Obsolete

Chapter 1

GENERATOR, TYPE UKX

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LEADING PARTICULARS

Generator, Type UKX	Stores Ref. 5UA/421
D.C. rating	29 V, 60 amp.
A.C. rating	80 V, 15 amp.
Frequency	2,300 c/s at 6,000 r.p.m.
Series capacitor	15 ± 1 μF
Brushes—	
Grade	Carbon, Type 2
Minimum length	0·5 in.
Minimum brush spring pressure	18 to 22 oz.

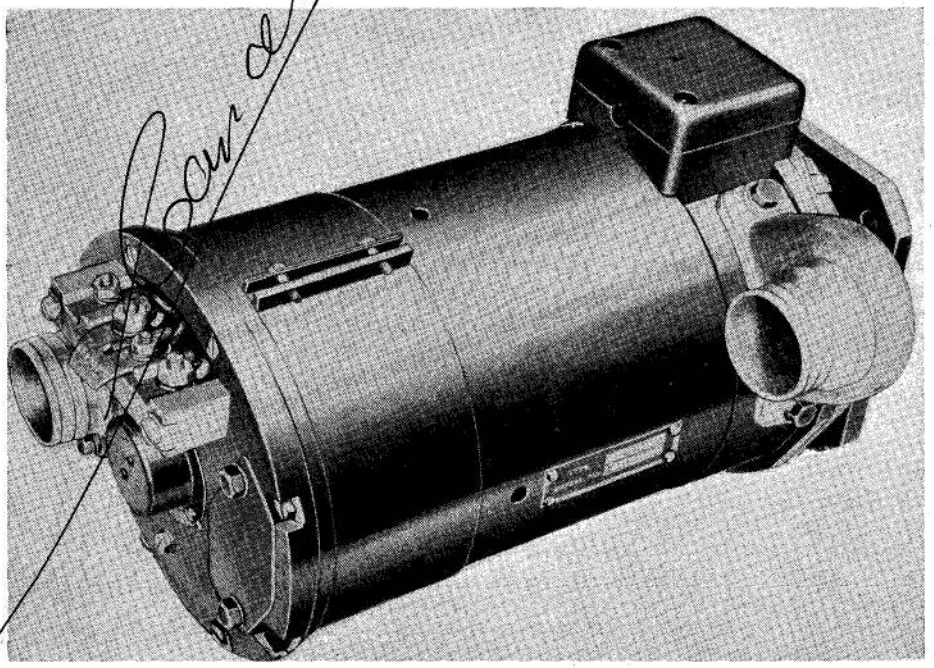


Fig. 1. Generator, Type UKX, with d.c. terminal block cover removed

Introduction

1. The engine-driven generator, Type UKX, has been designed to provide an output of 60 amps at 29 V, d.c. together with an output of 15 amps. at 80 V, a.c., the frequency at 6,000 r.p.m. being 2,300 c/s. The minimum speed at which the full rated d.c. output is obtainable is 3,250 r.p.m. and the maximum speed is 6,000 r.p.m., continuously and 7,500 r.p.m. for five minutes. The speed range over which the rated a.c. output is obtainable is from 3,250 to 6,000 r.p.m. The d.c. voltage is controlled by a carbon pile voltage regulator, Type J, and the a.c. voltage is regulated by a saturable choke controlled by a voltage regulator, Type E.

OPERATION

2. The dual purpose generator, Type UKX, is of the type in which the a.c. winding is wound in slots in the pole faces, the alternating E.M.F. being produced by the local variations of flux which are produced by the passage of the armature teeth past the slotted pole face. The construction is generally that of a normal 4-pole d.c. machine except that the usual yoke and separate poles are replaced by stator punchings with four large slots for the field coils (two sides per slot) and 32 smaller semi-enclosed slots (eight per pole) for the a.c. winding.

3. The shunt field winding is connected in the usual manner and is brought out to two terminals. There is, in addition, a series compensating winding which prevents the a.c. voltage being influenced by the flux distortion in the pole face, due to the d.c. flowing in the armature. It also improves commutation.

4. The a.c. coils embrace teeth in the pole face and are connected in series. The armature is of normal construction except that there are fewer slots than usual, i.e. 23, in order to obtain the desired frequency range.

5. The flux density at any point on the surface of the pole face will vary from a maximum, when it is opposite an armature tooth, to a minimum when it is opposite an armature slot. An alternative E.M.F. will therefore be generated in each stator coil of such a frequency that the passage of the armature tooth past a given point corresponds to one complete cycle so that bearing in mind that the armature has 23 teeth, it will be seen that the frequency at 6,000 r.p.m. will be 2,300 c/s. (A simple expression for determining the frequency is

$$\text{Frequency} = \frac{\text{N} \times \text{R.P.M.}}{60}$$

where N = Number of rotor teeth)

A series capacitor of 15$_\mu$F is used in the a.c. output to compensate for the inductive reactance of the a.c. winding.

6. In order to obtain the required ampere-turns in the restricted space available for the field windings then resistance has to be low—2·58 ohms cold as against approximately 7·5 ohms cold in the normal machines. It will thus be appreciated that the maximum power to be dissipated in the d.c. voltage regulator is considerably higher than that permissible for the standard F.24 regulator, which is used with the generator, Type KX. For this reason a special regulator, Type J, has been developed. This regulator is described in A.P.4343B, Vol. 1, Sect. 3, Chap. 4.

7. As in this type of single-armature dual-purpose generator the flux inside the machine is determined solely by requirements of the d.c. output, the a.c. voltage regulation is obtained externally by means of a saturable double wound choke connected across the a.c. terminals in the manner shown in fig. 2. The second winding on the choke is supplied through a rectifier with d.c. from a bridge circuit, of which three arms are formed by fixed resistances and the fourth by the carbon pile of a voltage regulator, Type E. The coil of this regulator is energised by the a.c. output from the load side of the series capacitor through the bridge rectifier embodied in the control panel, and the bridge circuit incorporating the carbon pile is supplied with d.c. obtained from the d.c. side of the generator.

8. When the a.c. voltage is low, the carbon pile is closed, its resistance is low and the point B is positive with relation to the point A. Current is, however, prevented by the rectifier in series with the choke from flowing from B to A through the choke. In order to reduce to zero the small amount of current which would normally flow through this rectifier in the reverse direction, a second rectifier short-circuits B and A when the voltage is directed from B to A. In this condition, the choke has its maximum inductance and therefore takes only a small alternating current from the a.c. generator. If the voltage tends to rise above the value for which the regulator, Type E, is set, the pile

resistance increases and the point A becomes positive with relation to the point B. Current then flows through the d.c. winding of the choke, partly saturating it and therefore reducing the inductance of the a.c. winding of the choke, which now takes an increased current, and causes the a.c. voltage to drop to its correct value. This equipment is contained within the control panel, Type 6 or 6B, and their associated choke box, Type 1. described in detail in A.P.4343B, Vol. 1, Sect. 7, Chap. 5 and 6.

The stator is a push fit in the yoke and is secured by welding in holes drilled in the yoke. The connections from the stator a.c. coils are brought out to a terminal block on the top of the yoke and those from the commutator and field are taken to a terminal block (33) on the commutator end frame (21), the latter being fixed to the yoke by screws (18). Both terminal blocks are fitted with shrouds and covers, between which are clamped ferrules (32) and (35) through which the external cables pass.

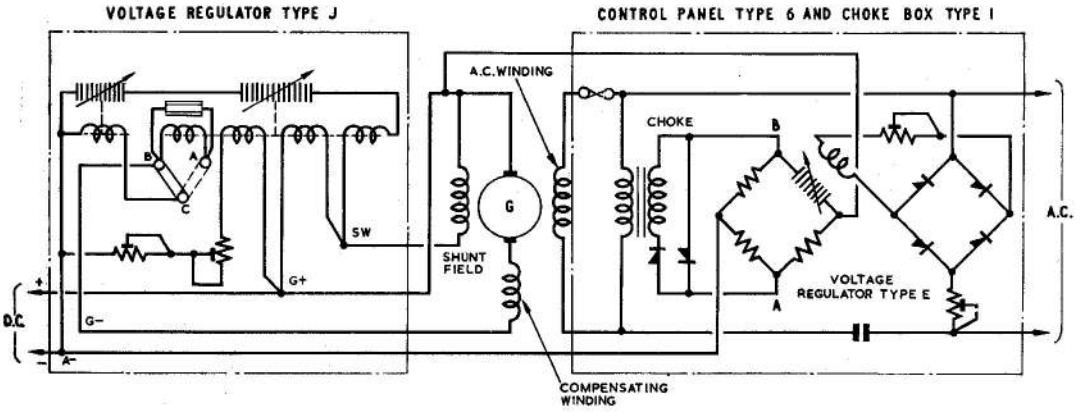


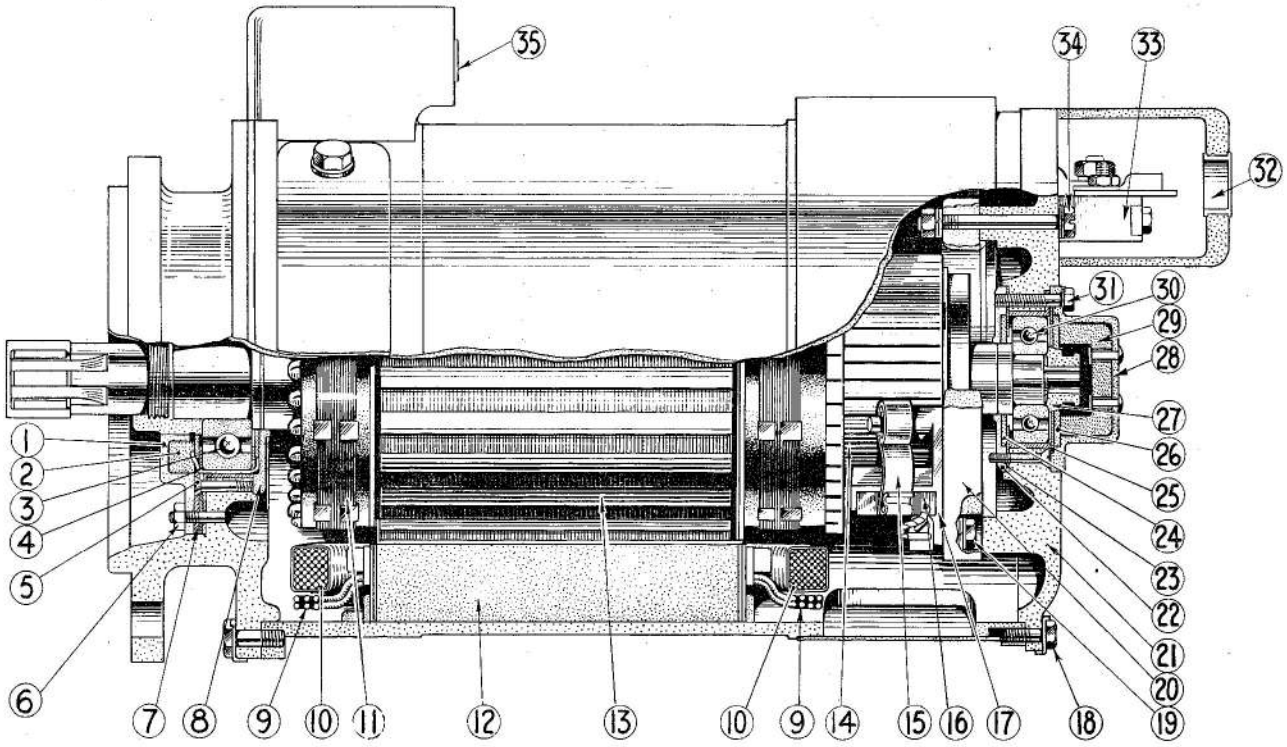
Fig. 2. Theoretical circuit diagram of generator and control equipment

DESCRIPTION

9. A general arrangement drawing is shown in fig. 3. The armature (13) is built up on a shaft which runs on ball bearings at both ends, the inner race of the bearing at the commutator end being attached to the shaft by the sleeve (27). The armature acts as an inductor type a.c. rotor, and also has slots containing d.c. armature windings, which are wave wound and brought out to a commutator (14). The field coils (10) and compensating winding (9), are wound in slots in the stator (12) and the former encompass the stator coils which are also wound in between the teeth of the stator. The resistance of the various windings is as follows :—

Field winding, 2·8 ohms ; a.c. winding, 0·52 ohm ; compensating winding, 0·02 ohm ; armature winding, 0·015 ohms.

10. Each of the four brushes (16) is contained within a box (17) which, in turn, is secured to the brush ring (20) by two screws (19). Since a compensating winding is incorporated, and the brushes are fixed in the neutral position, the brush ring has not been made adjustable ; two bolts (34) being used to affix it to the end plate. The contact between each brush and the commutator surface is maintained by a coil spring (15) on a pin which forms part of the brush box. The brushes are inserted into the brush box so that the brush leads are on the side nearest to the brush ring and can thus be easily connected to the terminals. Interconnections between opposite brush boxes are made by leads which are bound to the field coils for support. A ball bearing (30) is fitted at the commutator end, and is enclosed by an inner bearing cap (22), secured by three countersunk screws and by three hexagonal-headed screws (31) which also secure the outer bearing cap (28).



1	OUTER BEARING CAP	9	COMPENSATING WINDING	18	END FRAME FIXING SCREW	27	BEARING RETAINING SLEEVE
2	FELT OIL RESERVOIR	10	FIELD COIL	19	FIXING SCREW FOR BRUSH BOX	28	OUTER BEARING CAP
3	DRIVING END BEARING	11	BAND WIRE	20	BRUSH RING	29	FELT OIL RESERVOIR
4	OIL WICKS	12	STATOR	21	END FRAME	30	BALL BEARING
5	INNER BEARING CAP HOLDING SCREW	13	ARMATURE	22	INNER BEARING CAP	31	BEARING CAP SCREW
6	OUTER BEARING CAPNUT	14	COMMUTATOR	23	VELLUMOID WASHER	32	FERRULE
7	BEARING CLAMPING DISC	15	COIL SPRING	24	FELT WASHER	33	TERMINAL BLOCK
8	INNER BEARING CAP	16	BRUSH	25	VELLUMOID WASHER	34	BRUSH RING HOLDING BOLT
		17	BRUSH BOX	26	FELT WASHER	35	FERRULE

Fig. 3. General arrangement, generator, Type UKX

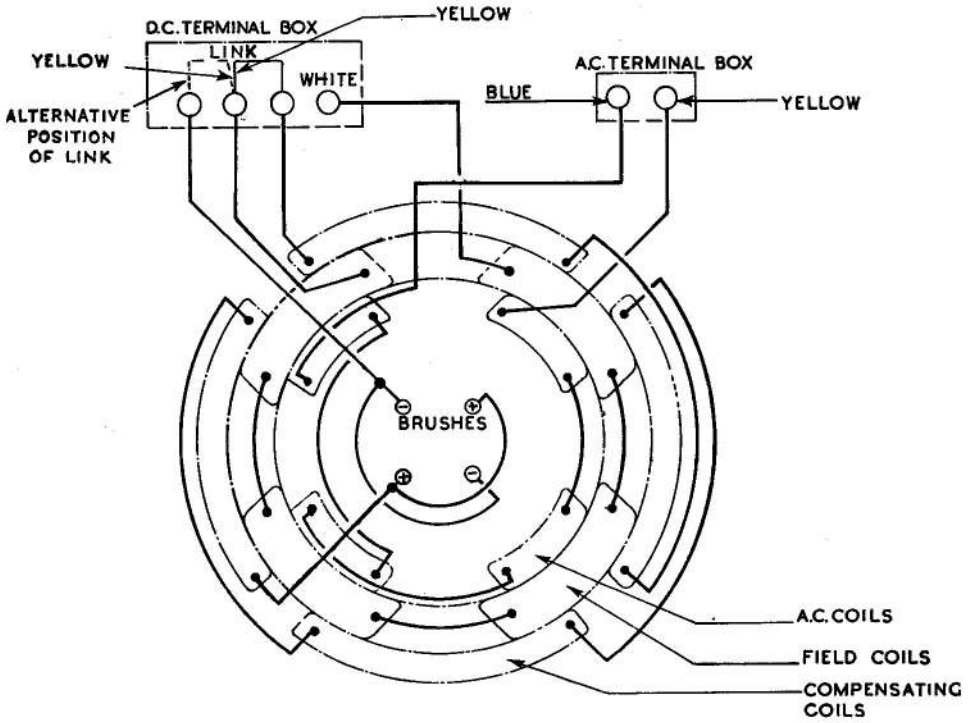


Fig. 4. Connection diagram, looking on driving end

11. The outer bearing cap (28) contains felt (29) soaked in lubricating oil which percolates into the two felt washers (24) and (26) which, in turn, rub on the bearing retaining sleeve and the shaft respectively, oil being wiped from the felt washers and transferred to the bearing by creepage and centrifugal force. The felt pads are secured to steel discs which are held in position by the bearing caps and screws. Vellumoid washers (23) and (25) at each side of the steel discs prevent leakage of oil. The bearing (3) at the driving end is similarly mounted, being located between the inner bearing cap (8) and outer bearing cap (1), but in this case a bearing clamping disc (7) is fitted between the cap and the end frame. The felt pads on each side of the bearing are interconnected by three wicks (4), which conduct oil from the reservoir (2) in the outer bearing cap to the inner felt pad. The inner bearing plate is secured by six countersunk screws (5) and the outer cap is secured by six nuts (6).

12. Cooling of the generator is by air blown direct into the commutator chamber, provision being made for pipes to be connected on either side of the end plate. The air emerges from the interior of the generator through an exit at the a.c. end, alternative openings being provided on both sides of the generator body for the connection of the pipes.

INSTALLATION

13. When installing the generator in the aircraft, the mounting flange is bolted to the appropriate flange in the aero-engine mounting and Dumet 19 cable used between the W plug on the control panel, Type 6, and the blue and yellow terminals on the a.c. terminal block on the generator. The generator is suitable for both clockwise and counter clockwise rotation. This is provided for by means of a link coloured yellow which connects between the positive shunt terminal and either of the main (armature) terminals. To suit the required direction of rotation, the link is connected as shown in fig. 5, the change being obtained by turning the link over so that the arrow indicates the direction of rotation required. The link can only be connected in either of the positions shown and the main (armature) terminal to which

the link connects is always positive, the other main (armature) terminal being negative. The negative shunt terminal is marked white. The three effective terminals are then connected to the suppressor and voltage regulator, Type J, with Trigenmet No. 3 cable in the orthodox manner. It should be noted that reversing the direction of rotation reverses the polarity of the main terminals and the cable should be connected accordingly.

14. When installing the generator, the direction indicating tag on the field link may be bent down so that the wires can be connected easily. This should only be done after checking the direction of rotation. Cable end fittings are not supplied with the generator and must be demanded separately.

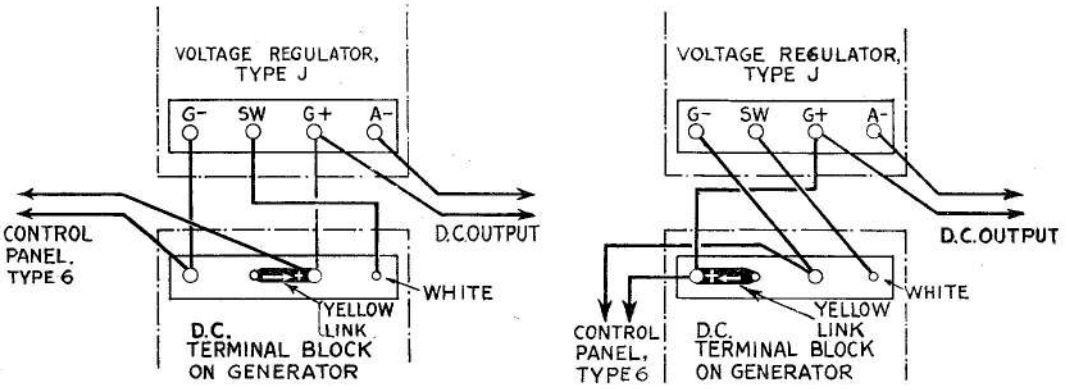
SERVICING

15. These generators are fitted with felt oil reservoirs which should be removed with the outer bearing cap and soaked in lubricating oil, OM–170. Care must be taken to ensure that the washers between the felt pad and the bearing are correctly replaced, in connection with which reference should be made to the sectional drawing in fig. 4. The connections in the terminal boxes should be tightened at regular intervals.

16. When checking the a.c. output of the generator, it is important to ensure that the voltmeter used is correctly calibrated as, in the case of rectifier type instruments, the accuracy may deteriorate with use on 1,000 to 2,000 c/s supplies.

17. Regular inspection should be made of the generator brush gear to ensure that all brushes are properly free in their boxes and that all springs are bearing correctly on the brushes. The specified brush pressure is 18 to 22 ounces. Further, the carbon brushes should have sufficient wearing length which should never be less than 0·5 in. When in doubt fit new brushes, which must be of the correct grade, as given in Leading Particulars.

18. General information on the servicing of d.c. generators is given in A.P.4343, Vol. 1, Sect. 2, Chap. 1.



DIRECTION OF ROTATION IS INDICATED BY ARROW ON CONNECTING LINK

Fig. 5. Method of reversing rotation of generator

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