# Chapter 52

# ACTUATOR, ROTAX, TYPE C5704

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## LIST OF ILLUSTRATIONS



## LEADING PARTICULARS

| | |
|---|---|
| **Actuator, Type C5704** | Stores Ref. 5W/412 |
| Voltage | 28 volt d.c. |
| Normal load | 450 lb. in. torque |
| Maximum static load | 600 lb. in. torque |
| Current required at normal load | 4·2 amperes |
| Rotation | 120 deg. |
| From fully clockwise positfon | Two stages: 40 deg. + 80 deg. |
| Ffrom fully anti-clockwise position | Two stages: 80 deg. + 40 deg. |
| Time for 120 deg. rotation | 5 to 7 seconds |
| Rating | |
| 20 deg. C. ambient temperature | 10 complete cycles |
| 90 deg. C. ambient temperature | 3 complete cycles |
| Operational temperature range | —70 deg. C. to +90 deg. C. |
| Operational ceiling | 60,000 ft. |
| Brush spring pressure | 2·3—3 oz. |
| Brush grade | DM4A |
| Minimum brush length | 0·281 in. |
| Gearbox reduction ratio | 1845 : 1 |
| Length | 8·437 in. |
| Width | 4·062 in. |
| Height | 4·624 in. |
| Weight | 5 lb. (approx.) |

### Introduction

**1.** Type C5704 actuator is a reversible, rotary machine, the angular travel of the output shaft being limited to 120 deg., with one intermediate position 40 deg. from fully clockwise, by limit switches. The actuator requires a 28-V d.c. supply and draws 4·2 amperes when rotating its normal load of 450 lb. torque. It can operate throughout a temperature range of —70 deg. C. to + 90 deg. C. and at altitudes up to 60,000 ft.

### DESCRIPTION

**2.** The actuator is of " in line " construction and consists of a reversible motor driving an output shaft through an epicyclic reduction gearbox. An electro-magnetic brake and an overrun clutch are also incorporated.

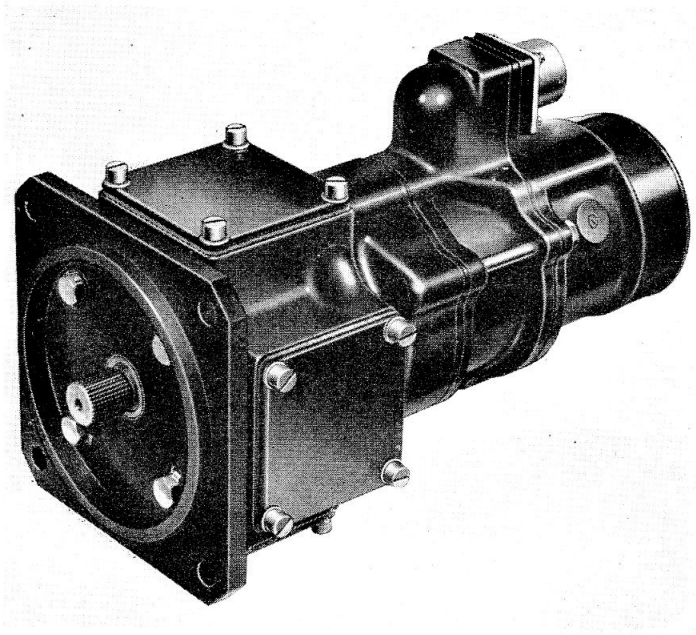

**Fig. 1. Type C5704 actuator**

**3.** The actuator is enclosed by four housings, viz., the motor housing which contains the motor armature, yoke, brushgear and commutator end ball bearing; an intermediate housing which encloses the brake and clutch and carries a four-pole plug for external connection; a gearbox housing containing the gear train, output shaft and limit switches; and the mounting flange plate which closes the end of the gearbox housing. The motor housing, intermediate housing and gearbox housing are held together by three bolts. A coverband encloses two window openings in the motor housing which give access to the brushes.

### Motor

**4.** The motor is a four-pole split field series machine, one half of the field winding being used for each direction of rotation. The armature is carried by a ball bearing at the commutator end, whilst the drive end shaft is splined to engage the clutch plate. Two brushes, set in the moulded brush block, make contact with the commutator, brush pressure being maintained by coil springs.

### Brake and clutch

**5.** The brake solenoid is secured to the interior of the intermediate housing. A brake drum, carried by a ball bearing can rotate about the solenoid, but is normally held stationary by four brake shoes (located by pins in the brake solenoid core or "spider") which are forced against its interior by helical springs. The shoes are pulled inwards away from the drum, leaving it free to rotate, whenever the solenoid is energized. The solenoid is in series with the motor armature.

**6.** The armature shaft passes through a bore in the centre of the brake solenoid core and engages a single clutch plate which is forced against the inner end surface of the brake drum by a helical spring about the armature shaft. The clutch plate and the drive end of the armature shaft are supported by a friction bearing in the centre of the brake drum. The clutch plate normally makes a friction drive with the brake drum, but slips to dissipate armature momentum when the brake drum is arrested as a result of the actuator supply being switched off. In this way overrun of the output shaft is reduced to a minimum.

### Gearbox

**7.** The first stage sun gear of the five-stage epicyclic gearbox is integral with the brake drum. The final stage planet carrier is integral with the output shaft. The five sets of planet gears run within a single annulus gear which is secured within the

gearbox housing. The reduction ratio of the gearbox is 1845 : 1.

#### Limit switches

**7.** The output shaft, which is supported by a plain bearing in the mounting flange plate, carries two cams which operate four limit switches mounted in the gearbox housing. The cam nearer the gearbox operates the two " end of travel " limit switches, whilst the second cam operates the remaining two switches, one for each direction of approach to the intermediate position.

**9.** Each limit switch consists of a moulded block fitted to a metal mounting plate. The fixed contacts and terminals are set in the block and the moving contact, pivoted to its terminal post is linked to an operating lever by a toggle spring. An operating plunger, which rides on the output shaft cam, engages the operating lever, and when the plunger rides up, moving the lever, the moving contact operates with a snap action.

#### Operation

**10.** Pole " A " of the four pole plug is the negative line ; pole " B " is positive for full clockwise rotation and pole " D " is positive for full anti-clockwise rotation, whilst pole " C " is positive for movement to the intermediate position from either direction.

**11.** When positive supply is connected to the required pole of the plug, the appropriate motor field is energized and the brake solenoid is energized via the armature. The brake shoes release the brake drum and the motor rotates the output shaft until the appropriate limit switch is opened by its cam. Supply is then broken and the motor stops. The output shaft is arrested by the brake shoes which are released onto the brake drum.

## INSTALLATION

**12.** Four 0·281 in. clearance holes are provided in the mounting flange, which is 0·250 in. thick. The holes are equispaced on a 4·312 in. P.C.D. concentric with the output shaft. There is a locating spigot 3·249 in. in diameter on the face of the mounting flange.

**13.** The output shaft has a nominal diameter of 0·500 in. into which are cut 36 fine serrations. The length of the serrated spline is 0·500 in. from the end of the shaft.

**14.** Electrical connection is made via a 4-pole breeze plug (Stores Ref. 5X/6006).

## SERVICING

**15.** Make a general inspection of the actuator to ensure that it has not sustained damage. Ensure that it is secure on its mounting and that the electrical connection is sound.

### WARNING

*On no account should the limit switch covers be removed or the setting of the switches interfered with in any way, since failure of the switches may result in serious damage to the actuator and its associated equipment. If any defect in the setting or functioning of these switches is suspected, the actuator must be removed as unserviceable.*

#### Brushes

**16.** Remove the coverband from the motor housing and make the following inspections.

**17.** Remove the brushes and examine them for cracks, security of flexible connections and wear. The minimum brush length is 0·281 in.; ensure that the length of the brush is sufficiently above minimum to give a satisfactory performance until the next servicing.

**18.** Examine the commutator for scores and burns. If its condition is such that commutation is likely to be impaired, the actuator is to be considered unserviceable.

**19.** Ensure that the brushes are free but not slack in their boxes. If they are tight as a a result of carbon being deposited in the brush boxes, the deposits should be removed.

**20.** Measure the pressure of each brush spring with a tension gauge (Stores Ref. 1H/59). Each spring should exert a pressure of 2·5—3 oz. (70·9 to 85 gm.) when it leaves the top of its brush.

#### Insulation resistance test

**21.** Measure the insulation resistance between live parts and frame, using a 250-V insulation resistance tester. A reading of at least 50,000 ohm should be obtained.

**Note . .**

*The value of insulation resistance given in para.* 21 *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.*

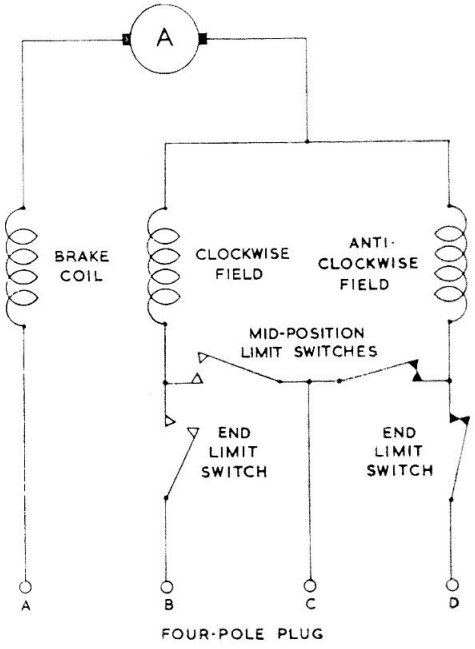


**Fig. 2. Diagram of internal connections**