Chapter 24

Actuators, Western, Types MAA 3001 and MAA 4001

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LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Actuator, Western, Type MAA 3001 MAA 4001 ..... **Ref. No. 5W/3984**

	Main	*Emergency*
Normal voltage	*28V d.c.*	*24V d.c.*
Voltage range	*23·5 to 28·5V d.c.*	*18 to 28V d.c.*
Max. current at normal W.L.	*1·5A*	*1·45A*
Normal W.L.	*30 lb*	*30 lb*
Max. W.L.	*45 lb*	*45 lb*
Normal stroke	*2·435 in.*	
Time of normal stroke with:		
1. *Normal load*		
2. *Normal voltage*	*Main*	*Emergency*
3. *At 20°C*		
Type MAA 3001	*24 sec.±10%*	*25 sec.±10%*
Type MAA 4001	*14 to 18 sec.±10%*	*16 sec.±10%*
Brushes (both motors)		
Type		*FM4*
Length new	*0·3 in.*	$^{+0}_{-0{\cdot}01}$ *in.*
Min. for re-use		*0·25 in.*
Brush spring pressure		*1·5 oz±0·2 oz (46·654g±6·22g)*
Commutator Diameter (both motors)		
New		*0·52 in.±0·003 in.*
Min. for re-use		*0·52 in.−0·006 in.*
Max. eccentricity		*0·0005 in.*
Bearings for both motors		*Hoffman N7185C PP*
Grease for gearbox (XG-275)		*Ref. No. 34B/9100512*

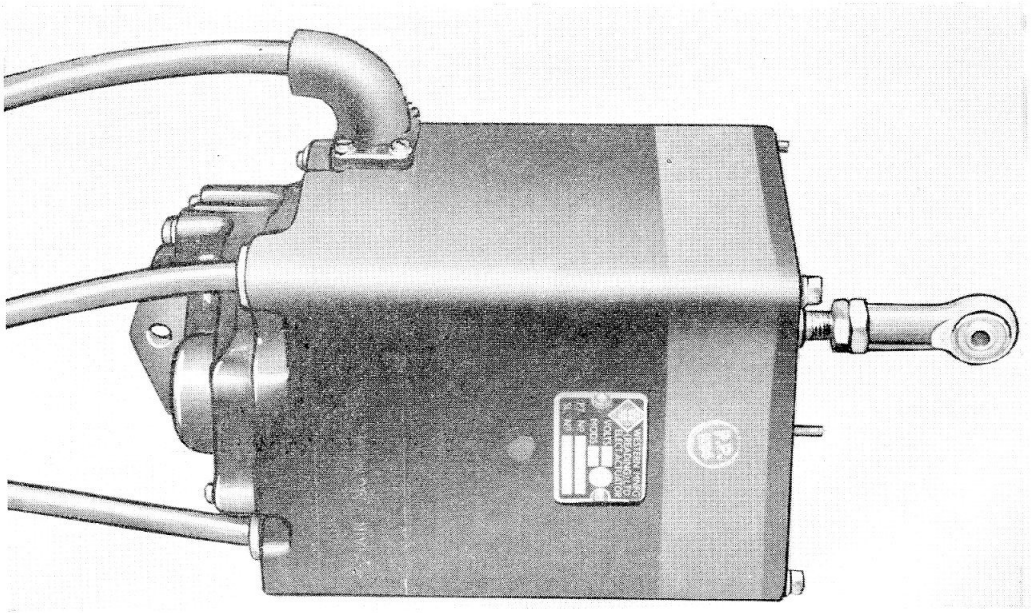

Fig. 1. Actuator, Western, Type MAA 3001

Introduction

1. ◀The actuator, Type MAA 3001, is described and illustrated in this chapter; the actuator, Type MAA 4001, is identical except for the time of stroke.▶ The actuator, Type MAA 3001 shown in Fig. 1, is designed for use on aircraft, where remote control of linear thrust and pull loads is required, within the ranges given in the Leading Particulars. The purpose of this actuator is to operate the ailerons. The movement of the aileron to a droop position coincides with the raising of the tailplane flap. The facility of drooping the aileron and raising of the tailplane flap is used in conjunction with the boundary layer control for take-off and landing. A description of this flying control system will be found in A.P.4744A, Vol. 1, Book 2, Sect. 6.

2. A Smith 3:1 standard Desynn indicator working in conjunction with this actuator is provided to record the position of the actuator piston at any point of its stroke.

3. The unit is totally enclosed, being proof against the ingress of dust and oil. In addition it is flameproof.

DESCRIPTION AND OPERATION

General

4. The actuator, a sectional view of which is shown in Fig. 2, is constructed with the axis of twin motors parallel with the axis of the ram, thereby producing a linear motion.

5. It consists basically of two fractional horsepower motors mounted side by side, which independently operate a worm-operated ram, through a differential, epicyclic and spur gearing.

6. Switches are provided to limit the linear travel of the ram, and mechanical stops are also fitted in the extend and retract positions in order to arrest the piston in the event of it over running.

7. A Desynn transmitter is provided for use in conjunction with the Smith 3:1 Desynn indicator.

8. A variable resistor RV1, in the main motor circuit (fig. 4) is provided to give a small degree of speed adjustment.

Motors

9. Two motors are used in this actuator the main motor operating from the aircraft

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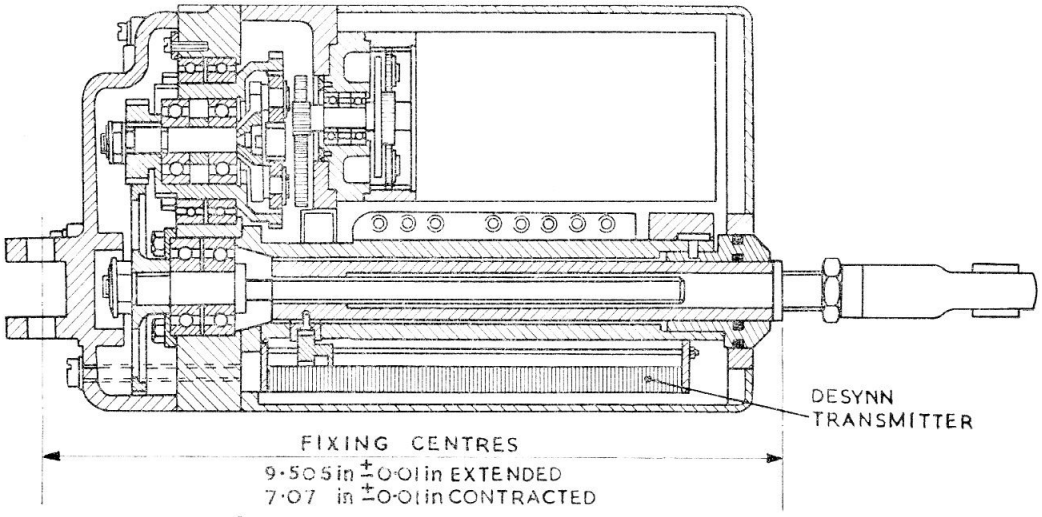


Fig. 2. Sectional view

supply at a nominal 28V d.c. supply, and the emergency motor operating from a nominal 24V d.c. standby supply.

10. Each motor is controlled by its own normal, and over travel limit switches, and in the event of one switch failing, the other will break the circuit.

11. Both motors are of the reversible, series split-field, d.c. type having integral electro-magnetic brakes. These brakes ensure that the ram maintains accurate extended and retracted centres, the brake being so constructed that the braking effort is applied as soon as the d.c. supply is interrupted.

Limit switches

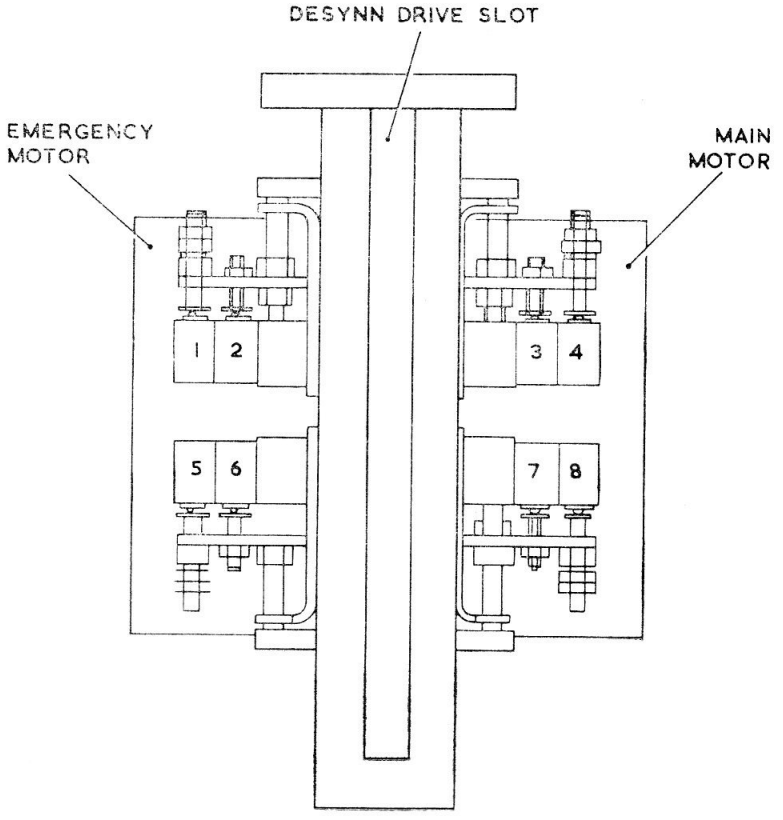
12. The two normal snap action limit switches (*Fig. 3 and 4*) of each motor, are set to operate at the required stroke, and when operated, open circuit the motor field in use, and allow the motor brake to be applied. In addition to the normal limit switches of the main motor there are two motor over travel limit switches (*Fig. 3 and 4*), these are set to operate at 0·035 to 0·040 in. piston movement beyond the nominal stroke in either the extend or retract positions. The over travel limit switches guard against the failure of the normal limit switches, or excessive over run.

13. When the main motor over-travel switches are operated, the common return of the supply circuit is interrupted, which results in the brake being applied to the motor, and hence rendering it inoperative. For further operation of the actuator it is necessary to bring the emergency motor into use.

14. The emergency motor over-travel switches are wired in series with its normal limit switches, and when the over-travel limit switches are operated further open circuit the field in use. Selection of the motor in the opposite direction of rotation must, therefore, be made in order to bring the main motor off the over-travel switch trip. Fig. 3 shows the switch position layout.

Note . . .

Do not attempt to adjust the limit switches. Where adjustment is found necessary the actuator should be removed and sent to a workshop where accurate setting up facilities are available. Failure to comply, might result in failure of the emergency motor and/or the piston running up to the mechanical stop and rendering the actuator inoperative.



Emergency motor

Sw. 1 OVERTRAVEL IN LIMIT
Sw. 3 NORMAL IN LIMIT
Sw. 5 OVERTRAVEL OUT LIMIT
Sw. 7 NORMAL OUT LIMIT

Main motor

Sw. 2 OVERTRAVEL IN LIMIT
Sw. 4 NORMAL IN LIMIT
Sw. 6 OVERTRAVEL OUT LIMIT
Sw. 8 NORMAL OUT LIMIT

Fig. 3. Switch position layout

Mechanical stops

15. In the event of the piston over-running both the normal and over-travel limit switches, the piston is arrested in either the extend or retracted positions by mechanical stops. These stops are set to operate at 0·02 to ·025 in. piston movement after operation of the over-travel limit switch. The actuator is not reversible after being arrested by either mechanical stop.

Desynn transmitter

16. A Desynn transmitter (*fig.* 2), is coupled directly to the piston to record the position of the piston at any part of its stroke. This transmitter consists of two built-in linear restistors adjacent to the piston housing, having sliding contacts directly harnessed to the piston. Operation of the piston from the fully extended to retract position gives a full 180° indicator movement on the Smith 3:1 standard Desynn indicator.

Potentiometer

17. A variable resistor RV1, is fitted adjacent to the Desynn transmitter, and its purpose is to control the speed of the main motor. The speed setting can be adjusted with the actuator installed on the aircraft and access to the adjusting screw is by the removal of a cap secured by three screws in the actuator cover.

Pre-set resistor

18. A restistor R1, connected in the armature and field circuit provides for current stability in the field system and is preset by the manufacturers. This resistor is located beneath the Desynn transmitter.

Electrical connections

19. The connection for the main and emergency motors are made to a terminal block in the unit by way of two flying leads. These leads pass through bushed holes provided in the actuator end frame. A bushed

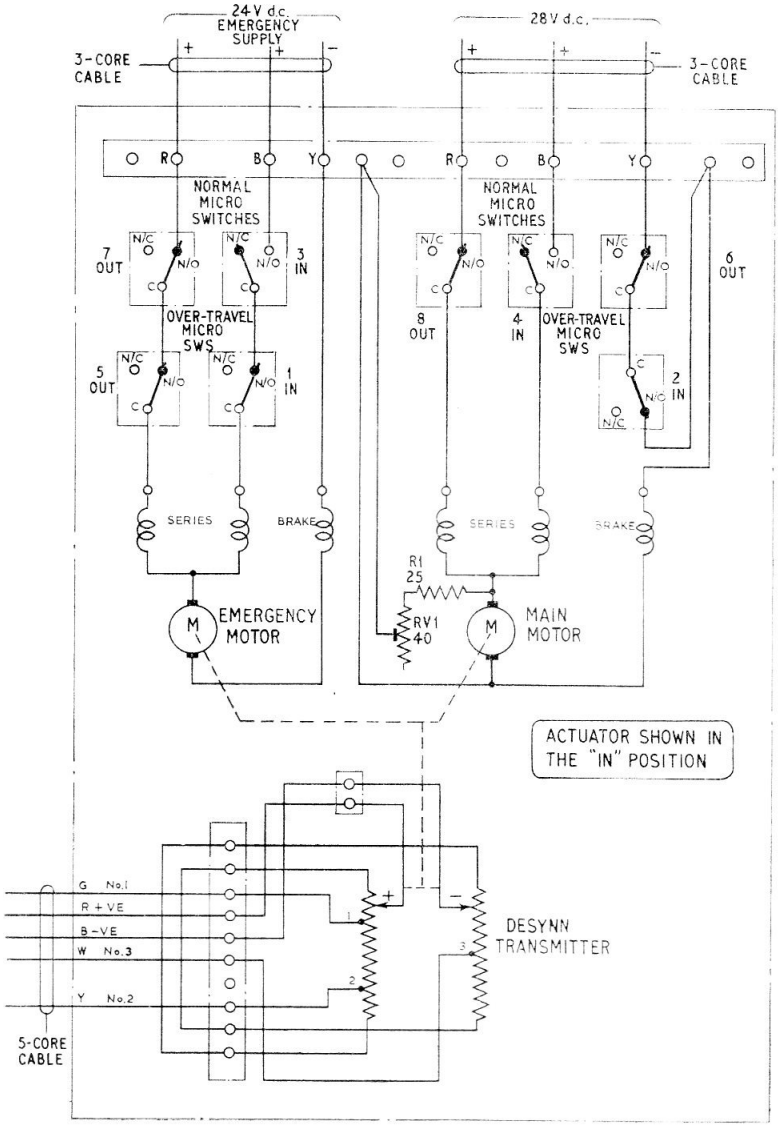


Fig. 4. Circuit diagram

nut fitted externally to the threaded portion of the bushed hole when secured, prevents undue strain on the cable.

20. The connection to the Desynn transmitter is by way of a six-core flying lead, which passes through a cable gland and clamp in the actuator end frame. The complete circuit diagram of the actuator is shown in *Fig.* 4.

INSTALLATION

21. The actuator is attached at the fixed end by a bolt passing through a fixed fork, whilst the moving end is attached by a bolt passing through a self-aligning eye. For full details of the installation of the actuator, reference should be made to the appropriate aircraft handbook.

SERVICING

22. The actuator should be inspected in accordance with the appropriate Servicing Schedule. General notes on the servicing of actuators will be found in A.P.4343, Vol. 1, Sect. 17. Very little servicing should be necessary during the life of the actuator (100 000 inching cycles) but should in general be as follows.

23. The actuator should be inspected for security of attachment, and the cables for serviceability.

Brushes

24. The brushes of both motors should be inspected in accordance with the appropriate Servicing Schedule and renewed where worn, or where wear is likely to be below the minimum length at the next inspection period. Details of the brush lengths are given in the Leading Particulars. The brushes should be inspected for freedom of movement in their boxes. Where binding is evident both the brush and brush box should be wiped clean. Any accumulation of carbon dust should be carefully blown away with dry compressed air.

25. When measuring the brush spring pressure, care should be taken to avoid undue strain on the spring. Use tension gauge, Ref. No. 1H/58.

Bearings

26. The bearings of both motors are of special pre-packed type, as given in the Leading Particulars. Where a replacement is necessary a bearing of the same type must be used to replace it.

Gearbox

27. The gearbox is adequately greased during manufacture, and should not require any further attention.

Functional test

28. A full functional test should be carried out in accordance with the appropriate aircraft Servicing Schedule.

Insulation resistance test

29. Using a 250 volt insulation tester measure the insulation resistance between live parts and the frame. The reading should not be less than 2 megohms under workshop conditions, but not less than 50 000 ohms, where humid conditions are prevalent, such as dispersal points.

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