Chapter 72

ACTUATORS, ROTAX, A1800 SERIES

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Introduction

1. Actuators in the A1800 series are designed for general application in aircraft having a 28V d.c. supply. Details of particular types within the series will be found in Appendices to this Chapter.

DESCRIPTION

2. A typical unit in the series is illustrated in fig. 1 and 2. The actuator is of in-line construction and embodies two identical reversible motors (main and auxiliary), each driving the screwshaft through an epicyclic gearbox. An electro-magnetic brake, a single plate clutch, and snap action limit switches are provided for each motor.

Motors

3. The motors are 28V d.c. split series field type, one field being used for each direction of rotation. The poleshoes and yoke are integral, being manufactured from one set of laminations. The two brushes for each motor are mounted on a moulded brushgear assembly, which is fitted to the commutator end frame by means of two screws. The motor armatures are supported at each end by ball bearings.

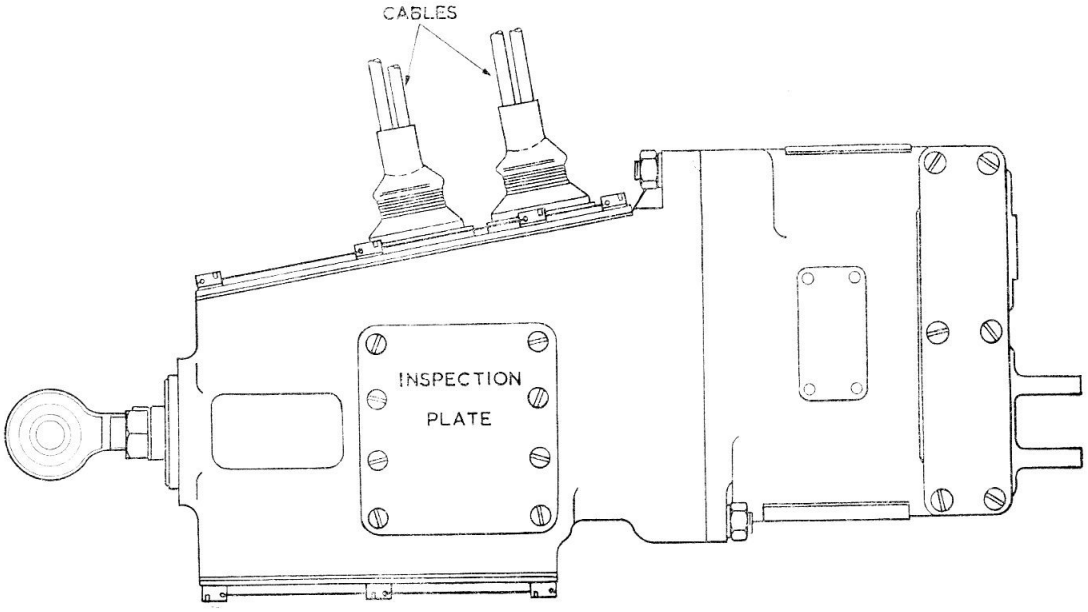

Fig. 1. Side view of typical A1800 series actuator

Brake and clutch

4. At the drive end of each motor is a disc type electro-magnetic brake. The brake disc is floating on the extended armature shaft and relative rotation between shaft and brake disc is prevented by three dowel pins, and twelve helical springs locating in the corresponding number of holes in the brake solenoid assembly apply a load to the brake disc. A tropicalized Langite brake lining is bonded to the brake disc. The brake coil is connected in series with the armature, so that when the motor is switched on, the coil is energized and attracts the brake disc against the force of the helical springs. When the motor is switched off, the coil is de-energized and the brake disc is forced back against the driving plate. Located on the extended armature shaft between the brake coil and brake disc is the single plate spring loaded clutch which is used to dissipate stored energy in the armature when the brake is applied.

Gearbox

5. The main motor gearbox is of four stage epicyclic construction with a revolving annulus in the first stage. The drive from the auxiliary motor is taken via an idler to the revolving annulus of the first stage and then through the following stages of the gearbox to the screwshaft. The fixed annulus which houses the three final trains, slides into the rear end of the screwshaft, housing and is secured by two rivets. The first, second and third planetary trains each comprise three planet pinions mounted on studs and held by means of a securing washer and riveted to their respective planet carriers. The carriers are integral with the second, third and fourth sun gears respectively. The fourth planet train is mounted in the same manner to the screwshaft flange. Spacing between each planet assembly and its relative sun gear is effected by a single steel ball located in a recess in the sun gear, except in the first gear where the ball is spring loaded.

Screwshaft

6. The screwshaft is a hardened steel rod with a semi-circular helical groove running down its entire length. Integral with the rear end is a flange, ground with a 45 degree chamfer on each side. This flange is supported by two thrust bearings composed of the two 45 degree chamfers, two sets of balls and two outer bearings. The ram which is hollow and fits over the screwshaft is also

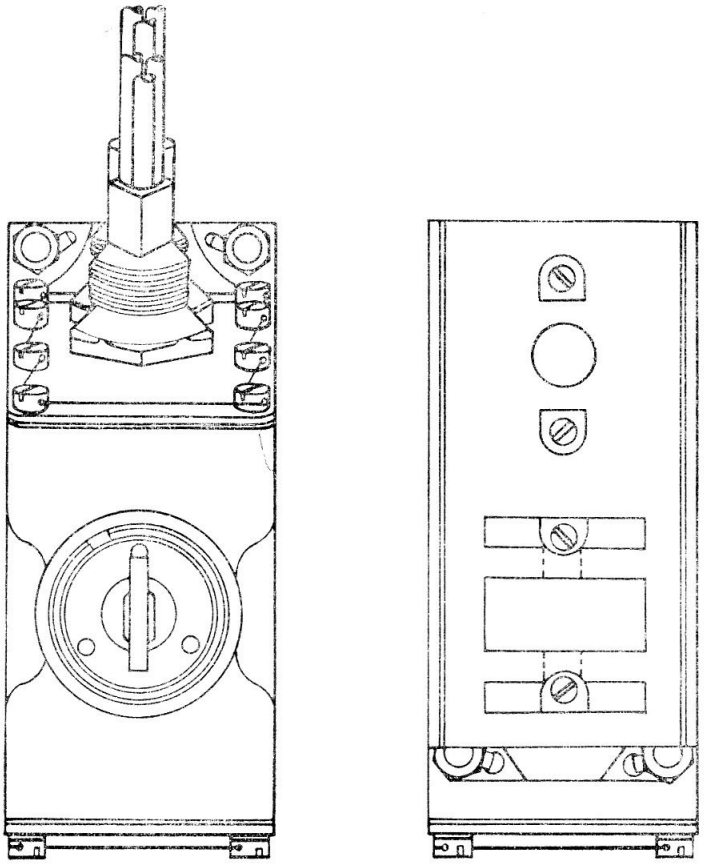

Fig. 2. End views of typical A1800 series actuator

machined internally with a semi-circular helical groove, but the screw in this instance extends approximately two turns only and the ends of two complete turns are connected by a short length of steel channel soldered into a slot on the inside of the ram. When assembled, these two turns are each completely filled with steel balls and during operation, the balls are diverted by the two channel pieces from the end of each turn back to the start of the same turn. With this arrangement there are two complete turns of continuously recirculating balls. At the rear end of the ram are two short rows of steel balls, each row fitted into countersinks in the side of the ram. These balls run in two straight grooves machined in the walls of the ram housing. They prevent rotation being imparted to the ram by the motion of the screw, and from setting up torque reaction in aircraft members and external linkage. Also, they provide a low resistance bearing for the linear motion of the ram. Mechanical stops are provided at each end of the ram housing to prevent excessive overrun of the ram.

Limit switches

7. The moulded limit switch plate assemblies are secured by two screws each in compartments above the ram housing. For adjustment of the switches, slotted securing screw holes are provided. Chamfers

on top of the ram at the rear end operate the switch plungers at the fully retracted and extended positions.

INSTALLATION

8. The actuators may be mounted in any attitude and are supported by their shackles. The external electrical connections are via uniefglas 16 (Ref. No. 5E/3878), 4 ft. in length.

SERVICING

9. This actuator 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.

Brushgear

10. The minimum length beyond which brushes should not be used is 0·2 in. Brushes should be renewed at periods prescribed in the relevant Servicing Schedule and whenever examination reveals that they will not remain serviceable for the period that must elapse before the next servicing.

11. Brush spring pressure, measured with tension gauge Ref. No. 1H/59, should be between $2\frac{1}{2}$ and $3\frac{1}{2}$ oz. (71 and 99 gm.) when measured $0{\cdot}062 \pm 0{\cdot}010$ in. above the top of the brush box.

Insulation resistance test

12. The insulation resistance, when measured with a 250 volt insulation resistance tester between all live parts and the frame, should be not less than 50,000 ohms.

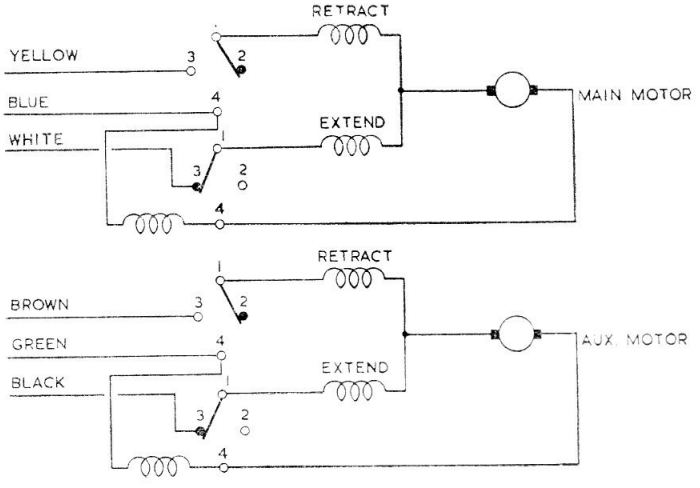

Fig. 3. Diagram of typical internal connections

Appendix 1

ACTUATOR, ROTAX, TYPE A1802

LEADING PARTICULARS

Actuator, Type A1802	*Ref. No. 5W/*
Operating voltage	28*V d.c.*
Current rating	2·25 *amp.*
Normal working load	10 *lb.*
Maximum static load	1,000 *lb.*
Working speed	1·9 *in. in* 5 ± 1 *sec.*
Auxiliary motor working speed	1·9 *in. in* 15 *sec.*
Temperature range	−55 *deg. C. to* +90 *deg. C.*
Overall dimensions	
Fully extended (shackle centres)	11·540 *in.*
Fully retracted (shackle centres)	9·640 *in.*
Width	1·750 *in.*
Height	4·156 *in.*
Minimum permissible brush length	0·2 *in.*
Brush grade	*Morganite DM4A*
Brush spring pressure	2·5 *to* 3·5 *oz.*
Weight	4 *lb.* 6 *oz.*

1. The actuator, Type A1802, is identical to that described and illustrated in the main Chapter. It is suitable for operation down to −55 deg. C. and details of operation are as given in Leading Particulars.

Appendix 2

ACTUATOR, ROTAX, TYPE A1803

LEADING PARTICULARS

Actuator, Type A1803	*Ref. No. 5W/2791*
Operating voltage	*28V d.c.*
Current rating	*2·25 amp.*
Normal working load	*10 lb.*
Maximum static load	*1,000 lb.*
Length of stroke	*1·9 in.*
Time of travel	
Main motor	6 ± 1 *sec.*
Auxiliary motor	12 ± 2 *sec.*
Temperature range	-40 *deg. C. to* $+90$ *deg. C.*
Overall dimensions	
Fully extended (shackle centres)	*11·540 in.*
Fully retracted (shackle centres)	*9·640 in.*
Width	*1·750 in.*
Height	*4·156 in.*
Minimum permissible brush length	*0·2 in.*
Brush grade	*Morganite DM4A*
Brush spring pressure	*2·5 to 3·5 oz.*
Weight	*4 lb. 6 oz.*

1. The actuator, Type A1803, is similar to that described and illustrated in the main Chapter. It is suitable for operation down to -40 deg. C. and details of operation are as given in Leading Particulars.

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