Chapter 76

ACTUATOR, ENGLISH ELECTRIC, TYPE AE 4518, Mk. 1

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LEADING PARTICULARS

Actuator, Type AE 4518, Mk. 1	**Ref. No. 5W/2632**
Rated voltage	28*V d.c.*
Speed of motor	14,000 *rev/min*
Output of motor	3·7 *watts*
Maximum working load	100 *lb. in.*
Normal working load	30 *lb. in.*
Working angle of rotation	$90^{\circ} \begin{matrix} -0^{\circ} \\ +2^{\circ} \end{matrix}$
Working temperature range	$-40^{\circ}C$ *to* $+150^{\circ}C$
Brush grade	*C.M.6. (H.A.M.)*
Minimum brush length	0·225 *in*
Brush spring pressure	4 *to* 5 *oz*
Time of operation (under normal working load at 28V)	15 *sec*
Weight of actuator	1 *lb.* 14 *oz*

Introduction

1. This actuator has been designed to provide a 90 degrees rotary movement to equipment such as valves.

DESCRIPTION

2. The actuator consists of a d.c. motor and gearbox. The motor is fitted with an electro-magnetic brake to prevent excessive overrun after the limit switches have cut off the supply to the motor (*para.* 21). The drive from the motor to the output shaft is provided by an arrangement of spur gears. The final gear is splined internally to form the output shaft, and provides a maximum rotary movement of 90 deg.

Housing and covers

3. The actuator housings comprise : a main cover (containing the motor and brake assembly, the limit switches and their operating mechanisms, and the Breeze plug); an outer bearing plate in which the output shaft is located; a centre bearing housing; an inner bearing plate which serves as the drive end endplate of the motor. The last three components are aluminium die-castings, and together form the gearbox. This gearbox is held together by four 4 B.A. screws, and the main cover is secured by two 4 B.A. screws at the Breeze plug end.

Gearbox

4. The gearbox is made up of three components as mentioned in para. 3. Inset in these components are ball bearings on which are mounted the spur gears forming the drive from the motor to the output shaft.

5. The first pinion of the gear drive is integral with the armature shaft. The drive continues through seven compound gears (spur and pinion) and is finally transmitted to a spur gear cut on the output shaft.

6. The last compound gear of the train has an extended shaft which protrudes through the inner bearing plate. Pinned to this shaft is a spur gear which operates the limit switch mechanism.

Motor and brake assembly

7. The motor is a two pole split field series wound 28V d.c. machine. The output is 3·7 watts at 14,000 rev/min. The reversal of rotation is effected by external switchgear.

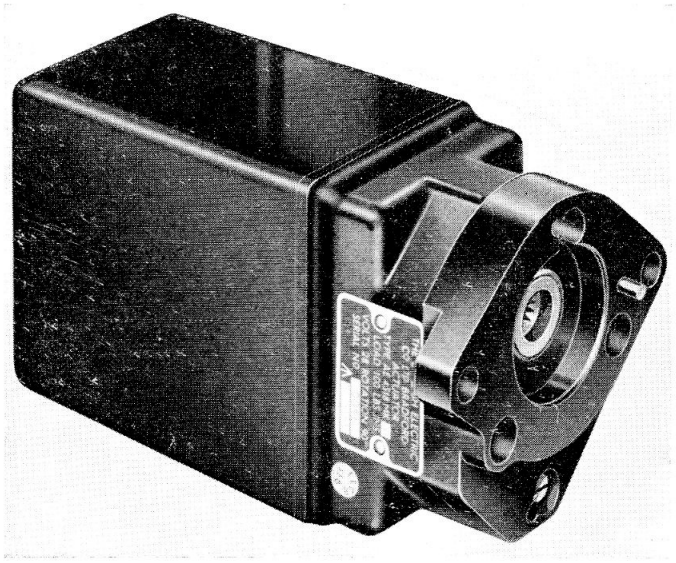


Fig. 1. General view of actuator, Type AE4518, Mk. 1.

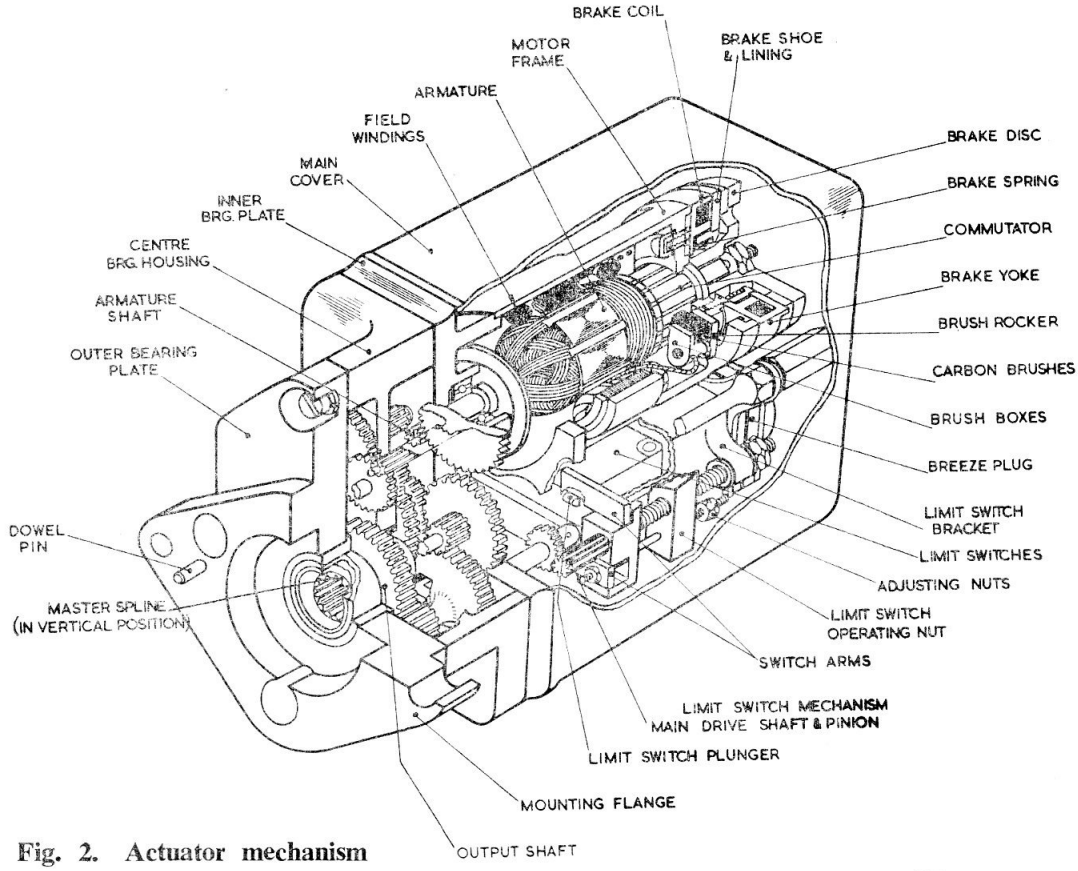


Fig. 2. Actuator mechanism

8. Two alloy brush boxes are mounted on a moulded rocker which is adjustable for setting the brushes on the neutral axis.

9. The brushes are C.M.6 (H.A.M.) type and are held against the commutator by coiled springs bearing on brush fingers which are in contact with the brushes. The brush spring pressure should be between 4–5 oz.

10. An electro-magnetic brake, connected electrically in series with the armature, and mechanically to the motor frame at the commutator end, is a single plate disc type.

Limit switches

11. A bracket holding the limit switch operating mechanism is attached to the motor frame by two 6 B.A. screws.

12. The spur gear mentioned in para. 6 meshes with a pinion integral with the main drive shaft of the switch operating mechanism. This main drive shaft has a two start, Whitworth thread cut on it. The mating operating nut, moving along this thread,

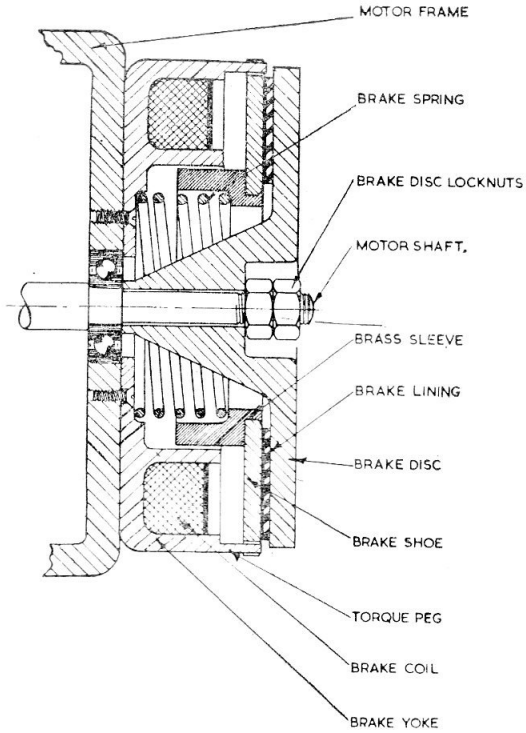


Fig. 3. Typical electro-magnetic brake (not to scale)

gives linear movement to the switch arms, which operate the limit switches. Adjusting nuts are provided on these arms so that the angle of rotation of the output shaft may be set accurately.

INSTALLATION

13. This type of actuator is provided with a mounting flange. Normally a mating flange to this standard is provided on the equipment operated by the actuator (valves etc.).

14. The master spline on the output shaft should be in the vertical position (*fig.* 2), and move 90 deg. anti-clockwise locking on the drive end of the actuator.

15. The external electrical supply is connected via a four-pole Breeze plug (*fig.* 4).

16. After installation the actuator should be given a functional check.

OPERATION

17. With the actuator installed, and the master spline in the vertical position, the operation is as follows.

18. With the master spline in the vertical position the "clockwise" limit switch will be "open" and the "anti-clockwise" limit switch "closed".

19. When the supply is switched on, the brake coil will become energized, and will pull the brake shoe away from the brake disc. At the same time the appropriate motor field being energized the armature will rotate, thus setting in motion the gear drive to the output shaft which will rotate anti-clockwise looking on the drive end.

20. As soon as the gears begin to revolve, the spur gear operates the screw on the limit switch mechanism, which causes the operating nut moving along the thread to give linear movement to the two switch arms, one of which operates the "clockwise" limit switch causing it to close.

Note . . .
Now both limit switches are closed, but, once one limit switch has been operated in one direction, approximately 20 *deg. of travel in the opposite direction must be completed, before reversal of the actuator can again take place. This is due to the differential action of the limit switches, and in no way constitutes a fault.*

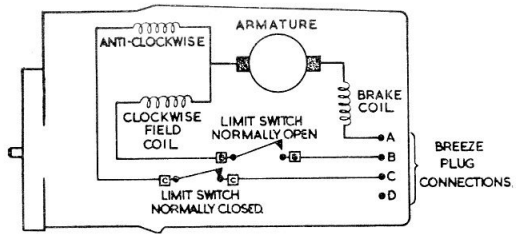
21. On reaching the anti-clockwise position (i.e., the master-spline 90 deg. anti-clockwise from the vertical position) the switch arm will operate the "anti-clockwise" limit switch, causing it to open, and the supply to the motor will be cut off. When this occurs, the brake will be de-energized, the brake shoe will be forced against the brake disc under the action of a helical spring, and the motor will come to an almost instantaneous stop.

SERVICING

22. The actuator is to be inspected and serviced in accordance with and at the periods specified in the appropriate Servicing Schedule.

23. For routine inspections, the external nuts, bolts, screws, should be checked for security. The wiring should also be checked for corrosion and security.

24. Worn brushes should be renewed before the minimum brush length limit is reached (0·225 in.). When it is necessary, only brushes of C.M.6 (H.A.M.) grade are to be used. These should be bedded down to the contour of the commutator for at least 80 per cent of their contact area.



NOTE:- DIRECTION OF ROTATION IS LOOKING ON DRIVE END OF ACTUATOR.

Fig. 4. Wiring diagram

25. The brush spring tension should be checked using a spring balance (Ref. No. 1H/97); the values obtained should be between 4–5 oz.

26. The brake lining wear should be checked by feeler gauges between the brake shoe and the brake yoke with the current off. This gap should be within 0·004—0·015 in.

27. The actuator is lubricated during manufacture and should require no further attention except at the periods laid down in the appropriate Servicing Schedule.

28. A final security check should be made on all nuts, bolts, screws and electrical connections, after servicing is completed.

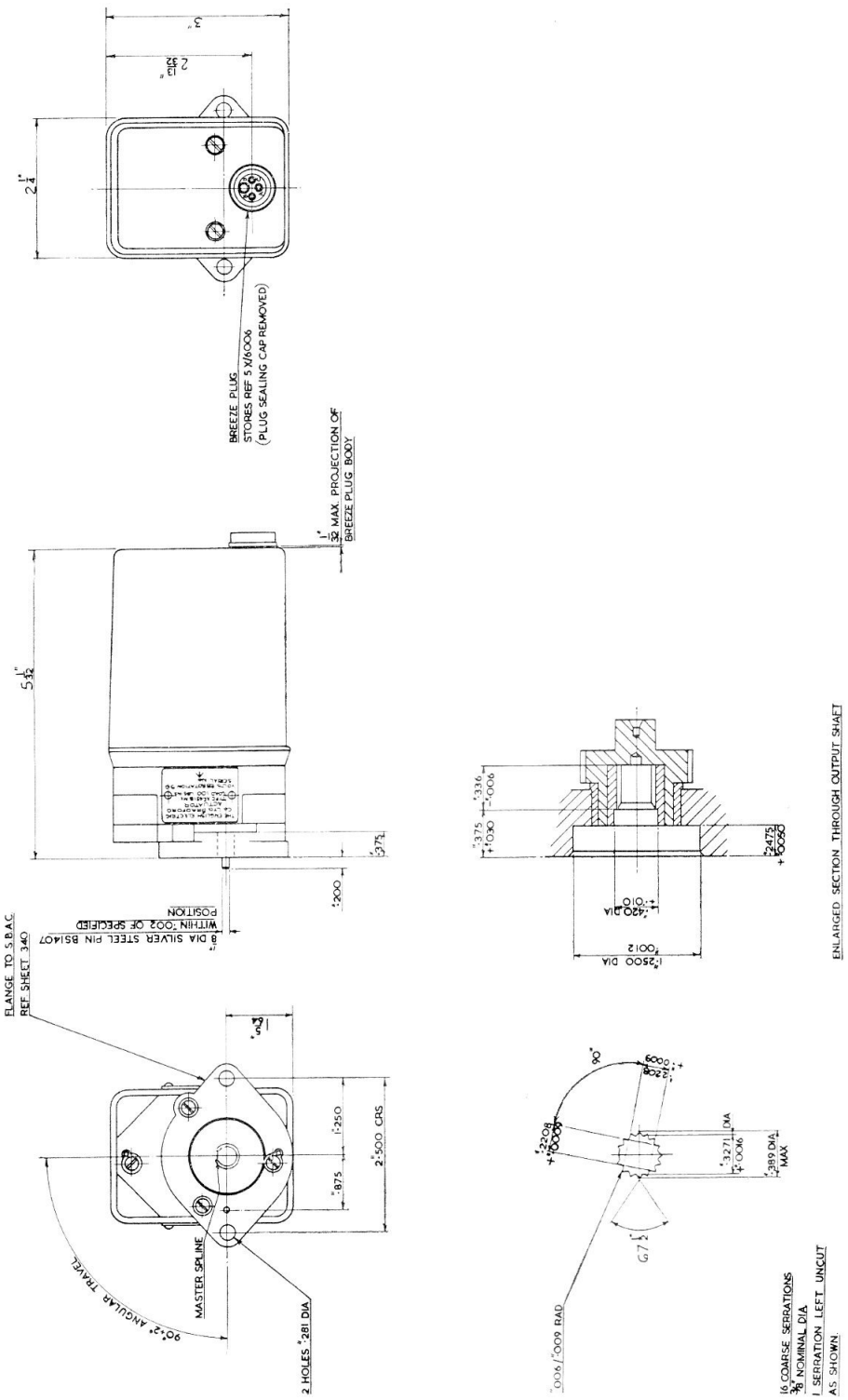


Fig. 5. Installation drawing

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