Cancelled now AP 120N-0105-11e

Chapter 4

MOBILE A.C. GENERATOR TEST RIG, TYPE AE7729

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Mobile alternator test rig	**Ref. No. 26DK/95423**
Overall dimensions	
Length	13*ft.* 6 *in.*
Width	4*ft.* 4 *in.*
Height	4*ft.* 8 *in.*
Weight	3318 *lbs.*
Tyre pressure	65 *lbs/in.*^{2}
Input	440*V*, 3-*phase*, 50 *c/s*
Synchronous induction drive motor	*English Electric Serial No. IWT*5769/1–4 *supply* 440*V*, 3-*phase*, 50 *c/s*
Speed	3000 *rev/min.*
Output	25 *HP, unity P.F.*
Full load stator current	31·9*A*
Brushes	*Le carbone EG*97*B*
Bearing (drive end)	*Hoffman RMS* 16*V high speed*
Bearing (non drive end)	*Hoffman M*14*V high speed*
D.C. exciter	*English Electric Serial No. IWT*5769/5–8 *output* 21·6*V*, 928·8*W*, *speed* 3000 *rev/min.*
Full load field current	43*A*
Brushes	*Morganite Type EG*12
Bearings (drive end)	*Skefko* 6203
Bearings (non drive end)	*Skefko FL*30
Starter (drive motor)	*Allen West Type SRO*
Starter (blower motor)	*Allen West Type SC2N*
A.C. generator	*English Electric Type* 162
Gear box	*Crofts Type M.P.T.*3
Oil filter cartridge	*Fram Type CX*–1106*PL*

Introduction

1. The test rig is designed for testing and fault finding on the a.c. power supply circuit and associated components fitted to the Lightning Mk.1 and 2 aircraft. The rig may also be used to test the Type 162 or similar type of a.c. generator.

DESCRIPTION

General

2. The rig (fig. 1) which is mounted on a four-wheeled chassis, comprises a Type 162 a.c. generator coupled to a synchronous induction drive motor via a gearbox. A d.c. exciter, which supplies field excitation current to the drive motor, is directly coupled to the opposite end of the motor.

3. A motor-driven air blower supplies cooling air to the a.c. generator located on the rig, and to the generator control equipment situated in the aircraft. The drive and blower motors are each equipped with starters, these are located at the towing end of the trolley.

Drive motor

4. The 3000 rev/min. synchronous induction drive motor (fig. 2) develops 25 h.p. at unity power factor. The star-connected rotor windings are supplied by the d.c. exciter and revolves in the field of the delta-connected stator windings which are excited from the 415V, 3-phase, 50 c/s mains supply.

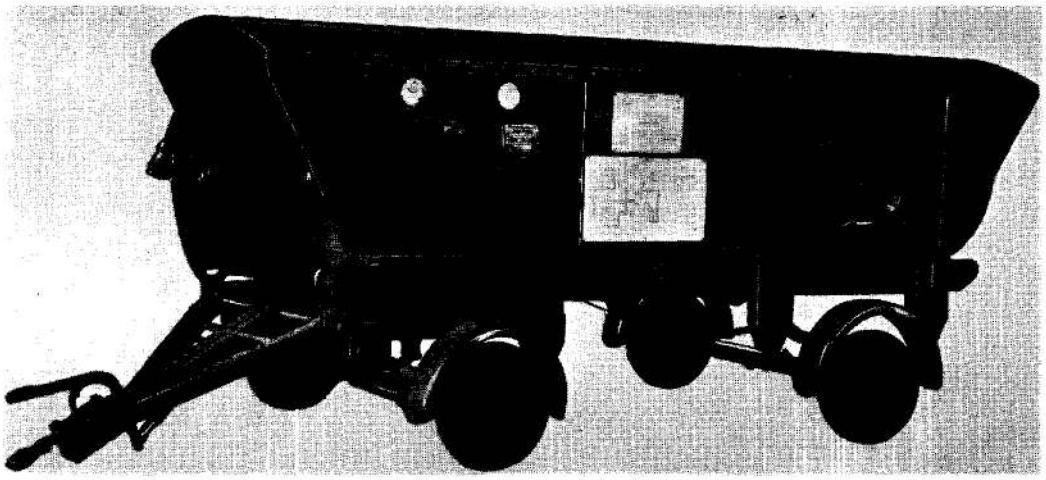

Fig. 1. Test trolley with side panel removed

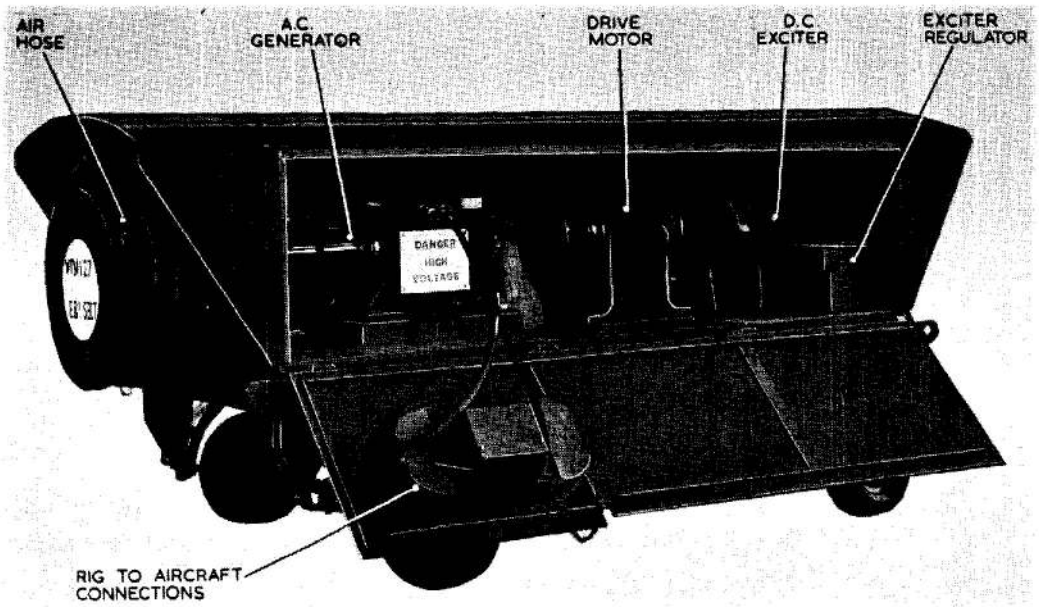

Fig. 2. Test trolley (rear view)

D.C. exciter

5. The 22V 900W d.c. exciter is a 6-pole shunt wound generator equipped with auxiliary field windings connected in series with the armature. It is directly coupled to the drive motor whose field excitation current it supplies. The exciter regulator which controls the value of current in the shunt field winding is located alongside the exciter.

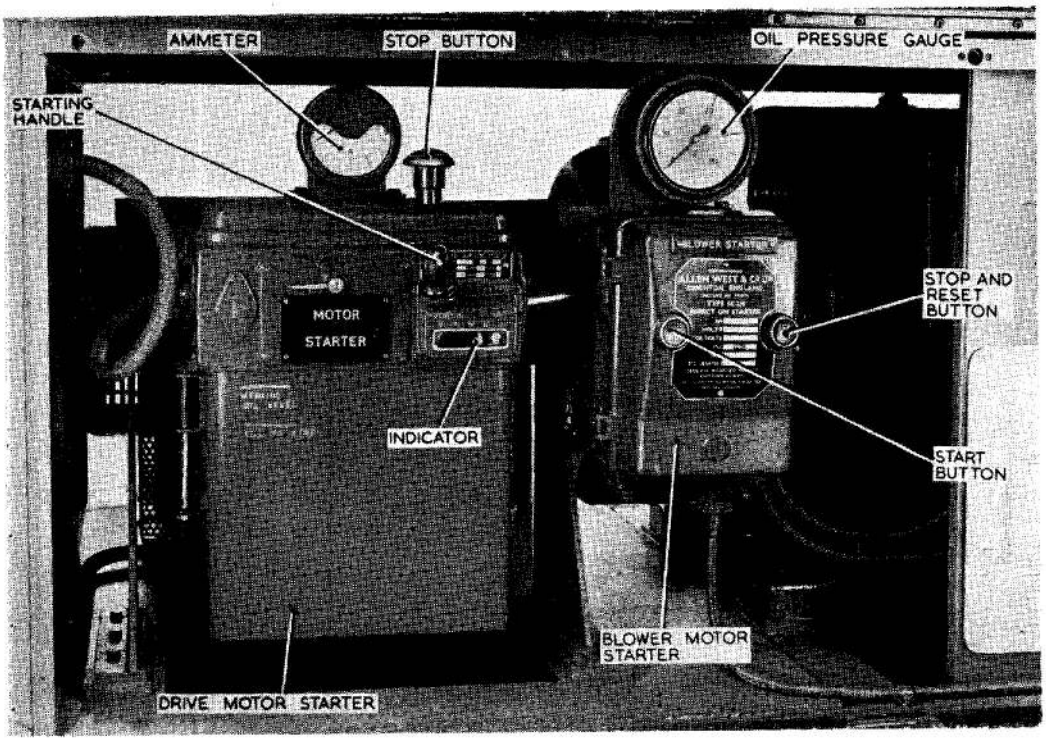

Fig. 3. Motor starters

Starter (drive motor)

6. The drive motor starter (fig. 3) is a combined oil-immersed stator circuit breaker and 3-phase hand-wheel operated rotor starter. The 3-phase rotor windings are connected via sliprings to three stepped resistor units which are connected in star configuration via the starter connections.

7. An indicator located immediately below the hand-wheel is marked off in five positions from FULL ON to OFF. The mechanism provides a positive movement between the positions, which correspond with the starter connections to the starting resistors.

8. The starter is equipped with an interlock which prevents closing of the stator contactor unless the rotor circuit resistance is "all in" (indicator at OFF) at the beginning of the starting procedure. A further interlock ensures that if, during starting, pressure on the starting handle is released before the FULL ON position is reached, the stator contactor will open and a further starting attempt must be made. A stop button is mounted on top of the starter.

9. Connected in series with the stator supply lines are three magnetically operated overcurrent relays, these are accessible by removing the plate bearing the label MOTOR STARTER.

Gearbox

10. A Crofts Type MPT3 gearbox (fig. 4) is interposed between the synchronous induction drive motor and the a.c. generator. The gears are of the continuous double helical type and are mounted on shafts supported on roller bearings.

Lubrication system

11. Mounted on the gearbox is an oil pump which circulates oil to lubricate the gearbox and the bearings of the a.c. generator. An oil pressure indicator is mounted above the blower motor starter (fig. 3), during running pressure in the system should not fall below 50 lb/in^2. The lubrication system is equipped with an oil filter which is located alongside the gearbox (fig. 4).

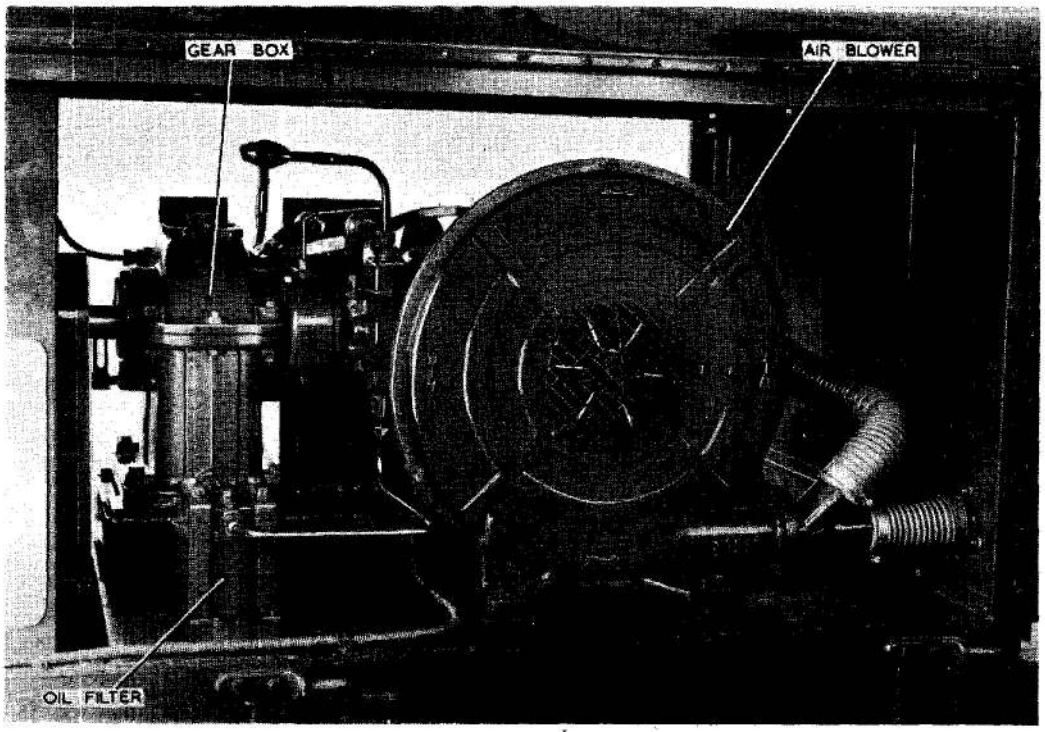

Fig. 4. Gear box and air blower

Forced air cooling system

12. Forced air cooling is provided for the a.c. generator on the rig and for the power supply components located in the aircraft. The air blower (fig. 4) which is driven by an induction motor, delivers air to the aircraft components via the air hose (fig. 2.) The end of the air hose must be inserted into the duct at the base of the aircraft fin before operating the test rig in conjunction with the aircraft power supply equipment.

Starter (blower motor)

13. An Allen West 3-phase starter Type SC2N (fig. 3) is used for starting the blower motor. Magnetically operated over-current relays equipped with oil dashpots protect the circuit against the effects of high current. The starting circuit is connected so that it is necessary for the blower motor starter contactor to close before a supply is completed to the stator circuit of the drive motor. This arrangement ensures that, providing the cooling system is properly connected, the a.c. generator and its associated components cannot be tested unless the cooling system is in operation.

A.C. generator Type 162

14. The a.c. generator Type 162 (fig. 5) is mounted on a bracket located at the aft end of the trolley and is driven through the gearbox by the drive motor. Connections to the generator are brought out to two multi-pole sockets which are also shown in fig. 5. Complete information on the generator Type 162 is contained in A.P.4343A, Vol. 1, Sect. 2.

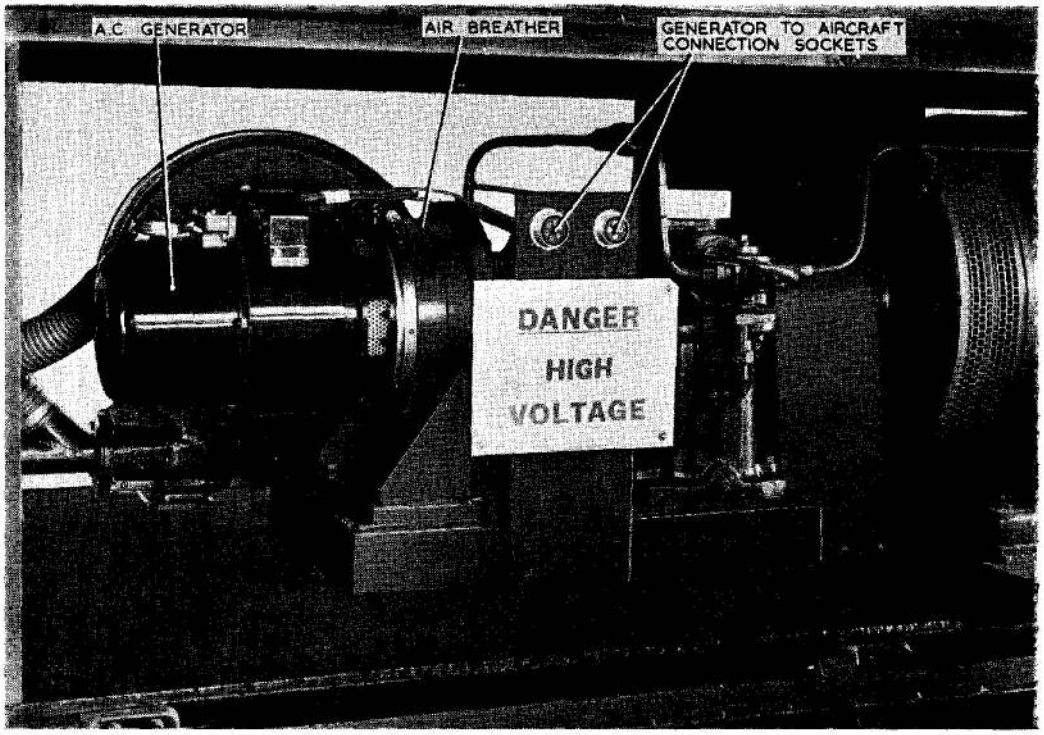

Fig. 5. A.C. generator type 162

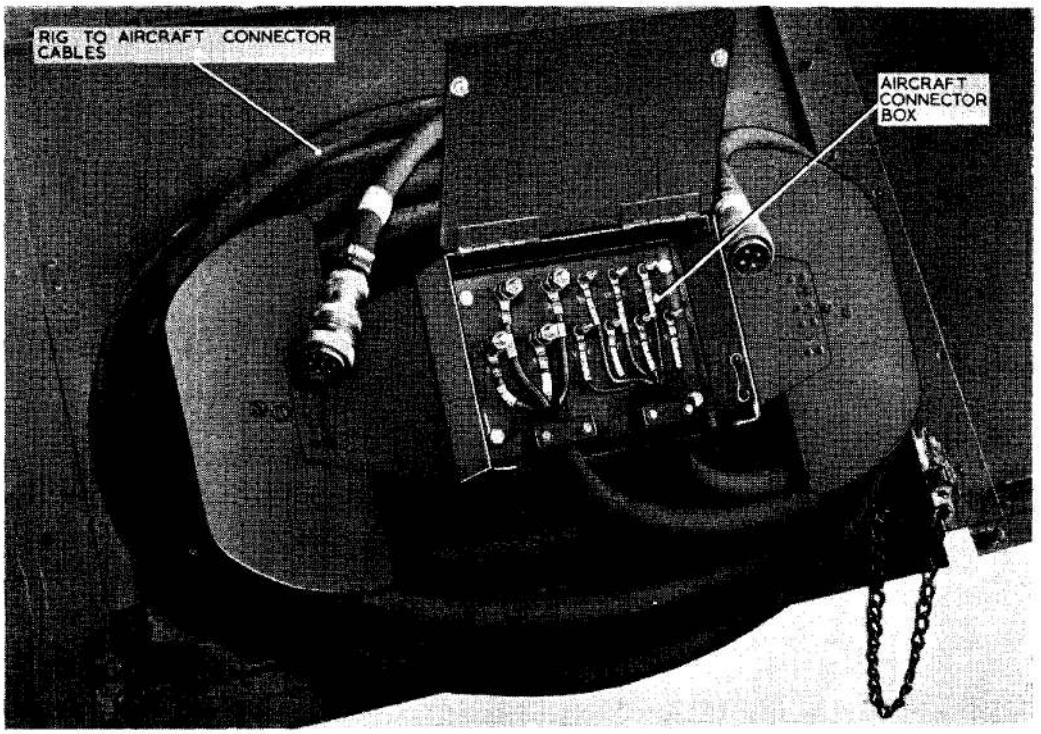

Fig. 6. Rig to aircraft connections

Test rig to aircraft connections

15. One four core and one seven core cable together with a connector box (fig. 6) are located on the trolley side-cover adjacent to the a.c. generator. Plugs attached to the ends of the cables, when connected to the sockets (fig. 5), complete connections between the generator output terminals and field system to the aircraft connector box.

Instruments and fuses

16. Mounted above the starter for the drive motor is a 0-60A range ammeter which meters supply current to the drive motor. Two fuses for the protection of the blower motor starter control circuit are contained within the starter.

OPERATION

Starting

Blower Motor

17. To start the blower motor depress the START button momentarily. The starter coil will then be connected between L1 and L3 of the 440V, 3-phase supply and contacts supplying the blower motor will close. Normally open contacts 4 and 5 will also close so enabling a supply to be completed to the coil of the drive motor starter.

Drive motor

18. Before starting ensure that the indicator is in the OFF position. Initial movement of the starting handle closes switch SW1, the stator contactor now closes due to the magnetic effect of the operating coil which is connected between L1 and L3 of the mains supply, its circuit being completed via SW1 and contacts 4 and 5 of the blower motor starter. Continued rotation of the handle progressively reduces the rotor circuit resistance and the motor speed accelerates to normal.

19. An interlocking mechanism ensures that the starter cannot be accidentally left in any of the intermediate positions between FULL ON and OFF. If pressure is released from the starting handle before the FULL ON position is reached the stator contactor opens and a further starting attempt must be made.

Stopping

Drive motor

20. To stop the drive motor only, depress the STOP button. Switch SW1 will open and de-energize the operating coil, so breaking the stator contactor connections and bringing the motor to rest. The handwheel must now be rotated until the indicator is in the OFF position, so re-selecting the rotor resistance to the " all-in " position in preparation for subsequent starting.

Blower motor

21. To stop the blower motor depress the STOP and RESET button. This will de-energize the operating coil and open the contacts supplying the motor. Contacts 4 and 5 will also open so de-energizing the operating coil of the drive motor starter, both motors will now come to rest.

Under-voltage release

22. In the event of under-voltage conditions developing the contactors of both starters will open so bringing the motors to rest.

Over-load protection

23. Both starters are fitted with magnetically operated over-load protection units fitted with adjustable oil dashpots. In the event of excess current flowing in the stator circuits of either motor a mechanical link operated by the over-current relays will cause the contactors to open and stop the affected motor. After removing the cause of over-load the over-load protection units may be reset by operation of the RESET button.

OPERATING INSTRUCTIONS

Starting preparation

24. Before starting the motors carry out the following procedure to ensure that sufficient oil is contained in the lubrication system.

(1) Remove the oil level plug in the gearbox and check the oil level.

(2) If necessary, replenish the lubrication system with oil 0X38 by removing the air breather and disc from the top of the alternator mounting and pouring oil through the air breather hole until the prescribed oil level is reached in the gearbox.

(3) Replace the oil level plug, air breather and disc before starting the motors.

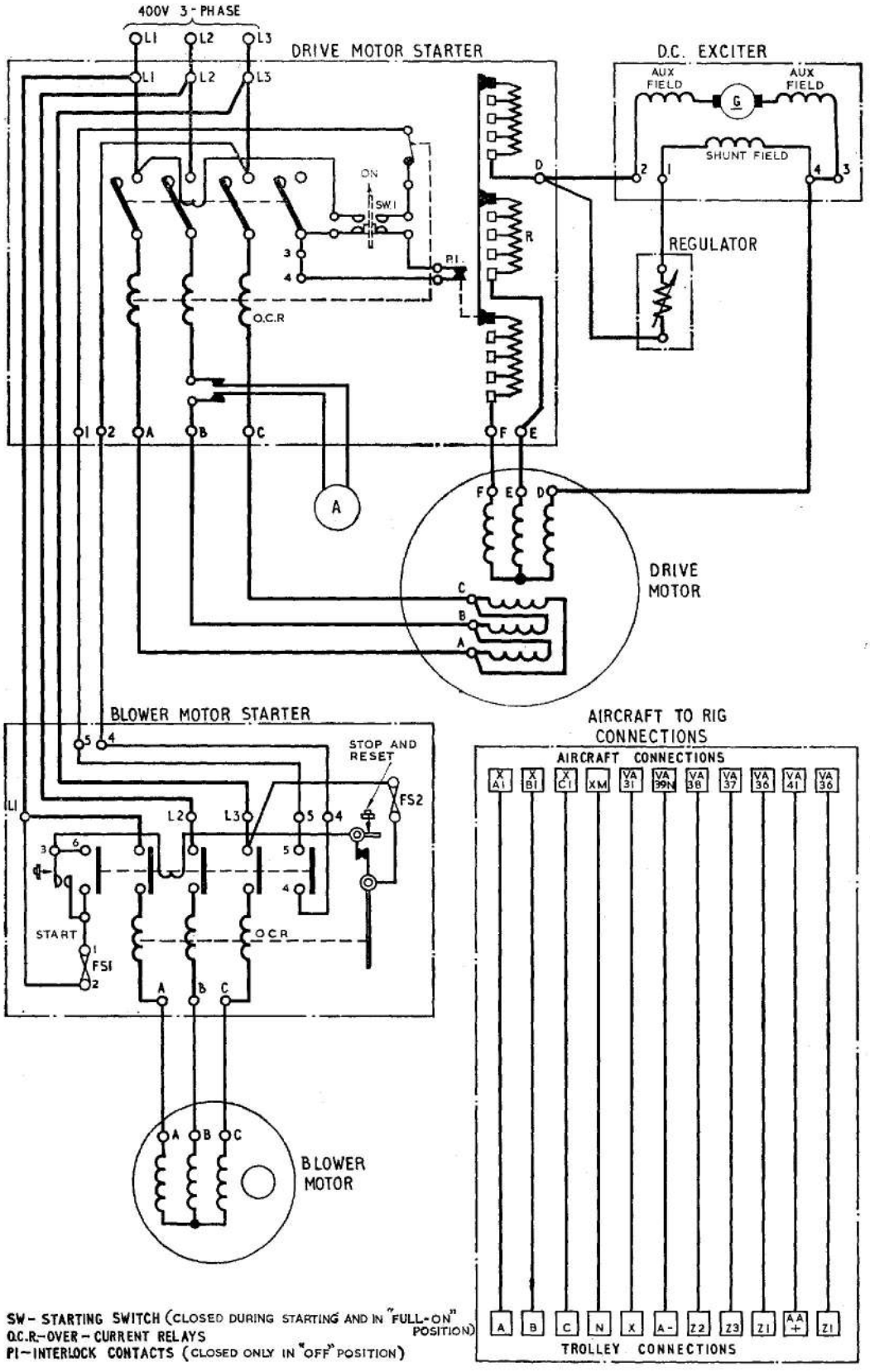

Fig. 7. Circuit diagram

Starting procedure

25. (1) Complete the connection between the trolley and the 440V, 3-phase supply.

(2) Insert the end of the air hose into the duct at the base of the aircraft fin.

(3) Open the side-panels on both sides of the trolley.

(4) Complete the connections between the trolley and the aircraft by removing the aircraft connector box (fig. 6) and making the connections into the aircraft power supply system.

(5) Depress the START button on the blower motor starter and start the drive motor as described in para. 18.

26. After running the motors for one minute check the oil pressure as indicated on the pressure gauge, the indicated value should not be less than 50 lbs/in^2. If the pressure is found to be fluctuating the motors must be stopped, and the level of oil in the lubricating system rechecked.

27. Detailed instructions concerning connection of the rig to the aircraft installation and operation of the rig in conjunction with the aircraft a.c. generator power system will be contained in A.P.4700A and B, Vol. 1, Book 2, Sect. 6.

SERVICING

Chassis

28. Periodically check the security of the chassis and road wheels, ensure that the towing frame and steering turntable have freedom of movement and that the hinged panels can be fastened securely. Operate the hand brake making sure that it will remain in the on position and that the wheels are efficiently braked. Inflate tyres to 65 lbs/in.^{2} pressure and check for excessive wear and deterioration. Lubricate the wheels, brake linkage, towing frame, turntable and all hinges and fasteners.

General

29. All cables should be examined for deterioration and wear and should be renewed as required. Connections, especially those to the supply cable and rig to aircraft connector cable, should be examined for security; ensure also that three-phase connections are connected in the correct phase sequence.

30. Inspect all components, pipes and couplings for cleanliness security and signs of damage. Grease, oil and congealed dirt may be removed with the aid of a cloth moistened with lead free gasoline. Remove all dust and fluff from ventilating grills by means of a brush, it is important to ensure that no extraneous matter be allowed to enter the ventilators, particular attention should be paid to the air blower inlet.

Drive motor

Brush gear assembly

31. The brush gear assembly should be examined to ensure that it is secure. Brushes must be free from contamination by oil or grease and have freedom of movement in their holders. Brushes must be free from damage and should be renewed if their length is reduced to less than $\frac{1}{2}$ in. Brush spring tension should be maintained at $1\frac{1}{8}$ lbs. on each brush. Remove carbon dust from the vicinity of the sliprings and brushes by means of a vacuum line or blast of clean dry air.

Sliprings

32. Sliprings should be clean and free from indications of burning, the surfaces may be cleaned with a soft non-fluffy material moistened in lead free gasoline or by the use of super fine glass paper applied evenly all round the slipring surface. If skimming is necessary the diameter must not be reduced below $4 \cdot \frac{5}{16}$ ins.

Lubrication

33. The bearings are lubricated on assembly, when further lubrication becomes necessary Grease XG-271 should be used. Care should be taken not to over lubricate the bearings or grease may be exuded from the bearings and will adversely affect operation of the motor.

Insulation resistance

34. The insulation resistance should be tested with a 500V Insulation Resistance Tester and should not be below 15,000 ohms.

D.C. Exciter

Brush gear assembly

35. The brush gear assembly should be serviced in the manner prescribed in para. 31.

Brushes should be renewed when worn to a minimum length of $\frac{1}{4}$ in.; brush spring tension should be maintained at between 14 and 18 ozs. for each brush

Commutator

36. The commutator should be maintained in a clean condition and be free from indication of arcing and burning; mica intersegment insulation should be undercut to a depth of $\frac{1}{32}$ in. The commutator may be cleaned with a soft non-fluffy material moistened on lead free gasoline. Light scoring may be removed by the use of super fine glass paper applied evenly all round the commutator surface. Should skimming be necessary the commutator diameter must not be reduced below $2\frac{9}{16}$ in.; eccentricity relative to the shaft must not exceed 0·0005 in.

Lubrication

37. Instructions concerning lubrication of the drive motor (para. 33) apply also to the D.C. Exciter.

Insulation resistance

38. The insulation resistance should be tested with a 500V Insulation Resistance Tester and should not be below 50,000 ohms.

Starter (drive motor)

39. Open the switch periodically and filter the oil in the tank to remove traces of carbonization. Clean the insulation, examine all cables and connections for serviceability. Contacts should be free from deterioration and excessive wear; if pitted or burnt the contacts should be dressed using grade 00 crocus paper (Ref. No. 33C/540) all swarf must be removed afterwards.

40. Ensure that the tank is clean; replace the oil and top up to the level indicated using Oil OM-16, reassemble the tank to the starter. Lubricate the operating handle and trip bar bearings with light machine oil.

Overload releases

41. Beneath the plate bearing the inscription MOTOR STARTER are the three electromagnetically operated overload releases. Removal of the dashpot retaining screws and dashpots will enable the oil level to be checked, this should be replenished as necessary using Oil OM-16.

42. Complete servicing instructions for the starter, Allen West Type SRO, will be given in A.P.4343G, Vol. 1, Sect. 15.

Starter (blower motor)

43. Complete servicing instructions for this starter, Allen West Type SC2N, are at present contained in A.P.4343G, Vol. 1, Sect. 15.

Gearbox and lubrication system

44. Ensure that oil in the gearbox is maintained at the correct level, this should be done by following the procedure prescribed in para. 24. Following the initial 20 hour running in period the manufacturers recommend that oil should be drained from the lubrication system and be replaced with new Oil OX-38, and that this procedure should subsequently be repeated at intervals of 500 hours running.

45. On each occasion when oil is changed, the oil filter should be renewed. Access to the filter is facilitated by removal of the hexagonal headed bolt which secures the filter bowl to the main assembly. When reassembling the filter care should be exercised to ensure that the bowl seats firmly on the washer and that the washer is undamaged, failure to observe this precaution will result in considerable oil leakage during running.

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