Group 1

GENERAL INFORMATION

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. This chapter contains descriptive and servicing information for the complete instrument installation on the aircraft. The Chapter is divided into eight groups which are arranged according to the services of the installation. Each group contains a description of a particular instrument system, with information on the servicing and removal of components. Illustrations depicting location and layout of the various instrument services are also included, and routing charts for the circuits of the electrically-operated instruments will be found at the end of each group.

2. Instruments which are electrically-operated, and bear the same circuit code letter will be found mainly under the same Group heading. Detailed information for different types of instruments will be found in the appropriate volume of the A.P.1275 series. Reference is made to these Air Publications where required, and tabulated where it is thought necessary.

3. Power supplies for electrically-driven instruments are dealt with only briefly, and reference should be made to Chapter 1 of this Section for full details. Instruments which form part of the radio equipment are described in Section 6 of this publication.

4. This Group offers information of a general nature, and also deals with the pitot-static system and the removal of the instrument panels. Fig.1 is a location illustration for all instrument panels and main services.

5. Descriptive and servicing information for the pitot-static system, which supplies the air-operated instruments is provided in the following paragraphs. It should be noted that the following Vulcan modifications which affect the pitot-static system, are included in the description:-

Mod.58 - Introduction of independent static vents for N.B.S.

Mod.336 - Introduction of pressure head Mk.9C in lieu of Mk.9 on replacement.

Mod.353 - Introduction of Zero Reader flight director.

Mod.378 - Introduction of drains to the pressure and static pipes in the port air intake.

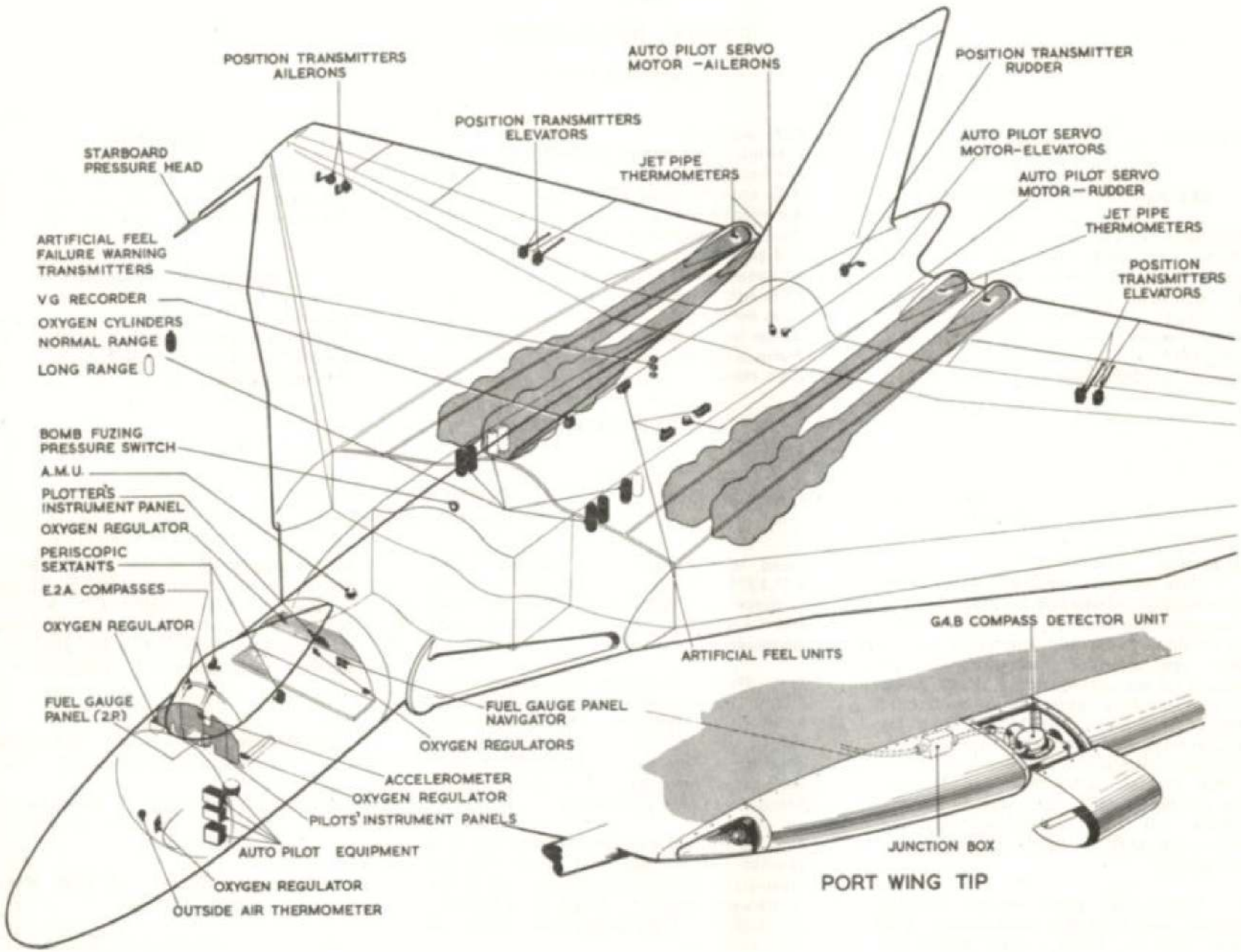

Fig. 1 Location of instrument services

Mod.424 - Revision to pitot-static connections for the A.M.U. (for a/c with Mod.58).

Mod.454 - To delete the V.G. recorder introduced by Mod.120, and install the V.G. recorder in the bomb bay.

Mod.828 - Introduction of pressure head Mk.9E on replacement (supercedes Mod.336.)

DESCRIPTION AND OPERATION

PITOT-STATIC SYSTEM

6. The pitot-static system consists of two independent systems, one port and one starboard. Light alloy tubing is used for both the pressure and the static pipe lines, each pipe length being connected by a low pressure union, Mk.1. Tees and crosspieces are used where pipes branch off for connections to components.

7. The pipe lines of each system are identified 'static' or 'pressure' accordingly at convenient intervals, and drains are provided at a number of points to trap any moisture accumulating in the pipes. Short lengths of Maricon tubing, Ref. No.32C/679, with clips, Type A.G.S.606 Mk.E, are used to connect the various instrument services to the pipe lines. Flying instruments connected to this system are described in Group 2 of this Chapter; other instrument services are dealt with in their associated Groups to which reference is made in the appropriate paragraphs.

8. On aircraft where Mod.58 has been embodied, independent static vents have been installed in the aircraft nose. These provide static pressure to the N.B.S. equipment in the cabin.

INSTRUMENT SERVICES

9. Air pressure for the pitot system enters an electrically-heated pressure head at each wing tip. The port system supplies the following instruments:-

First pilot's instruments

Artificial feel warning transmitters

Auto-mach unit (auto-stabilization controls).

The starboard system supplies the second pilot's instruments and the following services:-

Artificial feel units
Navigation station instruments
A.M.U.
V.G. recorder
Bomb fuzing pitot switch
T.4 bombsight (Mod.108)
Fatigue meter (Mod.374)
Yaw damper monitor (Mod.239)
Auto height switch (pitch damper) } Static only
Auto height unit (mach trim) } Static only
Autopilot } Static only
N.B.S. } Static only
Zero reader } Static only

PIPE RUNS

10. The pressure and static lines from the pressure head at each wing tip run inboard, behind the front spar, to each wing transport break. Drain pipes are provided in each line from tee connections at the wing tips.

11. The pipes continue from each wing break, across the main wheel bays and engine bays, to the outboard side of the bomb bay ribs. At this point, the pipes enter the bomb bay, the port run crossing to the starboard side of the bomb bay where they are connected to the artificial feel failure warning master transmitters.

The starboard pipes run aft on the starboard side of the bomb bay, and cross to the port side for the artificial feel unit connections.

12. From the outboard side of the bomb bay ribs, both port and starboard pipe lines run forward through the engine air intake fairings and enter the port and starboard sides of the nosewheel bay between formers 101 and 115.5. Connections are provided on the starboard pipes, as they enter the nosewheel bay, for the A.M.U., which is situated under the engine air intake.

13. From the nosewheel bay the pipe lines pass through the rear pressure bulkhead into the cabin, and the port system continues to the first pilot's panel. The starboard system serves the navigation station and the second pilot's instrument panel. The auto-pilot Mk.10 and N.B.S. equipment under the pilot's floor connect to the static line only.

Static vents

14. On aircraft where Mod.58 has been embodied, static vents are fitted to provide static pressure for the N.B.S. calculator below the pilot's floor. The static vents, Avro type 3/S.2156, are fitted one on each side of the upper nose structure at former 456. Both static vents are joined by a pipe running across the nose, and a tee piece in this line forms the connection point for the static line. The feed line runs aft, through the forward pressure bulkhead, along the undersurface of the pilot's floor to the N.B.S. calculator. A drain pipe is 'teed' into the line at this point.

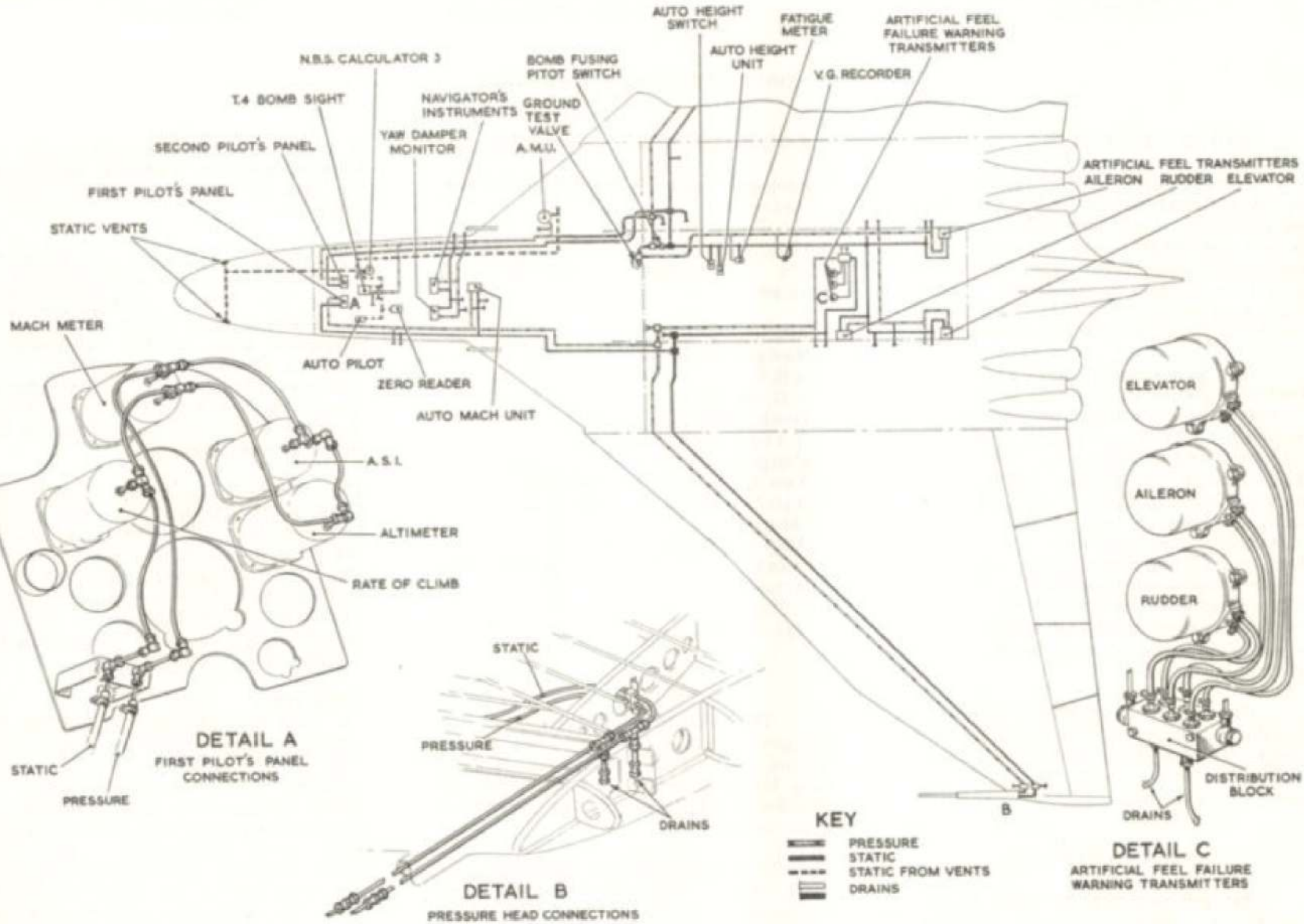

Fig. 2 Pitot - static system

15. On aircraft where Mod.424 is embodied, the A.M.U. is connected to the static vents, and not to the starboard static line. The piping layout is shown in fig.2. Where Mod.564 has been embodied, the autopilot, zero reader, and T.4 Bombsight are fed from the N.B.S. static system. The location of all drains is shown in fig.2.

DRAIN PIPES

16. Drain pipes, which are sealed at the ends, are fitted to a number of points in both the pressure and static lines. These can easily be uncoupled to release moisture trapped in the pipes. For convenience, drain pipes are installed at the wing tips, and those at the forward end of the bomb bay are fitted with removable plugs. The drains are provided at 6 points in the port system and 11 points in the starboard system. Additional vents are also provided in the N.B.S. static system. The location of all drains is shown in fig.2.

PRESSURE HEADS

17. Two electrically-heated pressure heads, Mk.9, (after Mod.828 pressure heads Mk.9E are fitted) are installed, one at each wing tip. Each pressure head is secured by two clamps inside a short boom projecting from the wing tip leading edge. The forward clamp takes the form of a screwed ring and collet, and is situated inside a cover at the forward end of the boom. The rear clamp is a round diaphragm, which is split at one side and tightened by a round-headed bolt. Access to the bolt is provided by a hole in the skin of the structure which is located inside a removable panel. The panel also provides access to the pitot-static pipe unions within the boom and to a plug and socket which connects the wiring to the heating element.

18. The heating elements of the pressure heads are controlled by their respective 2-position switches located on the starboard console (7P) in the cabin. Two magnetic indicators on the pilot's panel (1P) will be energized to show ON when the pressure heads are switched on. A routing chart of the circuit is contained in fig.3, and a full description of the Mk.9 electrically-heated pressure heads is given in A.P.1275B, Vol.1, Sect.1, Chap.17. On aircraft where Mod.336 has been embodied, the Mk.9 pressure head is replaced by Mk.9C.

INSTRUMENTS

19. The instruments installed on the first pilot's panel which are supplied by the port system are connected as follows:-

Pressure - A.S.I. and machmeter

Static - A.S.I., machmeter, altimeter and rate-of-climb indicator

A duplicate set of these instruments is installed on the second pilot's panel, and supplied by the starboard system.

20. The instrument panels are provided with anti-vibration mountings. The supply pipes connecting the instruments are joined to each system with flexible rubber tubing.

NAVIGATOR'S INSTRUMENTS

21. Fitted to the plotter's instrument panel at the navigation station is an air speed indicator and an altimeter. The panel is secured by anti-vibration mountings and rubber tubing connects the instruments to the starboard system. A darkened perspex front is fitted to the panel to diffuse the panel lighting to the instruments.

AUTO MACH UNIT

22. An auto mach unit. Ref.No.6S/108, is mounted in the cabin, below the crew's floor at the navigation station. The unit is connected to the port pitot-static system by the usual flexible pipes, and forms part of the mach trim control installation. Further details of this installation will be found in Group 3 of this Chapter.

ARTIFICIAL FEEL MASTER TRANSMITTERS

23. Three of these units are installed on the starboard side of the bomb bay adjacent to former 225. The transmitters are connected to the port pitot-static system main piping by flexible rubber tubing and a distribution block Type 174/S.1984, The distribution block is equipped with drain pipes. The master transmitters are employed in the artificial feel failure warning system, further information for this system will be found in Group 6, Chap.1 of this Section.

ARTIFICIAL FEEL UNITS

24. Three artificial feel units, situated towards the rear end of the bomb bay, are connected to the starboard pitot-static system by flexible tubing. These units are linked to the flying control push-pull rods and their action is controlled by actuators operating in conjunction with a transmitter unit which is sensitive to airspeed. Further information on the artificial feel units will be found in Group 5.

V.G. RECORDER (MOD.454)

25. A V.G. recorder is fitted in the bomb bay on the starboard side of bomb arch 123, and connected to the starboard pitot-static system. This instrument automatically records the accelerations imposed on the aircraft simultaneously with indicated air speed. The recorder is connected to the pitot-static system

by a 4-way cock mounted alongside the recorder. When the cock is turned to OFF, the connections are closed to the pressure and static lines and the recorder is isolated from the pitot-static system. Further information on the V.G. recorder is given in Group 5. On aircraft where Mod.454 is not embodied, the V.G. recorder is fitted on the port side of the cabin adjacent to the navigator's table.

AIR MILEAGE UNIT

26. An air mileage unit, Mk.4B, is fitted below the starboard engine air intake, and is connected to the starboard pitot-static system by flexible tubing. The A.M.U. is operated from a control panel at the navigator's station, and the installation is used in conjunction with the N.B.S. Further details of the A.M.U. will be found in Group 6 of this Chapter. On aircraft where Mod.424 (with Mod.58) is embodied, the static pressure line to the A.M.U. is fed from the static vents in the nose.

AIRSPEED PRESSURE SWITCH

27. An airspeed pressure switch, Type T.P.5099, mounted on the starboard side of the bomb bay aft of the front spar, is directly connected to the starboard system. The pressure switch forms part of the bomb fuzing and release circuit described in Chapter 1 of this Section. Further details are also given in Group 6 of this Chapter.

T.4 BOMBSIGHT

28. On aircraft where Mod.108 has been embodied, a T.4 bombsight installation is fitted, and pitot-static supply from the starboard system is connected to the bomb-sight computor, below the second pilot's floor. Further information of the T.4 bombsight will be found in Group 6.

AIRSPEED MONITOR

29. An airspeed monitor, connected in the yaw damper portion of the autostabilizer controls, is fitted to a panel beneath the port side of the crew's floor. The airspeed monitor is connected to the starboard pitot-static pipe-lines. Further information on the autostabilizer controls will be found in Group 2.

AUTO HEIGHT SWITCH

30. This unit forms part of the pitch damper and auto-mach trim portions of the auto stabilizer installation, and is supplied with Static pressure only from the starboard system. The auto height switch is installed on the starboard side of the bomb bay adjacent to bomb arch 64.5 further information will be found in Group 2.

AUTO HEIGHT UNIT

31. The auto height unit, which forms part of the auto mach trim system is installed on the starboard side of the bomb bay, adjacent to bomb arch 44.5. The unit is connected to the static line only of the starboard system. Further information will be found in Group 2.

AUTOPILOT

32. The autopilot Mk.10 installed under the pilot's floor is connected to the starboard static line only. The installation is described in Group 3.

FATIGUE METER

33. On aircraft where Mod.374 is embodied, a fatigue meter pressure switch is fitted in the bomb bay adjacent to bomb arch 95.9. This switch is connected to the starboard pitot-static pipe line. Further details on the fatigue meter installation will be found in Group 5.

ZERO READER

34. On aircraft where Mod.353 is embodied, a Zero Reader flight director system is installed. Static supply for the computor portion of this system is obtained from the starboard system. Full details of the Zero Reader installation will be found in Group 7 of this Chapter.

SERVICING

PITOT-STATIC TESTS

35. The system should be tested for leaks when the piping is disturbed or any part of the installation is suspect, as laid down in A.P.1275B, Vol.2, Part 1, Leaflet A8. Accumulation of moisture in the systems due to adverse weather conditions should be dried out in accordance with A.P.1275B, Vol.2, Part 1, Leaflet A2.

36. Mod.582 introduces plugs for the static vents (Mod.58) in the nose. These plugs will form part of the aircraft tool kit.

DRAIN PIPES

37. Drain pipes and plugs should be removed to allow moisture to drain out of the systems at intervals stated in the servicing schedule and when it is suspected that moisture has collected in the systems. Access panels are provided, one at each wing tip and one adjacent to the A.M.U.; the eight other drain pipe positions are easily accessible.

PRESSURE HEADS

38. The pressure heads should be examined visually to ensure that the pitot and

static orifices are free from obstruction. It is important that no sharp metal tools be used for clearing the orifices, since enlargement or burring of these will render the pressure head unserviceable.

39. Functional testing of each heating element should be carried out by placing the appropriate control switch on the pilot's starboard console (7P) to ON, and checking that the pressure head begins to warm up. The head must be switched off when it becomes too hot to hold with the naked hand, otherwise the element may be damaged through overheating in still air.

40. When the aircraft is not required for flight, protective covers should be placed over the pressure heads. Full servicing instructions for the pressure heads Mk.9 and 9C will be found in A.P.1275, Vol.1, Sect.1, Chap.17; the Standard Serviceability Test (S.G.7) is contained in Appendix 1 of the same chapter.

REMOVAL OF COMPONENTS

General

41. It is important that due care and attention be exercised when instruments are being disconnected and the associated panels are removed. Instruments should be handled carefully at all times and jarring avoided. This applies particularly to gyroscopic instruments where the mechanism is delicately balanced. Removal instructions for the various instruments are contained under the group heading where they are described. The following paragraphs deal with the flight instrument panels and pressure heads.

PILOT'S INSTRUMENT PANELS

42. The pilot's centre panel is secured at each side to an attachment bracket on each pilot's flight instrument panel. The two fastening studs must therefore be unscrewed to release the centre panel before the other two panels can be removed.

43. The flight instrument panels can be detached from the resilient mounting brackets by unscrewing the three fastening studs in each case. Should any difficulty be experienced in the removal of any of the instruments on the second pilot's flight instrument panel, the following procedure is recommended:-

(1) Remove the nut and bolt securing the second pilot's rudder pedal adjustment knob (the nut and bolt are located immediately behind the knob).

(2) Remove the adjustment knob from its tube.

(3) At the support brackets behind the instrument panel, disconnect the two pitot-static pipes clipped to the flexible rubber tubing. (These operations will allow the panel to be released without obstruction).

(4) Remove the two bolts securing the centre instrument panel, the panel can now be swivelled downwards to its fullest extent. It is important at this stage that a suitable strain cord is employed to take the weight of the panel.

(5) Remove the three attachment bolts from the second pilot's panel and withdraw the panel to a convenient position, ensuring that no undue strain is placed on the cables and connectors. The instruments should now be accessible for disconnection and removal.

PLOTTER'S INSTRUMENT PANEL

44. The plotter's instrument panel is fixed to the plotter's main panel by four brackets on resilient mountings. Access to the back of the instrument panel is gained when the main panel is unscrewed at the top and lowered. When the necessary instrument services have been disconnected, the instrument panel can then be unbolted at the resilient mountings and removed complete with perspex front.

PRESSURE HEADS

45. When it is required to remove a pressure head unit, the electrical and pitot-static services must be disconnected, and the two internal clamps loosened. The recommended procedure is as follows:-

(1) Unscrew and remove the access panel on the boom.

(2) Uncouple the pitot-static pipes and disconnect the electrical plug and socket.

(3) Loosen the rear clamp by inserting a screwdriver in the access hole provided, and turning the bolt head.

(4) Unscrew and remove the cover at the forward end of the boom.

(5) Unscrew the clamping ring from the collet.

(6) Withdraw the pressure head carefully from the boom.

46. The fitting of a pressure head is carried out by reversing the procedure outlined in para.45. It is important in this operation that the line marked TOP on the head should be visible in the top slot of the collet before screwing up the clamp.

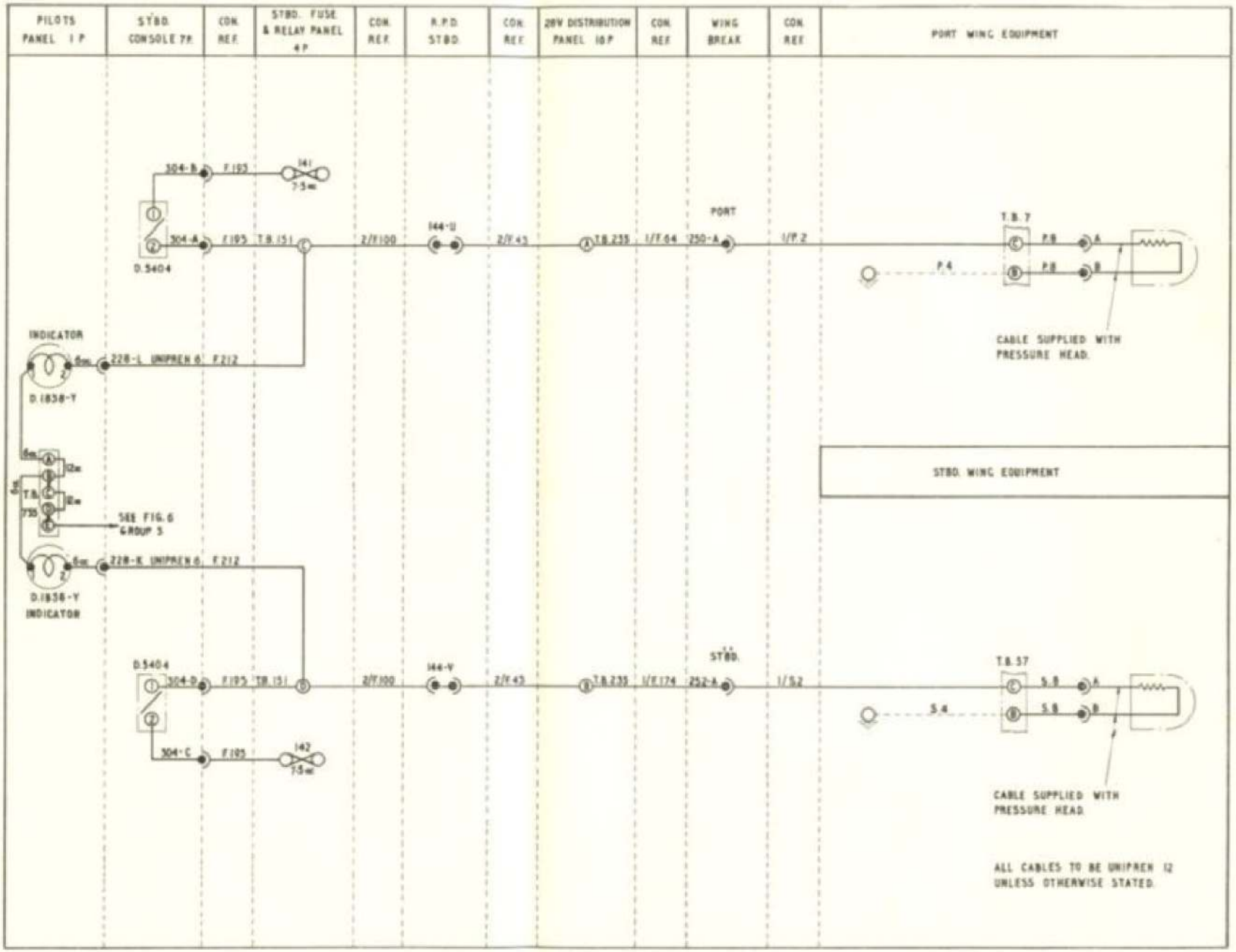

Fig. 3 Pressure head heating

RESTRICTED