

Chapter 6

ACTUATOR, ROTAX, TYPE A0406

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LEADING PARTICULARS

Actuator, Rotax, type A 0406	Stores Ref. 5W/612
Voltage	24V d.c.
Average working load	500 lb.
Maximum working load	1,000 lb.
Emergency maximum load	1,400 lb.
Maximum factored load	5,000 lb.
Ram travel	3 in.
Maximum time of travel (normal load)	22.2 sec.
Maximum current (normal load)	2.75 amp.
Maximum over travel at 24V	0.020 in.
Length between shackle fixing centres	14.25 in.
Brush spring tension	2 oz.
Minimum brush length	9/32 in.
Weight	8 lb.

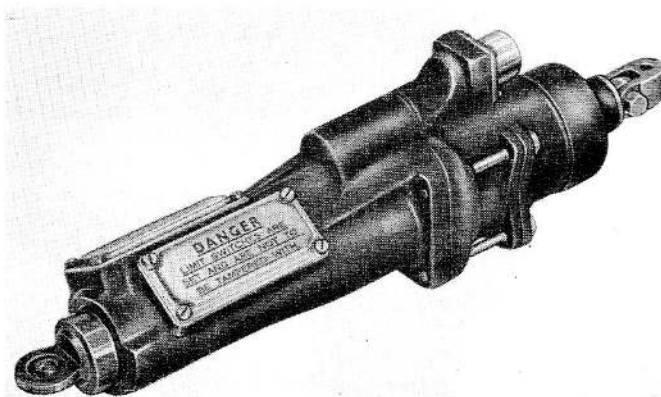


Fig. 1. General view of A 0406 actuator

Introduction

1. The A 0406 linear actuator is designed to operate auxiliary radiator flaps on in-line aircraft engines, and will operate at wind pressures produced by all conditions of flight up to a maximum emergency load on the actuator of 1,400 lb. It is of in-line construction, the whole of the operative mechanism being on one axis.

DESCRIPTION

General

2. The actuator consists essentially of a motor, a brake, a clutch,

a gearbox and a ram assembly, housed in three light alloy castings. Electrical connection is made by a four pole plug on top of the actuator.

3. The motor drives the ram through the single plate clutch, which prevents accidental overload damaging the motor, and a four stage epicyclic gear. The last planet train drives the ram assembly, which consists of a screw shaft in a hollow ram with a recirculating ball thread. Limit switches operate at each end of ram travel, switching off the motor, and an electro-magnetic servo brake stops the ram, limiting over-travel to 0.020 in.

Housings

4. The motor is carried in a motor housing which has an internally threaded boss at the rear end, into which the rear swivel connector is screwed. A window strap assembly secured by a bolt surrounds the motor housing over 2 windows, giving access to the brushgear.

5. The clutch, brake and first annulus are carried in the intermediate housing, which mounts also the four pole plug. The ram housing completes the casing, and these housings are all secured together by four long bolts which pass through four lugs on each housing.

Motor

6. The motor is a 24-volt, four pole split series type, two opposite field coils being used to retract the ram and the remaining two to extend it. Connected in series with each pair of fields is a limit switch, so that when the ram reaches its fully extended or fully retracted position, one of these switches cuts off the motor.

7. The yoke and poles are manufactured from one set of laminations so that the poles are integral with the yoke. The two brushes are mounted in a moulded brush gear assembly, with two flat coiled springs bearing one on each brush. The armature on its shaft is carried in two bearings, a ballrace at the commutator end in the motor housing, and a plain bearing in the brake drum into which the shaft is extended. The brake drum, in turn, is carried in a ballrace in the intermediate housing.

Clutch and brake

8. Interposed between brake drum and armature is a single plate spring loaded

clutch, the shaft of the latter being a sliding fit on the armature shaft. A pin through the armature shaft registering in two opposite slots of the clutch shaft prevents relative rotation. A spring presses the clutch plate against the inside (bottom) of the brake drum, adjustment of slipping torque being made by shims between this spring and a shoulder on the armature shaft.

9. An eight-pole brake spider is screwed to the intermediate housing, located within the brake drum on the extended armature shaft. The poles are in pairs and a single coil is wound around the brake spider between the poles, and connected in series with the armature. Each pair of poles has a cork faced shoe mounted on four steel pins in the solenoid poles. Pressure is exerted outwards on these shoes by helical springs located in taps in the spider. The undersides of the shoes are copper plated to eliminate the effects of residual magnetism.

Gearbox

10. This is a four-stage epicyclic gearbox, in which the first sun gear is integral with the brake arm. The gear housing functions also as a fixed annulus, and slides into the ram housing, with lugs clamping between those of the intermediate and ram housings.

11. The first, second and third planetary trains each consists of three planet gears in a carrier, integral with which are the second, third and fourth sun gears respectively. The fourth planet is similar, but is mounted on a flange at the end of the screw shaft.

Ram assembly

12. The screw shaft, which rotates inside the ram, is a hardened steel rod with a semi-circular helical groove running its entire length. At one end is a flange to which is fitted the last planet carrier in the gearbox, and this flange is carried in two thrust bearings consisting of a chamfer on each side of the flange, two sets of 42 balls and two outer bearings, one machined into the gearbox annulus housing, the other sliding into the ram.

13. The ram, inside which the screw shaft rotates, also has a semi-circular helical groove internally, but not along its entire length, and the ends of each of the two turns are stopped by a short steel rod riveted in. Each turn is completely filled with sixteen balls, and in operation the balls are diverted

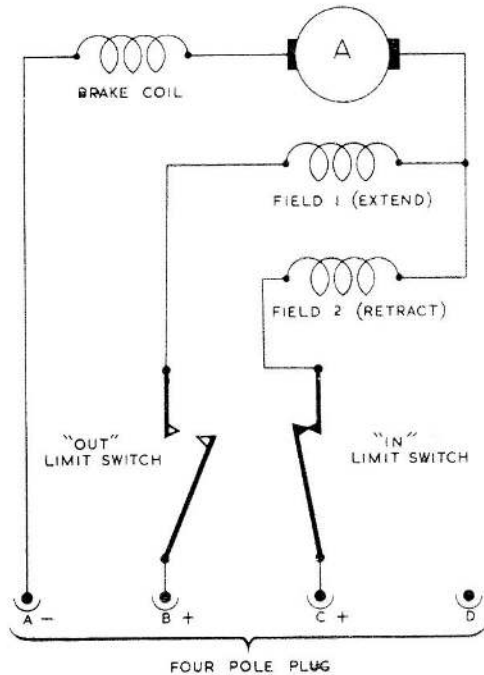


Fig. 2. Circuit diagram

through ports in the ram wall back to the commencement of groove.

14. Two rows of four balls are provided at the driven end of the ram in two straight grooves machined into inserts in the ram housing wall. These provide a bearing for axial ram travel and in addition prevent the setting up of torque reaction in the aircraft members or external linkage due to any rotation applied to the ram by the screw motion. At the output end, the ram passes through a rubber seal mounted between two circlips.

Limit switches

15. The two moulded limit switch assemblies (Rotax N.28249 and N.28261) are located in compartments above the ram, where a small plunger bears upon the ram through the housing and actuates a contact spring on dropping into a slot at the end

of the ram when it is fully extended or retracted.

INSTALLATION

16. Installation should be in accordance with the appropriate aircraft handbook. For details of internal connections, see fig. 2.

SERVICING

General

17. Servicing generally should be carried out as described in A.P.4343, Vol. 1, Sect. 17, Chap. 2. Particular attention should be paid to:—

- (1) Brush length (Leading Particulars).
- (2) Brush spring tension (Leading Particulars).
- (3) External condition of gaskets.

Lubrication

18. The actuator is sufficiently lubricated at manufacture to render unnecessary any lubrication at servicing periods.

Limit switches

19. Under no circumstances should any attempt be made to adjust the setting of limit switches. These are set to operate with a specified maximum ram over-travel, and this setting cannot be adjusted with the actuator installed in an aircraft.

Insulation resistance test

20. Using a 250-volt insulation resistance tester, measure the resistance between the four pins of the plug commoned together and earth. This must not be less than 50,000 ohms.

Note . . .

The value of insulation resistance given in para. 20 applies to actuators being tested under normal workshop conditions. Due allowance should be made for the climatic conditions of the locality and those of the aircraft servicing area or dispersal point where the tests are being applied. In particularly damp climates, the readings obtained may be low enough to give apparently sufficient reason for rejection and, in these instances, discretion should be exercised.

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