Chapter 80

ACTUATORS, ROTAX, A1000 SERIES

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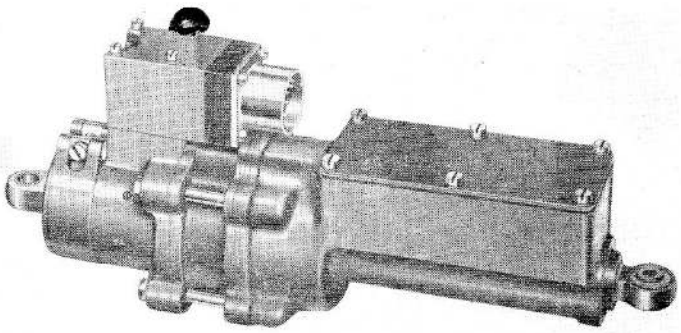

Fig. 1. Typical A1000 series actuator

Introduction

1. Linear actuators in the A1000 series are designed for use in 28-volt d.c. systems, for general application in the control of aircraft ancillary equipment.

DESCRIPTION

2. A typical actuator is illustrated in fig. 1. In general, these units comprise six main assemblies, viz., motor, clutch, electro-magnetic brake, gearbox, ram and screw-shaft and limit switch arrangement.

Motor

3. The actuator consists of a 28 volt split series field wound type machine. The armature is supported at the commutator end by a ball bearing contained in the motor housing assembly. The other end of the armature shaft extends through an Oilite bush in the brake assembly, the drum of which runs in a ball bearing situated in the intermediate gear housing.

Clutch

4. The spring loaded single plate clutch is located on the armature shaft between the Oilite bush and the armature windings. The clutch plate is formed integrally with a sleeve that is free to slide on the shaft, but is prevented from rotating about it by a driving pin through the armature shaft engaging two slots in the sleeve. The driving pin also serves to retain the clutch spring which is located on the armature shaft between the pin and the armature core end face. The clutch spring normally bears against the driving plate sleeve. A machined boss on the inner face of the brake drum body is used as a clutch driven plate.

Electro magnetic brake

5. The electro magnetic brake is located on the armature shaft extension, between the brake drum and anchored to the brake housing by four screws. The brake has an eight pole spider, the eight poles being arranged in four pairs, each pair of poles controlling one brake shoe. The latter are equally spaced around the poles. The outer faces of the brake shoes are cork lined, and are forced by the brake loading springs against the inner periphery of the brake drum, when the motor is de-energized. The inner periphery of the brake shoes are copper plated to counteract any tendency to stick to the pole faces, due to residual magnetism, when the motor is at rest.

Gearbox

6. The gearbox comprises a three stage epicyclic gear train, the total reduction between the motor and ram being 166·5:1. Each planet carrier assembly is lightly loaded axially against the other by means of a spring loaded ball housed in the centre stage planet carrier. Bearing surfaces are provided by phosphor bronze washers between the second and third stage planet carriers.

Ram and screwshaft

7. The ram assembly is of the re-circulating ball type, the ball providing a bearing surface between the ram and the screwshaft, thereby cutting frictional losses to a minimum. Torque reaction between the hollow ram and the screwshaft is controlled by two sets of guide balls located in diametrically opposite grooves in the ram housing.

Limit switches

8. Two limit switches are contained in a housing cast integrally with the ram housing, and are operated by spring loaded plungers, actuated by a cam ground into the root of the ram.

Electrical connections

9. Electrical connection to the actuator is made via a standard 5-pole plug (Ref. No. 5X/6016). It may be mounted in one of three positions, as shown in fig. 2; the code number has either no suffix, or suffix A, or suffix B, as an indication of the plug mounting position.

Operation

10. Assume the ram to be in the fully

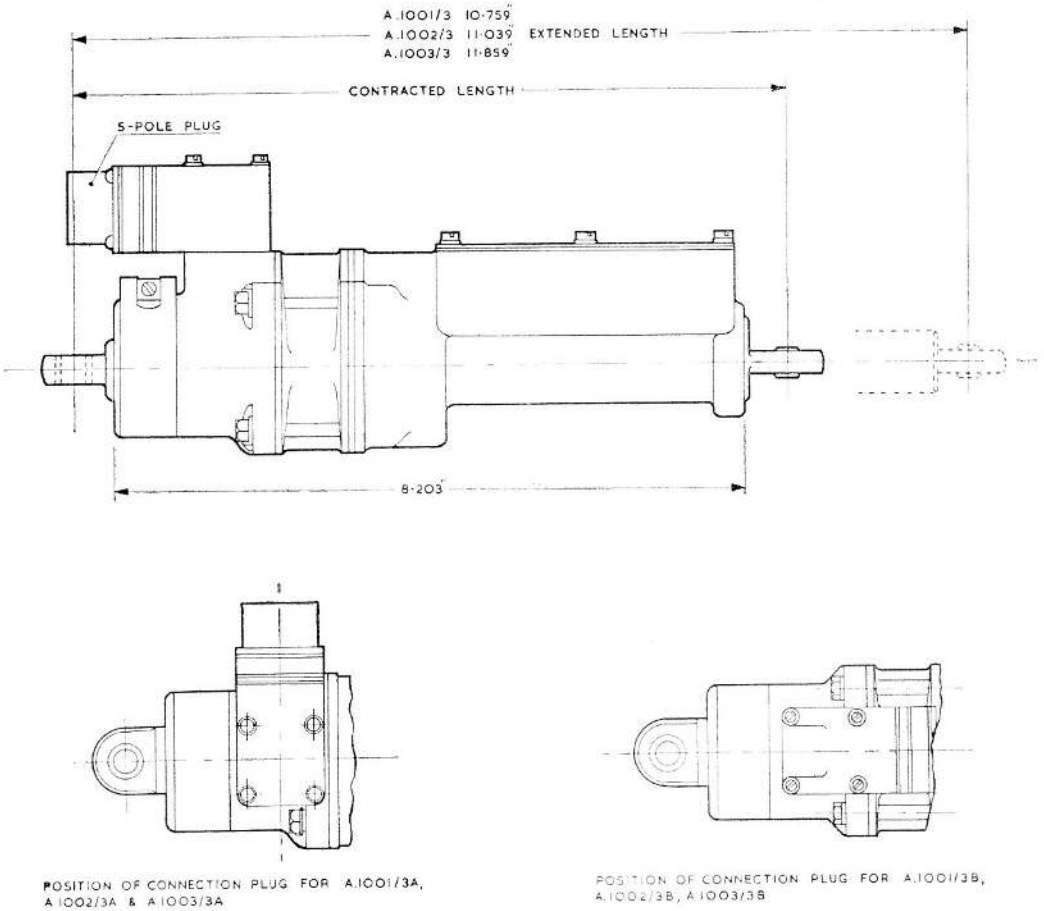

Fig. 2. Plug mounting positions

extended position, with the "OUT" limit switch "OPEN" and the "IN" limit switch "CLOSED"; as shown in fig. 3. The brake shoes, under these conditions, are held against the brake drum by their loading springs. When the external selector switch is operated, current flows through the "IN" limit switch, through the brake coil, armature and the "retract" field coil. The energized brake coil attracts the brake shoes against the tension of the springs, allowing the armature, and through the clutch, the brake drum to revolve.

11. The sun gear on the brake drum transmits the movement through the gear train to the ram which retracts until (actuated by a limit switch cam) the "IN" limit switch opens and breaks the supply. At any intermediate position both limit switches are closed; i.e., the "IN" limit switch being at position 3 (*fig.* 3) and the "OUT" limit switch being at position 2. Operation of the external selector switch will now extend or retract the ram as required.

INSTALLATION

12. Information concerning the installation of this actuator will be found in the aircraft manual relating to the equipment with which the actuator is being used. Although mounting in any position is permissible, the following points should be observed:—

Prior to installation, a check should be made on the associated equipment to ensure freedom of movement and that a complete operation will not be restricted.

On completion of the installation the unit should be given an operational run to ascertain that the actuator is functioning correctly.

SERVICING

13. These actuators 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

14. The minimum length beyond which the brushes should not be used is 0·260 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.

15. Brush spring pressure, measured with a tension gauge (Ref. No. 1H/59), should be between $2\frac{1}{2}$ and $3\frac{1}{2}$ oz. (71 and 99 gm.).

Insulation resistance test

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

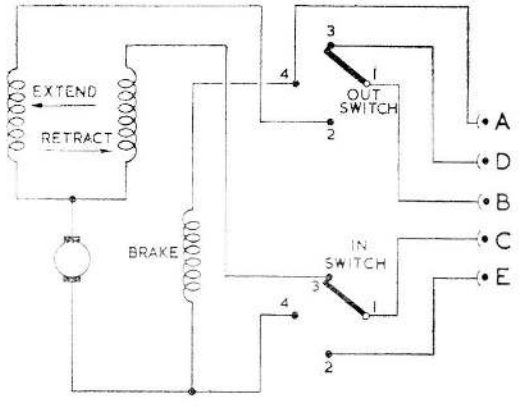

Fig. 3. Wiring diagram

Appendix 1

ACTUATOR, ROTAX, TYPE A1001/3

LEADING PARTICULARS

Actuator, Type A1001/3	*Ref. No. 5W/*
A1001/3A	*Ref. No. 5W/*
A1001/3B	*Ref. No. 5W/*
Voltage	28 *volts d.c.*
Normal load	275 *lb.*
Maximum static load	750 *lb.*
Maximum load	400 *lb.*
Stall load	650 *lb.*
Max. factored load	1,000 *lb.*
Current	4·15 *amp.*
Current (max. load)	4·65 *amp.*
Stall current	6·51 *amp.*
Travel	1·400 *in.*
Time for travel	5·5 *sec. (max.)*
Maximum overrun	0·020 *in.*
Rating	10 *cycles at 275 lb. load*
Operating temperature range	−40 *deg. C. to* +90 *deg. C.*
Minimum brush length	0·260 *in.*
Brush grade	*(Morganite) C.M.5-B-HAM*
Brush spring pressure	$2\frac{1}{2}$ *to* $3\frac{1}{2}$ *oz. (71 and 99 gm.)*
Distance between centres : —	
Retracted	9·359 *in.*
Extended	10·759 *in.*
Overall dimensions : —	
Height	4·03 *in.*
Width	2·25 *in.*
Length (when fully retracted)	10·169 *in.*
Weight	2 *lb.* 14 *oz.*

1. The A1001/3 actuator is similar to that described and illustrated in the main chapter. If differs from others in the series in that the travel is 1·4 in. in 5·5 sec. (max.).

2. The A1001/3 differs from the earlier A1001/2 in having a redesigned ram, which was introduced to increase the retract mechanical stop clearance.

3. A redimensioned gearbox has been introduced to reduce the maximum amount of end float on the gear train. New brake shoe springs are also provided to increase the brake static torque.

4. The connection plug positions for the A1001/3, /3A and /3B are as shown in fig. 3 of the main chapter.

Appendix 2

ACTUATOR, ROTAX, TYPE A1002/3

LEADING PARTICULARS

Actuator, Type A1002/3	*Ref. No. 5W/*
A1002/3A	*Ref. No. 5W/*
A1002/3B	*Ref. No. 5W/2849*
Voltage	28 *volts d.c.*
Normal load	275 *lb.*
Maximum static load	750 *lb.*
Maximum load	400 *lb.*
Stall load	650 *lb.*
Max. factored load	1,000 *lb.*
Current	4·15 *amp.*
Current (max. load)	4·65 *amp.*
Stall current	6·51 *amp.*
Travel	1·680 *in.*
Time for travel	6·6 *sec. (max.)*
Maximum overrun	0·020 *in.*
Rating	8 *cycles*
Operating temperature range	−40 *deg. C. to* +90 *deg. C.*
Minimum brush length	0·260 *in.*
Brush grade	*(Morganite) C.M.5-B-HAM*
Brush spring pressure	$2\frac{1}{2}$ *to* $3\frac{1}{2}$ *oz.* (71 *and* 99 *gm.*)
Distance between centres : —	
Retracted	9·359 *in.*
Extended	11·039 *in.*
Overall dimensions : —	
Height	4·03 *in.*
Width	2·25 *in.*
Length (when fully retracted)	10·169 *in.*
Weight	2 *lb.* 14 *oz.*

1. The A1002/3 actuator is similar to that described and illustrated in the main chapter. It differs from others in the series in that the travel is 1·68 in. in 6·6 sec. (max.).

2. The A1002/3 differs from the earlier A1002/2 in having a redesigned ram, which was introduced to increase the retract mechanical stop clearance.

3. A redimensioned gearbox has been introduced to reduce the maximum amount of end float on the gear train. New brake shoe springs are also provided to increase the brake static torque.

4. The connection plug positions for the A1002/3, /3A and /3B are as shown in fig. 3 of the main chapter.