Chapter 5

ARMAMENT INSTRUMENTS

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

LIST OF APPENDICES

◀

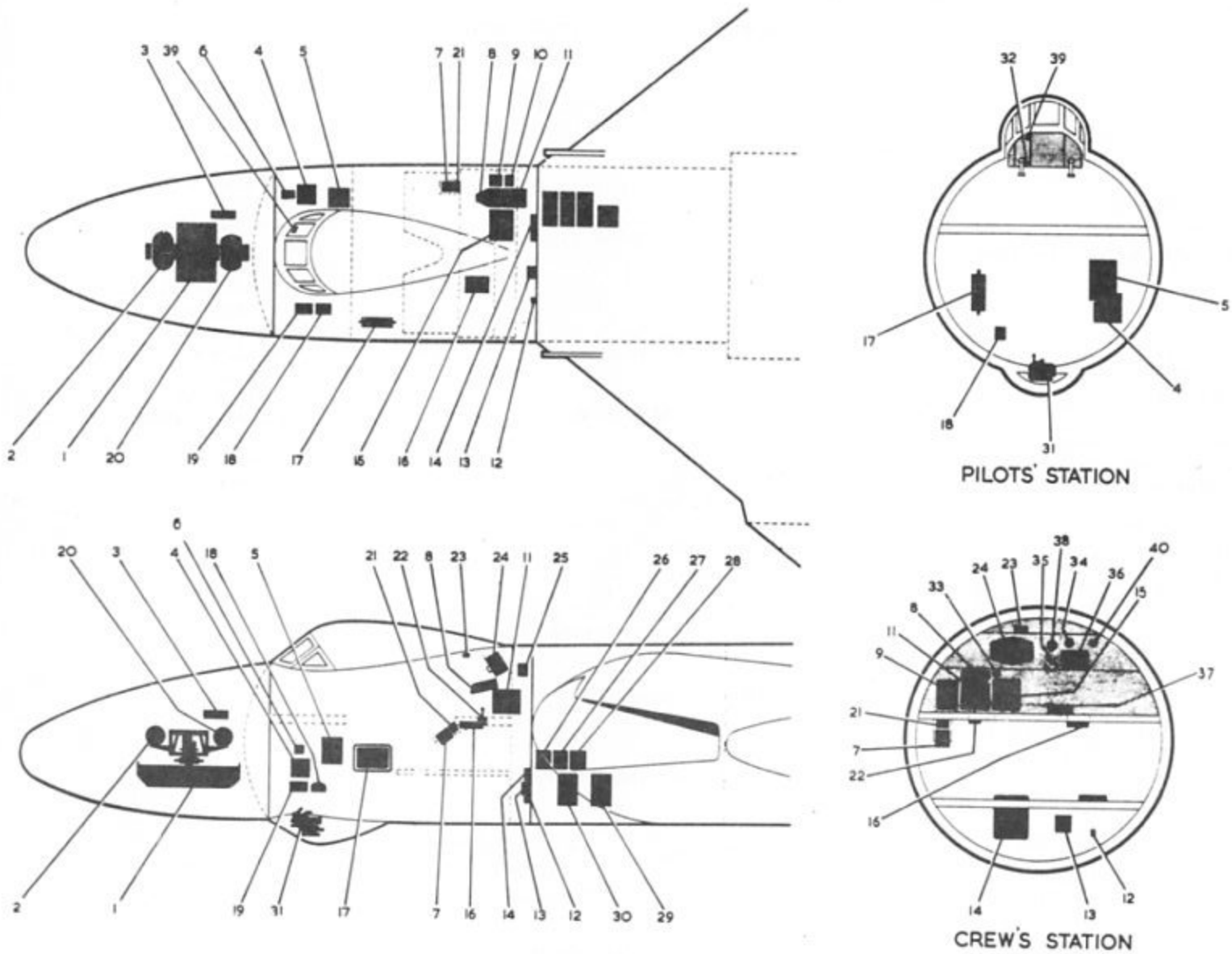


Fig.1 Location of armament instruments

KEY TO FIG.1

Location of armament instruments

1. SCANNER UNIT TYPE 121
2. AMPLIFIER A3703
3. AMPLIDYNE A3XX1
4. CALCULATOR, TYPE 2, MK.2
5. CALCULATOR, TYPE 3, MK.1
6. GROUND SPEED RESOLVER
7. CONTROL UNIT, TYPE 12580
8. CAMERA TYPE R88
9. CONTROL UNIT, TYPE 595
10. CONTROL UNIT (CAMERA) TYPE 903
11. INDICATING UNIT, TYPE 301C
12. SUPPRESSOR, TYPE G5
13. RESISTANCE UNIT MK.1
14. JUNCTION BOX, TYPE 343
15. CONTROL UNIT, TYPE 585C
16. CONTROL UNIT, TYPE 12558
17. T.4 BOMBSIGHT COMPUTOR
18. T.4 BOMBSIGHT SIGHTING HEAD CONTROL PANEL
19. T.4 BOMBSIGHT GYRO CONTROL

(Inoperative Post Mod. 2256 and 2377)

20. MODULATOR, TYPE 2
20. MODULATOR, TYPE 2
21. BOMBING SELECTOR SWITCH
22. CONTROL UNIT, TYPE 626
23. VARIABLE AIRSPEED UNIT, MK.3
24. NAVIGATIONAL PANEL, MK.1B
25. WIND UNIT, MK.2
26. POWER UNIT, TYPE 729
27. CALCULATOR AUTOMATIC 5A
28. WAVEFORM GENERATOR, TYPE 68C
29. CALCULATOR, TYPE 1, MK.1
30. POWER UNIT, MK.2
31. T.4 BOMBSIGHT SIGHTING HEAD *(Inoperative Post Mod.2256 and 2377)*
32. BOMBING INDICATOR, MK.1
33. WIND INDICATOR
34. FORWARD THROW INDICATOR
35. STEERING SIGNAL TEST J.B.
36. TRACK CONTROL UNIT
37. G.P.I. MK.6
38. COMPASS REPEATER, TYPE B
39. S.F.O.M. GUNSIGHT TYPE 812 A ▶
40. PILOTS' DIRECTIONAL INDICATOR ◀

Introduction

1. The instruments described in this chapter are those which form the Navigation and Bombing System (N.B.S.) Mk.1A. Information on the servicing and removal of these instruments is also provided.

2. Brief details of the a.c. and d.c. power supplies to the installations are given in this chapter but for more detailed information reference should be made to Sect.6, Chap.7 of this publication.

3. Fig.1 shows the location of the various units which comprise the installation, whilst the two tables (Table 1 and Table 2) give a complete list of the N.B.S. equipment, its location, and the necessary Type and Reference numbers. Further details concerning the individual units that make up the N.B.S. mentioned in this chapter, may be found in A.P.114E-1001-1A and 1C.

4. Although the N.B.S. functions as a complete system it has been found convenient in some instances to treat the radar service and the computing instruments as separate installations. By so doing it is hoped to avoid confusion when dealing with power supplies and removal instructions.

5. The following modifications are included in this chapter:-

Mod.812 Removal of cooling air supply to amplidyne unit A3XX1.

Mod. 972	Introduction of N.B.C. D.C. EMERGENCY switch.
Mod.1010	Introduction of control unit, Type 12558 and modification of control unit, Type 585.
Mod.1031	Removal of time-of-fall calculator, Mk.2A.
Mod.1078	Electrical changes for satisfactory functioning of store (Blue Steel aircraft only).
Mod.1188	N.B.S. bombing indicator connector terminations corrected.
Mod.1431	Introduction of bombing selector switch guard.
Mod.1720	Completion of N.B.S. wiring after H.R.S. junction box deleted by Mod.1719.
Mod.1851	Introduction of navigator's compass repeater Type B (S.O.O. Free Fall aircraft).
Mod.1852	Introduction of navigator's compass repeater, Type C (S.O.O. Blue Steel aircraft).
Mod.1888	N.B.S. connector changes when A.R.I.23172 introduced.
Mod.1908	Introduction of Heading Reference System Mk.2.
Mod.2034	Conversion of N.B.S. junction box 343 from Mk.2 to Mk.4 to provide a heading reference to N.B.S. calculator (Free Fall aircraft).
Mod.2256	Introduction of A.R.I.5972 in lieu of A.R.I.5951.

NOTE . . .
With Mod.2256 incorporated the T.4 bombsight system is inoperative.

▶ Mod.2363	Introduction of S.F.O.M. gunsight, Type 812A, in lieu of the second pilot's low level bombsight screen. ◀
Mod.2377	To increase the capacity of the cabin pneumatic system by isolating the air supply to the T.4. bombsight computor.
▶ Mod.2439	Introduction of pilots' directional indicator at the navigator (radar) station.
Mod.2473	To reposition the pilots' direction indicator. ◀

DESCRIPTION AND OPERATION

N.B.S. MK.1A

6. The N.B.S. Mk.1A comprises a Navigation and Bombing Computor (N.B.C.) Mk.2A and a search radar H.2.S. Mk.9B and is designed for use in medium and long range aircraft, operating beyond the range of ground based aids.

7. The system can be operated to produce steering signals for the aircraft, the response to which may be manual or automatic. In the latter case the N.B.S. is linked with the autopilot Mk.10A or 10B.

8. The N.B.S. is used in conjunction with the Heading Reference System (H.R.S.) described in Chap.10. Interconnection to the H.R.S. is made via the junction box previously used for blue steel (Post Mod.748), the ground speed resolver and the G.P.I. Mk.6.

Air cooling

9. To prevent loss of efficiency, due to overheating when in use, the units in the system are provided with a supply of cool air. The amplidyne unit and the H.2.S. scanner unit in the radome are supplied with cooling air from the cabin air conditioning system. The air is fed via a combined valve assembly mounted close to the pressure dome in the nose. Note that when Mod.812 is embodied the air supply to the amplidyne unit is removed. The air conditioning system is described in A.P.101B-1902-1B, Cover 1, Sect.6, Chap.12 and A.P.101B-1902-1A, Cover 2, Sect.3, Chap.8.

10. Those units installed on the starboard side of the nose wheel bay are cooled by air ducted from the starboard air intake. The ducting is arranged so that the cool air will flow up and around each unit. The N.B.S. power unit and calculator have special muffs fitted to further assist in distribution of air past the units.

Pressurization

11. The H.2.S. scanner system is supplied with air (nitrogen post Mod.2193) at a controlled pressure of 15 lb/in^2. The air (nitrogen) is supplied from a storage cylinder located in the nose of the aircraft on the port side. The cylinder is charged at 1 800 lb/in^2 which is subsequently reduced by valves and regulators to the required pressure. Two gauges are provided in the system, one at the charging

point in the nose, the other on the nav. bomber's panel. Both gauges are described in Chapter 4.

12. The various units fitted at the starboard side of the nose wheel bay are similarly pressurized from a second storage bottle adjacent to the scanner air bottle. Pressure in these units is maintined at 2.5 p.s.i. by a differential pressure regulator. Two pressure gauges are provided, one at the charging point the other on the nav. bomber's panel. Both gauges are described in Chapter 4.

13. Two switches adjacent to the gauges on the nav. bomber's panel control the pressurization of the units by means of electro-magnetic taps fitted in the pressure lines The complete pressurization system is dealt with in A.P.101B-1902-1B, Cover 1, Sect.6, Chapter 12.

Navigation computing

14. Before the navigation computor can operate certain inputs from associated equipment are required. Inputs representing true air speed are fed to the system from the True Airspeed Unit (T.A.U.) together with heading information from the compass system of the Military Flight System (M.F.S.) This information together with N/S and E/W components of wind velocity, which can be set in manually or semi-manually is sufficient to enable the computor to function and display the aircraft's track and ground speed The aircraft's ground displacement (N/S and E/W) from a starting point can also be calculated from the N/S and E/W components of ground velocity. Position numerators record the present position in terms of latitude and longitude.

15. Magnetic variation information is provided by the navigation computor for transmission to the compass system of the MFS via the Track Control Unit. Provision is also made for the comparison of N/S and E/W components of ground speed with the ground speed components from the G.P.I. These components are produced from the ground speed measured by A.R.I.5972 and are instantaneously more accurate than those provided by the navigation computing of the N.B.S.

Ballistic computing

16. Ballistic information relevant to the type of bomb carried is contained in a short piece of 35 mm. film. Information from the film is fed into the Calculator Type 3, Mk.1, which is connected to the static line of the starboard pitot-static system. The equipment then operates to calculate the required track to the release point Steering signals are fed to the M.F.S. via the bombing system selector switch and the M.F.S. selector switch. These signals are then displayed on the azimuth directors and can be interlocked with the Mk.10A or 10B autopilot through the Computor Unit (Navigational) of the M.F.S. Signals to open the bomb doors and release the bomb are also provided.

17 Mounted immediately above the indicating unit, Type 301 is a camera which photographs the P.P.I at intervals of 8 seconds throughout the bombing run. The film is marked automatically at the moment of bomb release and will continue to photograph the P.P.I. until completion of the bombing run.

Power supplies

18. A brief description of the a.c. and d.c. supplies to the N.B.S. system is given in the following text. For more detailed information and equipment locations, refer to A.P.101B-1902-1B, Cover 1, Sect.6, Chap.7.

19. The N.B.S. units requiring a.c. supplies are fed from the screened side of distribution panel 11P (fig.3(2), fig.4(2)). The a.c. supplies for the N.B.S. units are fed to panel 11P from either the No.1 or the No.2 frequency changer, and the N.B.S. transformer.

20. 28-volt d.c. is supplied from the main 28-volt system and 112-volt d.c. is supplied from a transformer rectifier unit (T.R.U.) in the nose of the aircraft.

N.B.C. Mk.2A power supplies

21 Power for the N.B.C. equipment is supplied from plugs 421 and 422 on panel 11P as follows:-

Plug 421 — 115-volt, 1600 Hz, single-phase a.c. and 28-volt d.c. to the junction box, Type 343.

Plug 422 : 115-volt, 400 Hz, three-phase a.c. to the junction box, Type 343.

22 The junction box, Type 343 (Mk.2 - Blue Steel aircraft, Mk.4 - Free Fall aircraft) is mounted in the cabin on the rear pressure bulkhead and is the main junction box for the N.B.C equipment

23 The No.1 frequency changer is controlled by two switches on panel 12P at the radar navigator's position. With the No.1 frequency changer running, a 115-volt, 1600 Hz, single-phase supply is available for

distribution to the equipment. If No.1 frequency changer fails, provision is made for switching the load to the No.2 frequency changer. Both frequency changers are mounted in the nosewheel bay. For further details, refer to A.P.101B-1902-1B, Cover 1, Sect.6, Chap.4.

24. The N.B.S. transformer provides a 115-volt, 400 Hz three phase a.c. supply when the N.B.S. transformer switch is set to ON. If the input supply to the transformer fails, provision is made for switching to an alternative source of supply. For details of the changeover circuit and equipment locations, refer to A.P.101B-1902-1B, Cover 1, Sect.6, Chap.7.

H.2.S. Mk.9B power supplies

25. Except for the 200-volt, 400Hz three phase supplies to the amplidyne unit and the 112-volt d.c. T.R.U. in the nose, all supplies to the H.2.S. equipment are fed from panel 11P. The H.2.S. connectors pick up the supplies directly from the aircraft systems either via plugs 423, 424, 426 and 437 or terminal blocks T.B.783, 784 in junction box 4J (radio supplies panel). T.B.785 in junction box 4J carries 28-volt and 112-volt d.c. supplies to the scanner. The various supplies are as follows:-

Panel 11P	plug 423	115-volt, 1600 Hz, single-phase a.c. and 28-volt d.c. to control unit, Type 595.
	plug 424	115-volt, 1600 Hz, single-phase a.c. and 28-volt d.c. to power unit, Type 729.
	plug 426	115-volt, 400 Hz, three-phase a.c. and 28-volt d.c. to control unit (camera), Type 903
	plug 437	115-volt 1600 Hz single-phase a.c. to control unit, Type 12580
J.B.4J	T.B.783	115-volt, 400 Hz, single-phase a.c. and 115-volt, 1600 Hz, single-phase a.c. to scanner.
	T.B.784	115-volt, 400 Hz, single-phase a.c. and 28-volt d.c. to scanner.
	T.B.785	112-volt d.c. and 28-volt d.c. to scanner.
Panel 75P		200-volt, 400 Hz, three phase a.c. to amplidyne motor.

26. Supplies to 11P are from the No.1 (or No.2) frequency changer and the N.B.S. transformer as described in para.20 and 21. Supplies are fed to the equipment when the H.2.S. switch is set to ON and the scanner stabilization switch is at any position other than OFF. With the switches in the positions stated, 200-volt a.c. supplies will be fed to the transformer-rectifier and the amplidyne motor, both in the nose of the aircraft. The transformer-rectifier will then produce a 112-volt d.c. output for use at the scanner, via T.B.785 in J.B.4J. A full description of the supplies, including normal and emergency operation, will be found in Sect.6, Chap.7 of A.P.101B-1902-1B, Cover 1.

Control switches and indicators

27. Supplies to the N.B.S. are controlled by four switches. Two of these, the N.B.C. switch and the H.2.S. switch, are double-pole, centre off, two-way switches which are selected up for ON and down for EMERGENCY. The switches are mounted side by side on panel 12P at the radar navigator's position.

28. The two other switches (scanner rotation and scanner stabilization) are mounted on the radar panel. The scanner rotation switch is a single-pole ON-OFF switch whilst the scanner stabilization switch is a 2 gang, rotary, four position switch. The four switch positions are OFF - EMERGENCY - STANDBY - ON.

29. Mounted immediately above the scanner rotation and stabilization switches are two magnetic indicators, one for the N.B.C. and the other for H.2.S. With the control switches in the OFF position the indicators present a white indication. When the equipment is operating the indicators are energized to show black. Two indicator lamps and a switch marked N.B.C. BOMB GEAR ISOLATION are mounted on the bombing panel 9P at the starboard side of the crew's cabin. The function and purpose of this switch will be found in A.P.101B-1902-1B, Cover 2, Sect.6, Chap.19, together with a routing chart for the circuit. For further details of the supplies and control of the N.B.S. system, reference should be made to A.P.101B-1902-1B, Cover 1, Sect.6, Chap.7.

Mod.748

30. With the introduction of Mod.748 the scanner rotation and stabilization switches are moved to the lower corner of the radar panel, port side. The two magnetic indicators, labelled N.B.C. and H.2.S. are now fitted at the bottom edge of the radar panel, between the indicating unit, Type 301C, and the navigation panel Mk.1B.

Mod.972 and Mod.1431

31. An additional switch is introduced into the system when Mod.972 is embodied. This switch, labelled N.B.C. D.C. EMERGENCY, is mounted on panel 12P and enables the d.c. supply to the N.B.C. to be switched on, independent of the a.c. supply. The switch is for emergency use only and circuit details will be found in A.P.101B-1902-1B, Cover 1, Sect.6, Chap.7. Mod.1431 introduces a guard over the Bombing Selector switch to prevent inadvertent operation.

Test sockets

32. Two Mk.4 test sockets are provided for checking the various supplies to the N.B.S. equipment. The first of these (595) is mounted on the starboard side of 11P, the other (594) is mounted in the nose section. Instructions for using both sockets will be found in para.48.

T.4 BOMBSIGHT

NOTE . . .
The T.4 bombsight system is inoperative Post Mod.2256 and dummy fuses fitted.

33. The T.4 bombsight, mounted centrally on the aircraft floor at the air bomber's prone position, is a visual impact bombsight which is designed to compute and indicate continously (at the instant of bomb release) the point on the ground which will be struck by the bomb.

34. The sight is designed to utilize the accurate ground speed and drift angle supplied by an aircraft's Doppler equipment. When A.R.I.5972 is fitted in lieu of A.R.I.5951 (Mod.2256), however, there is no supply of ground speed and drift angle information to the bombsight (fig.6).

35. The complete installation comprises the following items:-

(1) Computor.

(2) Sighting head.

(3) Amplifier.

(4) Gyro control unit.

(5) Sighting head control panel.

(6) Flexible drives and gear boxes.

(7) Mounting bracket for sighting head.

36. All the above items are located at the prone air bomber's position as shown in fig.1. A brief description of the function of each of these items is provied in the following paragraphs. For more complete details reference should be made to A.P.1275D, Vol.1, Sect.7.

Computor

37. The basic function of the computor unit is to calculate, in terms of sighting angle and drift angle, the various continuously fed inputs of height, airspeed, drift and ground speed, and to transmit these settings to the sighting head. A drift smoothing cut-out switch is mounted on the bomb aimers azimuth control panel.

Amplifier

38. The amplifier provides amplification for signals from the drift and ground speed synchro motors. The amplified signal is then fed to the servo motors to cause follow-up in their respective mechanisms.

Gyro control unit

39. This unit controls the electrical supplies to the Mk.8 gyro unit in the sighting head and the Mk.9 gyro unit in the computor unit.

Sighting head control panel

40. The sighting head panel controls the electrical supplies to the collimator lamp and the drift scale light in the sighting head.

Sighting head

41. The T.4 sighting head enables the air bomber to see a graticule in the form of a sword-shaped cross moving over the ground. Any point on the ground covered by the intersection of the cross represents the point of impact of a bomb released at that instant. In flight the apparent ground position of the graticule image is controlled by the computor through the rotation of two flexible shafts.

Power supplies

42. The following power supplies are

provided to operate the sight:

115-volt, 1600 Hz, single-phase a.c. from fuse 333 (11P) to the amplifier.

115-volt, 400 Hz, three-phase a.c. from fuse 250R and 250B (24P) to the gyro control unit.

28-volt d.c. from fuse 666 (3P) to the computor.

28-volt d.c. from fuse 667 (3P) to cockpit lamp.

28-volt d.c. from fuse 668 (3P) to the gyro control unit.

28-volt d.c. from fuse 669 (3P) to the sighting head control panel.

A routing chart showing the above supplies is provided in fig.6. Internal circuits of the components and their circuit operation will be found in A.P.1275D, Vol.1, Sect.7.

Air supply

NOTE . . .

With Mod.2377 incorporated the air supply is isolated from the T.4 bombsight computor rendering the computor inoperative.

43. The bombsight computor is fed with dry air at a pressure of 60 p.s.i. from an air storage bottle fitted at the starboard side of the aircraft, adjacent to the bombsight. The air is used for various purposes within the computor as explained in A.P.1275D, Vol.1, Sect.7. Details of the air bottle and its associated valves and gauges will be found in A.P.101B-1902-1A, Cover 2, Sect.3, Chap.7.

N.B.S. MK.1A

General

47. All N.B.S. items of equipment should be checked for security of mounting and tightness of plug and socket connections. Before removing any item of equipment suspected of being defective, checks should be made for continuity and insulation on the associated cable assemblies. Complete instructions for servicing the system in the aircraft will be found in A.P.114E-1001-1.

TRUE AIRSPEED UNIT

44. A True Airspeed Unit (T.A.U.) Ref. No. 6B/3013, is mounted below the starboard air intake. The unit is controlled by a control panel, Ref.No. 6B/3014, mounted on the radar panel, and provides inputs to an air mileage indicator and the variable airspeed unit. An air temperature bulb, Ref.No. 6B/3125, works in conjunction with the T.A.U. and is mounted on the starboard underside of the aircraft at former 189-5.

45. The control panel is fed with a 115-volt, 400 Hz, three-phase a.c. supply from fuses 248R and B in panel 24P. A 28-volt d.c. supply is fed to the control panel from fuse 725 in panel 48P. Pitot and static supplies are fed to the unit from the starboard pitot-static system. A detailed description of the T.A.U. and its associated equipment will be found in A.P.1275B, Vol.1, Sect.16, Chap.15.

AIRSPEED PRESSURE SWITCH

46. Mounted at the starboard side of the bomb bay just aft of the front spar is a Type TP.5099 airspeed pressure switch. This switch, which is operated by the starboard pitot-static system, forms part of the release circuit for a special store and is designed so that the switch contacts will close when the speed of the aircraft exceeds 150 knots. A description of the switch will be found in A.P.1275A, Vol.1, Sect.24, Sub-sect.A, Chap.2.

S.F.O.M. Gunsight

▶ 46A. The S.F.O.M. gunsight is mounted on the starboard side of the cockpit coaming. The gunsight is a collimated fixed-angle sighting head and is used as a low level bombsight. The sight line of the gunsight is fixed relative to the aircraft, however, the depression angle can be adjusted to allow for a range of speeds, A.U.W., height and relative air density. There are two scales on the sighting head, one calibrated in degrees and the other in milliradians. An optical lens, normally stored in its container on the starboard console, must be fitted to the sighting head prior to use.

CAUTION . . .
Care must be taken to avoid scratching the optical lens during handling.

46B. A28V d.c. supply is fed to the S.F.O.M. gunsight and also to a pillar lamp, which illuminates the scales on the sighting head, supply is fed from fuse 1314 in panel 4P through a dimmer switch located at the forward end of the stbd. cockpit rail. ◀

SERVICING

NOTE . . .

Before carrying out ground tests provision must be made for cooling the scanner unit equipment. An external cooling rig is available for this purpose and is described in A.P.101B-1902-1A, Cover 2, Sect.3, Chap.8.

Power supplies

48. The 115-volt, 400 Hz, three-phase output from the N.B.S. transformer can be checked at test socket 595 on the starboard side of 11P. The transformer output is connected to pins A, B and C of the socket, via fuses 340-R and B and the earthed yellow phase. At pins D and E of the same plug the 1600 Hz output from the No.1 frequency changer can be tested.

49. Test socket 594 in the nose section enables the 115-volt, 1600 Hz a.c. supply to equipment in the nose to be tested. The supply is fed via TB.785 to pins D and E of the socket.

50. As the test sockets are tapped across the actual supply leads to the equipment, tests may be made at the socket whenever the main power supplies are switched ON and the H.2.S. and N.B.C. switches are at ON or EMERGENCY Servicing details for the N.B.S. power transformers, and the frequency changers, will be found in the servicing notes for Chapter 4 and 7, Sect.6 in A.P.101B-1902-1B, Cover 1.

T.4 BOMBSIGHT

51. The units comprising the installation should be checked for security and tightness of plug and socket connections. The sighting head should also be examined for cleanliness and signs of damage.

52. Before removing any item suspected of being defective the fuses and power supplies to the various units should first be checked. Full details for servicing the bombsight in the aircraft will be found in A.P.1275D, Vol.1, Sec.7, Chap.7.

TRUE AIRSPEED UNIT

53. Full details for servicing the T.A.U. together with a fault finding table and the Standard Serviceability Test will be found in A.P.1275B, Vol.1, Sect.16, Chap.15.

S.F.O.M. GUNSIGHT

▶ 54. Full details for harmonization of the S.F.O.M. gunsight will be found in A.P.101B-1902-5A3 Sect.2, Cover 2, Chap.6 SP.450. ◀

REMOVAL AND INSTALLATION

N.B.S. MK.1A

General

▶ 55. The removal of the main items of N.B.S ◀ equipment requires the use of special equipment which is designed to assist in the smooth and efficient progress of this operation. In the paragraphs that follow reference will be made to the equipment required, followed by detailed instructions for removing the item in question. The method of assembly is in all cases the reverse of that for removals. Before removing any pressurized item of equipment check that the pressurization switches on the nav. bomber's panel are in the OFF position.

▶ ◀

Equipment under pilot's floor

56. The calculators, Type 2, Mk.2 and Type 3, Mk.1, are mounted at the starboard side of the aircraft under the second pilot's floor as shown in figs.1 and 2. The calculators slide into the radar crate and are locked in position by quick release 'pip' pins.

57. An H.S.A. built hoist Ref.26DC/95083 is available and when fitted between the bottom fuselage and the pilot's floor, as shown in fig.2, provides a means of lifting the calculators into, or out of, the aircraft as required.

58. The method of removal for the calculator. Type 3 Mk.1 after disconnection of all services, is shown in fig.2. The sequence of operations which is the same for both calculators is as follows. Note that the ratchet lever must be used in conjunction with the winding handle when raising or lowering the units.

(1) Place hoist in position and secure to bracket under pilot's floor with pin D.

(2) Locate pin A through pulley of swinging link at top of hoist.

(3) Slide calculator, Type 3, Mk.1, out of crate and slide gently onto cabin floor.

(4) Attach sling (Ref.No. 26DC/95094) to calculator.

(5) Lower the hoist hook by means of the winding handle and engage hook in sling.

(6) Raise calculator and engage pin B to secure hook to swinging link.

(7) Remove pin A and lower unit to foot of hoist.

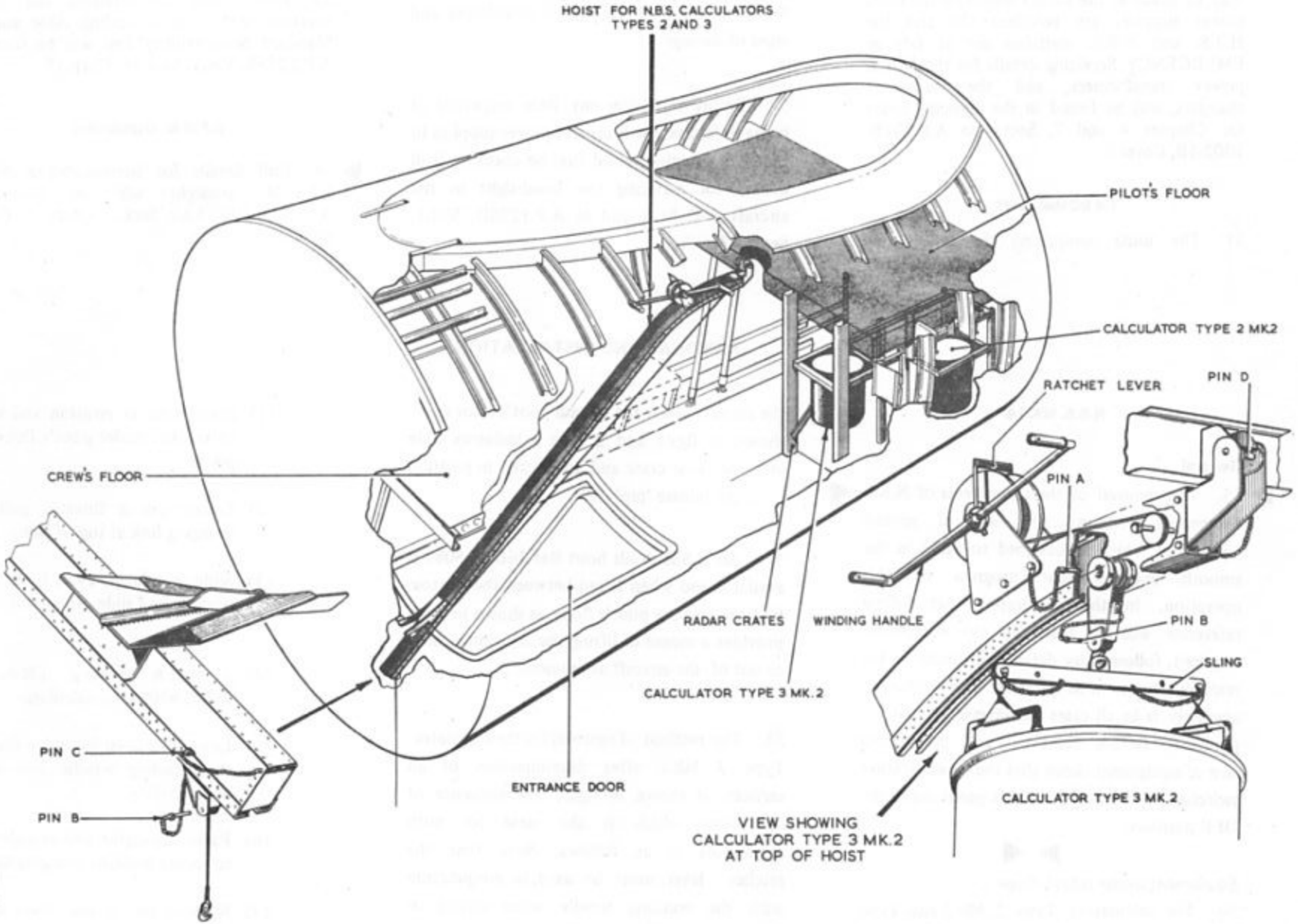


Fig. 2 Removal of N.B.C. calculators

(8) Locate pin C and remove pin B.

(9) Lower the unit onto a suitable trolley and remove sling.

(10) Repeat sequence of operations for calculator Type 2, Mk.2 and remove hoist.

Nav. bomber's equipment

59. The navigation panel Mk.1B, is secured to the radar panel by four screws. When the connector assemblies are uncoupled and the fastening nuts removed the unit can be withdrawn from the radar panel.

60. The control unit, Type 12558, is fitted inside the navigators table and is uncovered by a sliding panel in the table top. The unit can be lifted out when the securing nuts are unscrewed and the connectors removed.

61. Removal of other units at the nav. bomber's station should present little difficulty and no special instructions are required.

Equipment in nose-wheel bay

62. The power unit Mk.2 and calculator, Type 1 are fitted to resilient mountings on two sliding trays in the radar crate and are held in position by quick release pip pins. A "safety raiser" or similar elevating trestle is required to effect the removal of these units. The trestle should be positioned under the nose wheel bay and the platform raised to a convenient level

63. Two men are required on the platform and together should remove each unit in turn. When the connector assemblies are unscrewed and the pip pins pulled out, each unit should be withdrawn by the handles, together with its sliding tray, and lifted onto the platform. The platform should then be lowered to the ground and the units transferred to a suitable trolley.

H.2.S. equipment

Scanner unit

64. To permit the removal of the scanner unit the composite nose radome must first be removed in accordance with the instructions laid down in A.P.101B-1902-1A, Cover 2, Sect.3, Chap.1. The ground equipment required to remove the scanner unit comprises two trolleys for receiving and transporting the unit away from the aircraft. Each hoist is an assembly of parts listed in Table 1 of A.P.101B-1902-1A, Cover 1, Sect.2, Chap.4; the trolleys Ref.No. 4F/1787 and 4F/2202 respectively are fully described in A.P.4552A.

65. Preparations for the removal of the scanner unit and positioning of the hoists require the use of a service ladder. The removal operation should be carried out by four men to the following instructions:-

(1) Prepare trolley Ref.No. 4F/2202 to receive the scanner unit.

(2) Remove and protect all aircraft connectors from the scanner unit and stow the disconnected leads.

(3) Disconnect the air pressure line and the air cooling ducts at the scanner unit.

(4) Attach hoists, one each side, to the hook-up points on the structure above the scanner units.

(5) Pull the hoist cables downward and attach each hook end to the support points on the scanner unit.

(6) Winch up the cables until taut.

(7) Remove the bolts securing the scanner unit.

(8) Position the receiving trolley below the scanner unit.

(9) Lower the scanner unit gently to disengage the dowel pins.

(10) Lower carefully into position on the trolley and bolt the unit to the cradle.

(11) Unhook the cables and remove the hoists.

(12) Attach trolley Ref.No. 4F/1787 for transportation.

Amplidyne unit

66. The amplidyne unit in the nose is removed complete with its associated mounting. The mounting is secured to the structure by four bolts with distance tubes, and is free to pivot on two pins when the bolts are unscrewed. Note that the removal operation does not require the nose radome to be removed as in the case of the scanner unit. Access to the nose section is made from the porthole in the pressure dome.

67. With the bolts removed, and the cooling duct to the amplidyne disconnected, the mounting should be slid backwards, using the handle, and levered from the front end, until hanging vertically. The cables can then be disconnected and the unit, together with the mounting, lifted off at the pivot pins and brought away from the structure.

Navigator's equipment

68. The indicating unit, Type 301C and the control units, Type 585C and Type 595 are secured to the nav. bomber's radar panel by two knurled nuts in each case and held by retaining wires. To withdraw the units from the crate the connector assemblies should be removed, the knurled nuts slackened and the retaining wires released The camera fitted to the indicating unit should be swivelled to one side on its hinges and eased upwards after releasing the screw on the right hand side.

69. The control unit, Type 626 on the navigators table can be removed by uncoupling the connector from underneath the table and removing the four securing screws on the table top. The control unit Type 903 fitted behind the indicating unit can be removed by uncoupling the connectors and removing the three fixing screws.

Equipment in nose-wheel bay

70. The power unit, calculator and wave-form generator are fitted to a resilient mounting at the top of the radar crate and held by two knurled nuts in each case. A "safety raiser" is required for the removal operation and should be positioned under the nose wheel bay with the platform raised to a convenient height. The units can then be removed when the knurled nuts are slackened and the connectors uncoupled. When this has been carried out the units should be lifted onto the platform and the platform lowered to ground level. A suitable trolley should be made available for transporting the unit away from the aircraft.

TRUE AIRSPEED UNIT

71. The T.A.U. is mounted under the starboard engine air intake with the necessary connections facing inboard. Two round access panels are fitted side-by-side, flush with the aircraft skin, and provide facilities for removing the unit. Access to the electrical and pitot-static connections is gained from the inboard panel and the T.A.U. securing bolts are uncovered by the other panel. When the connections are removed the T.A.U. can be unbolted and lift downwards from the aircraft.

T.4 BOMBSIGHT

Computor

72. The computor unit frame is secured to the aircraft structure by four saddle brackets, two at the top of the frame and two at the bottom. By unscrewing the brackets, the computor unit complete with its mounting frame, can be withdrawn from the port radar crate. Before attempting to remove the unit the electrical, pitot-static and pneumatic services should be disconnected from the computor and fitted to the relevant stowages which are provided adjacent to the unit. Always ensure that the pneumatic air supply is turned off at the stop valve on the aft face of the pilots floor before disconnecting the air supply line from the computor.

Amplifier

73. The amplifier is easily removed from its mounting tray after disconnecting the plugs and sockets at the rear of the case. A stowage is provided for the disconnected leads.

Sighting head

74. No trouble should be experienced in removing the sighting head from its mounting bracket in the aircraft once the electrical services and the flexible drives have been disconnected. The flexible drives and electrical leads should be attached to the stowage provided.

Control panel

75. The control panel and other items are all easily removed from the aircraft and no special instructions are required.

TABLE 1

H.2.S. MK.9B EQUIPMENT

Unit	Ref. No.	No. off	Location
Scanner unit, Type 121	10B/16327	1	Nose radome
Amplifier A3703	10U/16761	1	
Modulator Type 2	10D/18638	1	
Transmitter receiver TR.3702	10D/18637	1	On scanner unit
Analyser unit (co-ordinate) sync.	10AD/3379	1	
Gyro unit Mk.6	6W/5	1	
Amplidyne unit A3XX1	5UB/6431	1	Nose radome
Indicating unit Type 301C	10Q/16734	1	Navs. station
Camera Type R88	14A/4260	1	On indicating unit 301C
Control unit Type 585C	5841-99-222-8482	1	Navs. position
Control unit Type 12558	10L/16493	1	Navs. position
Control unit Type 595	10LB/6376	1	Navs. position
Control unit Type 12580	10L/16495	1	Navs. position
Control unit (Camera) Type 903	10L/16154	1	Behind type 595 c/u
Control unit Type 626	10L/16060	1	Navs. table
Power unit Type 729	10DB/8811	1	Nose-wheel bay
Calculator Type 5A	10D/20968	1	Nose-wheel bay
Waveform generator Type 68C	10V/16511	1	Nose-wheel bay

TABLE 2

N.B.C. MK.2A EQUIPMENT

Unit	Ref. No.	No. off	Location
Bombing indicator	9D/1372	1	1st Pilot's instrument panel
Calculator Type 2, Mk.2	9D/1373	1	Under 2nd Pilot's floor
Calculator Type 3, Mk.1	9D/4	1	
Navigation panel, Mk.1B	9D/1803	1	
Wind unit Mk.2	9D/2212	1	Navigator's position
Indicator unit	9D/757	1	
Forward throw indicator	9D/1400	1	
Junction box Type 343, Mk.2	9D/1399	1	
Junction box, Type 343, Mk.4	9D/2217	1	
Suppressor, Type G5	-	1	R.P.B. cabin
Resistance unit Mk.1	9D/12	1	
Calculator Type 1, Mk.1	9D/2	1	Nose wheel bay
Power unit Mk.2	9D/2209	1	
Variable air speed unit, Mk.3	9D/1984	1	Navigator's position
Compass Repeater, Type B	6B/3647	1	Navigator's position
▶ Pilots' directional indicator	9D/4414905	1	Navigator's position ◀

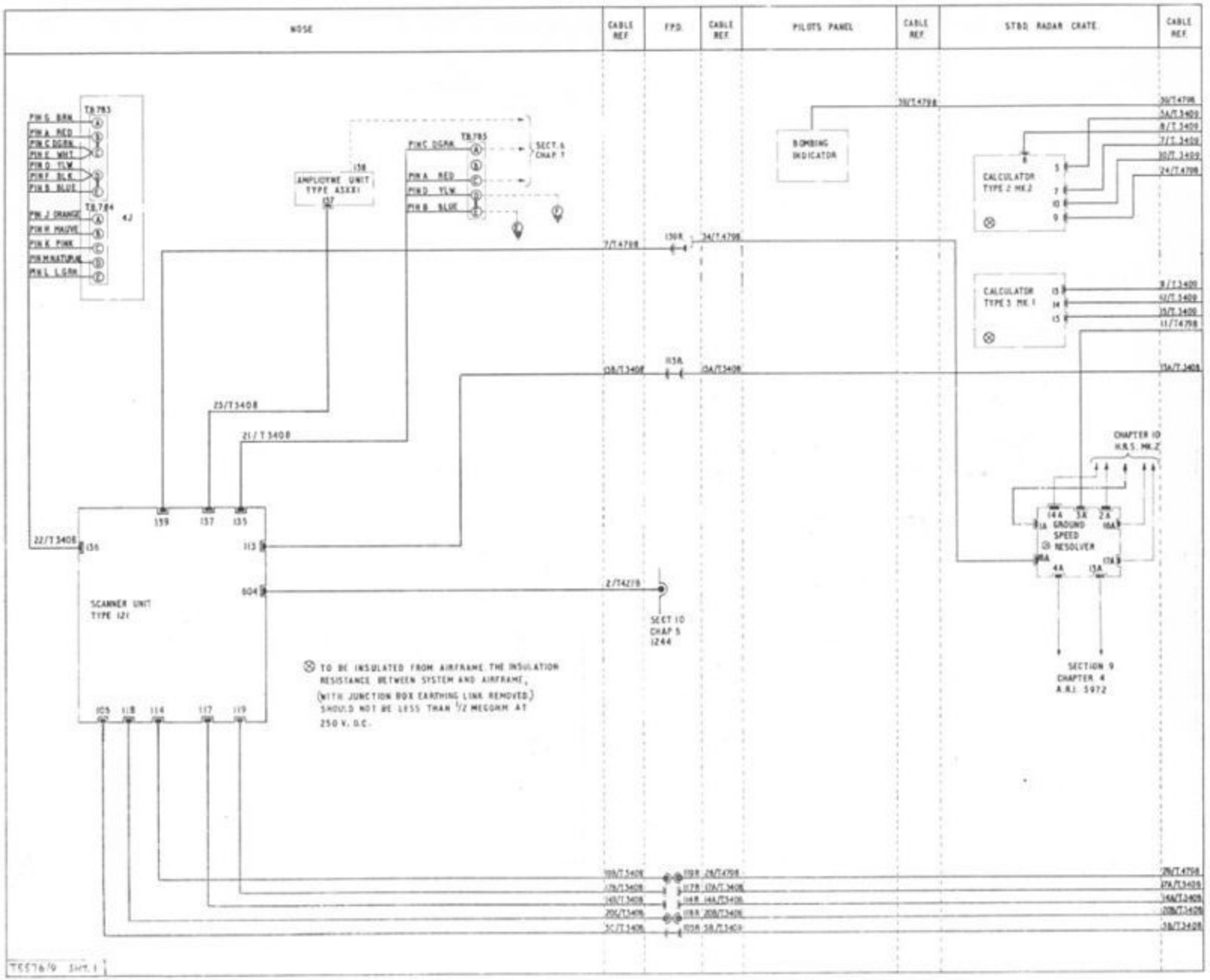


Fig 4 (1) N B S Installation

► Corrections to clarify circuit ◄

RESTRICTED

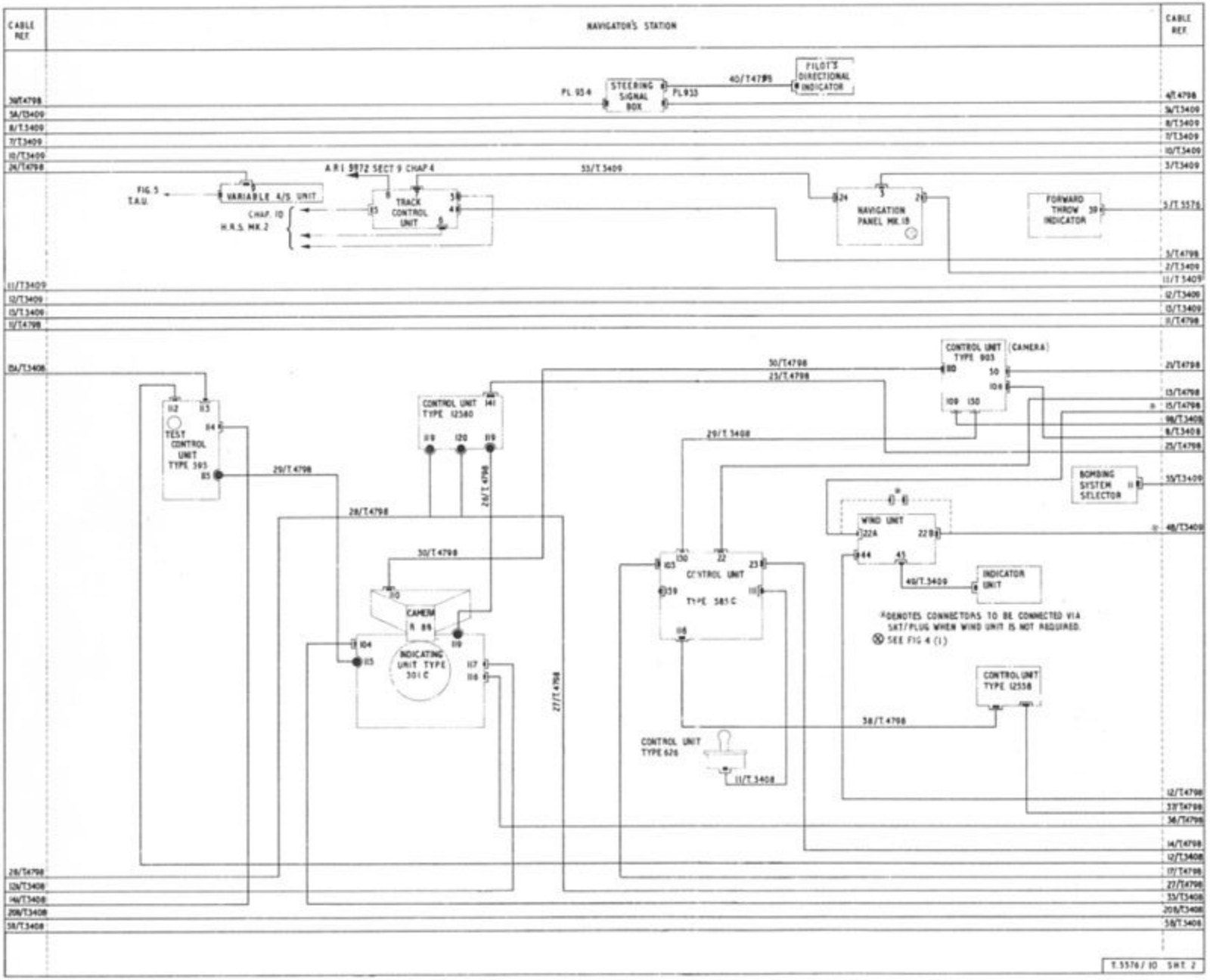


Fig 4 (2) N B S Installation

▶ *Corrections to clarify circuit* ◀

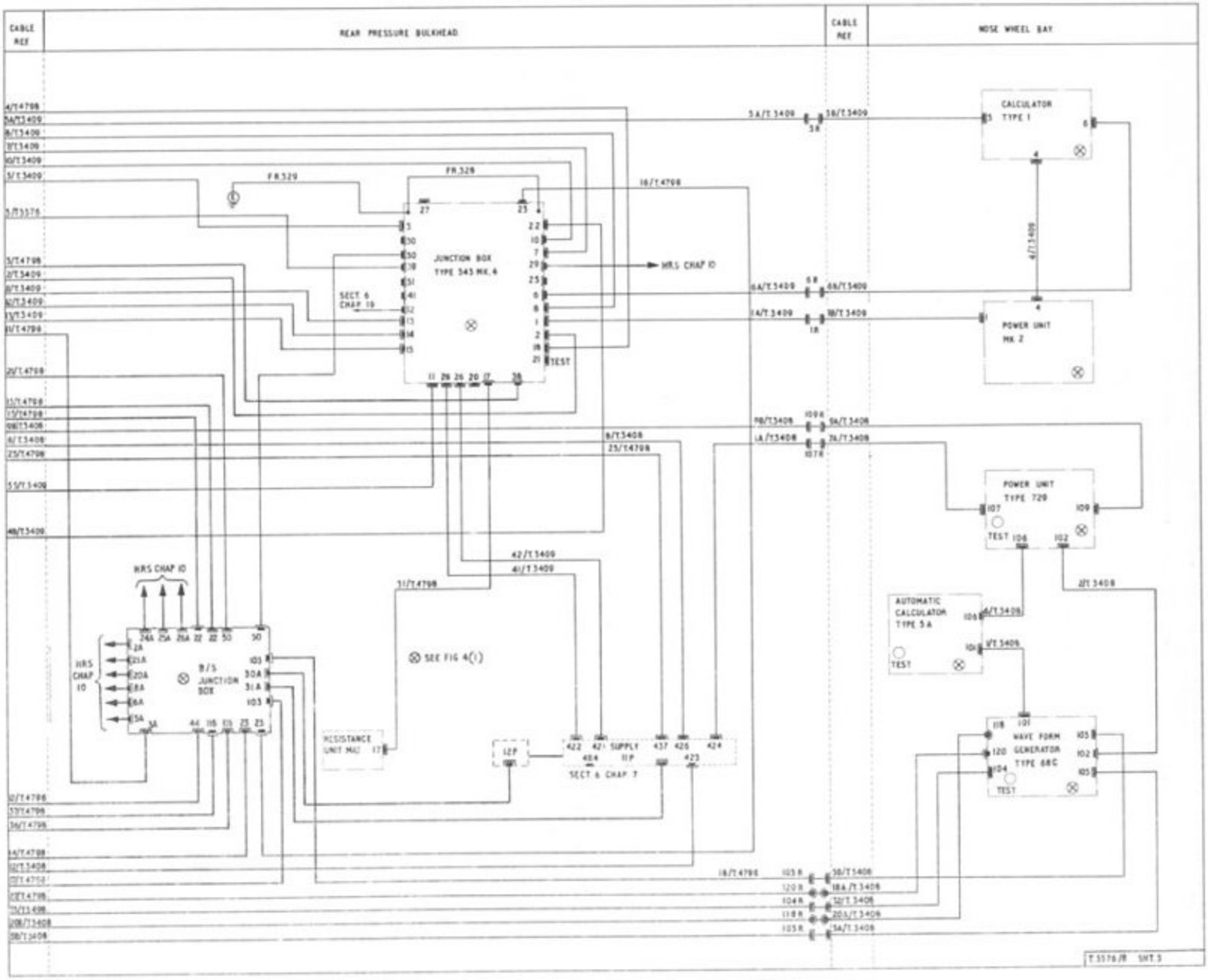


Fig 4(3) NBS Installation

▶ Corrections to clarify circuit ◀

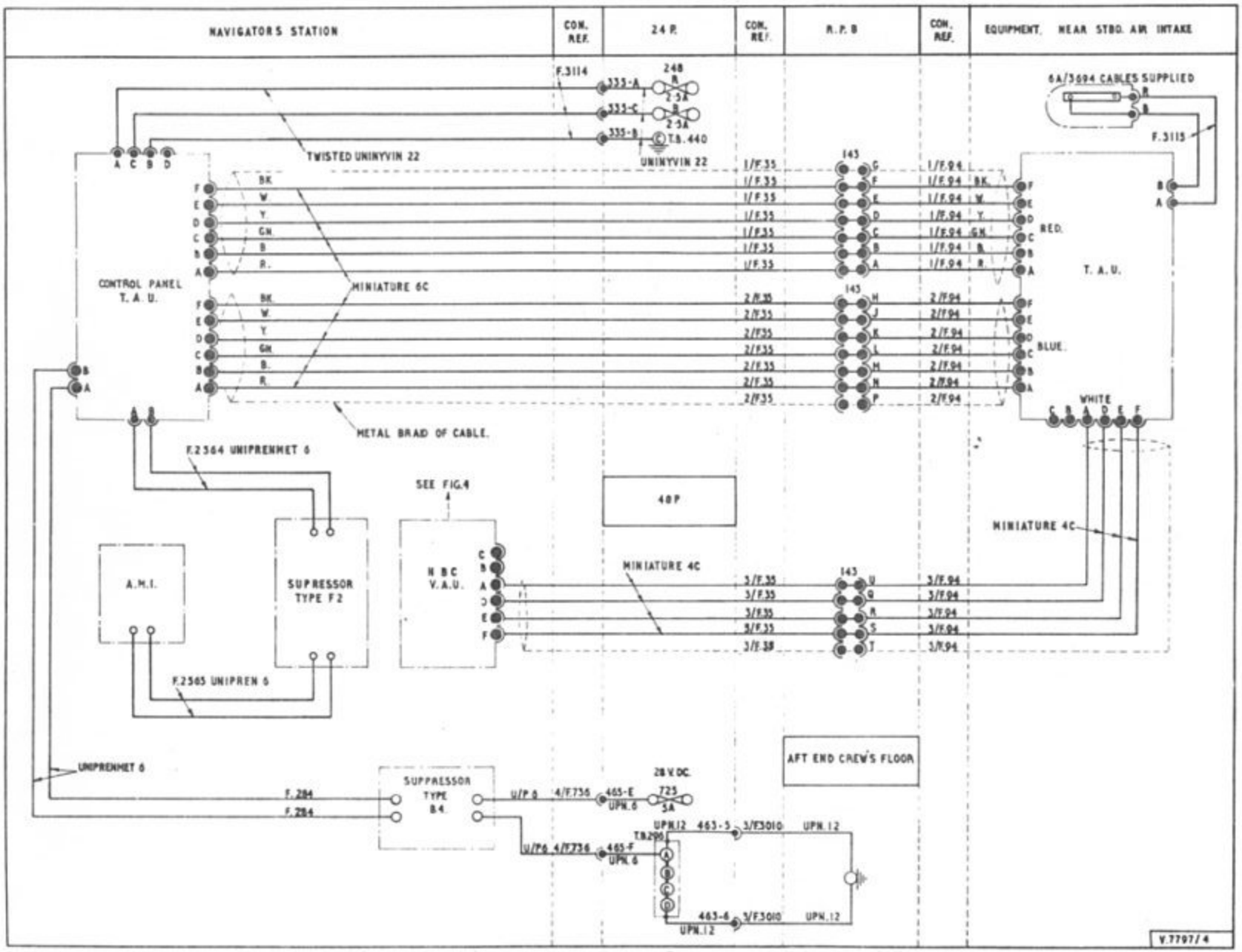


Fig. 5 T.A.U. for use with N.B.C.

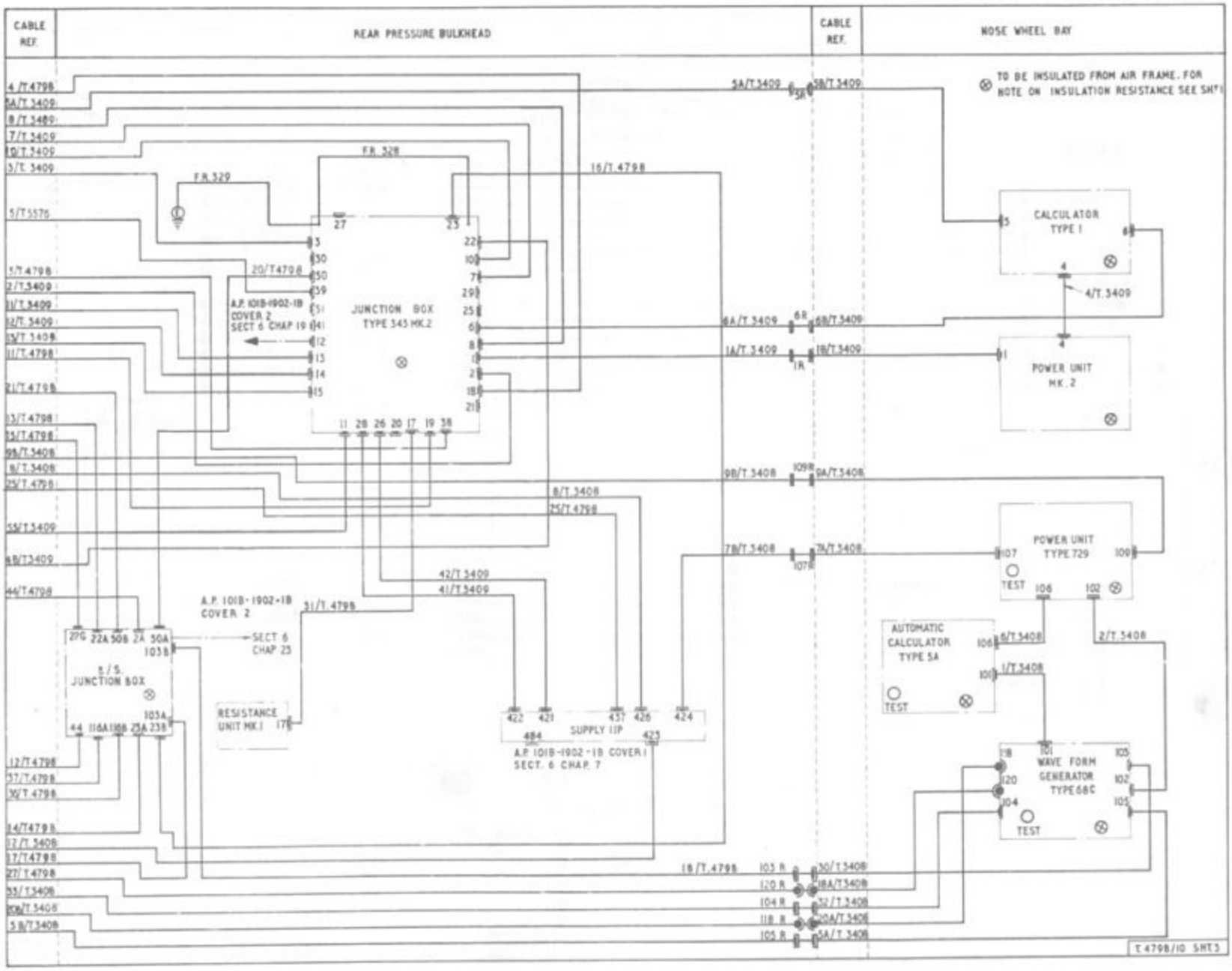


Fig 4 (2) N.B.S. installation (Post Mod 748)

◀Mods 1010 1031 1078▶

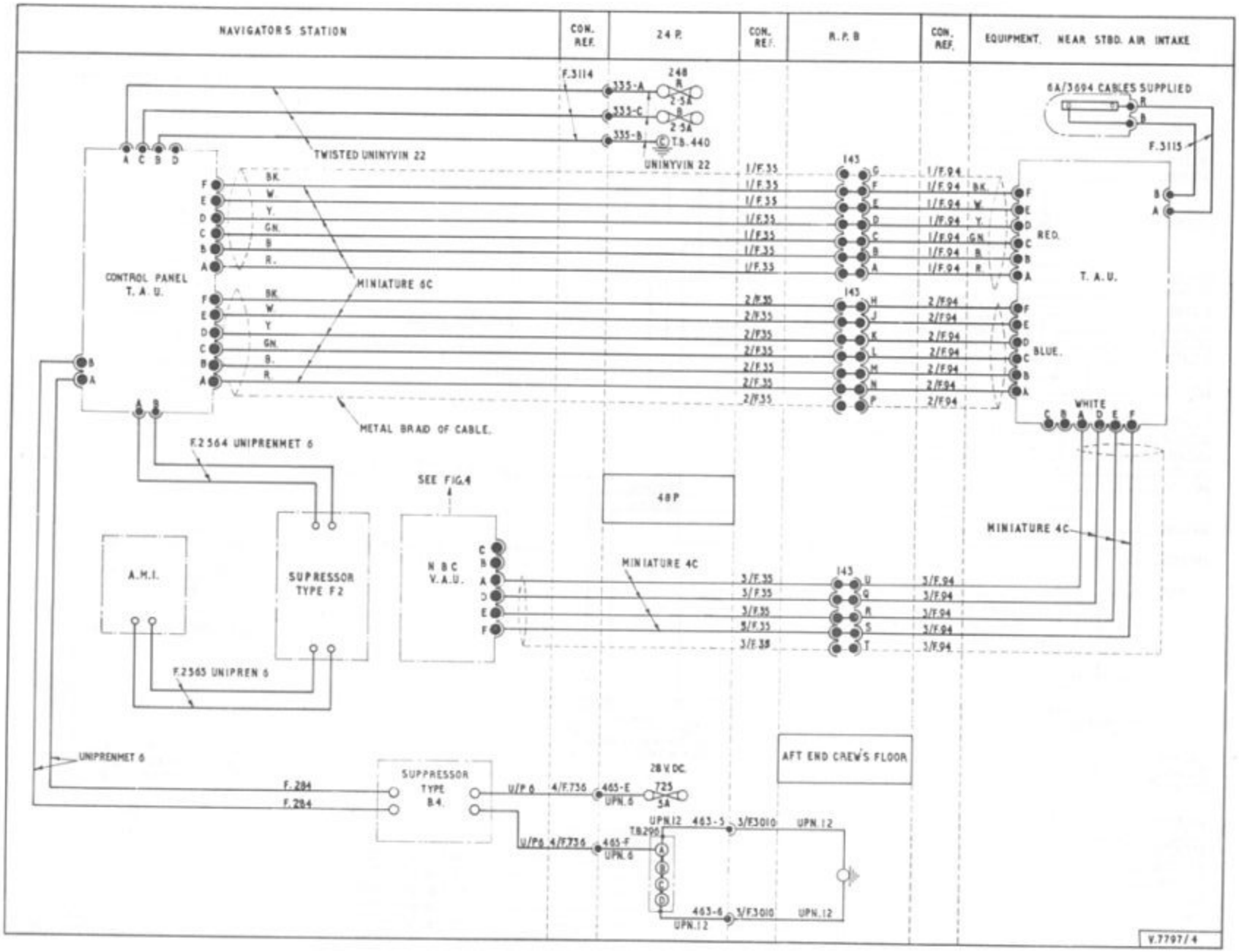


Fig. 5 T.A.U. for use with N.B.C.

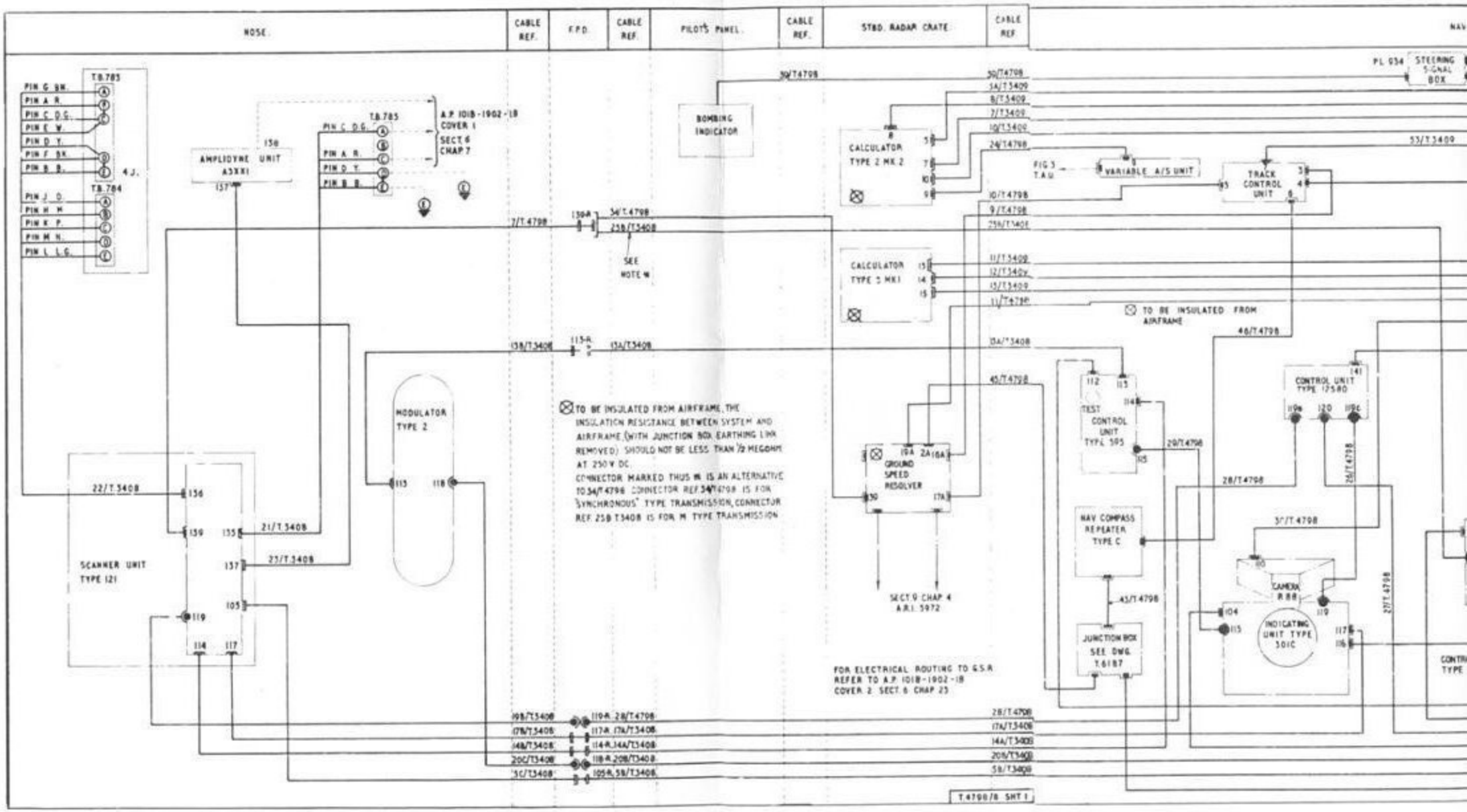


Fig. 4 (1) N.B.S. installation (Post Mod 748)

▶ Mod 2439 ◀

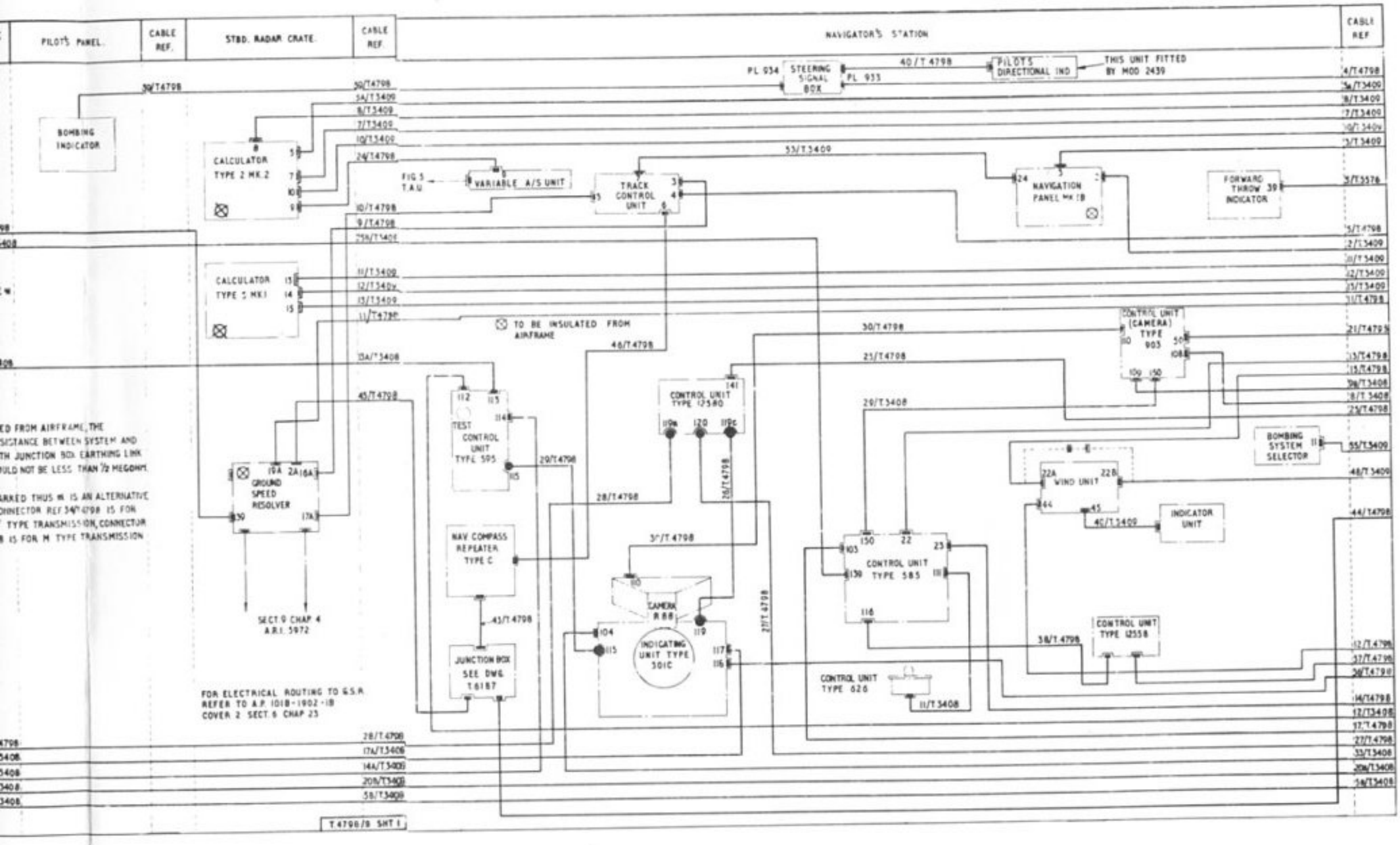
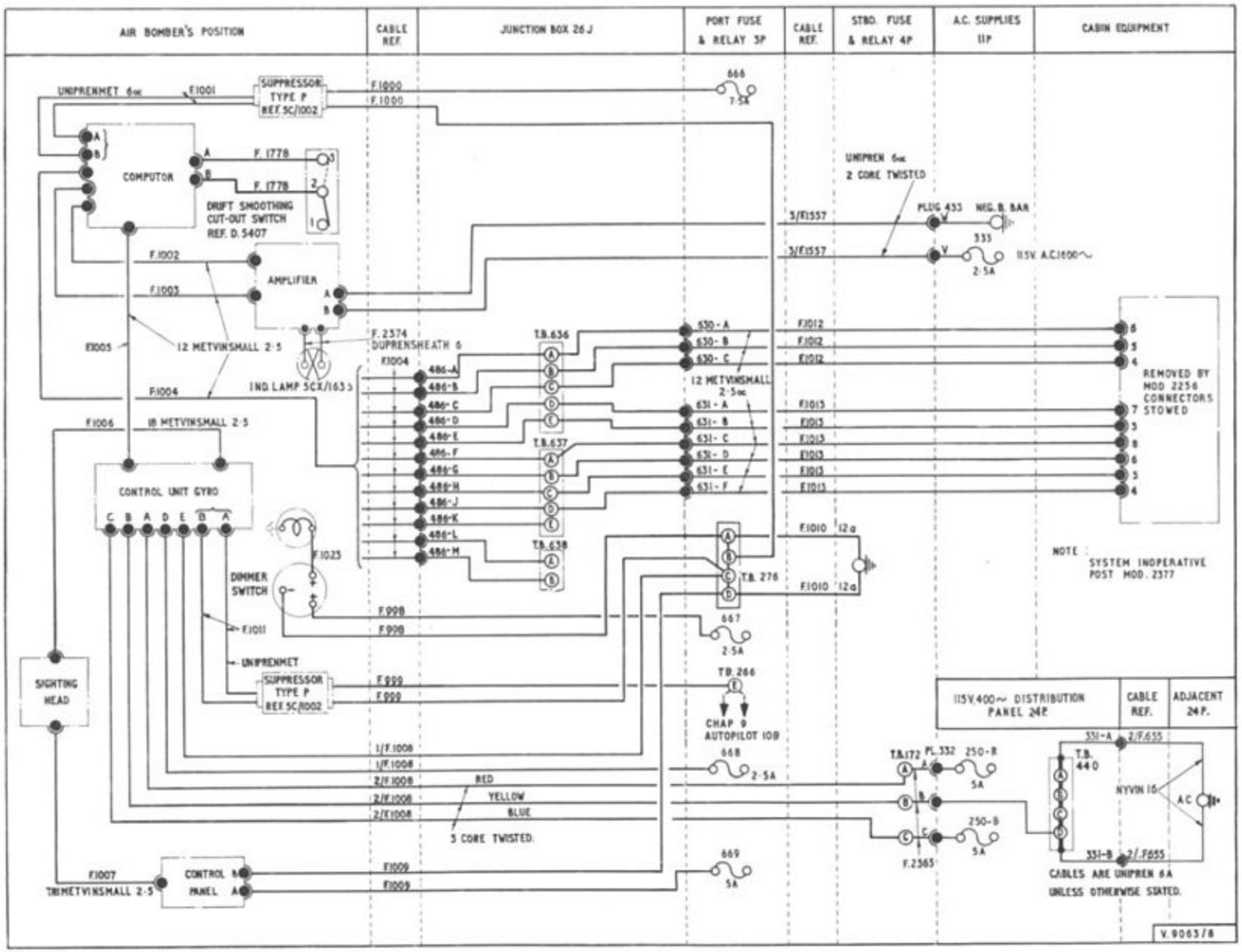


Fig. 4 (1) N.B.S. installation (Post Mod 748)

▶ Mod 2439 ◀



940054 580 3,74 H.S.A. 1354

Fig. 6. T4 Bombsight.

Note added

APPENDIX 1

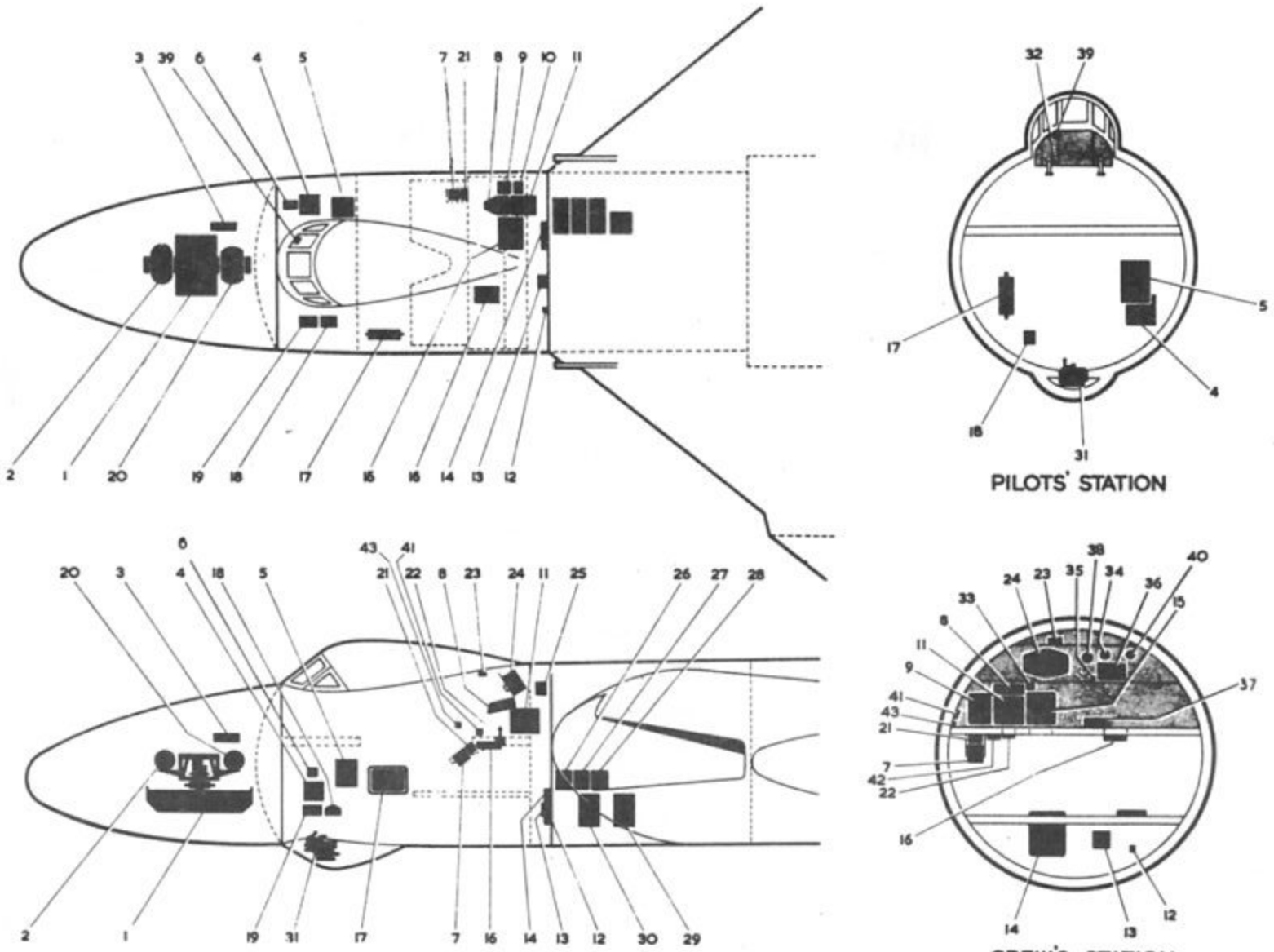
ARMAMENT INSTRUMENTS

(Reconnaissance Variant)

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS



19955

Fig. 1 Location of armament instruments

KEY TO FIG.1

Location of armament instruments

1. SCANNER UNIT TYPE 121
2. AMPLIFIER A3703
3. AMPLIDYNE A3XX1
4. CALCULATOR, TYPE 2, MK.2
5. CALCULATOR, TYPE 3, MK.1
6. GROUND SPEED RESOLVER
7. CONTROL UNIT, TYPE 12580A
8. CAMERA, TYPE R110 OR R88
9. CONTROL UNIT, TYPE 595
10. CONTROL UNIT (CAMERA), TYPE 903
11. INDICATING UNIT, TYPE 301D
12. SUPPRESSOR, TYPE G5
13. RESISTANCE UNIT MK.1
14. JUNCTION BOX, TYPE 343
15. CONTROL UNIT, TYPE 585C
16. CONTROL UNIT, TYPE 12558
17. T.4 BOMBSIGHT COMPUTER
18. T.4 BOMBSIGHT SIGHTING HEAD CONTROL PANEL
19. T.4 BOMBSIGHT GYRO CONTROL

(Inoperative Post Mod. 2256 and 2377)

20. MODULATOR, TYPE 2
21. BOMBING SELECTOR SWITCH
22. CONTROL UNIT, TYPE 626
23. VARIABLE AIRSPEED UNIT, MK.3
24. NAVIGATIONAL PANEL, MK.1B
25. WIND UNIT, MK.2
26. POWER UNIT, TYPE 729
27. CALCULATOR ATUOMATIC 5A
28. WAVEFORM GENERATOR, TYPE 68B
29. CALCULATOR, TYPE 1, MK.1
30. POWER UNIT, MK.2
31. T.4 BOMBSIGHT SIGHTING HEAD (inoperative Post Mod.2256 and 2377)
32. BOMBING INDICATOR, MK.1
33. WIND INDICATOR
34. FORWARD THROW INDICATOR
35. STEERING SIGNAL TEST JB
36. TRACK CONTROL UNIT
37. G.P.I., MK.6
38. COMPASS REPEATER, TYPE B
39. S.F.O.M. GUNSIGHT TYPE 812 A
40. PILOTS' DIRECTIONAL INDICATOR
41. CONTROL UNIT, TYPE 6204
42. JUNCTION BOX, TYPE 6205
43. VOLTMETER

Introduction

1. This appendix contains descriptive and servicing information for the Reconnaissance variant of the ARI-5928/6 introduced by SOO Mod.2411. The instruments described in this appendix are additional to those which form the basic Navigation and Bombing system (NBS) and this appendix should be read in conjunction with the main chapter.

2. Fig.1 shows the location of the various units which comprise the installation, whilst the two tables (Table 1 and Table 2) give a complete list of the NBS equipment applicable to the reconnaissance variant, its location, and the necessary type numbers. Further details concerning the individual units that make up the NBS mentioned in this appendix, may be found in AP 114E-1008-1A and 1B.

3. The following modifications are included in this appendix:-

Mod.812	Removal of cooling air supply to amplidyne unit A3XX1.
Mod.972	Introduction of N.B.C. D.C. EMERGENCY switch

Mod.1010 Introduction of control unit, Type 12558 and modification of control unit, Type 585.

Mod.1031 Removal of time-of-fall calculator, Mk.2A.

Mod.1078 Electrical changes for satisfactory functioning of store (Blue Steel aircraft only).

Mod.1188 NBS bombing indicator connector terminations corrected.

Mod.1431 Introduction of bombing selector switch guard.

Mod.1720 Completion of NBS wiring after HRS junction box deleted by Mod.1719.

Mod.1851 Introduction of navigator's compass repeater Type B (SOO Free fall aircraft).

Mod.1852 Introduction of navigator's compass repeater, Type C (SOO Blue Steel aircraft).

Mod.1888 NBS connector changes when ARI-23172 introduced.

Mod.1908 Introduction of Heading Reference System Mk.2.

Mod.2034 Conversion of NBS junction box 343 from Mk.2 to Mk.4 to provide a heading reference to NBS calculator (Free Fall aircraft).

Mod.2256 Introduction of ARI-5972 in lieu of ARI-5951.

Note . . .
With Mod.2256 incorporated the T.4 bombsight system is inoperative.

Mod.2377 To increase the capacity of the cabin pneumatic system by isolating the air supply to the T 4 bombsight computer.

Mod.2411 Introduction of additional facilities for reconnaissance purposes (SOO Reconnaissance aircraft only). This Mod is satisfied by SRIM 3873.

Mod.2500 Introduction of a voltmeter in order to facilitate the adjustment of the swept gain unit pre-sets. This Mod is satisfied by SEM/Vulcan/046.

DESCRIPTION AND OPERATION

4. The Reconnaissance variant of NBS (designated ARI-5928/8) provides facilities additional to those described in chapter 5. These additional facilities comprise of:-

(1) 3 million scale (shift less).

(2) Slow scan (4 rpm).

(3) Stepped gain.

(4) Automatic camera operation every second scan.

5. The units comprising the ARI-5928/8 are similar to those which comprise ARI-5928/6 (described in chapter 5). There are however, two additional units fitted and three existing items are replaced by different types. These items only are described in this appendix.

Control and unit location

6. The units are located as shown in fig.1. The two additional items are the control unit, Type 6204 (item 39) and the junction box, Type 6205 (item 40), whilst the units which are of a changed type are items 7, 8, 11 and 28.

Indicator 301D

7. The indicator Type 301C is replaced by the indicator, Type 301D the controls of which are as follows:-

(1) Scale selector switch:-
1M, ½M, ¼M, PC1, PC2.

(2) Function switch:-
T (Tanker), HO, NL.

(3) Marker Off switch:-
No longer biassed.

(4) Shift Off/On switch:-
A three position switch giving the following functions:-
switch down – shift on.
switch centre – shift off.
switch up – 3 million scale (when scale switch selected to 1M).

Waveform Generator 68B

8. This unit replaces the waveform generator, Type 68C and must be used in conjunction with the indicator, Type 301D.

Control unit, Type 12580A

9. The control unit, Type 12580A replaces the control unit, Type 12580 and has one extra control, the scanner normal/slow switch. Normal scanner speed is obtained with the switch at NORMAL and 4 rpm on 3M and 1M scales when SLOW is selected.

Control unit, Type 6204

10. The control unit, Type 6204 is located in the lower right hand corner of dummy stowage panel 9P together with a gain meter which is used (in conjunction with a calibration card) for setting the pre-set gain potentiometers. The following facilities are provided:-

(1) Camera Normal/Recon switch – on NORMAL the camera operates on single shot. When the RECON function is selected the camera will operate every second scan.

(2) Normal/Recon switch – on NORMAL the picture is controlled by use of the normal gain controls on the indicator, Type 301D. On RECON the picture gain is swept through 5 pre-set levels (set on 5 pre-set potentiometers on the front panel) by a ledex switch. There are a further six positions for this switch. Positions 1–5 select the individual five pre-set levels of gain whilst position 6 (marker), when selected, allows use of the two-tone facility when two-tone is selected on the control unit, Type 12580A.

Junction box, Type 6205

11. The junction box, Type 6205 is fitted to the underside of the indicator 301D mounting crate. Pre-set potentiometer RV1 is used, in conjunction with RV401 on the PJ6020, to set the slow scanner speed to 4 rpm.

WARNING . . .
Voltages in excess of 30 volts ac (rms) or 50 volts dc can be dangerous under certain conditions. Personnel must therefore ensure that the electrical system is electrically safe before any servicing is attempted. Where it is essential that tests or adjustments be made with the electrical power switched ON the greatest care must be exercised.

SERVICING

Precautions

12. It is essential that the utmost attention be given to servicing instructions where matters of safety are concerned. It is essential that maximum co-operation be maintained between trades mutually concerned in servicing operations.

General

13. The setting up, operating and servicing instructions for the installation and its components are contained in AP 114E-1008-1B. The security of all components should be checked regularly. All connectors, plugs, sockets and terminal blocks should be examined for damage and ingress of dirt and moisture.

REMOVAL AND INSTALLATION

General

14. Removal of the components which comprise the NBS should be carried out in accordance with the instructions laid down in chapter 5. Instructions for the removal of the control unit, Type 6204 and the junction box, Type 6205 are contained in paragraphs 16 and 18 of this appendix.

15. After the removal of any unit, all loose connectors should be secured to the adjacent aircraft structure to prevent damage.

Control unit, Type 6204

16. Removal of the control unit, Type 6204 is effected by the removal of quantity four 6BA screws which attach it to the dummy stowage panel 9P. After removal of the screws the control unit can be withdrawn from the panel but care must be exercised as connector 4/T8842 (152) is still connected and clearance is restricted. Disconnect SKT 152 and remove control unit, Type 6204.

17. The method of assembly is the reverse of that for removal.

Junction box, Type 6205

18. The junction box, Type 6205 is located on the underside of the indicator, Type 301D mounting crate (refer to fig.1). Disconnect the seven connector plugs/sockets. Remove quantity six screws attaching the junction box to the mounting crate (the unit must be supported during this operation) and lift clear.

TABLE 1

H2S Mk.9B EQUIPMENT

Unit	Type/Part No	No. off	Location
Amplidyne unit	A3XX1	1	Nose radome
Scanner unit	121	1	
Amplifier	A3703	1	
Modulator	2	1	
Transmitter receiver	TR3702	1	On scanner unit
Analyser unit (co-ordinate) sync.	–	1	
Gyro unit	Mk 6	1	
Indicating unit	301D	1	Navigator's position
Control unit	585C	1	
Control unit	12558	1	
Control unit	595	1	
Control unit	12580A	1	
Voltmeter	–	1	
Control unit	6204	1	
Control unit	626	1	
Power unit	729	1	Nose-wheel bay
Calculator	5A	1	
Waveform generator	68B	1	
* Camera	R88 or R110	1	On indicating unit 301D
Junction box	6205	1	Under indicating unit 301D mounting
Control unit (camera)	903	1	Behind Type 595 c/u

* Note . . .

The camera, Type R110 is usually fitted but the R88 may be used in lieu

TABLE 2

NBC Mk 2A EQUIPMENT

Unit	Type/Part No	No. off	Location
Bombing indicator	1AP341	1	1st Pilot's instrument panel
Calculator	Type 2, Mk 2	1	Stbd radar crate
Calculator	Type 3, Mk 1	1	
Navigation panel	Mk 1B	1	Navigator's position
Wind unit	Mk 2	1	
Indicator unit	IN34700	1	
Forward throw indicator	Mk 1	1	
Variable air speed unit	Mk 3	1	Navigator's position
Compass Repeater	B	1	Navigator's position
Junction box	Type 343, Mk 2	1	RPB cabin
Junction box	Type 343, Mk 4	1	
Suppressor	G5	1	
Resistance unit	Mk 1	1	
Calculator	Type 1, Mk 1	1	Nose-wheel bay
Power unit	Mk 2	1	

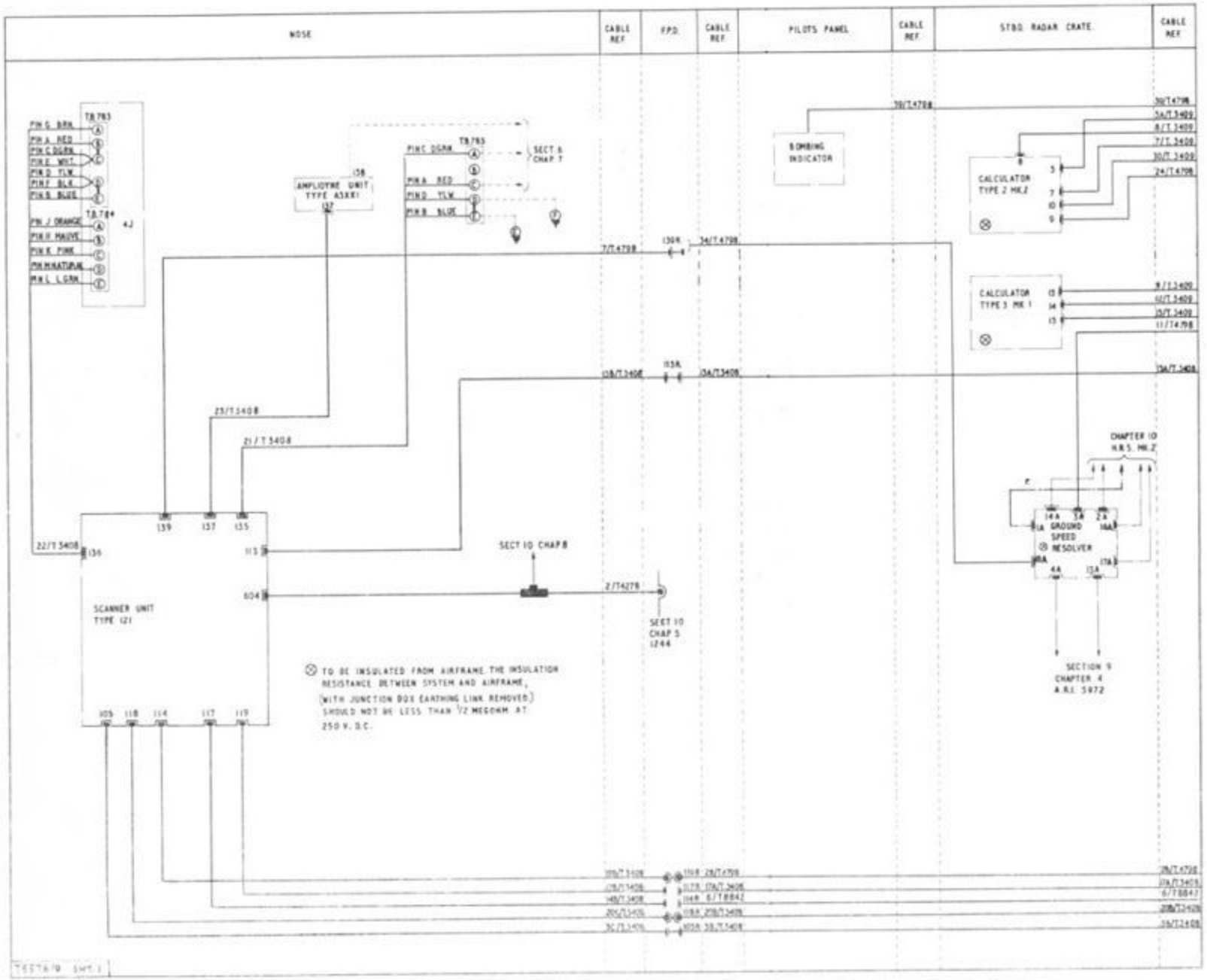


Fig. 2 (i) N.B.S. installation
Corrections to clarify extent

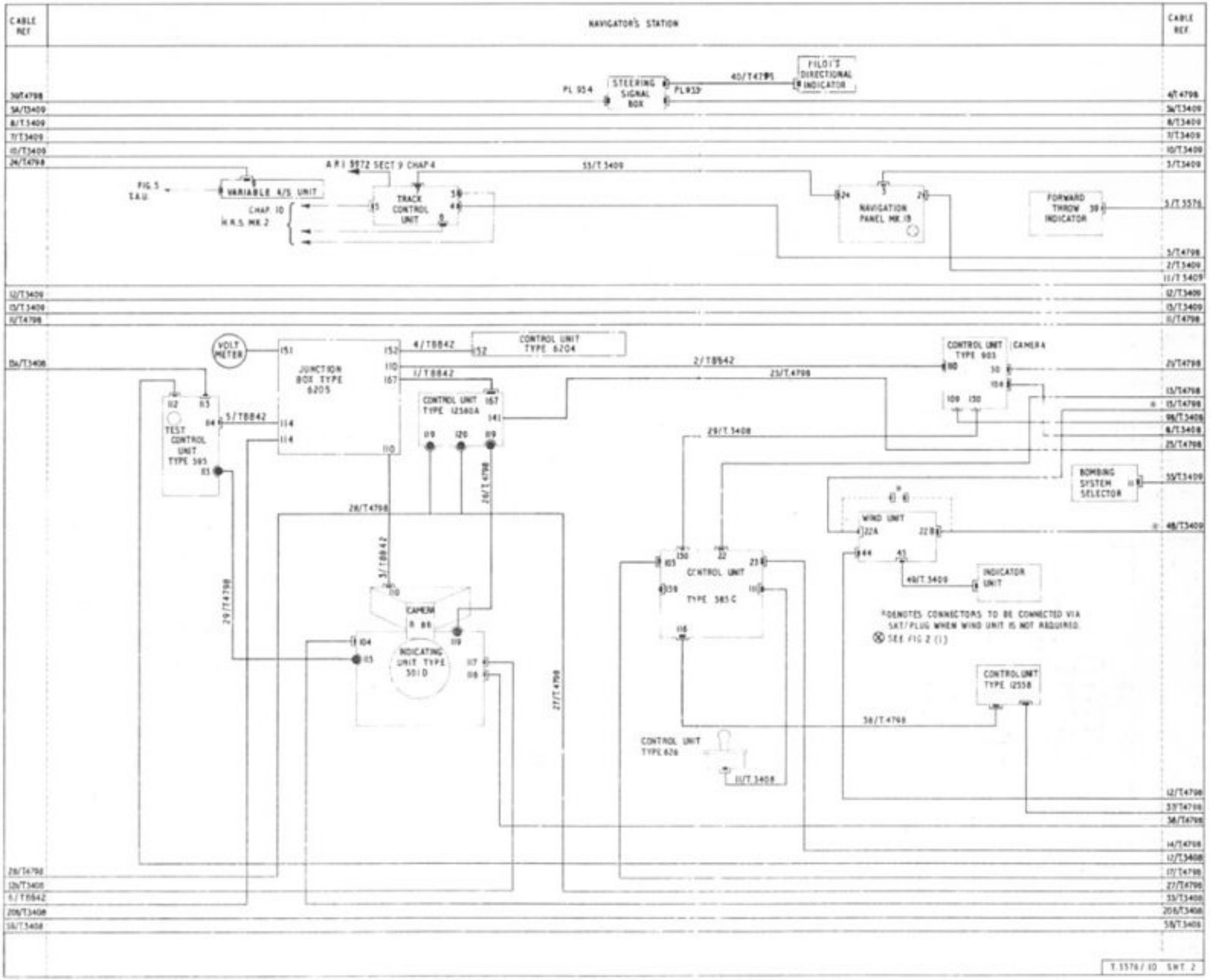


Fig 2 (2) NBS installation

▶ *Corrections to clarify circuit* ◀

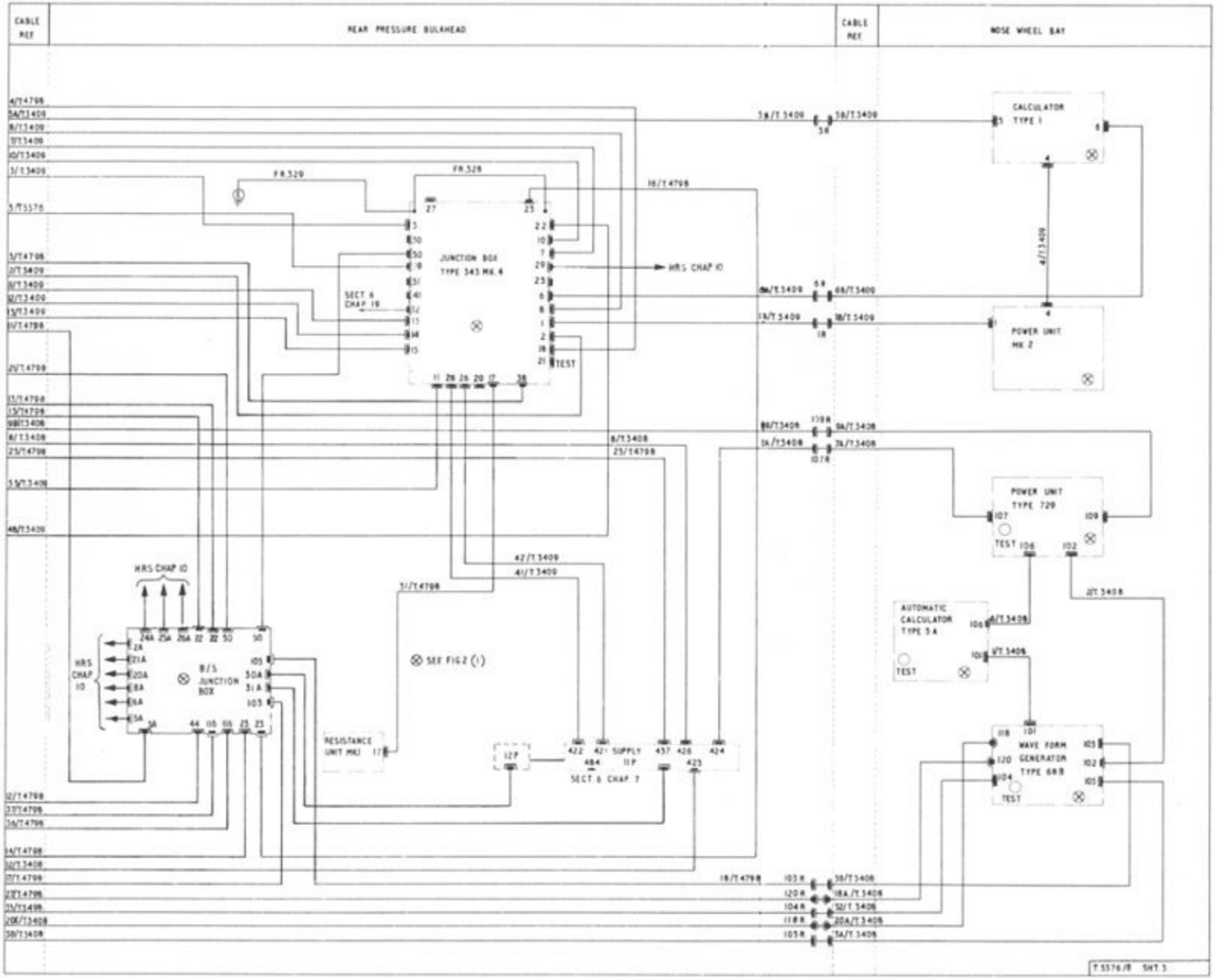


Fig 2 (3) N.B.S. Installation

Corrections to clarify circuit