Chapter 4

A.C. SECONDARY SUPPLIES AND DISTRIBUTION

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Introduction

1. Certain systems, such as wireless and radar, require for their operation input currents at 115 volts, 3 phase, 400 c/s and 115 volts, single phase, 1600 c/s. This Chapter contains descriptive and servicing information on the sources of these supplies, and the method of distribution from the sources to the feeders.

2. Components illustrations are provided in fig.1 and 3, and a list of a.c. secondary supply fuses is given in Table 1.

3. Routing charts for all circuits relating to the installations have been inserted at the end of the Chapter, and are supplemented by theoretical circuit diagrams which lend themselves more readily to an appreciation of the circuit operations described in the text.

GENERAL

4. Except for certain radar installations all loads requiring alternating current at 115 volts, 3 phase, 400 c/s are supplied from two main static transformers. All loads requiring alternating current at 115 volts, single phase, 1600 c/s are supplied from two frequency-changers. The radar installations which require 3-phase supplies at 400 c/s, and which are fitted at points removed from the main transformers, take their supplies from small static transformers positioned as near as possible to the consuming loads (Chapter 7).

3 kVA TRANSFORMERS

5. Two static transformers are provided for the supply of alternating current at 115 volts, 3 phase, 400 c/s and are mounted one over panel 27P on the port side, and the other over panel 28P on the starboard side of the rear face of the front spar, i.e., in the bomb bay. The installation is illustrated in fig.1.

6. The transformers are Ferranti Type RD5978 and rated at 3kVA. The input for the port transformer is taken from the 200-volt section of panel 27P, the output being directed to the 115-volt section of the same panel. The starboard transformer is connected in a similar manner to panel 28P. Both transformers normally operate on approximately half load.

7. Each transformer is controlled by its own switch, the two switches being mounted on the secondary supplies control panel, 50P, situated at the A.E.O's station in the cabin. Each switch has three positions, viz. ON-OFF - COUPLE, the last named being provided for the control of a circuit that enables the loads associated with one transformer to be transferred to the other. This arrangement allows all services to be maintained if either transformer should fail.

8. Two Dowty indicators Type C5175 Mk.7 each associated with one of the two transformers, are mounted adjacent to the control switches on panel 50P. The Mk.7 indicator is one of the 3-position type, having three distinct and separate presentations according to the state of its associated circuit. In this particular application the presentation is of diagonal stripes with the indicator de-energised, a vertical white line for normal circuit conditions with power on, and a horizontal white line for emergency conditions where the load associated with one transformer is transferred, or coupled to the other.

9. The control panel, 50P is designed to give clear indication of prevailing circuit conditions. A mimic circuit diagram is shown on the face of the panel, with the active components, such as the Dowty indicators, completing or breaking up the continuity of line in a manner consistent with the actual circuit state. The panel is illustrated in fig.1.

10. Protection against supplying a load from a source in which a phase has failed, or in which there is a reversal in phase sequence, is offered by connecting a torque switch across the output of the transformer, the d.c. switch contacts causing the transformer to be isolated if either of the above conditions is present. The torque switches for port and starboard installations are mounted on panels 27P and 28P respectively.

Circuit operation

11. The following description of circuit operation is based on the theoretical circuit diagram, fig.2.

12. On setting the No.1 control switch to ON, relay 222 will be energised by a 28 volt supply from fuse 614, and the now closed contacts 222/1, 222/2 and 222/3 will connect the transformer primary windings to the 200-volt, 400 c/s supply at fuses 190R, 190Y and 190B in panel 27P.

13. The secondary windings of the transformer are connected to the torque switch; the red and blue phases to terminals 1 and 3, via fuses 292R and 292B respectively, and the earthed yellow phase to terminal 2. If this supply is correct in respect of voltage and phase, the d.c. contacts of the torque switch will be closed.

14. The d.c. supply from fuse 614, via terminals 5 and 4 of the control switch, to terminal 4 of the torque switch will now energise relay 200. Contacts 200/1 will close to energise relay 221 and the transformer output will be connected to the No.1 load network via relay contacts 221/4 and 221/2 with fuses 269R and 269B protecting the feeders.

15. Until the transformer is switched on line the No.1 Dowty indicator is de-energised and shows diagonal stripes. Once relay 221 is energised, however, the indicator coil, connected across terminals 2 and 3 will be energised by a supply across relay contacts 221/3 to show a vertical white line for normal operation. Note that since relay 200 and 221 are energised, contacts 200/2, 200/4 and 221/1 will now be opened.

16. Similarly with No.2 control switch set to ON the output of No.2 transformer will be switched on line, and its associated Dowty indicator will register normal circuit conditions.

Emergency couple

17. Reference to fig.2 will show that with normal circuit conditions the coil of relay 223 will be isolated from its supply by contacts 221/1 and 200/4 associated with No.1 transformer, by contacts 224/1 and 201/4 associated with No.2 transformer, and by the positions of the two control switches.

18. With a failure of No.1 transformer, the No.1 torque switch will react immediately; its contacts will open to cut off the supply to relay 200. Contacts 200/1 will open to de-energize relay 221.

19. A change in the presentation at the Dowty indicator will be immediate. The open contacts 221/3 will isolate the solenoid connected across terminals 2 and 3 of the indicator, and the closed contacts 221/1 and 200/4 will cause relay 223 to be energized from fuse 687 via contacts 2-1 of the No.1 control switch. The solenoid connected across terminals 1 and 3 of the indicator will now be energized by a supply across contacts 223/1 via contacts 201/3 and 200/2, the latter being closed by the de-energizing of relay 200.

20. There will be an immediate transfer of the No.1 load to the No.2 transformer via the closed relay contacts 223/2 and 223/3, the No.1 transformer being isolated by the open contacts 221/2 and 221/4.

21. Although immediate load transfer has been achieved the conditions now prevailing are unsatisfactory. The input to the primary of the transformer is being maintained via contacts of relay 222 which is energized by a supply from fuse 614 via switch contacts 5 and 4. The transformer now operating under no-load conditions increases power factor losses in the main system. This condition is removed by setting the control switch to COUPLE and therefore de-energizing relay 222. Supplies to both services will still be maintained via relay 223 and contacts 2 and 3 of the control switch, relay 223 now being energized from supply fuse 687.

FREQUENCY CHANGERS

22. Alternating current at 115-volt, single phase, 1 600 Hz is supplied from two frequency changers (No.1 and No.2) situated in the nosewheel bay as illustrated in fig.3. Each frequency changer, B.T.H. Type 270, consists of a motor-generator, the motor being supplied at 200-volt, 3-phase 400 Hz from panel 28P in the case of No.1 and from 27P in the case of No.2. The control circuits for both are supplied at 28-volt d.c. from panel 48P.

23. The prime-mover is a synchronous motor that is brought up to synchronous speed by running it as an induction motor, a star-delta contactor being used as a current limiting device during the starting period. Automatic switching from STAR to DELTA is achieved by employing a relay operating as a function of generator output. D.C. excitation for synchronous running is switched in concurrently with changing from STAR to DELTA running.

24. Generator output frequency will be stable within the limits imposed on the input frequency by the frequency controller in the main generation system (Chap.2), and requires no additional control. Output voltage, on the other hand, requires regulation. For this a feedback system designed to influence d.c. excitation is used and employs a control panel, Type 40, in conjunction with a rectifier unit, Type C.P.40. The system is similar to that used for the regulation of output voltage of the Type 350 inverter, which is fully described in A.P.113D-0010-1.

25. Associated with each frequency changer are two control switches, one for START control and one for STOP control, and a power failure warning indicator, Ref. No. 5CZ/5074. These are positioned on 12P at the radar navigator's station.

Mods.915 and 1640

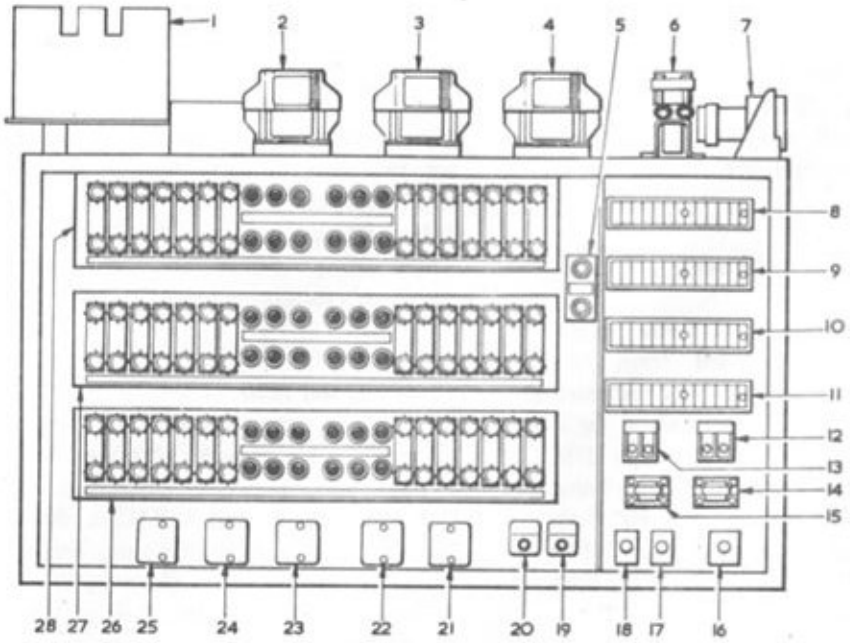
26. When the frequency changers are running, and a transfer of power supplies is being made between alternators, or the A.A.P.P., R.A.T. and G.P.U., a slight delay occurs in the changeover action. This is due to the synchronizing voltage pick-up unit (Chap.2) being temporarily held energized by a supply generated by the synchronous motors of the frequency changers (during the run down period) when the supply to the motors is removed. Mod.915 introduces two frequency pick-up units, Type AE7705, fitted one in the motor supply line of each frequency changer to enable a more instantaneous transfer of supplies. These units, which are Mk.1, (Pre Mod.1640) or Mk.2 (Post Mod.1640), are located on the crate at the port side of the nosewheel bay (fig.3).

Circuit operation

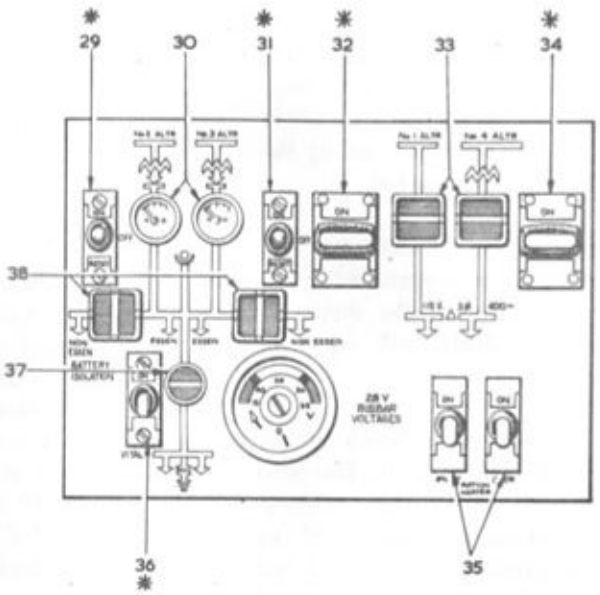
27. The circuits for the two frequency changers are similar. The description which follows is based on the theoretical circuit diagram fig.4, and concerns the No.1 frequency changer.

Start control – Pre Mod.915

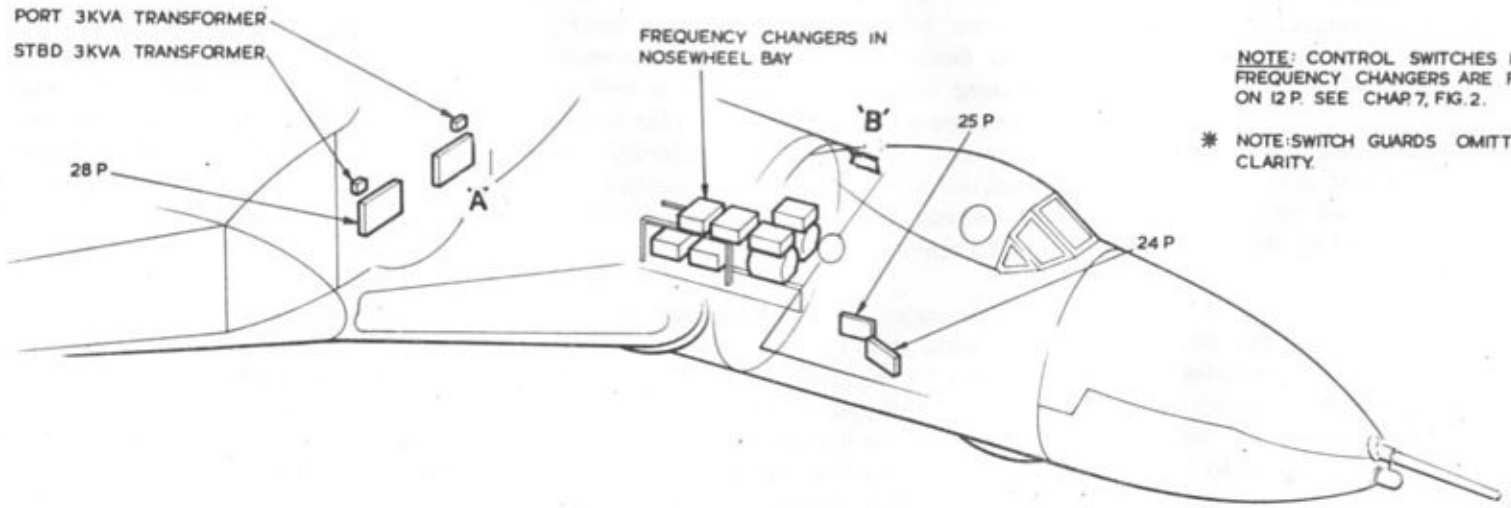
28. By pressing the START push-switch a



DETAIL 'A'
SUPPLY PANEL 27P AND EQUIPMENT



DETAIL 'B'
CONTROL PANEL 50P



NOTE: CONTROL SWITCHES FOR THE FREQUENCY CHANGERS ARE FITTED ON 12P. SEE CHAP. 7, FIG. 2.

* NOTE: SWITCH GUARDS OMITTED FOR CLARITY.

Fig. 1 Control and supply equipment

KEY TO FIG.1

CONTROL AND SUPPLY EQUIPMENT

1 PORT 3 kVA TRANSFORMER
2 RELAY NO.222
3 RELAY NO.221
4 RELAY NO.223
5 LIVE BUSBAR INDICATORS, 200 VOLT
6 RELAY NO.200
7 TORQUE SWITCH
8 FUSES 269 TO 280, 115 VOLT, RED PHASE
9 FUSES 281 TO 292, 115 VOLT, RED PHASE
10 FUSES 269 TO 280, 115 VOLT, BLUE PHASE
11 FUSES 281 TO 292, 115 VOLT, BLUE PHASE
12 T.B.655
13 T.B.656
14 AUTO-TRANSFORMER (NO.1 OIL PRESSURE INDICATOR)
15 AUTO-TRANSFORMER (NO.2 OIL PRESSURE INDICATOR)
16 T.B.654
17 T.B.653
18 T.B.650
19 T.B.651
20 T.B.652
21 RELAY 215
22 RELAY 214
23 RELAY 213
24 RELAY 212
25 RELAY 211
26 FUSES 185 TO 210, 200 VOLT, BLUE PHASE
27 FUSES 185 TO 210, 20 VOLT, YELLOW PHASE
28 FUSES 185 TO 210, 200 VOLT, RED PHASE
29 PORT T.R.U. CONTROL SWITCH
30 T.R.U. AMMETERS (Post Mod.2195)
31 STARBOARD T.R.U. CONTROL SWITCH
32 PORT TRANSFORMER CONTROL SWITCH
33 PORT AND STARBOARD TRANSFORMER INDICATORS
34 STARBOARD TRANSFORMER CONTROL SWITCH
35 RATION HEATER SWITCHES
36 BATTERY ISOLATION SWITCH
37 BATTERY ISOLATION INDICATOR
38 LOAD SHED INDICATORS

28-volt d.c. supply from fuse 713 will energize the magnetic indicator to show black, and at the same time the main supply contactor (MSC) will be energized to close contacts MSC/1, MSC/2, MSC/3 and MSC/4. A 200-volt, 3-phase, 400 Hz supply from fuse 236/R, Y and B will then be connected to field terminals A, B and C of the motor, but since for the moment the field windings are open-circuited by the STAR-DELTA contactor, no current flows.

29. In the meantime, however, a 28-volt d.c. supply from fuse 746 is connected across contacts MSC/1 and, via contacts SDR/2, MFC/1 and DC/1, to the coil of the STAR contactor SC. The ends AA, BB and CC of the motor windings are connected together in STAR configuration by the now closed contacts SC/3, SC/4 and SC/5, and the motor starts to turn and drive the generator. Note that when the start push-switch is released, a hold-in circuit for the main supply contactor MSC is made from fuse 746 via contacts MSC/1, DC/2, SPR/1, OVR/1 and the stop switch contacts. The magnetic indicator will also remain energized.

30. Initial d.c. excitation current for the generator is provided from fuse 746, via contacts MSC/1 of the main supply contactor, and contacts RL/1 of the starting relay RL1, in the control panel, Type 40. This supply is connected to the resistance R3 which is in series with the field windings X1 and X2. There will now appear across the generator terminals a voltage that is a function of generator speed and d.c. excitation. It is assumed that the latter is constant for the purpose of this description of the starting sequence.

31. Across the generator terminals is connected a system of diodes in series with the coil of the star-delta relay SDR. The supply to the system is controlled by the contacts SC2, now closed as a result of the contactor SC being energized.

32. The rectified current through the relay divides into two paths, one through R1 and part of the relay coil, and the other through R2, C1 and the remaining turns of the relay coil. This arrangement gives a slugging effect to the relay on closing and on opening.

33. The current through the path R1, L1 will be dependent only on generator output and will increase as the generator speed is increased. The current through the path R2, C1 and L2 in addition to varying with generator output, will be affected by the charged state of the capacitor C. Assuming a steady generator output the current through the path R2, C1 and L2 will be at maximum initially and zero when the capacitor is charged to a potential equivalent to the generator output. Since L1 and L2 are in opposition, the action of the relay is thus delayed, until C1 approaches fully charged conditions. This relay

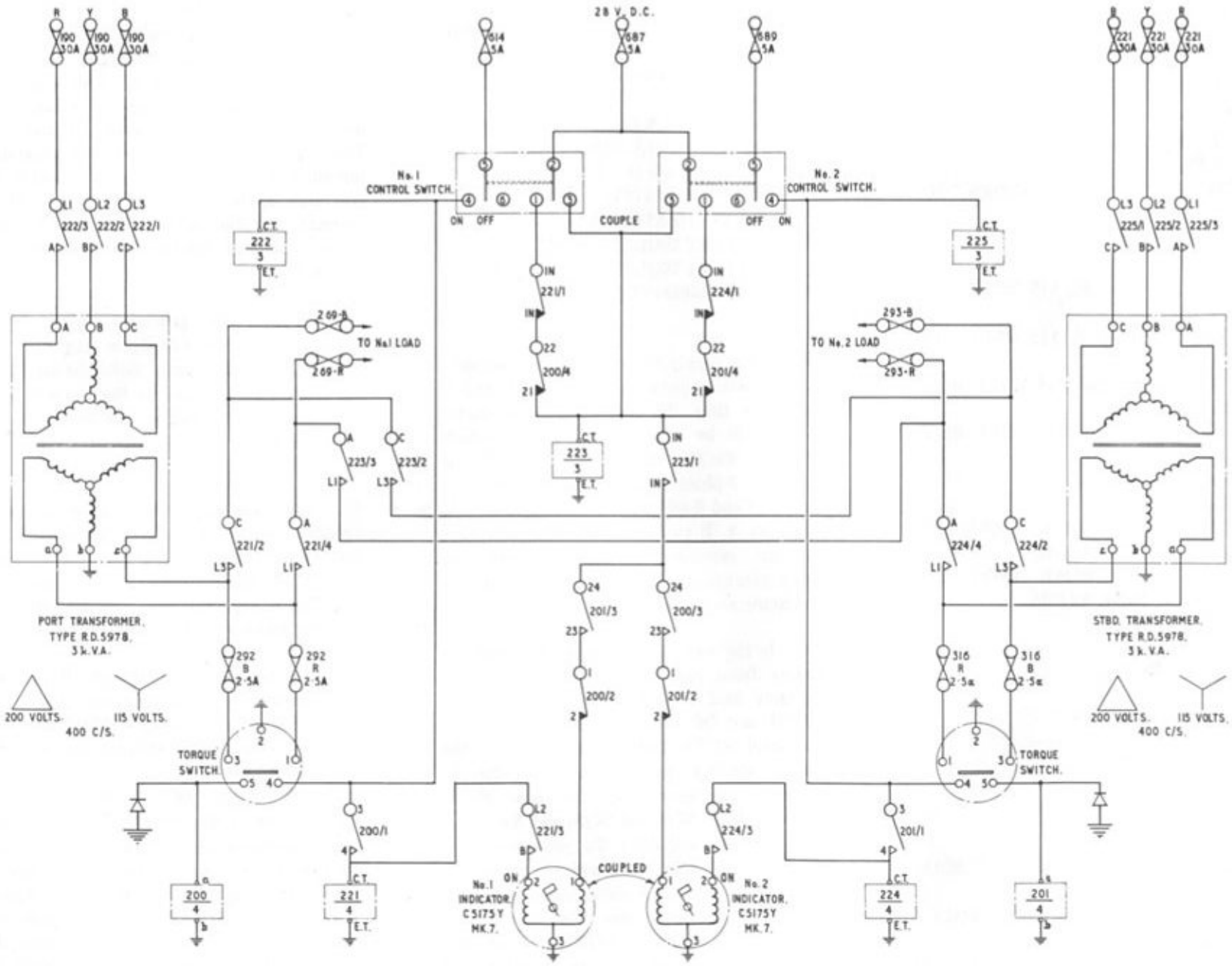


Fig. 2 Control of 115 volt, 400 c/s supplies.

gives the motor time to build up the speed necessary for satisfactory switching to delta running.

34. Once the star-delta relay is energized, contacts SDR/1 are closed and contacts SDR/2 open. The latter isolate the coil of contactor SC with the result that contacts SC/2, SC/3, SC/4 and SC/5 open and contacts SC/1 close. The delta contactor DC will now be energized by a supply via MSC/1, SDR/1, diode D2, and SC/1 to close contacts DC/3, DC/4 and DC/5. The motor now builds up to synchronous speed with the stator windings connected in delta configuration. At the same time the close coil of relay FFR/1 will be energized via contacts SDR/1, thus retaining the hold-in circuit for the main supply contactor MSC and the magnetic indicator, via the now closed contacts FFR/1.

35. The opening of the contacts SC/2 cuts off the supply to the star-delta relay, SDR. C1 is now discharged through R2, R1, and L1, L2 and the drop-out of SDR delayed, and a positive change-over, free of relay chatter, from STAR to DELTA running is achieved.

36. As soon as the contactor DC is energized the MAIN FIELD CONTACTOR (MFC) will also be energized by a supply across 3 and 2 of contacts DC/2. The relay will be held in by the closed contacts MFC/2, these contacts also maintaining the supply in the contactor DC via diode, D1. At the same time the coil of contactor SC is further isolated by the open contacts MFC/1.

37. D.C. excitation current for the motor field is supplied via contacts MFC/3 and the hold-in coil of the FIELD FAILURE RELAY (FFR). Thenceforth the motor will run at synchronous speed.

38. Note that although the close coil of relay FFR is isolated by the opening of contacts SDR/1, the relay will remain energized by the supply through the hold-in coil when MFC closes.

39. Once started, the generator will be self exciting. The generator output terminals are connected via poles G and H to the primary winding of the transformer T2 in the control panel, Type 40. The rectified output of this transformer is connected to the field terminals X1 and X2 via the series resistance R3.

40. A reference voltage from the generator output is fed back to the control unit, Type 40, via poles CD and AB. One line is adequately protected by a fuse. The starting relay RL1 is connected in series with the diode MR5 across this reference voltage, and will be energized when a suitable voltage appears across the generator output terminals. The contacts RL1/1 then open and the generator is self excited.

Stop control – Pre Mod.915

41. The generator may be stopped by pressing the STOP switch. This action cuts off the supply to the coil of the main supply contactor MSC, and the drive motor runs down.

Start and stop control – Post Mod.915

42. With the frequency pick-up unit incorporated, only a slight difference is made to the starting procedure already described. Reference to fig.4 will show that the unit employs a relay, operated by a transistor circuit connected to the red phase busbar, the contacts of the relay being in series with the main supply contactor MSC. When the frequency of the main supply is within the required limits, sufficient current will be applied via the diode to the base of the transistor, so that when the START push-switch is pressed, relay 1 will be energized. With the closing of contacts 1/1, the main supply contactor will be energized and the starting procedure will take place as outlined for pre Mod. conditions. Also when the stop push-switch is pressed, the main supply contactor will be de-energized as before.

NOTE . . .
It is important to note that during transfer of supplies on the synchronizing busbar, as the frequency of the input supply drops, the current on the base of the transistor within the frequency pick-up unit will drop and relay 1 will be de-energized, thus de-energizing in turn the main supply contactor MSC. The frequency changer will be disconnected from the main busbar almost instantly, and must be re-started when the transfer of supplies has been effected.

Voltage regulation

43. In order to maintain a stable voltage output at the generator it is necessary to compensate for variations in armature volt drop with load. The compensating winding connected across terminals X3 and X4 is provided for this purpose.

44. Direct current excitation for the compensating field windings is taken from the rectified outputs of a 2-stage magnetic amplifier housed in the control panel, Type 40. The input to the magnetic amplifier is taken from the secondary windings of the transformer T1, the primary windings of which are connected across the generator output reference voltage.

45. By adjusting the magnetic amplifier output; the d.c. excitation and the terminal voltage of the generator on 'No Load' can be regulated at 115-volt. If the generator is put on load there will be a drop in terminal voltage proportional to the load current. This reduced terminal voltage will now be sensed by the magnetic amplifier, and the output from the amplifier will be adjusted so that the effective excitation current will be increased by an amount sufficient to compensate for the volt drop in the armature.

Protection

46. The system is protected on the input side by a single-phasing relay, and on the output side by an over-volt relay.

47. A current transformer is interposed between the contactor (MSC) and the star-delta contactor in each of the supply lines. The rectified outputs from the current transformers are connected to the coil of the single phasing relay SPR. With a balanced 3-phase load the vector sum of the instantaneous line currents is zero, and the relay SPR remains unenergized, but an unbalanced load or the loss of one phase, as with a blown fuse, will cause the relay to be energized.

48. With relay SPR energized the contacts SPR/1 are open, the hold-in circuit for contactor MSC is broken, and the generator is shut down.

49. Again, the voltage appearing across the generator terminals is sensed by the over-voltage relay (OVR), connected in series with the diode across the voltage reference lines in the control panel, Type 40. This relay

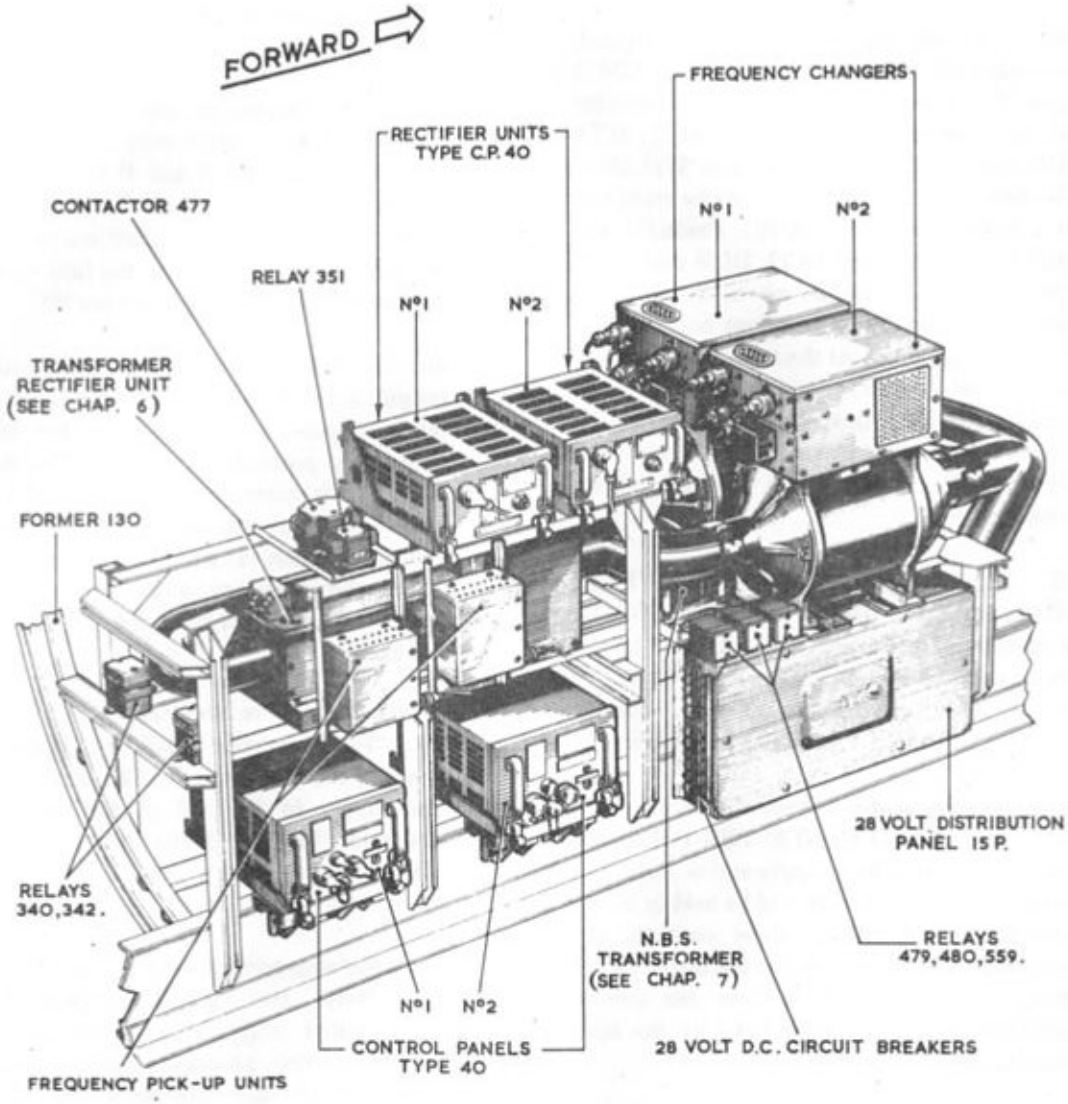


Fig.3 Frequency changers in nosewheel bay

is set to operate at 125% of the nominal voltage, (i.e., 143-volt), and when energized will cause the contacts OVR/1 to open. These contacts are in series with the coil of contactor MSC and will now cause the generator to be shut down.

DISTRIBUTION

115-volt, 3-phase, 400 Hz

50. Reference to fig.8 will show that the 115-volt, 3-phase, 400 Hz output from the port 3 kVA transformer is fed via relay 221 to a bank of distribution fuses in panel 27P. Two fused feeders interconnect 27P and 24P in which a further bank of fuses is mounted. Panel 25P is similarly interconnected with panel 28P to which the 115-volt, 3-phase, 400 Hz output from the starboard 3 kVA transformer is fed via relay 224.

51. The fuse numbers, ratings, and their associated consumers are given in Table 1.

115-volt, single phase, 1 600 Hz

52. The supply from the No.1 frequency changer is taken direct to the N.B.S. equipment. The No.2 frequency changer supplies other loads via 3 fuses located in panel 11P. Reference should be made to Chap.7 for the supply circuits.

3 kVA transformers

53. Servicing of the two 3 kVA transformers is restricted to examination of the attachment bolts and terminal connections for security and cleanliness. When insulation tests are being carried out the transformers should be tested across the primary and secondary windings to earth using a 500-volt insulation tester. Servicing instructions for the associated relays and torque switches will be found in A.P.113D-0015-1.

Functional testing

54. At the appropriate inspection periods the transformers should be tested for correct voltage and frequency output between phases, and the control circuit checked for emergency couple operation. Precision grade instruments should be used for testing the transformer outputs which can be done conveniently from the 115-volt busbars to earth in 27P and 28P. Tests should be carried out as follows:-

SERVICING

(1) Ensure that a 200-volt a.c. ground supply is connected and that all the associated transformer loads are switched off.

(2) Select the No.1 and No.2 control switches on 50P to ON. The indicators should now show normal operation (vertical lines).

(3) At 27P check for voltage and frequency across each of the 115-volt busbars and earth in turn. On no load conditions this should read 117.5 volts at 400 Hz.

(4) Repeat operations (3) at 28P.

(5) Select No.2 control switch to COUPLE. The No.2 indicator should now indicate couple conditions (horizontal line).

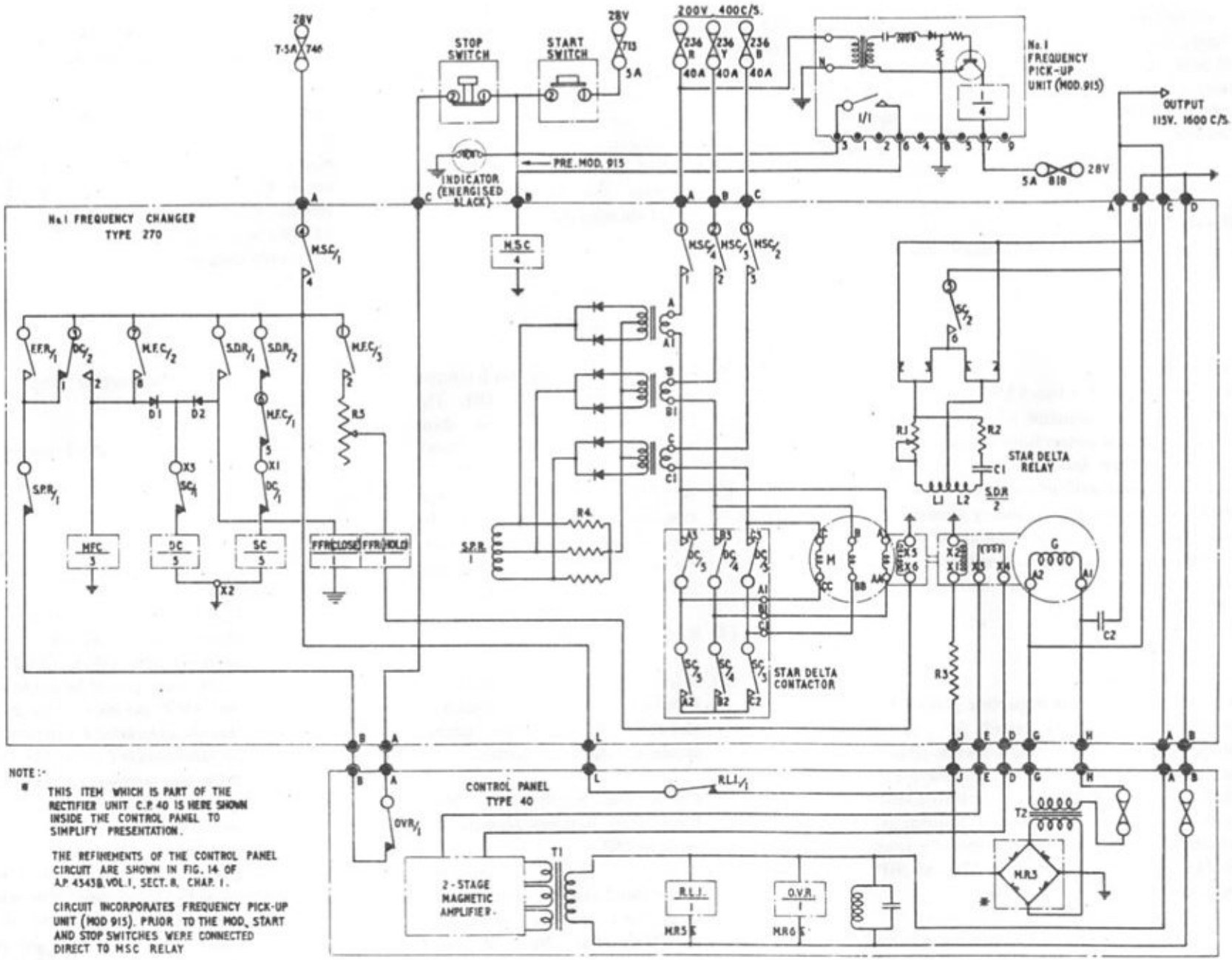
(6) Check the supply from No.1 transformer between busbars and earth in 28P.

(7) Select No.2 control switch to ON and No.1 control switch to COUPLE. The No.1 indicator should now indicate couple and the No.2 indicator should revert to normal.

(8) Check the supply from No.2 transformer in 27P.

(9) Return both control switches to OFF.

NOTE . . .
During functional testing, when either control switch is being operated from ON to COUPLE, a slight pause should be made in the mid OFF position. This ensures that the associated transformer will be disconnected from the circuit prior to coupling action taking place. Failure to observe this precaution may result in the transformer input fuses being ruptured. With Mod.1428 embodied, however, the control switches are changed to Rotax, Type D.5511. These are gated switches, the toggles of which are pulled to allow selection, thus effecting the necessary pause.



NOTE :-

* THIS ITEM WHICH IS PART OF THE RECTIFIER UNIT C.P 40 IS HERE SHOWN INSIDE THE CONTROL PANEL TO SIMPLIFY PRESENTATION.

THE REFINEMENTS OF THE CONTROL PANEL CIRCUIT ARE SHOWN IN FIG. 14 OF A.P 4343B VOL.1, SECT. 8, CHAP. 1.

CIRCUIT INCORPORATES FREQUENCY PICK-UP UNIT (MOD 915). PRIOR TO THE MOD, START AND STOP SWITCHES WERE CONNECTED DIRECT TO M.S.C. RELAY

Fig. 4 Frequency changers control circuit

Frequency changers

55. The No.1 and 2 frequency changers, control panels and rectifier units should be inspected periodically to ensure security of fitment and tightness of the connecting cable assemblies. Full servicing information including bench testing of the frequency changers and their associated equipment will be found in A.P.113D-0601-1. Attention is also drawn to A.P.113A-0308-1, Chap.3, where information is given on the performance and wear of brushes for all rotary machines.

56. It is important that the efficiency of the control panels and rectifier units is not impaired by the collection of dust or foreign particles. These items, therefore should be cleared at regular intervals by using a jet of dry clean compressed air.

3kVA transformers

59. The transformers are each secured by four bolts on the top of 27P and 28P respectively. Removal of these units can be carried out without difficulty when the associated wiring has been disconnected.

Frequency changers

60. A safety raiser or similar trestle is required to lower the No.1 and 2 frequency changers from their location in the nose wheel bay after removal, and must first be placed in position and brought to a convenient level prior to removal operations.

Functional testing

57. Tests for correct voltage and frequency output of the frequency changers should be made across terminals A and B on the 3-pin test socket mounted on the front of each control panel, Type 40. A 200-volt ground a.c. supply should first be connected and all associated loads switched off prior to the frequency changers being started.

WARNING . . .

A condition may occur whereby the frequency changers have been stopped by removal of the 200-volt a.c. supplies without the STOP push-switches being pressed. In this case, if Mod.915 is not embodied, the main supply contactors, MSC, could still be energized from the 28-volt d.c. supply (para.34). A re-application of the 200-volt supplies, therefore, would cause the frequency changers to start in delta configurations, and result in the rupture of the associated fuses. Consequently, it is essential, at all times, to press the STOP push-switches prior to connecting 200-volt supplies from any source. With the embodiment of Mod.915, however, the need for observing this precaution is obviated, since the action of the frequency pick-up units upon the removal of the 200-volt supplies will de-energize the circuit.

58. When both frequency changers are running at correct speed their outputs should read 115 volts ± 1% at 1 600 Hz in each case. Should the output voltage be found to be out of limits by a small amount correction can be achieved by adjustment of the trimmers positioned on the front panels of control panel Type 40. For further details of setting up and testing of the control panel Type 40, refer to A.P.113P-0743-1.

REMOVAL AND INSTALLATION

61. The frequency changers are fitted side by side secured to two T-section cross members, which are in turn secured to the mounting crate by four 3/8 in. bolts and captive nuts, the captive nuts being attached to the cross members.

62. Prior to removing the frequency changers the associated cables must be disconnected, and the cooling air ducts uncoupled at each end. No.2 frequency (inboard) is removed first, by unscrewing the four securing bolts and manually lifting the machine on to the safety raiser. No.1 frequency changer is then removed by unscrewing the four bolts securing the two cross members, and sliding the machine still attached to the cross members off the structure and lifting on to the safety raiser. Note that No.2 frequency changer must be removed first before No.1. The procedure for installing the frequency changers is the reverse of that for removal.

Controlling equipment

63. The removal of the controlling equipment in this chapter, such as the switches and relays associated with the 3kVA transformers and frequency changers, is straightforward and no further instructions are considered necessary.

TABLE 1

115-VOLT, 3-PHASE, 400 C/S SUPPLY

DISTRIBUTION FUSES

Fuse No.	Rating (amp.)	Service	Location	Type	Category
245	2.5	Sensitive altimeter, Mk.22 (Red phase only)	24P	S	E
246	5	Bomb fuzing and release (special store)	24P	S	E
247	2.5	Auto land instrumentation	24P	S	E
248	2.5	True airspeed unit (N.B.S.)	24P	S	E
249		Spare (Loran 2.5A – Post Mod 2471)	24P	(S)	(NE)
250		Spare	24P	S	
251		A.R.I.23051 (2.5 amp. Red phase) Bomb bay heating (5 amp. Blue phase)	24P	S	NE
252	5	Autopilot	24P	S	NE
253	2.5	Ultra-violet lighting	24P	S	NE
254		Spare	24P	S	
255	5	Autopilot	24P	S	NE
256		Spare	24P	S	
257	2.5	De-icing controls – fin	25P	S	
258	5	Bomb fuzing and release – (special store)	25P	S	E
259	2.5	A.R.I.23090 (Mod.2301)	25P	S	E
260		Spare	25P	S	
261		Spare	25P	S	
262	2.5	De-icing controls – wings (Red phase - port) (Blue phase - starboard)	25P	S	NE
263	2.5	Lighting – white fluorescent	25P	S	E
264	2.5	Lighting - red fluorescent	25P	S	E
265	2.5	Bomb fuzing and release (Red phase) cabin temperature (Blue phase)	25P	S	NE
266		Spare	25P	S	
267		Spare	25P	S	
268	2.5	Fuel flowmeters	25P	S	NE
269	20	Feeder to 24P	27P	S	E
270		Spare	27P	S	NE
270		Spare	27P	S	NE
272		Spare	27P	S	
273		Spare	27P	S	
274		Spare	27P	S	
275		Spare	27P	S	
276	2.5	Oil pressure (Red phase No.1) (Blue phase No.2)	27P	S	E
277		Spare	27P	S	
278	2.5	Fire detectors – port wing tanks (Spare, Post Mod 2455)	27P	S	E
279	2.5	Fire detectors – fuselage tanks (Spare, Post Mod 2455)	27P	S	E
280	2.5	R.A.T.O.G. fire protection	27P	S	NE
281	7.5	Feeder to 85P (Blue Steel)	27P	S	E
282	2.5	Radio altimeter Mk.7 (Red and blue phases)	27P	S	NE

TABLE 1 (cont'd.)

115-VOLT, 3-PHASE, 400 C/S SUPPLY

DISTRIBUTION FUSES

Fuse No.	Rating (amp.)	Service	Location	Type	Category
283		Spare	27P	S	
284		Spare	27P	S	
285	15	Feeder to 71P	27P	S	E
286	2.5	Autostabilization mach trim amplifier	27P	S	E
287	2.5	Autostabilization pitch and yaw amplifier	27P	S	E
288	2.5	Autostabilization pitch and yaw amplifier	27P	S	E
289	2.5	J.P.T. No.1 (Red phase - limiters) J.P.T. No.4 (Blue phase - limiters)	27P	S	NE
290		Spare	27P	S	
291		Spare	27P	S	
292	2.5	115-volt secondary supplies torque switch	27P	S	E
293	20	Feeder to 25P	28P	S	E
294	2.5	Oil pressure (Red phase - No.3) (Blue phase No.4)	28P	S	E
295		Spare	28P	S	
296	5	Bomb gear - protective relay unit	28P	S	NE
297	2.5	Bomb bay tanks - fire extinguisher system (Red phase)	28P	S	NE
298		Spare	28P	S	NE
299		Spare	28P	S	NE
300		Spare	28P	S	
301	5	Tacan supplies	28P	S	NE
302	5	Tacan supplies	28P	S	NE
303		Spare	28P	S	
304	2.5	Fire detectors - starboard wing tanks (Spare, Post mod.2455)	28P	S	E
305		Spare	28P		
306	2.5	R.A.T.O.G. fire protection	28P	S	NE
307		Spare	28P	S	
308		Spare	28P	S	
309		Spare	28P	S	
310		Spare	28P	S	
311	2.5	J.P.T. No.2 (Red phase - limiters), J.P.T. No.3 (Blue phase - limiters)	28P	S	NE
312	2.5	Autostabilization mach trim amplifier	28P	S	E
313	2.5	Autostabilization pitch and yaw amplifier	28P	S	E
314	2.5	Autostabilization pitch and yaw amplifier	28P	S	E
315	15	Feeder to 72P	28P	S	E
316	2.5	115-volt secondary supplies torque switch	28P	S	E
317	2.5	Military flight system - starboard compass	72P	S	E
318	2.5	Military flight system - starboard gyro vertical	72P	S	E
319	2.5	Military flight system - starboard comparator (Red phase)	72P	S	E
320	2.5	Military flight system - Variation setting unit	72P	S	E

TABLE 1 (cont'd.)

115-VOLT, 3-PHASE, 400 C/S SUPPLY

DISTRIBUTION FUSES

Fuse No.	Rating (amp.)	Service	Location	Type	Category
321	2.5	Military flight system - computor	72P	S	E
322	2.5	Artificial horizon control panel	72P	S	E
323	2.5	Military flight system - port compass	71P	S	E
324	2.5	Military flight system - port gyro vertical	71P	S	E
325	2.5	Military flight system - port comparator (Red phase only)	71P	S	E
326		Spare	71P		
327	2.5	Vibrator units (Altimeters Mk.19F)	71P	S	NE
328		Spare	71P	S	
329		Spare	11P	S	
330		Spare	11P	S	
331		Spare	11P	S	
339	5	H2S scanner and camera	11P	S	NE
340	5	N.B.S. and test socket	11P	S	NE
341	5	Inertia navigator	11P	S	NE
346		Spare			
347		Spare			
348		Spare			
349		Spare			
350	5	Inertia navigator	11P	S	NE
351		Spare	11P	S	
352	2.5	Heading reference system (Mod.1908)	11P	S	NE
353		Spare	11P	S	
354	2.5	Heading reference system (Mod.1908)	11P	S	NE
355	2.5	Heading reference system (Mod.1908)	11P	S	NE
356		Spare			
357		Spare			
358		Spare			
359		Spare			
360		Spare			
361		Spare			
362		Spare			
363		Spare			
364		Spare			
365		Spare			
366		Spare			
367		Spare			
368		Spare			
369		Spare			
370		Spare			

TABLE 1 (cont'd.)

115-VOLT, 3-PHASE, 400 C/S SUPPLY

DISTRIBUTION FUSES

Fuse No.	Rating (amp.)	Service	Location	Type	Category
372					
373					
374					
375					
376					
377					
378					
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384					
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387					
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390					
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393					
394					
1 145	5	No.1 Mag. amp. (Red phase), No.2 Mag. amp. (Blue phase) (Mod.200)	85P	S	E
1 146	2.5	Relay unit 523 (Red phase), relay unit 518 (Blue phase) (Mod.200)	85P	S	E
1 147		Spare	85P	S	
1 148	2	Spare	85P	S	
1 149		Spare	85P	S	
1 150		Spare	85P	S	
1 151	5	Telemetry relay switching unit (Mod.200)	85P	S	E
1 152		Spare	85P	S	
1 153		Spare	85P	S	
1 154		Spare	85P	S	
1 155		Spare			
1 156		Spare			

NOTE ... *For fuses listed above see Chap.23, Table 3.*

TABLE 2

115 VOLT, SINGLE PHASE, 1 600 C/S SUPPLY

DISTRIBUTION FUSES

Fuse No.	Rating (amp.)	Service	Location	Type	Category
332	2.5	High Level Radio Altimeter	11P	S	NE
333	2.5	◀T4 bombsight amplifier (Removed)▶	11P	S	NE
334	-	Spare			
335	-	Spare			
336	-	Spare			
337	-	Spare			
338	2.5	Aft periscope heater	11P	S	NE
342	5	H2S scanner	11P	S	NE
343	5	N.B.S.	11P	S	NE
344	10	N.B.S.	11P	S	NE
345	2.5	H2S CU.12580	11P	S	NE

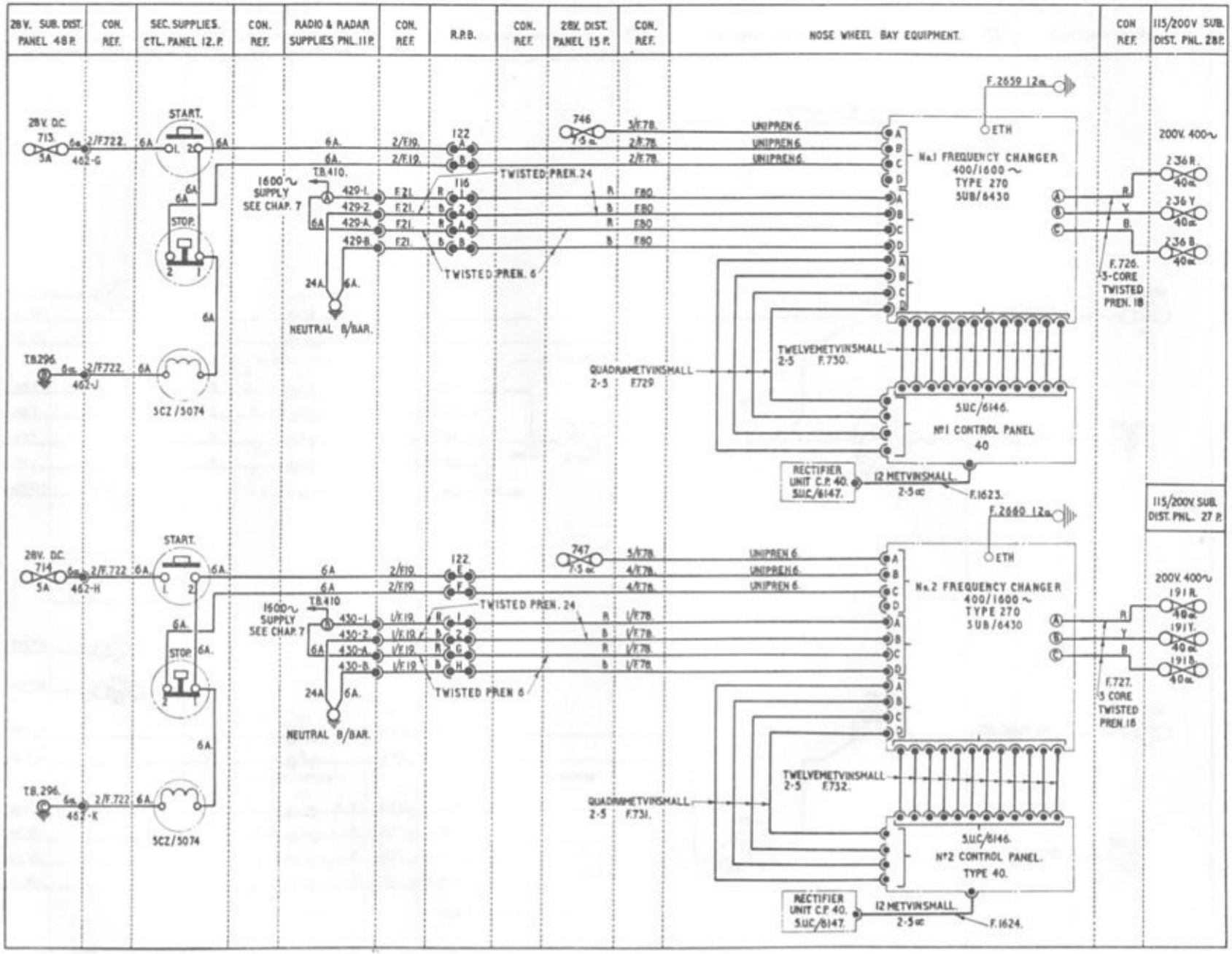

Fig. 5 400/1600 c/s frequency changers pre Mod. 915
(◀ Mod 15524 ▶)

RESTRICTED

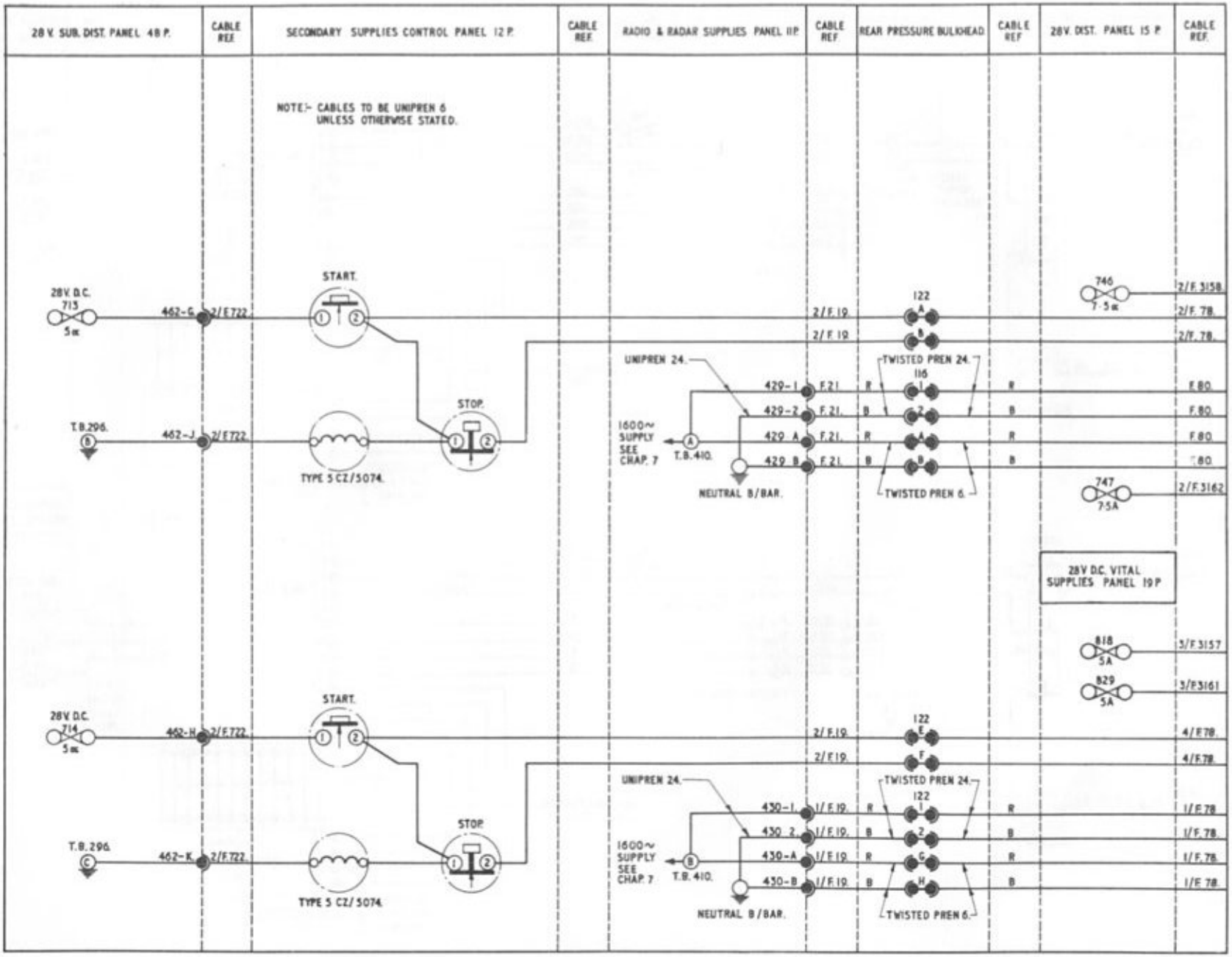

Fig. 6 (1) 400/1,600 c/s frequency changers-Post Mod. 915

RESTRICTED

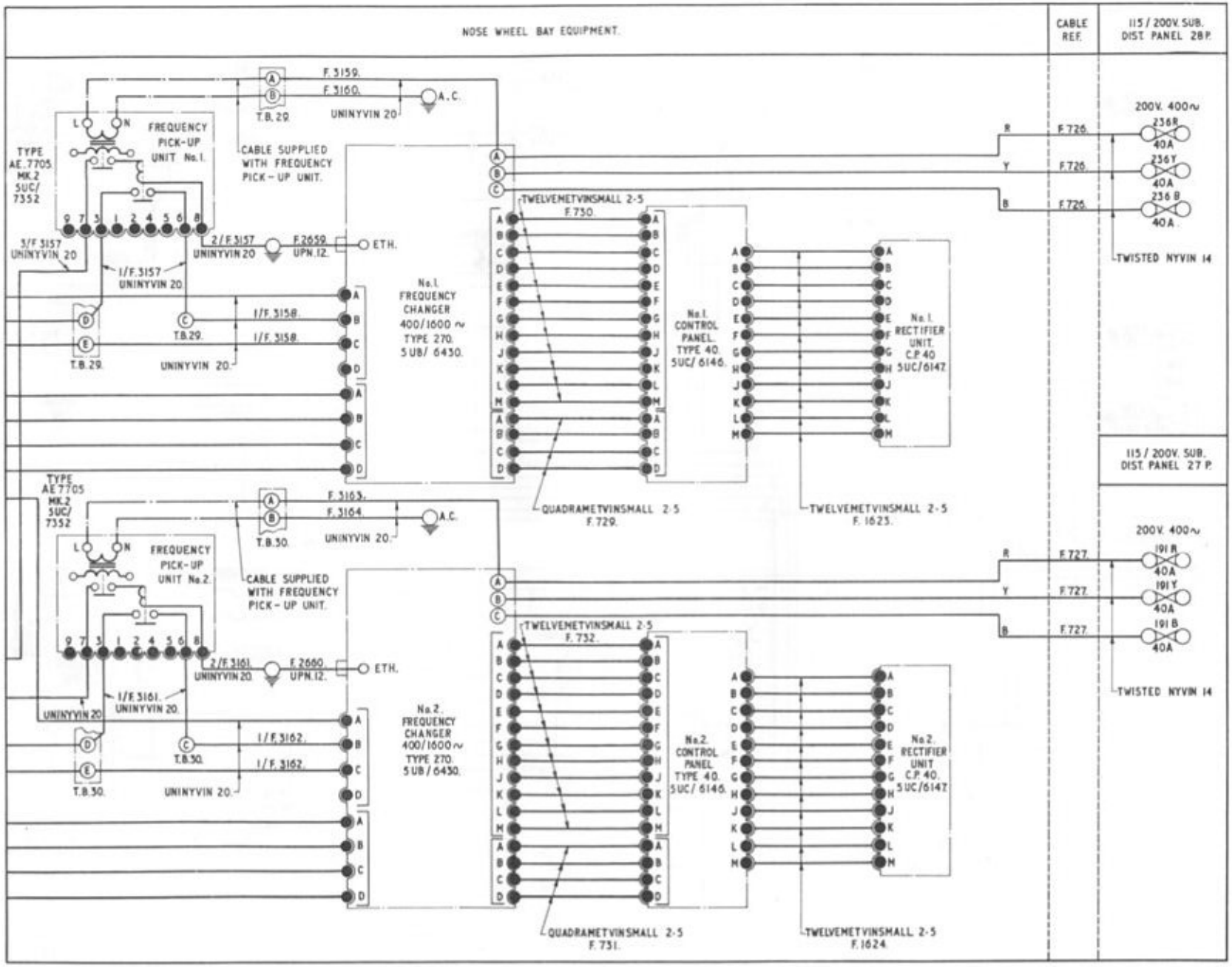

Fig. 6 (2) 400/1, 600 c/s frequency changers- post mod 915

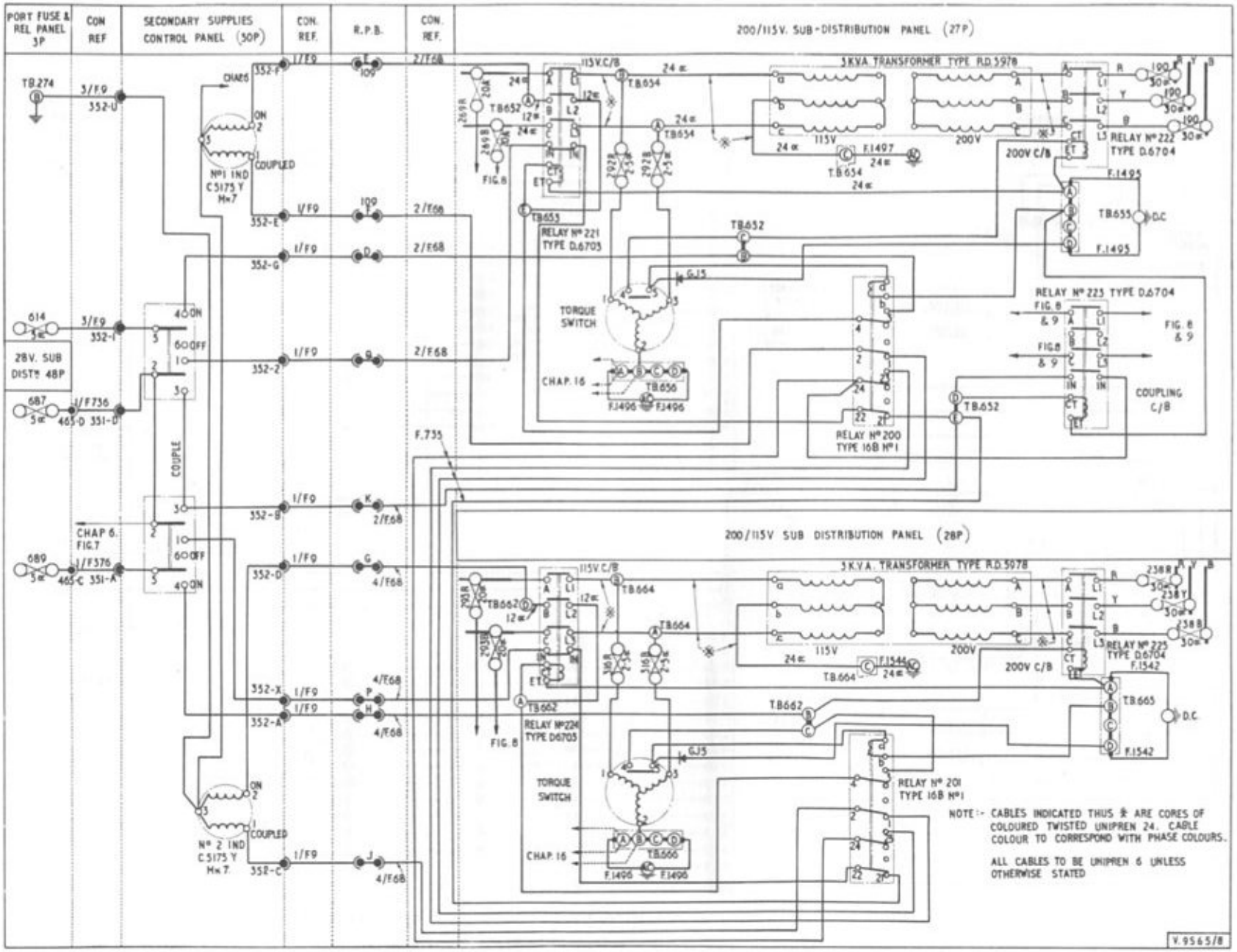

Fig. 7 Secondary supplies control circuit

◀ *Fuses 280 now 269, fuses 293 now 20A* ▶

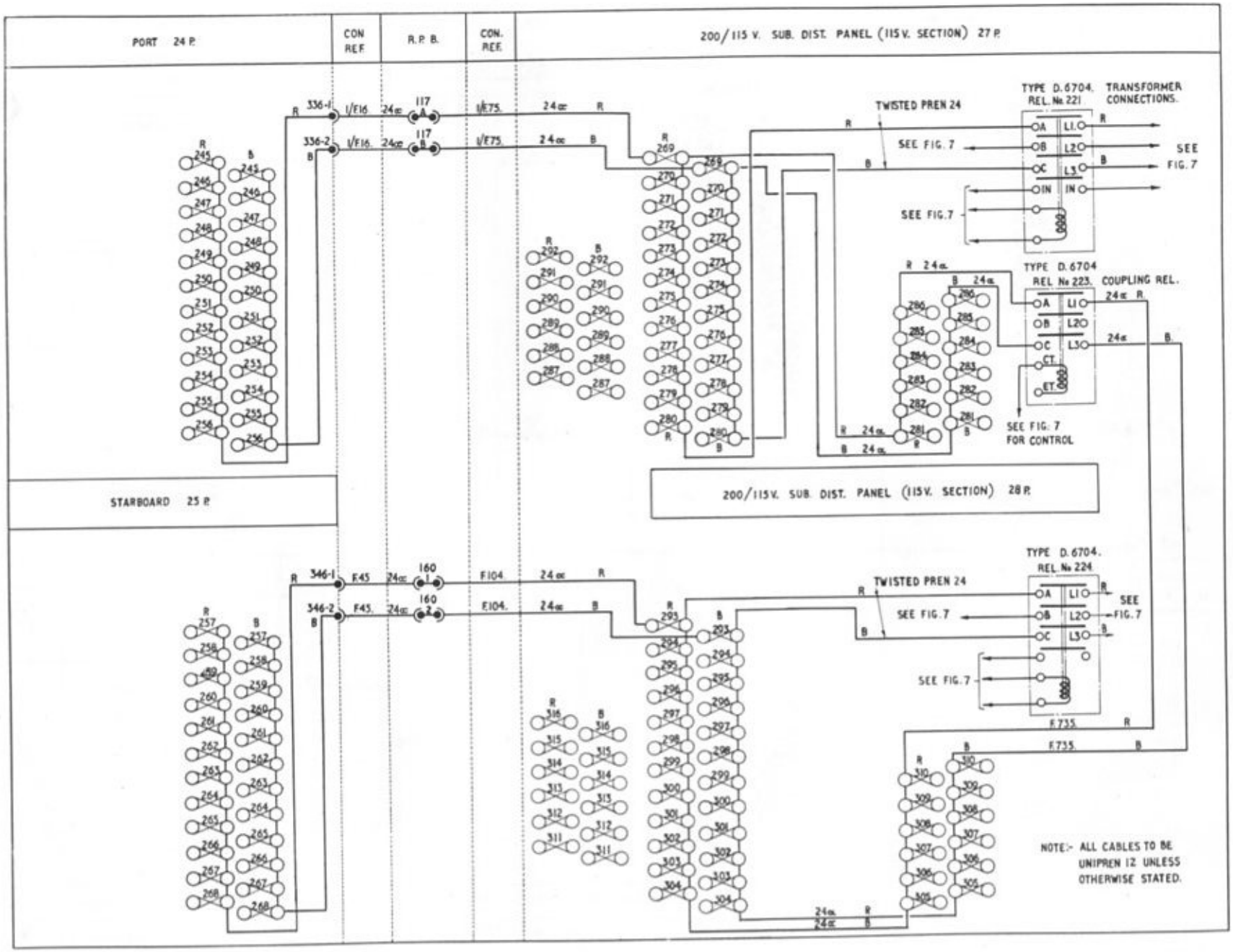

Fig. 8 115 Volt, 3-phase, 400 c/s distribution

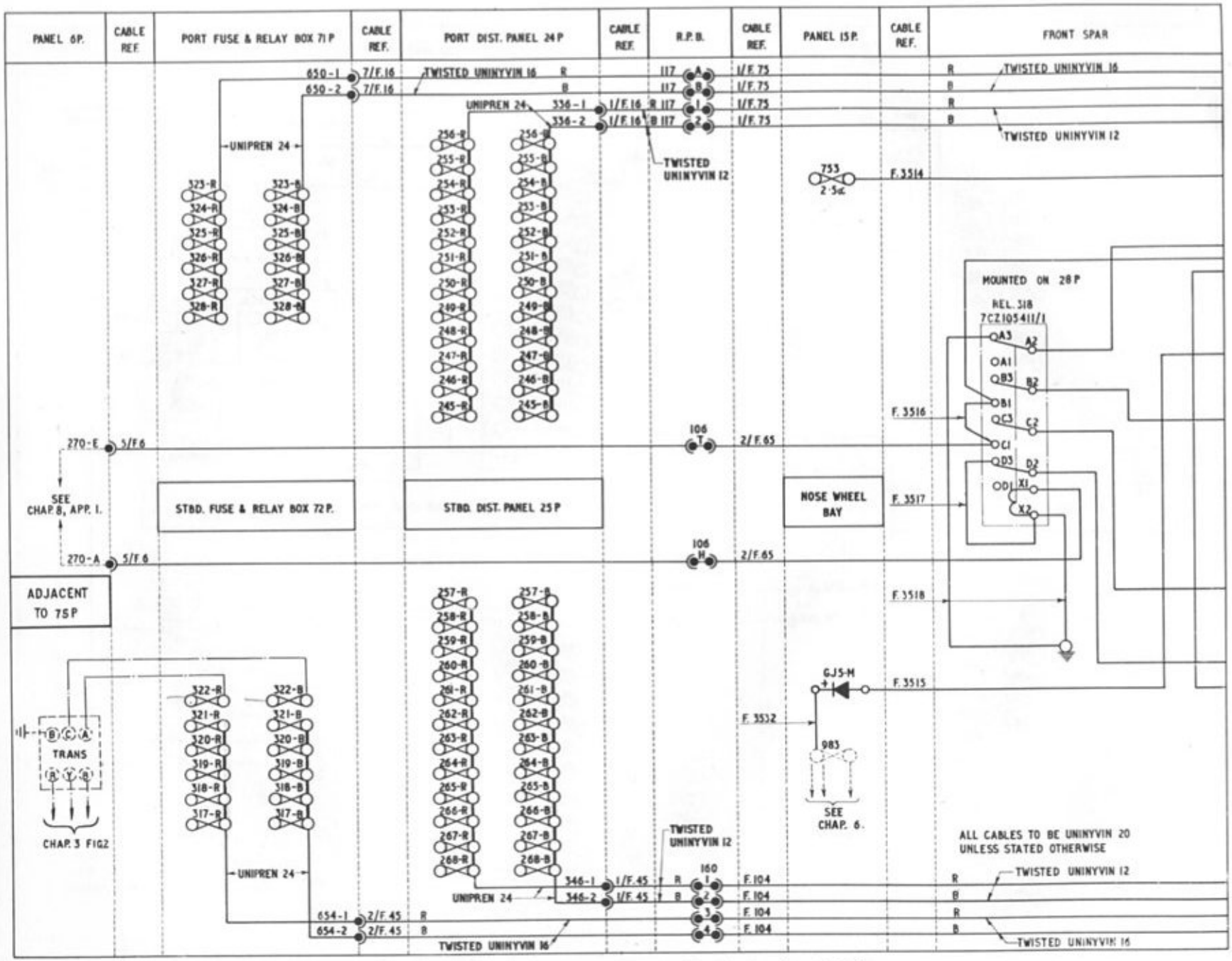

Fig.9(1) 115-volt, 3-phase, 400 c/s distribution (Mod.1320)

(Mod.2182 and 2235 incorporated)

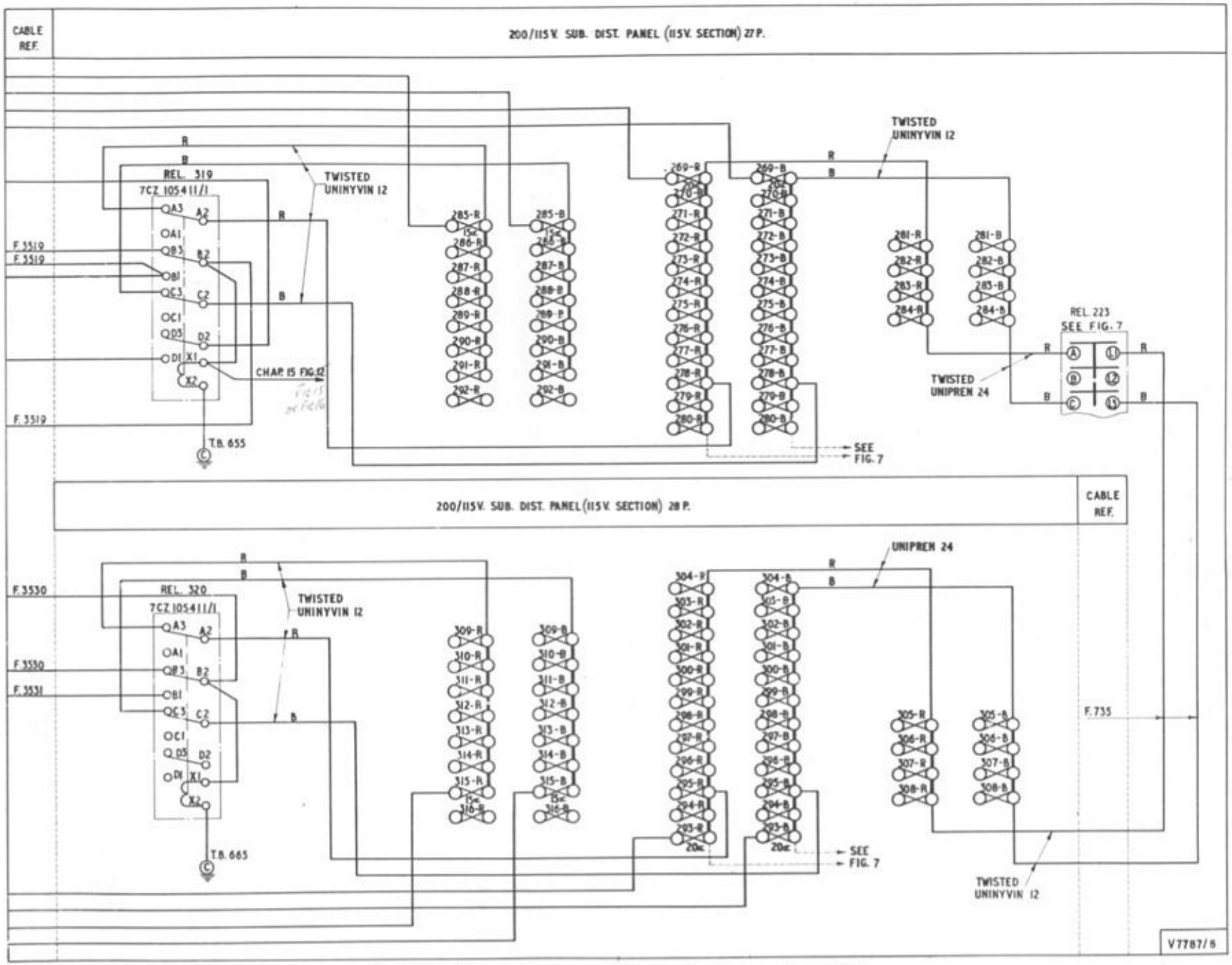

Fig.9(2) 115-volt, 3-phase, 400 c/s distribution (Mod.1320)

(Mod.2182 and 2235 incorporated)