

Chapter 20

IMMERSION SUIT, MK. 7

LIST OF CONTENTS

	<i>Para.</i>		<i>Para.</i>
<i>Introduction</i>	1	<i>Fabric parts of the suit</i>	17
Description		<i>Waist seals</i>	19
<i>Blouse</i>	2	<i>Wrist seals</i>	22
<i>Trousers</i>	3	<i>Neck seals</i>	23
<i>Size range</i>	4	<i>Urinating sleeve</i>	24
<i>Boots</i>	5	<i>Boots</i>	25
<i>Mitts</i>	6	Donning the suit	26
<i>Securing the boots to the trousers</i>	8	<i>Fitting the neck seal</i>	30
Servicing	9	To adapt the suit for use over an anti-g and an air ventilated suit	
<i>Treatment after immersion</i>		◀ <i>Mk. 1 Adapter</i>	31 ▶
<i>In fresh water</i>	10	<i>To remove an adapter</i>	33
<i>In salt water</i>	11	◀ <i>Mk. 2 Adapter (Ref. No. 22C/32417),</i>	
<i>Oil stains</i>	12	<i>Standard size</i>	36
<i>Mud and other stains</i>	13	<i>Method of fitting</i>	37
<i>Burnt areas</i>	14	<i>Mk. 3 Adapter (Ref. No. 22C/2775)</i>	40
Test for waterproofness	15	<i>Method of fitting</i>	41 ▶

LIST OF ILLUSTRATIONS

		<i>Fig.</i>
<i>Blouse, immersion, Mk. 7</i>	1	1
<i>Trousers, immersion, Mk. 7</i>	2	2
<i>Boots, rubber</i>	3	3
<i>Mitts, Mk. 3</i>	4	4

Introduction

1. The Mk. 7 immersion suit is provided to give a measure of protection under wet/cold conditions in the event of a ditching. Correctly used and cared for, the suit will provide protection for up to six hours. It consists of a blouse and trousers and is worn with boots attached permanently to the trousers legs; mitts may be secured to the cuffs of the blouse. The suit is made of a ventile cotton which is permeable to water vapour. It is, therefore, suitable for constant wear and aircrew are advised to continue to wear it if the weather is inclement after they have landed in a remote area. To avoid excessive sweating, however, the seals should be removed to permit adequate ventilation. When the suit is worn in water, the cowl should be used to protect the face and violent movements should be avoided as

they may lead to leakage. Simple muscular movements assist in promoting warmth. Floating on the back with the hands resting on the lobes of the stole is the most advantageous attitude.

Note . . .

The ventile properties of the cloth are impaired by oil, paint and other agents, therefore, local marking of suits is not permitted.

DESCRIPTION

Blouse

2. The blouse (fig. 1) is an anarak type garment with a parka hood attached. Rubber seals are fitted at the neck and cuffs and a wide rubber band at the waist enables a seal to be made with a matching band on the trousers. The neck seal is ringed with

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concentric markings for guidance when trimming the neck opening to the appropriate size. A nylon insert is fitted inside the neck to facilitate donning. Two breast pockets are provided and a three-compartment pencil pocket is located on the left sleeve. Button holes at the bottom of the waistband are aligned with buttons on the trousers; when the blouse and trousers are buttoned together, the waist seal is enclosed. Just below the neck seal on the front is a loop by which the blouse should be hung when not in use. Two other loops at the cuffs are provided as a means of securing the mitts. The hood, including the throat tab and cowl, is designed to fold back and fasten at the back of the blouse with three press studs so that it does not interfere during normal flying. In emergency the hood can be adjusted to protect the head and face by the draw cord. The cowl is fitted with a flexible wire at the front edge and can be moulded to the desired shape to provide added protection to the face.

Trousers

3. The trousers (fig. 2) are full-cut and are fitted with a wide rubber band which is provided to match the band on the blouse. When the bands are rolled together an effective seal is formed. A urinating tube suitably located is made watertight by twisting a key and wrapping the key and the material with the cord provided. The end of the cord should be secured in the crook of the key after the seal has been made and the end of the sleeve should be tucked into the loop on the trousers and covered by the flap. On each leg below the knee is a pocket with a specially designed flap secured by a button and on each thigh is a two-compartment map pocket. The upper compartments, which have angled entries, are used for the stowage of maps which can be transferred to the lower compartments after the wearer is seated in the aircraft so that they can be more easily withdrawn when required. The trousers are



Fig. 1. Blouse, immersion, Mk. 7

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Fig. 2. Trousers, immersion, Mk. 7

suspended, during wear, by braces fitted inside the waistband, where buttons are attached. A hanging loop is also fitted.

Size range

4. The size range and references of the garments are:—

Nomenclature	Size	Height of man	Ref. No.
Blouse	1	5 ft. 4 in. to 5 ft. 6 in.	22C/1671
	2	5 ft. 7 in. to 5 ft. 9 in.	22C/1672
	3	5 ft. 10 in. to 6 ft. 0 in.	22C/1673
	4	6 ft. 1 in. to 6 ft. 3 in.	22C/1674
	5	6 ft. 1 in. to 6 ft. 3 in.	22C/1675

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Inside leg measurement

Trousers	1	29½ in.	22C/1676
	2	31 in.	22C/1677
	3	32½ in.	22C/1678
	4	34 in.	22C/1679
	5	34 in.	22C/1680

Note . . .

Size 5 is larger in the chest, seat and waist than size 4. Garments of this size are not normally stocked, but can be obtained on special demand.

Braces

22C/1215

Boots

5. The boots (fig. 3) are rubber, half-wellington length. They are issued separately from the suit and are permanently attached to the bottoms of the trousers before they are used. The method of attachment is described in para. 8. The sizes and references are:—

Size	Ref. No.
5	22C/1632
6	22C/1633
7	22C/1634
8	22C/1635
9	22C/1636
10	22C/1637
11	22C/1638
12	22C/1639



Fig. 3. Boots, rubber

Mitts

6. Mitts are issued under different Ref. No. for the left and right hands as follows:—

Mitts, Mk. 3, L.H. Ref. No. 22C/1681

Mitts, Mk. 3, R.H. Ref. No. 22C/1682

7. The mitts (fig. 4) are lined with goose down and are fitted with inflatable seals in the gauntlets. They are inflated by mouth through inflation tubes fitted with simple non-return valves provided with rubber stoppers. The mitts are stowed in the personal survival pack and when required are secured to the cuffs of the blouse by passing the stiffened ends of the loops through matching loops on the cuffs and then passing the mitts through their retaining loops. When the mitts are put on the hands the cuffs are inflated and the stoppers inserted in the ends of the inflation tubes.

Securing the boots to the trousers

8. Equipment and stores required are:—

Ref. No.	Nomenclature
22C/2145	Cylinder, immersion boot attachment, complete with slides
22C/2069	Tape, indian, blue/grey, 1 in.
	Grade 000 emery cloth
	Solution, KB 156
	French chalk

Method

(1) Buff the outside of the boot lightly with the glass paper to a depth of 2½ 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 through 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 on each side of the leg to cover the gaps between the segments of the cylinder. Fit the boot on to the cylinder and over the inner layer of the fabric up to the join of both layers of fabric, ensuring that the toe of the boot is facing in the right direction.
- (5) Expand the cylinder by revolving the cylinder screw only; the boot and trouser leg are held firmly in position.
- (6) Fold back the top of the boot about $1\frac{1}{2}$ in. so that the inner layer of

fabric is exposed. Smooth out all rucks and lightly buff the exposed surfaces.

- (7) Treat the turned back area of the boot and the inner layer of trouser fabric with the solution and allow to become tacky.
- (8) Contract the cylinder slightly and lower the outer layer of fabric over the boot. Expand the cylinder to its original size.
- (9) Treat the outer surface of the boot to a depth of $1\frac{1}{2}$ in. with solution and similarly treat the inner surface of the outer layer of the fabric and allow to become tacky.
- (10) Contract the cylinder slightly and lower the outer layer of fabric over the boot. Expand the cylinder to its original size.
- (11) Cover the joint with 1 in. indiana tape, allowing $1\frac{1}{2}$ in. extra length for overlap. Treat the tape and the joint with the solution and allow to become tacky, then apply a second coat of solution.



Fig. 4. Mitts, Mk. 3

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(12) When the second coat of solution is tacky the tape should be pressed firmly over the joint with a small hand roller.

(13) Dust the joint lightly with french chalk.

(14) When the joint is dry, contract and remove the cylinder.

Note . . .

An even fitting joint without rucks is essential for water tightness.

SERVICING

9. Servicing should be in accordance with Vol. 4 at the intervals stated therein.

Treatment after immersion

In fresh water

10. Allow the suit to dry naturally, preferably in the open air. If the boots are wet inside, blow compressed air (at normal temperature) into them. Coat metal parts lightly with an anti-freeze grease. Examine the suit as detailed in the two-monthly servicing schedule (Vol. 4).

In salt water

11. Soak the suit in fresh water for $\frac{1}{2}$ hr. and then wash it in tepid soapy water. Stains may be lightly scrubbed with a soft brush and household soap. Rinse the suit thoroughly in fresh water and allow to dry naturally, preferably in the open air.

Oil stains

12. Oil stains will impair the ventile properties of the fabric. The presence of large oil stained areas necessitates the return of a garment for re-assessment of the ventile characteristics of the cloth under arrangements made by M.O.D. (R.A.F.). Small oil stains may be cut out and patched provided the repair will be within the dimensions given in Vol. 6 (2nd Edition).

Mud and other stains

13. Mud stains should be allowed to dry and the area cleaned with a soft brush or be sponged clean with cold fresh water and the area allowed to dry naturally.

Burnt areas

14. Burnt or singed areas within the permissible patch sizes given in Vol. 6 (2nd

Edition) may be repaired in the same manner as other damage, but burns or singes extending over greater areas render a garment beyond economical repair.

TEST FOR WATERPROOFNESS

15. The suit must be tested if it is suspected of having lost its waterproof quality, and also after any operation involving repair or renewal of parts. The tests consists of leaving the outer surface of the affected area in contact with water for $\frac{1}{2}$ hr. At the end of this time there must be no evidence of leakage through the fabric or seals, although a slight dampness on the reverse side of the fabric is acceptable. After the test the area should be allowed to dry naturally, if possible in the open air.

16. The only practical test for a complete suit is for the wearer to put it on and immerse himself in a bath of water, but, if considered essential, parts of the suit may be tested as described in subsequent paragraphs. If any leaks are apparent the suit should be withdrawn from use.

Fabric parts of the suit

17. 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 to stand for $\frac{1}{2}$ hr.

Note . . .

The more water than can be used the greater the weight and the effectiveness of the test.

18. If a sleeve has 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

19. 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.

20. To test the trouser seal, turn the trousers upside down and pour water between the trousers and the seal.

21. Patches on the seals themselves should be tested as described in para. 19.

Wrist seals

22. Hang the sleeve up so that the open end of the seal is supported and pointing upwards. Pour water into the channel between the cuff of the sleeve and the base of the seal. Alternatively, insert a smooth piece of wood into the sleeve and then place the cuff and about 12 in. of the sleeve in a container of water.

Neck seal

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

Urinating sleeve

24. Roll and whip the sleeve in the normal manner and test it as described in para. 19.

Boots

25. Place a hollow cylinder of suitable size inside the leg of the trousers and place the boot and at least 12 in. of the leg in a container of water.

DONNING THE SUIT

26. After placing the legs in the trousers, pull the boots on by the tabs and then pull the trousers up to the waist. Adjust and secure the braces and fasten the boot laces. Insert the hands into the wrist seals of the blouse and the head through the neck seal. Pull the blouse over the shoulders to the waist and then lay the rubber band on the trousers down over the thighs with the band on the blouse over it. Ensure that there are no wrinkles in the bands and that the white marks coincide.

27. With the palms of the hands flat, roll the bands together from the bottom to the top, rolling tightly and ensuring that no wrinkles develop. A ruck-free seal is essential for a complete water barrier. Pull the blouse waistband over the roll and fasten the blouse to the trouser buttons.

28. Ensure that the nylon neck insert is pushed inside the neck opening and check that the hood is folded neatly and secured.

Check that the urinating tube is correctly rolled and secured, and that the flap is secure.

29. If an anti-g suit/immersion suit adapter is fitted and the immersion suit is being worn over an anti-g suit, remove the blanking plug from the adapter and draw the anti-g suit hose and connector through the rubber seal. If an anti-g suit is not being worn, ensure that the blanking plug is correctly fitted.

Fitting the neck seal

30. The neck seal is designed to form an effective water barrier without causing discomfort in wear. This should be borne in mind when the neck seal is being trimmed to size. Trimming should be done with the greatest care in stages, the fit being tried by putting the blouse on before removing more material. The rings do not provide a strengthened edge and will not prevent a split from extending, therefore avoid leaving a jagged edge.

TO ADAPT THE SUIT FOR USE OVER AN ANTI-G AND/OR AIR VENTILATED SUIT**Mk. 1 Adapter**

31. The following items are required:—

Ref. No.	Nomenclature
22C/1625	Adapter, anti-g consisting of:—
22C/1626	Plug, flange, adapter
22C/1627	Flange, adapter
22C/1628	Washer, flange, adapter
22C/1629	Washer, rubber
22C/1630	Rounder, rubber, 3 in. dia.
	Screws, steel
	Screws, cheese head, chromium plated, $\frac{3}{8}$ in.
	Solution, rubber KB62
	Cement, gasket, compound

32. To fit the adapter in the correct position it is necessary for the wearer to put the trousers on over an anti-g suit. When the trousers have been correctly adjusted, the position of the anti-g inlet tube can be felt. Carefully ascertain the position in which the hose will pass through the immersion suit and mark it with a light-coloured pencil. Then proceed as follows:—

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(1) After the wearer has removed the trousers, punch a $1\frac{1}{4}$ in. dia. hole exactly over the mark. Separate the two layers of material, treat the inner surfaces with the solution to a width of about 1 in. all round the holes and leave until it is tacky. Apply a second coat of solution and, when tacky, press the two layers together and, using a hand roller, form a secure joint.

(2) When dry apply a coat of the solution to the inside surface of the trousers to width of about 3 in. round the hole. Allow to become tacky and apply another coat.

(3) Mark a $1\frac{1}{4}$ in. dia. circle in the centre of one side of the rubber rounder. Treat the area outside this circle with two coats of the solution, allowing the first to become tacky before applying the second.

(4) Apply a third coat of the solution to both the trousers and the rounder. When tacky, carefully place the rounder concentrically over the hole in the trousers and roll flat to obtain a good joint. Dust lightly with french chalk.

(5) Punch a $\frac{1}{4}$ in. dia. hole exactly in the centre of the rounder and then punch out the marked screw holes with a $\frac{5}{32}$ in. punch. Ensure that the holes are punched cleanly, as ragged edges may prevent the screws from being fully tightened.

(6) Treat the flat side of the adapter flange with a liberal coating of the solution and place it on the outside of the trousers over the $1\frac{1}{4}$ in. hole. At the same time place the metal washer on the inside of the trousers, aligning the screw holes.

(7) Dip the ends of the screw threads in the cement and screw home tightly and evenly. Dust lightly with french chalk.

(8) File down the protruding ends of the screw until they are flush with the metal washer. Ensure that there are no rough edges and that the anti-corrosive treatment on the washer is undamaged.

To remove an adapter

33. When it is necessary permanently to remove an adapter the following procedure should be adopted:—

(1) Unfasten the screws holding the plates together and carefully remove the plates.

(2) Remove the rubber rounder, taking care not to cut the material of the trousers.

(3) Remove all traces of the solution used in fitting the rounder with a stiff (not wire) brush and remove all residual dust.

(4) Cut two 3 in. dia. rounders of cloth, cotton L.28 and secure them concentrically over the hole, one on each side of the material. Using Solution KB62, secure them in position. Three coats of solution are needed on the rounders and the trouser material. The first two coats should be allowed to become dry and the third tacky before the rounders are fitted into position and rolled flat to remove bubbles and prevent raised edges.

(5) Put the trousers aside for the joints to dry and set for 24 hr.

34. A torn washer destroys the immersion properties of the trousers and cannot be renewed. Every care should, therefore, be taken when inserting and withdrawing the anti-g suit hose.

35. The attachment of the adapter is to be examined daily by the user and at two-monthly intervals by the flying clothing worker.

◀Mk. 2 Adapter (Ref. No. 22C/2417), Standard size

36. The items and tools required are:—

Ref. No.	Nomenclature	No. off
22C/		
2418	Adapter ring	1
2419	Adapter flange	1
2420	Flange retaining plate	1
2421	Blanking-off disc	1
2422	Sealing sleeve assy.	1
2424	Screw, retaining	6
2423	Reinforcement rounder	1
		for single adapter
2425	Reinforcement patch	1
		for double adapter
	$1\frac{1}{4}$ in dia punch	
	$\frac{5}{32}$ in dia punch	
	Solution K.B. 62	
	French chalk	

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Method of fitting

37. (1) With the immersion suit worn over appropriate clothing, including the anti-g and/or air ventilated suit, feel for the correct position in relation to the relevant hose and mark this with a light coloured pencil. Check the position with the wearer both sitting and standing, with particular reference to the seat parachute harness.

(2) Place the trousers over a smooth lead-covered block and punch out a hole with the $1\frac{1}{4}$ in. punch in the position which has been marked, taking out both the outer fabric and the lining. Ensure that both layers of fabric are free from puckers, otherwise the holes will be out of alignment.

(3) Separate the outer layer from the lining and apply one coat of K.B. 62 to the facing surfaces. Allow this coat to dry, apply a second coat to each surface and, when the solution is tacky, roll the surfaces together tightly with the apertures in alignment.

(4) Smear the outer surface of the outer layer of fabric with two coats of the solution, allowing the first to dry before applying the second.

(5) While the second coat is becoming tacky, punch a $1\frac{1}{4}$ in. hole in the centre of the reinforcement rounder. Prepare the rounder with two coats of solution in the same manner as the trouser fabric.

(6) When the outer coats of solution on the suit and the rounder are tacky, bring them together, ensuring the holes are in alignment and roll them together firmly, free from rucks.

(7) Place the adapter flange over the hole in correct alignment and mark the positions of the screw holes on the face of the rounder.

(8) Place the lead-covered block inside the trouser leg immediately under the rounder and punch $\frac{5}{16}$ in. dia. holes accurately in the positions marked, ensuring that the edges are clean.

(9) Apply a liberal coating of the solution to the underside of the adapter flange.

(10) Place the adapter flange on the rounder with the central and screw holes in alignment and press it firmly into position. If preferred the inner edges of the adapter flange and the flange retaining plate can be marked with a pencil to assist in correct alignment.

(11) Place the flange retaining plate inside the trouser leg with the holes aligned and secure the assembly with the screws. Dip the ends of the screws in K.B. 62 and insert them from the inside of the garment. Drive the screws securely into the flange retaining plate.

(12) With the suit being worn over the appropriate clothing as before, pass the appropriate hose and connector through the adapter and sealing ring, and position them by moving up or down until maximum comfort is achieved when the seal is screwed into the adapter.

38. To facilitate the assembly of the sealing sleeve on to the hose a smear of silicone grease M.S. 33 may be applied to the inside of the sealing sleeve. After assembly all surplus grease is to be removed from the hose.

39. If two adapters are to be fitted to an immersion suit the reinforcement patch (Ref. No. 22C/2425) is to be used instead of the reinforcement rounder. The operations of determining the positions of the adapters, punching of holes and securing the adapters are the same as are described for the fitting of a single adapter.

Mk. 3 adapter (Ref. No. 22C/2775)

40. The items and tools required are:—

Ref. No.	Nomenclature	No. off
22C/ 2775	Adapter Mk. 3	1 or 2
2889	Sealing ring, single or	1
2890	Sealing ring, double	1
2063	Solution K.B. 62	as required
2069	Tape, indiana, 1 in.	for two adapters as required
2776	Plug, blanking	1 or 2

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Method of fitting

41. (1) With the immersion suit worn over the appropriate clothing, including the anti-g and/or air ventilated suit, feel for the correct position of the adapter/s in relation to the hose/s and mark this/ them with a light coloured pencil. Check the position/s with the wearer both sitting and standing, with particular reference to the seat and parachute harness.

(2) After the suit has been taken off, place the adapter over the marked area so that the opening of the back face of the adapter is central. Mark round the opening on the inside surface of the trousers, again using a light coloured pencil. Cut out this marked area through both thicknesses of the suit.

(3) Separate the lining from the outer layer, treat the facing surfaces with two coats of solution, allowing the first to dry before applying the second, and, when the second coats are tacky, press the two layers of fabric together firmly, free from rucks, and roll down flat.

(4) Treat the back face of the adapter and the front fact of the trousers for an area equal to that of the adapter

with two coats of the solution, allowing the first to dry before applying the second and the second coats to become tacky. When the solution has become tacky fit the adapter to the trousers with the apertures in alignment. Press firmly into position and roll down to ensure a good seal.

(5) Fit the sealing ring in the same manner, using two coats of solution on the contact surfaces and allowing the second to become tacky.

(6) Fit the blanking plug before issuing the suit for use.

42. When two adapters have to be fitted, one for the anti-g suit and one for the A.V.S., the same procedure is followed, except that both positions are marked, the two adapters are butted together with indiana tape stuck with solution to the front faces and two openings need to be cut out. Normally the A.V.S. opening is in front of the anti-g aperture because the supply hose is fitted centrally to the A.V.S.

43. It will be found an advantage to apply silicone grease M.S. 33 to the inside and outside of the sleeve after every few insertions of the hoses and connectors. ▶

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