Chapter 9

ACTUATORS, WESTERN, IN-LINE, TYPE EJ SERIES

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Introduction

1. Western linear actuators of the EJ series are used to provide a thrust or pull for situations requiring a linear movement under remote control. The different situations necessitate some variations of actuator mounting, length of stroke and time of stroke at nominal load. Details of variants in this series are given in appendices to this chapter.

DESCRIPTION

2. The actuator consists basically of a fractional horse-power motor, epicyclic gearing and worm-operated piston (*fig.* 2). It is constructed with the motor axis coincident with the axis of the piston, the gearing coming between piston and motor. The assembly as a whole is sealed against the ingress of dust, oil, moisture, etc.

3. Internal electrical wiring is brought out to a 3-pole plug mounted on the inclined inlet of the housing. A typical circuit diagram is given in fig. 3.

Motor

4. The motor is a reversible series split field type and operates from a d.c. supply ranging from 25 to 29 volts. Only one pole winding is energized at any one time dependent upon the direction of rotation selected. It is encased in a cylindrical housing and is secured between two end plates by tie rods. These end plates house the ball races in which the armature rotates and the rear end plate also forms a housing for the brake coil. The brush gear is mounted on the inner face of the rear end plate; the brushes are high altitude electrographitic type with adjustable spring pressures. The complete brush assembly can be rocked radially to equalize speeds in both directions of rotation.

Brake

5. The brake comprises a spring-loaded brake shoe with a friction lining on one face. The lined face is adjacent to the face of the brake disc which is fixed to the armature shaft. The brake shoe can only move longitudinally and the brake disc rotates with the shaft. Operation of the brake is controlled by the brake solenoid which is connected in series with the armature and field windings.

Gear train and piston

6. Bolted to the motor end cap is the multi-stage epicyclic gear train contained within an annulus. The worm shaft rotates in a ball race and engages directly into the internally screwed shank of the piston. Two ears integral with the piston engage in longitudinal slots in the housing and restrict the piston to a linear motion. The total reduction ratio for each type in this series will be found in the appropriate appendix to this chapter.

Fig. 1. General view of actuator

End fittings

7. The actuator is secured at the fixed end by means of a bolt passing through two fixed lugs integral with the motor housing. Moving end fittings depend upon individual requirements and details will be found in the appropriate appendix to this chapter.

Limit switches

8. Two snap action limit switches are fitted on opposite sides inside the housing and are operated by an ear integral with the piston. Switching of the actuator takes place at the fully extended and fully retracted positions of the piston.

OPERATION

9. The motor is of conventional design and has its rotary output transmitted and translated into a linear motion by the epicyclic gear train driving a worm-operated piston. The worm extends and retracts the piston, the latter being located at one end of the actuator. Two limit switches break the motor circuit and control the limits of the piston at each end of its travel.

10. On breaking the motor circuit, overrun of the armature is prevented by a magnetic brake. The brake solenoid is energized by the motor supply and holds the spring-loaded brake shoe away from the braking disc fixed to the armature shaft. As soon as the supply is discontinued, however, the brake shoe springs back and engages the brake disc, thus limiting the shaft overrun.

INSTALLATION

11. Installation of the actuators in the aircraft may be anywhere and in any position subject to an ambient temperature range of —60 to +90 deg. C. For details of individual installations, reference should be made to the appropriate Aircraft Handbook.

SERVICING

12. Actuators in the EJ series should be serviced in accordance with the general chapter in A.P.4343, Vol. 1, Sect. 17, Chap. 2 and the instructions contained in the relevant Servicing Schedule. Dismantling and assembling instructions can be found in A.P.4343D, Vol. 6, Sect. 14.

13. Ensure that all external nuts, screws and locking devices are secure. Examine

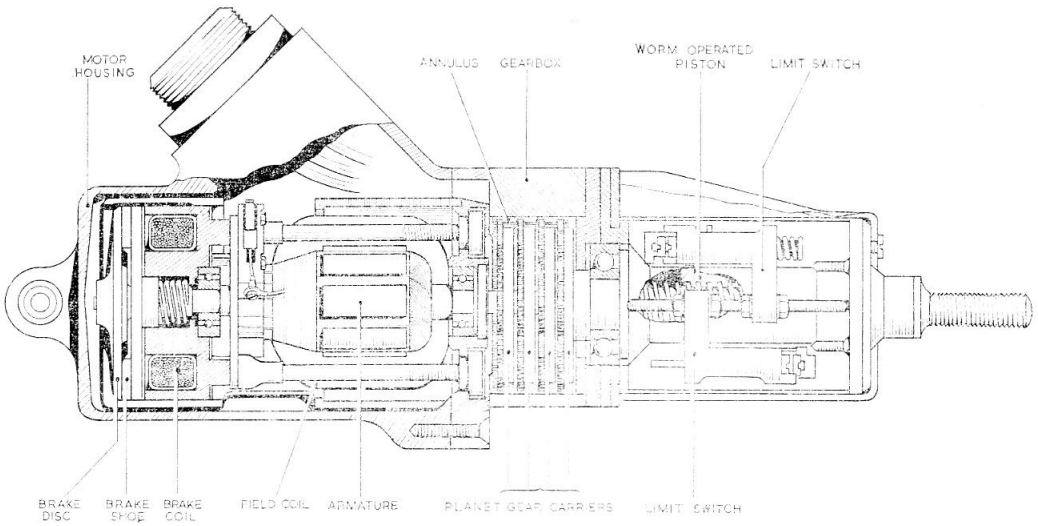

Fig. 2. Sectional view of actuator

the electrical connections to the actuator for security and freedom from damage. These actuators are lubricated during manufacture and should require no further attention between the appropriate overhaul periods.

Brushes

14. Motor servicing is normally restricted to brush inspection. Brushes should be examined for signs of wear and excessive sparking. In all cases brushes should be renewed before they are unduly worn.

Testing

15. A functional test should be performed using the Test Rig described in A.P.4343S, Vol. 1, Sect. 16. The maximum current consumption and the time the piston takes to complete its travel for a given load should not exceed the values given for individual actuators in the appropriate appendix to this chapter.

Insulation resistance test

16. The insulation resistance should be measured with a 250-volt insulation resistance tester. This should be accomplished by testing between each terminal of the connector plug in turn and the actuator body. A reading of at least 500,000 ohms (R.N.) or 50,000 ohms (R.A.F.) should be obtained for each test.

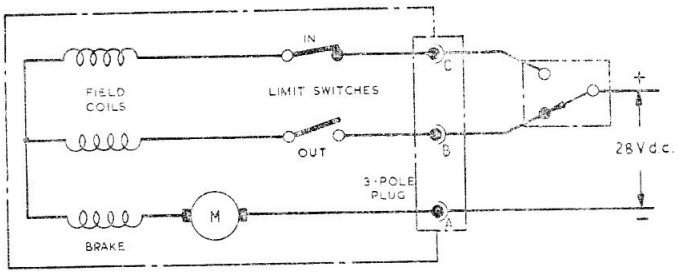

Fig. 3. Typical circuit diagram

Appendix 1

ACTUATORS, TYPES EJ 25, Mk. 1A, B, C, D AND E

LEADING PARTICULARS

Type EJ 25, Mk. 1A	*Ref. No. 5W/879*
Type EJ 25, Mk. 1B	*Ref. No. 5W/691*
Type EJ 25, Mk. 1C	*Ref. No. 5W/1037*
Type EJ 25, Mk. 1D	*Ref. No. 5W/2317*
Type EJ 25, Mk. 1E	*Ref. No. 5W/2850*
Voltage range	25 *to* 29*V d.c.*
Nominal voltage	28*V d.c.*
Normal working load	25 *lb.*
Current at normal working load	0·85 *amp.*
Maximum working load	50 *lb.*
Stalling load	100 *lb.*
Stall current	2·25 *amp.*
Length of stroke	1·0 *in.*
Time of stroke at normal load	3·5 *sec.*
Time rating of motor	1 *minute*
Fixing centres, Types EJ 25, Mk. 1A and E	
Extended	7·35 $^{+0·01}_{-0}$ *in.*
Retracted	6·35 $^{+0}_{-0·01}$ *in.*
Fixing centres, Type EJ 25, Mk. 1B	
Extended	7·03 ±0·02 *in.*
Retracted	6·03 ±0·02 *in.*
Fixing centres, Types EJ 25, Mk. 1C and D	
Extended	7·16 ±0·02 *in.*
Retracted	6·16 ±0·02 *in.*
Worm	*Two start*
Ambient temperature range	—60 *to* +90 *deg. C.*
Maximum altitude	60,000 *ft.*
Weight	1 *lb.* 10 *oz.*

1. The actuators, Type EJ 25, Mk. 1A, B, C, D and E, are rated to operate for one minute at a nominal load of 25 lb. with a current consumption not exceeding 1 amp.

2. The gearbox embodies a three stage epicyclic gear train, providing a total reduction ratio of 78·6 : 1. The typical circuit diagram in the main chapter is applicable to these actuators.

3. The main differences between these Mk. 1 actuators are as follows: —

(1) Mk. 1A and E are secured at the moving end by a bolt passing through a self-aligning eye, and at the fixed end by a trunnion held in position by a bolt passing through two fixed lugs, which are integral with the motor housing. A 3-pole plug, Type CZ48993 is fitted to both actuators, but with the EJ 25 Mk. 1E, the pin location insert is orientated to position 5, and the plug is then designated CZ48993/5.

(2) Mk. 1B is secured at the moving end by means of a $\frac{1}{4}$ in. screwed plug, and at the fixed end by a special bolt passing through two fixed lugs integral with the motor housing.

(3) Mk. 1C and D are secured at the moving end by means of a bolt passing through a self-aligning eye and at the fixed end by a bolt passing through two fixed lugs integral with the motor housing. The only difference between these two actuators is that the Mk. 1D is provided with drain holes in the limit switch cover and the motor housing.

SERVICING

4. Two types of carbon brushes are available for these actuators, i.e. Part No. 0211033 (Ref. No. 5W/604), and Part No. 0211949 (Ref. No. 5W/3902). Either type of brush may be used, but only one type can be used in one actuator i.e. the types must not be mixed in one actuator.

5. The maximum current consumption and the time the piston takes to complete its 1·0 in. travel should not exceed the values given in the following table :—

Type EJ 25	*Actuator load (lb.)*	*Max. time (sec.)*	*Max. current (amp.)*
Mk. 1A and E	0	3·3	0·9
	12	3·42	0·95
	25	3·5	1·0
Mk. 1B, C and D	0	3·43	0·8
	25	3·875	1·0
	37	4·0	1·1

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