Chapter 10
OXYGEN SYSTEM

(completely revised)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

Introduction

1. This chapter contains a description of the oxygen system installed in the aircraft and provides information on certain servicing and functioning checks which are carried out in-situ. Additional information on the system components is given in A.P.1275G, Vol.1 and 2.

WARNING . . .
Cleanliness is essential when dealing with the oxygen system as many materials, particularly oil and grease, ignite spontaneously when exposed to undiluted oxygen under pressure. Failure to comply with this instruction could result in an explosion causing loss of life or injury to personnel and/or damage to equipment.

DESCRIPTION

General

2. The oxygen system diagram and installation illustrations fig.1 and 2 show the basic oxygen system. Subsequent to Mod.668, six oxygen cylinders are removed from the power compartment and installed - three each side - in the bomb bay. Change brought about by the embodiment of Mod. 748, include removal of three oxygen pressure regulators and the two pressure gauges from the panels facing the rear crew members seats and repositioning

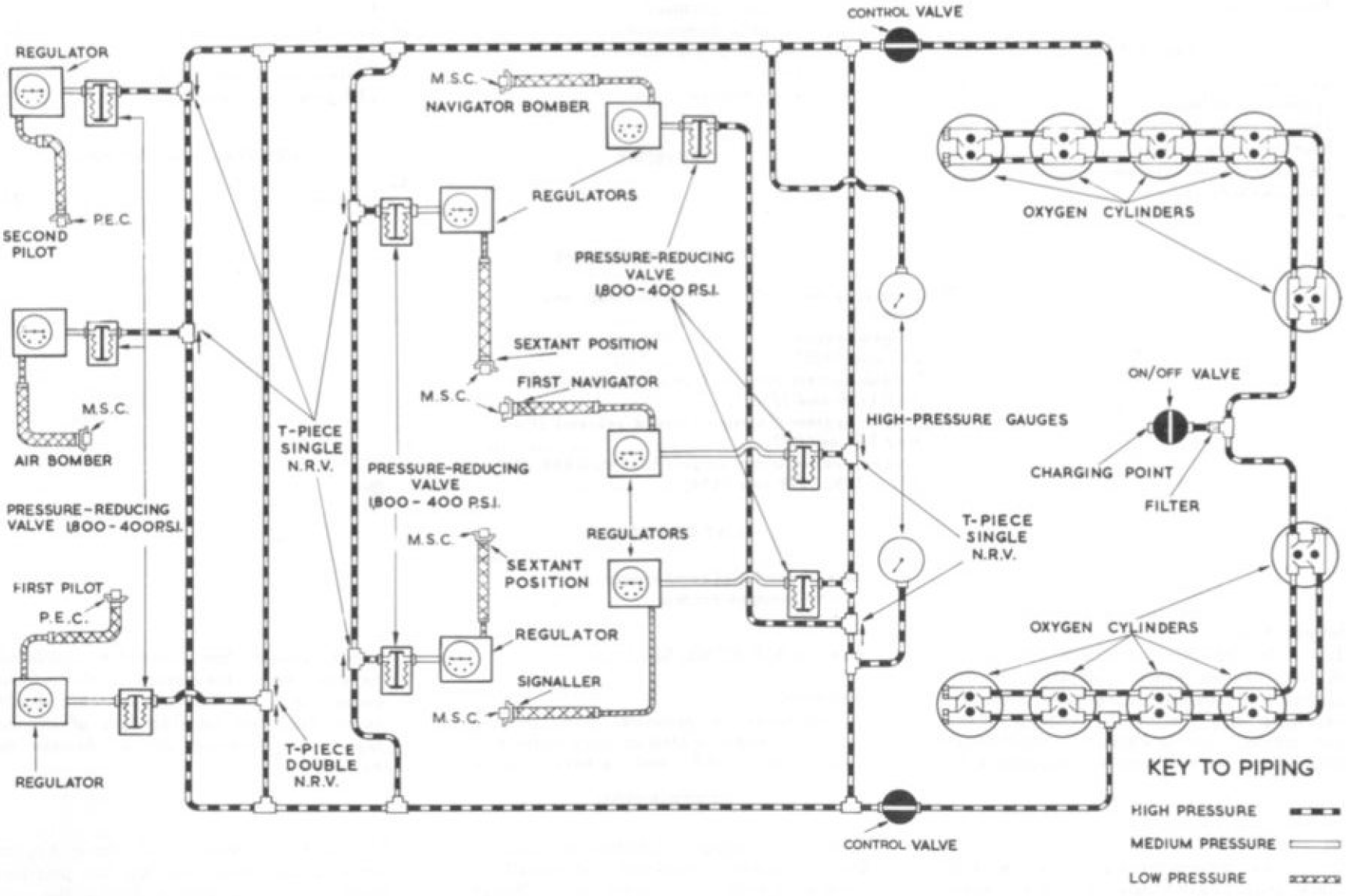

Fig. 1. Oxygen system diagram (Pre - Mod. 668 & 1159)

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them, face down, in the roof above the table. In this attitude, the regulators fail to meet the oxygen delivery requirements and Mod.1159 was raised to introduce pressure relief valves in the low pressure systems of the stations concerned. When Mod.897 is embodied, two additional 2,250 litre cylinders are fitted - one each side of the bomb bay. This increased storage facility is provided to enable pressure jerkins to be used over a longer period and, at the same time ensure that adequate supply is available to inflate the jerkin in the required time should the cabin become deflated at altitude. Post Modification system changes are shown in the diagram and installation illustrations fig.3, 4 and 5.

3. When Mod.1378 is embodied, Mk.21 and 21A type oxygen regulators are removed and replaced with Mk.21B type regulators. This regulator incorporates a pressure relief valve and a new injector assembly. The introduction of swivel and sliding seats at the rear crew positions (post Mod.1696) necessitates some re-arrangement of the low pressure oxygen system pipes in the vicinity of the seats. The floor mounted connectors are repositioned and mic./tel. oxygen hose wander lead assemblies with Q.R. connectors are fitted (M.S.C. type units previously deleted by Mod.1801).

NOTE . . .

Certain aircraft have been allocated for the application of S.O.O. Mod.No. 1961. When this modification is embodied, Mk.17F type oxygen regulators (Ref.No. 6D/2671) replace the Mk.21B type regulators now in use.

SYSTEM INSTALLATION

4. Subsequent to Mod.668 and 897, oxygen is carried in twelve wire-bound cylinders, four in the rear of the power compartment and four on each side of the bomb bay. Five-way connector heads incorporating non-return valves are fitted to all cylinders to prevent oxygen from flowing out of one cylinder into another. Special T-piece connectors, also containing non-return valves, are used to connect the cylinder storage system pipe to the two main cabin supply pipes. These connectors are positioned in such a manner that, in the event of damage to the pipes, leakage will be confined to one section of pipes or one group of cylinders. A charging valve and ON/OFF valve are mounted on the starboard support leg of the platform at the rear of the power compartment.

TABLE 1

List of principle components in oxygen system

Component	Mk.	Ref. No.	Qty.
Cylinder, oxygen	10A	6D/9429900	12
H.P. master valve	-	6D/2313	3
Filter, pipe-line	-	6D/574	1
Valve, non-return	1	6D/427	16
Gauge, pressure	4	6D/2237	2
Valve, pressure-reducing	-	6D/2344	8
Adapter, regulator inlet	-	6D/1647	4
Regulator, oxygen	21B	6D/2383	8
Regulator, oxygen (post Mod.1961)	17F	6D/2671	8
Valve, pressure relief	-	6D/2454	3

From the charging valve a single pipe connects to the filter branch of a special T-piece, the remaining branches of which connect to the charging system for each bank of cylinders. By this means all cylinders are charged simultaneously in-situ. For supply purposes, the cylinders on each side of the aircraft, i.e., four in the bomb bay and two in the power compartment, form one bank of cylinders which feed into the high pressure supply pipe on that side of the aircraft. These two pipes go forward to supply the controlled system in the crew's compartment.

High pressure system

5. From each bank of cylinders, separate high pressure supply pipes, pass along the bomb bay to a point just forward of former 44·592 where both pipes are turned outboard and routed forward along the air-intake ducts. After passing through the front spar, the pipes enter the crew's compartment through the rear pressure bulkhead. A master control valve is interposed in each pipe at this point, the pipes then continue forward along each side of the cabin and join at four positions, to interconnecting pipes which incorporate special non-return valve type T-piece connectors. The branch pipe from each T-piece connects to one of eight pressure reducing valves which supply oxygen at medium pressure to the regulator at each crew member's station.

Medium pressure system

6. The medium pressure system consists of the connecting pipes between each pressure-reducing valve and its associated oxygen pressure regulator. Individual supply to each regulator ensures that adequate pressure is available for rapid inflation of the pressure suit should the cabin become deflated at altitude. Normally oxygen at a pressure of between 200 and 400 p.s.i. is contained in these pipes.

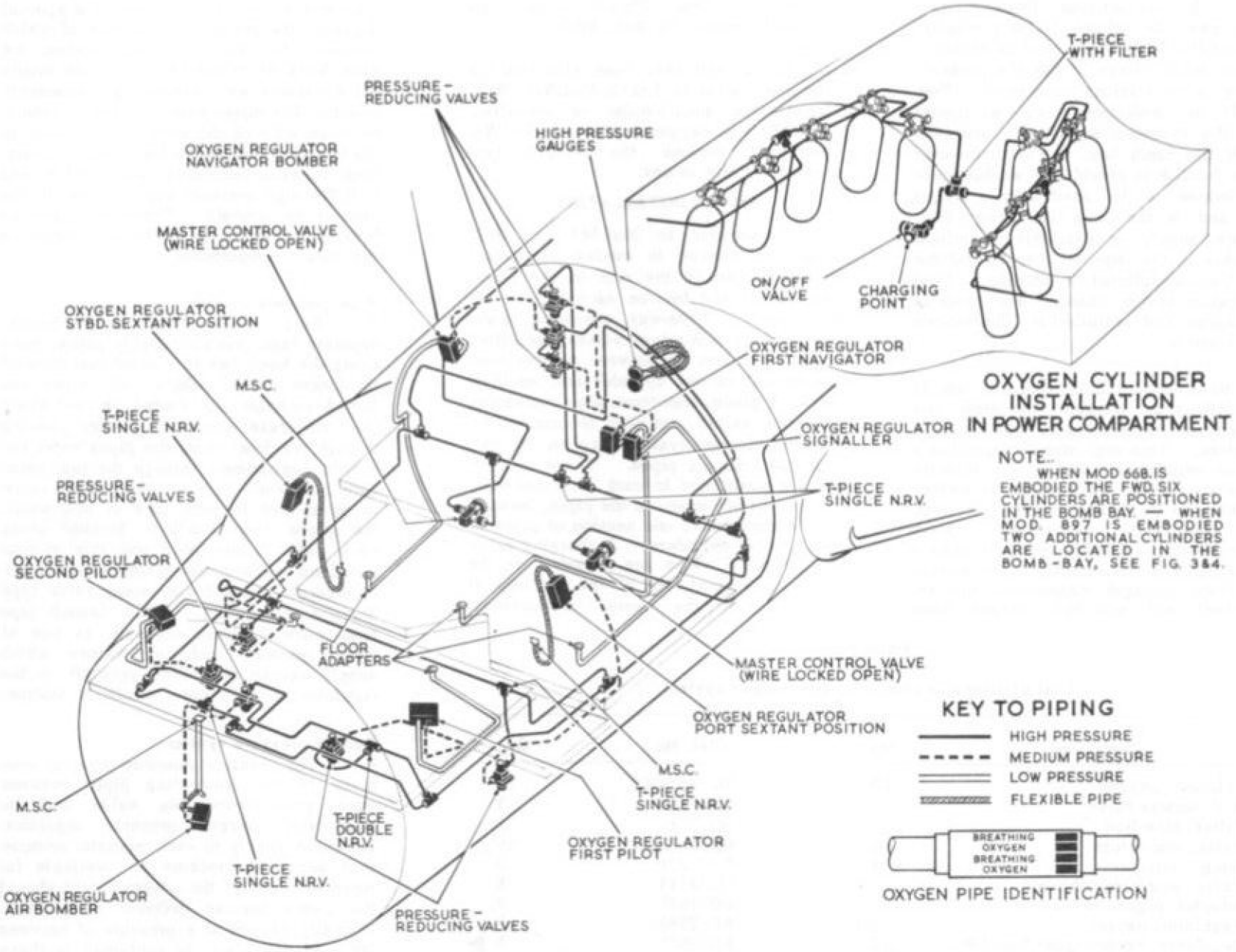

Fig. 2. Oxygen system installation (pre - mod. 668, 748, 897 & 1159).

Low pressure system

7. Both rigid and flexible pipes are included in this part of the system. Oxygen from the regulators is conveyed through rigid pipes to connectors in the floor adjacent to the individual crew members seat. From the connector at each pilot's station, a flexible pipe leads to the personal equipment connector (P.E.C.) on the ejection seat; flexible tubing leads from the P.E.C. to the pilot's face mask, and connected to this tubing is the emergency oxygen supply contained within the seat emergency set. From the floor connectors at the rear crew members station, oxygen is supplied to the user through mic/tel-oxygen hose wander lead assemblies which terminate in Q.R. connectors to mate with connectors on the users equipment. When not in use these Q.R. connectors are stowed on blanking plug stowage connectors, mounted on the roof structure above the seats. A similar type of wander lead is provided at the air-bomber's station and at the sextant reading positions.

CONTROLS AND INDICATORS

8. Subsequent to Mod.1378, Mk.21B type oxygen pressure regulators are fitted at all crew stations. Each regulator incorporates a pressure gauge registering supply, a doll's eye magnetic indicator which operates in phase with the users breathing cycle, a four position manual selector for oxygen flow control, an air inlet valve control lever and an ON/OFF valve control lever. Note that this ON/OFF lever must be locked in the ON position with 28 s.w.g. copper enamelled wire Ref.No. 5E/9102399.

9. Additional dolls' eye type indicators are provided at each crew members station, located in the instrument panel facing his normal post or on an adjacent panel within his vision range.

10. Two oxygen contents gauges, one to each bank of cylinders, are mounted face downward in the roof above the navigator's table. These gauges register delivery pressure in the pipes between the master ON/OFF switch and the pressure reducing valves in the cabin system.

11. The two master control valves are interposed in the main high-pressure supply pipes - one on each side of the cabin - and are mounted on the support struts of the crew's floor. Note that these valves must be wire-locked in the ON position at all times, other than when servicing operations involving their use are in progress.

General

15. Servicing of the high-pressure components is detailed in A.P.1275G, Vol.1.

FUNCTION CHECKS

System pressure tests

16. The high pressure pipes are pressure tested at 1 800 lb/in^2, the medium pressure pipes at 450 lb/in^2, the test pressure being held for 20 minutes in each case. There must be no leaks.

Cabin N.R.V. check

17. A functioning check on the N.R.V's in the pressure cabin can be conducted as follows:-

(1) Charge the system until both contents gauges indicate ¾ full, then unlock and turn both master control valves to the OFF position.

(2) Exhaust the oxygen from that part of the system between master valves and regulators and check that both contents gauges show zero.

SERVICING

DESCRIPTION OF COMPONENTS

Equipment (high-pressure)

12. The high-pressure equipment used in the system is available from stores as designated in Table 1 and is fully described in A.P.1275G, Vol.1, Regulators.

13. The demand oxygen and inflation regulator is designed to deliver a metered supply of oxygen in accordance with the physical demand of the user. The regulator will supply a specified pressure suit at altitudes of up to 56 000 ft. In the event of cabin depressurisation the suit will give protection to the wearer while the appropriate action is taken to descend to a safe altitude. Prior to Mod.1378, Mk.21A type regulators are fitted, subsequent to the modification Mk.21B type regulators are fitted at all stations. Regulators are described in A.P.1275G, Vol.1, Sect.2, Chapter 15.

Emergency oxygen

14. One emergency oxygen set is installed in each ejection seat and is operated automatically when the seat is ejected; the supply is, however, available in an emergency when the seat is not ejected. A manually-operated pull-off knob is located at the inboard side of each ejection seat, and when pulled releases the oxygen in the emergency pack and allows it to flow to the face mask.

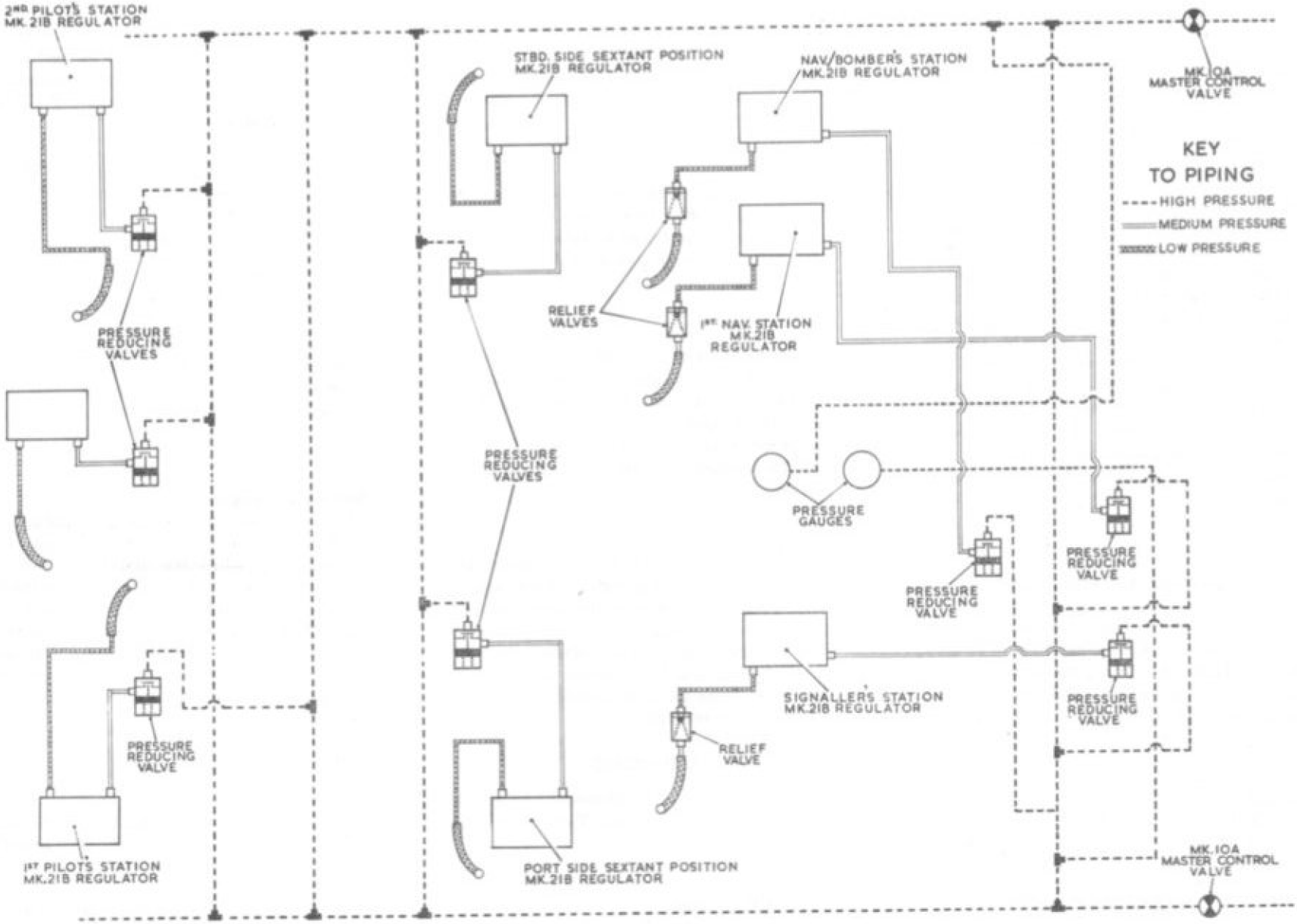

Fig.3. Oxygen system diagram - crew compartment
(Post-Mod. 1159 & 1378)

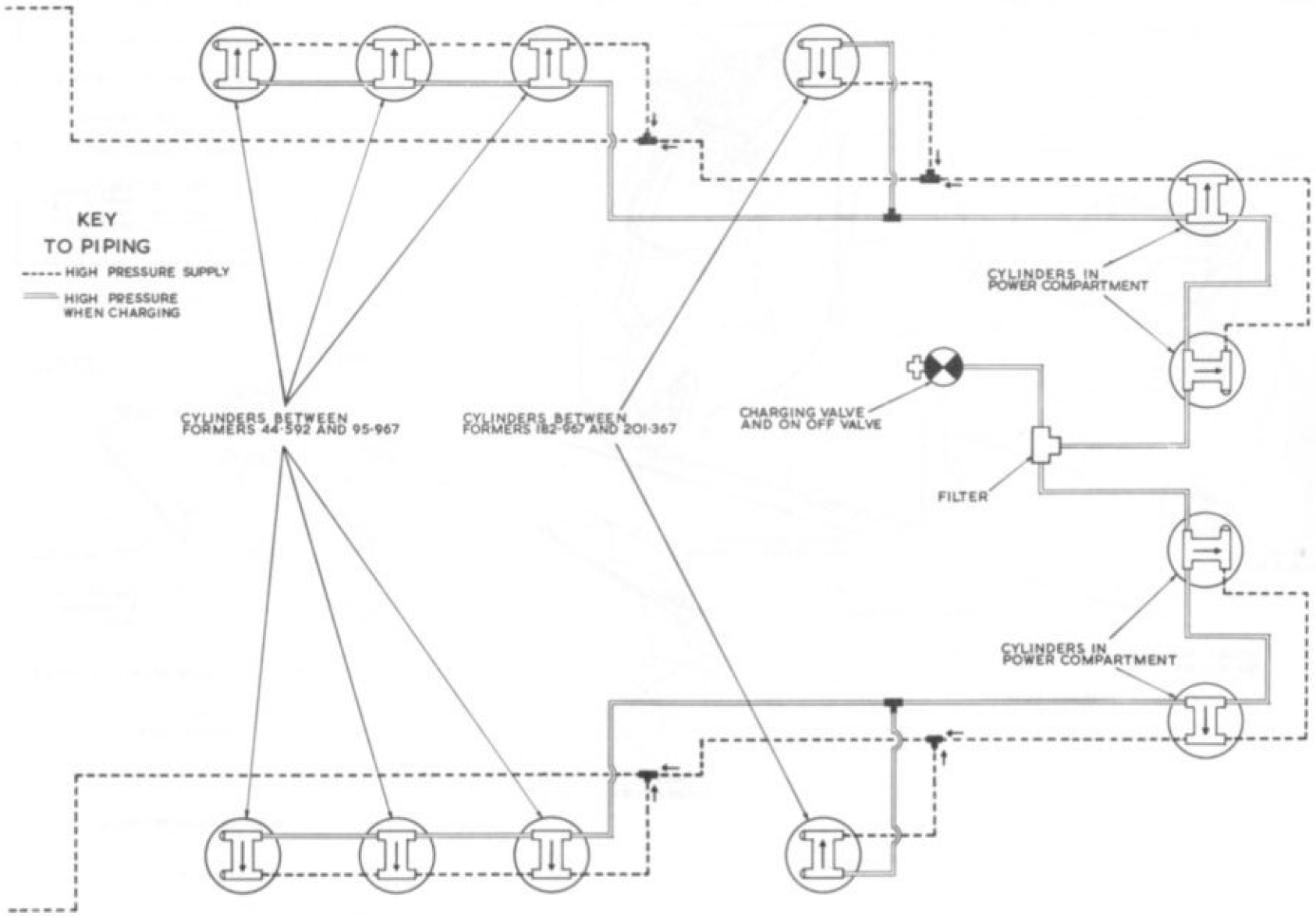

Fig. 4. Oxygen system diagram - storage system
(Post-Mod 668 897)

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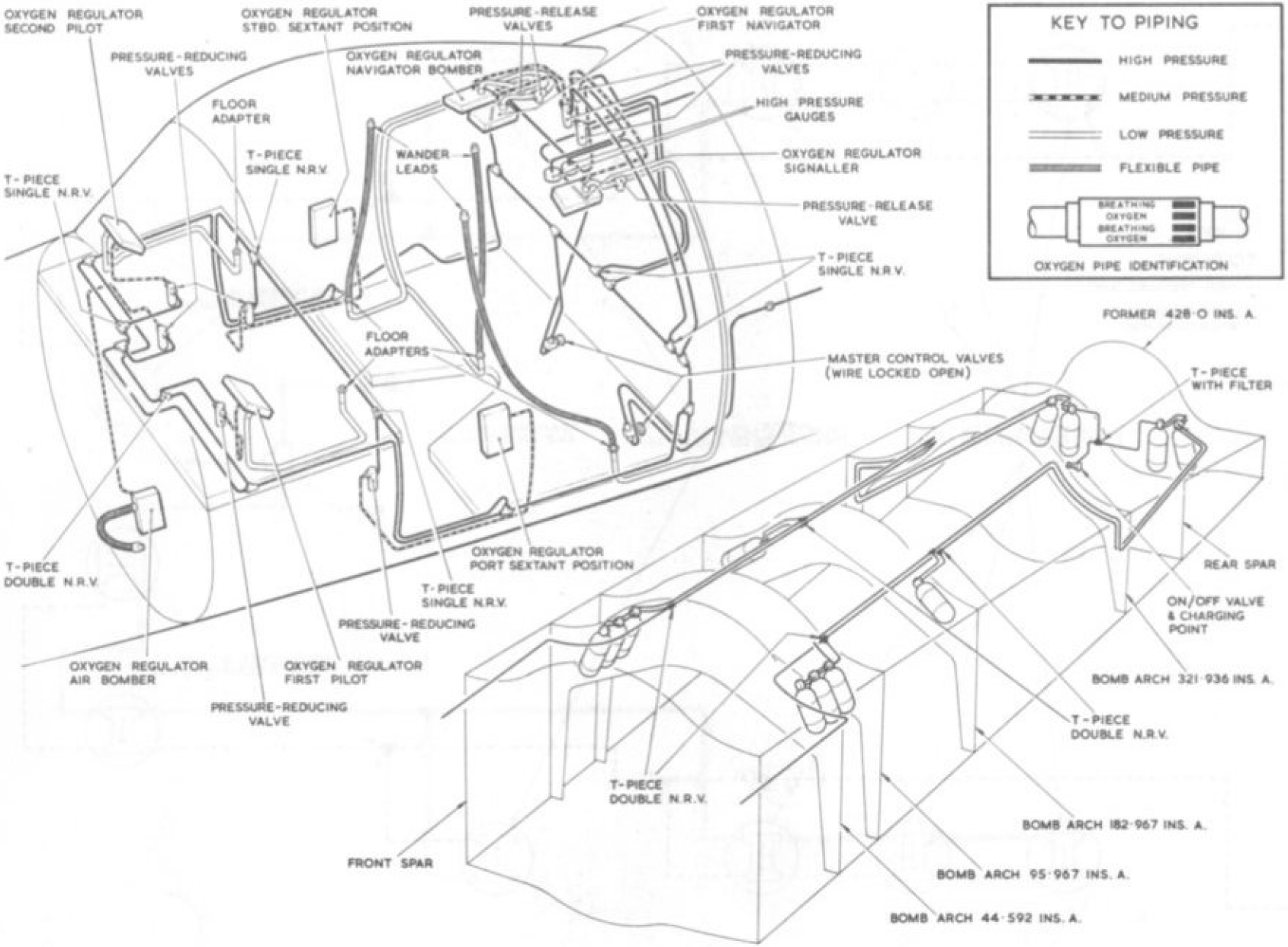

Fig. 5. Oxygen system installation (Post-Mod. 668, 748, 897, 1159, 1378 & 1696)

(◄H.P. pipe lines corrected►)

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(3) Disconnect the pipe from the outlet side of the port master valve and connect the flowmeter Mk.5A Ref. No. 6C/475 to the disconnected pipe.

(4) Turn the starboard master valve ON and check that the flowmeter indicates a flow of less than 12 litres per minute. This is the maximum permissible leak rate for the group of N.R.V's (see (10)).

(5) Turn the starboard master valve OFF, disconnect the flowmeter and reconnect the pipe to the port master valve.

(6) Exhaust the system as in (2) then disconnect the pipe from the outlet of the starboard master valve and connect the flowmeter to the pipe.

(7) Turn the port master valve ON and check indicated flow as in (4).

(8) If the results of these checks are satisfactory, turn the port master valve OFF, disconnect the flowmeter and reconnect the pipe to the starboard master valve.

(9) Turn both valves ON and wire-lock.

(10) If the flowmeter indicates a flow in excess of the permissible leak rate, each N.R.V. must be checked in-situ to determine which valve or valves fail to meet the requirements of the table given:-

Applied pressure lb/in^2	Maximum permissible leakage through one N.R.V.
1 000 - 1 200	2.0 litres per minute
1 200 - 1 400	3.0 litres per minute
1 400 - 1 600	4.0 litres per minute
1 600 - 1 800	5.0 litres per minute

(11) If the N.R.V's prove satisfactory, then the leak must be traced; it will be necessary to test the joints and all connections in the system involved, using one of the following:-

(a) Sherlock, Type 1, Ref.No. 33C/1788 for temperature range +35 to +160 deg F.

(b) Sherlock, Type 2 for temperature range –65 to +35 deg F.

(c) Snoop: Real Cool Snoop for temperature range –65 to +35 deg F.

NOTE . . .
It is found that leakage is generally caused by dirt on the nipple or branch mating face; this is remedied by cleaning and de-greasing the faulty fitting. There must be no external leaks, therefore, if the leak still persists, a renewal will be necessary. On completion of the checks the remains of the solution should be removed with a clean, non-fluffy, lint-free cloth.

System functional check

18. A system functional check can be carried out, in-situ, as follows:-

(1) Unlock and turn both master valves OFF. Select the ON/OFF valve of one regulator to the ON position and set the manual selector to JERKIN TEST to exhaust any oxygen remaining in the system. When pressure in the system is exhausted, return the manual selector to NORMAL.

(2) With the system fully charged turn ON the port side master valves; check that the appropriate contents gauge registers zero.

(3) Place the first pilot's regulator ON/OFF switch to the ON position and check that the gauge of the regulator indicates a pressure of 200 - 400 lb/in^2.

(4) Set the first pilot's regulator control arm to the OFF position and exhaust the trapped oxygen by setting the manual selector to the JERKIN TEST position. After releasing trapped oxygen return the manual selector to the NORMAL position.

(5) Repeat items (3) and (4) for each regulator in turn.

(6) Check that the operating pressure gauge reading remains constant for a period of 20 minutes. This serves as a leak test for one half of the system.

(7) Turn the master valve OFF and release pressure remaining in the system by operating one of the regulators.

(8) Turn the starboard side master valve ON; check the appropriate contents gauge for zero reading, then repeat items (3) to (6) inclusive.

(9) On completion of tests, wire-lock the master valves in the ON position and wire-lock the control lever on the regulators for the first pilot, air bomber, navigator/bomber and first navigator in the ON position.

CHARGING THE SYSTEM

19. The oxygen charging trolley, Mk.2 Ref.No. 4GD/4220, is fully described in A.P.1464G, Vol.1, Part 2, Sect.5, which also contains a description of the procedure to be adopted when charging oxygen cylinders in-situ.

REMOVAL AND ASSEMBLY

General

20. No specific instructions for removal are necessary. Precautions to be observed when uncoupling oxygen system pipe lines or dismantling generally are contained in A.P.1275A, Vol.1, Sect.8.

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