Chapter 18

ACTUATOR, PLESSEY TYPE CZ 54043

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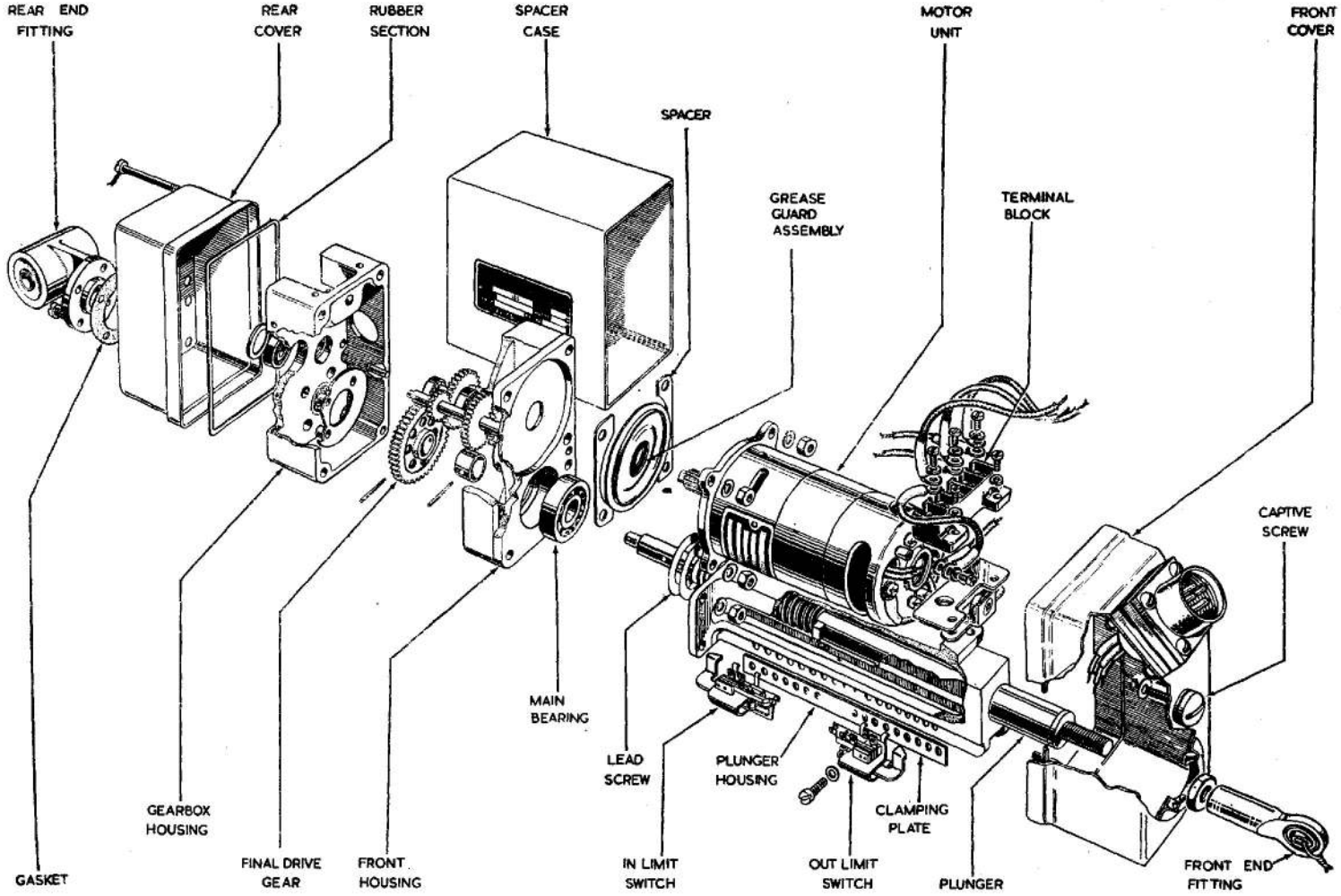

Fig. 1. *Exploded view of actuator*

Introduction

1. The CZ 54043 (Jaguar) is an offset linear actuator with a plunger stroke length of 3 in and a normal working load of 160 lb. (200 lb. max.). The actuator incorporates a split-field, series-wound, fractional-horsepower motor which drives the plunger through a gear reduction train and lead screw. The plunger stroke length is controlled by two micro switches. The motor, with its integral electro-mechanical brake and pinion, is a complete replaceable unit. In this chapter the overhaul procedure is given under two headings, viz. actuator (less motor), para. 2 to 23; motor, para. 24 to 57.

OVERHAUL (Actuator)

Tools and test equipment

2. In addition to an ordinary tool kit, the ballrace extractor, part number T 335187, is required for overhauling the actuator.

3. Equipment for setting the stroke of the actuator and carrying out the load tests is required. Details of this equipment will be found in A.P.4343S, Vol. 1, Sect. 16, Chap. 3.

DISMANTLING

4. Before commencing to dismantle the actuator, run the plunger to the half-way position between the extended and retracted positions. Dismantle the actuator in the sequence set out below:—

(1) Slacken the locking nut and remove the front end fitting from the plunger end.

(2) Unscrew the captive screw which secures the front cover to the plunger housing. Withdraw the front cover sufficiently to gain access to the terminal block on top of the plunger housing. Remove the three screws and their washers which secure the leads to the terminal block. Remove the leads and withdraw the front cover from the actuator.

(3) The plug, fitted on the face of the front cover, need not be removed unless any part of the plug or the cable assembly has to be renewed. The plug and cable assembly can be removed without difficulty by unscrewing the four nuts on the inside of the front cover.

(4) Remove the oil seal from its housing in the front cover.

(5) Withdraw the spacer case and the two rubber sections located at each end of the case.

(6) Disconnect the two leads to each limit switch. Cut the locking wire on the fixing screws of the limit switches. Remove the four fixing screws and the clamping plate in which the screws locate. Remove the switches. Note the position of the switches to facilitate reassembly.

(7) Remove the four bolts which secure the motor unit to the front housing of the gear box. Remove the motor and the grease guard assembly.

(8) Unscrew the two screws securing the terminal block to the plunger housing and remove the terminal block and the fixing bracket of the captive screw.

(9) Remove the four bolts securing the plunger housing to the front housing of the gearbox. Withdraw the plunger housing from the plunger. Unscrew and remove the plunger from the lead screw.

(10) Cut the locking wire on the fixing screws of the rear end fitting. Unscrew and remove the four end fitting screws. Remove the end fitting.

(11) Remove the rear cover. Remove the gearbox housing. Using the extractor T 335187, remove the small ball bearing from the gearbox housing.

(12) Tap out the tapered pin securing the final drive gear to the lead screw. Remove the

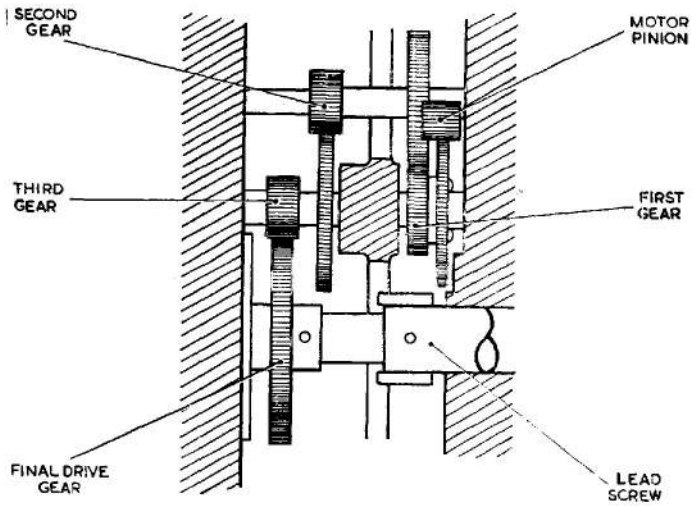

Fig. 2. *Gear train*

final drive gear from the lead screw and the third compound gear from the gearbox spacer case.

(13) Remove the gearbox spacer case from the front housing of the gearbox. Remove the first and second compound gears from the front housing.

(14) Remove the lead screw and main bearing from the front housing. It may be necessary to heat the housing to 100 deg. C. to facilitate the removal of the main bearing.

(15) Remove the main bearing from the lead screw.

INSPECTION AND REPAIR

5. Wash all metal parts of the actuator in an approved cleaning fluid and remove all traces of grease and sludge. The parts should then be laid out and examined carefully for signs of obvious damage, such as cracks or distortion and burring or scoring.

6. After cleaning and inspecting the actuator parts they must be checked against the Schedule of fits, Clearances and Repair Tolerances (App. 1), All parts worn beyond the permissible tolerances must be renewed.

7. The following points should be given special attention:—

(1) Gears:—The gear teeth must be examined for bruises, burrs or undue wear. The fit of the gears in their bearings should be checked and the gears or bearings renewed if necessary.

(2) Lead screw, plunger and housings:—Check the linear backlash between the threads of the lead screw and the plunger. Examine the threads of the lead screw for scoring or other damage. Inspect the ears of the plunger and the threads of the front stud of the plunger for damage or wear. Check the housings for cracks or distortion.

(3) Limit switches:—After an actuator has completed its overhaul life, it is recommended that the limit switches be renewed. Check the operation of each switch for continuity between the two terminals when the switch is in the inoperative position and for an open circuit between the terminals when the switch is in the operative position.

(4) Wiring:—Inspect the internal wiring of the actuator for chafed, worn or broken cables. Cables should be renewed if necessary and reference should be made to the wiring diagram (*fig.* 3) when fitting new cables.

Lubrication

8. Actuators are required to operate for a considerable period without inspection or maintenance. It is therefore important that the cleaning and lubrication be carried out with care. Lubrication should be carried out progressively during assembly. Use grease XG-275 for all applications. The parts of the actuator which require lubrication are:—

(1) Gear teeth
(2) Ball bearings
(3) Lead screw and plunger threads
(4) Bushes, thrust and sliding faces.

9. The lubricant should be applied after the parts have been cleaned and thoroughly dried out with a supply of clean, dry, compressed air. Cloth should not be used for drying. After cleaning, all parts should be placed in a clean receptacle and covered over until required for assembly.

10. The instructions set out below should be followed when lubricating the actuator. The grease applied to the parts must not exceed the stated amount since over-lubrication can be as harmful as under-lubrication.

(1) The grease should be applied with a suitable tool. Brushes must not be used, owing to the danger of bristles or hairs becoming detached and lodging in the mechanism.

(2) Work the grease into the spaces between the gear teeth around the whole circumference of each gear.

(3) Each side of each ball bearing must have grease pressed into the space between the inner and outer race for a distance of one third its circumference. The bearing should be then rotated to work the lubricant into the ball bearing.

(4) Fill the space between the threads on the lead screw with grease for a radial distance of one quarter of its circumference over the total length of the lead screw. The plunger should then be screwed on to spread the grease evenly around the lead screw thread. The excess grease removed by the plunger should then be wiped off.

(5) Smear bushes, thrust and sliding faces with grease.

Assembling

11. When all parts have been thoroughly cleaned and renewed where necessary, and when the motor has been overhauled in accordance with the instructions in para. 24 to 57, the actuator should be assembled in

the sequence set out in para. 12. The following notes must be read before commencing to re-assemble the actuator:—

(1) All lock washers, locking wire and gaskets must be renewed.

(2) All traces of old gaskets must be cleaned off and the metal surfaces cleaned and inspected.

(3) All gaskets must be coated on each face with Wellseal compound and care must be taken that no dirt adheres to the surface of the gaskets. After applying the compound, allow the solvents to "flash-off" before making the joints. All excess compound must be cleaned off after assembly.

(4) All drilled-head screws must be locked with 0·020 in. diameter stainless steel wire. Lock washers must be formed with the largest possible radius.

(5) Where soldered joints are made, it is important not to allow solder to run back along the cable conductor as this will stiffen the cable and render it liable to fracture.

(6) After testing and before the covers have been replaced, coat all leads, screw heads and the limit switches with approved varnish Ref. No. 33B/937. When applying the varnish to the limit switches, care should be taken not to coat the switch contacts.

12. Re-assemble the actuator in the sequence set out below:—

(1) Assemble the main bearing to the lead screw. Heat the front housing of the gearbox to 100 deg. C. and assemble the lead screw and bearing to the front housing.

(2) Fit the first and second compound gears to the front housing. Fit the spacer of the gearbox, with the two ball bearings inserted in their housing, to the front cover. Fit the third compound gear to the spacer. Fit the final drive gear to the lead screw and secure it with the tapered pin.

(3) Fit the lead screw end bearing and the bearing of the third compound gear in the gearbox housing. Fit the rear end retaining plate in position on the inside of the gearbox housing. Fit the gearbox housing to the spacer.

(4) Screw the plunger on to the lead screw and fit the plunger housing over the plunger. Fit the gearbox cover over the gearbox. Secure the plunger housing to the front housing with the four screws and nuts, inserting a spring washer under each nut.

(5) With the grease guard assembled to the overhauled and tested motor, fit the motor to the front housing, engaging the pinion with the first gear. Secure the motor with the four screws, nuts and spring washers.

(6) Fit the fixing bracket of the captive screw and the terminal block to the plunger housing and secure them with the two screws and spring washers.

(7) Fit the two limit switches to the plunger housing in the position noted during dismantling. Place the clamping plate behind the switch fixing flange of the plunger housing and secure each of the switches with two screws.

(8) Connect up the leads to the limit switches as shown in fig. 3.

(9) With the plug and cable assembly fitted to the front cover and a new oil seal fitted in the housing in the front cover, fit the cover over the plunger. Connect the terminals to the terminal block as shown in fig. 3.

(10) Secure the front cover to the plunger housing with the captive screw. The spacer case should not be fitted until after the stroke of the actuator has been set.

(11) Fit the rear end fitting in position with a gasket coated with Wellseal compound between the fitting and the gearbox cover and secure the fitting with the four fixing screws. Screw the lock nut to the plunger stud and fit the front end fitting.

Testing after overhaul

13. After re-assembly, the actuator must be tested in accordance with the acceptance figures below. During the tests, the actuator must not be overheated; the rating of the motor on normal working load is $1\frac{1}{2}$ minutes.

Functional test

14. Connect the 24 volt d.c. supply via a two-way switch to the actuator. With the supply applied, first to pin B and then to pin C, the plunger should extend and retract respectively. Check that the motor brake functions satisfactorily, i.e., operates without flutter.

Initial stroke setting

15. Fit the actuator to a stroke setting rig and, with 24 volt d.c. applied, set the stroke to 3 in. $\pm$ 0·030 in.

Endurance test

16. With the actuator fitted in a load test rig, operate the actuator on 24 volt d.c. against a load of 160 lb. for forty full cycles of operation. The load is to be compressive during twenty cycles (assisting retraction of the plunger and opposing extension) and tensile for twenty cycles. The test must be carried out at thirty cycles per hour. The actuator must operate satisfactorily during the test.

Insulation resistance test

17. Immediately following the endurance test, the insulation resistance between all plug pins and the frame is to be measured with a 250 volt insulation resistance tester. The resistance must not be less than 2 megohms.

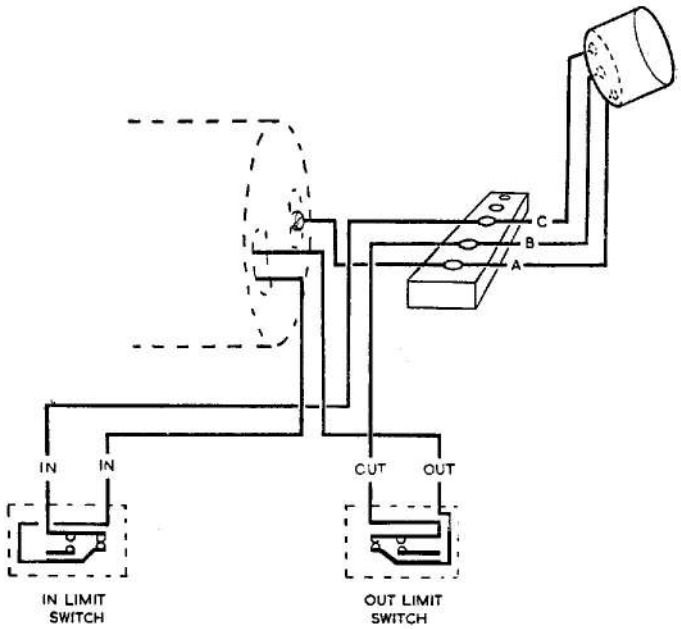

Fig. 3. *Actuator wiring*

18. Apply a high voltage flash test of 250 volt a.c. 50 c.p.s. for one minute between all plug pins and the frame.

Performance test

19. With the actuator fitted to the load test rig and the input supply connected via the test panel, set input voltage and actuator load consecutively to the values indicated in the table below. Check that the current does not exceed the stated maximum and that the time for the full 3 in. stroke is within the stated limits. The following abbreviations are used in the table of test figures:—

C.L.O. compression load opposing motion

C.L.A. Compression load assisting motion

T.L.O. tensile load opposing motion

T.L.A. tensile load assisting motion.

TABLE 1

Performance test

Applied voltage	Load lb.	Condition of load	Time Secs. Min.	Time Secs. Max.	Max. current amps.
29	0	Extend	5·5	7·5	1·2
29	0	Retract	5·5	7·5	1·2
29	160	C.L.O.	11·0	15·0	2·2
29	160	C.L.A.	7·0	10·5	1·6
29	200	C.L.O.	13·0	18·5	2·4
29	160	T.L.O.	11·0	15·0	2·2
29	160	T.L.A.	7·0	10·5	1·6
29	200	T.L.O.	13·0	18·5	2·4
24	0	Extend	7·0	10·0	1·2
24	0	Retract	7·0	10·0	1·2
24	160	C.L.O.	16·0	25·0	2·2
24	160	T.L.O.	16·0	25·0	2·2
24	200	C.L.O.	19·0	32·0	2·4
24	200	T.L.O.	19·0	32·0	2·4

Final stroke setting

20. Fit the actuator to the stroke setting rig and, with 24 volt d.c. applied, set the extended and retracted centres of the end fittings to 12·281 in. $^{+0\cdot03\text{ in.}}_{-0\cdot00\text{ in.}}$ and 9·281 in. $^{+0\cdot00\text{ in.}}_{-0\cdot03\text{ in.}}$ respectively.

Stroke variant check

21. After the final stroke setting, check that the stroke setting is within the stated limits indicated in the table below with the actuator operating under the specified conditions:—

TABLE 2

Stroke variant check

Applied voltage	Load lb.	Condition of load	Maximum error on centre distances	
			Retracted	Extended
24	160	T.L.O.	+0·050 in.	—
24	160	C.L.O.	—	−0·050 in.
29	160	T.L.A.	—	+0·050 in.
29	160	C.L.A.	−0·050 in.	—

22. After the stroke variant check, disconnect the leads from the terminal block remove the front end fitting from the plunger and remove the front cover and plug assembly. Fit a rubber section between the rear cover and the gearbox (see *fig.* 1). Fit the spacer case. Fit a rubber section into the channel formed around the edge of the front cover. Fit the cover over the plunger. Connect up the leads to the terminal block as shown in fig. 3. Secure the front cover by tightening up the captive screw. Fill the channels between the front and rear covers and the spacer case with Kalanoid waterproof plastic compound. Fit the locking nut and the front end fitting on the plunger stud.

23. After the spacer case has been fitted, the functional test (*para.* 14) is to be repeated to check for correct operation. Finally the four fixing screws of the rear end fitting are now to be locked with 0·020 in. stainless steel locking wire.

OVERALL (Motor)

Tools and test equipment

24. The special tools and test equipment listed in Table 3 are required for the overhaul of the motor.

DISMANTLING

25. When the motor has been removed from the actuator, dismantle it in the sequence set out below.

(1) Holding the drive pinion with special tool T 336913 remove the nut from the armature shaft. Using the pinion extractor tool T 336909, draw the pinion and braking disc off the tapered shaft. As this is done the brake spring will force the braking disc and the attraction disc out of the housing. Remove these together with the spring.

(2) Remove the lead passing through the brushgear housing from its terminal. Take out the screws holding the brush tags and remove the brushes from the holders. Take the two slotted 6 B.A. nuts off the ends of the long studs protruding through the brushgear housing. Thread the protective cap (part of the bearing extractor T 336907) on to the armature shaft. Holding the yoke in one hand, tap lightly on the cap with a plastic headed mallet or similar tool until the journal on the armature shaft is clear of the drive-end bearing, or until the bearing leaves the brake housing. Guiding the leads through the holes in the brushgear housing, part the latter complete with armature from the remainder. Remove the circlip, the bearing shield and the shims from the brushgear housing and, using a suitable brass drift, press out the end of the armature shaft from the bearing.

(3) If it should happen that the armature shaft retains the bearing, thus removing it from the housing, the insulating washer between the housing and the brush carrier will be damaged. It must be renewed on reassembly of the motor. Great care must be exercised in removing the bearing from the armature shaft. Use extractor tool T 336919.

TABLE 3

Special tools and test equipment

Nomenclature	Part No.	Ref. No.
Tools:—		
Drive pinion spanner with feeler gauges	T 336913	
Forward bearing support	T 336905	
Bush for forward bearing support	T 336912	
Press tool for comm. end bearing	T 336916	
Press tool	T 336906	
Spring checking tool	T 336908	
Torque pulley comprising:—		
Pulley	T 336917 detail 1	
Washer	T 336917 detail 2A	
Screw	T 336917 detail 3	
Collet	T 336917 detail 4	
Pinion extractor	T 336909	
Bearing extractor for $\frac{1}{2}$ in. bearing	T 336907	
Bearing extractor for $\frac{3}{8}$ in. bearing	T 336919	
Slotted screwdriver	T 336911	
Crimping pliers	CZ 50102	
Crimping jaws for pliers	Z 50102	
Hellermann sleeving tool	Type "S"	
Test equipment:—		
Torque test rig	4 CZ 94028	
Mounting flange	T B3692/1	
Overrun test rig and electronic amplifier	4 CZ 94029 TD 3159	

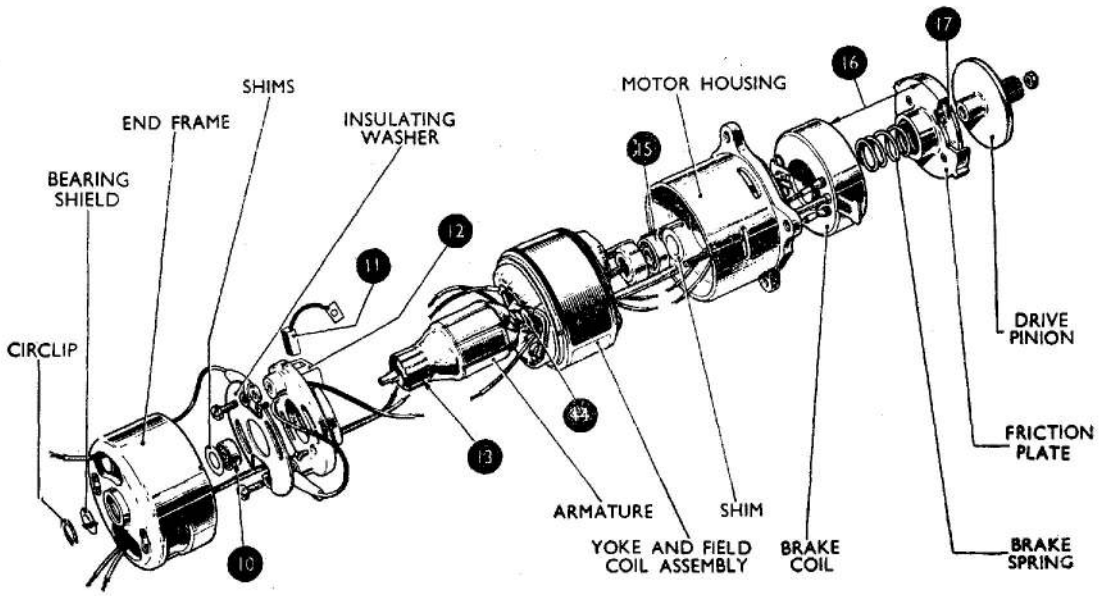

Fig. 4. *Exploded view of motor*

(4) Remove the moulded brushgear carrier by taking out the two 6 B.A. screws, taking care not to damage the insulating washer located between the two, and not to lose the two kidney-shaped nut-plates.

(5) To remove the bearing from the housing, heat to about 100 deg. C. and press out, using a piece of $\frac{5}{16}$ in. diameter brass rod having its end face square to its axis.

(6) To separate the drive-end housing from the yoke, remove the thread binding the leads to the long studs and unsolder the brake-coil lead from the solder tag on the field coil. Easing the leads through the gap between the stud and the yoke, remove the housing and brake-coil from the yoke. Remove the insulating sleeves from the studs. Withdraw the brake-coil assembly from the forward housing, taking care of the air-gap shims which will now be revealed and may fall away from the studs which they embrace.

(7) To remove the drive-end bearing, heat the housing to approximately 100 deg. C. and press out the bearing. Remove the shim from the housing. If the bearing remains on the armature shaft it must be carefully removed with the aid of the extractor T 336907 using the cap to protect the end of the shaft.

Inspection and repair

26. As far as is practicable, overhaul is dealt with assembly by assembly.

Soldering

27. All soldering must be carried out with approved solder. When making a joint see that the solder is not allowed to run back along the conductor, since this destroys the flexibility of the leads adjacent to the joint and gives rise to breaks. When the joint is satisfactorily made and no other leads are to be soldered to the same point, coat it with varnish.

Brake housing and components

28. All traces of carbon dust must be removed, both from the housing and the brake components. This is best done by loosening with a pencil-type brush and then using clean, dry, compressed air to remove it. On no account must the friction material be removed from the attraction plate, as it is machined after riveting in order to obtain correct operation.

29. Examine the brake housing for damage, paying attention to the mounting flange, torque reaction slots and spigot.

30. If it is necessary to renew the housing, then either the nameplate must be transferred to the new part or a new label must be stamped with the correct serial number and fitted to the housing. In the latter case, coat the underside of the nameplate with approved varnish and secure with two drive screws. Then coat the other side similarly. A nameplate left on a damaged housing should have the serial number obliterated.

31. Check against the Schedule of Fits, Clearances and Repair Tolerances in App. 1 that the dimension from the back of the attraction disc to the proud face of the friction lining is within permissible limits. If it is not, replace with a new assembly.

32. The brake spring must be checked for fatigue. The two-part tool T 336908 is available for this purpose. The weight required to compress the spring to a length of $\frac{5}{16}$ in. shall be 7 lbs. 4 ozs. $\pm$ 4 ozs.; with the top of the plunger level with the top of the tube, the spring is compressed to a length of exactly $\frac{5}{16}$ in. Note that the plunger weight of 2 oz. must be taken into account.

33. Examine the drive pinion for wear and renew if necessary.

34. The two leads attached to the solder tags on the brake-coil assembly must be renewed; the appropriate lengths required are $3\frac{1}{2}$ in. and $1\frac{3}{4}$ in.

35. Check the continuity of the brake-coil. The resistance must measure between 2·2 and 2·6 ohms at 15 deg. C.

36. Renew, if necessary, the insulating sleeving on the long studs using 2 mm. bore tubing (yellow).

Yoke and field coil assembly

37. Clean the assembly by the same method as that described in para. 28 and make a general examination for damage. Check the continuity of each field coil. The resistance must be between 2·55 and 2·95 ohms at 15 deg. C. The wiring leads must be renewed and this must be carried out by removing and replacing only one lead at a time. This is very important since the leads are colour coded by means of sleeving in order to obtain the required rotation. It is suggested that

the long leads from the field coils are tackled first, one at a time, and that the link between the common tags be replaced last. The length of each of the flying leads is 6 in. See that all leads are immediately sleeved with the correct colour, renewing if necessary.

Brushgear

38. Thoroughly clean the brushgear, removing carbon dust by the same method as that described in para. 28. Examine the moulding for damage and replace if necessary. Check the brush pressure as follows. Slide new brushes into the holders; do not secure the tags at this stage. With a standard spring or dial type gauge measure the pressure at the face of the brush when it projects $\frac{1}{32}$ from the holder. The pressure must be $3\frac{1}{2}$ to $4\frac{1}{2}$ oz. (100-130 grammes). If it is not so, the brushgear assembly must be renewed.

Armature assembly

39. Clean thoroughly and examine for damage. The commutator is best cleaned with a piece of clean, white linen. Check the resistance between any pair of diametrically opposed commutator segments. It must measure 1·0 to 1·2 ohms at 15 deg. C.

40. Measure the shaft journals for wear and see that they are within the limits given in App. 1.

41. Check the commutator for wear; refer to App. 1. If a track more than 0·005 in. deep is present it must be trued by skimming. During this process it should be run on the shaft journals, not between centres. The diameter over the segments must not be less than 0·470 in. at the completion of skimming. This must be followed by undercutting the micas 0·024 in. to 0·026 in. wide and 0·020 in. to 0·025 in. deep.

42. Using a 250 volt megger, check the insulation resistance of all wound assemblies, viz., brake coil, field coils, armature. This must be not less than 2 megohms each.

Bearings, cleaning and lubrication

43. Immediately prior to lubrication, bearings must be cleaned at least three times in white spirit. After cleaning, dry out with clean, dry, compressed air from a low pressure line. Do not allow the air to spin the races as, with no grease present, the resulting metal-to-metal contact can damage the bearings. Carefully examine the bearing for wear and damage and renew if necessary. If in any doubt about the condition of a bearing, always renew. Re-grease immediately after drying.

44. Each side of the bearing must be lubricated with grease XG-275 pressed into the space between the inner and outer races for a distance of one-third the circumference. If one side is inaccessible then two-thirds of the accessible side must be covered.

45. The bearings must then be rotated by hand to work the grease into the ball-tracks.

ASSEMBLY

46. Assembly the motor in the sequence set out below:—

(1) The drive-end bearing is dealt with first. If a new bearing is to be used, it must be selected from stock to give the correct fit. Refer to App. 1. Clean and lubricate in accordance with the instructions given in para. 43 to 45.

(2) Heat the brake housing in an oven to approximately 100 deg. C. making sure that the bearing recess is perfectly clean. Drop the 0·005 in. steel shim into the recess. Support the housing on tools T 336905 and T 336912 and, using T 336906 in an arbor press, press the bearing fully home in the recess, shielded side uppermost.

(3) Place the brake-coil assembly into the brake housing with the leads adjacent to the slot in the periphery of the housing. Slide on to the studs the lengths of insulation sleeving (yellow).

(4) Offer up the yoke assembly to the brake housing, noting that the two are radially located by the dowel pin on the yoke and the slot in the housing.

(5) Immediately before assembly, coat the spigot face of the yoke with approved varnish.

(6) The two leads from the brake coil must be fed through the yoke assembly on either side of the stud and to the outside of the stud, i.e. between field coils, the stud and the outer casing, not on the inside of the stud. Make the soldered connection between the shorter brake-coil lead and one of the common field coil solder tags. Sleeve the longer lead from the brake-coil with yellow tubing to the point where it emerges from the field coils. With two complete turns of glass thread, bind the two field coil leads and the longer brake-coil lead to the studs.

(7) In order to fit the armature shaft into the drive-end bearing and to fit the comm. end bearing and brushgear housing, it is essential to support the partly assembled motor via the inner race of the drive-end bearing. Tool T 336905 is designed for this purpose.

(8) Having the motor supported drive end downward on the tool, feed the threaded end of the armature shaft into the forward bearing. Using a brass cap over the other end of the shaft, press the armature fully home into the drive-end bearing.

(9) Refit the brushgear assembly, without brushes, into the brushgear housing over the insulating washer. If the insulating washer was damaged during dismantling it must be replaced. Secure the brushgear to the housing with two 6 B.A. screws and spring washers and the two nut plates (see *fig.* 4). Note that when viewed from inside the housing, the nut-plates have the large clearance holes pointing away from the screw in a clockwise direction.

(10) Clean and lubricate the comm. end bearing in exactly the same way as the drive-end one. If it is to be renewed, select the correct size from stock. Refer to App. 1.

(11) Heat the housing assembly to approximately 100 deg. C. making sure that the bearing recess is clean. Coat the spigot face of the yoke assembly with approved varnish. Place the housing in position on the yoke assembly, feeding the leads through the appropriate holes. Support the inner race of the forward bearing on tool T 336905. Using T 336916, press home the bearing into the housing, its unshielded side uppermost, and fully on to the armature shaft journal. Fit the two 6 B.A. slotted nuts on the stud ends with their spring washers, and taking each nut a turn or fraction of a turn alternately tightening the whole assembly.

(12) Shims of 0·002 in., 0·005 in. and 0·020 in. thickness are used to pack out the gap between the bearing and the bearing shield Select shims so that, when the shield is in position, the outermost shim still has a little clearance. On no account may they be tightly clamped by the cover plate.

(13) Replace the bearing cover plate and secure it with the circlip. Remove the motor from the supporting tool.

(14) The terminal tags and sleeves must now be fitted to the lead ends. The length of the flying leads is 6 in. The tag and thimble are crimped on to the conductors, using the correct crimping tool. The sleeving is pushed over the thimble, bound with glass thread and varnished before applying the rubber sleeve with the Hellermann tool. Finally, the sleeve is coated with approved varnish.

(15) At this stage the brushes should be fitted and a rotational check should be made. In the event of new brushes being fitted they should be "bedded-in". Refer to para. 49.

(16) Place the brake spring over the armature shaft, followed by the attraction plate, friction lining uppermost. Note the radial position of the driving pin relative to the housing. Pass the braking plate over the shaft, and, applying finger pressure to compress the spring, guide the torque reaction lugs into their slots and press on to the taper. Fit the 6 B.A. nut on to the armature shaft and tighten.

(17) The brake air gap, which is accessible through the two forward slots in the brake housing, must be set to between 0·008 in. and 0·011 in. at normal room temperature. Use the feelers attached to the pinion locking spanner. The gap is set by inserting shims through the two rearward slots in the housing.

Testing after overhaul

47. After assembly, the motor is to be subjected to the acceptance tests set out below.

Direction of rotation

48. With the common terminal connected to the negative lead of an 18 volt d.c. supply and the blue field lead to the positive, the armature must rotate in a clockwise direction when viewed from the drive end. The rotation is reversed with the red field lead connected to the positive.

Brush bedding

49. Brushes must be bedded in to the correct contour. This is done by running the motor in each direction alternately on no load on an a.c. or d.c. supply of about 11 to 12 volt with the brake mechanism removed. The actual supply voltage must be adjusted so that the motor does not exceed 15,000 r.p.m. This is continued until the brushes are bedded in over the complete arc and at least 80 per cent of their area. During running in, the motor should be periodically checked for overheating. After bedding in, the brush. gear must be cleaned out with clean, dry-compressed air at approximately 40 lb. per sq. in.

Brake air gap

50. Having set the gap, check for proper functioning by operating the motor on an 18 volt d.c. supply six times in each direction of rotation.

A positive click should be heard as the motor is energized. Check also that there is no excessive vibration.

Speed balance

51. The brushgear must be adjusted to give near equal speeds in both directions of rotation. This is carried out by slackening the two 6 B.A. screws securing the brushgear to the housing and rotating the brushgear through an arc until the speeds in each direction are within 2½ per cent of the mean speed.

Torque test

52. This is carried out with the motor at room temperature. By means of the torque pulley attached at the driving pinion and a torque test rig, record speed and current for torque loadings of 0·5 and 1·5 oz. in. at 18, 25 and 29 volt d.c. in each direction. The motor performance must be in accordance with the information in the following table.

54. Care must be taken during torque test not to overheat the motor.

Insulation resistance test

55. With the motor still warm from the torque test, the insulation must withstand 250 volt r.m.s. supply at 50 c.p.s. for 1 minute between the common lead and motor frame. The insulation resistance must be then immediately measured between the same points and must not be less than 2 megohms at 250 volt d.c.

Brake overrun test

56. With the motor running at 20,000 r.p.m. (voltage approximately 20 volt d.c.) the maximum overrun in switching off the supply shall be 15 revolutions of the braking disc, except where the brake spring and friction material are new, when it shall be 12 revolutions.

TABLE 4

Motor torque test

Terminal Volts d.c.	Torque oz. in.	R.P.M. Max.	R.P.M. Min.	Max. Current Amps.
18	0·5	—	12,000	1·25
18	1·5	—	5,000	1·8
25	0·5	—	17,000	1·35
25	1·5	—	10,000	1·9
29	0·5	26,000	—	1·45
29	1·5	19,000	—	1·9

53. During these tests the brushes must be observed to check sparking. Commutation is satisfactory if either intermittent or continuous blue pin-point sparking is observed. Sparking with occasional or continuous yellow flashes is not acceptable.

Re-check of brake air gap

57. Finally, the brake air gap must again be checked with the motor at normal ambient temperature and readjusted if necessary (*para.* 46 (17)).

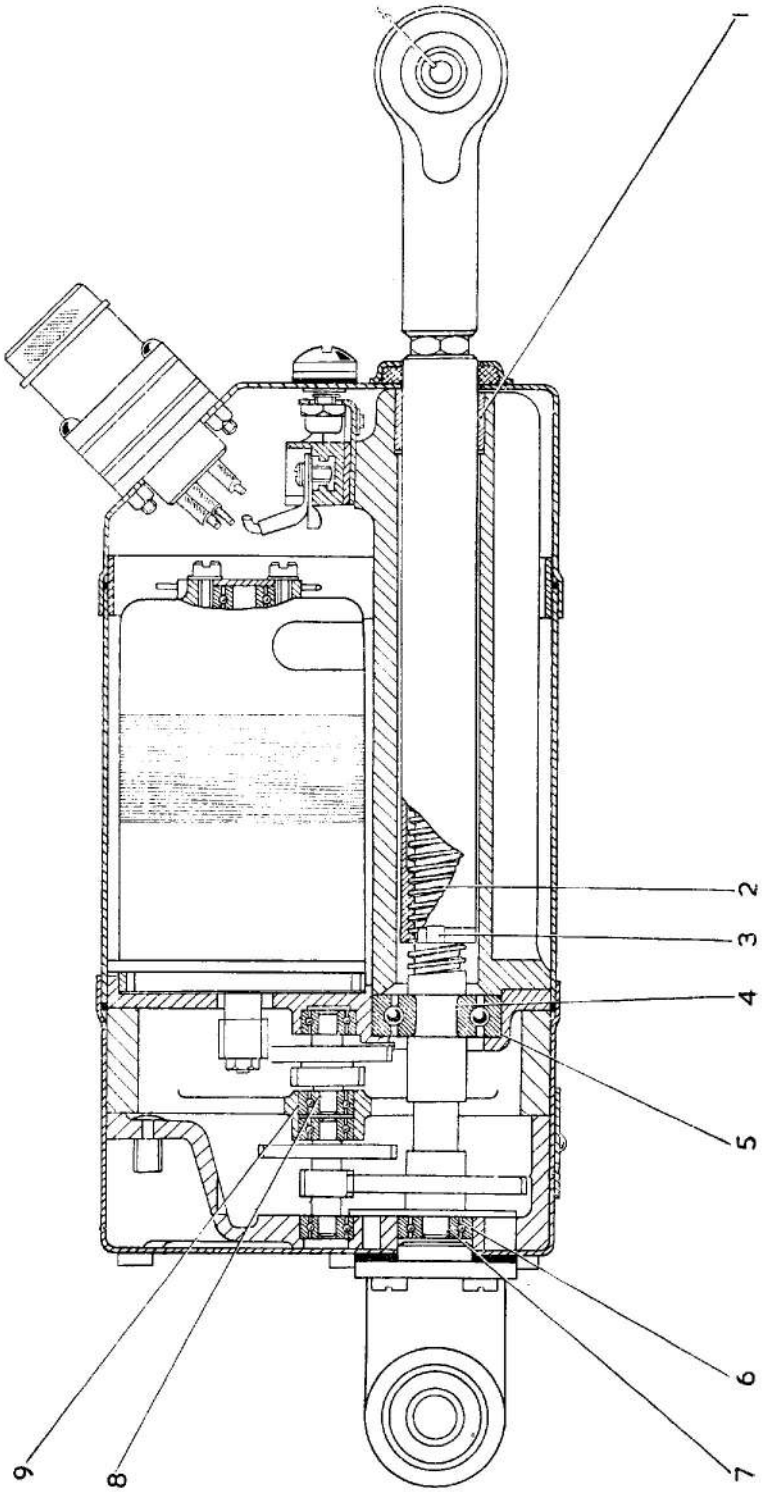

Fig. 5. *Fits and clearances diagram*

APPENDIX 1

Schedule of Fits, Clearances and Repair Tolerances (CZ 54043)

Note.—*This schedule should be read in conjunction with fig. 5*

Item No. (1)	Description (2)		Dimension New (3)	Permissible Worn Dimension (4)	Clearance New (5)	Permissible Worn Clearance (6)	Remarks (7)
	ACTUATOR (*fig.* 5)						
1	PLUNGER IN BUSH	Bush bore	0·4998 in. 0·5004 in.	0·5004 in.	0·0014 in. 0·0003 in.	0·0014 in.	
		Plunger dia.	0·4995 in. 0·4990 in.	0·4990 in.			
2	LEAD SCREW IN PLUNGER	Backlash in threads			0·006 in.	0·0025 in.	
3	PLUNGER EARS IN GUIDE SLOTS	Guide slot width	0·249 in. 0·252 in.	0·252 in.	0·000 in. to 0·004 in. clear	0·004 in.	
		Ear width	0·249 in. 0·248 in.	0·248 in.			
4	LEAD SCREW IN MAIN BEARING	Bearing bore	0·2753 in. 0·2758 in.	0·2758 in.	0·0004 in. clear to 0·0004 in. interf.	0·0004 in.	
		Journal dia.	0·2757 in. 0·2754 in.	0·2754 in.			
5	MAIN BEARING IN FRONT COVER	Bearing o/dia.	0·8658 in. 0·8653 in.	0·8653 in.	0·0002 in. clear to 0·0008 in. interf.	0·0002 in.	
		Front cover bore	0·8655 in. 0·8650 in.	0·8655 in.			

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APPENDIX 1

Schedule of Fits, Clearances and Repair Tolerances (CZ 54043)

Note.—*This schedule should be read in conjunction with fig.* 5

Item No. (1)	Description (2)		Dimension New (3)	Permissible Worn Dimension (4)	Clearance New (5)	Permissible Worn Clearance (6)	Remarks (7)
6	LEAD SCREW END BEARING IN REAR COVER	Bearing o/dia.	0·4992 in. 0·4997 in.	0·4992 in.	0·0008 in. clear to 0·0002 in. interf.	0·0008 in.	
		Rear cover bore	0·4995 in. 0·5000 in.	0·5000 in.			
7	LEAD SCREW END JOURNAL IN BEARINGS & 35-14T GEAR IN BEARINGS	Bearing bore	0·1872 in. 0·1877 in.	0·1877 in.	0·0010 in. clear to 0·0000 in. interf.	0·0010 in.	
		Journal dia.	0·1867 in. 0·1872 in.	0·1867 in.			
8	40-22T GEAR & 43-14T GEAR IN BEARINGS	Journal dia.	0·1247 in. 0·1252 in.	0·1247 in.	0·0005 in. clear to 0·0005 in. interf.	0·0005 in.	
		Bearing bore	0·1252 in. 0·1247 in.	0·1252 in.			
9	BEARINGS IN SPACER CASE FRONT AND REAR COVER	Bearing dia.	0·3742 in. 0·3747 in.	0·3742 in.	0·0008 in. clear to 0·0002 in. interf.	0·0008 in.	
		Cases bore	0·3745 in. 0·3750 in.	0·3750 in.			
	MOTOR (*fig.* 4)						
10	BEARING IN BRUSHGEAR HOUSING	Bearing dia.	0·3944 in. 0·3940 in.		0·0007 in. clear to 0·0002 in. interf.		
		Housing bore	0·3947 in. 0·3942 in.				

APPENDIX 1

Schedule of Fits, Clearances and Repair Tolerances (CZ 54043)

Note.—*This schedule should be read in conjunction with fig. 5*

Item No. (1)	Description (2)		Dimension New (3)	Permissible Worn Dimension (4)	Clearance New (4)	Permissible Worn Clearance (6)	Remarks (7)
11	CARBON BRUSH LENGTH		0·385 in. 0·355 in.	0·250 in.			
12	ARMATURE SHAFT IN COMM. END BEARING	Shaft dia.	0·1249 in. 0·1253 in.		Size to size 0·0001 in. interf.	Nil	Bearing selectively assembled to obtain fit in column (5)
		Bearing bore	0·1258 in. 0·1252 in.				
13	COMMUTATOR DIAMETER		0·490 in. 0·495 in.	0·450 in.*			*Max. permissible wear after skimming to min. allowable dia. of 0·470 in.
14	ARMATURE SHAFT IN DRIVE END BEARING	Shaft dia.	0·1874 in. 0·1878 in.		0·0001 in. clear to 0·0001 in. interf.		Bearing selectively assembled to obtain fit in column (5)
		Bearing bore	0·1873 in. 0·1877 in.				
15	BEARING IN BRAKE HOUSING	Bearing dia.	0·5196 in. 0·5192 in.		0·0005 in. clear to 0·0004 in. interf.		
		Housing bore	0·5197 in. 0·5192 in.				

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APPENDIX 1

Schedule of Fits, Clearances and Repair Tolerances (CZ 54043)

Note.—*This schedule should be read in conjunction with fig.* 5

Item No. (1)	Description (2)	Dimension New (3)	Permissible Worn Dimension (4)	Clearance New (5)	Permissible Worn Clearance (6)	Remarks (7)
16	BRAKE AIR GAP CLEARANCE			0·008 in. 0·011 in.	0·008 in. 0·011 in.	Maintained by shimming
17	ATTRACTION DISC AND FRICTION LINING	0·120 in. 0·125 in.	0·115 in.*			*Measured from rear face to projecting surface of lining subject to the rivets being below the surface


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