

## Chapter 1

# PERSONAL OXYGEN EQUIPMENT

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#### Introduction

1. The composition of the atmosphere is uniform up to about 70,000 ft., except that the moisture content falls off rapidly at the greater heights. Although the composition of the atmosphere is stable, however, the pressure becomes progressively lower at altitude, for example, at 10,000 ft., it is about two-thirds of its value at sea level, and at 20,000 ft., it is about half its sea level value. As the pressure decreases, the amount of oxygen absorbed by the lungs decreases. The human body cannot function efficiently unless the amount of oxygen breathed is increased to compensate for the decrease in pressure. At about 40,000 ft., however, the drop in atmospheric pressure is so great that even if pure oxygen is breathed at this decreased pressure, the amount of oxygen absorbed by the lungs is insufficient to maintain life, and some form of pressurisation is required—either a pressurised cabin or pressure-breathing equipment.

2. Basically, an oxygen system consists of one or more cylinders containing oxygen under pressure, a regulator which reduces the pressure of the oxygen and controls the quantity delivered, and a mask through which the oxygen is supplied to the user.

3. Oxygen equipment falls broadly into two classifications—systems based on the

use of an oxygen "economiser," and systems based on the use of a "demand" regulator. Each classification may be further divided into systems which supply oxygen at atmospheric pressure and systems which, in addition to supplying oxygen at atmospheric pressure, can also supply it at a pressure above that of the atmosphere.

4. In the economiser system, the flow of oxygen is determined by a regulator, which is set manually in relation to the height. The oxygen is delivered to the economiser, in which it accumulates until the user breathes in. (The economiser is obviously necessary, as it would be a waste of oxygen to continue to deliver it while the user was breathing out. The economiser acts as a reservoir, and converts the steady flow of oxygen from the regulator to the intermittent flow required by the user).

5. At heights below that at which pure oxygen is used, the flow of oxygen is small and the volume of gas for a full breath is made up by air admitted through a valve in the side of the mask. The economiser itself, which is a flexible storage bag enclosed in a rigid case, is installed in the aircraft.

6. When a pressure-breathing system is required, the economiser is replaced by an inflatable waistcoat, which is worn by the

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user. The waistcoat forms an oxygen reservoir and has the advantage of equalising the pressure inside and outside the lungs. The waistcoat can be used instead of the economiser for heights below that at which pressure-breathing is necessary.

7. In the demand system, the amount of oxygen delivered is controlled automatically by the regulator and any air necessary to make up the amount of breathing air required is admitted at the regulator instead of at the mask. The quantity of air mixture delivered is governed by the rate of breathing of the user, the suction of the inspiration operating a diaphragm on the regulator.

8. The pressure demand system is an elaboration of the normal demand system, whereby the air mixture can be supplied at pressures above those of the atmosphere.

9. It is necessary for the crews of large aircraft to be able to move about the aircraft, and to make this possible at heights which necessitate the use of oxygen, portable oxygen sets are provided at convenient points throughout the aircraft.

10. Emergency oxygen sets are attached to parachute or dinghy packs. They provide a limited supply of oxygen if the aircraft supply fails or if the wearer has to abandon the aircraft while it is flying at high altitudes.

#### Oxygen masks

11. The following types of oxygen masks are available:—

- (1) The Type H mask, for use in conjunction with an economiser oxygen system, is described in Chap. 4.
- (2) The Type J or M masks, for use in conjunction with pressure breathing equipment, are described in Chap. 2.
- (3) The Type L mask, for use by passengers, is described in Chap. 3.
- (4) The Type A-13A and A-13A/1 masks, for use in conjunction with demand and pressure demand oxygen systems, are described in Chap. 5.

#### Portable oxygen sets

12. A portable oxygen set is really a complete oxygen installation in miniature and consists of a small oxygen cylinder, a simple type of regulator, an outlet con-

nection, and a clip or straps to attach it to the user.

13. When a member of the aircrew wishes to move from one part of the aircraft to another, he takes a portable set from its stowage and attaches it to his harness, turns on the regulator, disconnects his mask tubing from the aircraft supply and connects it to the portable supply. Then, when he has stowed the aircraft supply tube in its stowage clip (cut-off valve) he is free to move about as long as the portable supply lasts.

14. There are two current types of portable oxygen set—the Mk. 1B (Stores Ref. 6D/916) and the Mk. 3 (Stores Ref. 6D/1333).

15. The Mk. 1B set (*fig. 1*) has no adjustment for height, and at all heights supplies sufficient oxygen for the greatest height at which it is likely to be used. The fully-charged cylinder contains enough oxygen for 10 minutes. A contents gauge reading 0-5-10 minutes is fitted.

16. The Mk. 3 set (*fig. 2*) is adjustable for height and, with the cylinder fully charged, has an endurance of about 1 hr. 10 min. at 10,000 ft. and just over 30

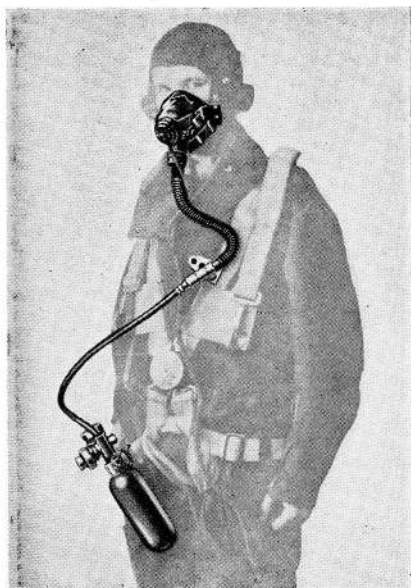


Fig. 1. Portable oxygen set, Mk. 1B



Fig. 2. Portable oxygen set, Mk. 3

minutes at 35,000 ft. The cylinder can be re-charged in flight from a re-charging valve in the aircraft oxygen supply.

17. For a full description of the portable

oxygen sets, and for re-charging and testing instructions, reference should be made to A.P.1275A, Vol. 1, Sect. 8.

#### Emergency oxygen sets

18. The emergency oxygen set is connected to the mask tube assembly and, when operated, supplies oxygen direct to the mask, regardless of whether the mask is connected to the aircraft supply or not. The set consists of a small oxygen cylinder with a regulator mounted on the head. The regulator is "turned on" by the operation of a ring or knob, which breaks the seal on the regulator. The equipment is attached to the parachute harness or the dinghy pack. The cylinder has a useful duration of about ten minutes.

19. The various types of emergency oxygen set are as follows:—

- (1) Mk. 1 (Stores Ref. 6D/721), is carried on Type A, Mk. 2\* and 3\* K dinghy packs.
- (2) Mk. 2 (Stores Ref. 6D/1188), is fitted on Type C, Mk. 1 and 2 parachute harnesses.
- (3) Mk. 3 (Stores Ref. 6D/1191), is fitted on Type D, Mk. 1 parachute harnesses.
- (4) Mk. 4 (Stores Ref. 6D/1460), is fitted on the harnesses of parachute assemblies used in ejection seats.

20. For details of these sets, and for instructions for use, testing, and so on, reference should be made to A.P.1275A, Vol. 1, Sect. 8.



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