

Chapter 4

(This chapter supersedes that issued with A.L. 26)

IMMERSION SUIT, Mk. 6

LIST OF CONTENTS

| | Para. | | Para. |
|----------------------------|-------|-------------------------------|-------|
| Introduction.... | 1 | Acid stains | 21 |
| Description | 2 | Oil stains | 22 |
| Cutting the neck seal | 11 | Mud and other stains | 23 |
| Attaching the boots.... | 12 | Burnt areas | 24 |
| Underwear | 14 | Tests for waterproofness | 25 |
| Donning the suit | 16 | Fabric parts of the suit | 27 |
| Storage | 17 | Waist seals | 29 |
| Servicing | 18 | Wrist seals | 32 |
| Treatment after immersion | | Neck seal | 33 |
| In fresh water | 19 | Urinating sleeve | 34 |
| In salt water | 20 | Boots | 35 |

LIST OF ILLUSTRATIONS

| | Fig. | | Fig. |
|-------------------------------|------|--|------|
| Trousers | 1 | Fitting for anti-g suit air connection | 6 |
| Blouse | 2 | Immersion boot attachment cylinder: expanded and contracted | 7 |
| Urinating sleeve | 3 | Rolling the waist seal | 8 |
| Hood and mitts in use | 4 | Suit fitted | 9 |
| Inflation valve on mitts | 5 | | |

Introduction

1. The immersion suit protects the wearer from cold and exposure after a ditching. The suit consists of a pair of trousers (*fig. 1*) fitted with rubber half-wellington boots and a blouse (*fig. 2*) with a hood attached. The trousers and blouse are made waterproof at the waist by rubber seals, and there are rubber seals at the neck and wrists.

Description

2. The suit is made of two layers of cotton fabric, the outer layer being slightly thicker than the inner. The fabric is permeable to vapour, i.e., it "breathes," but is impermeable to water. Pressure points such as the elbows, knees, and seat are reinforced with extra layers of material.

3. The rubber neck seal has a series of graduations so that it can be trimmed to fit the wearer. A nylon insert prevents the rubber from dragging over the skin when the blouse is put on or taken off.

4. A wrist seal is fitted inside each sleeve,

the seal being joined to a short inner cuff.

5. The waist seal is in two parts—one attached to the blouse and the other to the trousers. The seals are rolled together to make a watertight joint, the roll being held in position by a skirt on the blouse which fastens over it. White lines show the correct alignment of the seals. The trouser seal is beaded to facilitate rolling. A urinating sleeve (*fig. 3*) of fabric tube is made watertight by being wound round the stem of a metal key and bound with cord. The sleeve is covered by a fabric flap held in place by a snap fastener.

6. The boots are attached to the trousers after the wearer has been fitted with the suit. They are intended to be worn over two pairs of thick stockings and this is allowed for in the boot sizes. A man who normally wears size 9 boots will need size 9 immersion boots.

7. The hood is provided for survival purposes, and is fitted with a drawcord and

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Fig. 1. Trousers



Fig. 2. Blouse

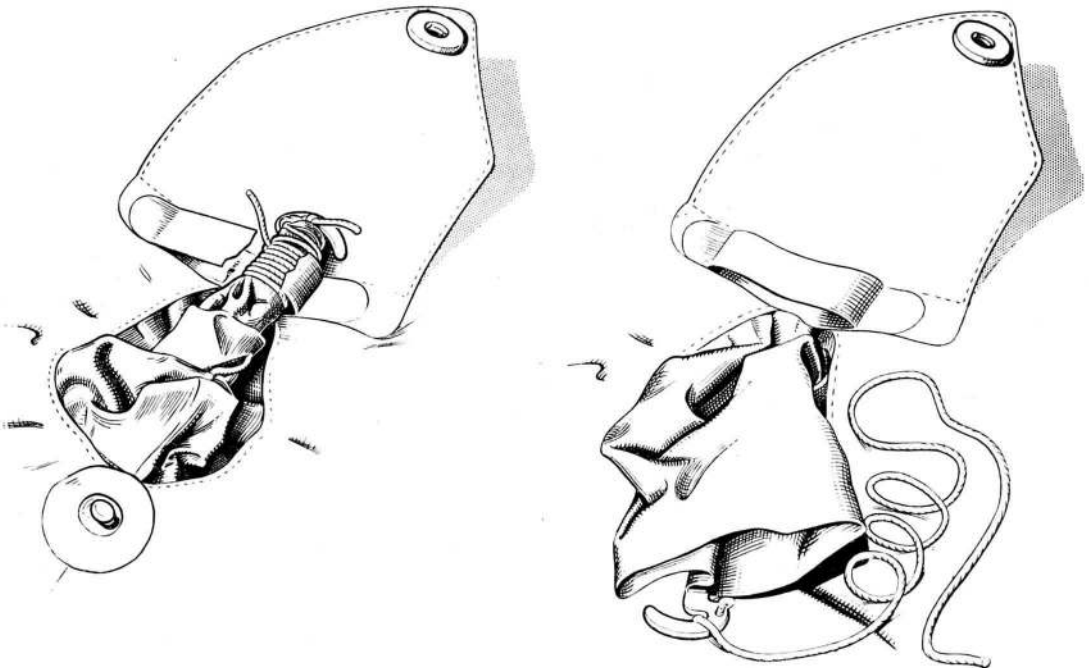


Fig. 3. Urinating sleeve

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a protecting curtain which extends beyond the face (fig. 4). A soft wire in the edge of the curtain enables it to be shaped as required. The hood is normally rolled up and fastened at the back of the neck.

8. Mitts are also provided for survival. They are padded for warmth, and the cuffs are fitted with inflatable seals about $2\frac{1}{2}$ in. deep which encircle the wrists. The mitts may easily be slipped on to cold stiff hands, and the seals then inflated by mouth. The inflated seals limit the circulation of water and the hands, though wet, retain their mobility and do not freeze. The inflation valve (fig. 5) is made of rubber and cannot cause damage to other equipment. To deflate the seal, the valve seat is distorted so that the air can escape. The mitt is marked externally to indicate the pressure points for deflation. The mitts are rolled and stowed in the foremost compartment of the pockets on the trouser legs, to which they are attached by tapes.

9. If the immersion suit is to be worn over an anti-g suit, the fitting shown in fig. 6 is provided on the immersion suit trousers for the air connection on the anti-g suit. The fitting incorporates a flexible rubber sleeve which fits tightly round the air connection and forms a watertight joint. If the anti-g suit is not worn, the fitting is blanked off with a metal cap.

10. If necessary, blouses and trousers of different sizes may be worn together, but because the fit of the blouse seal with the trouser seal is critical, this practice should be restricted to neighbouring sizes, for example, a blouse size 1 with trousers size 2. The immersion suit, Mk. 6, is available under the following Stores References in Section 22C of A.P.1086 :—

| Item | Size | Stores Ref. |
|----------|--------------------------|--------------|
| Blouse | 1 to 5* | 1199 to 1203 |
| Trousers | 1 to 5* | 1204 to 1208 |
| Boots | { 7 to 11 5, 6 and 12 | 1209 to 1213 |
| | | 1229 to 1231 |
| Mitts | One-size | 1375 |
| | | Left-hand |
| | | 1376 |
| | | Right-hand |
| Braces | One size | 1215 |

*Size 5 for R.C.N. use only.

Cutting the neck seal

11. The neck seal as supplied fits wearers whose collar size is 14-14 $\frac{1}{2}$ in. and may have to be cut to suit individuals taking larger collar sizes. Six graduations are marked on the seal, each graduation giving an increase of $\frac{1}{2}$ in. on the neck size. The seal should not be cut until the wearer has given it a comfort trial of several hours, and when it is cut, it should be cut one size smaller than that thought necessary, and worn again. If it is still too tight, it may then be cut to the full size.

Note . . .

Cut the seal very carefully with a razor blade against a firm padded surface. Ragged edges may lead to splits and tears.

Attaching the boots

12. The tops of the boots are cemented between the fabric layers at the ends of the trouser legs, and the joint is covered by sealing tape. To provide a means of making a more efficient join more quickly, the metal cylinder and slides (Vocab. No. 47063) should be used. Fig. 7 shows the cylinder only. It is essential that the cemented surfaces should fit evenly and without any rucks, which might result in leaks.

13. Each boot should be attached as follows :—

- (1) Buff the outside of the boot slightly with Grade 00 glass paper to a depth of $2\frac{1}{2}$ in. from the top.
- (2) Open the two layers of fabric at the bottom of the trouser leg to a depth of $1\frac{1}{2}$ in. The layers are stuck together to a depth of 2 in. by the manufacturer. Fold the top layer back up the trouser leg.
- (3) Pass the closed cylinder, narrow end first, through the waist opening of the trousers and down the trouser leg until 3 in. of the metal protrudes below the bottom of the leg. Ensure that the inside seam of the trouser leg lies along one seam of the cylinder.
- (4) Insert the two steel slides between the cylinder and the trouser fabric, one on either side of the leg to cover the two gaps or seams of the cylinder.
- (5) Fit the boot onto the cylinder and over the inner layer of fabric up to the joint of both layers of fabric of the trouser leg; ensure that the toe of the boot points in the right direction.

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Fig. 4. Hood and mitts in use

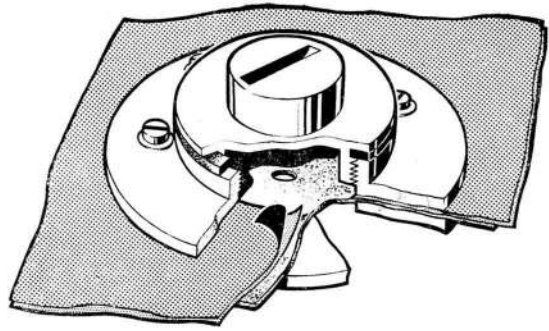


Fig. 6. Fitting for anti-air connection

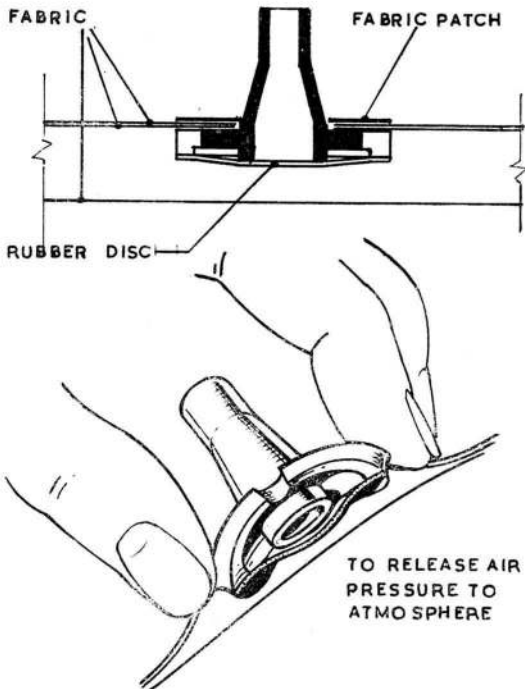


Fig. 5. Inflation valve on mitts

- (6) Expand the cylinder by revolving the knurled spindle screw until the boot and trouser leg are held firmly in position.
- (7) Fold back the top of the boot for about 1½ in. so that the inner layer of the trouser fabric is exposed. Smooth out any rucks and lightly buff the exposed surfaces with Grade 00 glass paper.
- (8) Treat the turned back area of the boot and the inner layer of trouser fabric with KB. 156 solution and allow the solution to become tacky.
- (9) Contract the cylinder slightly and roll back the top of the boot over the inner layer of trouser fabric. Expand the cylinder to its original position and smooth out any rucks.
- (10) Treat the outer surface of the boot with KB. 156 solution to a depth of 1½ in. Treat the outer layer of trouser fabric, which has already been turned back, with KB. 156. Allow the solution to become tacky.
- (11) Contract the cylinder slightly and roll down the outer layer of trouser fabric over the top of the boot. Expand the cylinder to its original position and remove any rucks.
- (12) Take sufficient length of tape, Indiana, blue/grey, 1 in. (Vocab. No. 47848) to cover the join, allowing 1½ in. extra for overlap.
- (13) Apply two coats of KB.156 solution to the join and the tape, allowing the first coat to become tacky before applying the second coat. When the second coat is tacky, apply the tape to the join and roll with a small hand roller to provide good adhesion.
- (14) Dust the taped join lightly with french chalk. When the join is dry, contract and remove the cylinder and slides.

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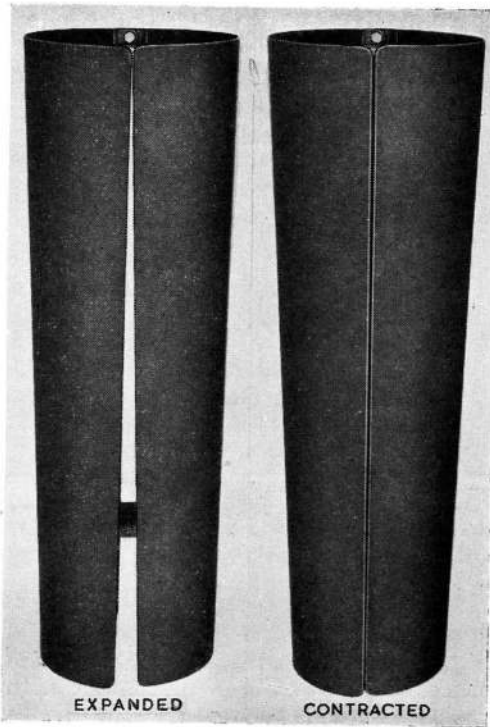


Fig. 7. Immersion boot attachment cylinder : expanded and contracted

Note . . .

- (1) The method of preparing KB. 156 solution is described in A.P.1182C, Vol. 6, or A.P.1182C (NAVAL), Vol. 6, as appropriate.
- (2) An even fitting join, without rucks, is essential for watertightness.

Underwear

14. To ensure protection against exposure, adequate underclothing must be worn with the immersion suit. The following garments are recommended as the minimum :—

| Description | Number | Reference |
|-----------------------------------|-----------|--|
| String vest | One | 22C/1162 — 1164 (Small, medium, and large sizes) |
| Long knitted drawers | One pair | 21191 — 94 (Sizes 1 to 4) |
| or | | |
| Pyjama type knitted pants | One pair | 22C/1188 — 1195 (Sizes 1 to 8) |
| Gym sweater | One | 25431 — 33 (Sizes 1 to 3) |
| Army pattern thick white socks | Two pairs | — |
| or | | |
| Socks, white, for seaboots and | One pair | 25711 — 13 (Sizes 1 to 3) |
| Army pattern thick white socks | One pair | — |
| Knitted cotton singlet (optional) | One | 21515 — 19 (Sizes 0 to 4) |
| Winter drawers (optional) | One pair | 25905 — 08 (Sizes 1 to 4) |

15. In addition, shirt and trousers may be worn.

Donning the suit

16. The following precautions should be taken when the suit is put on :—

- (1) Use the tabs on the boots to pull the boots on.
- (2) When donning the blouse, first insert then hands through the wrist seals and then put the head through the neck seal. (When undressing, remove the head first and hands last.)
- (3) Take care to tuck the nylon insert well back below the neck seal.
- (4) Make sure that the white lines on the front of the two waist seals are in alignment and that the blouse seal reaches down to the beading at the bottom of the trouser seal but does not overlap it. Roll the two seals together, starting the roll with the flat of the hands and rolling it tightly as far up as possible (fig. 7). The roll must be kept smooth, because rucks are a potential cause of leakage. Finally, fasten the blouse to the trousers so that the waist seal cannot unroll (fig. 8).

Storage

17. Suits not in use should be kept in a well-ventilated cupboard, on hangers and not on hooks or pegs. The trousers should be hung with boots just touching the ground, so that the weight is supported.

SERVICING

18. If it is suspected that any part of the suit is not watertight, it should be tested as described in para. 25-35.



Fig. 8. Rolling the waist seal



Fig. 9. Suit fitted

Treatment after immersion

In fresh water

19. Allow the suit to dry naturally, preferably in the open air. If the boots are waterlogged inside, blow compressed air (at normal temperature) into them. Coat metal parts lightly with an anti-freezing grease. Examine the suit as detailed in the two-monthly servicing schedule (Vol. 5).

In salt water

20. Soak the suit in fresh water for half an hour, and then wash it in tepid soapy water. Stains may be scrubbed with a soft brush and household soap. Rinse the suit thoroughly in fresh water and allow it to dry naturally, preferably in the open air. If the boots are waterlogged, blow compressed air (at normal temperature) into them. Coat metal parts lightly with an anti-freezing grease. Examine the suit as detailed in the two-monthly servicing schedule.

Acid stains

21. A suspected acid stain, and any surfaces which have been in contact with the stain, should be tested with litmus paper. If the result is positive, the affected part should be cut out, and as an added precaution, the area immediately surrounding it should be swabbed with a 50 per cent. solution of ammonia, sp. gr. 0.88, and distilled water. When the surface is dry, it should be patched (Vol. 6).

Oil stains

22. Severe oil stains will affect the special properties of the fabric, and badly stained areas must be cut out and patched. If the stain is slight, however, it should be tested for waterproofness before it is decided to cut away the affected area.

Mud and other stains

23. Mud stains should be allowed to dry and then removed with a soft brush or sponged clean with cold fresh water. Other minor stains should be sponged with cold fresh water and the fabric allowed to dry naturally.

Burnt areas

24. Singed, burnt or worn parts should be cut away, and patched.

TEST FOR WATERPROOFNESS

25. The suit must be tested for waterproofness if it is suspected that any area

has lost its waterproof qualities and also after any operation such as repair or renewal. The test consists of leaving the outer surface of the area under test in contact with water for half an hour. At the end of this time, there must be no evidence of leakage through the fabric or seal, though a slight dampness on the reverse side of the fabric is acceptable. After the test, the surface should be allowed to dry naturally, preferably in the open air.

26. It will be appreciated that the suit must be tested part at a time. The following paragraphs describe the methods to be used.

Fabric parts of the suit

27. Form the material, with the part under test at the lowest point, into as large a hollow as possible. Fill the hollow with fresh water and leave it to stand for half an hour.

Note . . .

The more water that can be used, the more efficient the test, but the weight must be supported.

28. If a sleeve is to be tested, turn it inside out, tie off the cuff, and fill the sleeve with water. The trouser legs should also be turned inside out.

Waist seals

29. To test the blouse seal, support the blouse the right way up and turn up the rubber seal. Pour water into the channel

thus formed, taking care that the weight is supported.

30. To test the trouser seal, turn the trousers upside down and pour water into the channel between the trousers and the seal.

31. Patches on the seals themselves should be tested as described in para. 27.

Wrist seals

32. Hang the sleeve so that the open end of the seal is supported and pointing upwards. Pour water into the channel between the base of the seal and the fabric cuff of the sleeve. Alternatively, insert a smooth cylindrical piece of wood in the sleeve, push it through the seal, and then place the cuff and about 12 in. of sleeve in a bucket of water.

Neck seal

33. Turn the blouse inside out and upside down, and then pour water into the channel between the neck seal and the blouse to a level just below the armholes, the sleeves being held up. A padded wooden clamp must be improvised to hold the edge of the neck seal.

Urinating sleeve

34. Roll and whip the sleeve in the normal manner and test it as described in para. 27.

Boots

35. Place a hollow cylinder of suitable size inside the leg, and place the boot and at least 12 in. of trouser leg in water.

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