Chapter 7

RADIO POWER SUPPLIES

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LIST OF ILLUSTRATIONS

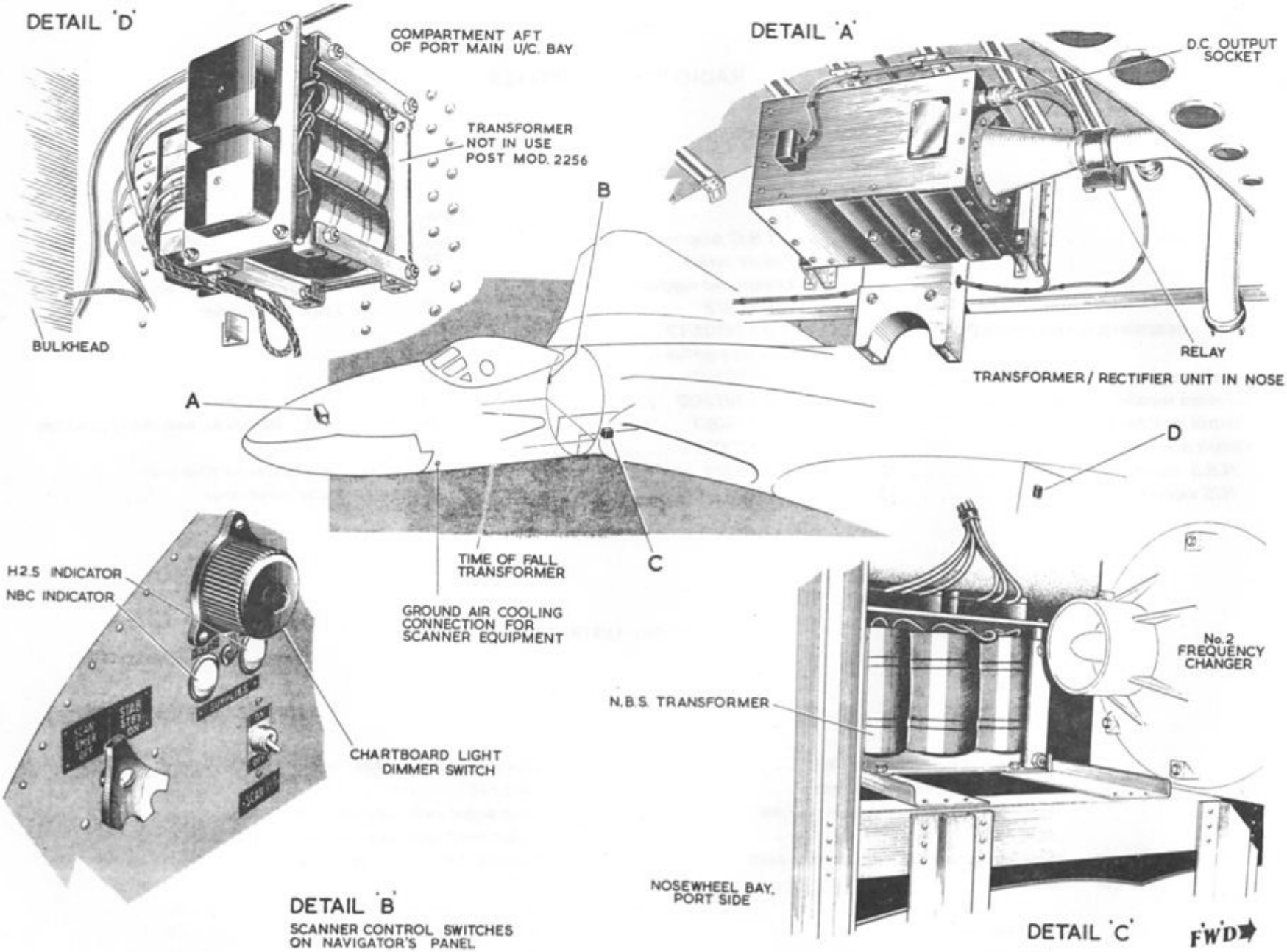


Fig.1 Location of transformer units.

Introduction

1. This chapter deals with the screened and unscreened power supplies required for the aircraft's radio and radar services. Some of these services are fed from the output side of the main 3 kVA transformers and frequency changers (Chap.4), while others are given individual a.c. supplies from small static transformers positioned near to the consuming loads.

2. The location of the static transformers is shown in fig.1, and the supply controls are shown in fig.2. Theoretical circuit diagrams of the screened supplies pre and post Mod.748 are provided in fig.3 and 4, the associated routing charts being included at the end of the text.

3. The following modifications are incorporated in this chapter:-

Mod.748 - To introduce fixed fittings for carriage of new store.

Mod.972 - To introduce an N.B.C. emergency switch to enable the d.c. supply to the N.B.C. to be switched on independently of the a.c.

Mod.1631 - To introduce A.R.I. 18107/13 in lieu of A.R.I. 5816.

Mod.1707 - To delete A.R.I.5924.

◀Mod.2117 - To introduce A.R.I.23172.▶

Mod.2155 - To introduce A.R.I. 23134/5/4 in lieu of A.R.I. 5848.

Mod.2256 - To introduce A.R.I. 5972 in lieu of A.R.I. 5951.

◀Mod.2292 - To introduce Height Encoding facilities.▶

DESCRIPTION AND OPERATION

SUPPLY REQUIREMENTS

4. Most of the radio and radar services require different types of supply at one and the same time. According to the requirements of each system therefore, combinations of the following supplies are used:-

200-volt, 3-phase 400 Hz a.c.
115-volt, 3-phase 400 Hz a.c.
115-volt, single-phase 400 Hz a.c.
115-volt, single-phase 1,600 Hz a.c.
112-volt d.c.
28-volt d.c.

All 28-volt d.c. supplies are taken from the main 28-volt system, and the 112-volt d.c. supply is provided by a 3-phase transformer-rectifier unit.

5. The A.R.I.5928 (N.B.S.), comprising the H2S and N.B.C. equipment, requires supplies which are screened. These supplies are fed from a screened section of panel 11P, which contains the associated control relays, suppressors and supply fuses.

6. Where a.c. supplies are taken from the main 3 kVA transformers and frequency changers, provision is made to enable the associated loads to be supplied from either transformer in the first instance or either frequency changer in the second instance, should breakdown of any one source occur. The transfer of loads from one transformer to another is achieved by selecting the associated control switch on 50P to COUPLE (Chap.4), and in the case of the frequency changers, the transfer of loads is effected by selecting the failure switch on panel 12P to No.1 FAIL or No.2 FAIL as required (para.25). The operation of the failure switch to No.1 FAIL will also transfer part of the A.R.I.5928 load from the 200-volt fuses 235 to 197.

SCREENED SUPPLIES – N.B.S.

7. Connection of the various components of the N.B.S. to the aircraft supply points is made by a series of numbered cable assemblies from terminal blocks, plugs and sockets as appropriate. In the paragraphs dealing with the circuit operation, the supplies up to, but excluding these cable assemblies, will be described and reference should be made to fig.3 in conjunction with the text. Minor wiring differences to the circuit for aircraft Pre Mod.748 and Post Mod.748 are covered in the routing charts fig.5 and 6 respectively.

8. The transformer-rectifier unit, Type AE5704, is fitted in the nose of the aircraft, and supplies the 112-volt d.c. required by the H2S scanner. A transformer, Ref. No. 5UB/6427, (N.B.S. transformer) supplies the H2S and N.B.C. with 115-volt, 3-phase 400 Hz a.c., and is located in the nose wheel bay. Other supplies to the installation include single-phase a.c. at 115-volt, 1 600 Hz from the No.1 and 2 frequency changers, and 28-volt d.c.

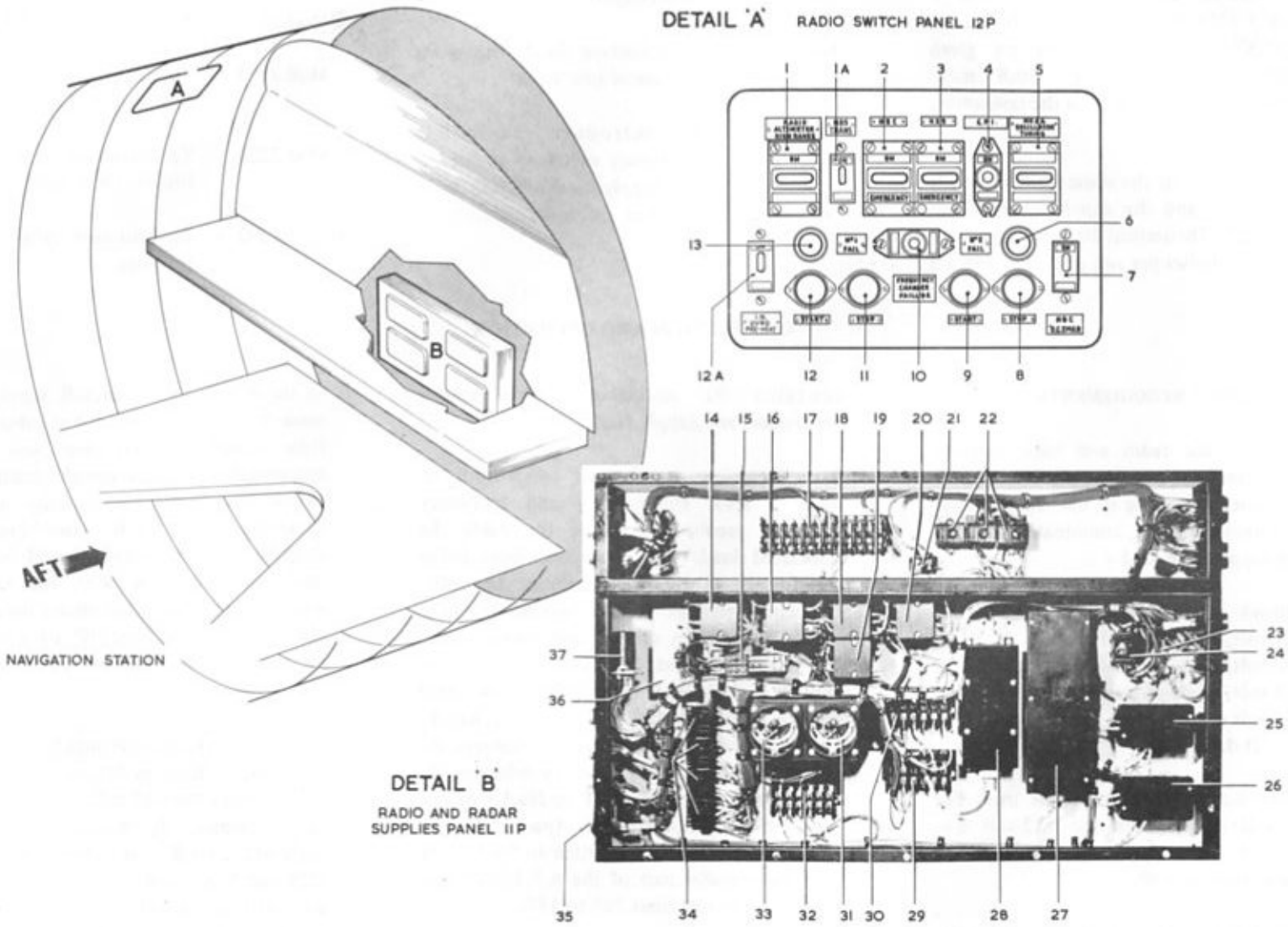


Fig. 2. Control and supply equipment

Control switches and indicators

9. Three switches are used for the control of supplies to the H2S installation. The first is the H2S control switch, a double-pole, two-way centre-off switch which is selected up for ON, and down for EMERGENCY. The second is the SCANNER STABILISATION SWITCH. This is a 2-gang rotary switch having four positions, viz. OFF, EMERGENCY, STANDBY and ON. The third is a single-pole, on-off switch designated SCANNER ROTATION SWITCH.

10. A double-pole, two-way, centre-off switch is used to control the supplies to the N.B.C., and is placed up for ON and down for EMERGENCY. In addition, with Mod.972 embodied, a single-pole d.c. emergency switch is provided to enable the d.c. supply to the N.B.C. to be switched on independently of the a.c. supply. A single-pole switch provides control for the N.B.S. transformer.

11. The H2S and N.B.C. control switches, the N.B.C. d.c. emergency switch, and the N.B.S. transformer switch are located on panel 12P; the two scanner switches are located on the starboard side of the navigator's panel. Fitted adjacent to the scanner switches are two magnetic indicators, Ref.No. 5CZ/5074, one for H2S and the other for N.B.C. When the equipment is switched off the indicators present a white face, and are energized to show black when the system is in operation.

KEY TO FIG.2

CONTROL AND SUPPLY EQUIPMENT

1 RADIO ALTIMETER MK.6A CONTROL SWITCH
1A N.B.S. TRANSFORMER SWITCH
2 N.B.C. CONTROL SWITCH
3 H2S CONTROL SWITCH
4 G.P.I. SWITCH
5 RADIO ALTIMETER MK.6A OSCILLATOR TUNING SWITCH
6 NO.2 FAILURE INDICATOR
7 N.B.C. D.C. EMERGENCY SWITCH
8 NO.2 FREQUENCY CHANGER STOP SWITCH
9 NO.2 FREQUENCY CHANGER START SWITCH
10 FREQUENCY CHANGER FAILURE SWITCH
11 NO.1 FREQUENCY CHANGER STOP SWITCH
12 NO.1 FREQUENCY CHANGER START SWITCH
◀ 12A I.N. GYRO PRE-HEAT SWITCH (POST MOD.748) ▶
13 NO.1 FAILURE INDICATOR
14 RELAY 101
15 RELAY 108
16 RELAY 102
17 FUSES 329-338
18 RELAY 103
19 RELAY 107
20 RELAY 104
21 NO.1 AND 2 RECTIFIERS
22 T.B.1589, 409 AND 411
23 BUSBAR
24 T.B.410
25 RELAY 105
26 RELAY 106
27 SUPPRESSOR, H.S.A. PART NO. V6826
28 SUPPRESSOR, TYPE 02
29 FUSES 853 - 858
30 FUSES 339 - 341
31 TORQUE SWITCH A
32 FUSES 342 - 347
33 TORQUE SWITCH B
34 T.B.406, 407, 408 and 1590
35 TEST SOCKET 595
36 SUPPRESSOR, H.S.A. PART NO. V6790
◀ 37 RELAY 540 (POST MOD.748) ▶

Circuit operation

N.B.S. transformer

12. Reference to fig.3 will show that when the N.B.S. transformer switch is selected to ON, relay 351 will be energized by a supply from fuse 728 via contacts 2-1 of the switch. Relay contacts 351/1, 351/2 and 351/3 will then close to energize the primary coil of the N.B.S. transformer from the 200-volt supply fuses 235R, Y and B via the normally closed contacts of relay 202. The transformer output at 115-volt, 3-phase 400 Hz will thus be available at normally open relay contacts 102/1, 102/2 and 101/1 and 101/2 via fuse 339 R and B, and 340 R and B respectively. ◀ On aircraft Post Mod.748 this output is also ▶ connected to the G.P.I.6, inertia navigator and flight data recorder via fuses 341 R, Y and B, and an additional control for the N.B.S. transformer is provided by the I.N. gyro pre-heat switch on panel 12P (Sect.6, Chap.23).

H2S Supplies

13. By placing the H2S control switch to ON, relays 352 and 102 will be energized from fuse 727 via contacts 2-1 and 5-4 respectively of the switch.

14. With contacts 352/1, 352/2 and 352/3 now closed, the 112-volt d.c.

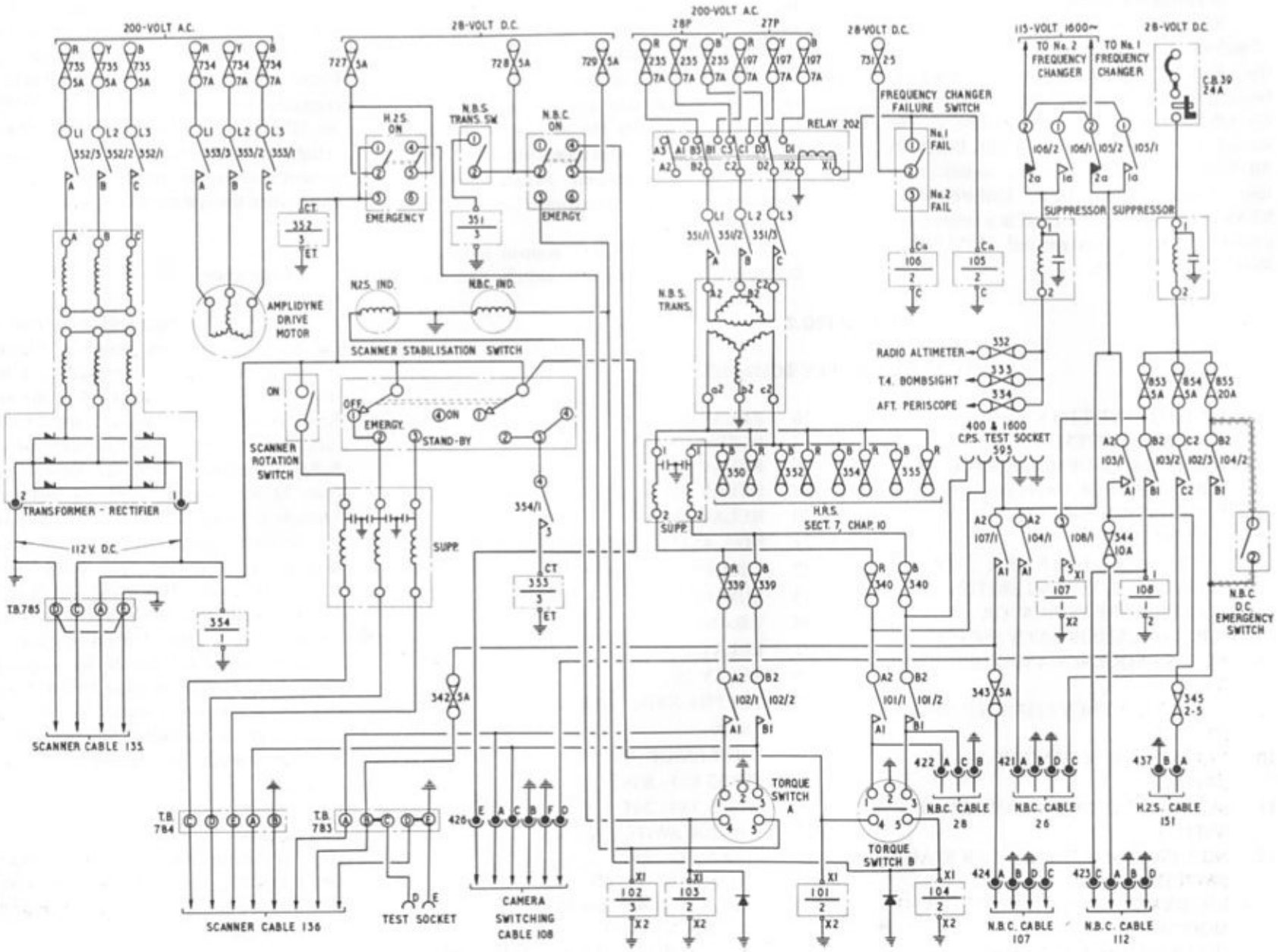


Fig.3 Screened supplies control circuit - pre Mod. 748

◀ *Identification for fuse 334 added* ▶

transformer-rectifier unit will be supplied from 200-volt fuses 735 R, Y, B in panel 75P. The rectifier output will be fed to the scanner unit via terminals C-D of T.B.785 and the scanner cable 135. A 28-volt d.c. supply is connected via terminals A-E of T.B.785 and the scanner cable.

15. Connected across the 112-volt d.c. output is the coil of relay 354, which will now be energized. The contacts of relay 354 are in series with the coil of relay 353, so that if now the SCANNER STABILISATION SWITCH is switched on, relay 353 will be energized by the 28-volt d.c. supply via terminals 2-1 of the H.R.S. control switch. The relay contacts 353/1, 353/2 and 353/3 will then close to connect the amplidyne drive motor to the 200-volt, 3-phase 400 Hz supply at fuses 734 R, Y and B in panel 75P.

16. By switching on the SCANNER ROTATION SWITCH a 28-volt d.c. supply is made available to the scanner cable 136 via terminal C of T.B.784.

17. Since relay 102 is energized (para.13), contacts 102/1 and 102/2 will close to connect the 115-volt N.B.S. transformer output from fuses 339 R and B to scanner cable 136 via T.B.784 (A-B) and T.B.783 (A), and to the camera switching cable 108 via plug 426 (poles A, B, C). Contacts 102/3 will also close to connect a 28-volt d.c. supply to cable 108 via pole D of plug 426.

18. At the same time the 115-volt, 400 Hz output is connected across the torque switch A via contacts 102/1 and 102/2. The torque switch contacts 5 and 4 will now close to energize relay 103 and the H2S indicator. The a.c. supply of 115-volt, 1 600 Hz from No.1 frequency changer will be connected to the control unit cable 112 via the now closed contacts 103/1, fuse 344 and pole A of plug 423. A parallel supply will also be made to the H2S cable 151 via fuse 345 and pole A of plug 437. In addition, a 28-volt d.c. supply via contacts 103/2 is made available to cables 112 and 107 from poles C of plugs 423 and 424.

19. The 28-volt supply across the contacts 103/2 will energize relay 108, and the now closed contacts 108/1 will connect the supply to relay 107. Alternating current at 115-volt, 1 600 Hz for the scanner cable 136 will be made available from No.1 frequency changer via contacts 107/1 and T.B.783B. This supply is also connected to the power unit cable 107 via plug 424 pole A, and to the test socket 594, pole C. Note that supply from the No.1 frequency changer is fed to test socket 595, pole D, direct from the normally closed contacts 105/2.

20. When the H2S control switch is placed to EMERGENCY, relay 352 will be energized from fuse 727 via contacts 2-1 of the switch, and supplies to erect the scanner will be fed as described in para. 14-15. Relay 102, however will remain de-energized and the associated supplies (para.17-19) will be switched off.

N.B.C. supplies

21. By selecting the N.B.C. control switch to ON, relay 101 will be energized by a 28-volt supply from fuse 729 via contacts 5-4 of the switch. The now closed contacts 101/1 and 101/2 will connect the 115-volt, 3-phase, 400 Hz output from the N.B.S. transformer to the torque switch B and to the N.B.C. cable 28 via plug 422 poles A, B and C. This supply is also connected direct from fuses 340 R and B to test socket 595.

22. Since the contacts of the torque switch are now closed, relay 104 and the N.B.C. indicator will be energized. The N.B.C. cable 26 will be supplied with 28-volt d.c. from C.B. 39 via fuse 855, contacts 104/2 and plug 421 pole C, and with 115-volt, 1 600 Hz a.c. from No.1 frequency changer via contacts 104/1 and plug 421 pole A. Note that with Mod.972 incorporated the d.c. supply to cable 26 can be completed by using the N.B.C. d.c. emergency switch to by-pass relay contacts 104/2.

23. From the foregoing paragraphs it will be seen that the connection of the 115-volt, 1 600 Hz and 28-volt d.c. supplies to the appropriate cables is dependent on the torque switches being energized. Thus a failure affecting the N.B.S. transformer or distribution fuses 339 and 340 will de-energize the two torque switches, relays 103 and 104, and the two magnetic indicators, which will show white. This results in the 115-volt, 1,600 Hz supply to all services being cut off, and the 28-volt d.c. supply from C.B. 39 to all services, except the camera switching cable 108, also being cut off.

24. However, by placing the N.B.C. control switch to EMERGENCY, relay 104 and the associated indicator will be re-energized by a supply across terminals 2 and 3 of the control switch. Thus the services fed via relay contacts 104/1 and 104/2 will be restored.

Failure switch

25. In the event of a failure affecting one of the frequency changers, immediate indication (white) will be given on the appropriate power failure indicator on panel 12P. If, for example, No.1 frequency changer fails, warning is given on No.1 power failure indicator. By placing the frequency changer failure switch to No.1

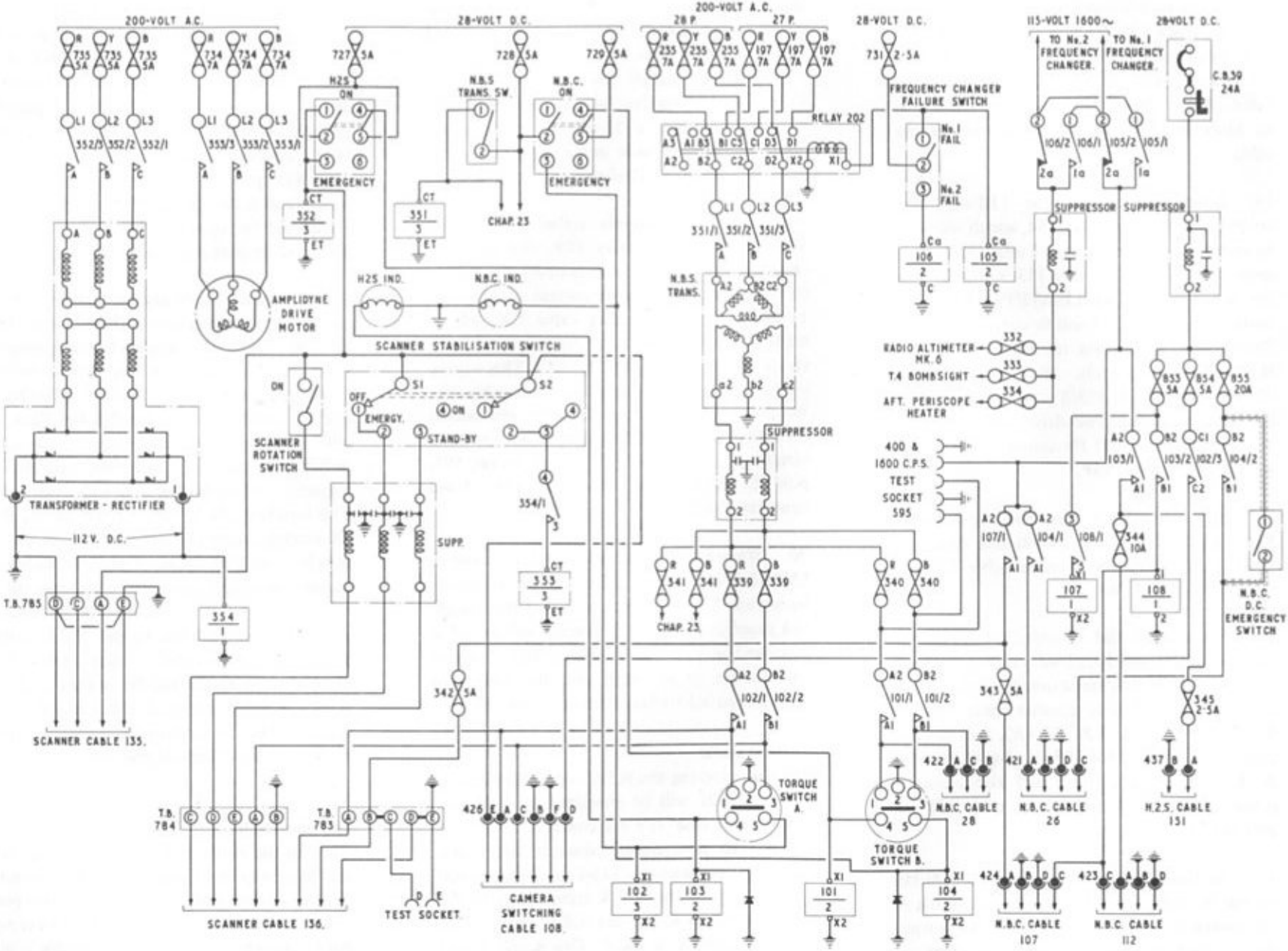


Fig. 4 Screened supplies control circuit – post Mod 748

FAIL, relay 105 will be energized, and the loads previously served by No.1 frequency changer via contacts 105/2 will be transferred by contacts 105/1 to the No.2 frequency changer. At the same time, relay 202 will be energized to change-over the 3-phase N.B.S. transformer supplies from fuses 235 to 197, i.e. from No.4 alternator busbar to No.1 alternator busbar. This ensures that the N.B.S. transformer remains coupled to the same alternator busbar as the frequency changer supplying the N.B.S. If No.2 frequency changer fails, and the failure switch is then placed to No.2 FAIL, relay 106 will be energized to change-over the load to No.1 frequency changer via contacts 106/1.

26. A 6-pole, Mk.4 test socket (595) is provided on the starboard side of panel 11P. The 115-volt, 3-phase, 400 Hz output from the N.B.S. transformer is connected to poles A, B and C of the socket via fuses 340 R and B, and the earthed yellow phase. The 1 600 Hz output of No.1 frequency changer is connected via the normally closed contacts 105/2 to the socket poles D and E (earth).

27. A further 6-pole, Mk.4 test socket (594) in the nose section provides a facility for checking the 115-volt, 1 600 Hz a.c. supply to the equipment in that section. Poles D and E of the socket are connected across terminals C and E respectively of T.B.783 at which point a supply should be available with the power supplies switched on and the H2S control switch placed to ON.

UNSCREENED SUPPLIES

A.R.I.5972

28. The A.R.I.5972 is provided with a 115-volt, 400 Hz single-phase a.c. supply from fuse 234 R in panel 28P. The supply is controlled by a single pole DOPPLER-ON switch on panel 101P and relay No.339.

29. With the switch set to ON (fig.7) a 28-volt d.c. supply from fuse 728 in panel 48P is routed via the switch contacts to energize relay 339. Contacts 339/1 close connecting the a.c. supply to the equipment.

A.R.I.18107/13

30. The supplies to the A.R.I.18107/13 consist of the following:-

(1) 115-volt, 3 phase, 400 Hz a.c. from fuses 301-R and B in panel 28P. (fig.12).

(2) 115-volt, single phase, 400 Hz a.c. from fuse 302-B in panel 28P. (fig.12).

(3) 28-volt d.c. from fuse 872 in panel 16P. (fig.12).

(4) 28-volt d.c. from fuses 974 and 975 in panel 3P. (Sect.9 Chap.6).

Test set supplies

31. A 3-pole, Mk.4 Plessey socket and a 2-pole Hellerman socket are mounted on a panel labelled TEST SET POWER fitted at the radio and radar crate in the nose wheel bay, between formers 115.5 and 130.0. These sockets provide facilities for connecting a 115-volt, 400 Hz a.c. supply to relevant test equipment, including the A.R.I.18107/13 performance test set. The sockets are supplied with 115-volt, single-phase, 400 Hz a.c. from fuse 302-R in the 115/200-volt sub-distribution panel 28P (fig.12 and 13).

A.R.I.23172

32. With the introduction of Mod.2117, A.R.I.23172 is fitted. A supply of 115-volt, 3-phase, 400 Hz is fed to the equipment from fuses 282 R and B in panel 27P (fig.7 and 8). Further supplies of 28-volt d.c. are fed from fuses 656, 657, 658 and 659, and are shown in Sect.8, Chap.7.

A.R.I.18124/2

33. Supplies for the A.R.I.18124/2 consist of a 200-volt, 3-phase, 400 Hz supply from fuses 230 R, Y and B in panel 28P (fig.5 and 6), and a 28-volt d.c. supply from fuse 822 in panel 19P (fig.7 and 8).

A.R.I.18090

34. Supplies to the A.R.I.18090 are controlled by two double-pole switches on panel 12P, viz., a high range switch and an oscillator tuning switch. Reference to fig.9 will show that with the high range switch placed to ON, a 28-volt d.c. supply, from fuse 718 in panel 48P is fed via switch contacts 2-1 and T.B.676(D) to the transmitter/receiver, whilst the 115-volt, single-phase, 1 600 Hz a.c. supply to the transmitter/receiver is fed from fuse 332 in panel 11P via switch contacts 4-5 and T.B.676(A). A 28-volt d.c. supply is also fed from fuse 718 to the tuning unit, via T.B.1205 (A) or (B) depending on the selection of the oscillator tuning switch.

A.R.I.23023

35. A supply of 115-volt, single-phase, 400 Hz a.c. for the A.R.I.23023 is fed from fuse 251 R in panel 24P. The 28-volt d.c. supply is fed from fuse 670 in panel 3P via a single-pole control switch on the navigator's panel at the A.E.O.'s position (fig.9).

A.R.I.5874

36. A supply of 28-volt d.c. for the A.R.I.5874 is fed from C.B.52 in panel 15P the supply being controlled by the H.F. supply switch on the inter-comm. R/T panel and relay 334. With the supply switch set to ON (fig.9) a 28-volt d.c. supply is fed from fuse 697 in panel 48P via switch contacts 2-1 to energize relay 334. Contacts 334/1 close connecting the d.c. supply from C.B.52 to the A.R.I.5874 equipment.

A.R.I.23134/5/4

37. Supplies to the A.R.I.23134/5/4 are controlled from a function switch on the control unit. (Sect.9, Chap.2A), located at the A.E.O.'s station. With the function switch set to STBY, NORM or EMGY, the switch contacts complete a supply from fuse 693 in panel 48P to energize relay 337 in the nose wheel bay (fig.10). Contacts 337/1, 2 and 3 close connecting a 115-volt, 400 Hz a.c. supply from fuse 233 in panel 28P and a 28-volt d.c. supply from fuse 693 via T.B.646 to the A.R.I.23134/5/4 equipment. An additional 28-volt d.c. supply is routed from fuse 828 in panel 19P via T.B.676 to the equipment.

38. A A.R.I.23134/5/4 test socket (1233) is fitted below the transponder shelf in the nose wheel bay. Reference to fig.11 will show that the 28-volt d.c. supply to the socket is routed from fuse 836 in panel 19P.

SERVICING

Transformer-rectifier unit

39. The 112-volt d.c. T.R.U. should be inspected at convenient intervals for security of mounting and connections. Further information on servicing the unit will be found in A.P.3434B, Vol.1, Sect.19.

40. The d.c. output voltage on 'no load' can be checked by connecting an accurate voltmeter across the poles of the plug. With a 200-volt a.c. ground supply connected and the H2S switch placed to ON, the voltage should measure 117 volts ± 3%.

41. A ground air supply connection is fitted on the port side outside the cabin to provide cooling air for the H2S equipment in the nose during ground functional tests. Note that this air supply, at approximately 15 cu ft./min., must be connected if it is required to run the T.R.U. for a period exceeding 5 minutes.

Static transformer

42. Servicing instructions for the 1 kVA transformer (Ref.No.5UB/6427) for the N.B.S. will be found in A.P.4343B, Vol.1, Sect.19. The transformer should be checked for cleanliness and security of connectors at regular intervals. In the event of a unit being replaced, a phase sequence indicator should be used to ensure correct phase rotation on the circuit side prior to any function tests on the system.

43. The supply from the N.B.S. transformer can be checked at test socket 595. The other supplies outlined in this chapter can be tested at the various supply points already described.

REMOVAL AND INSTALLATION

Transformer-rectifier unit

44. In order to remove the T.R.U. the composite nose radome must first be removed as described in Sect.3, Chap.1, and a safety raiser or similar trestle placed in position in order to lower the unit. The electrical connections on the unit should then be removed, and the cooling air pipe disconnected at the flexible coupling.

45. Removal of the unit can then be effected by releasing the four securing bolts and lowering it on the trestle.

Static-transformer

46. The 1 kVA transformer is secured by four bolts and presents no great difficulty in removal.

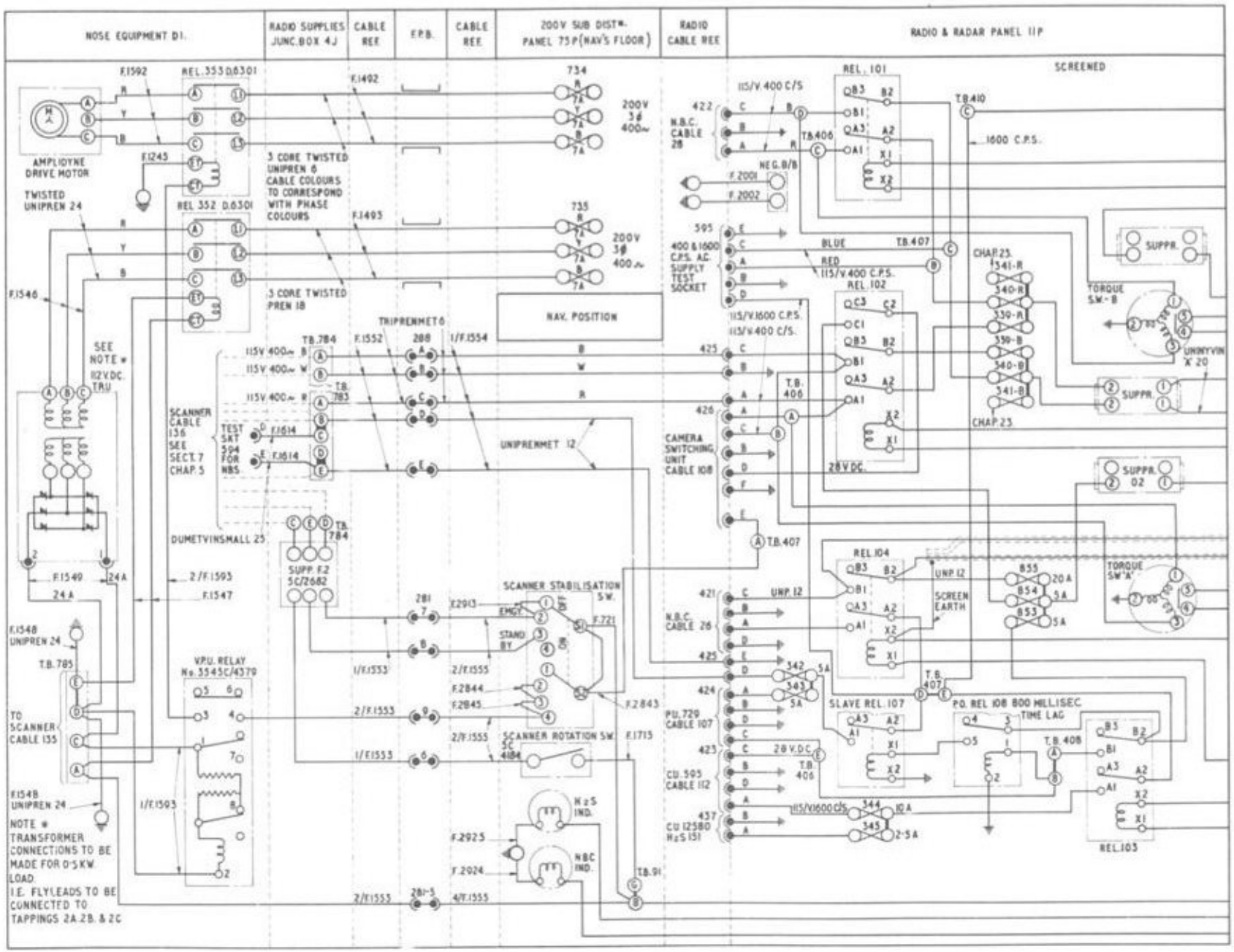


Fig. 5 (1). Screened radio supplies – Pre Mod. 748.

◂ Srim 3697 added ▸

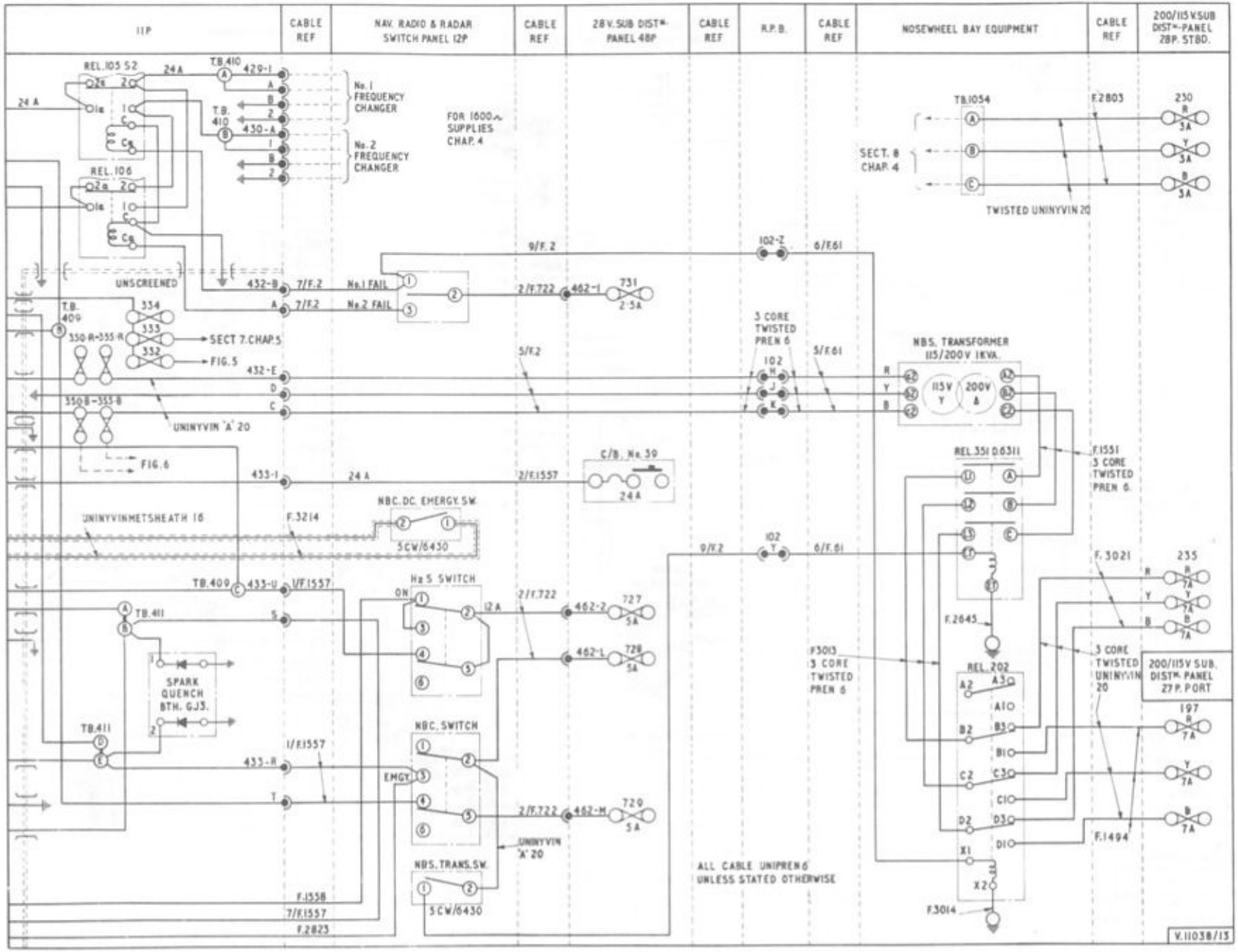


Fig. 5 (2). Screened radio supplies – Pre Mod. 748.

◂ Srim 3697 added ▸

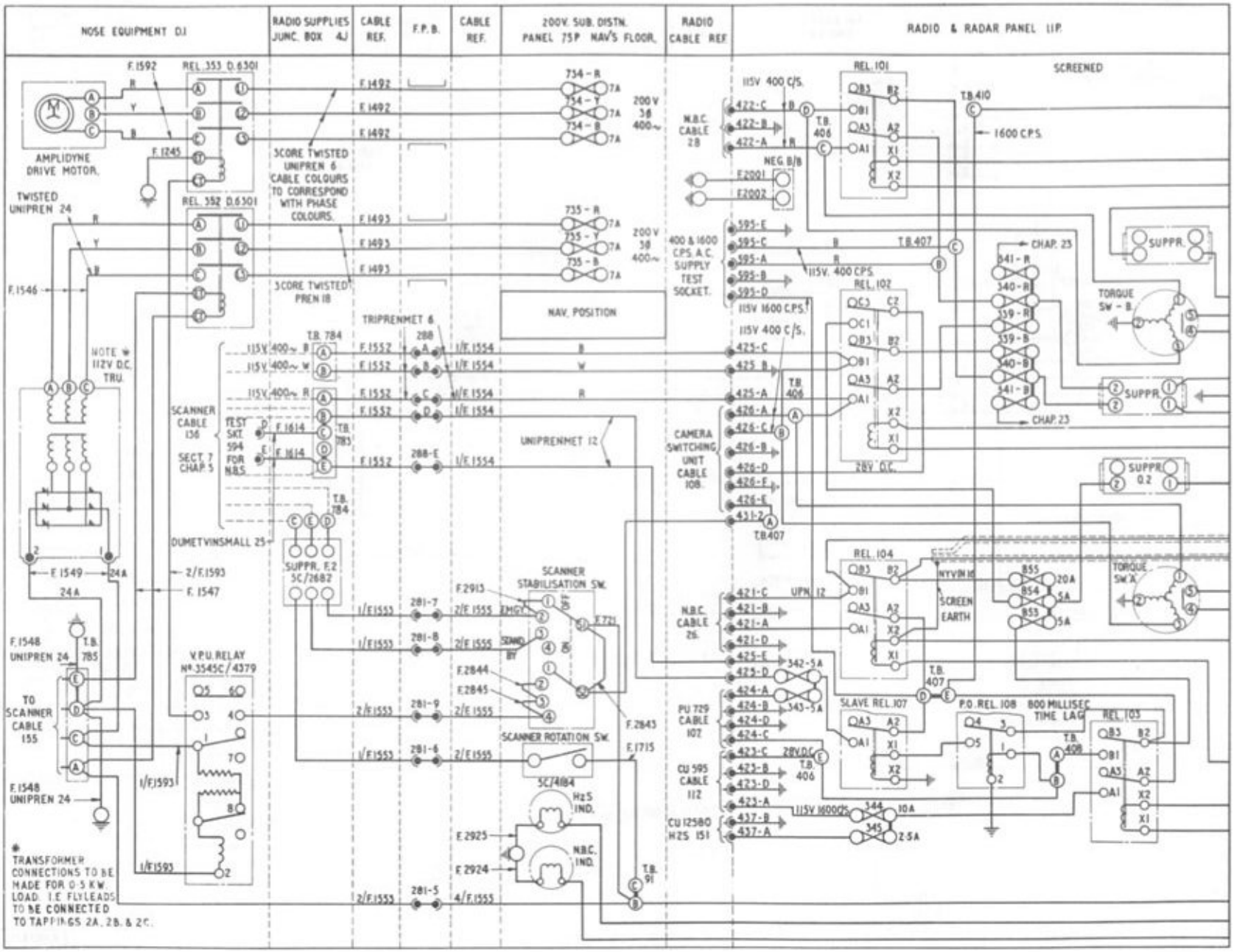


Fig. 6 (1). Screened radio supplies – Post Mod. 748.

◂ *Cross references changed.* ▸

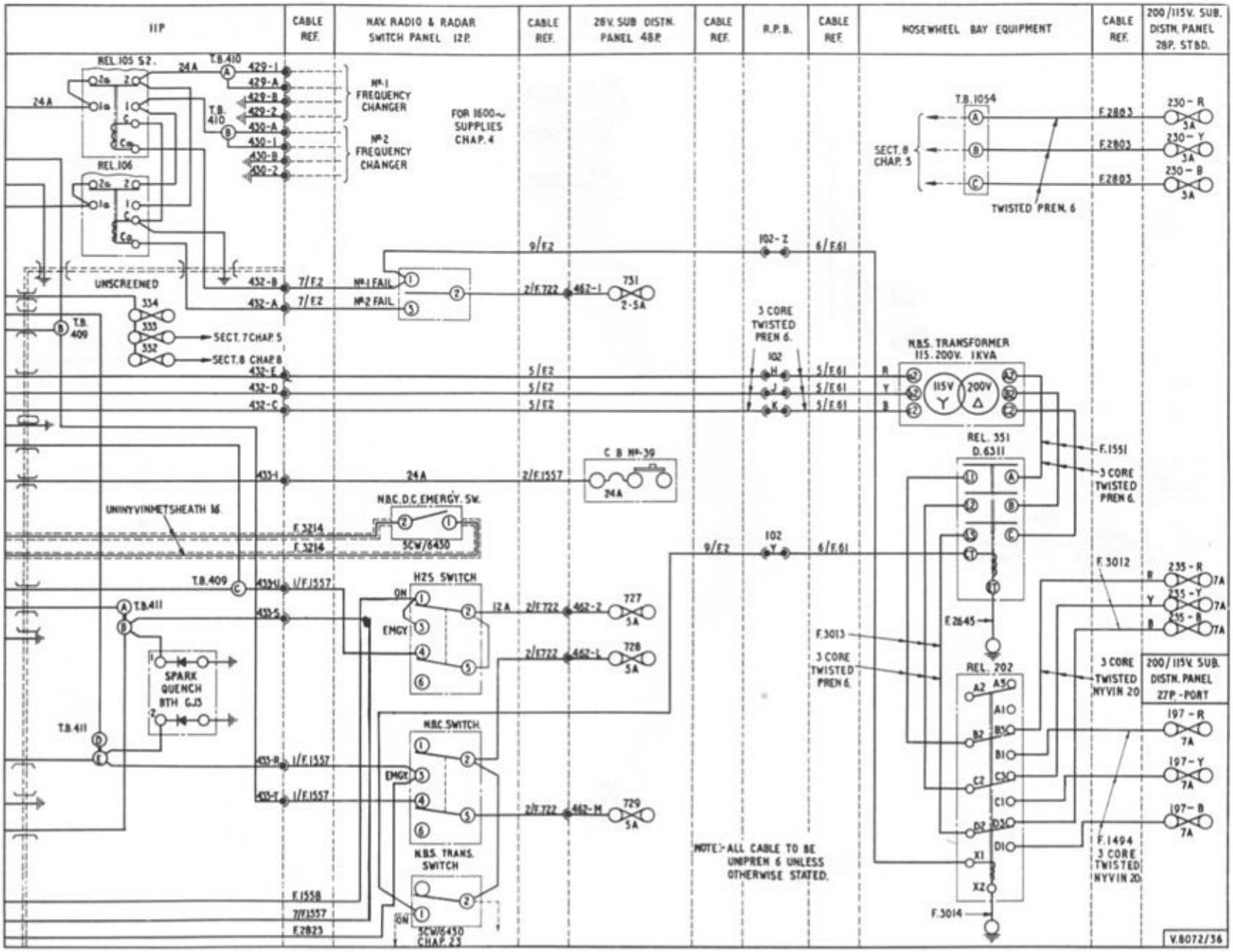


Fig. 6 (2). Screened radio supplies – Post Mod. 748.

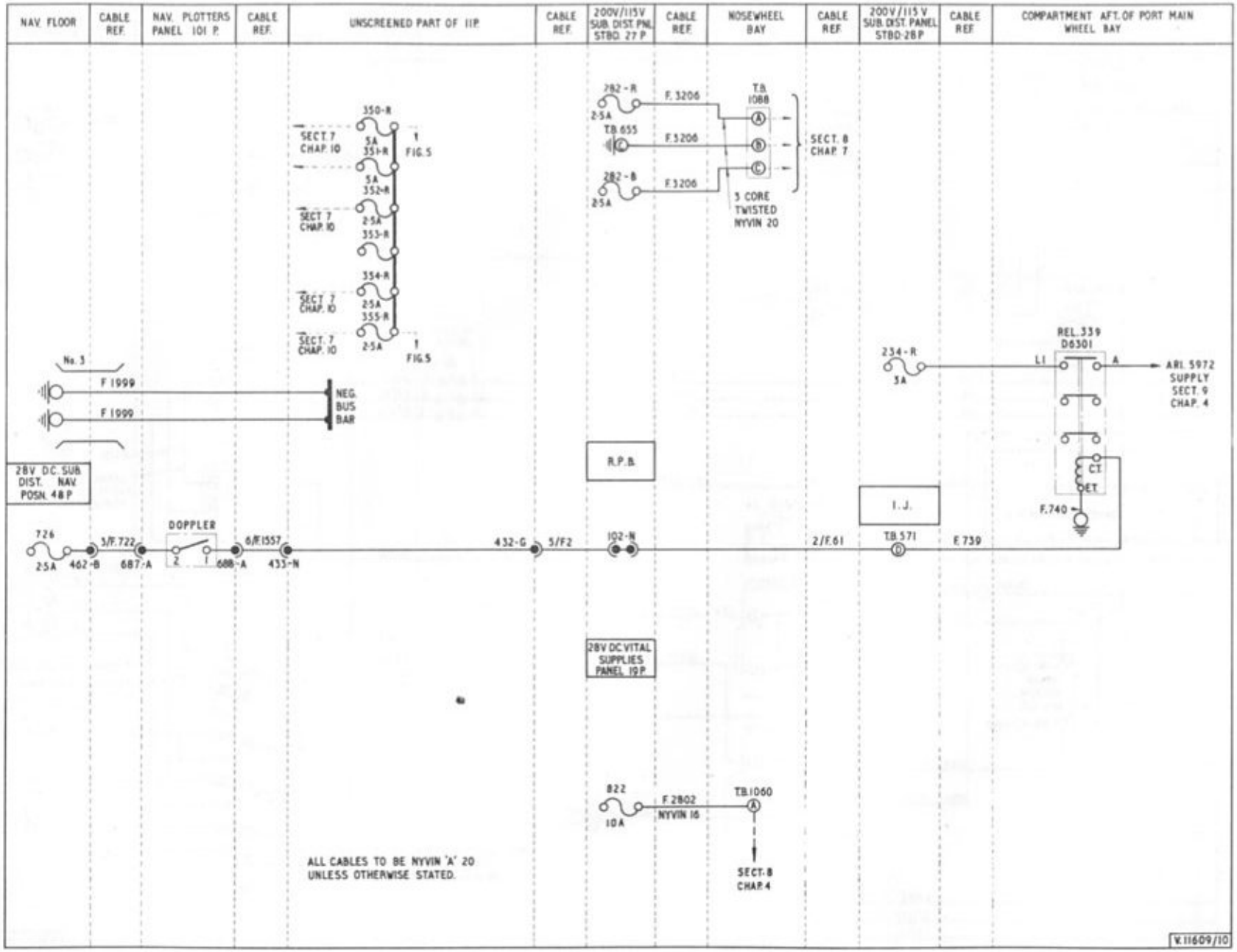


Fig. 7 Unscreened radio supplies – pre Mod. 748

◄ *Relay 399 changed to 339* ►

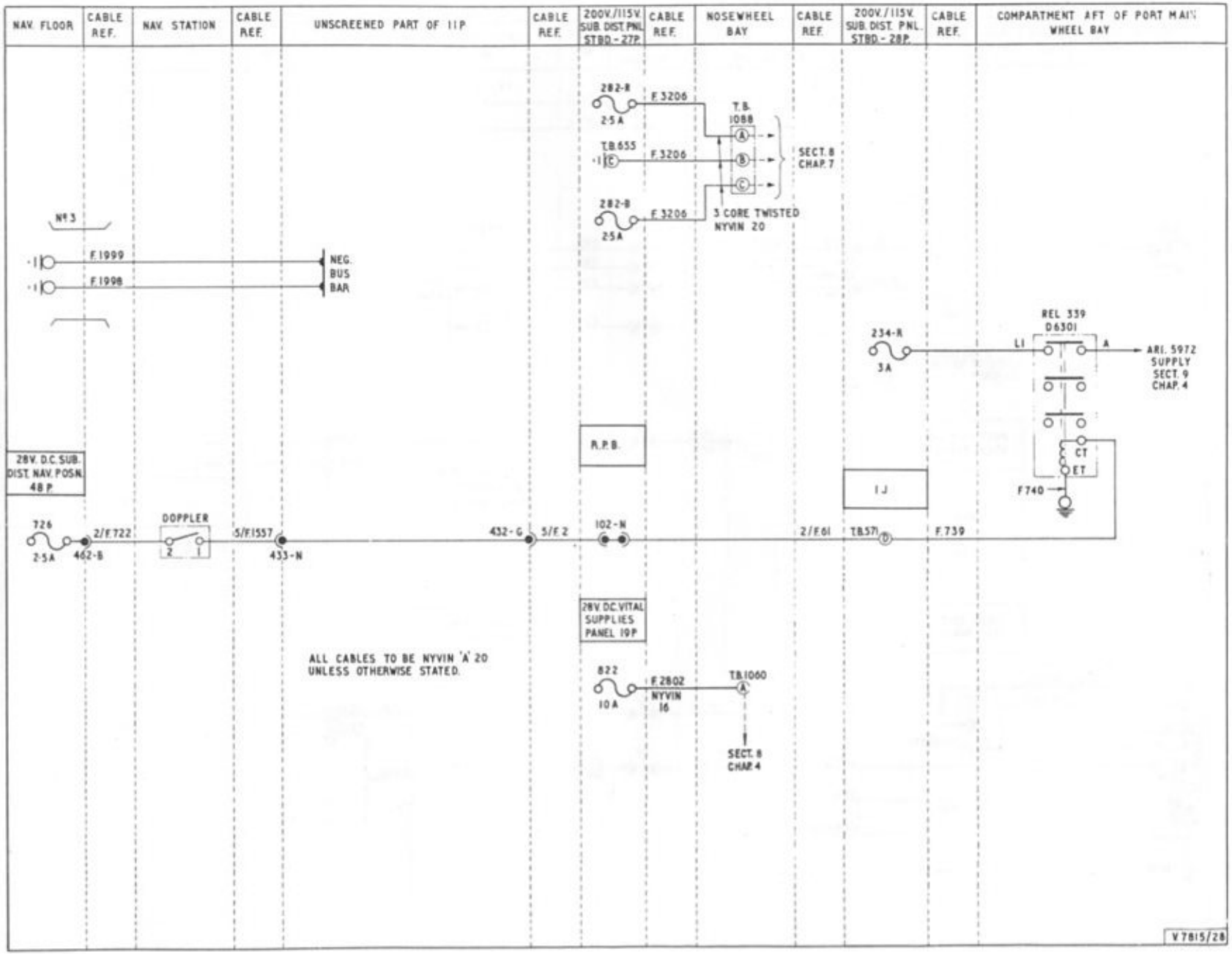


Fig. 8 Unscreened radio supplies - (Post Mod. 748)

◀ *Green satin deleted by Mod 2256* ▶

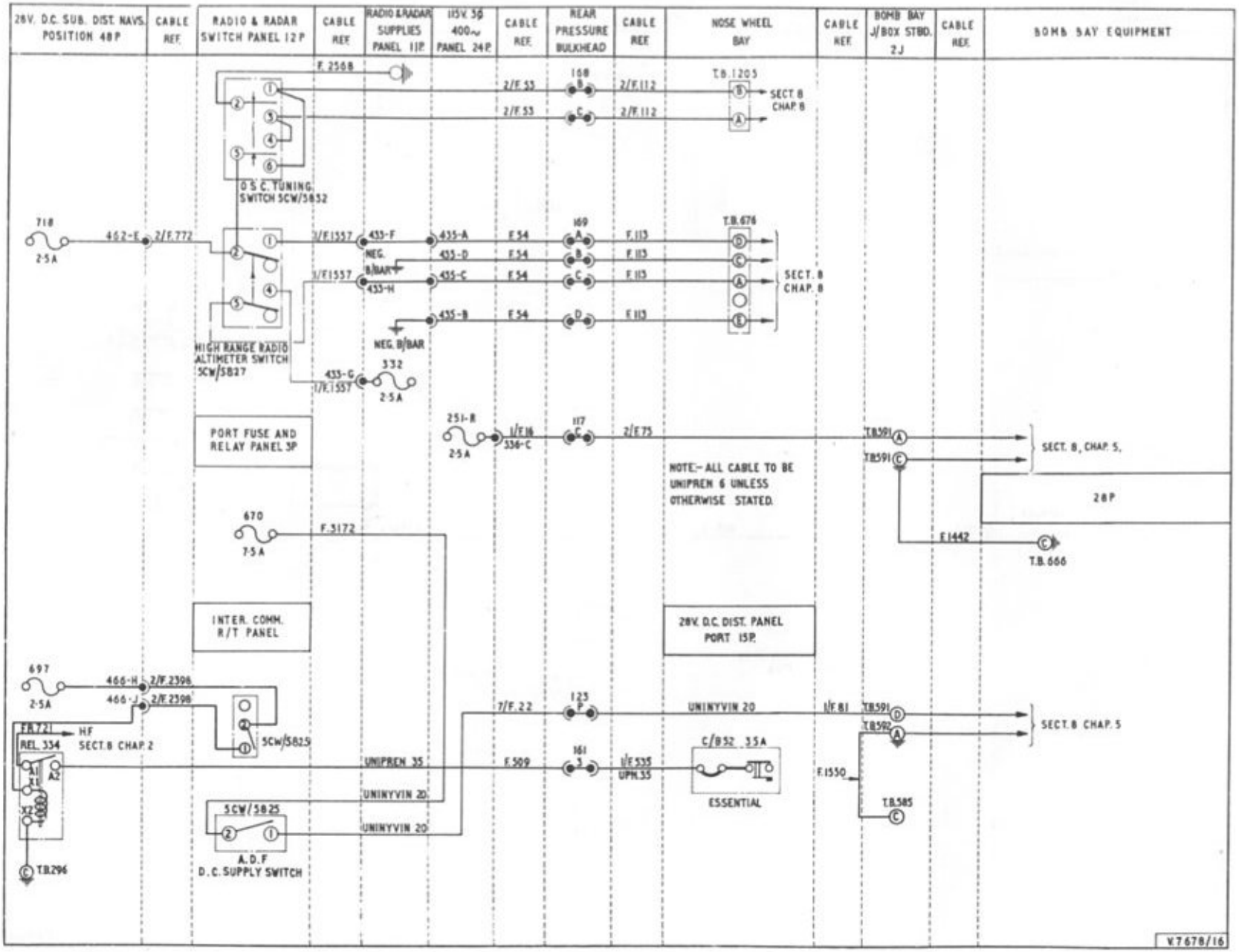


Fig.9 Supplies for ARI's 18090, 5874 and 23023

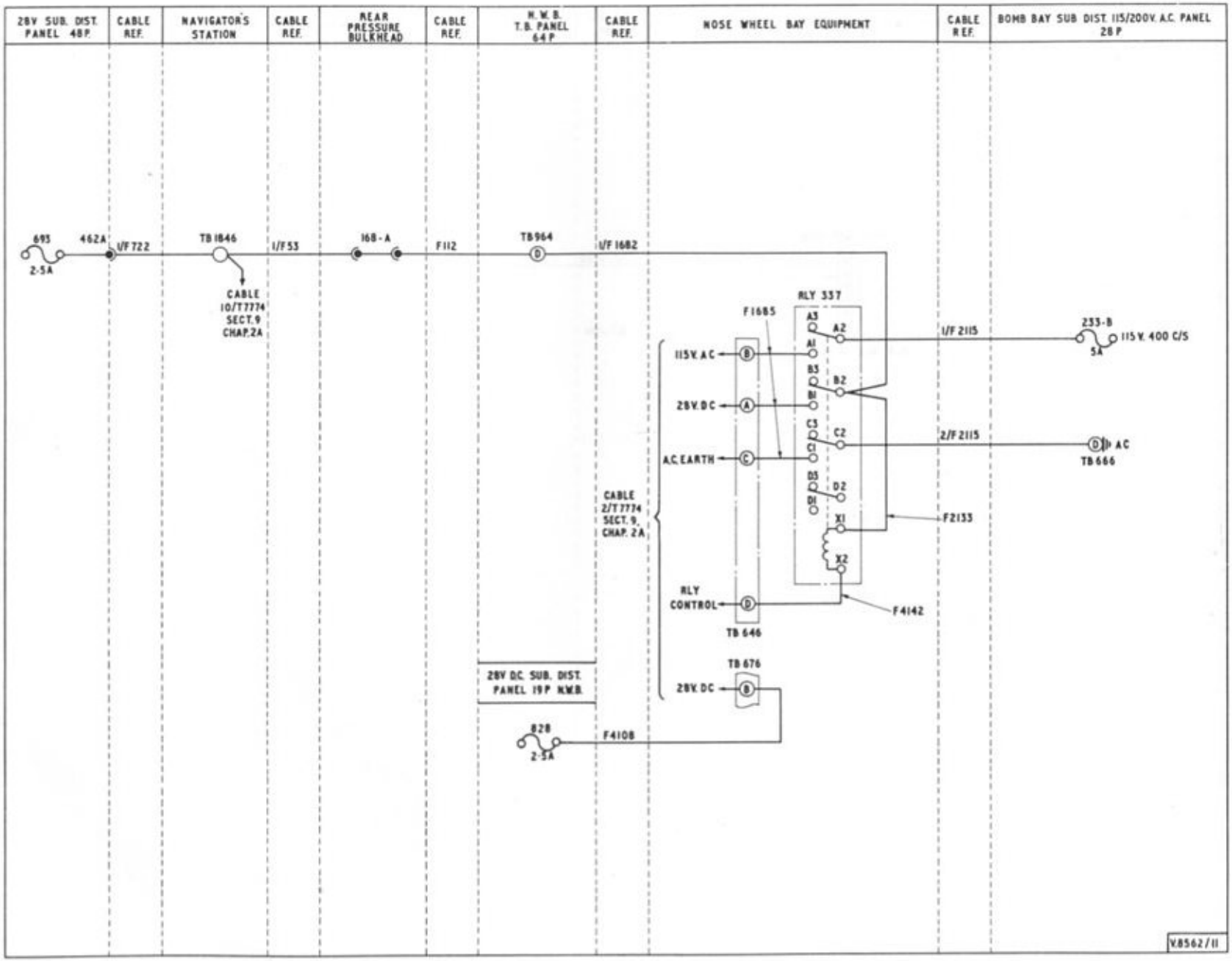


Fig. 10 Supplies for ARI. 23134/5/4

◄ Cross reference added for cable 10/T7774 ►

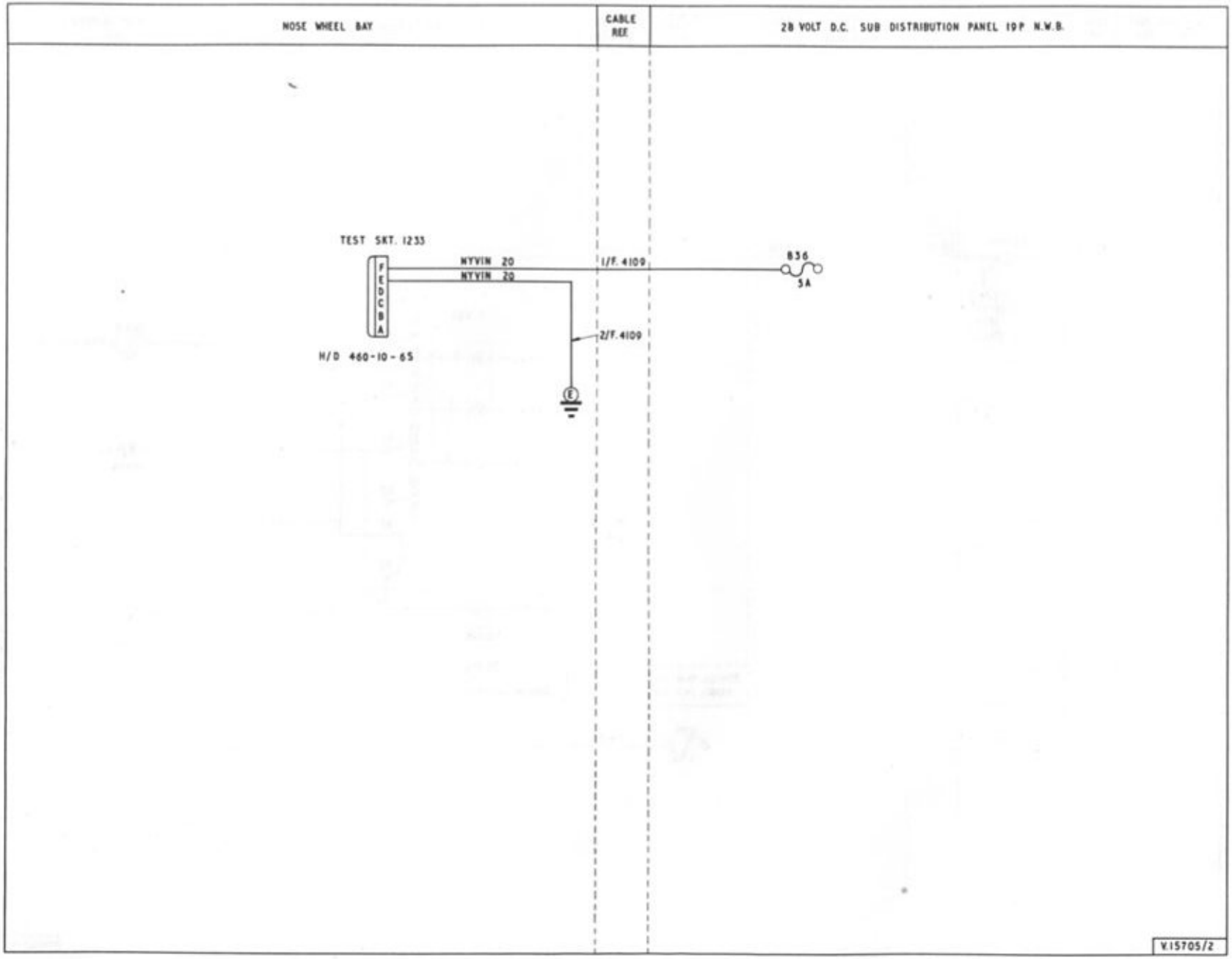


Fig.11 ARI. 23134/5/4 test socket

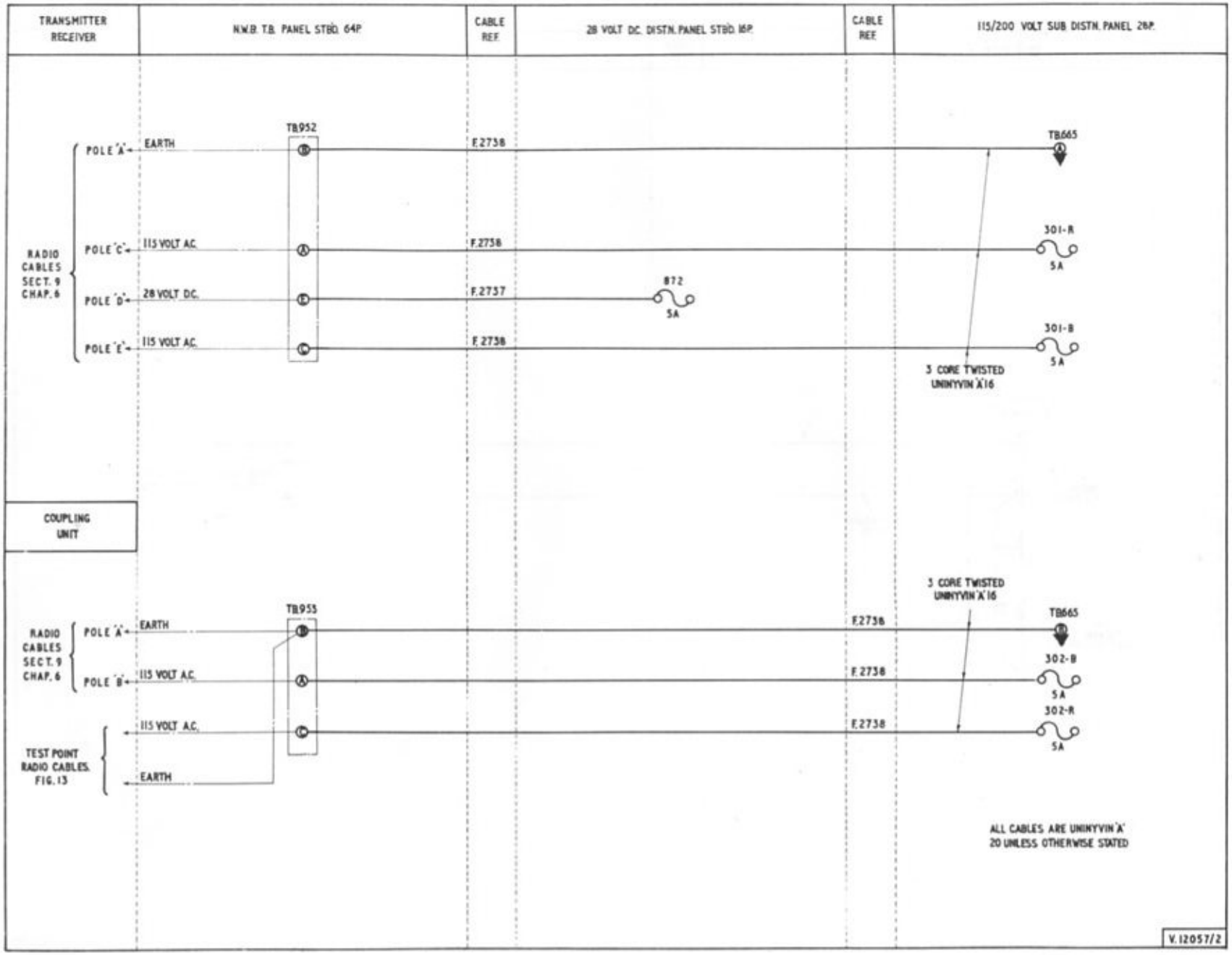
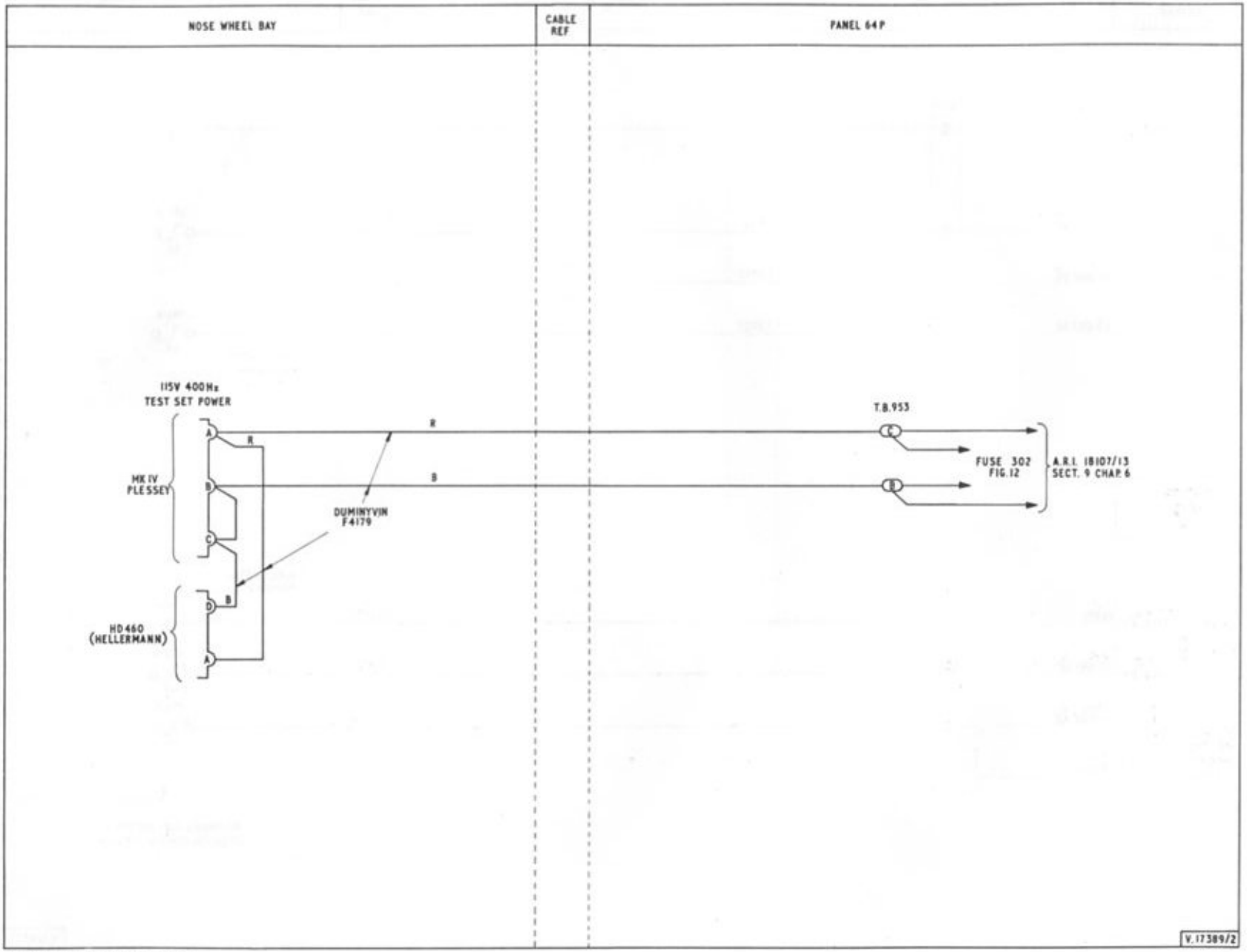


Fig. 12 Supplies for ARI. 18107/13

◄ Cross references added for radio cables ►



176675, 570, 2,75 H.S.A. 1354

Fig. 13 115-volt test set supplies

◀ *Issued by Mod. 2292* ▶