Chapter 31

TRANSFORMER-RECTIFIER UNIT, ROTAX, TYPE U 2704/1

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LEADING PARTICULARS

Transformer-rectifier unit, Rotax, Type U2704/1 *Ref. No.* 5UC/6630
Type U2704/2 *Ref. No.* 5UC/7088

Input	83 *amp. at* 208 *volts*, 3 *phase a.c.*
	71 *amp. at* 104 *volts*, 3 *phase a.c.*
	45 *amp. at* 65 *volts*, 3 *phase a.c.*
Output, a.c.—	
Voltage	208 *volts*, 3 *phase a.c.*
Power	30 *kVA*
Frequency	309 *to* 560 *c/s*

RESTRICTED

LEADING PARTICULARS—(*contd.*)

Output, d.c.—	
M.V. voltage	112*V d.c.*, 10 *kW*
L.V. voltage	28*V d.c.*, 3·0 *kW*
Rating	*Continuous*
Temperature range	−30 *deg. C. to* +45 *deg. C.*
Maximum altitude	40,000 *ft.*
Overall dimensions—	
Length	33·000 *in.*
Width	12·250 *in.*
Height	12·875 *in.*
Weight	121 *lb.*

Introduction

1. This unit is used in conjunction with the Type 164 generator (Rotax N0701/3) and the P4001 double compounding transformer to provide the outputs required for operation of Britannia aircraft main and ancillary equipment. Provision is made in the unit for the regulating and load sharing of the two d.c. outputs and for the protection of the complete system. For the significance of U2704/1 and /2, reference should be made to the note following para. 53.

Generating system

2. Internal connections of the alternator, transformer rectifier unit, multiple protection unit and other components used in the control and protection of the system are shown within their respective dotted lines (fig. 8).

3. Whilst the aircraft is on the ground and the ground flight and master control switches are turned OFF, the generating system is inactive. With the ground flight switches in the GROUND position and the engines started

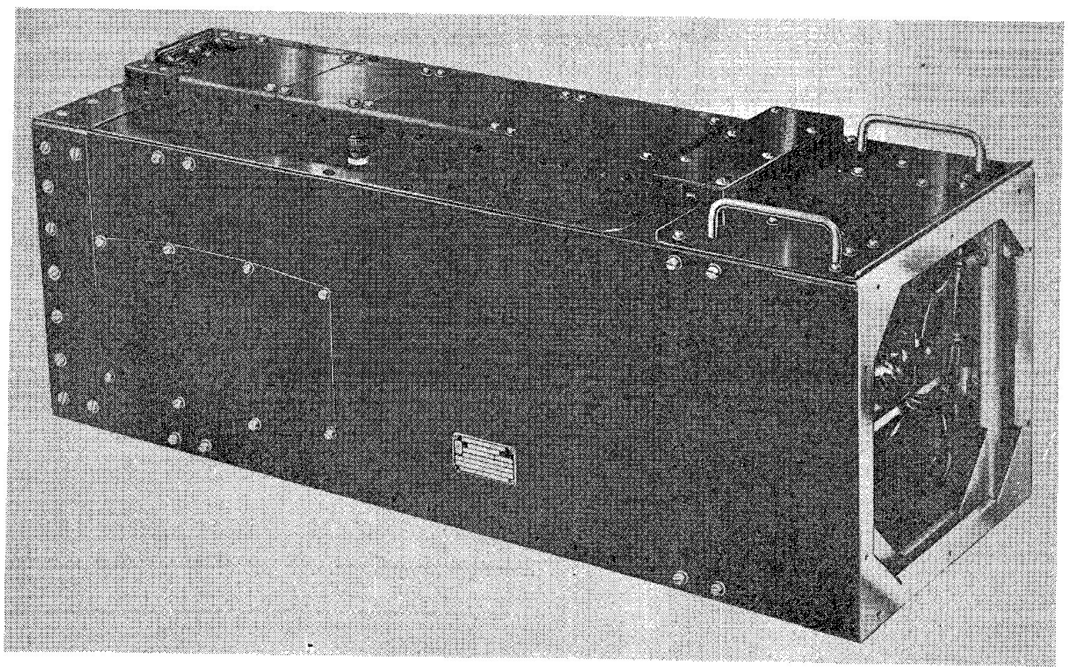


Fig. 1. General view of transformer-rectifier unit, Type U2704/2

the generating system is switched on to the busbars, via the relevant contactor, by turning the master control switch to the ON position.

Note . . .

Should the master control switches be turned to the ON *position before the engines are started, the arrangement is such that the system will still excite and be switched on to the busbars in the normal manner.*

4. The generator of the system is self-excited by residual magnetism in the rotor. A potential builds up at the output terminals and operation of the master control switch connects the system to the busbars as described. Should a fault condition cause the system to trip out, the appropriate master control switch is turned to the RESET position, but if there is a recurrence of the fault the system is switched off by operating the field isolation switch.

DESCRIPTION

5. The major components of the unit are listed in Table 2 with their circuit disposition and appropriate value, including the description of the components. The components are housed in a light-alloy case of riveted construction, and with the exception of the regulator assembly and main rectifier assembly are mounted on two separate chassis. The main rectifier assembly is attached by means of its support plates in one end of the case, and the regulator assembly, which is readily removable for ease of servicing, is housed in the other.

Operation

System

6. The a.c. generating scheme for the Britannia aircraft is, in basic principle, comparable to the Type 154 generator system described in A.P.4343, Vol. 1, Sect. 2, Chap. 7, though modified in certain respects to meet the particular requirements for the Britannia aircraft. It consists of four individual systems or channels, each basically comprising an N0701/3 generator, U2704/1 transformer rectifier unit and the relevant protection items. A single channel is fitted to each of the four aircraft engines to provide main and ancillary outputs over the full generator speed range of 6,175 to 11,260 r.p.m.

7. To fulfil the scheme requirements for the Britannia aircraft there are three independently regulated outputs, i.e. 208 volts a.c., 83 amp., 3 phase at maximum load; 112 volts d.c., 90 amp. at maximum load and 28 volts d.c., 110 amp. at maximum load. The 112V d.c. and 28V d.c. outputs are derived by rectification of the main alternator output.

Alternator

8. The N0701/3 is basically two generators each having a magnetically independent field system. The salient pole rotors are assembled on a common shaft and the full load excitation requirements are as follows:—

Main rotor:	28 volts d.c., 45 amp.
Booster rotor:	28 volts d.c., 10 amp.

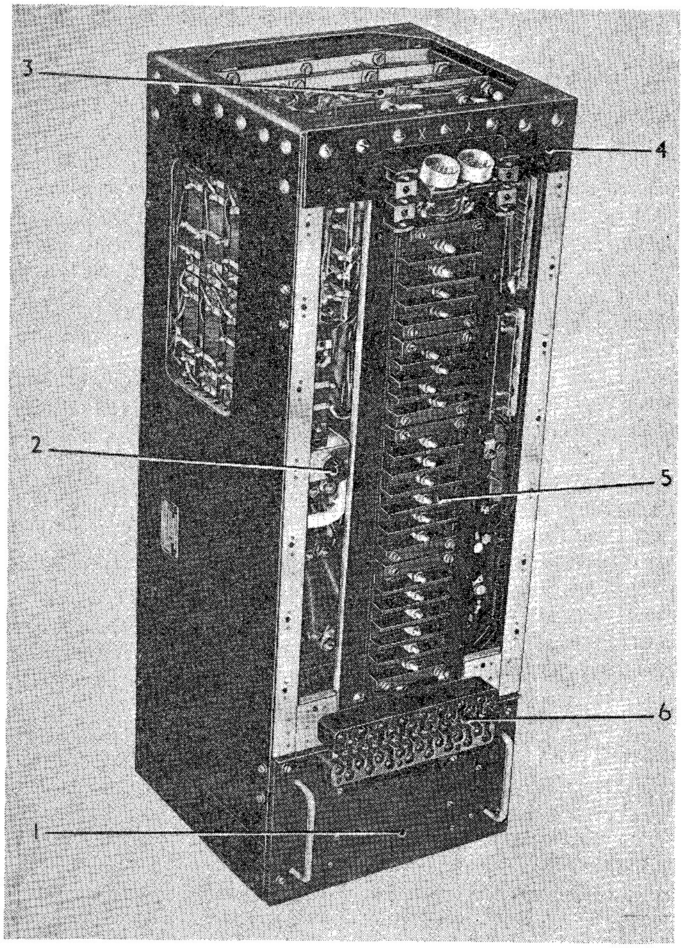
The stator of the main generator has two electrically-independent three-phase windings, lap wound on a common frame, from which are derived 208-volt and 65-volt outputs.

9. The winding of the booster stator is three-phase, open star, connected in series with the output lines of the 65-volt main stator winding to give a resultant full load output of 104 volts.

Transformer-rectifier unit

10. Where the generator is controlled by a carbon pile regulator, the reference voltage for the regulator is derived via a three-phase a.c. transformer and rectifier network from the output lines of the generator. The turns ratio of the transformer is arranged so that 208 volts line to line on the generator output produces 28 volts d.c. from the rectifier. The latter voltage is then applied via a suitable ballast resistor to the control coil of the voltage regulator. The rotor field current is supplied from a 28-volt d.c. source via the carbon pile of the regulator, and is controlled by variations in pressure on the carbon pile, producing changes in pile resistance which correspond to variations in generator output; i.e., a fall in alternator output causes the carbon pile to compress, thus decreasing the pile resistance and increasing the field current, and vice versa.

11. The sequence of events when load is applied to the generator is that the output voltage will fall below 208 volts nominal, causing a fall in voltage at the control coil



1 REGULATOR UNIT ZA6402/1
2 FUSEHOLDER
3 MAIN RECTIFIER ASSEMBLY
4 END FRAME ASSEMBLY
5 TERMINAL BLOCK TRAY ASSEMBLY
6 CONNECTORS

Fig. 2. Three-quarter view with panels removed

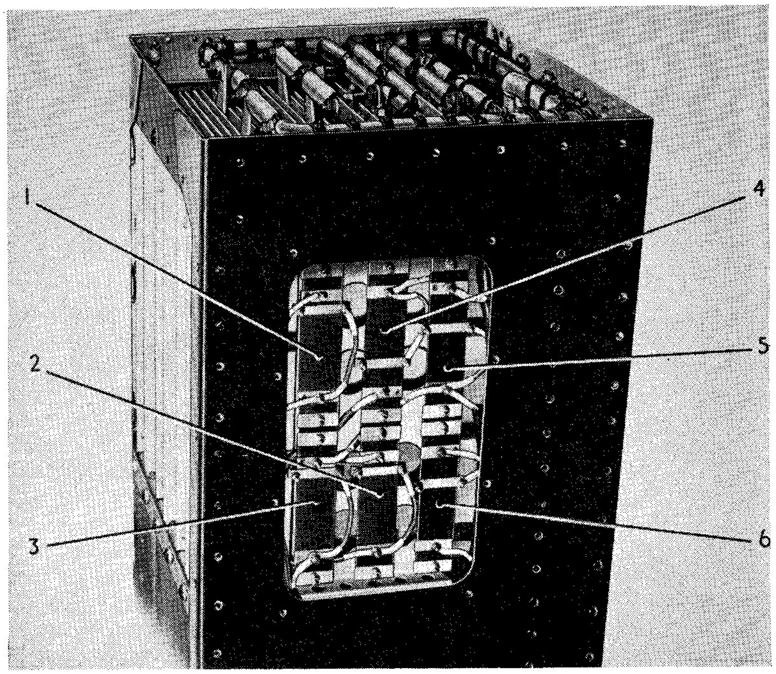
of the regulator. The regulator carbon pile will compress due to the fall in output voltage, and the rotor field current (If) will increase; generator voltage will rise due to increase of If and the output voltage will be restored to the 208 volts nominal value. Similarly, for an increase in output voltage, pressure on the carbon pile will decrease; the consequent reductions in If will cause the output voltage to return to the nominal value.

Compounding

12. The wide speed range of the generator necessitates a greater field current, which varies considerably with the speed of the machine. Therefore it will be necessary to assist the voltage regulator by compounding the rotor field current. The method of compounding consists of supplying the rotor field from two independent sources, i.e., from a 28-volt d.c. supply via the regulator, and from a rectified alternating current source which is proportional to the line output current, i.e., via a compounding transformer and rectifier.

Low voltage (28-*volt*) *d.c. system*

13. An additional field winding, the nominal output of which is 65 volts, and the 208-volt winding are located in the same stator slots and are therefore fed by a common rotor field; consequently the respective outputs are correlative.



1 M.V. LOAD SHARING RESISTOR
2 L.V. LOAD SHARING RESISTOR
3 L.V. STABILIZING RESISTOR
4 A.C. STABILIZING RESISTOR
5 L.V. BIAS RESISTOR
6 M.V. BALLAST RESISTOR

Fig. 3. Part view showing resistors

14. The 65-volt output depends upon the field current, which is controlled by the 208-volt a.c. regulator. Therefore load variations on the 208-volt circuit will be reflected in the 65-volt output. In practice it is found that the latter output voltage varies between 60 and 70 volts, dependent upon the load conditions of each winding.

15. From the 65-volt windings a low voltage (28-volt) d.c. output is derived via a transformer rectifier arrangement. To obtain control of this output at 28 volts d.c. independent of the 208-volt a.c. load variations, it is necessary to compensate for the above-mentioned voltage variations and also for the regulation of the transformers and rectifiers. This is achieved by using a transductor and a booster transformer.

16. The main transformer steps down the 65-volt output to a given value. This value is slightly below that required to give 28 volts d.c. from the rectifier and requires to be boosted. Input to the booster transformer is controlled by the transductor. Therefore it can be seen that the vector sum of the main transformer and the booster transformer secondary voltages is such that 28 volts d.c. is provided from the rectifiers.

17. It will be noted that the primary of the booster transformer is delta connected, thereby altering the phase angle of the secondary voltage. This compensates for inherent phase shift in the transductor. Hence, the circuit arrangement is such that under full load conditions, the output voltage of the booster transformer is in phase with the output from the main transformer.

18. The transductor is a three-phase saturable reactor, i.e., a variable reactor controlled by its level of magnetic saturation. By varying the current in the control, or excitation, coil, the saturation level and therefore the impedance of the reactor is varied. The excitation current is derived from the 28-volt d.c. output, from the rectifier via the carbon pile of the regulator.

19. The sequence of events when load is applied to the rectifiers (28-volt d.c. output), or when the output from the 65-volt winding of the generator falls is as follows:—

(1) The d.c. output voltage from the rectifiers falls below the 28-volt nominal level.

(2) Pressure on the carbon pile of the L.V. regulator increases slightly and the pile closes, thereby reducing its resistance.

(3) The d.c. control current in the transductor increases.

(4) Input voltage to the primary of the booster transformer increases, thereby boosting the voltage applied to the rectifiers.

(5) This boost voltage causes the output voltage from the rectifier to rise to the 28-volt nominal level.

Note . . .

An advantage of using the transductor control is that the transductor can be operated over a wide range of current change whilst the regulator operates over a comparatively narrow range, hence the size and weight of the regulator required is greatly reduced.

Medium voltage (112-*volt*) *d.c. system*

20. The additional booster windings are connected in series with the 65-volt winding of the main generator. Since both generators are driven at identical speeds and the corresponding outputs of each one are in phase, then the output from the booster will be added to the output from the 65-volt winding. In practice, the rotors of both machines are mounted on the same shaft, and the stators are arranged in a single housing. There is no magnetic coupling between the two machines.

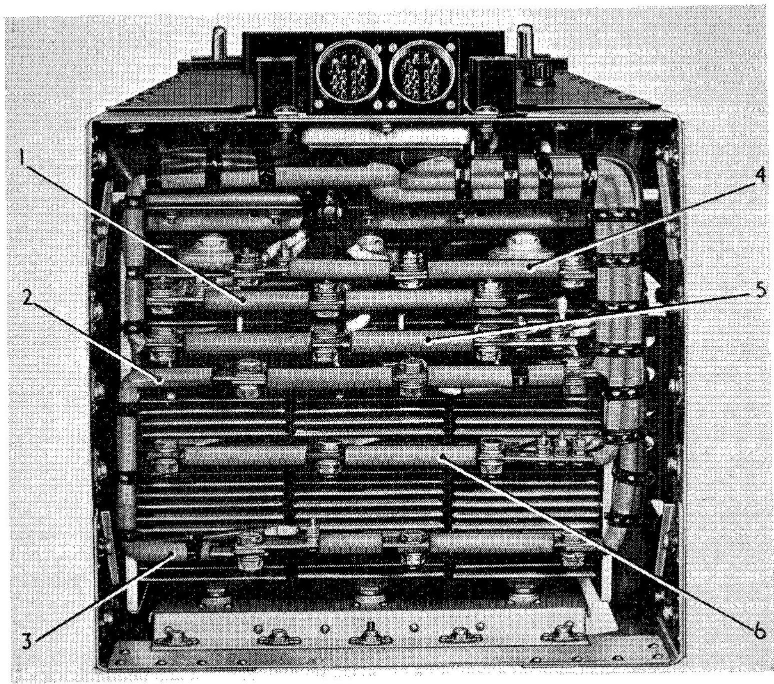
21. The output from the booster generator is fed into a set of three-phase bridge rectifiers giving an output voltage of 112 volts d.c. The booster generator supplies the difference between the voltage at the 65-volt winding and that necessary to produce 112 volts d.c. at the rectifiers under the various load conditions.

22. The output from the booster generator is controlled by its own field system which is supplied from a 28-volt d.c. source via the carbon pile of the M.V. regulator. Unlike a conventional d.c. generating system, an a.c. rectified system is switched on to a live busbar before the set is generating. Therefore, when considering the regulator coil conventionally connected across the M.V. output and negative, the coil of the regulator is pre-energized direct from the live busbar.

23. The time constant of the regulator is such that the generator output voltage builds up in excess of its normal controlled value before the regulator carbon pile opens. The excessive voltage gives the regulator an additional "kick" which in some instances causes the springs to collapse, and the armature to stick against the pole face with the pile open circuited; this is most prominent on a lightly loaded system. It causes the generator voltage to collapse to zero and the regulator pile to remain open-circuited as it is held in that position by the busbar voltage. This condition is aggravated when the generating sets are operating in parallel and is referred to as "cutting out".

24. To overcome the tendency to "cut out", a reference voltage for the regulator is taken between the negative of the 112-volt rectifiers and the star point of the a.c. input to the rectifiers. At the instant of switching on, the star point voltage will be less than the mid-potential of the rectifier output, i.e., less than the operating voltage of the regulator. In practice the actual value is determined by the back resistance of the three-phase M.V. rectifiers. Therefore, the amount by which the regulator coil is pre-energized will be insufficient to create the "cut out" condition when switched on to the busbars.

25. It is a natural tendency for the star point to alternate about a mean value which is approximately half the M.V. output voltage and of a frequency three times that of the fundamental. When the rectifiers are delivering current to an external load the star point voltage is locked at this value (i.e. 56 volts). Therefore a 56-volt regulator connected in this way will regulate the output voltage from the rectifiers at 112 volts. When the system is not generating, it is possible to move the star point voltage artificially to any desired voltage. In actual fact, this is what is done in the Britannia generating system during the "switch on" period.



1 COMPOUNDING RECTIFIER POSITIVE
2 L.V. RECTIFIER NEGATIVE
3 M.V. RECTIFIER NEGATIVE
4 COMPOUNDING RECTIFIER NEGATIVE
5 L.V. RECTIFIER POSITIVE
6 M.V. RECTIFIER POSITIVE

Fig. 4. Main rectifier d.c. connections

Combined a.c. and d.c. systems

26. The 208-volt a.c., low voltage (L.V.) d.c. and medium voltage (M.V.) d.c. systems combine to form the basic circuit for the Britannia generating scheme. The main and booster fields derive their supplies from the 28-volt rectifiers instead of from independent sources.

27. The two rotors are fed via a common positive supply and the carbon piles of the a.c. and M.V. regulators are connected in their corresponding negative leads.

28. The double compounding transformer has two primary windings. One winding is in series with the 208-volt generator winding and its effect is as previously stated in para. 10; the second primary winding, which is in series with the booster generator winding, carries the load current of the M.V. output.

29. As the M.V. load current increases, the consequent armature reaction from the 65-volt generator winding will cause a drop in a.c. output terminal voltage. The excitation current derived from the second primary winding compensates for the effects of armature reaction and thereby assists the a.c. regulator to maintain the a.c. output at 208 volts.

Load sharing circuit

30. On the Britannia aircraft, a current transformer and rectifier is used and connected as shown in A.P.4343, Vol. 1, Sect. 2, Chap. 7, para. 31 to 33 inclusive and fig. 8 and 9. In order to consider the operation, we must assume that one generator is supplying more load than the other and consider the effect on the regulators in their attempt to correct the out-of-balance condition; this is clearly outlined in the above-mentioned chapter on the Type 154 generator rectified a.c. system.

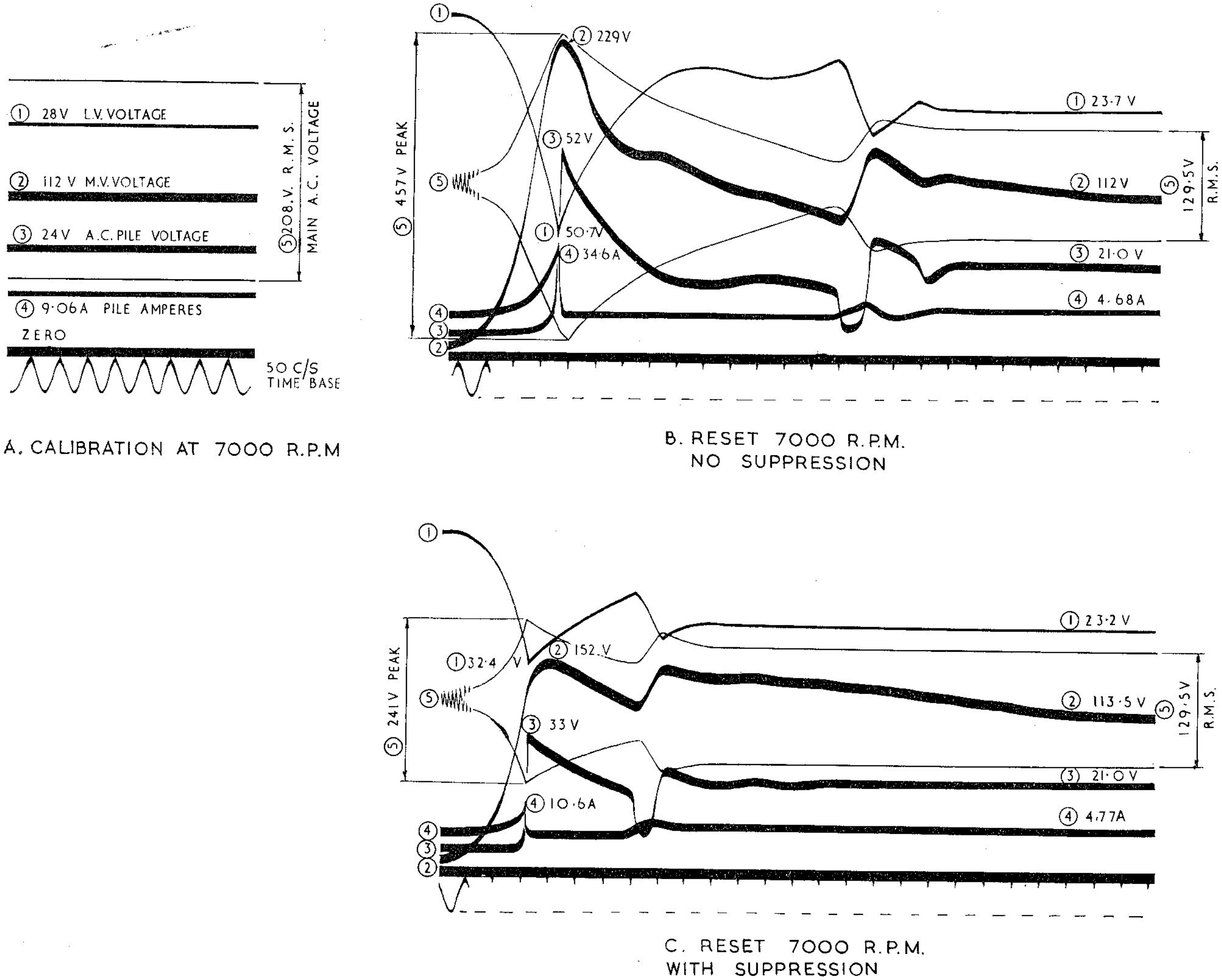


Fig. 5. Surge suppression curve

Surge suppression

31. Fig. 5A shows the oscilloscope trace of the nominal M.V. and L.V. levels for a typical system. Upon operating the reset switch and reclosing the main rotor contactor, with the generator running at speeds in excess of 6,000 r.p.m., the generated voltages rise very rapidly, since at the instant of switching on, all the regulators are inert and at minimum resistance; with no suppression, a surge in the voltage levels, such as that shown in fig. 5B, will result.

32. At this time the star point of the M.V. system is connected, through a pair of normally closed contacts of the relay fitted in the transformer rectifier unit, to the a.c. regulator control coil. This regulator then receives an excessive signal, since under normal running conditions the M.V. star point is 56 volts d.c., whereas the normal a.c. regulator reference voltage is 28 volts d.c.

33. The signal from the M.V. star point is proportional to the rate of increase of the system voltage, under reset conditions; the a.c. regulator pile will therefore be opening earlier than it would with its normal connection. The generated voltages therefore increase to a peak value, and, as the regulators begin to function, the voltages fall.

34. With surge suppression fitted, the relay reference voltage has meanwhile been maintained above the relay pull-in value sufficiently long enough for the relay to open and break the connection between the M.V. star point and the a.c. regulator control coil. The generated voltages then settle to their controlled levels with a much reduced surge, as shown in fig. 5C. Under these conditions, the main a.c. line voltage is 130 volts nominal. The master control switch may then be put to the ON position and all output voltages revert to their correct values with only slight surges.

35. Although only the a.c. regulator is pre-energized under reset conditions, it restricts the main rotor current and therefore limits the output from the generator. The transients of the a.c. inputs to all rectifiers in the transformer rectifier unit are therefore considerably reduced.

Current limiting

36. Current overloading is obviated by including in the generating system a control circuit which operates in conjunction with the voltage regulator unit (fig. 8). Up to full load this control circuit, i.e., the current limiting arrangement, is considered inactive and is merely idling. This means that no limitation is applied to the current flow via the L.V. output lines until an overload condition prevails.

37. The current wave forms and characteristics associated with the current limiting arrangement are illustrated in fig. 6. The current values chosen are purely arbitrary and are used only to give some idea of the operation. It will be noted that to simplify the explanations, wave forms of a single-phase system are described whereas in actual practice a three-phase system is used.

38. A sine wave is shown in fig. 6A which represents the current output from the current limiting transformer. The effect of the rectifier is shown in fig. 6B and we have the usual conventional two pulses per cycle.

39. The regulator control current (Ic) is constant in value up to full load conditions and is made up of two components. One component is supplied from the current limiting transformer via the rectifiers and is pulsating, as illustrated in fig. 6B. The second component is derived from the d.c. busbar in the normal manner; this is unidirectional but varies in magnitude in accordance with the horizontally shaded portion in fig. 6B. The two components are at all times, up to the full load condition, additive, and are together equal to the normal regulator control current, which in the illustrations in fig. 6 is one ampere.

40. Above full load conditions, the peak value of the a.c. component (fig. 6B) exceeds one ampere, and since the d.c. component from the busbar cannot reverse, the average value of the regulator control current similarly exceeds one ampere.

41. The circuit diagram of fig. 6E assumes equal values of current flow ($\frac{1}{2}$ ampere) from the current limiting transformer (Iac) and from the d.c. busbar (Idc) at an assumed instant of time. With reference to fig. 6D, the addition of these currents (Idc+Iac) forms the normal regulator control current. It can be seen, from the diagram in fig. 6E, that when Iac exceeds one ampere the regulator control current will increase.

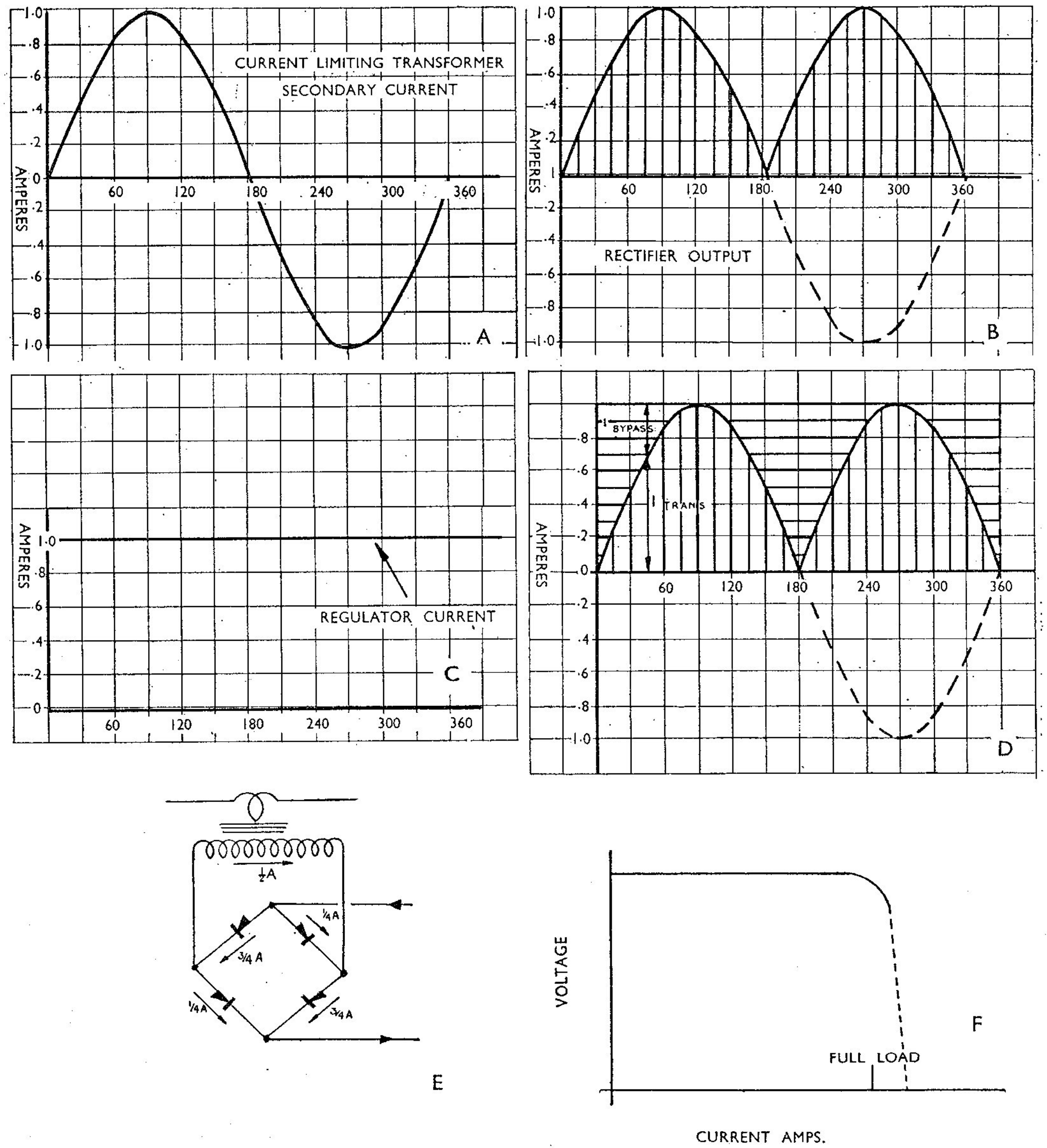


Fig. 6. Current limiting characteristics

42. Consequently the operation may be summarized as follows. Up to the full load condition the control current of the regulator is not upset, but if the load current exceeds the full load condition the pulsating current from the rectifier exceeds the regulator control current at its peak value. Therefore, the resultant control current is supplied in excess of normal. This increased current causes the regulator setting to decrease and the voltage setting is lowered.

43. Characteristics of the arrangement are shown in fig. 6F; the voltage remains constant up to full load, then the current limiting arrangement becomes active and the voltage begins to fall towards zero, by an amount which is dependent upon the state of the battery. Obviously the better the battery, the slower it will fall.

44. Although the regulator control current, for the purpose of explanation, has been chosen as one ampere, it is in actual practice much lower, but this does not affect the mode of operation.

45. With reference to fig. 8, it can be seen that a typical sequence of events when overload is applied to the L.V. output from the rectifier is as follows:—

(1) Up to the full load condition the system regulates normally.

(2) An overload condition occurs causing an increase above normal in the regulator control current.

(3) The carbon pile opens, reducing the value of current in the transductor coil.

(4) The output voltage falls, with consequent reduction in line output.

46. It should be noted that a similar current limiting arrangement exists for the 112-volt d.c. (M.V.) system. There are two items, namely a stabilizing transformer and a bias resistor, which have not been mentioned in the above description but are shown in fig. 8. Although neither item directly affects the basic explanation of the current limiting arrangement, it is thought to be a convenient stage to introduce them.

Stabilizing transformer and bias resistor

47. An electrical disturbance in the circuit, which may be due to a sudden switching of the load, is damped by the use of a stabilizing transformer. Such a disturbance would otherwise appear in the transductor d.c. coil. Its amplified effect would be repeated in the circuit, consequently building up into a series of oscillations.

48. Circuit connections to the stabilizing transformer are made so that the initial electrical disturbance, via the current limiting rectifiers, occurs in the transformer primary. This disturbance, opposite in phase when reflected in the secondary of the transformer, opposes current variations occurring in the transductor d.c. coil.

49. The circuit arrangement is such that with the carbon pile exhibiting a predetermined maximum resistance, the current through the transductor d.c. coil is zero.

50. This is achieved by including in the circuit a bias resistor. With the carbon pile at maximum resistance, the potentials at each side of the transductor coil are arranged to be equal, i.e. at 28 volts d.c., therefore no current flows through the coil.

51. Without the bias resistor it would be necessary to open-circuit the carbon pile in order to obtain the condition whereby no current flows through the transductor coil. This is detrimental to the operation of the carbon pile, as arcing between the carbon washers would result. Therefore it is necessary to determine the maximum safe limit to which the pile may be opened and use the bias resistor to reduce the transductor coil current to zero.

Multiple protection unit, Type F5103/1

52. The above unit is designed specifically for use in conjunction with the transformer rectifier unit, Type U2704/1. An internal connection diagram is shown in the composite circuit diagram (fig. 8). The function of the multiple protection unit is to break the low voltage supply to the alternator rotor circuits should any of the following faults occur on the generating system:—

(1) L.V. or M.V. rectifier failures, and a.c. line to earth faults.

(2) Excessive rotor current.

(3) Overvoltage on the L.V. or M.V. outputs.

RESTRICTED

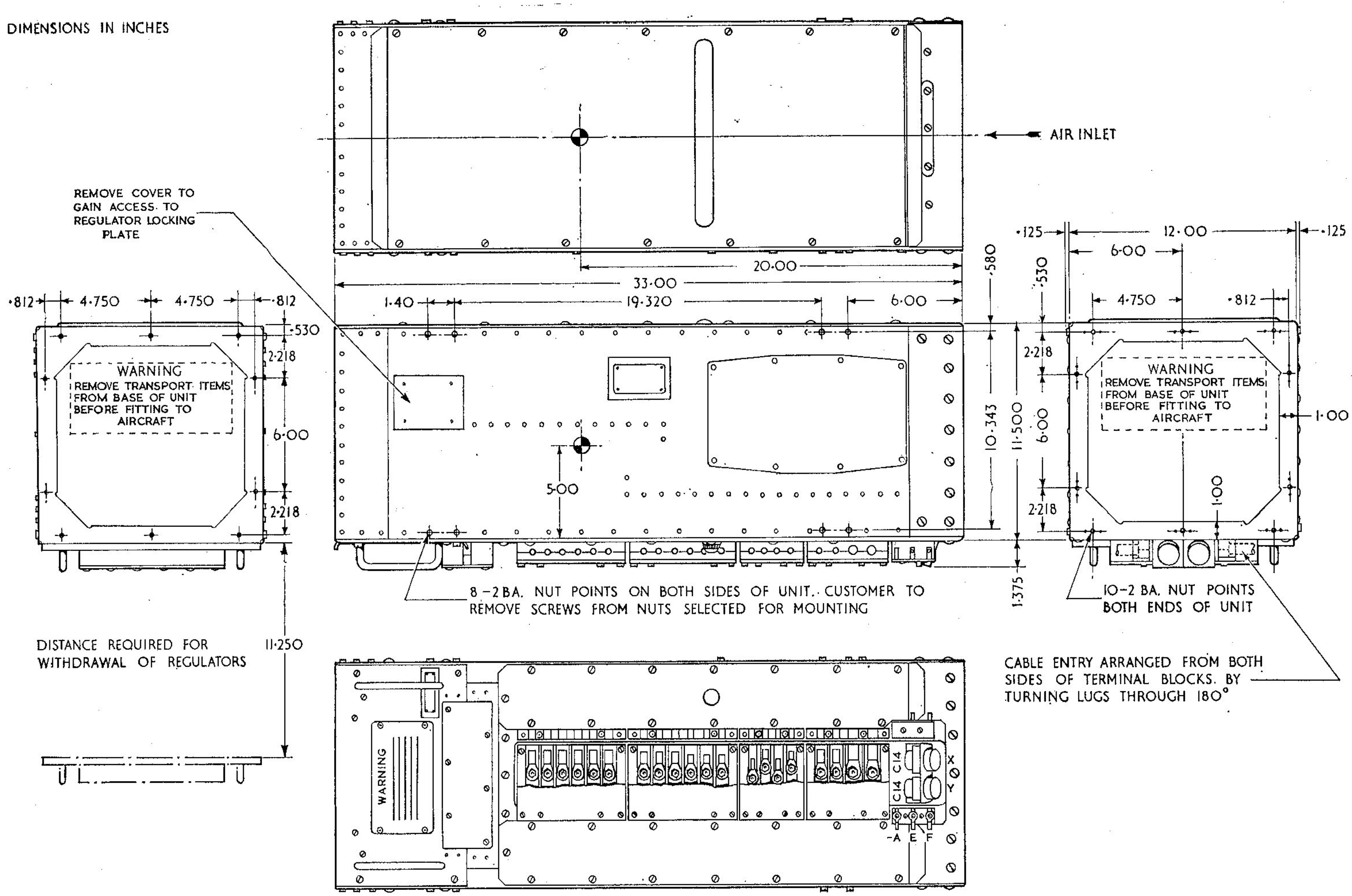


Fig. 7. Installation diagram

(4) Overvoltage on the a.c. output lines.

(5) Reverse current.

A detailed description and operation of the unit is given in A.P.4343C, Vol. 1, Book 3, Sect. 11, Chap. 6, together with the electrical connections and the F5103/1 circuit diagram.

INSTALLATION

53. Installation information can be found in the manufacturer's handbook of the aircraft to which these units are fitted. However, installation will be aided if reference is also made to the installation drawing (fig. 7).

Note . . .

The ZA6402/1 regulator unit and the U2704/1 transformer rectifier unit are tested as a complete unit; however, prior to dispatch from the manufacturer, the ZA6402/1 regulator unit is removed from the U2704/1 transformer rectifier unit. As a transport precautionary measure the regulator is then specially packed and dispatched separately under Rotax code ZA6402/1; the U2704/1 transformer rectifier unit is also dispatched from the manufacturer separately, and this code number is raised to U2704/2 for identification that the regulator is not included.

Electrical connections

54. Electrical connections to the unit are made as shown in Table 1.

SERVICING

55. Make a visual examination of the unit to ensure that it has not sustained any physical damage, and that it is secure on its mounting. Remove the terminal box covers, and examine the mouldings for signs of cracks or distortion; renew any terminal block if its condition is unsatisfactory. Check that the electrical connections are clean and secure and that there are no signs of corrosion. To gain access to the components remove the four panels in the sides of the case.

56. The two narrow panels flanking the terminal blocks are each secured by 15 quick-release fasteners, and the large panel on the opposite side of the case by 14 quick-release fasteners. The small panel towards the main rectifier end of the unit is fastened by eight 2 B.A. cheese-head screws.

Note . . .

Most of the nuts used in the construction of this unit are of the captive type, but care must be taken that non-captive nuts are not lost.

TABLE 1
Terminal connections

Terminals	Type of terminal	Cable entry	Cable lug Ref. No.
AA, AB, AC (a.c. input 104V)	0·250 in. dia. B.S.F.	Uninypren 70	5X/6520
BA, BB, BC (a.c. output 208V)	0·250 in. dia. B.S.F.	Uninypren 100	5X/6523
CA, CB, CC (a.c. input 208V)	0·250 in. dia. B.S.F.	Uninypren 100	5X/6523
MV+, MV−	0·250 in. dia. B.S.F.	Uninypren 100	5X/6523
DA, DB, DC (a.c. input 65V)	0·250 in. dia. B.S.F.	Uninypren 50	5X/6517
+, −M	0·250 in. dia. B.S.F.	Uninypren 50	5X/6517
LV+, LV−	0·312 in. dia. B.S.F.	Uninypren 135	5X/6527
P, R	0·250 in. dia. B.S.F.	Uninypren 35	5X/6513
A, C, E, F	4 B.A.	—	5X/6502
−A	4 B.A.	—	5X/6504
14-way plug X	Breeze plug	Socket CZ64517	5X/6207
14-way plug Y	Breeze plug	Socket CZ64517	5X/6207

Note . . .

The transformer rectifier unit U2704/2 should be mounted with the terminals at the bottom.

57. Check that the regulator ZA6402/1 carbon pile units are assembled correctly on their suspension springs, and that no damage has been sustained in transport or on assembly prior to installation, by removing the inspection plate covers.

58. To gain access to the two regulator locking plate assemblies, remove the two locking plate covers from each side panel on the transformer rectifier unit, by releasing the eight quick-release fasteners. Check that the regulator locking plates have been reversed after installation, and that the locking pegs point away from the stop screws. Further information will be found on the cover plate of the regulator unit front panel as illustrated in fig. 7, and will be included in the chapter on the regulator unit in A.P.4343B, Vol. 1, Book 1.

59. To remove the ZA6402/1 regulator unit from the transformer rectifier unit, first remove 16 nuts from one end of the connecting links only; i.e. the link ends secured to the connecting block integral with the transformer rectifier units, then release the quick-release fasteners fitted on the front panel of the regulator unit.

60. The regulator assembly can now be withdrawn for a visual examination of the internal components in the transformer rectifier unit, to ensure that there is no sign of damage or chafed leads, and that electrical connections are secure. Make a similar examination of the regulator assembly, paying particular attention to the suspension springs; any faulty springs must be renewed.

61. Replace both regulator assembly and connecting link securing nuts together with connecting link cover, on completion of the examination, but carry out the following tests prior to replacing any terminal covers.

Insulation resistance test

62. The insulation resistance should be measured with a 250-volt insulation resistance tester between the points enumerated below, and should not be less than 2 megohms.

(1) Between L.V. —ve terminal and the frame of the T.R.U.

(2) Between terminals CA, CB and CC, linked together, and the frame of the T.R.U.

(3) Between terminals AA, AB, AC (linked together) and the frame of the T.R.U.

(4) Between terminals AA, AB, AC (linked together) and terminals CA, CB, CC (linked together).

(5) Between terminals CA, CB, CC (linked together) and terminal L.V. —ve.

(6) Between DA, DB, DC (linked together) and frame.

(7) Between terminal 12 on P4301 transformer assembly and frame.

(8) Terminals A, C, E, F—A to frame.

(9) Between terminals of plug Y (shorted together) and frame.

(10) Between terminals of plug X (shorted together) and frame.

(11) All regulator terminals to frame when regulator is not fitted.

Reforming of selenium rectifiers after storage

63. If a selenium rectifier has been stored for longer than six months, it will require reforming before satisfactory operation can be guaranteed. If a transformer-rectifier unit is being taken from storage after a period exceeding six months, the following procedure should be adopted, before the unit is installed in an aircraft, to ensure that the rectifiers are serviceable. If a replacement rectifier which has been stored for more than six months is being fitted to a unit, it should first be fitted and the relevant part of the procedure be applied.

64. Prepare the unit for the reforming procedure as follows. Remove the links from the regulator unit ZA6402/1, and remove the plug from the protection unit F6001. The pins of plugs disconnected should be wrapped in insulation material to ensure that they do not make contact accidentally with the frame of the unit. During the reforming procedure, the unit should be supplied with cooling air at a rate of not less than 100 cu. ft. per minute, the air to be drawn in at the rectifier end of the unit.

65. *Low-voltage* (28-*volt*) *rectifier.*—

(1) Connect a variable d.c. supply to terminals LV+ and LV—.

(2) Set the applied voltage from zero to 40 volts and maintain for 10 minutes.

(3) Increase the applied voltage to 48 volts and maintain for 10 minutes.

(4) Increase the applied voltage to 56 volts and maintain for 10 minutes. The L.V. rectifier is now reformed.

66. *Medium-voltage* (112-*volt*) *rectifier.*—

(1) Disconnect the supply from the L.V. rectifier, and connect to terminals MV+ and MV−.

(2) Set the applied voltage from zero to 160 volts and maintain for 10 minutes.

(3) Increase the applied voltage to 192 volts and maintain for 10 minutes.

(4) Increase the applied voltage to 224 volts and maintain for 10 minutes.

The M.V. rectifier is now reformed.

67. Disconnect the supply from the M.V. rectifier. Re-fit the plug (having removed the temporary insulation material) and the links which were disconnected. Finally apply an insulation test between each terminal and the frame, using a 250-volt insulation resistance tester.

TABLE 2

Circuit component details

Circuit symbol	Description	Value	Rotax No.
N0701/3	A.C. generator (3-phase)	50 kVA	N0701/3
—	Double compounding transformer	—	P4001
—	Voltage regulator unit	—	ZA6402/1
—	Main rectifier unit (28V-112V—compounding)	—	N156544
—	Sub-power unit (multiple protection)	—	F5103/1
—	Remote voltage regulator trim units		
	28V d.c.-L/V trim	20 ohms	ZA2606
	112V d.c.-M/V trim	15 ohms	ZA10601
	200V a.c.-a.c. trim	20 ohms	ZA2606
—	Main transformer	—	P4201
—	Booster transformer	—	P4301
P4401/1	Transductor	—	P4401/1
F6001	Protection unit	—	F6001
P3701	Current limiting transformer (M.V.)	—	P3701
P1103	Load sharing transformer (M.V.)	—	P1103
P3801	Current limiting transformer (L.V.)	—	P3801
P3901	Load sharing transformer (L.V.)	—	P3901
P4101	Voltage reference transformer (a.c.)	—	P4101
P1604	A.C. overvoltage transformer	—	P1604
T6	A.C. stabilizing transformer	—	N127836
T3	28V stabilizing transformer	—	N119875
MR1	Current limiting rectifier (L.V.)	—	N156541
MR2	Load sharing rectifier (L.V.)	—	N156541
MR3	Pullin rectifier	—	N156541
MR7	Current limiting rectifier (112V)	—	N156545
MR8	Load sharing rectifier (M.V.)	—	N156541
MR9	Voltage reference rectifier (a.c.)	—	N156548
MR10	Overvoltage rectifier	—	N156542
MR11	Rectifier	—	N156546
RL1	Relay (112V)	—	N147363
RL2	Relay (28V)	—	N130875/37

TABLE 2—(*continued*)

Circuit symbol	Description	Value	Rotax No.
RV1	Load sharing resistor	12 ohms	N69671/2
RV2	Positive rectifier resistor (L.V.)	3 ohms	N69671/24
RV4	Stabilizing resistor (L.V.)	25 ohms	N69671/1
RV6	Bias resistor (L.V.)	400 ohms	N69671/14
RV8	Load sharing resistor (M.V.)	12 ohms	N69671/2
RV10	Stabilizing resistor (a.c.)	33 ohms	N69671/2
RV11	Overload resistor (a.c.)	12 ohms	N69671/2
R1	Bias resistor (M.V.)	200 ohms	N69671/23
R2	Bias resistor (M.V.)	200 ohms	N69671/23
R3	Field ballast (twin) resistor (two off, coupled in parallel)	0·2 ohms (each)	N151747
R4	Ballast resistor (M.V.)	(20 ohms +20 ohms)	N152945
R5	Ballast resistor (L.V.)	40 ohms	N150324/4
R6	Ballast resistor (A.C.)	45 ohms	N150323/1
C1	Capacitor	20 μF	N114260
C2	Capacitor	40 μF	N133314
C3	Capacitor	20 μF	N114260
C4	Capacitor	10 μF	N114259

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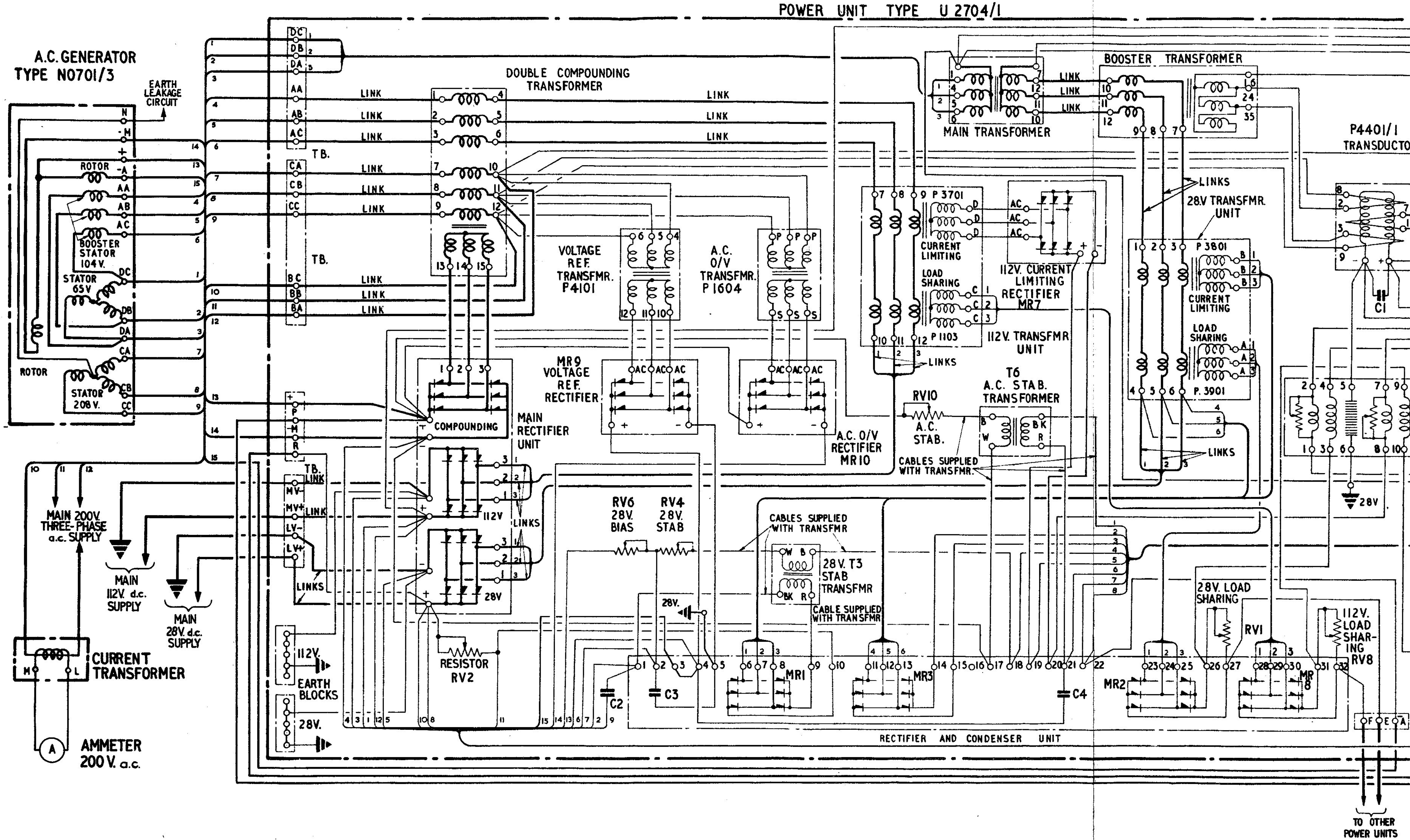

Fig. 8

Composite circuit diagram

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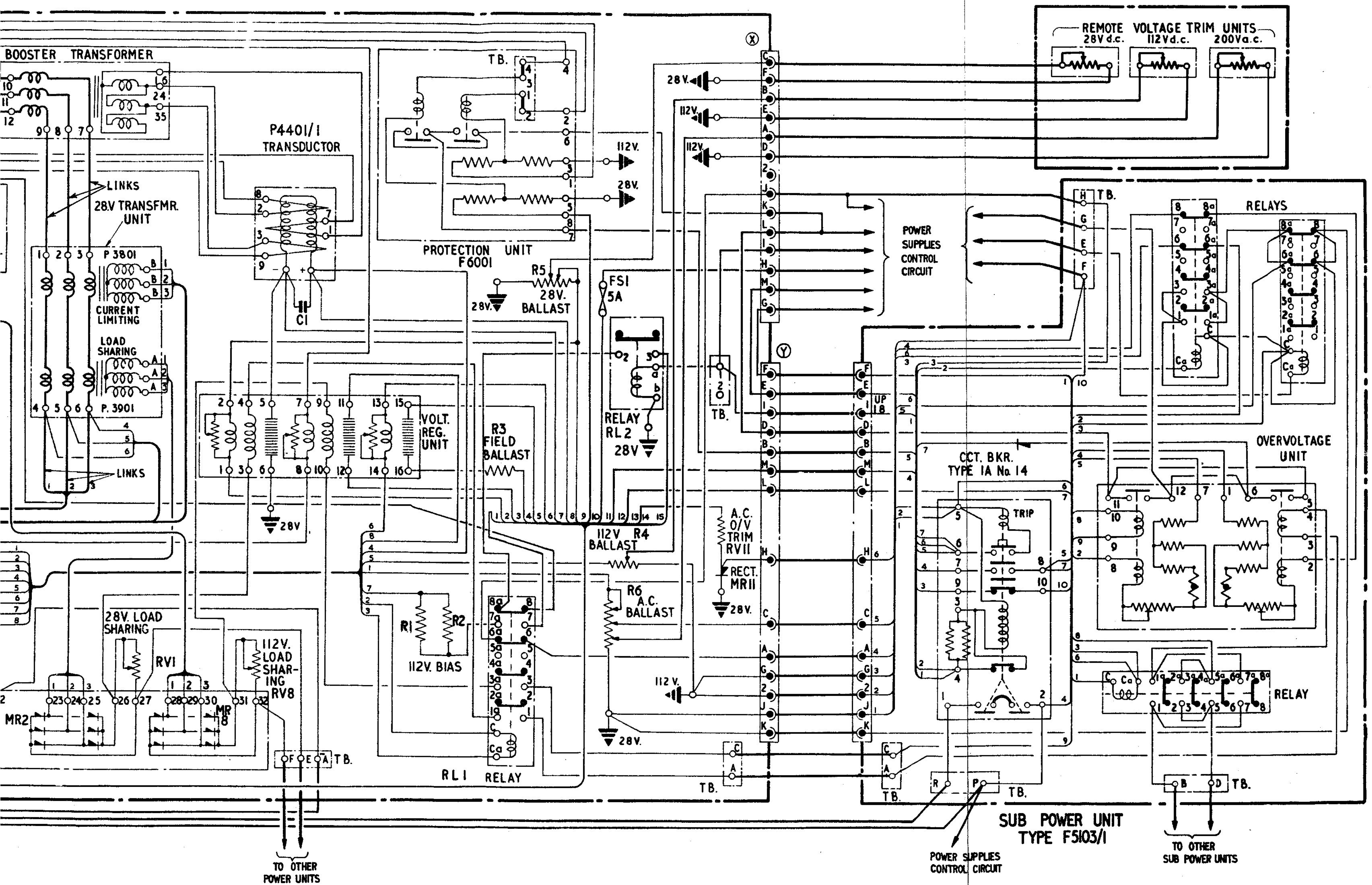

posite circuit diagram

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Fig. 8