

Chapter 1

ACTUATORS, ROTAX, A1100 SERIES

LIST OF CONTENTS

	Para.		Para.
<i>Introduction</i>	1	<i>Housings and covers</i>	14
Description	2	<i>Electrical connections</i>	15
<i>Motors</i>	3	Functioning	16
<i>Brake and clutch</i>	5	Servicing	19
<i>Gearboxes</i>	8	<i>Lubrication</i>	22
<i>Ram and screwshaft</i>	11	<i>Insulation resistance test</i>	23
<i>Limit switches</i>	12	<i>Final inspection</i>	24

LIST OF ILLUSTRATIONS

	Fig.
<i>Typical A1100 series actuator</i>	1
<i>Sectional view</i>	2
<i>Typical circuit diagram</i>	3

LIST OF APPENDICES

	App.		App.
<i>Actuator, Rotax, Type A1101</i>	1	<i>Actuator, Rotax, Type A1102/2</i>	2

RESTRICTED

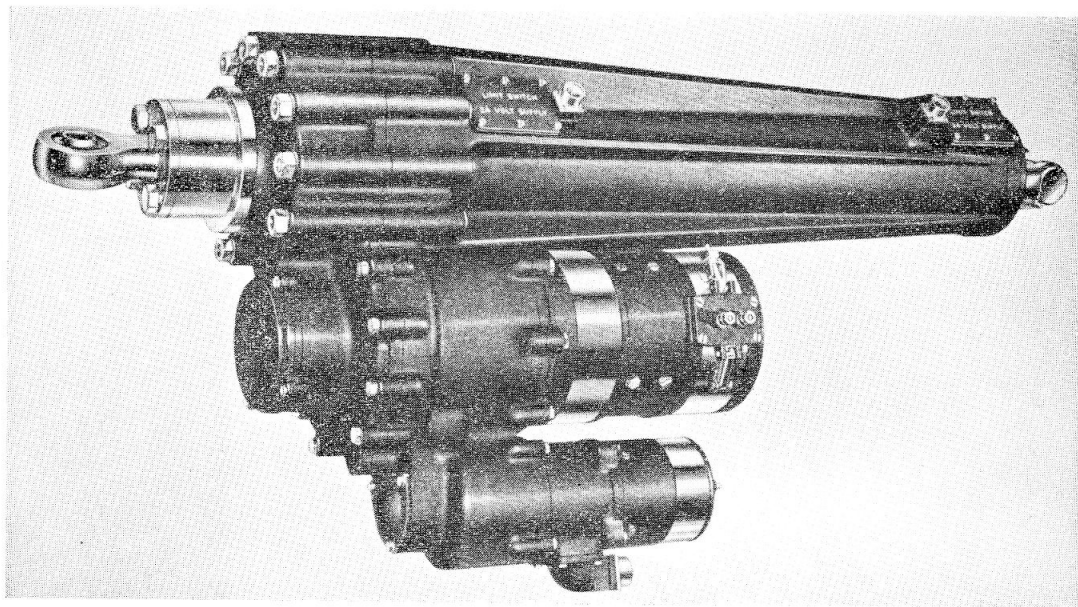


Fig. 1. Typical A0100 series actuator

Introduction

1. Linear actuators in the A1100 series follow the general design described in this chapter; specific details of individual types will be found in the appendices to the chapter.

DESCRIPTION

2. A typical actuator in the series is shown in fig. 1, with a sectional view in fig. 2. These actuators have their motors offset from, and parallel to, the ram axis. Each machine consists of a main motor, emergency motor and the ram and screwshaft assembly.

Motors

3. The main motor is a 4-pole, reversible, compound-wound machine, totally enclosed as a safeguard against the hazards normally associated with ground running. The emergency motor is a similar but smaller machine, intended, through suitable gearing, to operate the ram at a slower speed than when using the main motor.

4. In both instances, the wave-wound armatures are supported at each end by ball bearings, the drive end bearing being situated in an intermediate housing. Internally splined at the drive end, the armature shafts are hollow to reduce weight and to facilitate the entry of a clutch adjusting rod.

Brake and clutch

5. Between each motor and its associated gearbox is interposed a drum-type electromagnetic brake, and a multiple clutch which dissipates the kinetic energy in the armature when the brake is operated.

6. Wound on a solid core, the brake coil is energized when the motor is operating, attracting a set of six brake shoes against the force of helical springs. When the coil is de-energized, the springs force the brake shoes against the inside periphery of the steel brake drum, which is revolving at armature speed.

7. A clutch-loading device is fitted to both motors; this consists of a spring-loaded screw which protrudes from the commutator end of the motor and extends through the armature shaft to the clutch assembly.

Gearboxes

8. The two stage epicyclic main motor gearbox drives the ram screw-shaft through a multi-plate, overload clutch and a spur gear. The second planet carrier is extended to form a driving shaft, upon which is splined the multi-plate overload clutch, the shaft of which bears the spur gear; the latter meshes with a similar gear on the screwshaft.

9. A two stage epicyclic gear train is em-

R E S T R I C T E D

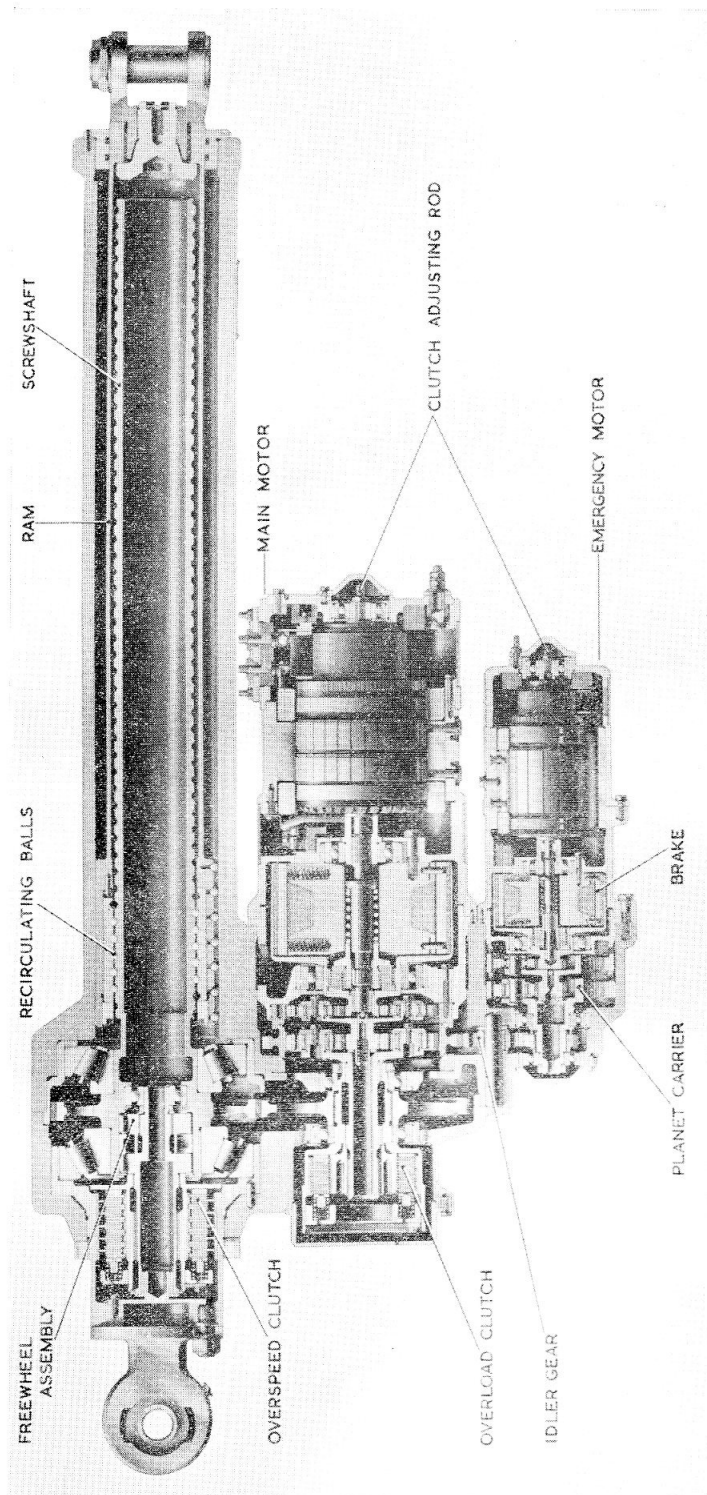


Fig. 2. Sectional view

RESTRICTED

played in the emergency motor gearbox, the drive being transmitted to the second stage annulus of the main gearbox via a spur wheel and an idler gear.

10. During normal operation of the actuator the second stage annulus is fixed, due to the emergency motor being locked by the action of the brake. Operation of the emergency motors frees the annulus which results in a correspondingly higher gear ratio between the motor and screwshaft.

Ram and screwshaft

11. A high efficiency thread of the recirculating ball type is employed (*fig. 2*), torque reaction between the ram and the screwshaft being absorbed by the three sets of steel balls located in the ram and running in steel guides in the ram housing. The screwshaft is supported at its root by taper roller bearings. An eye-bolt is splined to the ram and is secured by a tension pin.

Limit switches

12. Four pairs of snap action limit switches control the travel of the ram through external relays, each set of switches being connected in series to provide an additional safety factor. These limit switches are fitted within housings, provided on the body of the ram casing.

13. At the extreme limits of travel, cams, ground into the root of the ram, actuate spring-loaded plungers, operate the switch and thus cut off the supply to the motor.

Housings and covers

14. All housings are cast in light alloy, bolts securing the main and emergency motors to the common ram housing. Access to the brushes of the motors is provided by apertures covered by lined window straps. Inspection covers are fitted to the limit switch housings.

Electrical connections

15. Electrical connections are made to the

main motor via five $\frac{1}{4}$ in. B.S.F. terminals, to the emergency motor via a 5-pole plug (Ref. No. 5X/6061), and to the four limit switches via four 2-pole plugs (Ref. No. 5X/6001).

FUNCTIONING

16. Assume the ram to be in its fully retraced position and that conditions allow normal operation:—The IN limit switch is open and the OUT limit switch is closed.

17. Operation of the undercarriage selector switch energizes the coil of the external reversing switch via the OUT limit switch. The coil closes the 112-volt supply to the actuator via the starter panel with limits the initial current draw of the machine. The ram extends until, as a result of the operation of the OUT limit switch, the supply to the reversing switch is broken.

18. The first sun gear is integral with the brake drum, which revolves at armature speed. This transmits movement through the epicyclic gear train to the driving shaft. Splined upon the overload clutch assembly is the spur gear; this transmits the rotary movement to a meshing gear on the screwshaft. Linear movement is achieved through the action of the recirculating ball thread.

SERVICING

19. These actuators should be serviced in accordance with the general chapter in A.P.4343, Vol. 1, Sect. 17, Chap. 2 and the relevant Servicing Schedule.

20. Servicing of the electric motors is normally restricted to brush inspection. Ensure that the length of the brush is adequate to give satisfactory service until the next inspection. Check all brushes for freedom of movement in their boxes and examine for correct bedding; also check for correct brush spring tension.

21. After satisfactory completion of the brush inspection, examine the linings of the

RESTRICTED

window straps for signs of damage and renew the linings, if the damage is sufficient to warrant it. The securing screws should be firmly tightened and all other reasonable precautions taken to prevent the ingress of moisture.

Lubrication

22. All actuators are sufficiently lubricated during manufacture and normally will require no further attention between the appropriate servicing periods.

Insulation resistance test

23. The insulation resistance, when measured with a 250-volt or 500-volt insulation resistance tester as appropriate for the part concerned, between all live parts and the frame, should be not less than 0.5 megohm (for R.N.), or 0.05 megohm (for R.A.F.).

Final inspection

24. Ensure that all external nuts, screws and locking devices are secure. Examine the shackles and shackle pins for security. Ensure that good electrical contact exists between mating plugs and sockets.

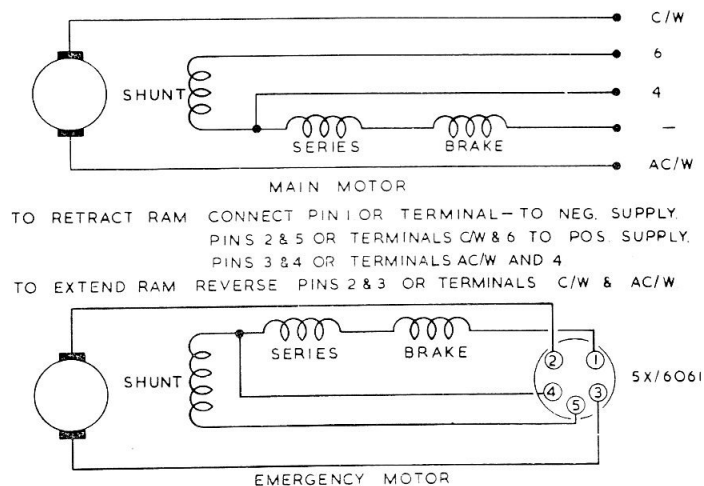


Fig. 3. Typical circuit diagram

Appendix 1

ACTUATOR, ROTAX, TYPE A1101

LEADING PARTICULARS

Actuator, Type A1101	.....	.....	.....	.....	<i>Ref. No. 5W/289</i>
<i>Voltage—</i>					
<i>Main and emergency motors</i>	.....	.....	.....	.....	<i>112V d.c.</i>
<i>Limit switches</i>	.....	.....	.....	.....	<i>28V d.c.</i>
<i>Current—</i>					
<i>Main motor (17,500 lb.)</i>	.....	.....	.....	.....	<i>120 amp. at 112V d.c.</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>32 amp. at 112V d.c.</i>
<i>Overload clutch setting</i>	.....	.....	.....	.....	<i>32,000 to 35,000 lb.</i>
<i>Maximum working load</i>	.....	.....	.....	.....	<i>22,500 lb.</i>
<i>Length of stroke</i>	.....	.....	.....	.....	<i>20·25 in.</i>
<i>Time operation—</i>					
<i>Main motor</i>	.....	.....	.....	.....	<i>10 seconds (max.)</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>40 seconds (max.)</i>
<i>Brush spring pressure—</i>					
<i>Main motor</i>	.....	.....	.....	.....	<i>30 to 34 oz.</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>14 to 16 oz.</i>
<i>Brush grade—</i>					
<i>Main motor</i>	.....	.....	.....	.....	<i>E.G.O.</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>E.G.12</i>
<i>Brush length (new)—</i>					
<i>Main motor</i>	.....	.....	.....	.....	<i>0·718 in.</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>0·687 in.</i>
<i>Brush length (minimum)—</i>					
<i>Main motor</i>	.....	.....	.....	.....	<i>0·437 in.</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>0·250 in.</i>
<i>Commutator diameter (new)—</i>					
<i>Main motor</i>	.....	.....	.....	.....	<i>2·850 in.</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>1·750 in.</i>
<i>Commutator diameter (minimum)—</i>					
<i>Main motor</i>	.....	.....	.....	.....	<i>2·814 in.</i>
<i>Emergency motor</i>	.....	.....	.....	.....	<i>1·709 in.</i>
<i>Overall dimensions—</i>					
<i>Retracted length</i>	.....	.....	.....	.....	<i>42·00 in.</i>
<i>Extended length</i>	.....	.....	.....	.....	<i>62·25 in.</i>
<i>Weight</i>	.....	.....	.....	.....	<i>190 lb.</i>

1. The actuator, Type A1101, is similar to that described and illustrated in the main chapter. Details of operation are as given under Leading Particulars.

RESTRICTED

Appendix 2

ACTUATOR, ROTAX, TYPE A1102/2

LEADING PARTICULARS

Actuator, Type A1102/2 ....	....	....	....	....	<i>Ref. No. 5W/2595</i>
Voltage—					
<i>Main and emergency motors</i> ....	....	....	....	....	112 <i>V d.c.</i>
<i>Limit switches</i> ....	....	....	....	....	28 <i>V d.c.</i>
Current—					
<i>Main motor (17,500 lb.)</i> ....	....	....	....	....	120 <i>amp. at 112<i>V d.c.</i></i>
<i>Emergency motor (17,500 lb)</i> ....	....	....	....	....	32 <i>amp. at 112<i>V d.c.</i></i>
Motor clutch setting—					
<i>Main motor</i> ....	....	....	....	....	16 <i>lb. ft.</i> +0·5 −0·0 <i>lb. ft.</i>
<i>Emergency motor</i> ....	....	....	....	....	3·5 <i>lb. ft.</i> +0·25 −0·0 <i>lb. ft.</i>
<i>Maximum working load</i> ....	....	....	....	....	22,500 <i>lb.</i>
<i>Maximum factored load</i> ....	....	....	....	....	53,000 <i>lb.</i>
<i>Overload clutch setting</i> ....	....	....	....	....	32,000—36,000 <i>lb.</i>
<i>Length of stroke</i> ....	....	....	....	....	20·25 ± 0·25 <i>in.</i>
Time of operation—					
<i>Main motor</i> ....	....	....	....	....	10 <i>seconds (max.)</i>
<i>Emergency motor</i> ....	....	....	....	....	40 <i>seconds (max.)</i>
Rating—					
<i>Main motor</i> ....	....	....	....	....	5 <i>complete operations</i>
<i>Emergency motor</i> ....	....	....	....	....	1 <i>complete operation</i>
<i>Temperature range</i> ....	....	....	....	....	−60 <i>deg.C to +50 deg.C</i>
Brush spring pressure—					
<i>Main motor</i> ....	....	....	....	....	30 to 34 <i>oz.</i>
<i>Emergency motor</i> ....	....	....	....	....	14 to 16 <i>oz.</i>
Brush grade—					
<i>Main motor</i> ....	....	....	....	....	<i>E.G. O.</i>
<i>Emergency motor</i> ....	....	....	....	....	<i>E.G.12</i>
Brush length (new)—					
<i>Main motor</i> ....	....	....	....	....	0·718 <i>in.</i>
<i>Emergency motor</i> ....	....	....	....	....	0·687 <i>in.</i>
Brush length (minimum)—					
<i>Main motor</i> ....	....	....	....	....	0·437 <i>in.</i>
<i>Emergency motor</i> ....	....	....	....	....	0·250 <i>in.</i>

RESTRICTED

LEADING PARTICULARS—*cont.*

Commutator diameter (new)—

<i>Main motor</i>	....	....	....	....	....	....	2·850 in.
<i>Emergency motor</i>	....	....	....	....	....	....	1·750 in.

Commutator diameter (minimum)—

<i>Main motor</i>	....	....	....	....	....	....	2·814 in.
<i>Emergency motor</i>	....	....	....	....	....	....	1·709 in.

Overall dimensions—

<i>Retracted length</i>	....	....	....	....	42·000 in.	± 0·25 in.
<i>Extended length</i>	....	....	....	....	62·250 in.	± 0·25 in.
<i>Weight</i>	....	....	....	....	....	.... 190 lb.

1. The A1102/2 actuator follows the same general construction as that described and illustrated in the main chapter, but differs in that there is no overspeed and drag clutch.

2. The basic A1102 actuator has been modified and the code number raised to A1102/2 as follows:—

(1) A1102 (Ref. No. 5W/380). Streng-

thened gears and a new idler pin introduced; code raised to A1102/1 (Ref. No. 5W/1107).

(2) A1102/1. New ram nut incorporating ball liners with increased wall thickness, including improvement to the ball path; code raised to A1102/2 (Ref. No. 5W/2595).

RESTRICTED