Chapter 31

ACTUATORS, PLESSEY, HAND-WIND, TWIN MOTOR JAGUAR SERIES

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Introduction

1. The hand-wind, twin motor Jaguar actuator, is designed to provide remotely controlled linear motion against tensile or compressive loads. A hand-wind mechanism is provided to enable the actuator to be operated manually in the absence of the electrical supply.

2. Basically, the actuator consists of two reversible motors which drive a leadscrew via suitable reduction and epicycle gearing. The leadscrew causes the plunger to extend or retract, depending on the direction of rotation of the leadscrew. The travel of the plunger is controllable by adjustable limit switches which are operated by the plunger and an auxiliary trip on the leadscrew. Electrical connections to the actuator are made by two multi-core cables which enter the actuator via angled glands on the front cover. The actuator is fitted with a trunnion mounting to provide one attachment point, the other being a front end fitting screwed on to the plunger and locked by a nut.

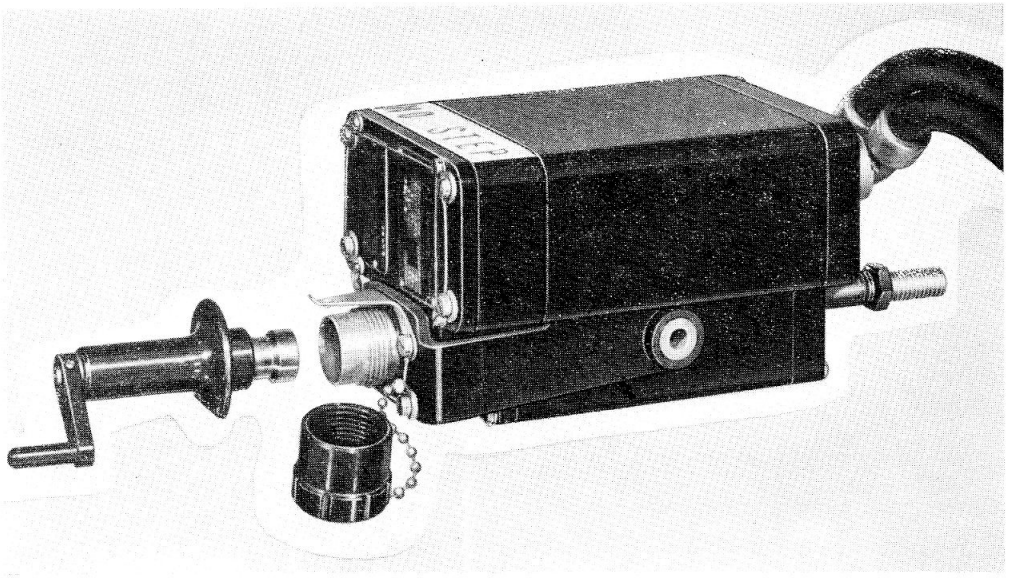

Fig. 1. General view of actuator and cable outlets

3. The hand-wind mechanism comprises a spring-loaded crank assembly which, when inserted into a socket at the rear of the actuator, disengages the power drive and provides a direct manual operation of the leadscrew. The socket is sealed by a screw-on cap when the hand mechanism is not in use.

DESCRIPTION

General

4. A general view of the actuator and hand-wind mechanism is shown in fig. 1 and a sectioned view in fig. 2. The two motors are mounted alongside each other and are both offset from the plunger. In normal operation, both motors are energized simultaneously, the actuator will however, function at half speed in the event of supply failure to one or other of the motors.

Motors

5. Each motor is series-wound and incorporates a split-field winding to permit reversible operation and an electro-magnetic brake. The armature is supported in two ball bearings, one is located in the drive end housing and the other in the commutator end housing. The housings are secured to the yoke by through-studs screwed into the brake coil housing and the assembly is secured by two nuts at the commutator end. The brushgear is secured to the commutator end housing by two studs and, for the purpose of adjustment, the brushgear can be moved radially within the limits of the two slots through which the studs pass.

6. The brake coil is enclosed within the drive end housing and, when energized, attracts the lined brake disc away from the rear face of the brake plate. The motor pinion forms an integral part of the brake plate, which is secured to the drive end of the armature shaft. The brake disc is prevented from rotating by two lugs on its periphery and is loaded by the brake spring.

Reduction gear trains

7. The gear trains (fig. 3) consist of two spur gear reduction trains (main and auxiliary), an intermediate epicyclic type differential stage and a final spur gear train, arranged to give a ratio of 32:1 between either motor and the final drive.

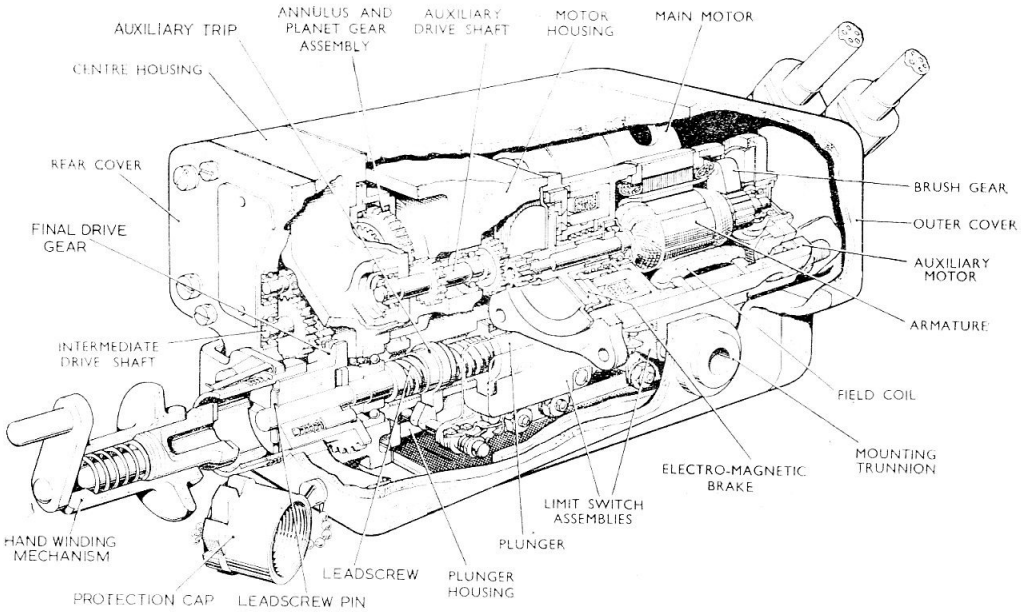

Fig. 2. Sectional view of Actuator

8. Normally, both motors are energized simultaneously so that the auxiliary motor drives the annulus of the differential at the same time as the main motor drives the sun gear. The planet carrier is thus driven at twice the speed which would obtain if either the annulus or the sun gear were stationary and the effective gear ratio becomes 16:1. If the supply to one or other of the motors fails, either the annulus or the sun gear is held stationary by the motor brake and the actuator operates at half speed.

9. The drive from the planet carrier is applied via the intermediate gears to the final drive gear which engages with a pin inserted through the leadscrew.

Leadscrew and plunger

10. The final drive gear is mounted on the rear end of the leadscrew and is spring-loaded to engage the leadscrew pin. A 12 t.p.i. Acme-form thread is cut along the length of the leadscrew and is a close mating fit with a similar thread on the inside of the plunger.

11. The plunger is prevented from rotating by two torque ears, which travel in slots in the plunger housing. The travel of the plunger is established by four snap-action limit switches which interrupt the electrical supply to the motors at the extended and retracted positions of the plunger. One pair of switches is operated by one of the torque-reaction ears when the plunger is extended, and the other pair by an auxiliary trip on the leadscrew when the plunger is retracted. The forward end of the plunger is threaded and fitted with a locknut for attachment of the front end fitting.

Hand-wind mechanism

12. The hand-wind mechanism is inserted at the rear of the actuator after removing the protective cap on the trunnion assembly. When the hand-wind mechanism is pushed home, the final drive gear is disengaged from the leadscrew pin, whilst grooves in the hand-wind mechanism engage this pin to provide positive manual drive to the leadscrew. When the hand-wind mechanism is withdrawn and the supply to the motors is made,

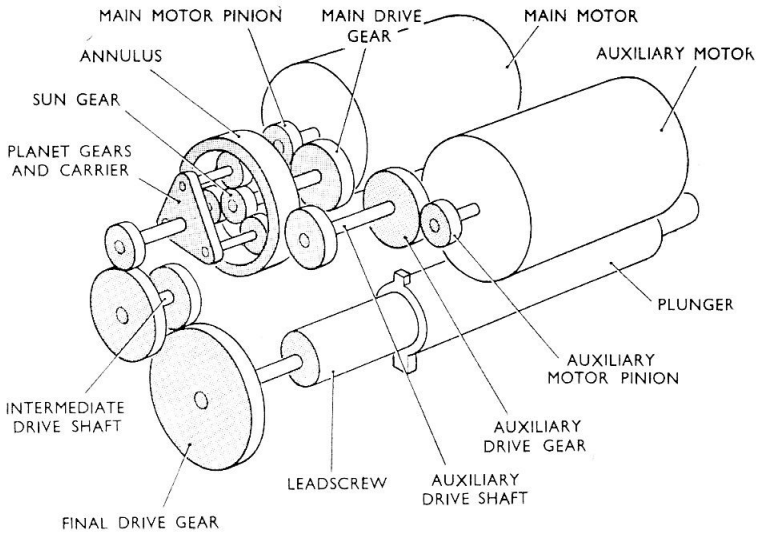

Fig. 3. Reduction gear trains

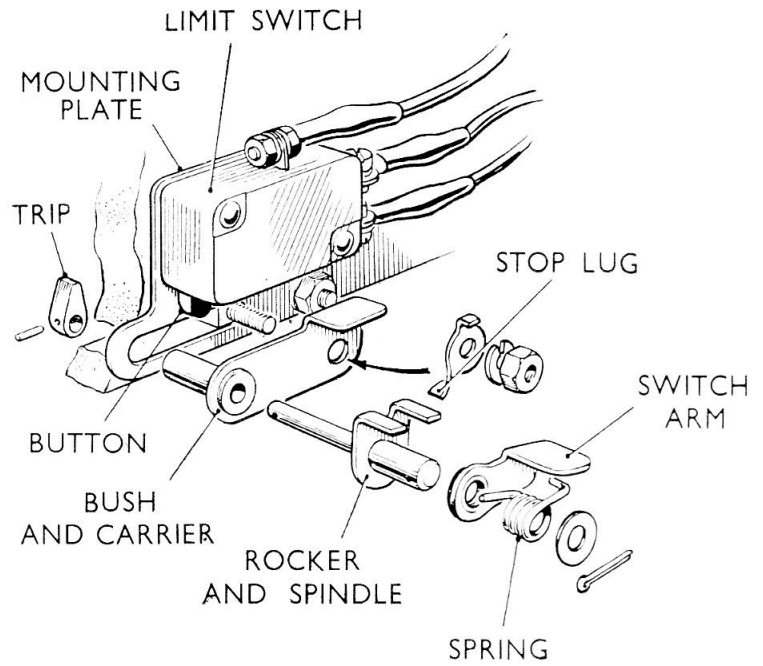

Fig. 4. Limit switch assemblies

the drive gear rotates, engaging with the leadscrew pin under the action of the loaded springs.

Limit switch assemblies

13. Two limit switch assemblies are mounted on each side of the plunger housing to control the extended and retracted limits of plunger travel. The two on the left-hand side (viewed from the rear) are in the main motor circuit and the two on the right-hand side are for the auxiliary motor.

14. Each switch assembly (fig. 4) consists of a limit switch, riveted to a mounting plate, and a switch operating mechanism. The trip arm, which is pinned to the inner arm of the rocker spindle, is contacted, either by the lower torque reaction ear on the plunger in one direction, or the auxiliary trip in the other. Movement of the rocker spindle causes the rocker, which is integral with the spindle, to load the spring.

15. One end of the spring is located under a flange on the rocker and the other end under the tongue of the switch arm. When the rocker end of the spring is loaded, the load is transferred to the other end which then moves the tongue on the switch arm upwards to operate the limit switch button. Any further movement of the rocker is absorbed by the spring.

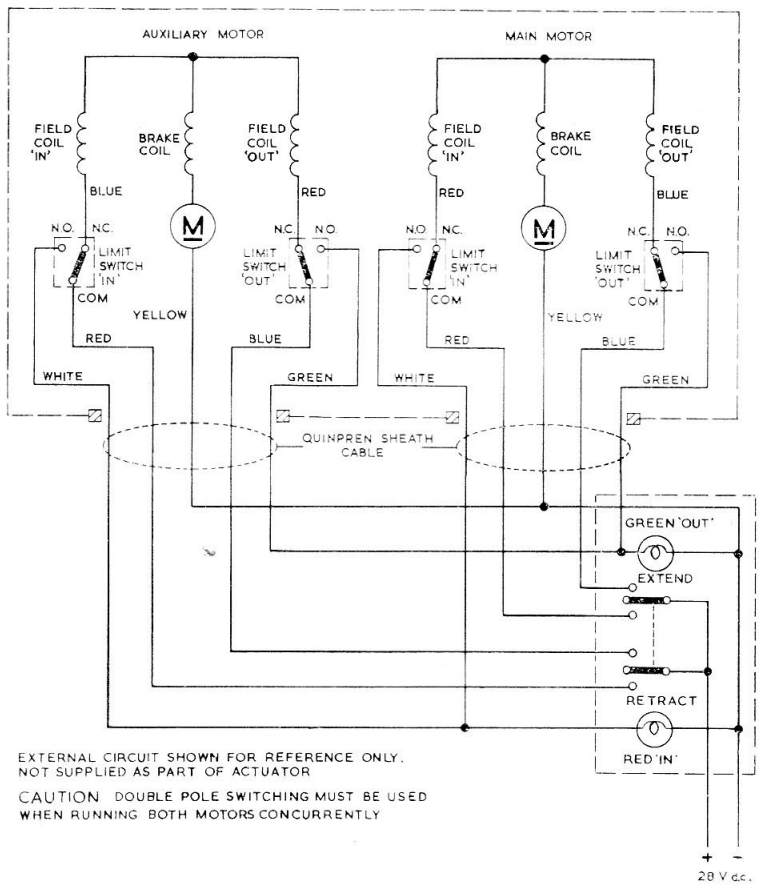

Fig. 5. Circuit diagram

16. When the plunger or auxiliary trip moves away from the extreme position, the load on the spring is released and the switch arm moves downwards away from the limit switch button. Further downward movement of the switch arm is prevented by a lug on a tab washer under one of the securing nuts.

17. The switch assemblies are secured to the plunger housing by two nuts and special screws. Adjustment to the plunger stroke is made by slackening the securing nuts and sliding the switch assemblies in the appropriate direction along the slots in the plunger housing.

Electrical connections

18. The connections to each motor and its associated limit switch assemblies are made by a length of quinprensheath cable. The two cables enter the front cover via elbow glands, unless otherwise stated in the appendices to this chapter. The internal connections are shown in the circuit diagram, fig. 5.

OPERATION

19. The reversible motors drive the leadscrew through a reduction train of spur and epicyclic gears. Moving over this leadscrew is the plunger, which incorporates two torque ears (or lugs), which move in locating slots in the plunger housing and prevent the plunger from rotating. Dependent on the direction of rotation of the motors therefore, the plunger extends or retracts in a linear motion within fixed limits. The extent of plunger travel is controlled by the adjustable limit switches which are connected in the motor field circuits and are operated either by one of the torque reaction ears or by the auxiliary trip. The electro-magnetic brake in each motor prevents overrun of the output shaft.

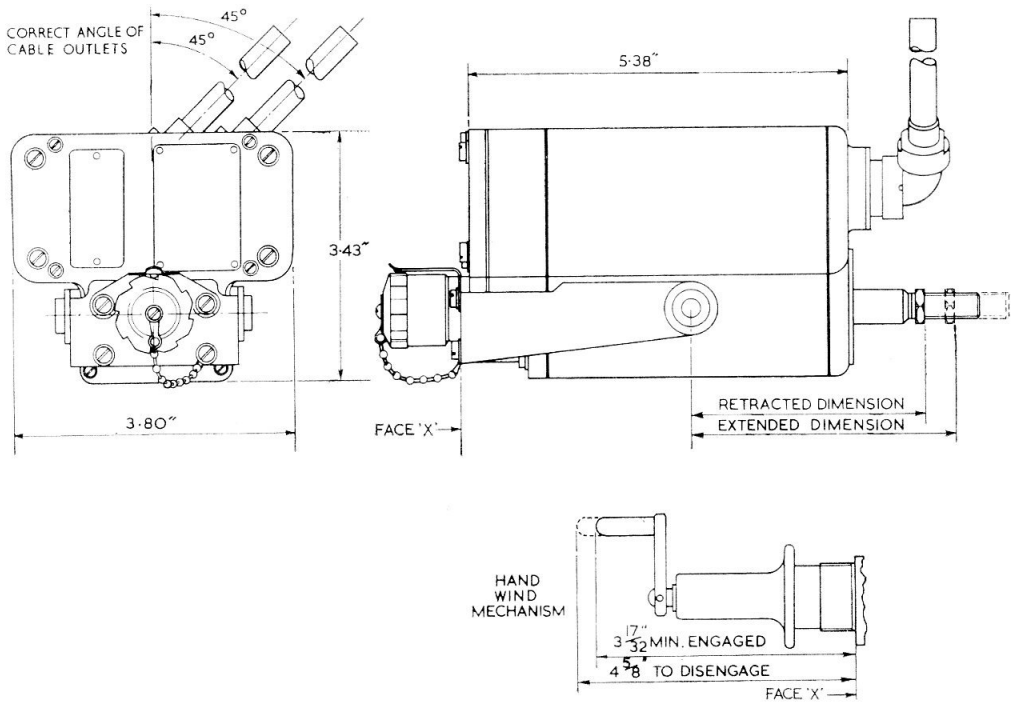

Fig. 6. Installation details

20. Should the d.c. supply fail, the leadscrew can be driven manually by means of the hand-wind mechanism. When the hand-wind mechanism is inserted in the socket at the rear end of the actuator, the final drive gear is disengaged from, and the hand-wind mechanism is engaged with, the leadscrew pin. The plunger is extended or retracted by turning the handle anti-clockwise or clockwise, respectively.

INSTALLATION

21. For details of an actuator installation in a particular aircraft, reference should be made to the appropriate Aircraft Handbook. Installation details are shown in fig. 6.

22. When installing a new or reconditioned actuator, first check that it is the correct type for the installation and has not been damaged in transit or storage. If its serviceability is suspect, carry out the Standard Serviceability Tests detailed in the Appendix A to this chapter.

23. Check that all external screws, nuts and bolts are fully tightened, and that the correct end fittings are available for securing the actuator to its associated component. Ensure that the actuator plunger and the drive shaft of the associated component are correctly positioned before coupling them together. After the actuator has been installed, check the security of the installation and operate the actuator to ensure that it functions correctly. No adjustments should be made to the plunger travel, except when the actuator is fitted to the linear actuator test rig.

24. After installation, operate the actuator in each direction in turn, to prove correct functioning.

SERVICING

General

25. Routine servicing of the installed actuator consists of examinations for security of mounting, serviceability of electrical connections and signs of damage or deterioration. At intervals prescribed in the relevant Aircraft Servicing Schedule the actuator is removed for bay servicing.

Bay Servicing

26. On removal from an aircraft the actuator should be cleaned externally, and examined for signs of damage or corrosion, the unit should then be dismantled to the extent necessary to enable the bearings to be cleaned, examined and lubricated if necessary. The brushgear and commutator should be cleaned and examined and new brushes fitted and bedded if necessary.

DISMANTLING

27. To gain access to the brushes, the actuator must be partially dismantled as follows:—

(1) Remove the front end fitting (if any), the nut on the plunger and the six through bolts (6) securing the front cover (1).

(2) Slacken the four gland nuts (7) and coat the cables liberally with a suitable lubricant. Carefully ease the cables through the elbows and entry glands, so that the front cover and casing (2) can be separated and removed sufficiently to gain access to the motors.

(3) Disconnect the main motor leads from the limit switches and the common yellow lead from the motor. Unlock the tab washers and remove the two nuts (5) and two bolts (3) securing the main motor to the motor housing (4). Remove the tab washers and withdraw the main motor.

28. Examine the main and auxiliary motor brushes and replace them if still serviceable. If the auxiliary motor brushes require renewal, the auxiliary motor must be removed from the actuator in a similar manner to that described for the main motor. The partially dismantled actuator is shown in fig. 7.

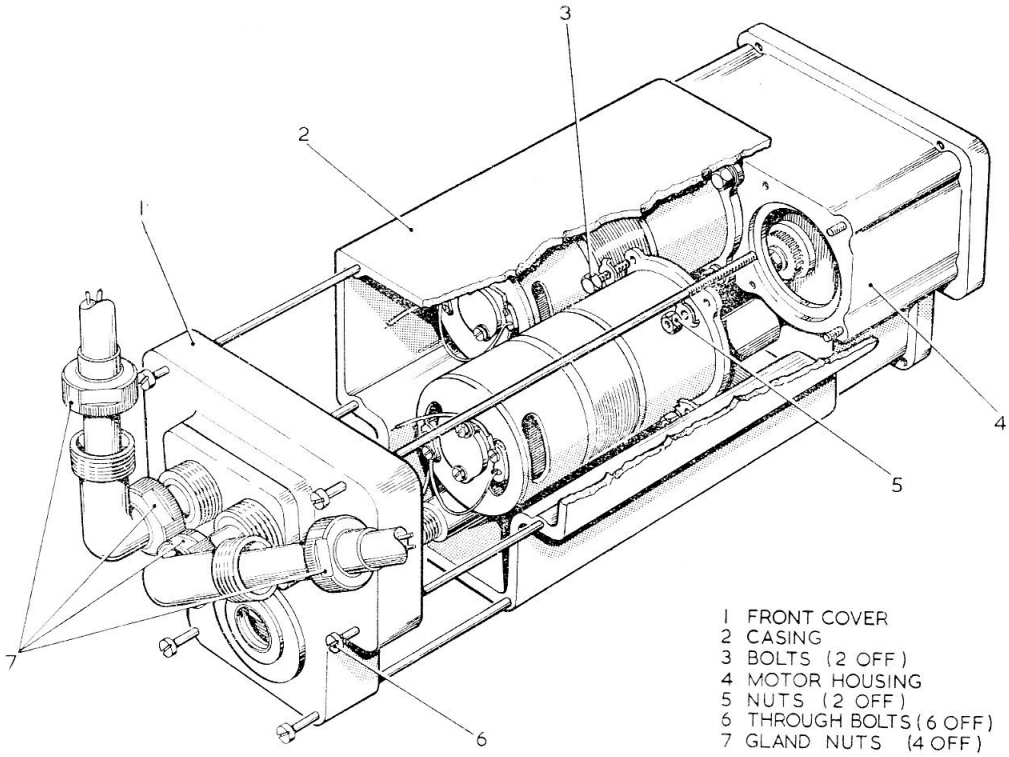

Fig. 7. Partially exploded view of actuator

Brushgear

29. All traces of carbon dust should be removed from the commutator and brushgear, using dry compressed air. New brushes should be fitted at the intervals prescribed in the bay servicing schedule and whenever examination reveals that they may reach the minimum length before the next servicing period. The new brushes should be a smooth sliding fit in their holders, without excessive clearance and the spring pressure should be within $3\frac{1}{2}$ to $4\frac{1}{2}$ oz. measured with a tension gauge, with the tip of the spring level with the top of the brush holder.

30. Information on brush bedding is contained in A.P.4343, Vol. 1, Sect. 1, Chap. 2. The final bedding is accomplished by running the motor at 12 volts on no-load for half-hour periods in each direction of rotation with the brake mechanism removed. The input voltage should be adjusted as necessary to ensure that the motor speed does not exceed 15,000 rev/min. The bedding run should be continued until each brush is bedded over its full thickness and at least 80 per cent of its contact surface. Care should be taken to avoid overheating of the motor during this running. External fan cooling is advisable. All traces of carbon dust must again be removed when the bedding is satisfactorily completed.

Lubrication

31. Bearings should be cleaned with lead-free white spirit to remove the grease and foreign matter. Dry compressed air should be used to dry the bearings, care being taken to avoid spinning the races by the air jet. Serviceable bearings should be re-greased immediately after drying by pressing grease, XG.275 between the inner and outer races for a distance of one-third of their circumference and rotating the bearings by hand to distribute the grease evenly over the tracks.

Re-assembling the actuator

32. On completion of the lubrication the gearbox and motor assemblies, complete with the plunger should be replaced. Re-assembly is carried out generally in the reverse order to the dismantling procedure previously described. The connections to the limit switch tag should be re-soldered and the negative leads secured to the central terminal block. Tab washers must be renewed and locked to the nuts and bolts securing the motor to the motor housing. The gaskets between the gearbox and casing and between the casing and the front end cover must be renewed, coating both faces with HYLOMAR SQ32R sealing compound. All gasket edges should be painted with Cellon epoxy lacquer (mixture SL5459 and CSL5538).

Note . . .

Care must be taken when feeding the cables through the glands and elbows to avoid straining any individual lead. When operating either motor independently, the red, white, blue and green leads not in use must be disconnected from the external circuit. It is essential to use a double pole switch when operating the two motors concurrently, otherwise the actuator will be damaged.

Testing

33. Check that the limit switches function correctly by noting the behaviour of the indicator lamps. After re-assembly, an insulation resistance test should be performed prior to placing the actuator on the test rig.

34. Using a 250V d.c. insulation resistance tester, Type C, or equivalent, measure the insulation resistance between the framework of the machine and each cable in turn. The reading should not be less than 50,000 ohms.

35. The actuator should be mounted on the linear actuator test rig (Ref. No. 4G/5420) in accordance with the instructions contained in A.P.4343S, Vol. 1, Book 2, Sect. 8, Chap. 3, and tests made as outlined in the Standard Serviceability Test Tables in the Appendix A to this chapter.

Hand-wind functional test

36. Remove the cap at the rear of the trunnion and engage the hand-wind mechanism. Extend the actuator against a 10 lb. load, by turning the handle anti-clockwise. Position the leadscrew so that when the hand-wind mechanism is withdrawn, the leadscrew pin engages with the grooves in the final gear.

37. Retract the actuator by simultaneous operation of the motors against a 10 lb. load, with the input voltage set to 28 volts. Extend the actuator against a 10 lb. load by simultaneous operation of the motors. Engage the hand-wind mechanism and retract the actuator by turning the handle clockwise. Position the leadscrew so that when the hand-wind mechanism is withdrawn, the leadscrew pin engages with the grooves in the final drive gear.

38. Replace the cap at the rear of the trunnion. Extend the actuator by simultaneous operation of the motors against a load of 10 lb., with the input voltage set to 28 volts.

Appendix A

STANDARD SERVICEABILITY TESTS

PLESSEY, HAND-WIND, TWIN MOTOR JAGUAR ACTUATORS

LIST OF TABLES

Introduction

1. The tests outlined in this appendix are intended to check the serviceability of actuators after servicing, or whenever their serviceability is in doubt.

Test equipment

2. The following equipment is required:—

(1) Linear actuator test rig (Ref. No. 4G/5420).

(2) Front and rear end mountings, Plessey Part No. T354569.

(3) Front end fitting Plessey Part No. CZ55524, with thread modified to $\frac{3}{8}$ in. UN.F. 24 T.P.I.

(4) A 250V d.c. insulation resistance tester, Type C (Ref. No. 5G/152).

(5) Tension gauge, Mk. 3 (Ref. No. 1A/56).

(6) A d.c. supply, variable between 18 and 29 volts.

Insulation resistance test

3. Using a 250V d.c. insulation resistance tester, Type C, or equivalent, parallel the corresponding leads i.e. blue to blue, red to red, etc., in the two cables and measure the insulation resistance between each pair of paralleled leads and the actuator frame, also between each pair of paralleled leads and each other pair of paralleled leads. The reading in each instance must not be less than 50,000 ohms.

Functional tests

4. The actuator should be fitted to the test rig in accordance with the instructions contained in A.P.4343S, Vol. 1, Book 2, Sect. 8, Chap. 3, and connected to a d.c. supply, variable between 18 and 29 volts. The length of the stroke should be measured after the actuator is run on no-load to both the extended and retracted positions, and where necessary, the limit switch trip levers adjusted to bring the strokes within the relevant limits. The actuator should then be operated under the various loads and input voltages shown in the appropriate tables of this appendix, to check that its performance is within the tabulated limits. There should be no excessive vibration during the tests and the actuator should be inched in each direction to check that the brake functions satisfactorily.

Testing details for hand-wind, twin-motor Jaguar actuators, 500/1/00250

TABLE 1

Main Motor

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (0·87 in.) min.	max.	Maximum current (Amperes)
29	50	T.L.O.	1·04	1·28	2·50
29	50	C.L.O.	1·04	1·28	2·50
18	50	T.L.O.	1·90	2·40	2·30
18	50	C.L.O.	1·90	2·40	2·30

TABLE 1A

Auxiliary Motor

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (0·87 in.) min.	max.	Maximum current (Amperes)
29	50	T.L.O.	1·20	1·48	2·60
29	50	C.L.O.	1·20	1·48	2·60
18	50	T.L.O.	2·20	2·80	2·40
18	50	C.L.O.	2·20	2·80	2·40

TABLE 1B

Simultaneous operation of main and auxiliary motors

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (0·87 in.) min.	max.	Maximum current (Amperes)	Maximum error on centres dimensions
29	10	T.L.O.	0·53	0·72	5·25	
29	10	T.L.A.	0·52	0·71	5·05	
29	10	C.L.O.	0·53	0·72	5·25	
29	10	C.L.A.	0·52	0·71	5·05	
29	0	Extend	0·50	0·68	5·10	+0·025
29	0	Retract	0·50	0·68	5·10	−0·025
18	0	Extend	0·80	1·10	3·80	
18	0	Retract	0·80	1·10	3·80	

Testing details for hand-wind, twin-motor Jaguar actuators 500/1/01165

TABLE 2

Main Motor

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (0·75 in.) min.	max.	Maximum current (Amperes)
29	50	T.L.O.	1·04	1·28	2·50
29	50	C.L.O.	1·04	1·28	2·50
18	50	T.L.O.	1·90	2·40	2·30
18	50	C.L.O.	1·90	2·40	2·30

TABLE 2A

Auxiliary motor

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (0·75 in.) min.	max.	Maximum current (Amperes)
29	50	T.L.O.	1·20	1·48	2·60
29	50	C.L.O.	1·20	1·48	2·60
18	50	T.L.O.	2·20	2·80	2·40
18	50	C.L.O.	2·20	2·80	2·40

TABLE 2B

Simultaneous operation of main and auxiliary motors

Applied voltage	Load (lb)	Condition of load	Time in seconds for full strokes (0·75 in.) min.	max.	Maximum current (Amperes)	Maximum error on centres dimensions
29	10	T.L.O.	0·53	0·72	5·25	
29	10	T.L.A.	0·52	0·71	5·05	
29	10	C.L.O.	0·53	0·72	5·25	
29	10	C.L.A.	0·52	0·71	5·05	
29	0	Extend	0·50	0·68	5·10	+0·060
29	0	Retract	0·50	0·68	5·10	−0·060
18	0	Extend	0·80	1·10	3·80	
18	0	Retract	0·80	1·10	3·80	

TABLE 3

Main motor

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (2·0 in.) min.	max.	Maximum current (Amperes)
29	50	T.L.O.	2·1	2·8	2·60
29	50	C.L.O.	2·1	2·8	2·60
18	50	T.L.O.	4·0	5·4	2·40
18	50	C.L.O.	4·0	5·4	2·40

TABLE 3A

Auxiliary motor

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (2·0 in.) min.	max.	Maximum current (Amperes)
29	50	T.L.O.	2·2	3·0	2·70
29	50	C.L.O.	2·2	3·0	2·70
18	50	T.L.O.	4·4	6·0	2·50
18	50	C.L.O.	4·4	6·0	2·50

TABLE 3B

Simultaneous operation of main and auxiliary motors

Applied voltage	Load (lb)	Condition of load	Time in seconds for full stroke (2·0 in.) min.	max.	Maximum current (Amperes)	Maximum error on centres dimensions
29	10	T.L.O.	1·08	1·42	4·20	
29	10	T.L.A.	1·02	1·34	4·00	
29	10	C.L.O.	1·08	1·42	4·20	
29	10	C.L.A.	1·02	1·34	4·00	
29	0	Extend	1·04	1·36	4·00	+0·025
29	0	Retract	1·04	1·36	4·00	−0·025
18	0	Extend	1·54	2·06	3·20	
18	0	Retract	1·54	2·06	3·20	

T.L.O. Tensile load opposing
T.L.A. Tensile load assisting
C.L.O. Compressive load opposing
C.L.A. Compressive load assisting

Appendix 1

ACTUATOR, HAND-WIND, TWIN MOTOR JAGUAR VARIANTS PLESSEY PART NO. 500/1/00250

Actuator, hand-wind, twin motor Jaguar, Plessey Part No. 500/1/00250	*Ref. No.* 5W/4788
Voltage range	18 *to* 29*V d.c.*
Normal voltage	28*V d.c.*
Load, normal working	10 *lb.*
maximum working	50 *lb.*
maximum static	800 *lb.*
Rating at normal load	1·5 *minutes*
Operating frequency, maximum	10 *cycles/hour*
Ambient temperature range	−50 *to* +100 *deg. C*
Reduction gear ratio, one motor running	32: 1
effective, both motors running	16: 1
Centres dimensions, retracted	2·73+0·050 *in.* −0·070 *in.*
extended	3·60+0·070 *in.* −0·050 *in.*
Stroke	0·87+0·140 *in.* −0·100 *in.*
Overall dimensions, height	3·43 *in.*
width	3·80 *in.*
length	5·38 *in.*
Motors, Type 1606*H*/41 *(Part No.* 4CZ93666)	*Ref. No.*
Output	0·03 *h.p. at* 15,000 *rev/min*
Commutator dia., new	0·490 *to* 0·495 *in.*
after skimming (min)	0·470 *in.*
worn (min)	0·450 *in.*
Undercut mica intersegments, width	0·018 *to* 0·022 *in.*
depth	0·020 *to* 0·025 *in.*
Maximum eccentricity to shaft journal	0·0003 *in T.I.R.*
Bearing, drive end	*Hoffman* 4666 *Ref. No.* 2*A*/9501383
commutator end	*Hoffman* 463 *Ref. No.* 2*A*/9501186
Brushes	
Grade	*Type HAM. E.G.*14 *Ref. No.* 5*W*/1041
New length	0·355 *to* 0·385 *in.*
Minimum length	0·250 *in.*
Spring pressure	$3\frac{1}{2}$ *to* $4\frac{1}{2}$ *oz.*

1. This actuator, Plessey Part No. 500/1/00250 is as described in the main chapter, but differs from other actuators in the series, in length of stroke, centres dimensions and the position of cable outlets. The stroke and centres dimensions are given in the Leading Particulars of this appendix; the correct position of the cable outlets is shown in fig. 1 and fig. 6 of the main chapter.

Appendix 2

ACTUATOR, HAND-WIND, TWIN MOTOR JAGUAR VARIANTS PLESSEY PART NO. 500/1/01165

LEADING PARTICULARS

Actuator, hand-wind, twin motor Jaguar, Plessey Part No. 500/1/01165	*Ref. No.* 11*A*/6326
Voltage range	18 *to* 29*V d.c.*
Normal voltage	28*V d.c.*
Load, normal working	10 *lb.*
maximum working	50 *lb.*
maximum static	800 *lb.*
Rating at normal load	1·5 *minutes*
Operating frequency, maximum	10 *cycles/hour*
Ambient temperature range	−50 *to* +100 *deg. C*
Reduction gear ratio, one motor running	32: 1
effective, both motors running	16: 1
Centres dimensions, retracted	2·60+0·075 *in.* −0·140 *in.*
extended	3·350+0·150 *in.* −0·140 *in.*
Stroke	0·75+0·140 *in.* −0·000 *in.*
Overall dimensions, height	3·43 *in.*
width	3·80 *in.*
length	5·38 *in.*
Motors, Type 1606*H*/41 *(Part No.* 4*CZ*93666)	*Ref. No.*
Output	0·03 *h.p. at* 15,000 *rev/min*
Commutator dia., new	0·490 *to* 0·495 *in.*
after skimming (min)	0·470 *in.*
worn (min)	0·450 *in.*
Undercut mica intersegments, width	0·018 *to* 0·022 *in.*
depth	0·020 *to* 0·025 *in.*
Maximum eccentricity to shaft journal	0·0003 *in T.I.R.*
Bearing, drive end	*Hoffman* 4666 *Ref. No.* 2*A*/9501383
commutator end	*Hoffman* 463 *Ref. No.* 2*A*/9501186
Brushes	
Grade	*Type HAM. E.G.*14 *Ref. No.* 5*W*/1041
New length	0·355 *to* 0·385 *in.*
Minimum length	0·250 *in.*
Spring pressure	3½ *to* 4½ *oz.*

1. This actuator, Plessey Part No. 500/1/01165 is identical to the actuator described in the main chapter, except for the stroke and centres dimensions and the position of the cable outlets. The stroke and centres dimensions are given in the Leading Particulars of this appendix; the correct position of the cable outlets is shown in fig. 1.

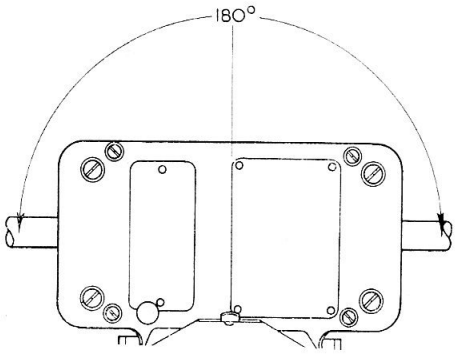

Fig. 1. Correct position of cable outlets

Appendix 3

ACTUATOR, HAND-WIND, TWIN MOTOR JAGUAR VARIANTS PLESSEY PART NO. 500/1/01660

LEADING PARTICULARS

Actuator, hand-wind, twin motor Jaguar, Plessey Part No. 500/1/01660	*Ref. No.* 5*W*/5054
Voltage range	18 *to* 29*V d.c.*
Normal voltage	28*V d.c.*
Load, normal working	30 *lb.*
maximum working	50 *lb.*
maximum static	800 *lb.*
Rating at normal load	1·5 *minutes*
Operating frequency, maximum	10 *cycles/hour*
Ambient temperature range	−50 *to* +100 *deg. C*
Reduction gear ratio, one motor running	32: 1
effective, both motors running	16: 1
Centres dimensions, retracted	2·73+0·148 *in.* −0·000 *in.*
extended	4·73+0·000 *in.* −0·010 in.
Stroke	2·00+0·000 *in.* −0·158 *in.*
Overall dimensions, height	3·43 *in.*
width	3·80 *in.*
length	5·38 *in.*
Motors, Type 1606*H*/41 *(Part No.* 4*CZ*93666)	*Ref. No.*
Output	0·03 *h.p. at* 15,000 *rev/min*
Commutator dia., new	0·490 *to* 0·495 *in.*
after skimming (min)	0·470 *in.*
worn (min)	0·450 *in.*
Undercut mica intersegments, width	0·018 *to* 0·022 *in.*
depth	0·020 *to* 0·025 *in.*
Maximum eccentricity to shaft journal	0·0003 *in T.I.R.*
Bearing, drive end	*Hoffman* 4666 *Ref. No.* 2*A*/9501383
commutator end	*Hoffman* 463 *Ref. No.* 2*A*/9501186
Brushes	
Grade	*Type HAM. E.G.*14 *Ref. No.* 5*W*/1041
New length	0·355 *to* 0·385 *in.*
Minimum length	0·250 *in.*
Spring pressure	$3\frac{1}{2}$ *to* $4\frac{1}{2}$ *oz.*

1. This actuator, Plessey Part No. 500/1/01660 is identical to the actuator described in the main chapter, except for the stroke and centres dimensions and the position of the cable outlets. The stroke and centres dimensions are given in the Leading Particulars of this appendix; the correct position of the cable outlets is shown in fig. 1.

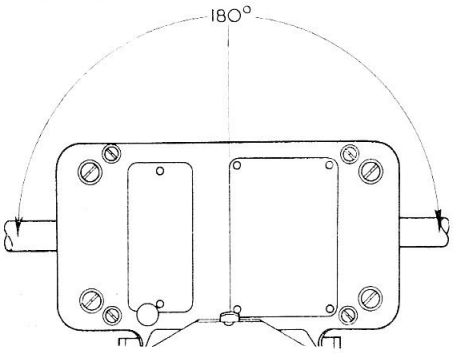

Fig. 1. Correct position of cable outlets

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