer Tr-1, the latter reads infinity and with armature rotated voltage of starter-generator does not exceed 1 - 2 V (due to residual magnetism), send such starter-generator for repairs.

Operations	Possible faults	Remedy
To measure voltages and currents, connect the portable test desk to appropriate receptacles 48X located in the left-hand electrical unit of the aircraft. Set on the switch of the generator in question and by changing the speed of engine shaft within 5000- 10,000 r.p.m. and generator load from 0 to 60 A (connection of electric motors of fuel pumps to generator imposes approximately 60 A load), check the voltage maintained by the voltage regulator. It should lie within 27.0 - 29.7 V for regulator R-27.	brushes do not contact commutator (jamming of brushes in brush holders); starter-generator is demagnetized.	Remove brushes from brush holders, slightly dress side surfaces of brushes with sand paper No.180 or 200 to ensure that they move freely in holders. Magnetize starter-generator by connecting storage battery for 1 - 2 sec. to terminals Ш and "-" in accordance with proper polarity ("+" of storage battery to terminal Ш and "-" of battery to terminal "-"). Generator may become demagnetized owing to excessive load, short circuit, impact, incorrect connection of exciting winding or shorts of exciting winding to aircraft frame.

Operations	Possible faults	Remedy
Shut down the first generator and check the operation of the second generator in a similar manner.		A short may occur if seal wire of the adjusting screw of carbon contact in voltage regulator touches aircraft frame. To prevent damagnetization of generators in flight, check to see that it is impossible for ends of seal wire to touch aircraft structure. To carry out the check, shift regulator and seals on all sides as far as shock absorbers of panel and seal wire will permit. If wire ends touch, cut them off, leaving one turn after seal, and then coat seal with insulating tape.
	Malfunctions of carbon-pile voltage regulator.	If starter-generator produces voltage with voltage regulator disconnected

Operations	Possible faults	Remedy
		and armature rotates, while terminals Ш and "+" are connected, replace carbon-pile regulator.
	Voltage does not correspond to Specifications.	Using rheostat of manual adjustment, readjust voltage. To increase voltage, turn slider clockwise, to decrease - turn it counter-clockwise.
12. Check of Parallel Operation of Starter-Generators		
After the check of each starter-generator separately, check adjustment of their parallel operation and, if necessary, adjust their parallel operation in the following way: to measure voltages and currents on both generators, connect the deck (See Fig.2) with voltmeters and ammeters to receptacles 48K fitted in the left-hand electrical unit; warm up voltage regulators for 5 minutes with engines running at 10,000 r.p.m.;		

Operations	Possible faults	Remedy
at 10,000 r.p.m. by means of the control resistor of the voltage regulator adjust the voltage of each generator at no-load for 28.5 V for which purpose disconnect the generators in succession from the aircraft mains; after the equal voltages are obtained at no-load, connect both generators to mains; switch on all loads and determine load currents of the generators. Difference in load currents of the generators should not exceed 25 A. If the difference in currents is over 25 A, make the currents equal with the help of control resistors of the voltage regulators. For this purpose, on the generator with less load (less current) increase the voltage by shifting the slider of the control resistor clock-		

Operations	Possible faults	Remedy
wise, while on the generator with more load (greater current) decrease the voltage by shifting the slider counter-clockwise. Check for stability of parallel operation of the generators with engines running at different speeds, for which purpose set the right engine at 5000 r.p.m. and the left engine at 10,000 r.p.m. and vice versa.		

Note: At loads up to 25 per cent of the summary rated output of the generators the equal (within the limits of technical specifications) distribution of load between the generators practically may not occur and in some operation conditions there may be cases of disconnection of one of the generators. Such operation should be regarded as normal if the swing of the aircraft electric equipment is not observed (pilot lamps do not flicker) and if disconnection of the operating generator from the aircraft mains by the switch on the right electrical panel switches on the generator which became disconnected earlier.

13. Filling Bearings with Grease

The bearings are filled with grease, grade OKB-122-7, by the Manufacturer and in the course of operation of the starter-generator they are not to be refilled during the entire guaranteed life time (200 operating hours).

On the expiration of the guaranteed life time of the starter-generator the bearings should be refilled. This work should be carried out indoors and in clean surroundings to prevent dirt and foreign matter from getting into the starter-generator.

To fill bearing 180506 (on the drive side) with grease, make a partial disassembly of the starter-generator in the following way:

bend the tabs of the stop washer off the circular nut, turn out the nut and remove the stop washer and distance plate;

find the cut in the elastic steel ring of the bearing by the tip of a screw-driver and carefully hook the ring at the bevel. Remove the elastic ring from the circular groove in the outer race of the bearing.

Remove the rubber seal and inner steel ring;

wipe off accessible used grease by clean flannel and check the bearing for damage and corrosion;

if the bearing is damaged and has corrosion, send the starter-generator for repairs;

refill the bearing with grease, grade OKB-122-7.

By the protruding end of the flexible shaft, rotate the armature so that part of the grease gets to the balls of the bearing. The grease should uniformly cover the cage and fill the space between the cage and races of the ball bearing.

To reassemble the ball bearing, reverse the above procedure. In reassembling, before the installation of the elastic ring in the circular groove of the outer race, carefully smooth out the rubber seal to prevent formation of wrinkles and folds on the rubber after reassembly. Replace the stop washer with a new one from the set of spare parts.

After reassembly bend the tabs of the stop washer into recesses of the nut. Then remove brushes from brush holders and check the ease of run in the starter-generator by rotating the protruding end of the flexible shaft. The armature is to move freely, without jamming.

The procedure for disassembly of ball bearing 180504 (on the commutator side) basically coincides with the procedure for disassembly of ball bearing 180506 (on the drive side), the only difference being that ball bearing 180504 is not fitted with an inner steel ring. To fill ball bearing 180504 with grease, it is necessary to disassemble the starter-generator for the purpose of removing the armature. Therefore, filling of ball bearings 180504 must be conducted only in maintenance units.

CARBON-PILE VOLTAGE REGULATOR

Operation	Possible faults	Remedy
14. External Inspection of Carbon-Pile Voltage Regulator		
Remove the carbon-pile voltage regulators from the panels and mark them to avoid misplacement of them during reinstallation. Check the condition of the carbon-pile regulator. Special attention during inspection and routine maintenance should be given to the condition of shock absorbers.	Traces of dirt, dust and moisture.	Remove dust, dirt, and moisture with waste cloth and blow with compressed air at pressure of 1 kg/sq.cm.
	Damage of regulator fastening locks.	Replace the regulator panel.
Check by hand to see that wire lugs are securely attached to panel terminals, capacitors, that lugs are serviceable and wires are securely coupled to lugs.	Loose fastening screws and terminal nuts.	Tighten up screws and nuts.

Operations	Possible faults	Remedy (Specifications)
Reinstall the carbon-pile regulators in their former seats (on the generators they were installed before disassembly).	Damaged soldering of wires (to lugs).	Resolder.
15. Check of Adjustment of Carbon-Pile Voltage Regulator		
To check the voltage maintained by a carbon-pile regulator, use an installation designed for testing generators and voltage regulators and complete with a generator of 3000 - 12,000 W power and 0.9 - 8 A excitation current. The regulator can be checked when operating in conjunction with the equivalent generator, which should have 28.5 V rated voltage. The excitation		TECHNICAL SPECIFICATIONS 1. Rated voltage should be 28.5 V. 2. Maximum power dissipated in a carbon pile should be 85 W. 3. The accuracy of operation of the regulator at an ambient temperature of +20±5°C, with the steady setting of the rheostat, the voltage of the D.C. generator connected in conjunction with regulator P-27 should be within 27.0 - 29.7 V under the following operating conditions:

Operations	Possible faults	Remedy (Specifications)
current of the equivalent generator should correspond to the excitation winding data of the aircraft generators.		(a) speed of the generator varies from minimum to maximum; (b) the load current of the generator varies from zero to rated; (c) the temperature of the regulator components varies before and after heating cycle. Note: The rheostat should provide for a voltage increase of 2.0 V as minimum and a voltage drop of 2.5 V as minimum (with transformer, series TC-9). 4. The insulation resistance of current-carrying parts relative to the regulator body in the cold state should be not less than 20 megohms, after the heating cycle not less than 2

Operations	Possible faults	Remedy
		megohms, and after a moisture-resistance test not less than 1 megohm. During the regulator service voltage may be readjusted by aid of rheostat BC-25B.
16. Check of Electric Characteristics of Regulator Measure the insulation resistance of windings when cold. Then test the regulator in conjunction with generator PCP-3000M (or an equivalent generator) when cold and hot at 4000, 6500 and 9000 r.p.m. To make a test, follow the procedure below: Start the generator at no-load and develop the top speed. At the top speed cut in and out		

Operations	Possible faults	Remedy
the load three times, then change over to the bottom speed. The entire operation should continue not more than 1 minute. At the bottom speed and reverse run record the voltage value. Then set the regulator for 1 hour heating cycle with an equivalent generator at a shunt current of 3.5 - 4 A. After this check the operation of the heated regulator at the maximum speed once again. At the top speed thrice connect and disconnect the load, then change over to the minimum speed. Cut in the rated load, raise the speed from minimum to maximum, cut off and in the load three times, then change over to the bottom speed.		As driven over it is possible to use D.C. motor of not less than 1.5 kW and with range of r.p.m. between 3000 and 8000.

Operations	Possible faults	Remedy
During the test when the regulator is hot, record voltage values at each prescribed speed. At an excitation current of 1.5 A and idle running of the generator, check the limits of voltage control with rheostat by shifting the rheostat slider from the middle to either side. Voltage spread should not exceed 2.7 V and voltage should remain within 27.0 to 29.7 V. Check the stability of the regulator operation by observing voltmeter readings and with the help of headphones when checking the regulator on the desk.		

Operations	Possible faults	Remedy
17. Check of Voltage Regulator in Aircraft When testing the engines in conjunction with the generator and differential minimum relay, check the adjustment and steadiness of operation of the carbon-pile regulator. The check should be made both in cold and hot state at three points of the engine shaft speed, for example, at 5000,8000 and 11,000 r.p.m. (against the aircraft tachometer).	Generator voltage below 27 V.	Readjust voltage regulator by increasing resistance of adjusting rheostat. Rheostat slider should be shifted clockwise. If voltage remains below rated one, replace regulator.
While varying the speed of the engine shaft within the indicated range and the generator load from 0 to 60 A, check the voltage maintained by the voltage regulator.	Voltage exceeds 30 V (cannot be controlled) due to following:	

Operations	Possible faults	Remedy
The voltage should be within 27.0 - 29.7 V. With the help of headphones check in succession the adjustment of each regulator and the stability of their operation, for which purpose:	baking of carbon discs in regulator pile;	Replace defective regulator.
	no or poor contact between stud E and appropriate contact plate;	Correct fault. To this end, wash contact points of regulator studs and panel plates with clean gasoline;
connect headphones with series-connected resistance of the order of 18,000 - 20,000 ohms to terminals A and B;		Check contact pressure of contact plates against regulator studs which should be not less than 1 kg.
disconnect external power source and the aircraft battery from the mains, set the engine at the top speed;	o/c in operating winding of regulator;	Replace defective regulator.
	wear of carbon discs of regulator	Replace defective regulator.

Operations	Possible faults	Remedy
by cutting in (for a short duration) and off the generator load which should be 50 per cent the rated load listen to the regulator operation and make sure that in case of the load drop the regulator produces only separate clicks.	pile or partial short circuit between turns of operating winding.	Replace defective regulator.
	Voltage fluctuation due to the following: regulator became misadjusted (starts chattering);	Replace defective regulator.
	sticking of carbon discs of pile in duralumin tube, burning or breakdown of several discs;	Send regulator for repairs.
	after disconnection of load, continuous crackling or chattering is heard in headphones.	Serviceable and correctly adjusted regulator should produce no chattering.

Operations	Possible faults	Remedy
	No voltage due to: no contact between contact studs A and B and contact plates of regulator panel owing to contamination of contact surface or because of bending off contact plates of regulator panel; o/o in wire connecting "+" of generator with terminal B of regulator.	Wash contact surfaces of regulator studs and panel plates in clean gasoline; check to see that regulator studs to contact plates contact of regulator panel is good. Pressure of contact plates against regulator studs should be not less than 1 kg. Locate o/c and correct it.

Operations	Possible faults	Remedy
18. Check of Action of Winding for Parallel Operation of Regulator The check of the action of the winding for parallel operation of the regulator is carried out at the idle running of the generator at 8000 r.p.m. The decrease in voltage is measured after 0.2 V is three times applied to the winding of parallel operation, the "-" of the D.C. power source being connected to terminal Г of the winding and the "+" to terminal Я. During the check of the influence of the equalizing		

Operations	Possible faults	Remedy
winding directly in the aircraft the switch of the generator under the check should be turned off. Voltage is checked against the voltmeter of the portable desk of the generator under the check. The results of the test are considered satisfactory if the generator voltage decreases within 1.5 - 1.8 V.		
19. Check of Insulation Resistance To check the insulation resistance of the winding relative to the body and between terminals A and Ж use a megger rated at 500 V. Connect the megger in succession between terminal A and the body, between terminal Ж and the body and between terminals A and Ж.		

Operations	Possible faults	Remedy
The delivered voltage of the megger should be kept for 1 minute. The insulation resistance of current-carrying parts relative to the regulator body in the cold state should be not less than 20 megohms, and not less than 2 megohms when hot.		

DIFFERENTIAL MINIMUM RELAY

Operations	Possible faults	Remedy
20. External Check of Differential Minimum Relay for Condition Remove the relay from the aircraft, open the contactor cover and check the condition of contact points. Check the wiring of the relay equipment, soldering of wires to lugs and serviceability of electric contacts. When accomplishing periodic maintenance operations without removal of the relay, check the tightness of relay fastening	Contamination of contacts of contactor.	Wipe contaminated contacts with chamois leather or cotton cloth moistened in alcohol. Blow with compressed air at pressure of 1 - 1.5 kg/sq.cm. Do not dress contacts of the contactor during service life as transfer of metal from contact to contact is not dangerous for contacts of alloy CK-12 (88 per cent of silver and 12 per cent of cadmium oxide); a brown film

Operations	Possible faults	Remedy
screws by a screw-driver, and by a wrench check the attachment of electric wires and busbars, tightness of contact screw nuts; at the same time check to see that the lug of the wire from the negative terminal of the differential minimum relay is securely attached to the aircraft frame.		of cadmium oxide does not in any appreciable way increase the contact resistance and slight roughness of the surface sometimes increases the contact surface rather than decreases it. As a result, the contact resistance of such contacts changes negligibly and sometimes it even increases. Transfer of metal may become dangerous and cause welding of contacts in such cases when the contacts have bad pits and pimples and when erosion reaches the material of the contact busbar which manifests itself by appearance of small splashes of copper on contacts.

Operations	Possible faults	Remedy
		Careless dressing of contacts may cause deterioration of contactor operation. In dressing fine sand dust may remain on contacts and get in between core and guide bushing. This dust may cause sticking of moving part.
	Loose screws or nuts.	Tighten up screws and nuts.
21. Check of Pick-Up and Drop-Out Voltages of Differential Minimum Relay and Contactor		
Pick-up and drop-out voltages of the contactor and relay may be checked by means of a voltmeter and ordinary potentiometer. When	Pick-up (drop-out) voltage does not meet	If pick-up (drop-out) voltage of contactor does not meet specifications, contactor should be readjusted by installation of required number of discs under buffer spring or

Operations	Possible faults	Remedy
checking the contactor, connect the voltage from the potentiometer to terminals A and "-", when checking the auxiliary relay - to terminals "+" and "-". By shifting the potentiometer slider, smoothly increase the voltage until the relay or contactor becomes closed and measure the pick-up voltage; decrease the voltage until the contactor or relay becomes open and measure the drop-out voltage. Pick-up voltage in the cold state should be not more than 13.5 V for the contactor and not over 14.0 V for relay TKE-210E (within 13.5 - 16 V for relay PM-2A). Drop-out voltage in the cold state should be not more than 3.5 V for contactors and not	specifications.	by changing contact and magnetic gaps which should be 2 ± 0.15 and 2.6 ± 0.15 mm, respectively. Contactor should be readjusted in repair units.

Operations	Possible faults	Remedy
over 4 V for auxiliary relay TKP-2105 and relay PK-2A. 22. Check of Contact Resistance of Contactors Contact resistance is measured with the help of a millivoltmeter by passing a current through contacts and taking readings of voltage drop across contacts. Load may be applied to contacts with the help of a check load desk. For the electrical key diagram of the desk see Fig.3 To check the voltage drop, follow the procedure below: connect the relay in question to the load check desk and power source as shown in Fig.4;	Voltage drop across contacts is great.	Wash contacts with alcohol and blow with compressed air. Check contact pressure of contactor. For this, connect contactor into circuit and increase voltage by rheostat until contactor becomes closed. Then decrease voltage across contactor to 4 V and at this voltage measure value of contact pressure which should not exceed 5.5 kg. If contact pressure is below permissible value, send differential relay for repairs.

Operations	Possible faults	Remedy
create at the desk a load at which contacts are checked; measure the voltage drop across the contacts. Disconnect the millivoltmeter; then switch off the winding of the contactor under check. Voltage drop across contacts of the contactor at 400 A current should not exceed 0.2 V, which corresponds to 500 microhms.		

It is possible to check the contact resistance by measuring contact voltage drop at any current below rated but in this case the value of contact resistance, as a rule, exceeds that which may be obtained at a rated current passed through the contacts. Therefore, it is possible to confine to measurement of contact resistance at any current below rated only when results of the check meet specifications. If the results of such a check exceed the permissible value measure it once again at the rated current flowing through the contacts. To determine contact resistance, use the formula:

$$R = \frac{\Delta V}{I},$$

where: ΔV - voltage drop across contacts;

I - is a current flowing through contacts.

Voltage drop should be measured by a millivoltmeter with an accuracy grade of 2.5 or higher. In checking contact resistance the winding of the contactor or relay checked should be connected for rated voltage (28.5 V). Contact voltage drop should be measured across busbars of equipment at points situated as near to the contacts as possible.

CAUTION: The millivoltmeter should be connected only at the moment of taking voltage readings. Take care that the contacts across which voltage drop is measured are closed and that voltage of the power source does not get to the millivoltmeter terminals, otherwise, the instrument will be damaged.

Operations	Possible faults	Remedy
23. Check of Difference between Generator Voltage and Mains Voltage at Which Relay Operates		
Difference between generator voltage and mains voltage at which the differential relay operates for connection may be checked by connecting the relay into the circuit as shown in Fig.5.	The differential relay fails to cut in due to the following:	

Operations	Possible faults	Remedy
	dirty contacts of relay TKE-210B(PI-2A);	Replace relay. On relay ДМР-400 eliminate contamination of contacts of relay PI-2A by wiping them with shammy or cotton cloth moistened in alcohol.
To check the operation of the differential relay, follow the procedure below: set the potentiometer slider to the position which corresponds to the minimum potential difference between terminals BATTERY (BAT.) and GENERATOR (GEN.) (voltmeter 3 should give no readings):	o/c in coil of differential relay or relay TKE-210B.	Replace relay.
cut in the auxiliary relay by the switch (the contactor now should not operate);	Differential relay operates and closes, but contactor does not operate due to:	

Operations	Possible faults	Remedy
smoothly shift the slider of potentiometer 4 and observe the voltmeter reading;	dirty or burnt contacts of differential relay;	Wipe contacts with chamois leather or cotton cloth moistened in clean gasoline.
take the voltmeter reading at the moment the differential minimum relay comes into operation (this moment may be marked by operation of the contactor and the voltmeter reading will sharply drop). The potential difference between terminal GENERATOR and terminal BATTERY should be within 0.3 - 0.7 V.	jamming of moving parts of contactor or o/s in contactor winding.	Replace differential minimum relay.
24. Check of Reverse Drop-Out Current of Differential Minimum Relay		
The reverse drop-out current of the relay should be checked with the help of	Reverse drop-out current of differential minimum relay	Increase of reverse drop-out current of differential minimum

Operations	Possible faults	Remedy
the load check desk and two D.C. power sources of 24 - 28 V voltage.	is above specifications.	relay results from misadjustment of differential relay or decrease of contact pressure in contactor.
To check the differential minimum relay, follow the routine below: connect the relay to be checked to the load check desk and power sources as shown in Fig.6; make sure that switch 1 is turned off while the slider of potentiometer 2 is set to the position corresponding to the minimum potential difference between terminals BATTERY and GENERATOR (voltmeter 3 gives no readings);		Replace defective relay.

Operations	Possible faults	Remedy
turn on switches 4 and 5 and, if the contactor does not close, smoothly move the slider of potentiometer 2 until the differential relay and contactor close, turn off switch 5; turn on switch 1, set changeover switch 3 at the desk to the DISCHARGE (РАЗРЯД) position and by means of the rheostat and desk resistors smoothly increase the relay current; at the moment of disconnection of the differential relay, take the reading of the desk ammeter; turn off switch 1, set the slider of potentiometer 2 to the initial extreme position, turn on switch 5; repeat the check.		

Operations	Possible faults	Remedy
The reverse drop-out current of the differential minimum relay should be within 15 - 35A. 25. Check of Insulation Resistance The insulation resistance of current-carrying parts relative to the body should be measured by a 500-V megger at two points (terminals GENERATOR and "-") relative to the contactor body and the control relay base. In each case keep the delivered voltage for 1 min. The insulation resistance of the differential minimum relay should be not less than 2 megohms. Install the differential minimum relay in the aircraft. Connect the electric wiring to the relay, check the condition of contact screws and nuts, see	Damaged soldering or wire lugs.	Resolder or replace defective lugs.

Operations	Possible faults	Remedy
that the lugs are good and properly soldered to the electric wiring. 26. Check of Differential Minimum Relay in Aircraft The connection of the differential minimum relay is checked when the operations listed in Para.11 are carried out; each relay should cut in the generator when the aircraft engine operates at the low speed. If one of the relays fails to cut in the generator when one more generator has already been cut in, this does not make a faulty condition; to check the operation of this relay for connection, increase the speed of the	The differential relay fails to cut in generator. Poor contact at terminals GENERATOR, "+" or "-" on relay panel.	Check and correct contact. Check condition of generator switch 2B-45 and generator disconnecting relay РП-2 by avometer Тт -1. In the event of o/c in windings of relay or contactor, replace differential minimum relay.

Operations	Possible faults	Remedy
aircraft engine which mounts the generator complete with the relay checked. If even with the increase of the engine speed the relay does not cut in the generator, disconnect the operating generator with the circuit and using the voltmeter (of the desk) check that the relay being checked cuts in the generator. The drop-out of the differential minimum relay should be checked when the engine comes to a standstill. For this purpose set the engine control stick to the STOP position and by the ammeter of the portable desk measure the reverse current at which the differential relay will disconnect the generator (with the decrease		

Operations	Possible faults	Remedy
of the generator speed the ammeter pointer will move to the left, pass the zero mark and the moment the generator is cut off it will sharply return to zero). The reverse current at which the differential relay disconnects the generator should be within 15 - 35 A.		

Note: It is recommended to check one of the differential minimum relays when the starter-generator on the other engine is put into operation, while the second relay is checked when a ground power source or the aircraft battery is used.

ELECTRIC CONTROL ACTUATORS, TYPE VT-6K

Operations	Possible faults	Remedy
27. External Inspection of Electric Actuators, Type VT-6K With the participation of the aircraft technician (mechanic) remove the mechanism, wipe dirt from the body, check the external condition and make sure that components of the actuator are not corroded and damaged.		
28. Check of Commutator Condition Remove the protective band. Inspect the working surface of the commutator through ports in the shield. If the electromotor operates normally, the commutator surface grows slightly dark, but has no traces of burning and contamination. To remove contamination and brush dust, wipe electromotor parts with a piece of cloth and blow the internal cavities of the electromotor with compressed air (at 1 - 1.5 kg/sq.cm.pressure).	Contamination or burning of commutator bars.	In case of contamination (fat black film) wipe commutator with clean cotton cloth slightly moistened in gasoline and blow with compressed air (at pressure of 1 - 1.5 kg/sq.cm.) If contamination cannot be removed with cloth, use sand paper No.180 or 220, then clean grooves of

Operations	Possible faults	Remedy
		commutator bars with wooden stick, wipe with cotton cloth, moistened in gasoline and blow with compressed air (at pressure of 1 - 1.5 kg/sq.cm). Commutator should be cleaned with brushes removed. Do not use emery cloth.
29. Check of Brushes and Their seating Check to see that the brushes are correctly set and easily move in brush holders. The brushes should enter brush holder races without jamming or rocking. Measure the brush height by means of a calipers and a ruler with millimeter division. Brushes worn away to 6 mm should be replaced with new ones from the spare parts set.	Jamming of brushes in brush holders	Grind side surface of brushes with sand paper No. 180 or 220. Brushes should move in brush holders without jamming or rocking.
	Brush wear and other mechanical defects.	If brushes are broken or worn out, renew them. Seat new brushes to commutator. When seating brushes, place sand paper

Operations	Possible faults	Remedy
Check to see that the brush pig tails are safe.		No.180 or 220 around commutator with sanded side outwards. Sand paper should be of the same width as that of commutator and cover commutator through 180° as shown in Fig.7. Install brush to be run in into brush holder and press it with spring. Shift sand paper to and fro until brush makes perfect fit to commutator. Maximum wear of brush during seating should be within 0.5 - 0.6 mm. To give final seating to brushes, set them in brush holders and run electromotor at no-load for 5 - 10 min at voltage of 18-24 V. After seating is over blow

Operations	Possible faults	Remedy
		electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.)
30. Check of Spring Pressure on Brushes By means of a dynamometer with a measurement range of 0 - 200 gr or 0 - 500 gr check spring pressure on the brushes. Pressure against the brushes should lie within 100 - 130 gr.		When checking spring pressure on brush, position electromotor so that axis of brush in question is located vertically; dynamometer axis should be aligned with brush axis. In this case dynamometer will read spring pressure on brush the moment pressing end of spring comes off brush. Dynamometer reads most accurately if its position in checking spring pressure corresponds to position during calibration.

Operations	Possible faults	Remedy (Specifications)
31. Check of Electric Actuator on Stand The electric actuator may be checked under load on a simple portable device (See Fig.8). To check the system, follow the procedure below: place wooden block 4 under the actuator body and secure the ear of the actuator to bracket 6 with coupling bolt 5; the movable rack of the actuator should lie horizontally; fasten shackle 2 with rope 7 to the ear of the movable rack by means of shaft 3; connect the actuator to the power source and instruments according to the diagram shown in Fig.9;		SPECIFICATIONS 1. Rated voltage.....26 V 2. Range of operating voltage .... 23.4 - 28.6 V 3. Current drawn at a load of 20 kg on rack, not more than ..... 0.75 A 4. Rated load on rack 20 kg 5. Maximum load on rack ..... 40 kg 6. Maximum travel of rack ..... 21.6±0.5mm 7. Time required for trim tab to pass from one extreme position to the other at 23.4 V across electromotor terminals and at 40-kg load

Operations	Possible faults	Remedy (Specifications)
sling the rope over pulley 6 (See Fig.8) and attach a 40-kg load to the rope while the movable rack is retracted;		not more than ....30 sec. 8. Duty ..... intermittent. Number of operation cycles ..... 10 Interval between cycles ..... 1 min. 9. Friction coupling is to slip through when a load of 150 kg is applied to rack and should not slip through at a load of 60 kg.
at 23.4 V across the electromotor terminals switch on the actuator for extension of the movable rack and make sure that the shackle moves parallel to its original position (without turning around and rubbing against the mechanism). During the operation of the actuator make adjustments of the supply voltage for 23.4 V;		
sling the rope with the load over pulley 1 and switch on the actuator for retraction	Actuator does not operate when connected to power source.	Poor contact at wire connections on terminal panel or o/c at plug connector. Restore contact

Operations	Possible faults	Remedy
of the movable rack. During extension and retraction of the rack, measure the duration of the rack travel. Duration of extension and retraction of the strip should not exceed 30 sec.;		on terminal panel or correct o/c at plug connector.
when the strip is retracted, attach a 20 kg load and adjust the voltage across the electromotor terminals for a rated value of 26 V;	Current oscillation during operation of actuator.	Check to see that brushes move smoothly in brush holders, check brush height, condition of commutator and brush springs.
give the actuator ten complete shifts at 1 min. intervals between successive switchings;	Non-uniform travel of actuator.	Correct jamming or replace defective brush or spring. If necessary, dress commutator as indicated in Para.28.
at the last extension and retraction of the movable rack, readjust the supply voltage and measure the current consumed by the actuator; it should be not more than 0.75 A;	With actuator on, electromotor rotates but extension rack remains immovable.	Sticking of reductor. Send electric actuator for repairs.

Operations	Possible faults	Remedy
During the check of the actuator, measure the travel of the actuator rack, using calipers or a ruler, from one extreme position to the other position which corresponds to the closed state of contacts in the circuit used for signalization about the neutral position of the trimtab. The complete travel of the rack should be equal to 21.0-0.5 mm while the contacts of the pilot lamp should be closed at the middle of the rack travel within ±0.7 mm from the proper middle of the rack travel; at 23.4 V across the electromotor terminals and at 75 Kg load applied along the rack axis in the direction opposite to the move, after 30 seconds of slipping-through		

Operations	Possible faults	Remedy
at each of the stops, make two complete shifts of the rack at 1 min. interval; in this case the coupling is not to slip through, that is, if the motor operates continuously, the rack is to move through the complete length of the working travel. After the actuator completely cools down, switch it on at the same voltage and at 150 Kg load on the rack, first in one direction, then in the other, In this case the coupling is to slip through in either direction at any point of the rack travel.	Pilot lamp indicating neutral position does not come on.	Check incandescent lamp, replace lamp if burnt out. Check to see that contact of wire 3 (See Fig.9) on terminal panel is good. If contact is normal, remove cover of actuator and make sure that pusher is clear of electric harness. Correct the sticking of the pusher by tightening of wires which are in the way of pusher. Check shape of spring. When necessary, restore shape of spring and readjust operation of contact by bending spring.

Operations	Possible faults	Remedy
	Excessive sparking under brushes.	Check position of brushes in brush holders, fit of brushes to commutator and condition of springs which press brushes against commutator. Dress commutator, if necessary.
32. Check of Insulation Resistance The check of insulation resistance should be carried out not later than 3-5 min. after the check of the system under load. To measure insulation resistance, use a 500-V megger which should be connected between the system body and the winding leads. The supplied voltage should be maintained for 1 minute.	Low insulation resistance.	Remove protective band from electromotor, clean commutator, support and brush holder from brush dust, dirt and moisture. Blow electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).

Operations	Possible faults	Remedy
Insulation resistance should be not less than 2 megohms. 33. Check of Electric Actuators УТ-6Д for Trimtabs of Elevator and Aileron on Aircraft Operation of control mechanisms for trimtabs of the elevator and ailerons should be checked together with the technician (mechanic) of aircraft. To make a check, follow the procedure below: (a) wire an ammeter with a measurement range of 0 - 5 A between the receptacle of the ground electric source and the aircraft plug GROUND POWER SUPPLY (АЭРОДРОМНОЕ ПИТАНИЕ), then connect the ground source to the aircraft plug;	Electromotor operates. Trimtab does not move due to the following: jamming in kinematics from rack of electric mechanism to trimtab;	Together with technician (mechanic) of aircraft locate jamming in kinematics and correct it.

Operations	Possible faults	Remedy
(b) measure, by the ammeter, the current of the motor which are continuously increasing; (c) close the circuit-breaker [illegible] (d) [illegible]; (e) pull back the changeover switch of the elevator trimtab. In this case the trimtab should freely turn downwards. The complete turn of the trimtab from the neutral po. the trimtab should be 10±1°;	friction coupling slips through.	Replace defective actuator.
(f) by shifting the trimtab switch successively forward and back give the actuator three complete shifts;		Before installing new actuator check externally its serviceability. Set it on check stand and check to see that its technical data meet Specifications. Procedure for check is outlined in Para.31 "Check of Electric Actuator on Stand". After installation of actuator in aircraft, check its efficiency.

Operations	Possible faults	Remedy
(e) pull back the changeover switch of the elevator trimtab. In this case the trimtab is to turn downwards. The complete turn of the trimtab from the neutral position should be 10±1°; (f) by shifting the trimtab switch successively forward and back give the actuator three complete shifts; (g) during the operation of the mechanism measure (by the ammeter) the current consumed by the electromotor of the trimtab drive and, using the stop-watch, measure the time necessary for the shift of the trimtab from one extreme position to the other. The current consumed by the electromotor should not	Electromotor fails to operate due to fault in circuit, wear or jamming of transmiss in holders.	Check circuit, locate faults and correct them. Condition of circuit is checked by means of test lamp (or avometer Ty -1). Check should be started from plug connectors P-61 - for actuator of elevator trimtab; P-30 - for actuator of aileron trimtab. Connect test lamp to terminals 1-2 and 1-4 (P-61 and P-30); connect battery and, by successively throwing switch of elevator (or aileron) trimtab in both sides, check serviceability of circuit for sinking and diving (to the right and to the left) against pilot lamp. If circuit is serviceable,

Operations	Possible faults	Remedy
exceed the rated value (not over 0.75 A) while the duration of the complete shift should not exceed 30 sec.; (h) on completion of the check of the actuator, set the trimtab to such a position that the pilot lamp of the neutral position of the trimtab is on. Make sure that the trimtab is actually in the neutral position; (i) set the changeover switch of the aileron trimtab to the left. In this case the aileron trimtab should turn downwards; (j) set the changeover switch of the aileron trimtab to the right. In this case the trimtab should turn upwards. The complete turn of the	Current consumed is above specifications due to: jamming in kinematics from actuator rack to trimtab; heavy contamination or burning of commutator.	remove actuator from aircraft and check its condition in the way outlined in Paras 27 - 31. Together with technician (mechanic) of aircraft locate jamming in kinematics and correct it. Remove actuator from aircraft, wipe commutator with cotton cloth slightly moistened in gasoline B-70. Contamination which cannot be removed with cloth should be

Operations	Possible faults	Remedy
aileron trimtab should be 15 ± 1^{0} upwards or downwards from the neutral position; (k) setting the changeover switch to the left or to the right, give the actuator three complete shifts and perform the operations outlined in sub-paragraphs (g and h). 34. Check of "Trimtab Effect" Electric Actuator YT-6A in Aircraft The operation of the "trimtab effect" electric actuator should be checked together with the technician (mechanic) of the aircraft while the ground hydraulic	Electromotor is operating. Effort on stick does not become less since friction	wiped off with sand paper as outlined in Para.28. Replace defective electric actuator. Before installation of new actuator check externally its condition. Set it on check desk and

Operations	Possible faults	Remedy
pump and ground power supply are connected or while the aircraft engine is running. To make the check, follow the procedure below: Set on circuit-breaker АЗС-5 TRIMTAB OF ELEVATOR AND AILERON, (ТРИМЕР Р.В., ЭЛЕРОН) circuit-breaker АЗС-5 LANDING GEAR SIGNALIZATION, BRAKE FLAPS, CONTROL UNIT OF AILERON, NAVIGATION LIGHTS (СИГН.ШАССИ, ТОРМ.ЩИТКИ, БУ-ЭЛЕРОНА, АНО) located on the right panel; on the left desk set the three-point switch ПЗШ-20 (located on the left panel) designed for manual and automatic changeover of the spring-feal mechanism to the HEAVY (ТЯЖЕЛЫЙ) position;	coupling slips through,	make sure that technical data are in conformity with specifications.
	Electromotor does not operate due to faults in electric circuit, wear or jamming of brushes in brush holders.	Check condition of electric circuit, locate fault and correct it. To check condition of electric circuits, use test lamp or avometer Т-1. If hydraulic electric valve ГА-74/3 is operative, begin check from plug connector Р-59. The test lamp should be connected first to terminals 1-2 and then to 1-4.

Operations	Possible faults	Remedy
push the control stick of the aircraft all the way forward and press the button of the four-point switch on the control stick to the DIVING (ПИКИРОВАНИЕ) position until trimtab effect actuator УТ-6Д makes a complete shift. In this case the effort on the stick becomes less and the pilot lamp of the neutral position of the trimtab comes out; set the "trimtab effect" electric actuator УТ-6Д to the neutral position, against the pilot lamp; pull the stick all the way backward and press the button to the CABBING (КАБРИРОВАНИЕ) position; in this case the effort on the stick becomes less and the signal lamp comes out;		With battery on, successively press button of four-point switch on control stick of aircraft first to DIVING position, then to CABBING position, check condition of circuits for control of "trimtab effect" electric actuator. If circuits are in good condition, remove actuator from aircraft and check condition of electric actuator in the way outlined in Para.31. If hydraulic electric valve ГА-74/3 does not operate, start check from plug connector of valve. For this, connect test lamp in succession to terminals 1-3 and 2-3 with power source and circuit-breaker АЗС-5 LANDING GEAR SIGNALIZATION, BRAKE FLAPS, CONTROL UNIT OF AILERON, NAVIGATION LIGHTS ON; accordingly,

Operations	Possible faults	(Specifications)
set the "trimtab effect" electric actuator to the neutral position against the pilot lamp ELEVATOR TRIMTAB IN NEUTRAL POSITION (ТРИММЕР Р.В. НЕЙТРАЛЬНО); set the handle of the three-point switch ПЗШ-20 to the CIRCUIT-BREAKER (АВТОМАТ) position and set off the circuit-breakers, power source and ground hydraulic pump. 35. Check of "Trimtab Effect" Electric Actuator ЭП-100Г in Aircraft The operation of the "trimtab effect" electric system should be checked		switch three-point switch ПЗШ-20 to the HEAVY and then LIGHT (ТЯЖЕЛЫЙ) position by lighting of test lamp, check condition of circuits for control of hydraulic electric valve ГА-74/3. SPECIFICATIONS 1. Rated voltage ..... 27 V 2. Working voltage range ..... 24.3 - 29.7

Operations	Possible faults	Remedy (Specifications)
together with the technician (mechanic) of the aircraft. To make a check, cut in the ground hydraulic pump and ground power source or run the aircraft engine. While checking follow the routine below: throw on the switch BOARD, GROUND BATTERY (АККУМ.БОРТОВОЙ,АЭРОДРОМ) and circuit-breakers AILERON TRIMTAB, TRIMTAB EFFECT (ТРИММЕР ЭЛЕРОНА,ТРИММЕРН.ЭФФЕКТ), STABILIZER CONTROL UNIT, ROCKETS (БУ СТАБИЛ.,РАКЕТЫ) located on the right panel and cut in the hydraulic booster of the control unit by switch STABILIZER BOOSTER (ГИДРОУС.СТАБИЛ.) on the left panel;		3. Load: (a) rated ..... 100 kg (b) maximum ..... 150 kg 4. Travel of rod ..... 80±1.5 mm Note: The travel of the rod may be set within 10 to 80±1.5 mm. 5. Speed of rod travel with load acting against it ..... 2.7 mm/sec. ±5% 6. Current: (a) rated current not more than ..... 2 A (b) maximum current not more than.. 2.3 A 7. Duty .....intermettent: at rated voltage and load extension and retraction of rod followed by 1 min.interval.

Operations	Possible faults	Remedy
switch on the ground hydraulic pump and build up a working pressure of 135±7 kg/sq.cm.; push the control stick of the aircraft all the way forward and press the "trimtab effect" button to the diving position until the "trimtab effect" actuator MI-100M makes a complete shift. Check the operation of the electric actuator by hearing. In this case the effort on the stick becomes less and the pilot lamp of the "trimtab effect" neutral position comes out.	Electromotor fails to operate.	Total number of such cycles should be six which must be followed by an interval of not less than 1 hour. Check condition of electric wiring, locate fault and correct it. To check condition of electric wiring, use test avometer Tr-1. Start check from plug connector on electric actuator. Connect test lamp in succession to terminals B - M, then to A - M.

Operations	Possible faults	Remedy
Set electric actuator MI-100M to the neutral position against the pilot lamp; pull the stick all the way backward and press the "trimtab effect" button to the cabring position; in this case the effort on the stick becomes less and the pilot lamp comes out. Set the "trimtab effect" electric actuator to the neutral position against the pilot lamp; throw off circuit-breakers, power source and ground hydraulic pump.	Pilot lamp of neutral position does not come on.	ith battery and circuit-breaker AILERON TRIMTAB, TRIMTAB EFFECT ON, press "trimtab effect" button to DIVING position, then to CABRING position; if the pilot lamp comes on, wiring is in good condition. If circuit is intact, remove electric actuator from aircraft and check condition of brushes, commutator and windings. Check condition of lamp, replace defective lamp. If lamp is in good order, check condition of electric wiring. Start check from CIII fittinge. Positive wire (marked 38M1-1) runs from fittings through connector MP No.16

Operations	Possible faults	Remedy
		(4th socket), connector НР No.18 (9th socket) and circuit-breaker AILERON TRIMTAB, TRIMTAB EFFECT. Negative wire runs from fittings through connector НР No.16 (3rd socket), hermetic connector НРТ No.4 (15th socket), connector НР No.57 (pin 10) and connector of electric actuator (socket Д).

AIR DISTRIBUTOR (Item 525)

Operations	Possible faults	Remedy
36. External Inspection of Electric Actuator of Air Distributor Wipe dust, dirt, moisture from the body and check the	Loose screws.	Tighten screws.

Operations	Possible faults	Remedy
external condition of the body of the electric actuator and linkage, see that fastening screws of the electromotor housing and fastening nuts of the air distributor cock are tightened and locked, check the condition of linkage springs.	Improper locking of screws.	Lock screws with 0.5 mm dia. steel wire.
37. Check of Commutator Remove the protective band. Inspect the working surface of the commutator through the ports in the electromotor housing. If the electromotor operates normally, the commutator surface becomes slightly dark, but contains no traces of burning and contamination.	Contamination or burning of commutator bars.	In case of contamination (fatty black film), wipe commutator with clean cotton cloth slightly moistened in gasoline B-70, blow with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).

Operations	Possible faults	Remedy
To remove contamination and brush dust, wipe the electromotor parts with a piece of cloth and blow internal cavities of the electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm).		To remove contamination which cannot be wipped off with cloth, use sand paper No.180 or 220 as outlined in Para.28.
38. Check of Brushes and Their Seating Make sure that the brushes are correctly set and easily move in brush holders. The brushes should enter brush holders without jamming and rocking. Measure the height of brushes by means of a calipers or a ruler. The brushes worn down to 5.8 - 6 mm should be replaced with new ones from the spare parts set. Check to see that pig tails are secure.	Jamming of brushes in brush holders. Wear of and mechanical damage to brushes.	Grind side surface of brushes with sand paper No.180 or 220. The brushes should move in brush holders without jamming and rocking. Seat new brushes to fit commutator as outlined in Para. 29. After seating brushes blow internal cavity of elcotromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).

Operations	Possible faults	Remedy (Specifications)
39. Check of Spring Pressure on Brushes Check spring pressure on the brushes by means of a dynamometer with a measurement range of 0 - 200 gr or 0 - 500 gr. The method of the check is outlined in Para. 30. Spring pressure should be within 100 - 130 gr.		
40. Check of Electric Actuator of Air Distributor The electric actuator of the air distributor may be checked with the help of a simple test desk which is schematically shown in Fig.10. To make a check, follow the procedure below:		SPECIFICATIONS 1.Voltage ..... 27 V 2.Current, not more than ..... 1 A 3.Time of complete changeover of air supply from one line to another, at

Operations	Possible faults	Remedy (Specifications)
connect the actuator to the test desk in accordance with the diagram (Fig.10); connect the power source and by aid of the potentiometer adjust the supply voltage to 24.3 V;		pressure of 4 kg/sq.cm. in distributor and temperature from +15° to +340°C, not more than ..... 40 sec. 4. Angle of turn of potentiometer cam and slider ..... 90±5° 5. Duty ..... intermittent (output shaft of reduction gear turn from one extreme position to the other and back should be followed by 2 minute interval).
switch on the actuator for operation and measure the current consumed by the electromotor of the actuator and the time of the shift from one extreme position to the other. The current consumed by the actuator should not exceed 1 A while the time of the shift from	When connected to power source, actuator fails to operate. Current fluctuation during operation of actuator. Non-uniform operation of actuator.	No contact or wire break at plug connector. Restore contact or solder broken wire in connector. Make sure that brushes freely move in brush holders, check height of brushes, condition of commutator and security of brush springs. Eliminate jamming or replace

Operations	Possible faults	Remedy
one extreme position to the other should be within 20 - 40 sec.; Measure the impedance of the feedback potentiometer with the ohmmeter; the impedance should be 570±25 ohms; connect the ohmmeter to the potentiometer slider by switch 10. Switch the actuator on for operation and observe ohmmeter readings. Ohmmeter readings should vary smoothly, without jumps.		defective brush. If necessary, dress commutator as outlined in Para.26.
41. Check of Efficiency of Air Distributor Electric Actuator in Aircraft To check the operation of the air distributor electric actuator, follow the procedure below:	Electromotor of actuator fails to operate.	Check condition of electric circuit, locate fault and correct it. To check condition

Operations	Possible faults	Remedy
open fully the cock for supply of the cockpit; connect the ground power source to the aircraft mains; close the circuit-breaker marked COCKPIT SUPPLY, ЗУП-53, ANTI-ICING, LMP CABLE (ПИТАНИЕ КЛЕНИ, ЗУП-53, ПРОТИВООБЛЕД., КАБ.ЛАМПЫ); set the changeover switch of cockpit air heater in the COLD (ХОЛОДНЫЙ) position; in this case the electric actuator should become switched on for operation and in the extreme position it gets disconnected; set the switch in the HOT (ГОРЯЧИЙ) position and simultaneously start the stop-watch; check the operation of the electric actuator and time of the shift from one extreme		of circuit use test lamp or avometer Ts-1. Check should start from plug connector of air distributor electric actuator. Connect test lamp to terminals B and E, switch on battery; set switch of cockpit air heater to COLD position, then connect test lamp to terminals B and A, set switch of cockpit air heater to HOT position, check condition of electric circuits by using test pilot lamp. Wires from contact pairs A and E of air distributor plug connector pass through hermetic connector No.3 (sockets 13 and 14, respectively), cockpit air thermoregulator (sockets Д and Л, respectively) and run to switch of cockpit air heater. If circuit is intact, remove electric actuators from aircraft and check its condition as outlined in Paras 37 - 40.

Operations	Possible faults	Remedy
position to the other. The time of a complete shift of the distributor should not exceed 40 sec. Note: If by setting the switch in the COLD position the electric actuator is not switched on (this may be due to the fact that the distributor has already been set to this position), first set it to the HOT position, then to the COLD position; Close the cock of cockpit supply, switch off the circuit-breaker and disconnect the power source from the aircraft mains.		

THERMOSTAT OF COCKPIT AIR TEMPERATURE REGULATOR

Operations	Possible faults	Remedy
42. External Inspection of Thermostat Check externally to see that the thermostat body is clean and has no dents and damage. Remove the thermostat housing and inspect the thermostat contacts by the naked eye or with the help of a magnifying glass.	Burning of thermostat contacts.	Dress thermostat contacts with grinding paper, grade K3H-14, K3H-20, K3H-28 or with sand paper No.180. For dressing contacts, cut band of grinding paper. The band should be 5 - 10 mm wide, of arbitrary length. Insert band between contacts and dress contacts by moving band backward and forward. Contacts should be dressed in such manner as to preserve, if possible, their spherical surface. After dressing operation wipe contacts with chamois leather or clean cotton cloth and check them by naked eye or with the help of a magnifying glass.

Operations	Possible faults	Remedy
43. Check of Thermostat Efficiency For this purpose: place it into the circuit of the temperature regulator with electric actuator (item 525); set on the circuit-breaker marked CABIN SUPPLY, SVT-53, ANTI-ICING, LAMP CABLE; set the switch of cockpit air heater to the AUTOMATIC (ABTOMAT) position; turn the thermostat scale all the way to one and the other side. If the thermostat is serviceable, the output shaft of the electric actuator should alter the direction of rotation.		

Note: At an ambient temperature of below +15°C and above +26°C the thermostat operation may be checked by the careful displacement of the armature by hand in such a manner that it becomes closed first by one contact of the thermostat, then by the other.

Operations	Possible faults	Remedy
If the thermostat operates satisfactorily, mount the housing, turn in and lock the screws which faster the housing.		

ELECTRIC ACTUATOR ЭМФ-2 FOR DRIVE OF HEAT LIGHT ЛФСВ-45

Operations	Possible faults	Remedy
44. External Inspection of Electric Actuator Remove the electric actuator from the aircraft. Check externally the condition of the electric actuator, make sure the electric actuator parts have no corrosion or damage.		
45. Check of Commutator Condition Remove the protective housing of the electromotor, inspect the working surface of the commutator. If the electromotor operates normally, the commutator surface	Contamination or burning of commutator bars.	In case of contamination (fatty black film) wipe commutator with clean cotton cloth slightly moistened in gasoline Б-70 and blow with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).

Operations	Possible faults	Remedy
If the thermostat operates satisfactorily, mount the housing, turn in and lock the screws which faster the housing.		

ELECTRIC ACTUATOR MMO-2 FOR DRIVE OF HEAD LIGHT MCB-45

Operations	Possible faults	Remedy
44. External Inspection of Electric Actuator Remove the electric actuator from the aircraft. Check externally the condition of the electric actuator, make sure the electric actuator parts have no corrosion or damage.		
45. Check of Commutator Condition Remove the protective housing of the electromotor, inspect the working surface of the commutator, If the electromotor operates normally, the commutator surface	Contamination or burning of commutator bars.	In case of contamination (fatty black film) wipe commutator with clean cotton cloth slightly moistened in gasoline B-70 and blow with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).

Operations	Possible faults	Remedy
becomes slightly dark,but has no traces of burrs and contamination. To remove dirt and brush dust, wipe the parts and blow the electromotor with compressed air (at a pressure of 1 - 1.5 kg/sq.cm.).		If contamination cannot be removed with cloth, use sand paper No.180 or 220 as outlined in Para.28.
46. Check of Brushes and Their Seating. Check to see that the brushes are correctly set and easily move in brush holders. The brushes should enter brush holders without jamming and rocking.	Jamming of brushes in brush holders.	Grind side surface of brushes with sand paper No.180 or 220.
Measure the height of the brushes with the help of	Wear and other mechanical in-	Replace defective brushes. Carefully seat new brushes.

Operations	Possible faults	Remedy Specifications
calipers or a ruler. The brushes worn down to 6 mm should be replaced from the spare parts set. Make sure that the pig tails are not damaged.	juries of brushes.	After seating blow electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).
47. Check of Spring Pressure on Brushes. Check spring pressure on the brushes by means of a dynamometer with a measurement range of 0 - 200 or 0 - 500 gr. The method of the check is outlined in Para.30. Spring pressure should be within 110 - 130 gr.		
48. Check of Electric Actuator in Test Device. The electric actuator may be checked under load on a simple portable device (Fig.11). To check the actuator follow the procedure below:		SPECIFICATIONS 1. Rated voltage ..... 26 V 2. Range of working voltage ..... 24-30 V 3. Maximum current of consumption under

Operations	Possible faults	Remedy (Specifications)
lift lever 5 of the device and secure the head light to the device; lower the lever and hang up the strip-pointer 8,9 N, weight, which in this motion of the lever, creates a load of 220 kg-cm with the extended head light (distance from lever rotation axles 1 and 2 to the point of weight suspension is 240 mm); connect the actuator according to the diagram (Fig.19); switch the system on for extension of the head light. During the operation of the actuator measure supply voltage to the rotor coil (26 V); switch on the actuator for retraction of the head light; again switch on the actuator for extension and retraction of the head light.		maximum load, not more than ..... 2.8 A 4. Maximum rotation angle of actuator sector ..... $86^{\circ}30' \pm 30'$ 5. Maximum load moment .....220 kg-cm 6. Time for travel through angle of $86^{\circ}30' \pm 30'$ at the sinusoidally increasing moment from 0 to 220 kg-cm and 26 V should not exceed 10 sec. and through angle of $76^{\circ} \pm 30'$ - 9 sec. 7. Duty ..... intermittent. Number of working travels - 8, interval between working travels - 2 min. (Working travel of actuator implies movement of sector in one direction)

Operations	Possible faults	Remedy (Specifications)
It is necessary to make 8 switchings at 2 min. intervals; At the last extension of the head light readjust the voltage once more and, before cutting off the actuator in the extended position of the head light, measure the current consumed by the electromotor of the actuator; the current should not exceed 2.8 A; in the process of the check of the actuator measure by a stop-watch the time of head light extension which should not exceed 10 sec. and by means of the angle gauge of the test device measure the angle of head light extension which should be $83^{\circ}10' \pm 1^{\circ}$. If the angle of light extension does not meet the specifications,		8. Inertia run-out of actuator ..... 2° 9. Play sector when assembled with actuator not more than: (a) 30 angular minutes for a new actuator; (b) 1 degree for actuators whose life is over. 10. Insulation resistance after rated duty should be not less than 2 megohms.

Operations	Possible faults	Remedy
it should be adjusted as outlined in Para. 49 "Adjustment of Turning Angle of Electric Actuator Sector"; disconnect the plug connector of the mechanism from the circuit of the device and, not more than 3 - 5 min. after the operation of the actuator under the rated duty, measure insulation resistance of the current-carrying parts relative to the body. In measuring insulation resistance, use a megger rated at 500 V. The megger should be connected in between the actuator body and pins of the connector; the supplied voltage should be maintained for 1 min.	When connected to power source actuator fails to operate.	Damaged soldering of wires at plug connectors. Solder broken ends of wires to contact pins of connector.
	Current fluctuation during operation of actuator. Non-uniform operation of actuator.	Check to see that brushes move smoothly in brush holders and remove jamming of brushes. If commutator is dirty, wipe it with cloth moistened in gasoline. Replace slack or broken springs.

Operations	Possible faults	Remedy
When checking, make sure that insulation resistance is not less than 2 megohms.	When electric actuator is switched on, electromotor consumes current over 2.3 A. Heavy sparking under brushes.	Disconnect electromotor with reduction gear and check the latter for jamming, send actuator for repairs, if reduction gear at fault. Check position of brushes in holders, fit of brushes to commutator and condition of springs pressing brushes against commutator. If necessary, dress commutator.
	Low insulation resistance.	Remove protective hood from electromotor, clean commutator, support and brush holder from brush dust, dirt and moisture. Blow electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.). If cable lugs touch frame, correct this fault.

Operations	Possible faults	Remedy
	Angle of head light extension does not meet specifications.	Readjust angle of head light extension.

49. Adjustment of Turning Angle of Electric Actuator Sector

The design of electric actuator MT2-2 allows for adjustment of the turning angle of the sector (angle of head light extension) from 50 to 86°30'±30'.

To adjust the turning angle of the actuator sector for the required value, follow the procedure below:

remove the electric actuator from the aircraft and set it in the test device designed for checking of control units;

unlock and turn out the screws securing cover 8 (Fig.13) to body 10 and shift the cover aside;

if the required turning angle of the sector (head light) is within 73 - 85°30', loosen screw 6 and by sliding terminal switch 9 and plate 7 along the guiding slots make it possible for stop 5 to disconnect terminal switch 9 at the required turning angle of the sector (head light). After adjustment, tighten screw 6;

If the required turning angle of the sector (head light) lies within 63 - 73° or 50 - 63°, loosen screw 6, shift terminal switch 9 and plate 7 to the extreme right position (when adjusting the angle within 50 - 63°, move to the extreme left position) and tighten screw 6. Loosen screw 3 and turning stop 4 make it possible for terminal switch to be cut off at the required turning angle of the sector. After the adjustment tighten screw 3 and lock the stop by punching the body of segment 2 into the opening of sector 1;

after the adjustment and check of operation of the electric actuator reinstall cover 8, turn in and lock the cover-to-body fastening screws. On completion of the adjustment make the following entry in the certificate of the electric actuator: date of adjustment, angle to which the actuator is adjusted, name of organization, position, name and signature of the person who made the adjustment.

Operations	Possible faults	Remedy
50. Check of Electric Actuator MT2-2 of Head Light PGSB-45 in Aircraft To make a check, follow the procedure below:	Electro-motor fails to operate.	Check condition of relay PN-2 designed for switching head lights on. When circuit-breaker

[illegible]	Possible faults	Remedy
[illegible] the ground power source to the aircraft [illegible] [illegible]; [illegible] the circuit-breaker of head light control [illegible]; By the switch of head light control (on the instrument panel) switch on the landing light. In this case the light should smoothly extend and, when the light extension is completed, the drive actuator of the light should become cut off. The bulb should come on 1.5 - 2 sec. after the beginning of the light extension; set the changeover switch of the head lights to the OFF		LIGHTS is on and changeover switch of head lights is set to the position of the landing light, the switching relay should produce click. If switching relay of head lights operates normally, check condition of circuit, locate fault and correct it. To check condition of circuit, use test lamp (or avometer Тт-1). Start checking from plug connector of actuator. Connect one end of wire of test lamp to aircraft frame and the other end successively to terminals Б (extension of head light) and А (retraction of head light); using test lamp check circuits for head light extension and retraction. In case

Operations	Possible faults	Remedy
(ВЫКЛЮЧЕНО) position. As a result, the head light should return to the initial position and the light bulb comes out. The time of the complete shift of the light (complete extension or retraction) should not exceed 10 sec. CAUTION: To prevent the filament of the lamp from burning out, do not keep it on for more than 2 minutes.		electric circuit is intact, remove actuator from aircraft and check its condition in manner outlined in Paras 45-49.

51. Check of Position of Head Light Beam

To check the position of the head light beam, place the aircraft on an even surface. With the help of the reference points ascertain that the longitudinal and lateral axes of the aircraft are located horizontally. If necessary, hoist the aircraft and obtain the horizontal position of its axes.

The position of the light beam should be checked in the dark time by observing the light spot of maximum brightness on a vertical shield put up in front of the aircraft at a distance of 5 metres from the head light. The axis of the light beam in the horizontal plane should be located at a distance of 1065±100 mm from the longitudinal axis of the aircraft and at a distance of 705±50 mm from the longitudinal axis of the aircraft in the vertical plane (Fig.14). This location of the axis of the beam corresponds to the head light extension throughout 83°10'±1° and to the angle of 5±1° in the horizontal plane between the axis of the beam and the longitudinal axis of the aircraft. If the location of the beam does not meet the above requirements, adjust the position of the head light by moving it along the fastening slots.

After the adjustment of the position of the beam of the landing head light the following entry should be made in the Service Log of the aircraft: date of adjustment, name of organization, position, name and signature of the person who performed the adjustment.

Note: If check marks are provided, check the position of the landing head light in the aircraft by means of the check marks and the angle of the light extension.

52. Check of Position of Taxiing Light Beam

To check the position of the taxiing light beam, place the aircraft on an even surface. With the help of the reference points ascertain that the longitudinal and lateral axes of the aircraft are located horizontally.

The position of the beam should be checked in the dark time by observing the light spot of maximum brightness on a vertical shield put up in front of the aircraft at a distance of 5000±50 mm from the taxiing light.

The axis of the beam should be located at a distance of 1055±100 mm (Fig.15) from the longitudinal axis in the horizontal plane and at a distance of 1340±100 mm from the lateral axis in the vertical plane.

To adjust the light, disengage the props of the light casing, loosen the large locking nut and position the ФР-100 so that the centre of the light spot coincides with the centre of the spot on the shield for aiming of the taxiing light. Tighten the locking nut. Insert the guide into the axle of the front wheel and, turning the wheel all the way to the left and right, measure the gaps between the ФР-100 and flaps of the section of the landing gear front strut. The gaps should be not less than 5 mm. In case the gap on one side is greater, while on the other side it is less than 5 mm, loosen the bolt which tightens the stirrup and bracket on the strut, turn the bracket with the light towards the large gap. Then again aim the light and check the distances to the flaps.

Loosen the locking nuts on the props of the light casing and by turning the props align their lugs with the flats of the stirrup and secure them on the flats.

Fully tighten the large nut, check nut, and stirrup fastening nut (if the stirrup was unfolded for adjustment of the light).

Paint check marks in red:

on the strut of the spherical support and on the locking nut;

on the thrust journal of the light and on the bracket;

on the stirrup of the bracket and on the front wheel strut.

After the adjustment it is necessary to make the following entry in the aircraft Service Log: date of adjustment, name of organization, position, name and signature of the person who performed the adjustment.

Note: If check marks are provided, check the adjustment of the taxiing light (position of beam) with the help of these marks.

ELECTRIC ACTUATOR AMC-4

Operations	Possible faults	Remedy
53. External Inspection of Electric Actuator Check externally the condition of the electric actuator. Clean the external surface of the electric actuator from moisture, dirt and oil, check to see that the electric actuator is properly secured and mounted.		
54. Check of Commutator Condition Remove the electromotor hood. Check the condition of the working surface of the commutator through the ports in the commutator shield. To remove dirt and brush dust, wipe the electromotor elements with cloth and blow the internal cavities with compressed air (at a pressure of 1 - 1.5 kg/sq.cm.).	Contamination or burning of commutator bars.	Remove electric actuator together with technician (mechanic) from aircraft and correct fault as outlined in Para.28.
55. Check of Condition of Brushes and Their Seating Check to see that the brushes are correctly set and easily move in brush holders. The brushes should enter brush holders without jamming and rocking.	Jamming of brushes in holders.	Correct fault as outlined in Para.29.

Operations	Possible faults	Remedy (Specifications)
Measure the height of the brushes with the help of calipers or a ruler. The brushes worn down to 12 mm should be replaced with new ones from the spare parts set. Check for damage to the pig tails, make sure the brush springs are sound and correctly set.	Wear of brushes and mechanical damage.	Correct fault as outlined in Para.29. To obtain fine fit to commutator, insert brushes in brush holders, run electromotor for 5 - 10 minutes under no-load (when electromagnetic coupling of reversing gear is disengaged) at voltage of 20 - 28 V.
56. Check of Electric Actuator in Aircraft Electric actuator AMC-4 operated by a ground power supply at a voltage of 27 V ±10 per cent should be checked together with the technician (mechanic) of the aircraft. When pressure in the hydraulic system is absent, check in the following manner:		SPECIFICATIONS 1. Rated voltage ...27 V 2. Range of working voltage 24.3 - 29.7 V 3. Current consumed: (a) rated current, not more than ...13.5 A;

Operations	Possible faults	Remedy (Specifications)
cut in a 0 - 20 A ammeter between the connector of the ground power source and the plug on the aircraft and connect the source to the aircraft line; close the switch located on the right desk and marked AIRCRAFT, GROUND BATTERY (АККУМ. БОРТОВОЙ, АЭРОДРОМ.); close the circuit-breaker marked APU-2A CONTROL (УПРАВЛ. АРУ-2А) and located on the right desk. This switches on the green pilot lamp on the instrument panel, marked LAMP IS NOT ON AT LANDING - CHANGEOVER TO APU MANUAL CONTROL (НА ПОСАДКЕ ЛАМПА НЕ ГОРИТ, ПЕРЕХОДИ НА РУЧНОЕ УПРАВЛЕНИЕ АРУ); close the circuit-breaker marked STABILIZER CONTROL НУС-2 (УПРАВЛ. НУС-2 СТАБИЛ.), check by hearing that the electromotor of the actuator is operating;		(b) maximum current not more than ..... 17 A 4. Load on rod in both directions of movement: (a) rated load ..... 680 kg (b) maximum load ..... 1150 kg (c) assisting load ... 1700 kg 5. Speed of rod movement: (a) under rated load, not less than ..... 11.2 mm/sec. (b) under maximum load, not less than ..... 9 mm/sec. (c) under maximum assisting load not less than ... 22 mm/sec. 6. Travel of rod: (a) working travel ..... 116 mm. (b) maximum travel ..... 123 mm 7. Load overcome by electric actuator, not less than ..... 1200 kg

Operations	Possible faults	Remedy (Specifications)
by pulling the control stick backward and forward see that the stick and stabilizer move smoothly; during operation of the electric actuator measure the current consumed by the electric actuator with an ammeter. The current should not exceed 13.5 A. 57. Check of Automatic Connection of Electric Actuator АПС-4 The check of the automatic connection of electric actuator АПС-4 should be performed together with the technician (mechanic) of the aircraft. The check should be started from the ground hydraulic pump and ground power source in the following order: close the switch marked AIRCRAFT, GROUND BATTERY, the circuit-breakers marked STABILIZER CONTROL НУС-2 CONTROL UNIT OF STABILIZER, ROCKET	When there is no pressure in hydraulic system and circuit-breaker STABILIZER CONTROL НУС-2 is switched on, electric actuator АПС-4 fails to operate.	8. Rod load held by electric actuator until friction coupling slips through in both directions, not less than ... 2000 kg When closing switches of power sources, check by hearing connection of contactor КМ-25Д (72М). If contactor does not become connected, check electric circuit from terminal of contactor winding to circuit-breaker. If contactor becomes connected, check electric

Operations	Possible faults	Remedy
(БУ СТАБИЛ., РАНЕЕ) located on the right panel, turn on the hydraulic booster БУ-14МС by the switch located on the left panel and marked STABILIZER BOOSTER (ГИДРОУС. СТАБИЛ.); turn on the ground hydraulic pump and build up a working pressure of 135±7 kg/sq.cm., after which turn the pump off; pulling the control stick backward and forward, observe the pressure decrease in the hydraulic system. At a pressure of 50^{+2} kg/sq.cm. the terminal switch (4ОМ) will operate from the cylinder (behind hydraulic valve ГА-74/5) and turn on the electric follow-up system; the stabilizer will become electrically controlled.		circuit from plug connector of electric actuator to circuit-breaker marked МУС-2 ELECTROMOTOR (ЭЛЕКТРОДВ. МУС-2) and located on the right power unit. By connecting test lamp or avometer Тт-1 between aircraft structure and plug connector of electric actuator АМС-4 (2nd socket, wire marking 113М2-1), check electric circuit for being intact. The conductor passes through plug connector No.93 (9th pin), contactor contacts, plug connectors No.93 (19th socket), No. 58 (19th socket) and circuit-breaker. If electric wiring is good, remove electric

Operations	Possible faults	Remedy
The changeover of control can be determined from the speed of the control stick movement and from the noise of the operating electromotor.	If pressure in hydraulic system is below 50^{+2} kg/sq.cm., automatic connection of electromotor does not take place.	actuator from aircraft and check its condition. Check condition of terminal switch of actuating cylinder after hydraulic valve ГА-74/5 of stabilizer booster.

(...variable ratio automatic boost control unit)

Operations	Possible faults	Remedy
11. Removal Inspection of ... Electric Actuator		
Remove the electric actuator from the aircraft. Then assemble the condition of the electric actuator, make sure it has no mechanical injuries or damage of the varnish coating. Carefully inspect the security of the braiding, wire bundles and plug connectors. Take special care that the protective caps of the limit switches are sound, limit switches are in good order, that the levers press against the centres of the limit switch buttons, that the pressing levers move easily and have no corrosion.		
59. Check of Commutator Condition		
Remove the protective band from the electromotor. Check the condition of the working surface of the commutator through the ports in the commutator shield.	Contamination or burning of commutator bars.	Correct fault as outlined in Para.28.

Operations	Possible faults	Remedy
To remove dirt and brush dust, wipe the electromotor elements with cloth moistened in clean gasoline and blow the internal cavities of the electromotor with compressed air (at a pressure of 1 - 1.5 kg/sq.cm.).		
60. Check of Condition of Brushes and Their Seating		
Check to see that the brushes are correctly set and easily move in the brush holder races. The brushes should enter the brush holders without jamming and rocking.	Jamming of brushes in brush holders.	Correct fault as outlined in Para.29.
Measure the height of the brushes with the help of calipers or a ruler. The brushes worn down to 9 mm should be replaced with new ones from the spare parts set. Check to see that the brush pig tails are not damaged and the springs are set correctly.	Wear of brushes and mechanical damage.	Correct fault as outlined in Para.29.

Operations	Possible faults	Remedy
61. Check of Spring Pressure on Brushes By means of a dynamometer of the 0 - 500 gr measurement range check the spring pressure on the brushes. The spring pressure should be within 120 - 180 gr. Install the elements of the automatic system in the aircraft. The control unit should be installed horizontally with the hood up and secured to a special plate on the four shock absorbers. The plate with the control unit is attached with the help of special latches in the aircraft cockpit under the instrument panel. The installation must be carried out carefully, without twisting the shock absorber bolts, since twisting deteriorates shock absorbing. The installation of the control unit should enable its free displacement so that it remains clear of other aircraft parts during amplitude swings of the shock absorbers. Before supplying the impact and static pressures to the system, remove protective rubber caps from the pipe unions of the control unit. The static pressure pipe should be connected to the pipe union marked C, while the impact pressure pipe should be connected to the pipe union marked Д.		Check should be performed as outlined in Para.30.

Operations	Possible faults	Remedy
CAUTION: If the impact and static lines are misconnected or confused, the operation of the automatic system may be upset or even rendered unserviceable. When installing the actuating mechanism take care that in the extreme positions of the control stick (set against the stops) the bunched conductors with the plug connector are not drawn and have a slight sag. If the conductors have an excessive sag, they may hamper the movement of the actuating mechanism. After the installation of the automatic system in the aircraft check its operation. 62. Check of Regulation Law of Automatic System in Aircraft Check of Regulation Law of Automatic System by Ram Pressure CAUTION: To avoid failure of the electromotor of the APU actuator, perform the check with booster БУ-14МС or electric actuator АМС-4 switched on.		

Operations	Possible faults	Remedy
To check the operation of the AFY automatic system, release the control stick and follow the procedure below: 1. Connect a ground power source. Its voltage should be 27 ± 1 V when checking the characteristics of the automatic system. For checking the operation of the automatic system the voltage should be within 28.3 - 29.7 V. 2. Set on the switch marked [illegible], BATTERY located on the right panel. 3. Close circuit-breaker marked AFY-2A CONTROL located on the right panel. This switches on the green pilot lamp on the instrument panel marked [illegible] AFY [illegible] 4. Close the circuit-breaker marked [illegible] and ensure by hearing that the electromotor of electric actuator AM is operating.	When circuit-breaker AFY-2A CONTROL is switched on "large arm" lamp does not come on.	Check condition of lamp and replace defective lamp. If lamp is good, check condition of limit switch for extended position of rod. For this, disconnect connector from AFY actuating mechanism and connect socket 8 with aircraft frame. If pilot lamp comes on, limit switch is defective. If limit switch is good, check condition of electric wiring by avometer TP-1 (or test lamp). Check should be started from fittings CHH of pilot lamp. In this case it is necessary to keep in mind that positive wire (marked 109M1-III) passes via plug

Operations	Possible faults	Remedy
5. Set the AFY selector switch on the left panel to the AUTOMATIC position. 6. Connect the MIV-3 instrument to the impact chamber of the air speed tube (PVD). 7. When pressure change slowly (for 60 - 90 sec.) in the impact chamber of ram pressure transmitter MPD-106 (at atmospheric pressure in static chambers of ram pressure transmitter MPD-106 and altitude transmitter MPD-10B) which corresponds to the [illegible] of indicator speed from 460 - 510 km/hr to 880 - 930 km/hr and vice versa, check the adjustment of the follow-up system. The adjustment of the follow-up system depends on the number of switchings of electromotor MP-100M which should be not less than 18, with the pressure changing in one and the same direction. When increa the	Is checking regulation by ram pressure, electric actuator does not operate.	connector No.16 (10th socket), No.20 (15th pin) and circuit-breaker marked AFY CONTROL. Negative wire (marked 73M2-1) from fittings CHH passes via plug connector ZP No.16 (10th socket), hermetic plug connector ZHP No.6 (3rd pin), plug connector ZP No.58 (23rd pin) and plug connector of AFY electric actuator (5th socket). Set operation changeover switch in MANUAL position. Switch on electric actuator to "small arm" position by manual control switch. If mechanism does not operate, disconnect connector from AFY electric

Operations	Possible faults	Remedy
pressure observe the readings of the AFV indicator (against outer figures on the speed scale) which should approximately correspond to the readings of the instrument on the KUV-2 and of the aircraft speed indicator within the range of the indicator speed from 405 ± 25 to 900^{+30}_{-20} km/hr. The actuating rod should start its movement for retraction from the large arm, 95 - 99 mm long, at a speed of 460 - 510 km/hr. It should end its movement for retraction at a speed of 850 - 900 km/hr while the arm towards the booster should be equal to 49 - 53 mm.		actuator, connect test lamp between 9th socket and aircraft frame or 1st socket. If the test lamp comes on, replace defective electric actuator, and automatic system. If test lamp does not come on while relay PPT-40 operates, check condition of electric wiring from connector of electric actuator to connector of AFV control unit. In this case electric wire (marked 10AM2-1) runs from connector MP of electric actuator (9th socket), via connector MP No.48 (2nd socket), hermetic plug connector MPT No.11 (11th socket) and to plug connector MP of control unit (2nd pin).

Operations	Possible faults	Remedy
The actuating rod should end its movement for extension (with the decrease of pressure in the impact chamber of transmitter MPM-106) at a speed not less than 410 km/hr while the arm towards the booster is 95 - 99 mm. This switches	Position indicator of AFV actuator fails to operate.	If AFV electric actuator operates from manual control, one of the element of control unit has become unserviceable due to puncture of rectifier in diagonal of altitude bridge, o/c in winding of relay PMC or PC-3, o/c in potentiometer windings of degenerative feedback of transmitter MPM-106. Defective unit should be replaced together with the entire automatic system (control unit and electric actuator). Disconnect indicator from aircraft mains and connect it to D.C. power source. If pointer deflects, indicator is intact.

Operations	Possible faults	Remedy
on the pilot lamp LAMP IS NOT ON AT LANDING - CHANGEOVER TO APV MANUAL CONTROL.		Defective indicator should be replaced.
8. Disconnect instrument KIU-3 from the air speed tube (ПВД), open all circuit-breakers and switch off the power source.		Check condition of indicator potentiometer for which purpose disconnect connector from APV electric actuator, connect the ohmmeter to terminals 10 and 11. The potentiometer resistance should be 370^{+40}_{-20} ohms.
Check of Regulation Law by Ram Pressure and Altitude The check of APV operation by ram pressure and altitude should be carried out with using a ground power supply at a voltage of 28±0.5 V (the check may be carried out also at a voltage of 27 V±10%		Check condition of electric wiring with the help of test lamp or avometer Tr-1.

Operations	Possible faults	Remedy
but in this case the regulation law may be observed with deviations unharmful to flight operation) and ground hydraulic pump connected to the main hydraulic system. To make a check, follow the procedure below: disconnect the static line from transmitter MPД-106; for this, disconnect the hose from the tee-pipe which joins MPД-106 transmitter to MPД-126 located behind the instrument panel; stop the union of the tee-pipe; join instrument KIU-3 to the impact chamber of the air speed tube ПВД. Join second instrument KIU-3 to the static of the air speed tube ПВД; Make sure that the changeover cock of the impact line (on the left panel) is set to the AIR SPEED TUBE OPERATING (ПВД РАБОЧ.) position; close the switch AIRCRAFT, GROUND BATTERY circuit-breakers marked APV CONTROL, CONTROL UNIT OF STABILIZER, ROCKET and MYC-2		For this purpose disconnect plug connector ШР from APV electric actuator, connect test lamp between the 11th socket and aircraft structure. Electric wiring is intact if lamp is on (power source and APV CONTROL circuit-breaker should be on). Electric wire (marked 104M8-1) runs from the plug connector of the electric actuator (11th socket) through connector ШР No.57 (7th socket), hermetic plug connector ГРТ No.11 (13th socket), connector ШР No.20 (15th pin) and circuit-breaker marked APV CONTROL. Check condition of electric wire running from slider of potentiometer used for signalling about position of actuating

Operations	Possible faults	Remedy
STABILIZER CONTROL, set the APV selector switch to the AUTOMATIC position; this switches on the pilot lamp marked LAMP IS NOT ON AT LANDING - CHANGEOVER TO APV MANUAL CONTROL; switch on the ground hydraulic pump and booster EV by the switch located on the left panel and marked STABILIZER BOOSTER (ГИДРОУС.СТАБИЛ.); build up excessive pressure in the impact line by smoothly increasing the pressure to the value which corresponds to an indicator speed of 900^{+30}_{-20} km/hr. In this case the APV rod will move to the "small arm" position and the pilot lamp will come out at an indicator speed of 450 - 510 km/hr; create rarefaction in the static line (transmitter ИПД-12С) and increase it until it corresponds to an altitude of 10,000±350 m.	During check of regulation law by ram pressure APV automatic system starts operating in conditions of self-oscillations.	rod to position indicator. Electric wire (marked 108М2-1У runs from plug connector of mechanism (2nd socket) through connector ШР No.48 (1st socket), hermetic plug connector ШРТ No.5 (5th socket), connector ШР No.16 (14th pin) and positive terminal of position indicator. Failure of dynamic braking of electromotor МТ-100АШ may be the most probable cause of self-oscillations of APV system in course of operation. APV system may start operating in conditions of self-oscillations due to other, less frequent causes such as: short circuit of normally closed

Operations	Possible faults	Remedy
The actuating rod should pass over to the "large arm" position (not less than 93 mm). In this case at a static pressure varying from the altitude of 4700 - 5300 m. to 9650 - 10,350 m. and at a stable speed of 880 - 930 km/hr the number of electromotor switchings should be from 13 to 47; decrease rarefaction to the value which corresponds to an altitude of 5000±300 m., as a result the APV rod should pass over to the "small arm" position. Make sure that the APV indicator gives correct readings. The indicator readings (See bottom figures on the altitude scale) should approximately correspond to the readings of the aircraft altimeter within altitudes from 5000±300 to 10,000±350 m.; lower the pressure in the impact line to the atmospheric value; in this case the rod shifts to the "large arm" position and the pilot lamp comes on; after the check open the circuit-breakers, power sources, ground hydraulic pump, remove		and normally opened contacts in "large arm" relay РС-3, short circuit between moving contact Я and fixed contact П of relay РПС with armature in neutral position, increase of positive feedback, etc. Failure of dynamic braking may occur due to burning or contamination of contacts in reversing and breaking relay РРТ-40.

ELECTROMOTORS

Operations	Possible faults	Remedy
ELECTROMOTORS ЭП-100Б OF FUEL PUMPS НМп-1		
63. External Inspection of Electromotor Remove fuel pumps of the 3rd and 4th tanks. Wipe the body and check the external condition. Check to see that the electromotor elements have no corrosion and damage.		
64. Check of Commutator Condition Screw out plugs in the commutator shield, remove brushes and check the working surface of the commutator, check for fuel and brush dust inside the electromotor. If the electromotor operates normally, the commutator surface grows slightly dark, but has no traces of burning and contamination.	Fuel inside electromotor. Contamination or burning of commutator bars.	**Send electromotor for repairs.** **In case of contamination (fatty black film) wipe commutator with clean cotton cloth slightly moistened in clean gasoline and blow with compressed air (at pressure of 1 - 1.5 kg/sq.cm.**

Operations	Possible faults	Remedy
To remove contamination and brush dust from electromotor elements, use a piece of cloth and blow internal spaces of the electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).		If contamination cannot be removed with cloth, use sand paper No.180 or 220, after which clean commutator grooves with wooden stick, wipe with cotton cloth moistened in gasoline B-70 and blow with compressed air (at pressure of 1 - 1.5 kg/sq.cm.) Before dressing commutator remove brushes. Do not use emery cloth.
65. Check of Condition of Brushes and Their Seating Check to see that the brushes are correctly set and easily move in the brush holder races. The brushes should enter the brush holder races without jamming and rocking. Measure the height of the brushes with the help of calipers or a ruler. Brushes worn down to 10 mm should be replaced from the spare parts set.	Jamming of brushes in brush holders. Wear of mechanical	Grind side surface of brushes with sand paper No.180 or 220. Brushes should move in brush holders without jamming or rocking. Replace defective brushes. Seat new brushes to fit commutator. For this purpose wrap strip of

Operations	Possible faults	Remedy
	damage to brushes.	sand paper around commutator with sanded side upwards. Width of strip should be equal to commutator length. Paper should cover commutator through 180° as shown in Fig.7. Insert brush to be seated into brush holder and move paper across commutator back and forth until entire working surface of brush fits commutator. Lift brush when sand paper is moved against rotation of electromotor. After seating blow internal spaces of electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.). To make finish grinding of brushes to commutator, start electromotor at no-load and at voltage reduced to 10 V.

Operations	Possible faults	Remedy
66. Check of Spring Pressure on Brushes Check spring pressure on brushes by means of a dynamometer with a measurement range of 0 - 500 gr. The method of the check is outlined in Para.30. Pressure should be within 160 - 200 gr. Remove the brushes and make sure that the shaft of the electromotor armature rotates smoothly. If the ball bearings jam or move non-uniformly, send the electromotor for repairs.		Grinding is sufficient if brush has not less than 60 per cent contact with commutator.
67. Check of Pump Electromotor of 3rd Fuel Tank in Aircraft Connect the ground power source to the aircraft plug GROUND POWER SUPPLY (АЭРОДРОМНОЕ ПИТАНИЕ) and cut in a 0-20 A ammeter between the connector of the ground supply and that of the aircraft.	Electromotor fails to operate.	Check condition of circuit, locate fault and correct it. To check condition of electric circuits, use test lamp or avometer Tr-1.

Operations	Possible faults	Remedy
Measure the current consumed by constantly cut in loads of the aircraft. Close the circuit-breaker PUMP OF 3rd TANK (НАСОС 3-го БАКА). This actuates fuel transfer pump НШР-1 of the 3rd tank and switches on the pilot lamp indicating the operation of pumps of the 3rd and 4th tanks. If the 3rd tank contains fuel, the lamp is to come out in 3 - 4 sec. after the pump was actuated. During the operation of the pump take by an ammeter measures of the current consumed by the electromotor. The current should not exceed the rated value (not more than 7 A). After the check open the circuit-breaker. 68. Check of Pump Electromotor of 4th Fuel Tank in Aircraft Connect the ground power source to the aircraft plug GROUND POWER SUPPLY and connect a 0 - 20 A ammeter between the connector		The check should be started from the electromotor terminals. Positive conductor marked 17Ж1 runs through electric filter Ф-14А and connectors: No.56 (1st pin.), No.4 (18th pin), No. 25 (8th pin) and circuit-breaker АЗС-10 PUMP OF 3rd TANK. If electric circuit is intact, remove fuel pump from aircraft and check condition of electromotor as outlined in Para.65. Electromotor with a defective field winding or armature winding should be sent for repairs.

Operations	Possible faults	Remedy
of the ground supply and the aircraft plug. Measure the current consumed by constantly connected loads of the aircraft. Close the circuit-breaker marked PUMP OF 4th TANK. This actuates fuel transfer pump НШР-1 of the 4th tank and switches on the pilot lamp. If the tank contains fuel, the lamp is to come out in 3 - 4 sec.after the pump was started. During the operation of the electromotor take ammeter readings of total current. When the electromotor is shut off, measure the current of constantly connected loads and determine the current consumed by the electromotor of the fuel pump of the 4th tank. The current of the electromotor should not exceed 7 A. After the check open the circuit-breaker.	Electromotor fails to operate.	If electromotor does not operate, check condition of electric circuit with the help of test lamp or avometer Ts-1. Check should be started from electromotor connector. Test lamp should be connected to terminal of conductor marked "18Ж1" and to aircraft structure. Positive conductor for power supply of electromotor runs through electric filter Ф-14А and plug connectors: No.56 (5th socket), No.4 (13th pin), No.25 (14th pin) and circuit-breaker АЗС-10 PUMP OF 4th TANK.

Operations	Possible faults	Remedy
69. Check of Electromotor MT-130 of Fuel Pump ПЭН-2 in Aircraft Connect the ground power source to the aircraft plug GROUND POWER SUPPLY and cut in a 0-20 A ammeter between the connector of the power source and that of the aircraft plug. Take ammeter readings of constantly connected electric loads of the aircraft. Close the circuit-breaker PUMP OF 2nd TANK. This actuates fuel transfer pump ЭЦВ-2 and switches on the pilot lamp indicating the operation of the pump of the 2nd tank. If the tank contains fuel, the lamp is to come out in 3 - 4 seconds after the pump was actuated. During the operation of the pump measure the current consumed by the electromotor by using an ammeter. The current should not exceed 10.5 A. Check the operation of the electromotor by hearing. After the check open the circuit-breaker.	The electromotor fails to operate. Noise in ball bearing.	Check condition of circuit. locate fault and correct it. To check condition of electric circuits, use test lamp or avometer TT-1. Check should be started from connector of electromotor. Conductor 14M1 runs through electric filter Ф-14A and connectors: No.7 (5th pin), No.25 (7th pin) and circuit-breaker A3C-15, PUMP OF 2nd TANK. If electric circuit is intact, remove fuel tank from aircraft and check condition of electromotor. Replace fuel tank.

Operations	Possible faults	Remedy
70. Check of Electromotor of Unit A95A in Aircraft Connect the ground power source to aircraft plug GROUND POWER SUPPLY and connect a 0-50 A ammeter between the connector of the power supply and that of the aircraft. Take ammeter readings of the current consumed by the constantly connected electric loads of the aircraft. Close circuit-breaker A3C-5 PUMP OF 1st TANK. This actuates the booster pump and switches on the pilot lamp indicating the operation of the pump of the 1st tank. If the tank contains fuel, the lamp is to come out in 3 - 4 sec. after the pump was started. During operation of the pump measure the current consumed by the electromotor with an ammeter. The current should not exceed 37 A. After the check open the circuit-breaker.	Electromotor fails to operate.	Close circuit-breaker A3C-5 PUMP OF 1st TANK and by hearing check cutting in of contactor destined to switch on pump of fuel tank No.1. If contactor does not get cut in, check condition of circuit, locate fault and correct it. Check should be started from electric terminal on contactor KM-50M of conductor marked 11M1-III. Conductor runs through plug connectors No.7 (8th pin), No.25 (1st pin) and circuit-breaker PUMP OF 1st TANK.

Operations	Possible faults	Remedy
		If contactor КМ-50Д becomes cut in when circuit-breaker PUMP OP 1st TANK located in cockpit on left panel is closed, the fault should be looked for in power supply circuit of electromotor. Check should be started from connector of electromotor. Conductor 80М2 for power supply of electromotor runs through plug connectors Nos 84 and 99, filter Ф-37, contactor КМ-50Д and circuit-breaker АЗС-40 marked PUMP OP 1st TANK and located in the left power unit. If electric circuit is intact, remove fuel tank from aircraft and check condition of electromotor.

Operations	Possible faults	Remedy Specifications
71. External Inspection of Electromotor	ELECTROMOTORS МУ-102А	SPECIFICATIONS
Wipe the electromotor body and check its elements externally. Clean the external surfaces of the electromotor of moisture, dirt and oil, check to see that the electromotor is properly secured to body and the plug connecter coupling nut is tightened. The electromotor should be connected to the aircraft mains by means of a shielded wire which should not be drawn.		1. Rated voltage ..... 27 V 2. Rated current, not more than..... 7 A 3. Speed ..... 3500±250 r.p.m. 4. Rated moment on the shaft, not less than... 5.5 kg-cm 5. Duty ..... intermittent, 5 cycles. Each cycle contains 40 seconds of operation at rated load and 1 min. interval. After 5 cycles of operation it is necessary to completely cool down electromotor. When electromotor МУ-102А operates in conjunction with unit ПНР-10-9Б, it is possible to have 80 seconds of operation and 1 minute of interval; after 3 such cycles cool electromotor down.

Operations	Possible faults	Remedy
72. Check of Commutator Condition Remove the protective hood of the electromotor, inspect the working surface of the commutator. The working surface should be clean and have no traces of burning on the commutator bars. If the electromotor operates normally, the commutator surface grows slightly dark, but has not traces of burning or contamination. To remove contamination and brush dust wipe the component parts and blow the internal cavities of the electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).	Contamination or burning of commutator bars.	In case of contamination (fatty black film) wipe commutator with clean cotton cloth slightly moistened in gasoline B-70 and blow through with compressed air (at pressure of 1 - 1.5 kg/sq.cm.). If contamination cannot be removed, clean running commutator with sand paper No.180 or 220 which should be wrapped up around a wooden or fibre stick. Then groove commutator bars with a sharpened wooden stick and blow the internal cavity with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).
73. Check of Brushes and Their Seating Check to see that the brushes are correctly set and easily move in the brush holders. The brushes should be well ground to the commutator and enter the brush holders without jamming and rocking.	Jamming of brushes in brush	If brushes do not move freely, locate point of jamming (which is indicated by shiny trace

Operations	Possible faults	Remedy
Measure the height of the brushes with the help of calipers or a ruler. The brushes worn down to 11 mm should be replaced from the individual set of spares.	Holders. Wear of or mechanical damage to brushes.	on brush) and carefully grind in sides of brush with sand paper No.180 or 220. Replace defective brushes. Seat new brushes to commutator as outlined in Para.29. After seating blow internal cavity of electromotor with compressed air (at pressure of 1 - 1.5 kg/sq.cm.).
74. Check of Brush Springs The brush springs should be fastened in the slot of the brush holder arm. They should freely, without jamming, enter the slot of the brush and press approximately on the centre of the butt end of the brush. By means of a 500 gr dynamometer check spring pressure which should be within 120 - 180 gr. The procedure for the check is outlined in Para.30.		

FILTERS

Operations	Possible faults	Remedy
75. External Inspection Open the covers, inspect the internal hook up of the filters. Check the attachment of the filters by hand and make sure that the wires are securely fastened to the terminals and that the parts and wires are intact.	Loosening of filter fastening screws. Dust, dirt on filter elements.	Tighten filter fastening screws. Wipe filter elements with cloth.
76. Check of Capacitors for Condition The condition of the capacitors should be checked with direct current of not more than 50 V. To make the check, charge and discharge the capacitors. To charge the capacitors, touch terminals "+" and "-" on the panel with the tips of the wires running from the D.C. power supply; to discharge them, short terminals "+" and "-" with any conductor. If in this case a discharge (spark) occurs, the capacitor is serviceable. If the discharge does not occur or is weak, it shows up a puncture or heavy leakage.	Contact screws are not securely tightened.	Tighten screws. Make care that separate strands of wires do not bend aside and all enter contact sockets otherwise they may come into contact with adjacent terminals or body which will lead to short circuiting.
	Screen braiding is loosely	Tighten screws of clips which fasten

Operations	Possible faults	Remedy
If the filter was removed from the aircraft for the check, reinstall it in the aircraft. Connect the filter to the aircraft mains, for which purpose: remove the cover from the box; insert the wires through pipe unions and connect them to the terminals as shown in the diagram (the photographic diagram is on the inside of the cover); fasten screen braiding on the pipe unions; close the filter cover and securely tighten the screws.	secured to filter pipe unions.	Screen braiding. Screen braiding should be tightly pressed against filter pipe unions.

SOLOVIEV PANEL

Operations	Possible faults	Remedy
77. External Inspection of Starting Panel Remove the starting panel from the aircraft. Starting panels are generally checked by external inspection. For this purpose remove the panel cover and covers of the contactors. When inspecting give special attention to the condition of contactor contacts and to the security of wiring and soldering of leads.	Dust and moisture on parts of panel. Surface of contacts has well noticeable dents and overflows consisting partially of copper.	Remove dust and moisture. Dry starting panel. Replace defective contactor or starting panel.
78. Check of Commutator Condition Open the cover of the time automatic switch-gear and examine the working surface of the commutator, check for brush dust inside the electromotor. To remove contamination and brush dust wipe the electromotor elements with cotton cloth moistened in gasoline B-70 and blow internal cavities of the electromotor with compressed air (at pressure of 1 - 1. 5 kg/sq.cm.).	Contamination or burning of commutator bars.	In case of contamination wipe commutator with clean cotton cloth moistened in gasoline B-70 and blow with compressed air (at pressure of 1 - 1. 5 kg/sq.cm.) Contamination which cannot be wiped off with

Operations	Possible faults	Remedy (Specifications)
		cotton cloth should be removed with sand paper No.180 or 220, after which clean grooves of commutator bars with wooden stick, wipe with cotton cloth moistened in gasoline B-70 and blow with compressed air (at pressure of 1 - 1,5 kg/sq.cm.). Before cleaning commutator, take out brushes. Do not use emery cloth.
79. Check for Starting Program Time The starting program time should be checked on a special stationary test desk. If this proves impossible, the panel may be checked by means of a simple portable tester. The electric key diagram of the portable tester for check of elements of starting panels is shown in Fig.16. To check the panel, follow the procedure below:		SPECIFICATIONS 1. Range of working voltage 19 - 28 V 2. Rated voltage ..... 24 V 3. Time from pushing on starting button till operation of 1st switch ..... 0.3 - 0.7 sec. 4. Time from pushing on starting button till operation of 2nd switch ..... 1.1 - 1.5 sec. 5. Time from pushing on starting button till operation of 3rd switch ..... 3.5 - 40 sec.

Operations	Possible faults	Remedy (Specifications)
(a) connect a 26-V D.C. power source and the panel to be checked to the tester as shown in Fig.17; (b) close circuit-breaker A3C-5(2) (See Fig.16) and adjust the supply voltage to 15 V by potentiometer 3; (c) push button 7 or 8 and ascertain that the starting automatic timer and contactors operate normally; (d) after the program is carried out push button 7 or 8 once more and 5 - 6 sec. later open circuit-breaker 2 in the supply circuit of the starting panel; (e) close circuit-breaker 2 and ascertain that the starting autoratic timer has fully accomplished its program while the contactors and interlocking relay PM-9Ш are not brought into play (the lamps do not come on);		6. Time from pushing on starting button till operation of 4th switch .....8.2 - 8.8 sec. 7. Duration of performance of entire starting program .... 43.8 - 44.8 sec. 8. Pick-up voltage of relay PM-9Г at an ambient terperature of 20°C after heating cycle, not more than ..... 10 V 9. Drop-out voltage of relay PM-9Ж under same conditions, not more than ..... 2.5 V 10. Insulation resistance, not less than ..... 2 megohms 11. Duty ..... intermittent: 5 successive switchings on at a 2 min. interval. Then follows an interval up to complete cooling down.

Operations	Possible faults	Remedy
(f) adjust the supply voltage to 28 V and repeat the operations outlined in sub-paragraphs (c) - (e); (g) adjust the supply voltage to 24 V and with the help of a stop-watch check the time of the program performance in steps beginning from the pushing on the starting button: with the button depressed the main contactor should be on within 1.1 - 1.5 sec; the auxiliary contactor - within 3.6 - 4.0 sec.; 4th cam - within 8.2 - 8.8 sec.; the total time of the program performance should be 43.8 - 44.8 sec.; (h) disconnect the starting panel with the tester; (i) attach wires to terminals 16 and 1 of the tester and, connecting them successively to the terminals of the contactors and the interlocking relay, check the pick-up and drop-out voltages of the contactors and relay:	Starting cycle continues over 44.8 sec.	Check condition of working surface of commutator; dress, if necessary. If commutator is clean and has no traces of burning, dress contacts of electromotor centrifugal speed governor.

Operations	Possible faults	Remedy
by means of the potentiometer smoothly increase the supply voltage from zero to the moment the contactor or blecking relay becomes cut in and measure the pick-up voltage; smoothly decrease the voltage until the contactors or interlocking relay becomes cut off and measure the drop-out voltage. Repeat these operations 3 - 4 times. The pick-up voltage of heated contactors should not exceed 18.5 V, while the drop-out voltage should not exceed 5 V. The pick-up voltage of the interlocking relay at a temperature of +20°C should be not more than 10 V after the operation of the panel under the rated duty, the drop-out voltage of the blocking relay should be not over 2.5 V; (j) the insulation resistance of starting panels should be checked with a megger rated at 500 V or 250 V after all rated operations of the panel are carried out; (k) mount the panel in the aircraft and check the operation of the starting panel in the conjunction with the starter-generator operating as a starter. See Para.10		

Operations	Possible faults	Remedy
"Checking Starter-Generator for Operation under Starting Duties".		

IGNITION COILS

Operations	Possible faults	Remedy
80. Inspection of Unit of Starting Coils KH-21H1, KH-21E1 Open the cover of the starting coil and examine it. When installed in place, check the condition of insulation of high voltage leads, for which purpose shift the screen 10 - 15 mm aside. Check the condition of interrupter contacts.	Dust, dirt, moisture on parts of coils. Puncture of insulation, overheating or darkening of insulation or damaged varnish coating of high-voltage conductor. Burning of contacts (transfer of metal from one contact to the other).	Wipe dust and moisture from starting coils. Replace high-voltage conductor which insulation is damaged. Dress contacts for which purpose: turn out contact screw with screwdriver through port in body; dress the working surfaces of the contacts with flat barette file as shown by broken line in Fig.18

Operations	Possible faults	Remedy (Specifications)
		until working surfaces of contacts fit tightly against each other; after dressing carefully wipe contacts with chamois leather moistened in alcohol; adjust current of primary circuit of coil against ammeter M4-70 to $2^{+0.25}_{\ }$A at 24^{+1} V.
81. Check of Starting Coils on Installation Starting coils are checked on a special stationary or portable tester provided with three-electrode dischargers. The current consumed of the coil and continuity of sparking can be checked with the help of a simple portable tester the electric diagram of which is shown in Pig.19.		SPECIFICATIONS 1. Unit of starting ignition coils should ensure continuous sparking on standard three-point spark gap with gap of 6 mm at 12 - 28.6 V supplied, with shunt resistance of 1 megohm connected in parallel with secondary circuit, screened high-voltage wire being 7 mm in diameter and 1.2 m. long.

Operations	Possible faults	Remedy (Specifications)
To check the unit of coil КИ-2111 or КИ-2151: connect the leads of the primary winding to the tester (See Fig.19); connect the leads of the secondary winding to the three-point spark gap of the tester by aid of shielded wires ПВЛЭ, each 1200 mm long. The screen braiding creates for the secondary windings a capacitive load which is equivalent of the real capacitive load; connect the common point of the spark gap to the body of the coil unit by the wire ПВЛЭ; connect the tester to the power source of 24 - 28 V. To check the unit of starting coils, follow the procedure below: (a) place an insulation piece (for instance, a strip of clean paper) between contacts of one of coil interrupters; (b) set a gap of 6 mm between main points of the spark gap and a gap of 0.05 - 0.1 mm between the main and auxiliary points;	No sparking in secondary circuit owing to: puncture of capacitor;	2. Current in primary circuit of each coil measured by ammeter, type М4-70, should be $2^{+0.25}_{-0.4}$ A at -24^{+1} V and under conditions stipulated in Item 1. 3. Coil unit is designed for intermittent duty: 3 switchings on of 40 seconds each at 2 min. interval. Permissible number of separate spark misfires during one switching on is 5. Replace defective unit of starting coils.

Operations	Possible faults	Remedy
(c) switch on the coil for operation by depressing the button of the tester and set a voltage of 24^{+1} V by the rheostat;	puncture of insulation of secondary winding. Current consumed by coil is less than 1.75 A.	If current of primary winding decreases below 1.75 A, dress contacts, then wipe them with chamois leather moistened in alcohol. After dressing adjust current in primary winding to $2^{+0.25}$ A measured by ammeter М4-70 at voltage of 24^{+1} V.
(d) switch on the coil for 40 sec. operation; measure the current consumed by the coil and make sure that on the spark gaps proper sparking takes place. The current consumed by each coil should be $2^{+0.25}_{-0.4}$ A; (e) by means of the button, give the coil three 40 sec. switchings at 2 min. intervals. In making the third switching recheck the current consumed by the coil and continuity of sparking;		

Operations	Possible faults	Remedy
(f) disconnect the coil from the tester terminals and not less than 3 - 5 min. after the check measure insulation resistance relative to the body with a 500-V megger. The megger should be cut in between the leads of the primary winding and the body; maintain the delivered voltage for 1 min. Insulation resistance should be not less than 1 megohm. (g) remove the insulation piece placed between contacts of one of the interrupters, place it between contacts of the interrupter of the coil that has been checked and perform operations outlined in sub-paragraphs (a) - (e). 82. Check of Starting Coil КЦ-1А To check high-power starting coil КЦ-1А, follow the procedure below: set a gap of 4±0.1 mm between the main points of the spark gaps;		

Operations	Possible faults	Remedy (Specifications)
adjust the supply voltage to 24^{+1}_{-7} by the rheostat; switch on the coil for 30 sec. operation; measure the current consumed by the coil and make sure that on the spark gap uninterrupted sparking takes place. The current consumed by the coil should be $2^{+0.25}_{-0.4}$ A; by means of the button, switch on the coil three times for 30 seconds at 2 min. intervals. In making the last switching recheck the current and continuity of sparking; disconnect the ignition coil from the tester.		SPECIFICATIONS 1. Starting coil should ensure continuous sparking on a standard three-point spark gap which has spark gap of 4±0.1 mm or on spark plug СД-92 which has gap of 1.8±0.1 mm between the electrodes. Voltage of power supply should be within 12 - 28.6 V, length of shielded wire from coil to spark plug not more than 2 m., shunt resistance connected in parallel with secondary circuit not less than 0.5 megohm. 2. Current in coil primary circuit measured by 5-A ammeter М4-70 should be $2^{+0.25}_{-0.4}$ A at 24^{+1}_{-7} V and under conditions given in Item 1.

Operations	Possible faults	Remedy Specifications
		3. Starting coil is designed for intermittent duty: (a) with coil designed for installation in afterburner 5 sec. and not more than 5 successive switchings during one cycle, after which allow the coil to cool down; (b) with coil designed for combustion chamber - 30 sec. and not more than 3 successive switchings at 2 min. intervals followed by cooling down. When starting in flight, it is permissible to make one 60 sec. switching with subsequent interval of 10 min.
	Current consumed by coil is less than 1.75 A.	If current of primary circuit decreases below 1.75 A, dress contacts as outlined in Fig.18, then wipe them with chamois leather moistened in alcohol. After dressing adjust current of coil primary circuit to $2^{+0.25}$ A by means of 5-A ammeter M4-70 at a voltage of 24^{+1} V.

COMMUTATING EQUIPMENT

Operations	Possible faults	Remedy
CONTACTORS AND RELAYS		
83. External Inspection Check contactors externally for attachment and see that screws and nuts are securely tightened, that terminals are properly secured to panel and looked; check for dents on parts, for stripped thread on terminals and cover fastening screws, for breaks in control winding. By manually switching on the contactor make sure that the armature is not jammed. Open the contactor cover and check externally the condition of the contacts.	Jamming of armature of contactors. Contamination of contactor contacts. Burnt contacts of contactors and relays.	Replace defective contactor. Wipe contaminated contacts of contactors with cotton cloth moistened in clean gasoline and allow them to dry out for 20 - 30 min. The opening of electric circuit in most cases is accompanied by arcing. As a result contacts become burnt after several initial switchings of the live circuit, part of contact surface looses polishing and acquires rough appearance and dark-brown colour.

Operations	Possible faults	Remedy
		Transfer of some amount of metal from one contact to the other is not dangerous for contacts of alloy OK-12 (88 per cent of silver and 12 per cent of cadmium oxide) since this phenomenon alters contact resistance negligibly, in some cases contact resistance even decreases. Contact resistance of new contactors should be such that the voltage drop across contacts does not exceed 150 millivolts for two pairs of contacts. Transfer of metal may become dangerous and cause welding of contacts in those cases when contacts are worn to a degree where bad nuts or craters appear, also when erosion reaches the material of the contact busbar which manifests itself by appearance of small copper splashes on contacts. Insufficiently carefull dressing of contacts may cause deterioration of contactor operation. In dressing an amount of fine sand dust and filings may remain on contacts, get in between core and guide sleeve. This dust and filings may cause sticking of contactor moving parts.

Operations	Possible faults	Remedy
		For this reason do not dress contactor contacts in the course of employment. Contactors having large overflows, craters, and small copper splashes should be replaced.
84. Check of Pick-Up and Drop-Out Voltages Pick-up and drop-out voltages may be checked in the cold state at no-load on the contacts of the power circuit by means of a voltmeter and an ordinary potentiometer. For this purpose it is possible to use the potentiometer of the portable tester designed for the check of elements of starting panels. To make a check, follow the procedure below: (a) connect the contactor to be checked to the test desk or to the potentiometer; (b) set the potentiometer slider to the position which corresponds to the		

Operations	Possible faults	Remedy
minimum voltage and switch on supply voltage; (c) smoothly increase voltage until the contactor becomes cut in and measure the pick-up voltage; (d) repeat operations (b) and (c) three times; (e) smoothly increase voltage in the winding by the potentiometer until the contactor becomes open and measure the dropout voltage. Technical data of contactors and relay are given in Table 1.		
85. Check of contact pressure of contactors		
Contact pressure should be checked in the cold state without electrical load of power circuit contacts. To make the check, use a dynamometer with a loop of strong thread (or a special trace). Contact pressure and voltage at which contact pressure is checked are given in Table 1.		

Operations	Possible faults	Remedy
86. Check of Insulation Resistance After heating cycle use a 500-V megger to check insulation resistance of current-carrying parts of the heated contactor (relay) relative to the body and between fixed contact busbars. Insulation resistance should be not less than1 megohm.		

Table 1

Technical Data on Contactors and Relays

No.	Value to be checked	Type of contactor or relay								
		KM-50[illegible]	KM-[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	2	3	4	5	6	7	8	9	10	11
1	Rated supply voltage of windings, volts	27±10%	27±10%	27±10%	27	27	27	27	27	27
2	Voltage of contact circuit: (a) at direct current up to, volts	27	27	27	30	30	30	30	30	30

1	2	3	4	5	6	7	8	9	10	11
	(b) at one-phase alternating current of 400 c.p.s. up to, volts	220	-	-	208	208	208	-	-	-
	(c) at three-phase alternating current of 400 c.p.s. (line voltage), volts	-	-	-	-	70	70	-	-	-
3	Rated load at contacts:									
	(a) direct current of ohmic load (main contacts), amperes	50	100	200	8	8	8	40	15	15
	(b) direct current of inductive load with time constant τ =0.015 sec., amperes	-	-	-	5	5	5	-	10	10
	(c) auxiliary contacts at ohmic load, amperes	-	-	-	-	-	-	10	10	-
4	Drop of voltage across one pair of contacts at rated current, millivolts	150	150	150	120	120	120	120	-	-
5	Maximum load current of working contacts during 5 min., amperes	100	200	400	10	10	10	80	-	-
6	Current consumed by control winding at an ambient temperature +20±5°C, amperes, not over	0.4	0.45	0.5	0.15± ±10%	0.18± ±10%	018± ±10%	0.27	0.35	0.35

1	2	3	4	5	6	7	8	9	10	11
7	Pick-up voltage in the cold state at an ambient temperature +20±5°C, volts	-	-	-	-	-	-	16	-	-
8	Drop-out voltage in the cold state at an ambient temperature of +20±5°C, volts	-	-	-	-	-	-	-	-	-
9	Pick-up voltage in the hot state at an ambient temperature of +20±5°C, volts, not more than	20	20	20	18	18	18	20	18	18
10	Drop-out voltage in the hot state at an ambient temperature of +20±5°C, volts, not more than	5	5	5	5	5	5	-	4	4
11	Contact pressure (in contactors pressure should be measured at a voltage of 4 V), grams, not less than	400-520	900 -1200	1800 -2400	40	40	40	-	80- -140	45-80
12	Pick-up current at pick-up voltage in the cold state, amperes, not more than	0.25	5	5	-	-	-	-	-	-
	Duty	cont.	cont.	cont.	cont.	cont.	cont.	cont.	cont.	cont.

Operations	Possible faults	Remedy
CIRCUIT-BREAKERS, SWITCHES AND BUTTONS		
87. Check of External Condition and Installation of Circuit-breakers, Switches and Buttons		
Check attachment of circuit-breakers A3C, switches and buttons, make sure that the circuit is de-energized, check for proper mechanical operation.	Insufficient tightening of fastening screws.	Tighten up screws.
Check to see that the mechanical parts of rheostats of lamps Ж90 and cockpit lamp are intact for which purpose, smoothly turning the rheostat knob, shift the rheostat slider from one extreme position to the other.	Inaccurate operation or jamming of moving parts.	All buttons, circuit-breakers, and switches should operate accurately, without jamming. Replace defective equipment.
	When load is applied, circuit-breaker automatically opens.	Maladjustment of circuit-breaker. Check pick-up time of circuit-breaker at current two times of rated value as outlined in Appendix 3. Replace defective circuit-breaker.

Operations	Possible faults	Remedy
If in the course of operation moisture got inside switches check insulation resistance of these switches as outlined in Appendix 4.	Loose rheostat knob on axle. Jamming of rheostat slider.	Tighten up screw with a narrow end driver. Replace rheostat.
BOX PIIA-2001 (PIIA-200A)		
88. Check of External Condition		
Check the external condition of box PIIA-2001 (PIIA-200A) and make sure that wires are securely connected. For this, remove the box hood, inspect the cover and the unit body as well as the equipment mounted in the box. Check for their external condition.	Dirt and moisture on units and parts of box.	Wipe with cloth and blow with compressed air at pressure of up to 1 kg/sq.cm.
Check by hand that the contactors, relays, contact screw blocks are securely fastened and that the wires are securely attached to the equipment.	Loose attachment of relay unit (box) or of separate components.	Tighten fastening nuts and screws, check and, if necessary, restore locking.
89. Check of Technical Data		
Check the basic technical data of relay boxes PIIA-2001 and PIIA-200A.		

Operations	Possible faults	Remedy
Before the check remove the jumper between terminals 5, 9 and 10 on panels of the boxes which connect ground power sources. Make sure that the switch of the aircraft battery is in the OFF position, that the battery is not mounted in the aircraft (or the battery plug connector is disconnected), that the aircraft power sources are not connected to the aircraft mains. To check the equipment of each box, follow the procedure below:		
Commutating Relay ТКЕ-52ПД (Auxiliary Relay РП-2А, Boxes РПА-200А)		
Deliver 18 – 20 V to terminals 4 and 9. Adjust the voltage with the help of the potentiometer or switch on 8 – 10 cells of the battery.	Relay fails to pick up.	Remove box, open hood, check for condition of relay winding. Box РПА-200М (РПА-200А) with defective winding of relay ТКЕ-52ПД (РП-2А) should be replaced.

Operations	Possible faults	Remedy
The picking up of the relay is followed by a click. Check with avometer Ts-1 (or a test lamp), that the circuits between terminals 1 and 5, 2 and 5, 3 and 11 are closed. Disconnect relay ТКЭ-52ПД (РП-2А) and in the same manner make sure that the circuits between terminals 3 and 6, 2 and 12, 1 and 12 are closed.	No contact or unstable contact in any circuit when the winding is connected or deenergized.	Open the relay cap, check circuits of external connections of contacts and correct faults. If wiring is in good condition, remove hood of relay ТКЕ-52ПД(РП2А) and wipe contacts of relay contact system with chamois leather or writing paper. Take care not to damage contact system.
Relay ТДЕ-210 (РПП-А)		
Deliver a voltage of 18 – 20 V connecting "+" of the power source to terminal 4, "-" to terminal 10, a click indicates the closing of the relay; when the relay is closed, check that the circuit between terminals 11 and 10 is opened.	Relay picks up when "+" of power source is connected to terminal "10" and "-" to terminal "4".	Replace box of relay РПА-200М (РПА-200А).
Deliver a voltage of 31 – 32 V (from 15 – 17 cells of two series-connected batteries) to terminals 10 and 4. In this case, connect "+" of	No electric circuit between terminals 10 and 11 when	Check condition of external connections and correct faults. If external connection is intact,

Operations	Possible faults	Remedy
the power source to terminal 10, and "-" to terminal 4; make sure that relay ТКЕ-210 (РКЗ-А) does not close while the circuit between terminals 11 and 10 remains closed (check of selenium rectifier).	relay winding is deenergized.	but circuit remains open, replace defective box.
	Relay does not pick up when "+" of power source is connected to terminal 4, and "-" to terminal 10.	Replace defective box of relay РПА-200М (РПА-200А).
Contactor КП-200Х (К-200Б)		
Supply 16 - 18 V across terminals 10 and 11 of the box; a click indicates that the contactor has picked up with the contactor closed, check to see that the circuits between terminals 8 and 10, A and Б are closed.	Contactor fails to pick up.	Check contact at terminals of contactor winding and at box panel and correct faults located. If no faults are found in external wiring remove box from aircraft and replace it.

Operations	Possible faults	Remedy
After the check of the box of relay РПА-200М (РПА-200А) check for tightening of the fastening screws and lock them with red enamel. Pick-up and drop-out voltages of contactors and relays of boxes РПА-200М and РПА-200А are given in Table 2.	No circuit between terminals 8 and 10 on box panel.	Check for condition of flexible jumper of moving contact of contactor, check to see that jumper is securely fastened to contact and that wires are securely attached at terminals; correct faults located or replace box.

Table 2

Pick-Up and Drop-Out Voltages of Contactors and Relays of Boxes PMA-200[illegible] and PMA-200A

Type of box	Name of equipment	Pick-up voltage, volts: when cold, not more than	Pick-up voltage, volts: when heated, not more than	Drop-out voltage, volts: when cold, not more than	Drop-out voltage, volts: when heated, not more than
PMA-200[illegible]	[illegible]	[illegible]	[illegible]	3.5	5
	[illegible]	[illegible]	13	3.5	5
	[illegible]	[illegible]	[illegible]	5	8
	[illegible]	[illegible]	[illegible]	2.3	3.2
PMA-200A	[illegible]	[illegible]	[illegible]	within 1-2.3	3.2
	[illegible]-A	14 - 1[illegible]	1[illegible]	7.5	9

[illegible]

Operations	Possible faults	Remedy
90. Check of Aircraft Mains		
Check externally: that the electric wiring is securely attached to elements of aircraft structure;	Inadvertent opening of locks fastening electric bunches. Insecure clamping of bunches in clips.	Repair lock. If lock does not close securely, safety-wire lock in closed position. Correct fault. If bunch is not securely held in clips, apply vinyl chloride tape or put on sleeve and fasten it to bunch with thread No.[illegible].
condition of insulation of open parts of electric wiring;	Dust, oil and moisture on electric wires. Insulation of wires or vinyl chloride sleeves damaged.	Wipe wires with clean cloth and dry out. If wires of aircraft mains or their insulation is damaged, replace defective wire between two nearest connectors. In field conditions insulation of wires may be repaired as outlined below.

Operations	Possible faults	Remedy
	Wire breaks.	If damage to insulation is not serious (current-carrying strands are intact, put a vinyl chloride sleeve over damaged place. At the ends of the pipe make 8 - 10 mm binding of thread No.0 or 00 (Fig.20 a). The thread binding should be coated with shellac or nitrovarnish. It is permissible to employ cambric pipes, vinyl chloride tape or adhesive cellophane (Fig.20 b). Detailed description of insulation repair is given in Appendix 2. As a rule, wire breaks occur at points of connection to equipment, in fittings and in connectors. Wire breaks especially often occur at soldered lugs as soldering makes wire end stiff which may cause a break during vibration. Wire breaks at lugs should be corrected in full conformity with type of dressing of broken end. To tin wires and solder lugs, use tin solder ПОС-40, in soldering use only acid-free fluxes (colophony or denatured alcohol). Never use acid in soldering and tinning. To correct wire break in the middle of wire length, insert new wire of the same or slightly

Operations	Possible faults	Remedy
		larger section. If damaged wire is in a bunch of conductors and cannot be removed, carefully insulate and secure the lugs and wire ends. The new wire should run along bunch and be attached to it by means of binder twine at intervals of 300 - 400 mm. In emergency cases, as a temporary measure, it is permissible to joint wires at points of breakage by cold (Fig.21) or hot soldering. Cold soldering should be employed for wires with a section of up to 4.0 mm^2. Hot soldering is employed for wires of all sections, especially for wires of 6.0 mm^2 and more. Detailed description of jointing of wires by cold or hot soldering is given in Appendix 2.
condition of shield braiding;	Broken, rubbed out shield braiding.	To repair damaged metal shield braiding (broken, rubbed out, etc.), use one of the following methods: (a) repair breaks in braiding with a piece of braiding of a larger diameter (Fig.22) having wound damaged slot by insulating tape; at the ends this piece of braiding should be securely tightened by metal band or clips. Take care that piece of

Operations	Possible faults	Remedy
condition of thread bindings.	Form-out bindings	brushing is accurately cut and cleared at ends and has no burrs, especially on inside surfaces; (b) to cover broken shield, aluminium tubes may be also used (fig.23). In this case, first bead pipe at ends and make three or four cuts along it so that pipe ends might be tightened by clips. Length of cuts should be twice width of clip; (c) to cover broken shield, solder a belt of sheet brass or copper 0.5 - 0.6 mm thick or wind with copper wire dia.0.5 mm and then carefully tin (Fig.24). Repair bindings with thread No.0 or 00 and coat with shellac or nitroglue, grade AK-20.

Note: The condition of the electric mains should be checked by using compartment by compartment method, for instance, upper nose compartment, well of landing gear nose strut, well of landing gear right strut, well of landing gear left strut, engine compartment, tail unit, left and right power units, and cockpit.

Operations	Possible faults	Remedy
91. Check of Cockpit Air-Heating System When checking, use a ground power source and follow the procedure below: open the cockpit feed tap all the way; close the battery switch and the circuit-breaker marked CABIN SUPPLY, 3VII-53, DE-ICER, CABIN LAMP; at an ambient temperature below +16°C changeover the feed system to cold delivery of air, after which set the changeover switch in the AUTOMATIC position, if the temperature regulator operates normally, the system will changeover to hot delivery of air;	With changeover switch of system in COLD or HOT position, electromotor of system fails to operate. When switch is set to AUTOMATIC position, electromotor does not operate when in cold delivery position below 16°C or when in hot delivery position above 16°C.	Perform operations outlined in Para.41. Check condition of electric circuit by means of test lamp or avometer TT-1. Check should be started from connector of temperature regulator. To check, follow the procedure below: switch on ground power source; close circuit-breaker marked COCKPIT SUPPLY, 3VII-53, DE-ICER, CABIN LAMP, set changeover switch

Operations	Possible faults	Remedy
at an ambient temperature above +16°C changeover the feed system to hot delivery of air, after which set the switch in the AUTOMATIC position. Switching-over the system to cold delivery will show that the temperature regulator operates properly; close the cockpit feed tap, set the battery switch OFF and open the circuit-breaker.		of feed system in AUTOMATIC position; connect test lamp between aircraft frame and terminal Б of the temperature regulator connector; if lamp comes on, electric circuit is intact. In this case remove temperature regulator from aircraft and check its condition. Defective regulator should be replaced.

Note: It is necessary to bear in mind that at an ambient temperature of 16 ±4°C the regulator contact may be in the neutral position; the distributor changeover may not take place under these temperature conditions.

92. Check of Electric System of Flap Control

The electric system of flap control should be checked together with the aircraft technician, when the main hydraulic system is under	When button TAKE OFF (ВЗЛЕТ) or LANDING (ПОСАДКА) is de-	Check condition of electric circuit with the help of test lamp or avometer Ts-1. Check should be started

Operations	Possible faults	Remedy
pressure and the ground power supply is switched on. To make a check, follow the procedure below: close the battery switch and circuit-breaker marked LANDING GEAR, FLAPS, BRAKE CHUTE (ШАССИ, ЗАКРЫЛКИ, ТОРМОЗН.ПАРАШЮТ); depress button TAKE OFF with resultant operation of the right electromagnet of cock ГА-46М/2 (the power supply conductor of the winding is marked 67М2-1). If pressure is present in the main hydraulic system, the flaps will begin to extend. When the flaps turn through 15° button switch КВ-6А marked 15 (located under the left flap) should open the circuit of the electromagnet winding and close the circuit of the pilot lamp;	pressed, right-hand electro-magnet does not operate.	from connector of right-hand electromagnet. When checking, follow the procedure below: switch on ground power source; close circuit-breaker LANDING GEAR, FLAPS, BRAKE CHUTE; connect test lamp between aircraft frame and terminal 2 of plug connector; depress button TAKE OFF or LANDING. If lamp comes on, circuit is intact; supply conductor of electro-magnet winding runs from plug connector ГА-46М/2 (67М2-1) through connector ШР No.43 (16th pin), connector ШР No.37 (5th pin), then through terminal switch of take off position (wire coding 67М2-III) and in parallel with wire marked 64М1-1 through

Operations	Possible faults	Remedy
the lamp comes on and the flaps stop turning; depress button LANDING with resultant operation of the right electromagnet (conductor 67Ж-1). The flaps will turn downward. When the flaps turn through 25°, the button switch КВ-6А marked 25 closes the circuit of the pilot lamp indicating the extended position of the flaps for LANDING. In this case, with the landing gear retracted, the pilot lamp located on board ШС-2 and marked EXTEND LANDING GEAR (ВЫПУСТИ ШАССИ) should also come on; depress the buttton RETRACTED (УБРАНО) with resultant operation of the left electromagnet of cock ГА-46Ц/2 (power supply conductor of the winding is	When button RETRACTION" (УБОРКА) is pressed and flaps are extended, left electromagnet does not operate.	connector ШР No.37 (4th or 6th pin), No.43 (17th or 19th pin), No.8 (2nd or 4th pin) and on to desk of flap control. Check condition of electric circuit. Check should be started from plug connector of left electromagnet. Check procedure is as follows: close the battery switch and circuit-breaker; connect test lamp between aircraft frame and 2nd terminal of left electromagnet connector (wire marked 67Ж1-I); depress button RETRACTION. If lamp comes on, circuit is in good condition. Conductor runs through connectors ШР No.43 (7th pin) and 44 (6th pin) via parallel-

Operations	Possible faults	Remedy
marked 57Ж1-II). The flaps will turn upward. In the retracted position the flaps press on the rods of limit switches ВК-2-140Б-1. When pressing the circuit feeding the electromagnet winding will open and the limit switch located under the right board will close the circuit of the pilot lamp indicating the retracted position of the flaps; set the battery switch off and open the circuit-breaker. 93. Checking for Air Brakes Electric Control The electric controls of air brakes should be checked by the electrician together with the aircraft technician when pressure is present in the main hydraulic system and a ground	Electromagnet fails to operate, with power source on, circuit-breaker closed and button depressed.	connected limit switches ВК-2-140Б-1 to connectors No.43 and 44 (6th and 7th pins, respectively), from connector No.43 (6th pin) to connector No.8 (6th pin) and to flap control desk. If electric circuit proves to be serviceable, check condition of electromagnet windings. Hydroelectric cocks ГА-46Ц/2 with defective electromagnet windings should be replaced. Check condition of electric circuit. Check should be started from connector of electromagnet. Check procedure is as follows: switch on battery and close

Operations	Possible faults	Remedy
power source is switched on. To make the check, follow the procedure below: close the battery switch and circuit-breaker marked LANDING GEAR SIGNALIZATION, BRAKE FLAPS, AILERON CONTROL UNIT, NAVIGATION LIGHTS (СИГН.МАССН, ТОРМОЗ.ЩИТКИ, ЭУ ЭЛЕР.БАНО); depress the button located on the aircraft control handle; in this case the electromagnet of cock ГА-13М/4 should operate and if, pressure is present in the main hydraulic system, the air brakes start to extend. As a result, terminal switch ВК-2-14СВ will operate and the pilot lamp located on board ПИС-2 and marked FLAPS EXTENDED (ЩИТКИ ВЫПУЩЕНЫ) will come on; release the button. As a result,		circuit-breaker; disconnect connector from electromagnet and connect test lamp to terminals of mains part of connector; depress button of air brake control. If lamp comes on, electric circuit is intact. Positive conductor (marked А6М2-1) designed for power supply of electromagnet runs through connector НР No.57 (5th socket), No.4 (7th pin), No.24 (1st socket), to switch of air brakes extension and in parallel with switch through connector No.30 (11th pin) to button of air brakes control. If positive conductor is marked 103М3-II, it runs through connector No.93 (20th pin), normally closed contacts of interblocking relay РП-8, connector No.93

Operations	Possible faults	Remedy
the electromagnet winding will become deenergized and the brakes will retract. With the brakes retracted, pilot lamp FLAPS EXTENDED should come out; set on the switch of air brake extension. As a result, the electromagnet will operate and the air brakes will extend all the way; set off the switch of air brake extension. As a result, the electromagnet winding of cock ГА-13М/4 should get de-energized and the brakes should become completely retracted; open the battery switch and the circuit-breaker.	Pilot lamp indicating extended position of air brakes does not come on.	(10th pin) and on without changes. If electric circuit is serviceable, check condition of electromagnet winding of cock ГА-13М/4. If electromagnet winding of hydraulic cock is defective, remove cock and send it for repairs. Check condition of lamp. If defective, replace.
94. Checking Brake Electric Controls To check the brake electric controls for automatic operation,	Pneumatic electric	Check condition of electric circuit.

Operations	Possible faults	Remedy
hoist the aircraft. The procedure for the check is as follows: disconnect the plug connector on transmitters YA-23 of automatic braking; connect a ground power source and close the battery switch and the circuit-breaker marked WHEEL BRAKING (ТОРМОЖЕНИЕ КОЛЕС) located on the left panel; depress brake lever and build up a pressure of 4 - 5 kg/sq.cm. in the brake system; successively close the terminals on the disconnected part of the plug connector of transmitter YA-23, first for the left wheel, then for the right wheel. When the terminals on the left or on the right connector are	valve YH-30 fails to operate.	Check should be started from plug connector No.46 (right wheel) or No.39 (left wheel). Check procedure is as follows: close the battery switch and the circuit-breaker; disconnect the plug connector and connect test lamp between the aircraft frame and 3rd socket of plug connector No.46 or No.39; depress brake lever and build up a pressure of 4 - 5 kg/sq.cm. in brake system; check condition of electric circuit up to the electric valve, if test lamp comes on, circuit is serviceable. Supply conductor of winding of left wheel electric valve YH-30 runs (from the valve) through plug connectors No.39 (3rd pin), No.43 (1st pin), then through con-

Operations	Possible faults	Remedy
closed, both pneumatic valves YH-30 should operate simultaneously, allowing the air to escape from the brakes and release the wheels from the brakes. With the terminals open, the wheels should become braked; check the condition of inertia transmitters YA-23, for which purpose connect an ohmmeter to the connector terminals on the transmitter. With the wheel speeded up and abruptly stopped by hand the transmitter switch should close. The closure is checked against zero reading of ohmmeter.		tacts of pneumatic switch to circuit-breaker marked WHEEL BRAKING. Positive conductor of right wheel winding of YH-30 runs through plug connectors No.46 (3rd pin), No.44 (1st pin), No.43 (1st pin), then power supply is delivered through common conductor which was mentioned above in relation to pneumatic electric valve of left wheel. Positive conductor of valve winding of nose wheel runs from connector of YH-30 through connector No.14 (8th pin), through contacts of pneumatic switch to circuit-breaker. If electric circuit is serviceable, check condition of winding of pneumatic electric valve YH-30.

Operations	Possible faults	Remedy
		If winding is defective, replace valve УП-30. Replace defective inertia transmitter.
	Inertia transmitter ЖА-23 at fault and cannot be switched on.	
95. Check of Fire-Warning System. To check the operation of the fire-warning system, follow the procedure below: 1. Through the hatch cover of the fuel pump of the 3rd tank disconnect the negative wire (marked THERMO-SENSITIVE UNIT ЗОКЗ) of the fire-warning system. 2. Connect a ground power source to the aircraft mains and close the switch marked AIRCRAFT, GROUND BATTERY. 3. Close the circuit-breaker marked ENGINE INSTRUMENTS, FIRE-	Fire-warning lamp does not come on (with negative wire disconnected).	Check condition of lamp filament. If filament is defective, replace lamp. If lamp is good, check condition of electric circuit. Check should be started from plug connector No.29. Check procedure is as follows: 1. Close battery switch and circuit-breaker ENGINE INSTRUMENTS, FIRE-PROTECTION EQUIPMENT and by hearing check cutting in of relay РП-2 (when negative wire connected). If relay РП-2 picks

Operations	Possible faults	Remedy
PROTECTION EQUIPMENT (ПРИБОРЫ ДВИГ.,ПОЖАРН.ОБОРУД.) located on the pilot's left panel. If the fire-warning lamp comes on, the lamp and the fire-alarm system are in good condition. 4. Connect negative wire to the aircraft frame and look the union nut of the negative connector with 0.5 mm dia. steel wire. It is possible to check the condition of the fire-warning system and lamp without disconnecting the negative wire. When the power source on, give the circuit-breaker ENGINE INSTRUMENTS, FIRE-PROTECTION EQUIPMENT 2 - 3 switchings. If in switching on the circuit-breaker the fire-warning lamp burns at half-candle power, the fire-warning lamp and system are serviceable.		up, the fault should be searched for in circuit between the fire-warning lamp and plug connector No.29 (22nd terminal). If electric circuit proves to be serviceable, the fault should be searched for in relay РП-2. Remove relay РП-2 and check to see that wires are securely soldered to relay terminals and that contacts are clean. 2. Relay does not pick up. In this case the fault should be searched for between circuit-breaker and plug connector No.29 (20th pin). Connect test lamp between aircraft frame and contact socket 20 of plug connector No.29; switch on battery and circuit-breaker; if test lamp coces on, circuit is operable. Keep in mind

Operations	Possible faults	Remedy
In this case remove the light filter from the warning lamp when checking the fire-warning system.	Fire-warning lamp glows, when power supply and circuit-breaker are switched on.	that the electric wire runs through connector ШР No.25 (15th pin). Check to see that negative wire of thermo-sensitive units is properly attached to aircraft frame. With power source on, check by hearing condition of relay by switching on and off circuit-breaker ENGINE INSTRUMENTS, FIRE-PROTECTION EQUIPMENT. If relay РП-2 is serviceable, check condition of thermoswitches by using avometer ТТ-1. If thermoswitches are serviceable as well, check condition of electric circuit between plug connectors No.57 (6th socket) and 29 (23rd socket). In this case the electric wire runs through hermetic plug connector No.3 (7th pin).

Operations	Possible faults	Remedy
96. Check of Afterburner Automatic Control Unit in Aircraft The check of afterburner automatic control unit can be performed when the aircraft engines are shut down. To make the check, follow the procedure below: (a) cut off the locking arrangement of afterburner switching device, for which purpose shift all the six splines on afterburner automatic control box КАС-2 from the vertical to horizontal position; (b) disconnect the plug connector from the hydraulic retarder of fuel pump НР-10А of the left and right engines, after which close sockets 1 and 2 on the disengaged part of the connectors with jumpers;	When engine control lever is shifted from STOP to AFTER-BURNER, flaps of jet nozzle do not change their position.	With power source on, check by hearing condition of relay РП-2 used to interlock flaps in relation to by-pass bands closing and opening circuit-breaker SHUT COCK, OIL PRESSURE (ПЕРЕКРЫВНОЙ КРАН, ДАВЛЕН.МАСЛА). If the relay does not pick up, check condition of electric circuit between plug connector ШР No.64 and circuit-breaker. Test lamp should be connected between aircraft frame and plug connector No.64, 9th socket (12th socket); if lamp comes on, circuit is intact. Electric wire runs through plug connector No.36, 6th pin (plug connector No.33, 6th pin); through contacts of limit switch designed

Operations	Possible faults	Remedy
(e) make sure that the air by-pass bands of both engines are released; (d) make sure that all circuit-breakers and switches in the aircraft cockpit are open and connect the ground power source to the aircraft mains; (e) close the switch marked AIRCRAFT, GROUND BATTERIES located on the pilot's right panel; (f) close the circuit-breakers of both engines marked AFTER-BURNER (ФОРСАЖ), SHUT COCK, OIL PRESSURE (ПЕРЕКРЫВНОЙ КРАН, ДАВЛЕНИЕ МАСЛА) located on the pilot's left panel. The circuit-breakers ENGINE FLAPS (СТВОРКИ ДВИГ.) and ENGINE STARTING UNITS (АГРЕГАТЫ ЗАПУСКА		to interlock afterburner cutting in regarding by-pass band, plug connectors No.36, 24th socket (connector No.33, 24th socket). hermetic plug connector No.3, 9th pin (8th pin); plug connector No.25, 23rd socket (18th socket) and circuit-breaker. If, on closing circuit-breaker, relay РП-2 picks up, check condition of electric circuit between plug connector of КАФ-2 and circuit-breaker ENGINE FLAPS. Test lamp should be connected between aircraft frame and plug connector КАФ-2, 10th socket; if, with circuit breaker on, test lamp comes on, circuit is intact. Electric wire running from connector КАФ-2 to circuit-breaker is solid.

Operations	Possible faults	Remedy
ДВИГ.) located in the left power unit should be closed as well; (g) make sure that the flaps of the jet nozzle are in the maximum open position when the engine control levers on the throttle control sector are in the STOP position. The flaps must be in the maximum open position within the angle from the STOP position to 23 $\pm 2^{\circ}$ (on the dial of control panel ПУ-3). In this case the first terminals of hydraulic units ГА-21 No.2 of both engines, as well as second terminals of hydraulic units ГА-21 No.1 of both engines should be energized; (h) check the afterburner automatic control unit on each engine for which purpose:		If electric wiring is intact, check condition of afterburner automatic control box КАФ-2 as outlined in Section "Check of Afterburner Automatic Control Box КАФ-2".

Operations	Possible faults	Remedy
smoothly shift the control lever of the checked engine on the throttle control sector to the stop which corresponds to the rated conditions of engine operation. When the engine control lever passes the position corresponding to the angle of 75^{0} on the sector from the STOP position, the nozzle flaps should be in the middle position which corresponds to the rated conditions of engine operation. In the range from 23 ± 2^{0} to the MAXIMUM (МАКСИМАЛ) stop the flaps should be in the rated position. In this case the second terminals of hydraulic units ГА-21 No.1 and 2 should be energized; smoothly shift the control lever of the engine being checked from the RATED (НОМИНАЛ) position to the MAXIMUM position.		

Operations	Possible faults	Remedy
Note: Before shifting the stick from the RATED position to the MAXIMUM position, open the circuit-breaker SHUT COCK, OIL PRESSURE. When the engine control lever is set in the MAXIMUN position, the terminal switch which cuts in or out the engine for maximum duty should operate. The terminal switch adjusted to an angle of 75^{0}_{-1} from the STOP position energizes the winding of relay Ж (K). The relay located in the afterburner automatic control box КАФ-2 controls the power supply for electromagnet windings of hydraulic unit ГА-21 No.1. The nozzle flaps must be in the maximum closed position. In this case terminal 1 of hydraulic unit ГА-21 No.1 and terminal 2 of hydraulic unit ГА-21 No.2 of		

Operations	Possible Faults	Remedy
the engine in question should be energized; smoothly shift the engine control lever from the MAXIMUM position to the AFTERBURNER (ФОРСАЖ) position. When the lever is set in the AFTERBURNER position, the terminal switch which cuts in or out the engine for afterburner conditions should operate. The switch adjusted to an angle of 85°_{-1} from STOP position energizes the winding of relay Г(В). The relay located in the afterburner automatic control box КАФ-2 controls the power supply of electromagnet windings of hydraulic unit ГА-21 No.2. As a result, the flaps of the jet nozzle will move to the maximum open position which corresponds to the afterburner operating conditions of the engine.		

Operations	Possible Faults	Remedy
In this case terminals 1 of hydraulic units ГА-21 No.1 and No.2, starting coil КПЗ-1А, the fuel cock solenoid should be energized and the pilot lamp of afterburner must come on. Note: It is allowed to hold the engine control lever in the AFTERBURNER position only for 5 - 6 seconds, since in this position of the lever the afterburner ignition coil КПЗ-1А and spark plugs СН-02 are operating; (i) set the engine control lever to the STOP position; (j) to check the afterburner automatic control unit of the other engine, use the same procedure. Location of equipment and fittings pertaining to the check of the afterburner automatic control unit of the right engine is given in brackets;		

Operations	Possible Faults	Remedy
(k) open all circuit-breakers (except circuit-breaker [illegible]) and the battery [illegible]; (l) cut in the locking [illegible] ment of afterburner switching device for which purpose [illegible] the six splines from the horizontal into vertical position; (m) remove the jumpers from sockets 1 and 2 of the plug connectors and connect them to the hydraulic retarder of fuel pump HP-10A; (n) the check of the afterburner automatic control should be performed by the electrician together with the aircraft technician.		

Notes: 1. [illegible] flaps are opened by the pressure of gases from the operating engine, therefore, the position of flaps is determined by the position of [illegible] control [illegible] of flaps.

Operations	Possible Faults	Remedy

2. When pressure is absent in the main hydraulic system, the afterburner automatic control should be checked with the help of a lamp which is to be connected to the respective terminals indicated in these Instructions.

97. <u>Check of Afterburner Automatic Control Box KAΦ-2</u>

Operations	Possible Faults	Remedy
The operation of the afterburner automatic control box may be checked, using portable tester. The electric key diagram of such tester is given in Fig.25. The tester makes it possible to check the box when it is removed or when in situ. In both cases the procedure for the check of the box is absolutely identical. To check the operation of the afterburner automatic control box of the left engine, follow the procedure below:	When knob [illegible] ([illegible]) is in [illegible] position, lamp 2[illegible]([illegible]) or 3[illegible] ([illegible]) does not come on.	Lamp 2[illegible] ([illegible]) does not come on. Check condition of electric circuit between sockets [illegible] and 1[illegible] ([illegible] and 10) of KAΦ-2 plug connector by using avometer [illegible]. Electric wire runs through normally closed contacts of relay [illegible]. Lamp 3[illegible] ([illegible]) does not come on. Check condition of electric circuit between sockets 10 and [illegible] ([illegible] and 1[illegible]) of KAΦ-2 plug connector. Electric wire runs through normally closed contacts of relay [illegible]) and relay [illegible].

Operations	Possible faults	Remedy
(a) connect the portable tester to a D.C. power source of 24 - 28 V; (b) connect the afterburner automatic control box to the tester; (c) using potentiometer 1C readjust voltage to 24 V against voltmeter BT; (d) close circuit-breakers 1A3 and 2A3 (2A3 and 3A3) marked AFTERBURNER OF LEFT ENGINE (ФОРСАЖ ЛЕВОГО ДВИГАТЕЛЯ) and ENGINE FLAPS (AFTERBURNER OF RIGHT ENGINE and ENGINE FLAPS) located on the tester. As a result, signal lamps 2RC and 3RC, 12RC and 11RC come on which corresponds to the maximum open position of the nozzle flaps of the left and right engines, respectively;	When knob 1ПР (2ПР) is in RATED position, lamp 4RC(14RC) does not come on. When knob 1ПР (2ПР) is in MAXIMUM position, lamp 1RC(13RC) does not come on. When handle 1ПР(2ПР) is in AFTERBURNER posi-	Check condition of circuit between sockets 10 and 29 (10 and 15) of КАФ-2 plug connector. When shifting handle 1ПР(2ПР) to MAXIMUM position, check connection of relay Д(К) by hearing. If relay picks up, check to see that wires are securely soldered at relay Д(К) and at КАФ-2 plug connector socket 32 (1). If relay Д(К) does not pick up, check condition of circuit between sockets 36 and 16 (3 and 16) of the КАФ-2 plug connector. In shifting handle 1ПР (2ПР) to AFTERBURNER position, check connection of relay Г(В) by

Operations	Possible faults	Remedy
(e) smoothly shift knob 1ПР (2ПР) to the RATED position. As a result, the installation button switch STARTING will operate and lamps 2RC and 4RC (12RC, 14RC) will come on. Lamps 2RC and 4RC (12RC, 14RC) should be on within the range from the RATED position to the MAXIMUM position. This proves the serviceability of the box circuits which ensure the operation of the engine under the rated conditions.	tion, lamp 3RC (11RC) does not come on.	hearing. If relay does not pick up, check condition of electric circuit between sockets 26 and 16 (12 and 16) of КАФ-2 plug connector. Electric wire runs from socket 26 (12) through normally closed contacts of relay И(Е), winding of relay Г(В) and socket 16 of КАФ-2 plug connector. If relay Г(В) picks up, check to see that wires are securely soldered at socket 32 (1) of КАФ-2 plug connector, at relay Д(К) and that contacts of these relays are clean.

Note: Positions 1ПР and 2ПР correspond to knobs imitating the control levers of the left and right engines, respectively.
Each knob has four locked positions: STOP (СТОП), RATED (НОМИНАЛ), MAXIMUM (МАКСИМАЛ) and AFTERBURNER (ФОРСАЖ).
In the STOP position the rods of all limit switches are free, in the RATED position the rod of the switch STARTING is being depressed; in the MAXIMUM

Operations	Possible faults	Remedy
position the rods of the terminal switches STARTING and MAXIMUM are being depressed, in the AFTERBURNER position all the three rods remain depressed. When the knobs are being shifted from one position to the other, the rods of the respective limit switches remain under pressure;		
(f) smoothly shift knob 1HP (2HP) from the RATED position to the MAXIMUM position. As a result, the button switch MAXIMUM energizes the winding of relay K(K). When knob 1HP(2HP) is being set in the MAXIMUM position pilot lamps 1KC and 4KC (13KC and 14KC) come on which proves the serviceability of the box circuits ensuring the operation of the engine under maximum duty;		
(g) set knob 1HP (2HP) from the MAXIMUM position to the AFTERBURNER position. As a result, the button switch AFTERBURNER energizes the windings of relay P(B) and E(D).		

Operations	Possible faults	Remedy
Setting the knob to the AFTERBURNER position causes signal lamps 1KC, 3KC, 5KC, 6KC and 7KC (13KC, 11KC, 10KC, 9KC and 8KC) to come on which proves the serviceability of the box circuits ensuring the operation of the engine under afterburner conditions;		
(h) momentarily depress button 1KV (2 KV) which causes relay E(A) to operate and extinguishes lamp 6KC (9KC). This proves the serviceability of relay E (A) which disconnects the ignition coils when coming over to operate under afterburning conditions.		

Note: Button 1 KV (2 KV) imitates the contacts of the afterburner needle, pump HP-11A needle;

Operations	Possible faults	Remedy
(i) close switch 1B (2B) which corresponds to the absence of pressure in the main hydraulic system. This causes relay H (Н) to operate, deenergizes the windings of relays Г and Е (Р and Д), and extinguishes pilot lamps 5MC, 7MC and 3MC (10MC, 8MC and 11MC). Lamps 1MC and 4MC (13MC and 14MC) come on. Glowing of pilot lamps 1MC and 4MC (13MC and 14MC) shows that the elements of the afterburner automatic control box have come over from the afterburner position to the position which ensures operation of the engine under maximum duty. Open switch 1B (2B) which corresponds to the presence of pressure in the main hydraulic		

Operations	Possible faults	Remedy
system. This deenergizes the windings of relay M(Ж), opens relays Г and Е (В and Д), causes signal lamps 1MC, 5MC, 7MC and 3MC (8MC, 15MC, 17MC and 11MC) to come on, while signal lamp 4MC (14MC) comes out. Glowing of the pilot lamps shows that the elements of the afterburner automatic control box are in good condition and that they have come over to the position which corresponds to the afterburning conditions of engine operation; (j) close switch 3B which corresponds to the absence of fuel pressure in the main fuel system. As a result, relay Н (designed to interlock afterburner in relation to pressure in the main fuel		

Operations	Possible faults	Remedy
system) operates, the windings of relays Б, Г, Ж and Е (А, В, Ж and Д) become deenergized, pilot lamps 1ЖС, 5ЖС, 7ЖС and 9ЖС (2ЖС, 10ЖС, 12ЖС and 11ЖС) come out and pilot lamps 2ЖС and 4ЖС (12ЖС and 14ЖС) come on. Glowing of the pilot lamps shows that the elements of the afterburner control box are intact and that they are in the position that ensures engine operation under nominal conditions; (k) open switch Ж which corresponds to the presence of fuel pressure in the main fuel system. As a result, the winding of relay М becomes deenergized, the windings of relays Ж, Г, Е and Е (А, В, Д and Ж) become connected to the power supply, pilot lamps		

Operations	Possible faults	Remedy
2ЖС and 4ЖС (12ЖС and 14ЖС) come out and pilot lamps 1ЖС, 3ЖС, 5ЖС, 6ЖС and 7ЖС (8ЖС, 9ЖС, 10ЖС, 13ЖС and 11ЖС) come on. Glowing of the pilot lamps shows that the elements of the afterburner automatic control box are in good condition and that they have come over from the nominal conditions to the position which ensures the engine operation under afterburning conditions; (l) set knob 1КР (2КР) in the STOP position which causes lamps 2ЖС and 8ЖС (12ЖС and 11ЖС) to come on. Glowing of these lamps shows that the elements of the afterburner automatic control box are in good condition and have come over to the position which ensures the normal starting of the aircraft engine;		

Operations	Possible faults	Remedy
(m) to check the elements of the afterburner automatic control box, which ensure the operation of the right engine, follow the same procedure as for the left engine. The denominations of the equipment pertaining to the check of the afterburner automatic control box are given in brackets.		
98. Check of Control Panel IV-3 in Aircraft		
The operation of the control panel may be checked with the help of portable test set the key diagram of which is given in Fig.26.	One or several lamps do not light.	Check condition of limit switches. If defective, replace.
To check the operation of the control panel, follow the procedure below:	Maladjustment of limit switches.	Make adjustment of limit switches as outlined in Section "Adjustment of Limit Switches".
(a) disconnect the plug connector from control panel IV-3		

Operations	Possible faults	Remedy
and connect the connector of the test set to the panel;		
(b) connect the test set to the D.C. power supply of 24 - 28 V;		
(c) close switch B. When the control lever of the engine is set to the STOP position, lamps 30 and I located on the test set should come on (if the air by-pass band is released).		
If the air by-pass band is not released, lamp I does not come on;		
(d) smoothly shift the engine control lever from the STOP to the AFTERBURNER position and check by lighting of the set pilot lamps that the limit switches are in good condition and that angles of operation are correct. The lamps should come on in the following succession:		

Operations	Possible faults	Remedy
when the control panel lever is shifted by 4°_{-1}, pilot lamp XII should come on; when the control panel lever is shifted by $23 \pm 2^{\circ}$, pilot lamp 3Ш should come on while lamp 3Ф should come out; when the engine control lever is set in position MAXIMUM 75°_{-1} and AFTERBURNER 85°_{-1} (against dial), pilot lamps Ж and Ф should come on, respectively; set the engine control lever to the STOP position. In this case the pilot lamps come out and come on in the reverse order; (e) repeat three times the operations outlined above at (d); (f) disconnect the plug connector of the test set from the control panel and connect the control panel to the aircraft mains.		

99. Adjustment of limit Switches

If in checking the operation of the control panel, it is disclosed that one or several limit switches operate unstably or their angles of operation are incorrect, make a complete adjustment of the panel limit switches. The adjustment of the limit switches should be carried out by the electrician together with the aircraft technician.

Before making an adjustment of the control panel limit switches, disengage the engine control rod from the panel lever.

To adjust the limit switches, use the portable test set (for the key diagram of the set see Fig.26) and follow the procedure below:

1. Remove the top cover of the control panel and unlock the adjusting (2) and coupling (1) screws of the profiled cam.

2. Unlock adjusting screws 7 and locknuts 6 of the limit switches.

3. Set the panel control lever to $90 \pm 2^{\circ}$ from the STOP position (against the panel dial); in this case all tongues of the limit switch pressure devices should be on the lobes of the profiled cam.

In the STOP position the scores on the body and lever of the control panel should be in one line and mark 0 on the dial should be in line with score 0 on the panel body. If the 0 of the dial cannot be aligned with score 0, release the panel nut and set the 0 of the dial in line with score 0.

4. Operating the adjusting screws of the limit switches, obtain the normal operation of limit switches XII 3,Ш and Ф. To adjust each limit switch, take the following steps:

(a) turn out the adjusting screw of the limit switches until the respective pilot lamp of the portable test set comes out, then gradually turn in the adjusting screw

until the same lamp comes on. After the pilot lamp comes on, turn in the adjusting screw through 180°;

(b) by pressing (with a trial rod) on the tongues of the pressure device check the free play of the limit switch rods which should equal at least 0.1 mm. If free play is absent, set the required value of the free play by turning out the adjusting screw of the limit switches. Do not turn out the adjusting screw through more than 90°. If 90° are not sufficient for obtaining the required free play, replace the control panel.

5. Turn out the coupling screws of the profiled cams two to three times through 360°; using the adjusting screws of the cams, adjust the operation of the limit switches which depends on the angles through which the control panel lever is turned. The procedure for adjustment is as follows:

(a) set the panel lever to 5°_{-1} against the panel dial and adjust the operation of the cold running limit switch by turning the adjusting screw of the profiled cam until the cold running limit switch III operates. The operation of the switch is indicated by lamp III of the test set;

(b) in the same way adjust the operation of the limit switches:

З - when the panel lever is set to $23^{\circ} \pm 2^{\circ}$ and pilot lamp З comes on;

И - when the panel lever is set to 75°_{-1} and pilot lamp И comes on;

Ф - when the panel lever is set to 85°_{-1} and pilot lamp Ф comes on.

After adjustment of each limit switch, lock the profiled cams with the coupling screws.

When the control panel lever is moved in the opposite direction, i.e. to the STOP position, the limit switches should operate at the same angles, but in the reverse order.

6. After adjustment of the panel safety-wire the adjusting screws of the limit switches and profiled cams, coupling screws of the cam and locknuts of the limit switch adjusting screws.

7. Install the top cover of the panel, secure it with screws and lock the screws with plate washers.

8. After adjustment check the operation of the control panel as outlined in Section "Check of Control Panel ИУ-3 in Aircraft".

9. Disconnect the portable test set from the control panel and connect the panel to the aircraft mains.

10. Join the engine control rod to the panel lever.

Appendix 1

L I S T

of Instruments, Tools, and Fixtures Used for Routine Maintenance Operations

Nos	Description	Nomenclature number or type	Quantity
1	2	3	4
1	Avometer	T_3-1	1
2	Ammeter of 0 - 2.5 A	M-70	1
3	Ammeter of 0 - 20 A	ditto	1
4	Electric engineer's tools kit	ЧИС-48	1
5	Megger	M-1101	1
6	D.C. megger BST-250-A-20		1
7	Portable test desk to check generator operation (a board incorporating two voltmeters and two ammeters)		1
8	Test set to check starting panels		1
9	Test desk to check starting ignition coils		1
10	Test set to check afterburner automatic control box KAO-2		1
11	Test set to check control panel ПУ-3		1
12	Load check desk (for 500 A)		1
13	Test desk to check control mechanisms		1
14	Meter of low resistance	ИМС-48	1
15	Set of dynamometers		1 set

1	2	3	4
1	Frequency meter	Ч4-6	1
17	400 c.p.s. A.C. voltmeter with measurement range of 150 V		1
18	10 A rheostat		1
19	0 - 3 V voltmeter		1
20	Box with seats for tools		2
21	Bag for electrician's tools		3
22	One-side, bit brace with chuck up to 6 mm	34210/001	1
23	Set of drills, 1.1; 1.6; 2.1; 2.6; 3.1; 3.6; 4.1; 5.1; 6.0 mm in dia.		1 set
24	Electric soldering iron of 24 V, 90 W with three replaceable tips	34305/007	1
25	Electric soldering iron of 220 V, 80 W with angular and straight tips	32305	1
26	Bench vices, parallel, with jaws 70 mm wide		1
27	Hack saw	3 310/203	1
28	300 mm metallic ruler		1
29	150 gr fitter's hammer with handle	31000/003	1
30	Pen-knife		1
31	File, flat, smooth-cut, of 2nd grade, 150 mm, with handle		1

1	2	3	4
32	File, flat, barette, of 2nd grade, 150 mm, with handle		1
33	File, three-cornered, smooth-cut, 200 mm, with handle		1
34	Needle file, flat, Nos 1, 2 and 3		1
35	Needle file, round		1
36	Needle file, three-cornered		1
37	Phillips type screw-driver No.1 (for cross-slot screws)		1
38	Phillips type screw-driver No.2 (for cross-slot screws)		1
39	Screw-driver with wooden cheeks and 7 mm drive end...	32000/001	1
40	Screw-driver with 4 mm drive end	32001/003	1
41	Screw-driver with 2 mm drive end	32001/001	1
42	Pliers, combined	34410/003	1
43	Round-nosed pliers "Duck Nose", 100 - 150 mm	34420/004	1
44	Cutters, small	34400/004	1
45	Side-cutters		1
46	Tweezers, straight, 110 mm	54450/011	1
47	Tinman's shears		1
48	Electric lamp, portable, with 10 m. cord (ПЛ-36)		1

1	2	3	4
49	Adjustable wrench No.1	54464/003-135	1
50	Wrench for plug connectors ШРТ-4	СД 7803-200/1	1
51	Wrench for plug connectors ШРТ-3, ШРТ-7	СД 7803-200/2	1
52	Wrench for plug connectors ШТ-9	СД 7803-200/3	1
53	Wrench for plug connectors ШТ-13	СД 7803-200/4	1
54	Wrench for plug connectorsШРТ-13, ШРТ-23	СД 7803-200/5	1
55	Wrench for СКШ	СД 7804-150	1
56	Wrench for plug connectors of ground supply receptacle	СД 7803/200-6	1
57	Head of wrench for plug connectors ШРТ-20 and ШРТ-26	СД 7803/200-7	1

L I S T

of Tools and Instruments which Make Up Electrician's Bag

Nos	Description	Nomenclature number	Quantity
1	2	3	4
1	Bag with seats		1
2	Screw-driver with 7 mm drive end, L = 200 mm		1

1	2	3	4
3	Screw-driver with 4 mm drive end, L = 150 mm	3201-003	1
4	Phillips type screw-driver No. (for cross-slot screws)		1
5	Phillips type screw-driver No.1 (for cross-slot screws)		1
6	Screw-driver of small diameter, with drive ends of 2 and 4 mm		1
7	Pliers, combined, L = 150 mm		1
8	Cutters with 20 mm cutting edge, L = 130 - 150 mm		1
9	Technical knife		1
10	Metal mirror		1
11	Wrench, 5x7 mm		1
12	Wrench, 9x11 mm	32100-002	1
13	Wrench, 11x22 mm	32101-003	1
14	Wrench, 14x17 mm	CH7804-727	1
15	Socket wrench, 7x9 mm	CH7804-50	1
16	Socket wrench, 9x11 mm	CH7804-715	1
17	Socket wrench, 14 mm	CH7804-245	1
18	Socket wrench, 5x7 mm	CH7803-50	1
19	Wrench for CAH	CH7803-160	1
20	Hair brush, L = 160 - 200 mm	C7804-340	1
			1

Appendix 2

REPAIR OF AIRCRAFT MAINS

Damage of the aircraft mains results in failures of electrically operated mechanisms. In the course of operation of aircraft it is necessary to regularly check the technical condition of the mains, to repair it and to eliminate causes of faults.

Electric wiring in the aircraft is done with low-voltage aircraft wire, type БПВЛ. Wire, type БПВЛ (Fig.28) has insulation of vinyl plastic at protected by braiding of cotton yarn coated with lope. The wire has one strand. The current-carrying strand consists of several tinned copper conductors. The main specifications of wire, type БПВЛ, are given in Table 3.

Table 3

Main Specifications of Wires, Type БПВЛ

Nos	Rated section, sq.mm	Permissible load under continuous duty, A	Quantity and diameter of wires, mm	Rated outer diameter of wire, mm	Ohmic resistance of 1 km. wire at 20°C, ohms	Weight, kg/km.	
						БПВЛ	БПВЛЭ
1	2	3	4	5	6	7	8
1	0.35	4.0	7x0.25	2.3	58.0	7.5	20
2	0.50	6.0	7x0.30	2.5	41.3	10.0	23

1	2	3	4	5	6	7	8
3	0.75	9.0	7x0.37	2.7	26.8	13	29
4	0.88	10.0	7x0.40	2.8	22.8	15	32
5	1.0	11.0	19x0.26	3.0	20.5	16.5	33
6	1.25	13.0	19x0.29	3.1	16.3	20	50
7	1.5	14.0	19x0.32	3.4	13.3	23	61
8	1.93	17.0	19x0.36	3.6	10.42	30	62
9	2.5	20.0	19x0.41	3.9	8.0	35	68
10	3.0	22.0	19x0.45	4.1	6.58	42	77
11	4.0	25.0	7x7x0.32	4.7	5.0	50	86
12	5.15	32.0	7x7x0.36	5.1	3.85	70	110
13	6.0	35.0	7x7x0.39	5.4	3.3	72	114
14	8.8	46.0	19x7x0.29	6.2	2.4	112	158
15	10.0	50.0	19x7x0.32	6.9	2.0	126	196
16	13.0	60.0	19x7x0.36	7.5	1.5	165	237
17	16.0	70.0	19x7x0.39	8.0	1.2	178	261
18	21.0	80.0	19x7x0.45	8.9	0.96	250	335
19	25.0	90.0	19x7x0.49	9.5	0.8	270	360
20	35.0	100.0	27x19x0.29	11.1	0.57	370	477
21	41.0	125.0	27x19x0.32	12.0	0.49	470	597
22	50.0	145.0	37x19x0.3	13.0	0.40	515	634
23	70.0	180.0	37x19x0.37	14.5	0.29	690	815
24	95.0	210	37x7x0.68	17.0	0.20	952	1100

Note: If the bunch contains not more than three wires, the load for wires may be increased by 30 per cent.

Repair of Broken Wires and Damaged Insulation

When AYKP pipe covers of bunched wires are damaged, wrap fabric AYKP around the damaged section and treat it with glue No.88.

If the damage occurs in a hot place, wrap fabric AYKP around the damaged place, paste the fabric together with glue No.88, wrap 2 mm dia. asbestos flex around this section of the bunch and coat with varnish ФТ-9 or БФ-2. Leather, grade КЗО-Х0.8, is used to protect wire bunches running along hydropiping. At places near hot piping the bunched wires should be protected with fabric AYKP and tape АНЭМ.

When wiring of the aircraft mains or its insulation is damaged, replace the defective wire between two adjacent plug connectors. The new wire should be of the same cross-section as the defective one or of the next larger section.

If the damaged wire is in the bunch and cannot be removed from it, carefully insulate its lugs and broken ends and fasten them. A new wire then should be laid along the bunch and fastened to it.

In field conditions insulation of wires may be restored and their breaks remedied in the manner outlined below. If only insulation of a wire is damaged, while current-carrying strands are safe, cover the place of damage with insulation material, for instance, select a vinyl chloride tube so that its internal diameter corresponds to the diameter of the wire and pull the tube on the wire. It is permissible to use cambric, vinyl chloride tape or adhesive cellophane. In selecting vinyl chloride or cambric tubes, use the data given in Tables 4 and 5.

Table 4

Specifications of Vinyl Chloride Tubes

Nos	Internal diameter, mm	Thickness of walls, mm
1	1 ±0.2	0.3 - 0.5
2	2 ±0.25	0.3 - 0.5
3	2.5 ±0.25	0.3 - 0.5
4	3.5 ±0.25	0.3 - 0.5
5	4.5 ±0.25	0.5 - 0.7
6	5 ±0.25	0.5 - 0.7
7	6 ±0.3	0.5 - 0.7
8	7 ±0.3	0.5 - 0.7
9	8 ±0.5	0.5 - 0.7
10	9 ±0.5	0.5 - 0.7
11	10 ±0.5	0.6 - 0.8
12	12 ±0.5	0.6 - 0.8
13	14 ±0.5	0.6 - 0.8
14	16 ±0.8	0.8 - 1.0
15	20 ±1.0	1.0 - 1.3
16	25 ±1.0	1.0 - 1.3
17	30 ±1.3	1.3 - 1.5
18	34 ±1.3	1.3 - 1.5
19	36 ±1.3	1.3 - 1.5
20	40 ±2.0	1.5 - 2.0

Table 5

Specifications of Cambric Tubes

Nos	Section of wire BHBL, sq.mm	Type and diameter
1	0.75 - 1.5	T4 - 5.8
2	2.5 - 4.0	T5 - 6.8
3	5.15 - 6.0	T6 - 7.8
4	8.8 - 10.0	T7 - 8.8
5	13 - 21.0	T9 - 10.8
6	21.0 - 25.0	T10 - 11.8

The tube pulled over the wire with damaged insulation should have at its ends thread bindings 8 - 10 mm long. Coat the thread binding with shellac or nitroglue AK-20.

If a portion of wire with damaged insulation is in the bunch or at a considerable distance from the connectors insulate this portion with vinyl chloride tape or with a tube which must be cut alongside. The tape is applied in half overlaps, then it is necessary to splice it at a pitch of 40 - 50 mm with thread and apply bindings at the ends. Fig.20 illustrates typical methods for repair of damaged insulation.

In cases when the wire is broken or its current-carrying strands are damaged, while the wire as a whole cannot be replaced, it is possible to joint the wire with the help of individual connectors, type MP, or to joint with the help of a bolt with lugs soldered on beforehand.

Fig.29 illustrates methods of such jointing. The joints of wires should be

insulated in the same way as it was described earlier in the case damaged insulation.

If the wire is damaged over a considerable section or broken at several points, the jointing should be carried out with the help of wire pieces. These should be made of wire of the same or next larger section. If the bunch has several damaged wires at one and the same place, locate the joints of wires with some displacement (in an oblique line) so that the joint bulges might be positioned in stages (Fig.30). When a great number of wires is damaged it is recommended to use connectors. In urgent cases, as a temporary measure, it is possible to joint wires with "cold" or "hot" soldering. "Cold" soldering should be employed for wires having cross-sectional areas of up to 4.0 sq.mm. "Hot" soldering is employed for wires of all sections, especially for wires of 6.0 sq.mm section and over. When employing "cold" soldering, divide the current-carrying strand of the both wire ends into 2 parts: the lower parts of the strands (See Fig.21) should be twisted in a usual manner (overlapping), the upper part of one of the strands should be turned around the twist in the direction of its turns. Turn the upper part of the second strand over this layer, in the opposite direction. Carefully squeeze the twisted joint with pliers until separate bristling wires which may puncture insulation are removed.

The main method for terminating copper wires into the lugs is soldering. Styles of termination of wires into the lugs and contacts of connectors are shown in Figs 31, 32, 33 and 34.

In some cases wires may be connected up without lugs, but in these cases the strand should be twisted and tinned (under screw) or terminated in a loop and also tinned (under nut).

In repairing wires and their insulation the following requirements should be met:

1. In terminating the wire make a circular cut of insulation. The cut should be made carefully, so as not to damage the copper strands. Carefully strip insulation from the wire end.

2. Twist the strands of the cleared wire end with pliers.

3. To tin wires and solder lugs, use tin solder MOC-40; colophony or denatured alcohol should be used as flux.

On no account acid may be used in soldering and tinning.

4. Tinned ends of wires and soldered lugs should have smooth clean surface without overflows of solder and flux.

5. Before terminating wire ends into pins and sockets of a connector or into lugs, pull a vinyl chloride tube 30 - 50 mm long (depending on the cross-sectional area of the wire) on each wire. After the soldering, pull the pipe on the lug so that it provides insulation for the cylindrical part of the lug. The vinyl chloride tube, pulled over the wire, should bear the marking of this wire.

Marking of Wires

All wires of the aircraft mains bear letter and figure marks. If the marking is damaged or a vinyl chloride tube with the marking is broken, as well as when the wires are replaced or terminated into lugs and connectors, restore the marking at wire ends. The marking is painted on vinyl chloride tubes with special marking paint.

Marking paints for vinyl chlorids and cellophane materials (tubes, tapes, films) are solutions of dyes; one of such paints is the solution of resin and organic dyes in the compound of organic solvents which includes:

Ethyl alcohol 24%
Butyl alcohol 24%
Benzene 30%
Polyvinylbuteral 4%
Induline 10%
Dye, red, aliphatic 7%
Dibutylphthalate 1%

To prepare the paint, pour the solvent compound (ethyl alcohol, butyl alcohol and benzene) in a retort with water heating and, stirring, fuse polyvinylbuteral in it. Then grind induline and red aliphatic dye in the mortar, adding the solution of polyvinylbuteral in small portions. The paint prepared in this way should be filtered through fabric АОД. Then add dibutylphthalate and thoroughly stir it. The ready paint should be stored in hermetically sealed vessel.

To apply the paint to the marking tags (pipes), use a brush or pen, dry it out for 6 - 8 min. at a temperature of 15 - 20°C, then boil in water for 20 minutes.

The paint of other composition given in Table 6 is prepared in a similar manner. Depending on the dyes, the paint will acquire a black, violet, green or red colour.

Table 6

Nos	Name of components	Percentage			
1	Acetone	38	39	39	39
2	Amyl acetone or butyl acetone	48	51	51	51

Nos	Name of components	Percentage			
3	Perchlorovinyl resin	8	9	9	9
4	Induline	5	-	-	-
5	Aliphatic orange dye	1	-	-	0.6
6	Aliphatic yellow dye	-	-	0.6	-
7	Aliphatic dark-red dye	-	-	-	0.4
8	Basic blue dye	-	-	0.4	-
9	Basic violet dye	-	1	-	-

Termination of Wires into Connectors ИР and ИРТ

1. Remove the nut from the body of the connector (plug or receptacle).
2. Remove the fibre band and terminal block from the connector body.
3. Remove the textolite piece from terminal necks and take the terminals out of the block.
4. Remove the adapter sleeve from the connector and install it in the nut.
5. Put the case bearing number of the connector over the adapter sleeve and secure it on the sleeve by a thread binding.
6. Coat the thread binding with nitroglue АК-20.
7. Tin the connector terminals with solder ПОС-40.
8. Solder needles of wires to ИР or ИРТ terminals in accordance with the electric diagram.

Note: Needles of wires should be previously twisted and soldered with solder POS-40.

9. Wash soldered joints with gasoline.
10. Coat soldered joints with Zapon varnish.
11. Pull vinyl chloride tags (tubes) over terminal necks.
12. Insert the terminals into the socket of the connector terminal block in accordance with the diagram and put the textolite piece on terminal necks.
13. Cut a tape 50x100 or 50x200 mm of cambric fabric AM-1 and lap two layers of tape over the connector terminals.
14. Secure the cambric fabric on the bunch with a thread binding.
15. Coat the thread binding with nitroglue AK-20.
16. Install the terminal block into the connector body, insert a fibre ring and turn the nut with the adapter sleeve into the body.
17. Secure the case of fabric AKP to the wires with a thread binding.
18. Coat the thread binding with nitroglue AK-20.

Procedure for Connection of CSH-51 Holder

1. Place a rubber case onto the wires running to CSH-51 holder.
2. Tin the lugs of the holder with solder POS-40.
3. Insert the needle of the wire in the hole of the lug and bend it off.
4. Solder the wire to the holder lug with solder POS-40.
5. Wash the soldered joint with gasoline.
6. Check the soldered joint and paint it with Zapon varnish.
7. Pull the vinyl chloride tag (tube) on the lug.

8. Repeat operations 3, 4, 5, 6 for the other lugs.
9. Pull the rubber case over the holder and fasten it with two thread bindings. The bindings should be coated with nitroglue AK-20.

Procedure for Connection of Negative Connector PSH-2

1. Place the vinyl chloride tag (tube), coupling nut (155NA74) and case (155N288) on the negative wire.
2. Solder a contact socket (155N290) to the wire with solder POS-40.
3. Insert the contact socket (155N290) with the soldered wire, washer (155N289), ring (155NA78) into the cap (155N288) and assemble.
4. Pull the tag over the case (155N288) and apply two thread bindings over it (along part 155N6A7).
5. Coat the thread bindings with nitroglue AK-20.

Procedure for Connection of Electric Connector, Type MP-1

1. Tin the internal surface of the socket of connector MP-1 with solder POS-40.
2. Tin the needle of the wire with solder POS-40 (the needle should be as long as to fit the size of the socket of connector MP-1).
3. Insert the wire needle into the MP-1 socket and solder it to the needle.
4. Wash the soldered joint with gasoline.
5. Make the jointing of the MP-1.

Pull over a 4 mm dia. vinyl chloride tube, 100 mm long. Apply 4 thread bindings: two to the MF-1 and two at the end of the tube.

Pull over a 5 mm dia. [illegible], apply 4 bindings and coat with nitroglue AK-20.

Appendix 3

CHECK OF THERMAL CIRCUIT-BREAKERS

Thermal circuit-breakers, type A3Ç-45, are checked on a portable installation (load check desk) which allows to apply the required load to the breaker. The electric [illegible] diagram of the portable load desk is shown in Fig.3. The [illegible] installation is supplied from a ground storage battery or from any other power supply of 24 - 27 V, ensuring the intermittent load with current up to 100 A. If D.C. power supplies are not available, it is permissible to check the circuit-breakers with the help of A.C. power supplies of up to 30 V.

When examining thermal circuit-breakers A3Ç-45, check:

1. External condition.
2. The operation time of the breaker when the load is two times the rated current.
3. Operation of the circuit-breaker at a high ambient temperature (+40°).
4. Insulation resistance of current-carrying parts relative to the body.
5. Contact resistance of contacts.

To check the external condition, make an inspection of the breaker. When inspecting the breakers, manually close and open the circuit a few times and ascertain that the moving parts of the breaker operate accurately and do not stick.

The operation time of the breakers when current is two times the rated current should be checked at an ambient temperature of +20°C without preliminary heating of the breakers.

To check the operation of the breaker at a high temperature, it is necessary to have a clock and a thermostat in which a temperature of 50 ± 2° can be maintained.

To check the operation time of the breakers with the help of the load check desk, follow the procedure below:

1. Connect the breaker in question to the load check desk and the power source as outlined in the diagram (Fig.35).

2. If the load of the breaker is to be above 50 A, connect the breaker to the desk terminal marked CT (broken line).

3. Set switch CHARGE-DISCHARGE (ЗАРЯД-РАЗРЯД) in the DISCHARGE position.

4. Make sure that the breaker under the check is switched off.

5. Close the common switch of the desk, and, closing the switch of load resistances and moving the rheostat slider, adjust the current against the desk ammeter to the value two times the rated current.

6. Open the common switch of the desk.

7. Simultaneously switch on the breaker under the check and start the stop-watch; maintaining the prescribed current by the rheostat.

8. At the moment of operation (automatic disconnection) of the breaker, stop the stop-watch and determine the operation time.

Make three measurements of operation time for each circuit-breaker. The breaker may be closed again after it cools down (in 40 - 50 min.). Operation time in each measurement should be within the ranges given in Table 7; while a deviation in operation time for each breaker should not exceed ±25 per cent of the mean arithmetic value of the three time measurements.

In cases when operation time is measured at a current two times the rated current, but at a temperature other than +20°C, in order to determine the serviceability of the breaker, multiply the obtained value of response time by a correction factor given in Table 8 for a respective temperature.

Table 7

Technical Data and Requirements for Check of Circuit-Breakers

Nos	Technical data	Type of circuit-breakers								
		АЗС-2	АЗС-5	АЗС-10	АЗС-15	АЗС-20	АЗС-25	АЗС-30	АЗС-40	АЗС-50
1	Rated current, A	2	5	10	15	20	25	30	40	50
2	Current in breaker when checking operation time, A	4	10	20	30	40	50	60	80	100
3	Operation time at temperature of +20°C, sec.	25-80	20-60	15-45	15-45	20-60	20-60	20-60	25-80	25-80
4	Operation time at temperature of +50°C, sec., not less than	5	5	5	5	5	5	5	5	5
5	Contact resistance, microhms, not more than	5000	5000	5000	5000	5000	5000	5000	5000	5000
6	Insulation resistance, megohms, not less than	20	20	20	20	20	20	20	20	20

Table 8

Table of Correction Factors to Correct Operation Time of Circuit-Breakers at Temperature of +20°C

(in round numbers)	Type of circuit-breaker								
	A30-3	A30-5	A30-10	A30-15	A30-20	A30-25	A30-30	A30-40	A30-50
+30°	1.16	1.12	1.14	1.1	1.14	1.1	1.1	1.07	1.18
+20°	1	1	1	1	1	1	1	1	1
+10°	0.87	0.9	0.86	0.9	0.88	0.92	0.91	0.93	0.85
0	0.75	0.8	0.76	0.82	0.76	0.85	0.84	0.86	0.71
-10	0.64	0.71	0.67	0.74	0.67	0.79	0.78	0.81	0.58
-20	0.53	0.63	0.57	0.67	0.56	0.72	0.71	0.75	0.45
-25	0.48	0.6	0.54	0.64	0.54	0.69	0.68	0.73	0.41

Notes: 1. To obtain operation time at a temperature of +20°C, multiply the result of measurement at other temperature by the correction factor given in the Table.

2. For intermediate temperatures an intermediate correction factor should be determined.

To check the operation of the breaker at a high ambient temperature (+50°C), connect the lugs of wires brought into the thermostat to the breaker terminals; close the breaker and put it in the thermostat, shut the thermostat cover. The terminals of current supply for electric heating should be connected to a source of 24 - 28 V, while

the terminals of current supply for the breaker should be connected to the terminals of the load check tester by using the method shown in Fig.35.

To check the operation time of circuit-breaker A30-45 at a temperature of -50°C, follow the procedure below:

1. Switch on the thermostat heating and raise the temperature to 50 ±2°C (the temperature should be measured with the thermometer introduced into the thermostat).

2. Close the common switch of the load check desk and set the rated current of the circuit-breaker by means of the ammeter.

3. Open the common switch of the desk and, maintaining the prescribed current with the rheostat, heat the circuit-breaker for 15 min.

4. Close the common switch of the desk and adjust the current to the double value of the breaker's rated current.

5. Open the common switch and simultaneously start the stop-watch.

6. The moment the breaker trips, stop the stop-watch and determine the operation time.

For each circuit-breaker make three measurements with intervals sufficient for a circuit-breaker to cool down. The operation time of the breaker in each measurement should be not less than 5 sec.

To measure the insulation resistance of the breakers use a 500-V megger which should be connected in succession between the breaker leads (with contacts open) and between the leads and the breaker body. Insulation resistance is to be measured for 1 min.; during this time insulation is not to be punctured. Insulation resistance should be not less than 20 megohms.

The contact resistance of breaker contacts is measured by means of a microhmmeter or by observing the voltage drop across contacts at the rated current. To measure the

contact resistance, connect the probes of the microhmmeter or millivoltmeter as shown in Fig.36.

Contact resistance of circuit-breakers АЗС-45 should not exceed 5000 microhms.

Appendix 4

CHECK OF INSULATION RESISTANCE OF SWITCHES

Switches В-45 and ПП-45 are not airtight, water and dust may get inside the switches (changeover switches) through gaps between the textolite panel and the body, as well as along the lever.

Water getting inside the switches cannot be chemically pure, it is at least a weak solution of acids, salts or bases, that is, electrolyte. The presence of electrolyte inside the body and of voltage between the contacts and the body causes the decay of contact silver. Silver dissolves in the solution. When moisture dries out inside the switches, current-carrying dark powder which contains basically silver and its oxides deposits on the component parts. The presence of current-carrying powder inside the switches may cause inadvertent connection of electric devices, as well as short circuit between contacts of the switches. Therefore, it is necessary to check switches inside which moisture might get. The presence of current-carrying dust inside the switch may be disclosed by the check of insulation resistance between the contacts (open) as well as between the contact set and the body of switches.

Insulation resistance should be checked by means of a 500-V megger.

The switches may be checked in situ without their removal. To make a check, follow the procedure below:

1. Disconnect electric wires from the switch to be checked.

2. Connect terminal З (earth) of the megger to some power element of the aircraft structure, the second terminal "+" of the megger must be connected to the closed contacts of the switch to be checked.

As for changeover ПП-45, its insulation resistance should be checked first in one position of the lever, then in the other position.

When measuring insulation resistance between the switch contacts, connect one of the megger terminals to the moving contact, the other - to the fixed contact. When checking the changeover, make two measurements: first between the moving contact (middle lead) and one of the fixed contacts, then between the moving contact and the other fixed one.

In measuring insulation resistance between contacts, the latter should be open.

3. Increase the rotation speed of the megger handle to 100 - 120 r.p.m. and observing the megger readings, maintain this rotation speed for one minute and smoothly decrease it to zero.

During the check of insulation make sure that there is no puncture or flashover of the insulation (i.e. the megger gives stable readings) and that insulation resistance is not less than 20 megohms.

If insulation resistance is less than the above value, replace the switch.

Note: If access to the switch to be checked is difficult, the check of insulation resistance may be made at the closest plug connector. If some electric wires of the switch do not run through this plug connector, make the check at the circuit-protection device and plug connector. In this case the check of insulation resistance is carried out in the same manner as described above, with the plug connector, and circuit-protection device opened and capacitors disconnected (if the latter are present in this section of the circuit).

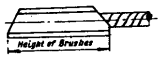


Fig.1. Measurement of Brush Height

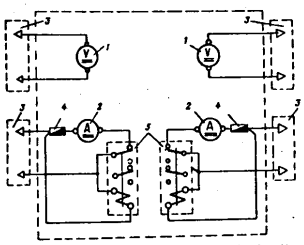


Fig.2. Electrical Diagram of Test Desk for Checking Operation of Starter-Generators in Aircraft

1-voltmeter (4 pcs); 2 ammeter (2 pcs), 3-plug 48 M (4 pcs); 4-fuse Ø1-1 (2 pcs); 5-relay РП-2 (2 pcs).

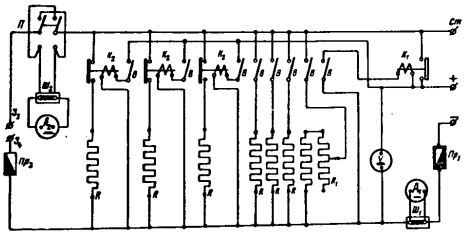


Fig. 3. Electrical Key Diagram of Check Load Desk

V-voltmeter (0-30V); A_1 and $Ш_1$-ammeter with shunt (0-500A); A_2 and $Ш_2$-ammeter with shunt (0-50 A); B-switch B-45 (8pcs); K_1-contactor K-200Д; K_2-contactor K-100 (3pcs); $Пр_2$-fuse ПП-400; $Пр_1$-fuse box Б3-30 with fuse link ПВ-60; R_1-rheostat (0.5-15A, 20 ohms); R_2-wire-wound resistor (for 10, 20, 40, 80, 120 and 150A); П-button ПКН-45; Cm, +- and --- terminals for 600 A; $Ш_3$ and $Ш_4$-terminals for 50 A.

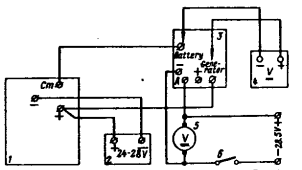


Fig. 4. Diagram for Checking Contact Voltage Drop in Contactors of Differential Minimum Relay

1-check load desk; 2-power source; 3-relay to be checked; 4-millivoltmeter; 5-voltmeter (0-30 V); 6-supply switch of contactor winding.

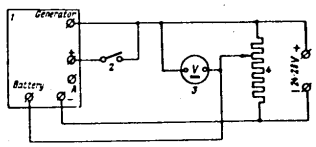


Fig 5 Diagram to Check Connection of Differential Minimum Relay

1-relay to be checked; 2-switch of auxiliary relay; 3-voltmeter (0-3V); 4-potentiometer (3.3 ohms, 1A).

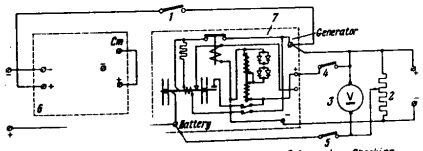


Fig. 6. Diagram for Connection of Differential Minimum Relay when Checking Its Drop-Out Current
1-switch of relay series winding; 2-potentiometer (50-100 ohms, 0.5-1A); 3-voltmeter (0-3V); 4 and 5-switches; 6-check load desk; 7-relay to be checked.

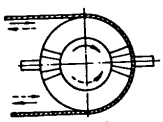


Fig. 7. Seating of Brushes

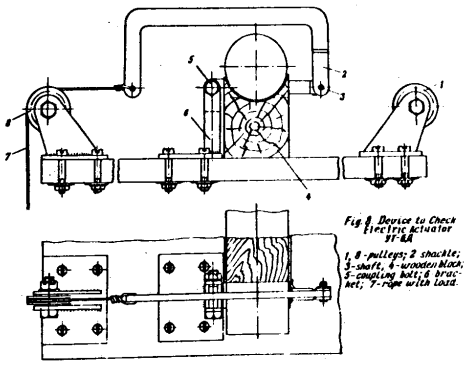


Fig 8. Device to Check Electric Actuator VF-8A

1, 8-pulleys; 2 shackle; 3-shaft, 4-wooden block; 5-coupling bolt; 6 bracket; 7-rope with load.

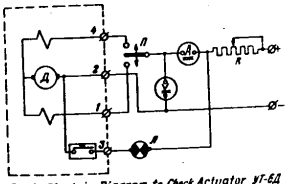


Fig.9. Electric Diagram to Check Actuator YT-6Д
Д-motor of mechanism; А-ammeter (0-2.5А);
V-voltmeter (0-30V); П-pushbutton Switch
(ПН-45); Л-pilot Lamp; R-rheostat (10ohms, 3А).

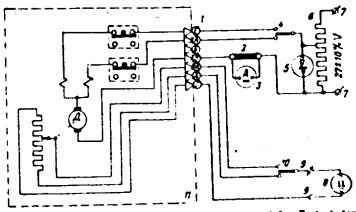


Fig.10. Diagram for Checking Electric Actuator of Air Distributor
(Item 525)
1-plug connector, 2 and 3 ammeter with shunt 0-2.5A, 4 and
10-switches, ПН-45, 5-voltmeter (0-30v), 6-potentiometer
(50-ohms, 1W), 7 and 9-terminals (4 pcs), 8-ohmmeter,
11-electric mechanism of a.c. distributor

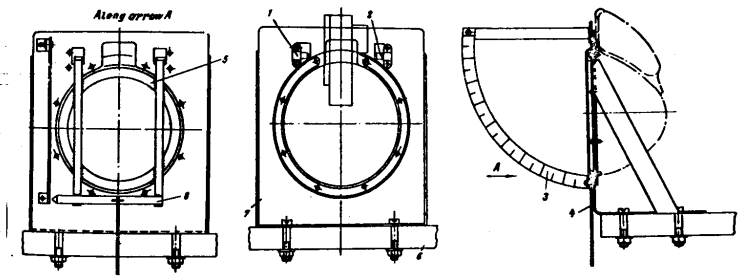


Fig. 11. Device to Check Electric Actuator МПФ-2 in Conjunction with Light ЛФСВ-45
1, 2-lever axles; 3-angle gauge; 4-rope with weight; 5-lever; 6-cover of table; 7-bracket; 8-strip-pointer

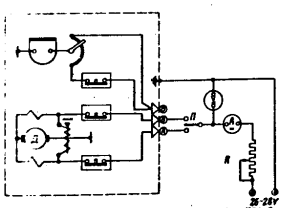


Fig.12. Electric Diagram for Checking Actuator MMP-2
A-ammeter (0-5A); П-button switch (ПН-45);
V-voltmeter (0-30V); R-rheostat (10 ohms, 3A).

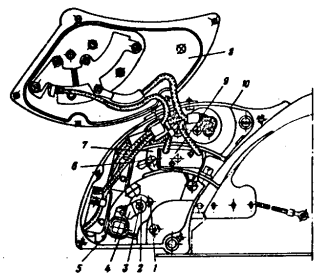


Fig. 13. Limit Switches of Actuator MMP-2
1-opening for punching; 2-segment; 3-screw; 4-stop;
5-stop; 6-screw; 7-plate; 8-cover; 9-terminal switch;
10-bolt.

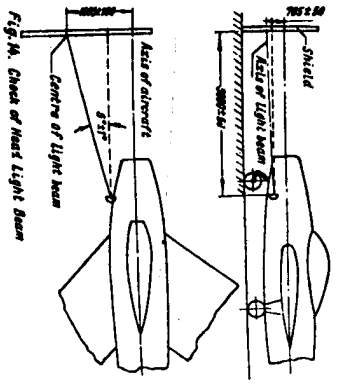


Fig. 14. Check of Heat Light Beam

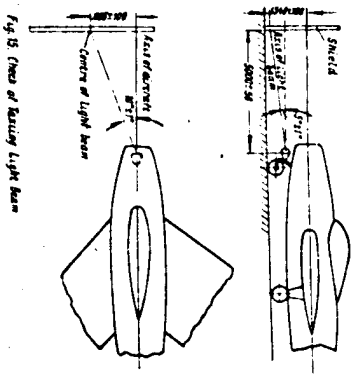


Fig. 15. Check of Ranging Light Beam

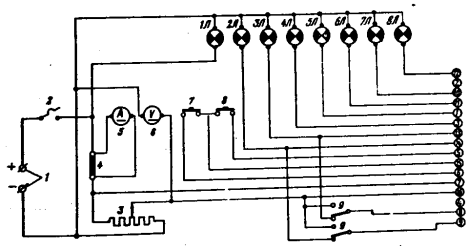


Fig.16. Key Diagram of Portable Tester for Check of Starting Panel Elements
1-terminals (2pcs); 2-circuit-breaker A30-5; 3-rheostat; 4-shunt; 5-ammeter (CM-70, 0-50); 6-voltmeter (0-30V); 7 and 8-buttons SN (2pcs); 9-change-over switch TM-43 (2pcs); 1A through 8A-fittings CJIU-51 with pilot lamp CM-30.

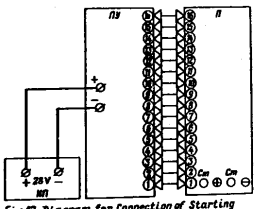


Fig.17. Diagram for Connection of Starting Panels to Portable Tester
ИП-power source; ПУ-portable tester; П-starting panel.

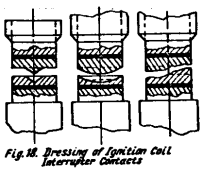
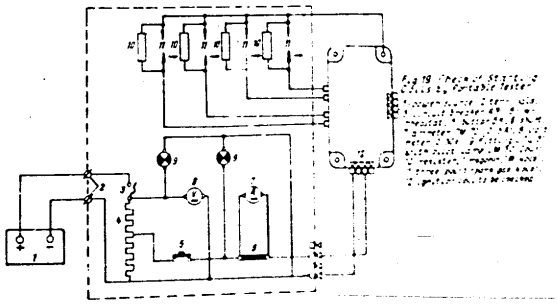


Fig.18. Dressing of Ignition Coil Interrupter Contacts



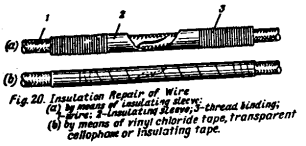


Fig. 20. Insulation Repair of Wire
(a) by means of insulating sleeve;
1—wire; 2—insulating sleeve; 3—thread binding;
(b) by means of vinyl chloride tape, transparent cellophane or insulating tape.

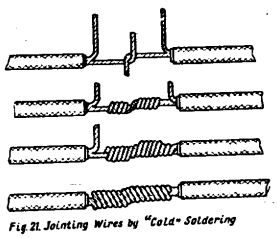


Fig. 21. Jointing Wires by "Cold" Soldering

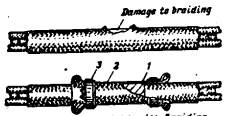


Fig. 22. Repair of Shield with Braiding
1-insulating tape; 2-braiding;
3-fastening band (clip).

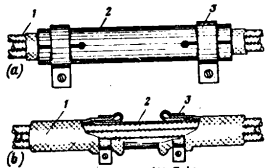


Fig. 23. Repair of Shield with Tube
(a) when pipe is put on shield:
1-conductors; 2-tube; 3-fastening clip;
(b) when pipe is put under shield:
1-braiding; 2-tube; 3-fastening clip.

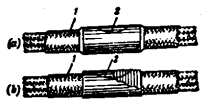


Fig. 24. Repair of Shield
(a) with sheet material:
1-braiding; 2-foil;
(b) with wire: 1-braiding; 2-wire.

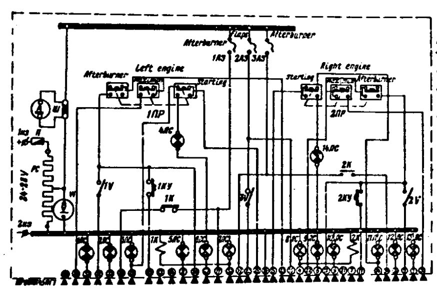


Fig.25. Electric Key Diagram of Portable Tester Used to Check Operation of Afterburner Automatic Control Box КАФ-2

BT-voltmeter (0-30V); A and Ш-ammeter with shunt (0-10A); PC-rheostat (0.5-15A, 60ohms); 1B-3B-switch B-45 (3pcs); 1KY and 2KY-button 5K (2pcs); 1K and 2K-contactor KM-50Д (2pcs); 1A3-3A3-circuit-breaker A3C-5 (3pcs); П-fuse unit БЗ-30 with fuse link ПВ-6; 1ЛС-14ЛС-fitting СЛЦ-51 with pilot lamp СМ-30 (14pcs); 1ПР and 2ПР-control handles of terminal switches КВ-6 (6pcs).

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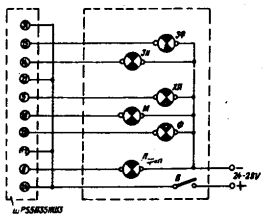

Fig. 26. Electric Key Diagram of Portable Test Set to Check Control Panel ПУ-3
B-switch B-45; ЗФ, ЗИ, ХП, М, Ф, Лампа-connection of СЛЦ-51 with pilot lamp СМ-30 (8 pcs).

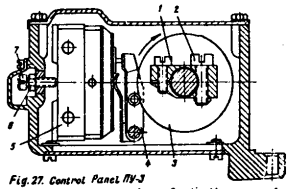

Fig. 27. Control Panel ПУ-3
1-coupling screw of cam; 2-adjusting screw of cam; 3-profiled cams; 4-tongue; 5-terminal switch (8 pcs); 6-lock nut of adjusting screw; 7-adjusting screw of terminal switch.

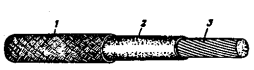

Fig. 28. Wire БПВЛ
1-braiding of cotton yarn coated with nitrodope; 2-vinyl chloride; 3-strand of tinned copper wires.

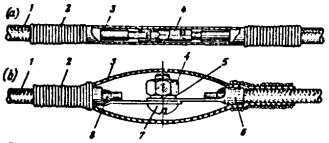

Fig. 29. Jointing of Wires
(a) individual connector jointing:
1-electric wire; 2-twine; 3-insulating tube; 4-connector type NF-1;
(b) bolt jointing:
1-electric wire; 2-twine; 3-insulating tube; 4-nut; 5-split washer; 6-lug; 7-bolt; 8-strand of wire.

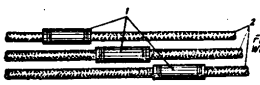

Fig. 30. Arrangement of Wire Jointings
1-insulating tubes;
2-wires.

Fig.31. Terminating of Wire into Lug for Connection to Nut Terminals
1-lug; 2-vinyl chloride tube; 3-wire.

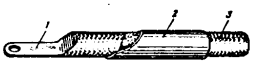

Fig.32. Terminating of Wire into Pipe Lug
1-lug; 2-vinylchloride tube; 3-wire.

Fig.33. Terminating of Wire into Connector Pin
1-Pin; 2-vinyl chloride tube; 3-wire; 4-strand.

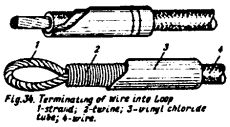

Fig.34. Terminating of Wire into Loop
1-strand; 2-twine; 3-vinyl chloride tube; 4-wire.

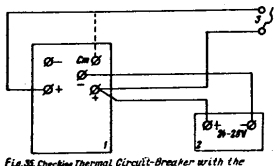

Fig.35. Checking Thermal Circuit-Breaker with the Help of Load Check Tester
1-Load check tester; 2-power source; 3-circuit-breaker to be checked.

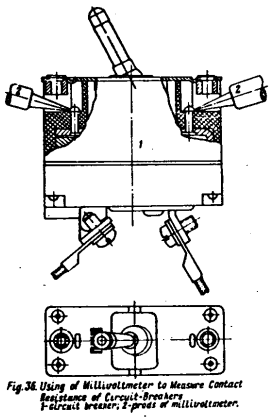

Fig.36. Using of Millivoltmeter to Measure Contact Resistance of Circuit-Breakers
1-Circuit breaker; 2-probes of millivoltmeter.

50X1-HUM