Chapter 96

ACTUATORS, PLESSEY, JAGUAR (WORM DRIVE) SERIES

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF APPENDICES

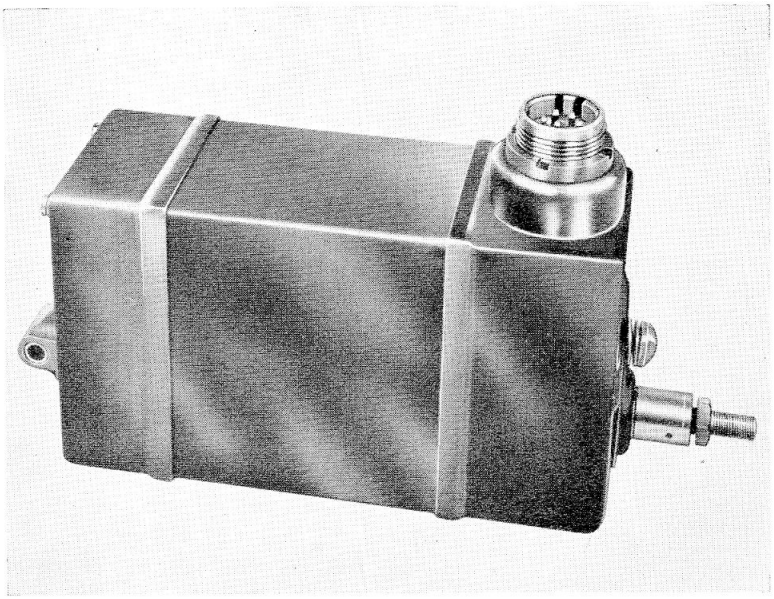


Fig. 1 General view of Jaguar actuator

Introduction

1. The Jaguar series of actuators are designed to provide remotely-controlled linear motion against tensile or compressive loads.

2. Basically the actuators in the worm drive range consist of a reversible motor which drives a leadscrew, threaded into a plunger, through a double worm reduction gear train. The travel of the plunger is controlled by two adjustable limit switches which are operated by the plunger. Electrical connections to the actuator are made through a plug which is mounted on the top of the front cover. An end fitting screwed on to the plunger provides one attachment point, the other being an end fitting secured to the rear of the actuator body.

3. Variants in this range differ in their plunger travel, gear ratio, leadscrew thread and end fittings. Details of these variants will be found in appendices to this chapter.

Note . . .

The servicing details given in this chapter are limited to the information available at the time of issue. More detailed and comprehensive servicing instructions will be issued later.

DESCRIPTION

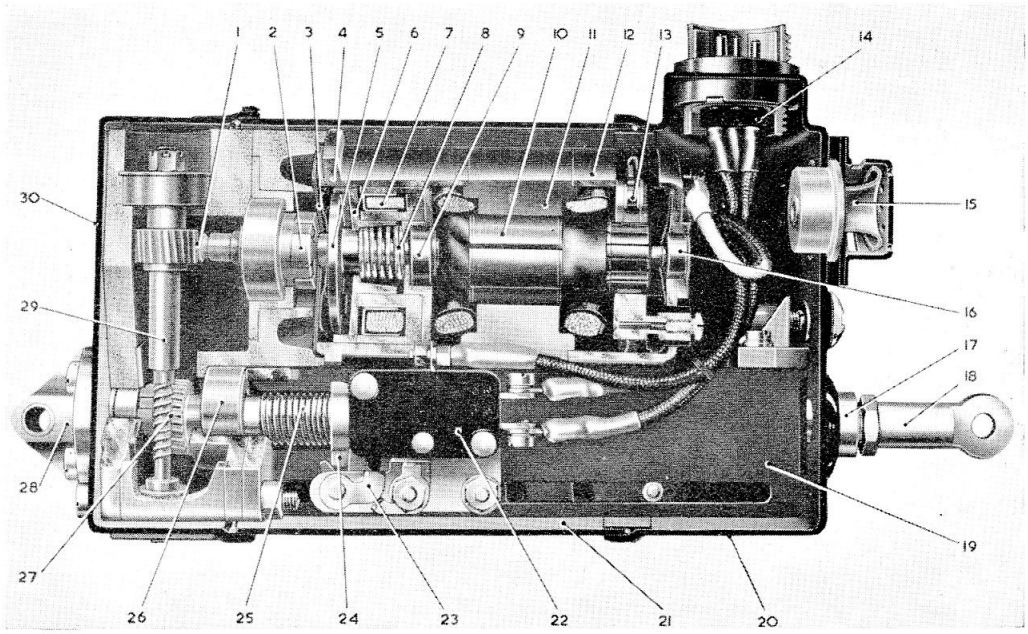
General

4. A general view of a typical Jaguar actuator is shown in fig. 1, and a unit in this worm drive range is shown sectioned in fig. 2.

Motor

5. The motor is series-wound and incorporates duplicate field windings, to permit reversible operation, and an electro-magnetic brake. The armature is supported in two ball bearings, one 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 casing in the drive-end housing, and the assembly is secured by two nuts at the commutator end. The brushgear is secured to the commutator-end housing 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 driving lugs



1 TOP WORM
2 DRIVE COUPLING
3 GREASE GUARD
4 MOTOR DRIVE-END HOUSING
5 BRAKE PLATE
6 BRAKE DISC
7 BRAKE COIL
8 BRAKE SPRING
9 DRIVE-END BEARING
10 ARMATURE
11 YOKE
12 COMMUTATOR-END HOUSING
13 BRUSHGEAR
14 PLESSEY PLUG
15 FLAME-TRAP AIR VENT (NOT FITTED TO ALL VARIANTS)
16 COMMUTATOR-END BEARING
17 PLUNGER
18 FRONT END FITTING
19 PLUNGER HOUSING
20 FRONT COVER
21 SPACER CASE
22 LIMIT SWITCH
23 SWITCH OPERATING MECHANISM
24 PLUNGER TORQUE-REACTION EAR
25 LEADSCREW
26 LEADSCREW BALL BEARING
27 BOTTOM WORM
28 REAR END FITTING
29 VERTICAL DRIVE SHAFT
30 REAR COVER

Fig. 2 Sectional view of Jaguar actuator

form an integral part of the brake plate which is secured to the drive end of the armature. The brake disc is prevented from rotating by two lugs on its periphery and is loaded by the brake spring.

Reduction gear train

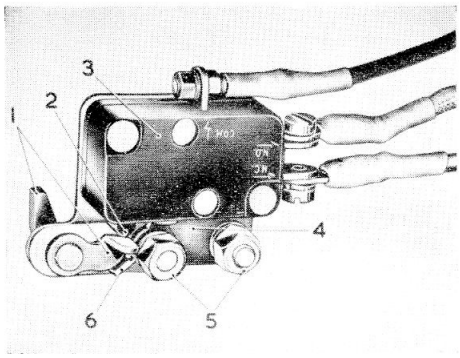
7. The drive from the driving lugs on the motor to the leadscrew is through a double worm reduction gear. The worms are located one at each end of a vertical drive shaft which transmits the drive from the motor to the leadscrew.

8. Ball bearings support the vertical drive shaft, the top horizontal shaft and the rearward extension of the leadscrew.

Leadscrew and plunger

9. The driven gear of the second worm is secured to the end of the leadscrew. An Acme, Whitworth or B.S.F. thread machined on the outside of the leadscrew and in the bore of the plunger serves to convert the rotary action of the leadscrew into linear movement of the plunger, causing the plunger to extend or retract. The plunger is prevented from rotating by integral torque-reaction ears which locate in slots in the plunger housing.

10. A large ball bearing supports the rear end of the leadscrew and plunger assembly while the front end of the assembly is supported in a plain bush. The outer end of the plunger is threaded to carry the front end fitting for attachment to the component being driven.



1 OPERATING ARMS
2 SWITCH PLUNGER
3 LIMIT SWITCH
4 MOUNTING PLATE
5 SECURING NUTS
6 SPECIAL WASHER AND STOP

Fig. 3 Limit switch assembly

Limit switches and operating mechanism

11. Plunger travel is controlled by two limit switches, mounted one on each side of the plunger housing. The switches are operated by a mechanism (*fig.* 3) which is tripped by one of the torque-reaction ears on the plunger.

12. At the preset limit of plunger travel, the lower torque-reaction ear comes into contact with the operating arm of the switch mechanism. Movement of this arm is transmitted through a transverse spindle to an operating arm on the outside which moves upwards to depress the limit switch plunger and so cut off the power supply to the motor.

13. Adjustment of plunger travel is made by altering the position of the limit switch assemblies along the slots in the sides of the plunger housing, so that the torque-reaction ear on the plunger contacts them earlier or later.

Electrical connections

14. The electrical connections to the actuator are made through a plug mounted on the top of the front cover.

15. The internal connections and a typical external circuit are shown in fig. 4.

End fittings

16. The rear end fitting is spigotted into the rear housing and is secured with screws. The front end fitting is screwed on to the front end of the plunger and is locked by a locknut. The type of end fitting used varies with the actuator type.

OPERATION

17. The motor rotates the leadscrew through the reduction gear train. The plunger, being threaded on to the leadscrew, is caused to extend or retract according to the direction of rotation of the leadscrew and is itself prevented from rotating by two integral torque-reaction ears which locate in slots in the plunger housing.

18. At the extremes of plunger travel, the contacts in one of the limit switches are opened by the switch operating mechanism, thereby cutting off the power supply to the motor; the brake incorporated in the motor prevents excessive overrun of the plunger. The reverse rotation is achieved by selecting the alternative position of the external control switch.

INSTALLATION

19. For details of an actuator installation in a particular aircraft, reference should be made to the appropriate aircraft Air Publication.

20. When fitting a new or overhauled unit, first check that the actuator is of the correct type for the installation; no adjustment of the plunger travel is possible in service since a special test rig is used to obtain the required

accuracy. Check that the actuator has not been damaged in transit, that all external screws, nuts and bolts are fully tightened, and that the necessary fittings are available for securing the actuator to its associated component. Ensure that the plunger of the actuator and the drive shaft of the associated component are correctly positioned before coupling them together.

21. After the actuator has been installed, check the security of the installation and operate the actuator to ensure that it functions correctly.

SERVICING

22. These actuators are fully lubricated during manufacture or overhaul and require no internal re-lubrication during their overhaul life. A thin film of grease should be maintained on the plunger, and any external fittings should be kept well lubricated with a low-temperature grease.

23. During routine inspection, carried out in accordance with the appropriate Aircraft Servicing Schedule, the actuator should be examined for signs of damage. All external nuts, screws and bolts and the mounting of the unit should be checked for security. The actuator should then be operated over its full range in both directions to ensure that it functions satisfactorily.

24. An insulation resistance test can be carried out with the actuator installed in the aircraft. Using a 250-volt insulation tester, the resistance must not be less than 50,000 ohms.

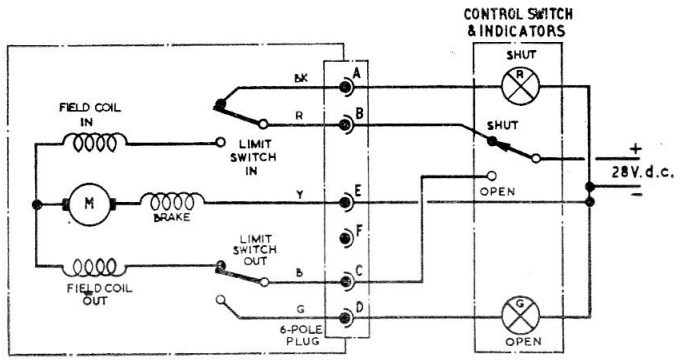


Fig. 4 Typical circuit diagram

Appendix 1

ACTUATOR, PLESSEY, TYPE 1CZ 135460/A

LEADING PARTICULARS

Actuator, Plessey, Type 1CZ 135460/A ..	Ref. No. 5W/2635
Operating voltage range	18 *to* 29*V d.c.*
Normal voltage	28*V d.c.*
Working load—normal	120 *lb.*
maximum	150 *lb.*
Maximum static load	800 *lb.*
Current consumption (normal load)	1·55 *amp*
Rating (normal load)	3 *minutes*
Plunger travel	3 *in.*
Centres—retracted	7·86 *in.*
extended	10·86 *in.*
Time for 3 *in. travel*	2 *minutes (approx.)*
End fittings—front	*Not supplied*
rear	*CZ* 54077
Ambient temperature range	—60°*C to* +90°*C*
Motor, Type C 1606*B*/8	*Ref. No.* 5*W*/3466
Output	0·0155 *h.p. at* 15,500 *r.p.m.*
Commutator dia., new	0·490 *to* 0·495 *in.*
*worn**	0·450 *in.*
Undercut micas, depth	0·020 *to* 0·025 *in.*
width	0·024 *to* 0·026 *in.*
Maximum eccentricity	0·0003 *in. T.I.R.*
Bearings, Type, drive end	*Hoffman No.* 4666
comm. end	*Hoffman No.* 463
Brushes, Type	*High-altitude; carbon grade CM5H (Morgan Crucible Co. Ltd.)*
Length, new	0·355 *to* 0·385 *in.*
worn	0·250 *in.*

* *After skimming to* 0·470 *in.*

The basic construction of this actuator is as described and illustrated in the main chapter. This particular variant has an 18 t.p.i. Acme thread machined on the outside of the leadscrew and in the bore of the plunger, and a flame-trap type air vent is fitted on the front cover.

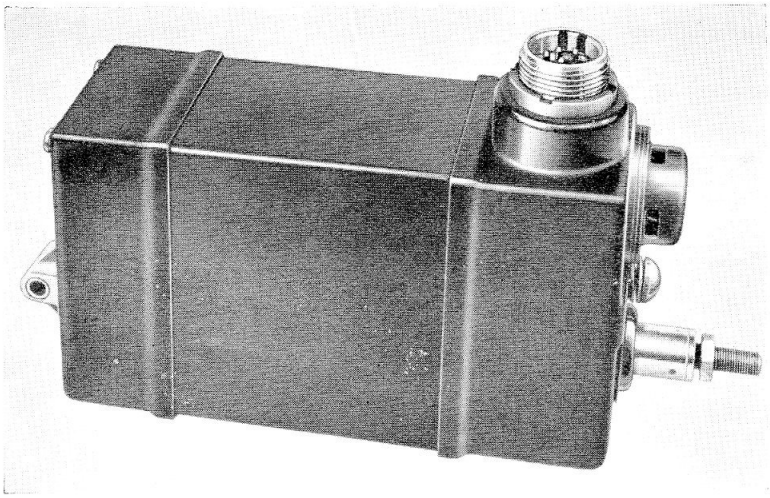


Fig. 1 Actuator, Type 1CZ 135460/A

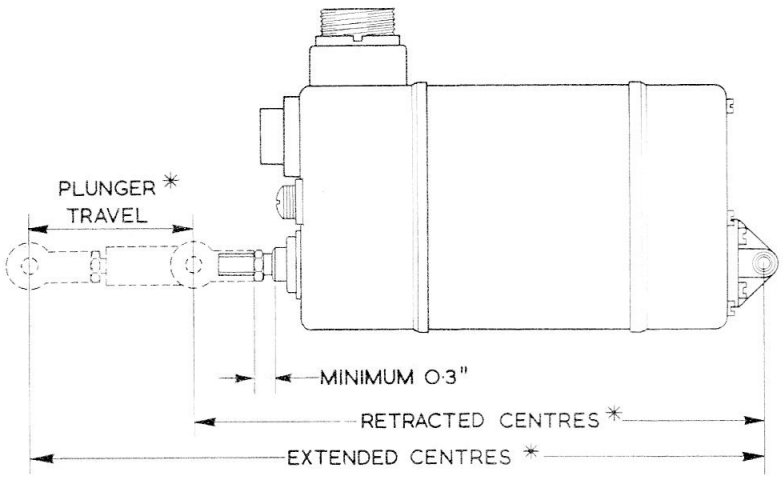


Fig. 2 Installation details