

## Chapter 11

### AIR-VENTILATED SUIT Mk. 1

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#### Introduction

1. Because of the high cockpit temperatures and humidity which occur under certain operational conditions, some means of cooling the body is essential both on the ground and in flight.

2. This requirement has been satisfied by the introduction of an air-ventilated suit which is supplied with conditioned air from aircraft or ground supply sources. The suit provides evaporative cooling and enables the wearer to withstand high ambient temperatures and humidities more comfortably than would otherwise be possible.

3. In addition to describing the suit and its servicing, this chapter will also include information concerning air supply requirements and systems.

#### AIR-VENTILATED SUIT, Mk. 1

##### Description

4. The suit (*fig. 1 and 2*) is an overall type of garment which covers the trunk and thighs. It consists of a lightweight nylon fabric overall which carries an air inlet tube connected to a system of manifolds and P.V.C. tubes, terminating in jets located in

the main sweat areas of the body. The suit is fastened in front of the body by tapes.

5. For identification, the ventilating system of the suit has been divided into two sections referred to as "primary manifold and supply tubes" and "secondary manifolds and supply tubes". The primary manifold (*fig. 3*) has six outlet ports each of which is connected to a length of large bore P.V.C. tubing; the other ends of these tubes are connected to the secondary manifolds, of which there are six, and from there, air is carried through small bore tubes to jets through which it is sprayed or blown over the body.

6. Each of the secondary manifolds has sixteen outlet ports and since each port is connected to a separate length of tubing there are 96 jets through which air flows to the body.

7. The positioning of the manifolds and tubing serves two purposes. It ensures a free passage for the air by eliminating sharp bends and it is so placed in relation to the general lines of the suit that the possibility



**Fig. 1. Air-ventilated suit, Mk. I : front view**

of crushing the tubes when the wearer sits down is largely eliminated. The tubing is retained in position by being threaded through specially prepared tapes stitched to the overall, and by stitching; the jets

are covered with tape to prevent skin irritation.

**8.** The suit is available in the following sizes.

Size	Stores Ref. 22G/	Height		Chest (under jacket)	Waist (under trousers)	Seat (under trousers)
		ft.	in.			
1	1465	5	0	32 to 35	27 to 31	33 to 36
2	1466	5	3	36 to 40	32 to 36	37 to 40
3	1467	5	4	33 to 36	28 to 32	34 to 37

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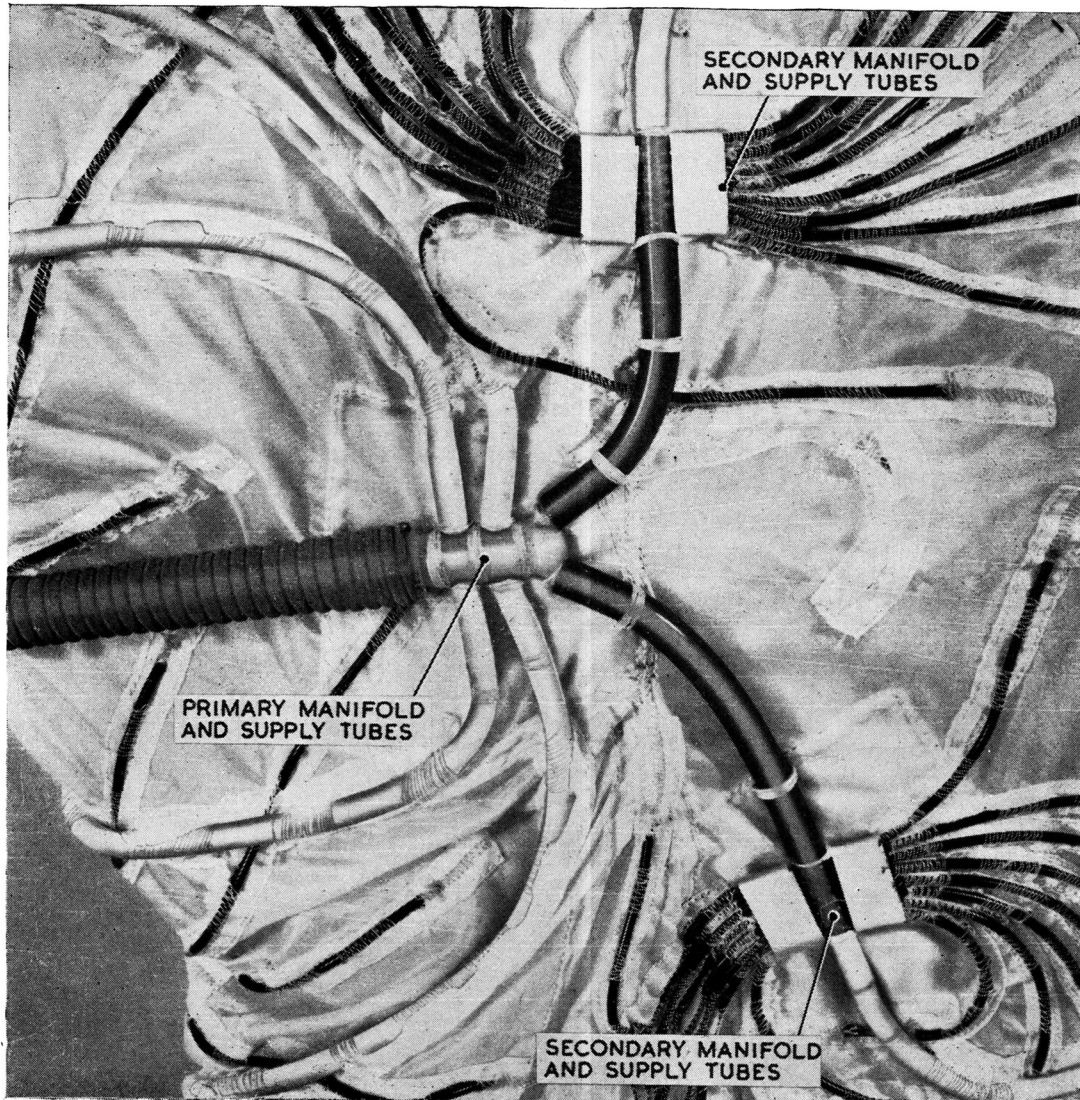


Fig. 2. Air-ventilated suit, Mk. I : rear view

Size	Stores Ref. 22C/	Height ft.	Height in.	Chest (under jacket)	Waist (under trousers)	Seat (under trousers)
4	1468	5	7	37 to 41	33 to 37	38 to 42
5	1469	5	8	34 to 37	29 to 33	36 to 39
6	1470	5	11	38 to 41	34 to 38	40 to 43
7	1471	6	0	35 to 38	30 to 34	37 to 40
8	1472	6	3	39 to 42	35 to 39	41 to 44

**RESTRICTED**

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**Fig. 3. Enlarged view of manifolds and tubes**

#### **Fitting and wearing**

**9.** The suit is intended to fit loosely over a string vest and a pair of short cotton drawers (*Stores Ref. 22C/1475 to 1478*), the tapes by which it is fastened allowing for variations in girth. Comfort is the main consideration when selecting a size, since the effectiveness of the suit is not seriously impaired if it is a little too large or too small.

**10.** Although designed primarily for wearing over a string vest and underpants, the suit may be worn over a partial pressure suit and can also be worn under the partial pressure suit or the anti-G suit Mk. 4.

Generally, all other clothing is worn over an air-ventilated suit, but it may be necessary to modify certain garments to provide an opening for the air inlet tube.

**11.** Since the suit is permeable to water vapour it can, if necessary, be worn for many hours without air supply and without great inconvenience to the wearer, provided conditions are not extremely hot.

#### **Handling**

**12.** Care is to be exercised when handling the suit, particularly in cold weather when



the P.V.C. tubing tends to harden and so become more susceptible to damage, either cracking or fracture.

#### Air supply requirements

**13.** The following information concerns flow, pressure, and conditioning of the air supply for the aircraft or ground supply sources. The figures quoted refer to conditions at the inlet coupling of each suit.

**Maximum flow.** Measured at 95 deg. F. and cockpit pressure—8.5 c.f.m.

**Maximum pressure.** At maximum flow—7.5 p.s.i.

**Inlet temperature.** Desirable temperature range—80 to 115 deg. F. Maximum permissible temperature range—70 to 130 deg. F.

**Water content.** Preferably less than 7.5 gm. water/cu. metre air, at 95 deg. F. and cockpit pressure. Cer-

tainly less than 15 gm. water/cu. metre air. There must be no free water in the supply air.

**Oil contamination.** There must be no oil contamination.

#### Aircraft/ground air supply systems

**14.** Aircraft and ground air supply systems will not necessarily be standard even for a particular type of aircraft, e.g., all single-seater fighters may not have the same layout. There will, however, be standard components, and the illustrations in fig. 4 and 5 show the recommended layout of installations using standard parts. The actual supply sources and method of conditioning are not shown, since these will vary from aircraft to aircraft.

**15.** Most of the components used require no description, since their function is self-evident. It should, however, be explained

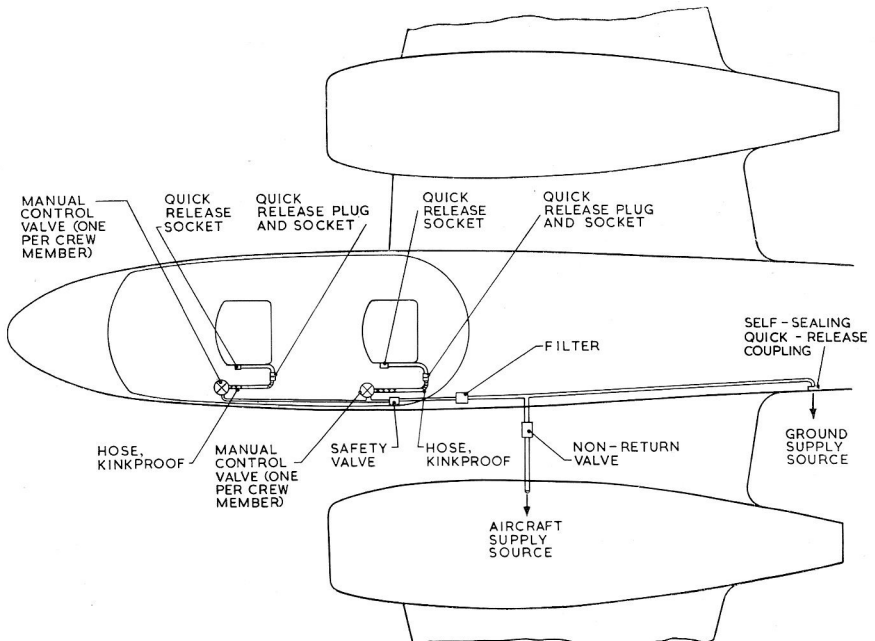


Fig. 4. Air supply installation for two-seater aircraft

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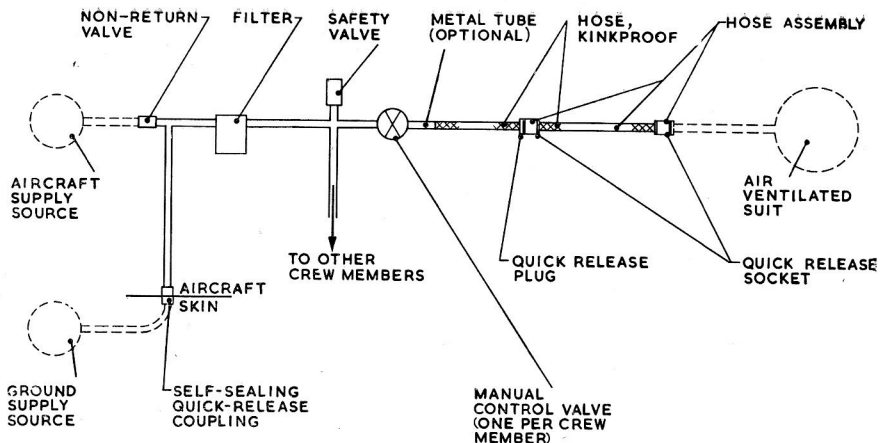


Fig. 5. Air supply installation for multi-seater aircraft

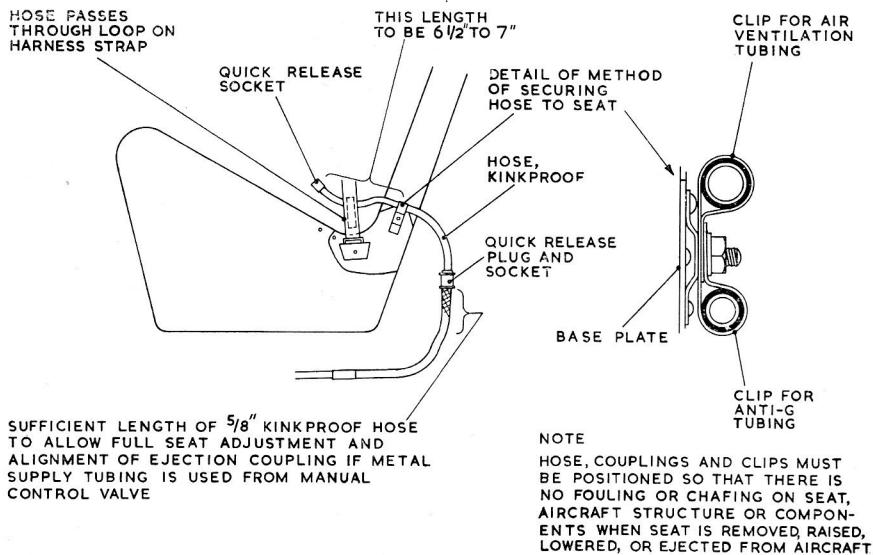


Fig. 6. Arrangement of air supply components at ejection seat

that the pressure of air fed into the suit remains constant, i.e., it is set at the source and cannot be altered by the crew, but each individual crew member can regulate the flow of air into his suit and a manual control valve, provided at each crew station, is there for that purpose.

16. The suit is connected to the air supply system by two quick-release couplings (fig. 6). The first is the crew member's personal connection which he makes on entering and breaks on leaving the seat. The second is the seat to aircraft coupling which automatically breaks when the seat is

ejected or lifted out of the aircraft. A quick-release coupling is also provided between the aircraft and the ground supply hose at a convenient position on the aircraft skin.

#### **Storage**

**17.** A suit is received from the manufacturer packaged; it is folded round a special former which prevents the P.V.C. tubing from being crushed, from kinking and from being damaged in transit. In its packaged state the suit may be stored for long periods under climatic conditions with temperatures ranging from—30 to +130 deg. F.

**18.** When it is removed from its package on receipt at a user unit, the suit should be suspended by its loop or over a coat hanger in a dust-proof cupboard, away from heating apparatus; if a cupboard is not used it should be stored away from heating apparatus and direct sunlight. The temperature and humidity of the store should be similar to that appertaining in a parachute servicing section.

**19.** When stored at temperatures below 32 deg. F., the package containing a suit should be placed in a room temperature of not less than 45 deg. F. for approximately three hours to allow the P.V.C. tubing to become pliable before the suit is handled; if a suit is stored in very low temperatures, or if the room temperature is appreciably above 45 deg. F., the "thawing-out" period will vary from the figure quoted.

#### **Servicing Repairs**

**20.** Only minor repairs are permitted and these are primarily of a "first-aid" nature for use in an emergency. Small holes and tears in the fabric may be darned or patched; cellophane or similar tape may be used for patching.

**21.** Leaks in the tubing may be repaired by treating the damaged area with Durofix and/or binding it with P.V.C. tape. Suits which require extensive repairs, either to the fabric or tubing, are to be replaced by serviceable items.

#### **Cleaning**

**22.** To assist with the cleaning of suits, an air compressor capable of delivering air at a

pressure of 5 to 10 p.s.i. and at a flow of up to 10 c.f.m. is required.

**23.** The suit may be washed in warm, not hot, water using an emulsion detergent (Stores Ref. 33C/1129) as the cleaning agent. To clean the suit proceed as follows:—

- (1) Connect the quick-release plug on the main air inlet tube to the air supply.
- (2) Turn on the air supply, immerse the suit in the solution of warm water and detergent, and maintain the flow of air through the tubes throughout the washing process. The air will assist in producing the kneading or massaging process necessary to remove or "float" the dirt from the fabric.
- (3) When the suit is clean rinse it in clean cold water, maintaining the flow of air through the tubes.
- (4) Hang the suit to dry, by its loop or over a coat hanger, and maintain the flow of air through the tubes while the surface moisture drains off; two or three minutes will normally suffice to clear surface moisture from the suit.

**24.** During the washing and rinsing processes a continuous flow of air will prevent dirt and scum from blocking the jets, it will also ensure that water does not lodge in the tubes. Air pressure should be maintained between 5 and 10 p.s.i. and should not be allowed to exceed 15 p.s.i.

**25.** Suits should be dried naturally, i.e., they should not be placed near heating apparatus or in direct sunlight to accelerate the drying process.

#### **Examination and testing**

**26.** When the suit is unpacked it should be examined for mechanical damage, such as holes, tears, cracked or fractured tubing, and to ensure that the tubing is properly secured. It should then be connected to an air supply delivering air at a pressure of 5 to 10 p.s.i. and at a flow of up to 10 c.f.m.; all the jets should be examined to ensure that air flows through them. Once the suit has satisfied the test it may be repacked or suspended by its loop or over a coat hanger until required.

**27.** At the intervals prescribed by Admiralty or Air Ministry, as appropriate, the suit should be examined for damage and repaired within the limits of para. 20 and 21. If the P.V.C. tubing is fractured or severely kinked the suit should be returned to the Equipment Section labelled "Repairable".

**28.** The following tests are to be applied :—

- (1) Connect the suit to a suitable test rig capable of supplying air at pressures up to 10 p.s.i. and capable of passing and measuring flows up to 10 c.f.m.
- (2) Apply 7·5 p.s.i. pressure to the suit inlet connection and check the ventilating system for leakage using soap solution applied to the tubes, manifolds and other joints. If there is excessive leakage, as evidenced by violent frothing, the suit should be returned to the Equipment Section labelled "Repairable". Minor leakage, identified by

minute frothing, may be reduced by effecting repairs as described in para. 21.

- (3) Apply 7·5 p.s.i. pressure to the suit inlet connection and check that there is a full flow of air from each of the 96 jets. If there is little or no flow from four jets in any one manifold, or from eight or more jets over the whole system, the suit should be returned to the Equipment Section labelled "Repairable".
- (4) Apply 7 p.s.i. pressure to the suit inlet connection and check that the flow into the suit is between 8 and 9 c.f.m. free air, measured at room and inlet temperatures of 50 to 70 deg. F. If the flow is outside these limits the suit should be returned to the Equipment Section labelled "Repairable".

**29.** When returning unserviceable equipment for repair, the nature of the unserviceability should be stated on the label.