Chapter 1

STARTER MOTORS, ROTAX, C6800 SERIES

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Introduction

1. Starters in the C6800 series are designed for electrical starting of certain gas turbine engines which include an engaging jaw mechanism and a reduction gearbox of suitable ratio. They are normally used in conjunction with a two-stage starter panel.

DESCRIPTION

2. A typical starter in the series is illustrated in fig. 1 and 2. The motor is a 112-volt d.c. four-pole compound-wound machine which develops 45 B.H.P. at a torque of 39 lb. ft. and a speed of 6,100 r.p.m. for a rated operational period of sixty seconds.

3. There are four principal assemblies, i.e. an armature with its bearings, a yoke and field, a commutator end frame which carries the brushgear, and a driving end frame.

4. The driving end of the armature shaft is serrated to engage the engine coupling, and the mounting flange is fitted with eight 0·375 in. B.S.F. captive mounting bolts. Electrical connection is to two shrouded terminals on the commutator end frame.

Armature

5. The armature is wave wound, and its copper conductors lie in 43 semi-enclosed slots in the laminated core. Each slot carries two conductors, which are wedged and insulated, and the windings are banded by steel rings. All connections to the commutator are "Silfos" brazed.

6. A hollow shaft carries the armature; this shaft is serrated at the driving end, and has a hexagonal extension at the commutator end to allow the motor to be turned with a 2B.A. box-spanner.

Bearings

7. The armature runs in two ball bearings, one at each end. Each bearing is a clearance fit on the shaft, and in its liner, and each is clamped on the shaft by a keyed nut which is locked by a tabwasher and a key washer.

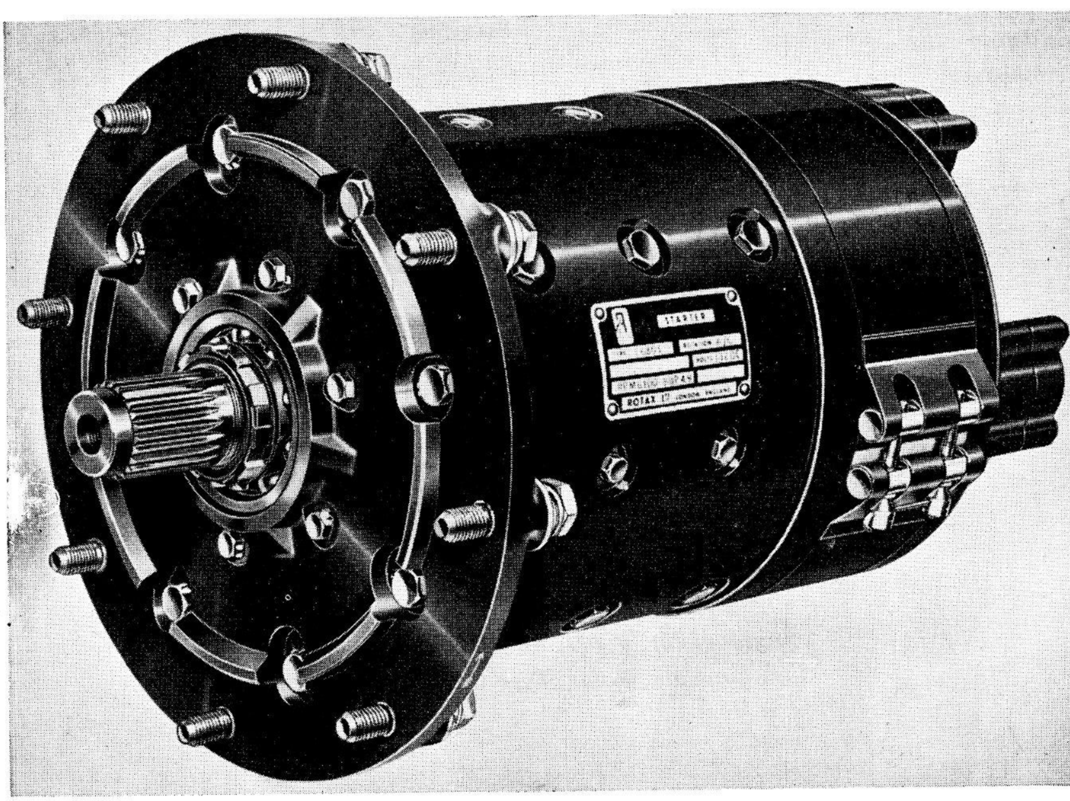

Fig. 1. General view of typical starter

8. A bearing cap encloses the commutator end bearing, which is grease lubricated.

9. The driving end bearing is open and lubricated by oil from the engine to which the starter is fitted. The liner, extending behind the ball bearing, houses an oil seal which is pressed into position and retained by a circlip.

Yoke and field coils

10. Four laminated "Permendur" poles, which are energized by series and shunt windings, and four solid interpoles (the windings of which are in series with the series field), are bolted to the interior of a mild steel yoke. The complete assembly is impregnated with varnish.

Brushgear

11. The brushgear consists of four brush boxes bolted to a reinforced Bakelite brush-ring. Each brush box has a platform for connections and carries two brushes which are held in contact with the commutator by swan-necked springs. A copper strip is fitted to interconnect the two negative brush boxes.

12. Four 2B.A. hexagon head bolts secure the moulding to the commutator end frame. All exposed surfaces are coated with "Dulux Red" paint to prevent tracking which may result from the presence of carbon dust.

Terminals

13. The two brass terminal posts are fitted in holes in the commutator end frame and

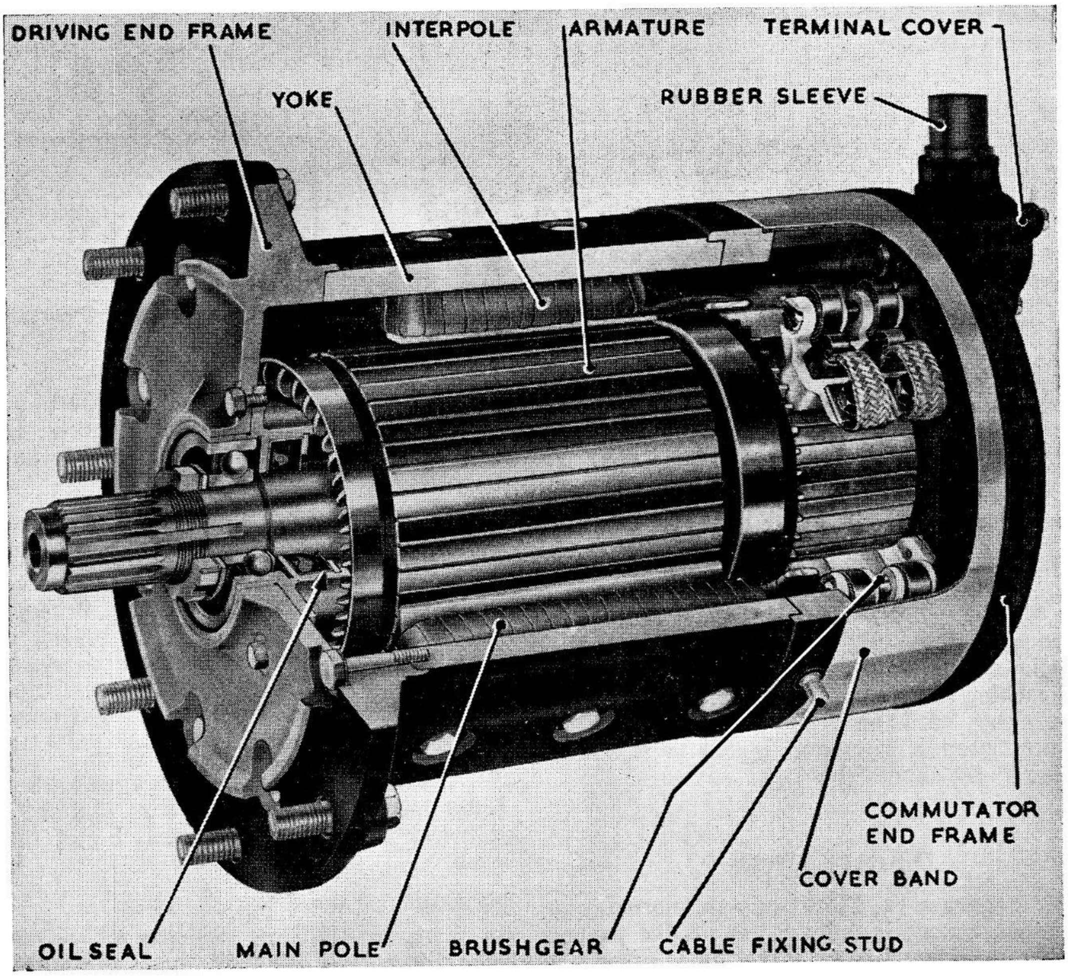

Fig. 2. Sectional view of starter

are insulated by shockproof Bakelite bushes and washers. A nut, with a spring washer and a plain washer (bearing on the insulating washer) secures each terminal post and holds the lower part of each terminal casing in place.

14. Three 2B.A. hexagon bolts secure each complete terminal cover assembly, consisting of a lower casing and cap. Rubber sleeves are fitted to ensure good insulation and to prevent cable chafing.

Internal connections

15. The series and interpole fields are connected, at one end, to the negative terminal and, at the other, to a flag terminal on one of the negative brush platforms. The shunt field is connected through flexible leads to brush boxes of opposite polarity. The positive brushes are connected to the positive terminal by copper strips.

End frames

16. Eight 2B.A. hexagon head bolts secure the commutator end frame to the yoke, two being accessible from each of four window openings. A coverband, which closes these openings, is held in place by two captive screws secured by a locking wire.

17. Eight ¼ in. B.S.F. hexagon head bolts secure the driving end frame to the yoke. The mounting flange is a part of this end frame. Both end frames are magnesium alloy castings.

Operation

18. Although wound with both series and shunt fields, the Type C6803 starter has a series characteristic. It develops a high torque at slow speed when accelerating the engine and, after the turbine has lit up and is reaching self-supporting speed, this torque diminishes until, under no load conditions, motor speed is high but limited to a safe value by the shunt field.

INSTALLATION

19. Starters in the C6800 series are normally flange-mounted; installation details for particular machines will be given in the appropriate Appendix, and reference should also be made to the relevant Aircraft Handbook.

Lubrication of oil seal

20. Before mounting the starter, lubricate the oil seal and driving end bearing with oil of the same grade as that used in the engine to which it is to be fitted.

21. Coupling will be facilitated if a 2B.A. box-spanner is used to turn the armature shaft from the commutator end to engage the driving pinion or serrated shaft with the engine mechanism. No attempt should be made to turn the engine by hand cranking the armature shaft.

22. Electrical connection is made to two enclosed terminals on the commutator end frame. Two studs, to which the supply cables must be anchored, are fitted to the commutator end frame.

Note . . .

> *When mounting the starter, it is very important that no oil is allowed to contact the unsealed housing and seep into the motor.*

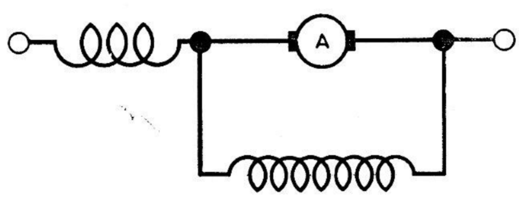

Fig. 3. Diagram of internal connections

SERVICING

23. These starters should be serviced in accordance with the general chapter in A.P.4343, Vol. 1, Sect. 15, and the relevant Servicing Schedule.

Brushgear

24. The minimum length beyond which brushes must not be used is 0·720 in., the length when new being 0·843 in. Brushes should be renewed at periods prescribed in the relevant Servicing Schedule, and whenever examination reveals that they will not remain serviceable for the period that must elapse before the next servicing.

25. Brush spring pressure, measured with a spring balance, should be between 28 and 32 oz. when the spring leaves the top of the brush.

Insulation resistance test

26. The insulation resistance, when measured with a 500-volt insulation resistance tester between all live parts and the frame, should be not less than 50,000 ohms.

Appendix 1

STARTER MOTOR, ROTAX, TYPE C6803

LEADING PARTICULARS

Starter motor, Type C6803	**Ref. No. 37F/5500**
Voltage	112 *volts d.c.*
Current (*full load*)	400 *amp.*
Rating	60 *seconds*
Rated H.P.	45 *B.H.P.*
Output	39 *lb. ft. at* 6,100 *r.p.m.*
Rotation	*Anti-clockwise from drive end*
Brush grade	*E.G.*7439
Brush spring pressure	28 *to* 32 *oz.*
Brush length (*new*)	0·843 *in.*
Minimum permissible brush length	0·720 *in.*
Commutator diameter (*new*)	3·2 *in.*
Commutator diameter (*minimum permissible*)	3·14 *in.*
Weight	56 *lb.*

1. The starter motor, Type C6803, is identical to that described and illustrated in the main chapter.

2. Mounting is by means of eight $\frac{3}{8}$ in. B.S.F. captive bolts equally spaced on an 8 in. pitch circle diameter. The end of the serrated driving shaft is axially tapped $\frac{3}{8}$ in. B.S.F. to a depth of $\frac{3}{4}$ in. and countersunk at 60 deg. to a diameter of 0·450 in. The length of the motor from the end of the bearing cap to the flange is 11·594 in. The maximum diameter (i.e. the diameter of the flange) is 8·850 in.

Appendix 2

STARTER MOTOR AND CLUTCH, ROTAX, TYPE C6805/1

LEADING PARTICULARS

Starter motor and clutch, Type C6805/1	**Ref. No. 37F/5503**
Voltage	112 *volts d.c.*
Current (full load)	400 *amp.*
Rating	60 *seconds*
Rated H.P.	45 *B.H.P.*
Output	39 *lb. ft. at* 6,100 *r.p.m.*
Rotation	*Clockwise from drive end*
Brush grade	*E.G.*7439
Brush spring pressure	28–32 *oz.*
Brush length (new)	0·843 *in.*
Minimum permissible brush length	0·720 *in.*
Commutator diameter (new)	3·2 *in.*
Commutator diameter (minimum permissible)	3·14 *in.*
Mounting flange	*Part of commutator end frame assembly, Rotax* N.99343–1 (*to S.B.A.C. Drg. RS.*305, *Sht.* 1)
Clutch setting	70 *lb. ft* $^{+20}_{-0}$ *lb. ft.*
Weight	59·5 *lb.*

1. The C6805/1 unit is similar to that described and illustrated in the main chapter, but has a clutch assembly incorporated, as illustrated in fig. 1 of this appendix. It differs from the previous C6805 (Ref. No. 37F/5501) which it supersedes in having a revised terminal arrangement, with increased clearance between the terminals and terminal cover.

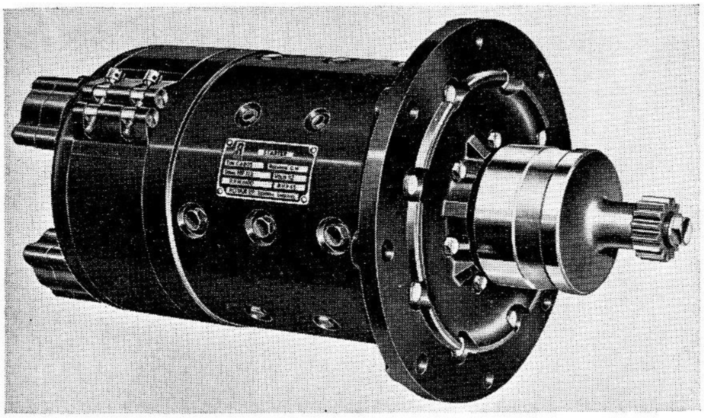

Fig. 1. General view of C6805/1 starter motor

2. A new commutator end frame has also been introduced, the difference being in the eight flange mounting holes, i.e. seven holes 0·3906 in. diameter are counterbored 0·468 in. diameter × 0·450 in. deep, and one hole only is drilled through 0·468 in. diameter. Installation details are shown in fig. 2.

3. The clutch assembly consists of an outer clutch barrel, which is integral with the driving pinion, and an inner coupling, torque being transmitted through seven inner steel clutch plates and six outer plates of steel sintered with phosphor bronze. The outer surface of the coupling and the inner surface of the barrel are splined to engage their respective plates. Pressure is applied to the clutch plates by a ring of twelve helical springs compressed by an adjusting nut which screws into the clutch barrel and is secured by two locking plates. The clutch is set to slip at 70–90 lb. ft. torque.

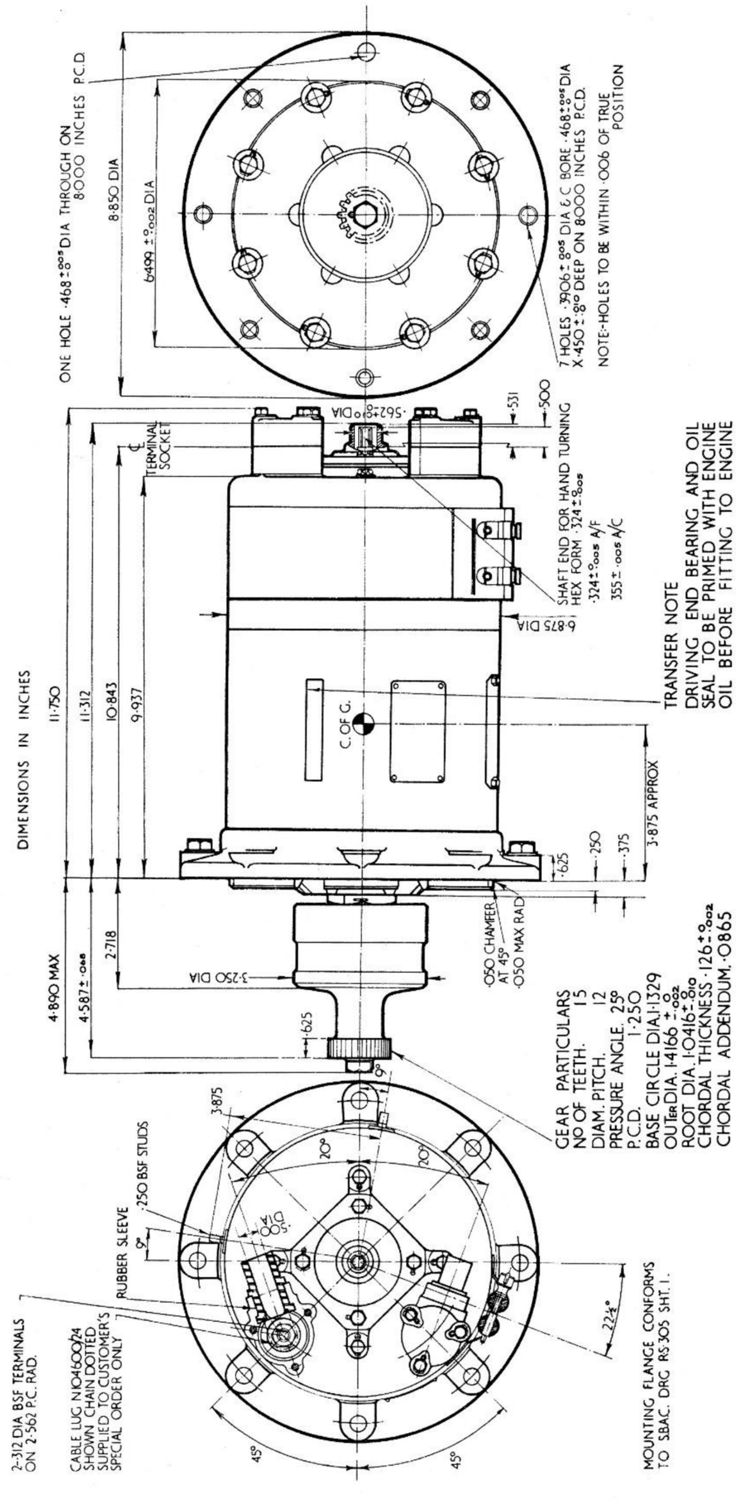

Fig. 2 Installation details

Appendix 3

STARTER MOTOR, ROTAX, TYPE C6810

LEADING PARTICULARS

Starter motor, Type C6810	**Ref. No. 37F/5505**
Voltage	112 *volts d.c.*
Current (full load)	400 *amp.*
Rating	60 *seconds*
Rated H.P.	45 *B.H.P.*
Output	39 *lb. ft. at* 6,100 *r.p.m.*
Rotation	*Anti-clockwise from drive end*
Brush grade	*E.G.*7439
Brush spring pressure	28–32 *oz.*
Brush length (new)	0·843 *in.*
Minimum permissible brush length	0·720 *in.*
Commutator diameter (new)	3·2 *in.*
Commutator diameter (minimum permissible)	3·14 *in.*
Mounting flange	*Part of commutator end frame assembly, Rotax N.*99343
Weight	56 *lb.*

1. The C6810 unit is similar to that described and illustrated in the main chapter except that the armature shaft drive end is to BSS.A19, 1·125 in. nominal coarse serrations; the terminal box and associated rubber sleeves are of a modified type to the main chapter, but incorporating the two 0·312 in. diameter B.S.F. terminals on a 2·562 in. P.C. radius. The rotation of the unit is anti-clockwise when viewed from the drive end. Installation details are shown in fig. 1.

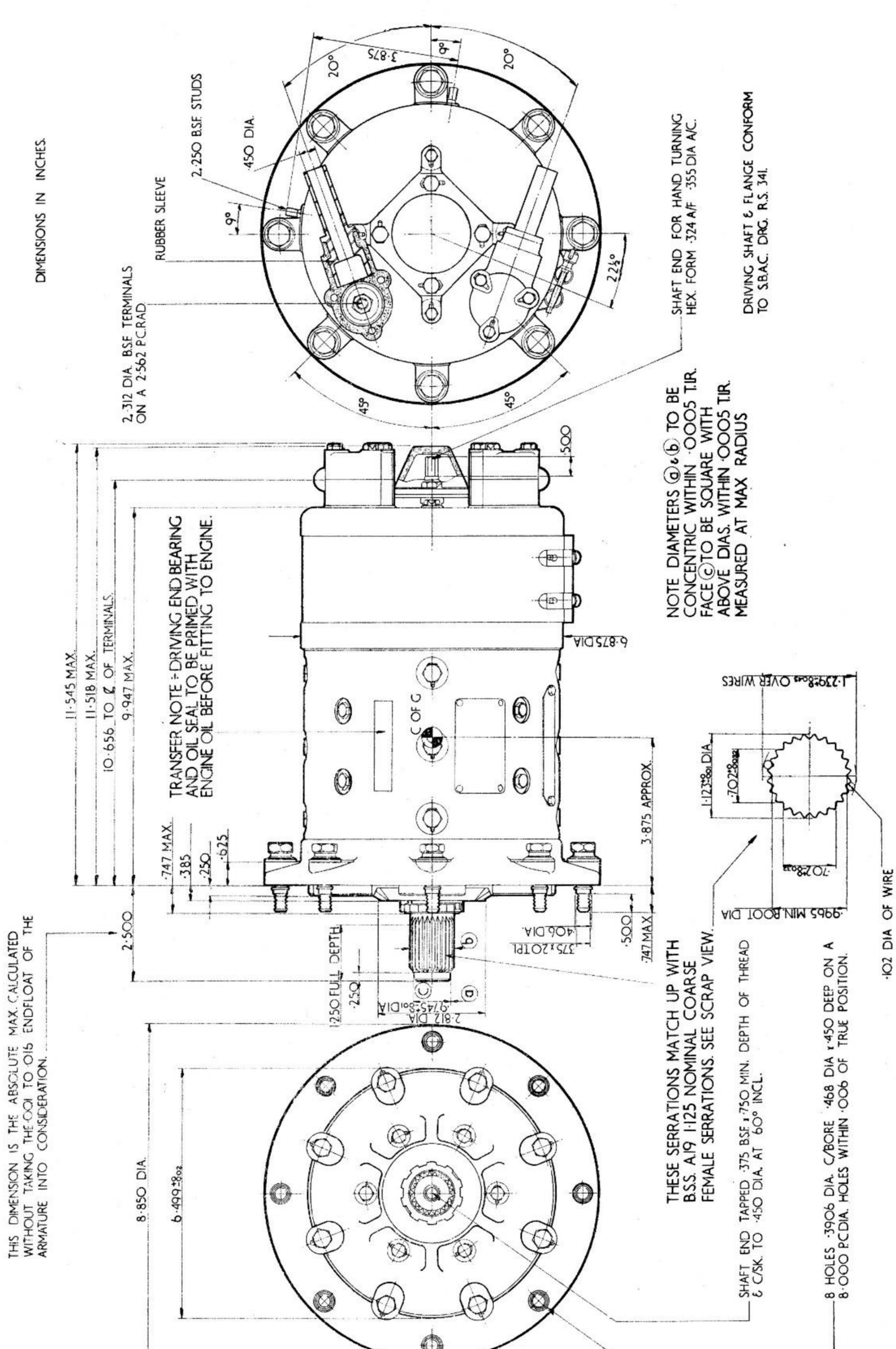

Fig. 1 Installation details

Appendix 4

STARTER MOTOR, ROTAX, TYPE C6814

LEADING PARTICULARS

Starter motor, Type C6814	**Ref. No. 37F/5506**
Voltage	112 *volt* d.c.
Current (full load)	400 *amp.*
Rating	60 *seconds*
Rated H.P.	45 *B.H.P.*
Output	39 *lb. ft. at* 6,100 *r.p.m.*
Rotation	*Anti-clockwise*
Brush grade	*E.G.*7439
Brush spring pressure	28–32 *oz.*
Brush length (new)	0·843 *in.*
Minimum permissible brush length	0·720 *in.*
Commutator diameter (new)	3·2 *in.*
Commutator diameter (minimum permissible)	3·14 *in.*
Mounting flange	*Part of commutator end frame assembly, Rotax N.*99343
Weight	56 *lb.*

1. The C6814 unit is similar to that described and illustrated in the main chapter, except that a new brushgear assembly has been introduced with additional insulation added to prevent possibility of armature current tracking to earth.

2. A new armature bearing cap has been introduced with an air pressure release hole, to prevent bearing grease and carbon dust forming near the commutator assembly. Installation details are shown in fig. 1.

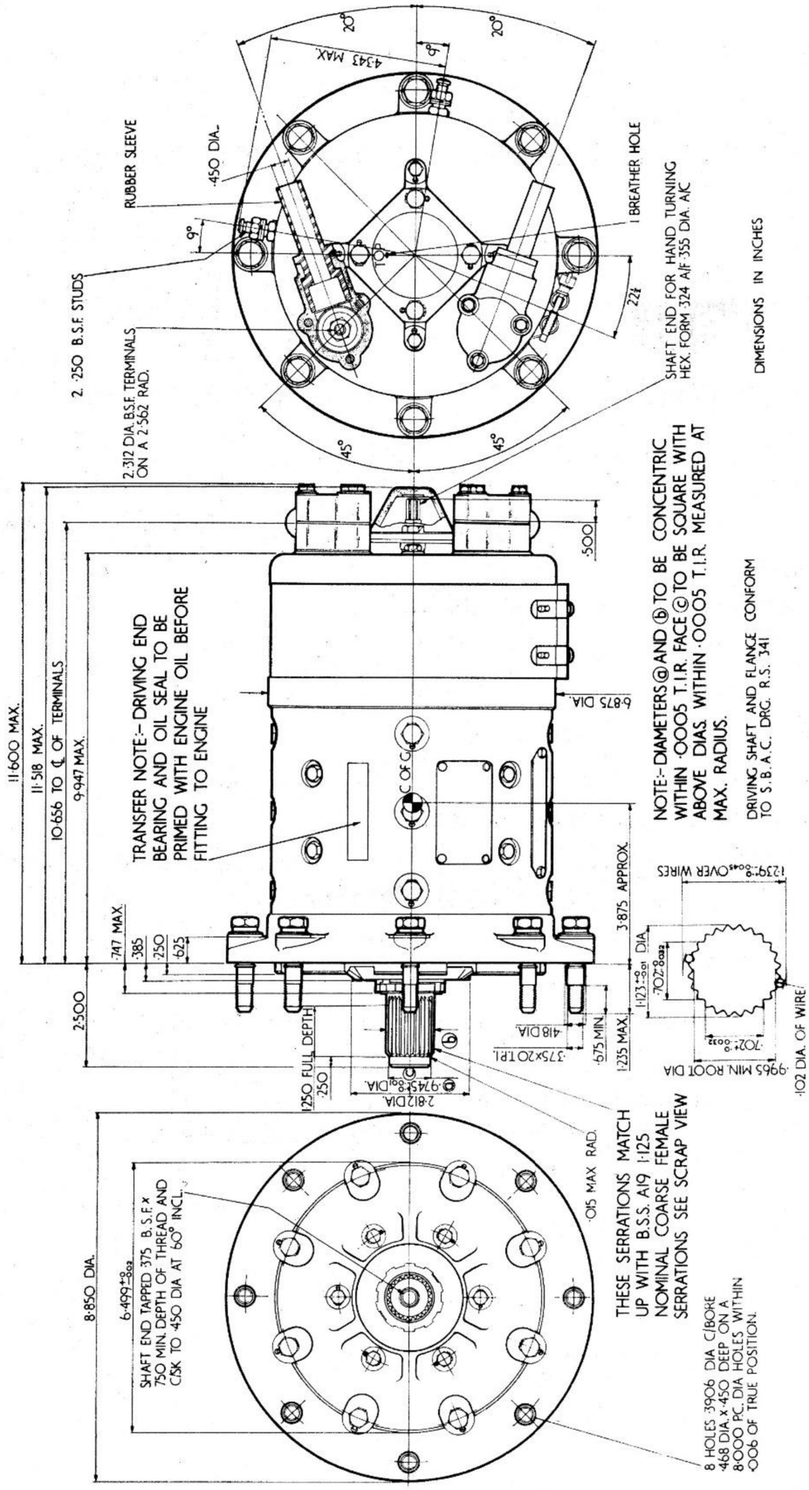

Fig. 1 Installation details

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