

Chapter 4
(Completely revised)

SURVIVAL EQUIPMENT

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GENERAL

1. The items of survival equipment normally carried in the personal survival pack may vary according to the type of aircraft and the theatre of operations. The uses and the limitations of the various items of equipment, together with a brief description and operating instructions where necessary, are given in this chapter. The prime requirements of uninjured survivors are:-

- (1) Protection from environmental stress, i.e., heat, cold and immersion.
- (2) Rapid location by rescue services, e.g., by the use of S.A.R.A.H.
- (3) Water.
- (4) Food.
- (5) Ancillary survival aids.

The above list gives the order in which survivor's needs should be met and also indicates the order in which survivors are most likely to use the equipment.

FOOD AND WATER

2. Food and water are essential to survival and, as water is the more vital it (or a means of producing it) is provided in greater quantity. The methods used are:-

- (1) Sealed vacuum tins.
- (2) A chemical desalting apparatus to render sea water fit for drinking.
- (3) A Solar still to produce fresh water from sea water by evaporation.
- (4) Catching rain water and storing it in any convenient container.

Drinking sea water is highly dangerous and should NEVER be practised. Contrary to what has been said, either verbally or in writing, there is as yet no evidence that the ingestion of sea water will benefit survivors at sea.

SEALED VACUUM TINS

3. The tins of water each contain about two-thirds of a pint and, provided the tins are in good condition, the water remains usable for three years from the date stamped on the tin.

CHEMICAL DESALTING APPARATUS

4. The chemical desalting apparatus is available in various sizes, each size indicating the amount of drinking water it will produce. The two-pint size is for use with single-seat dinghies and consists of:-

- (1) A rubberised fabric storage bag.
- (2) Sixteen chemical briquettes (one charge consists of four briquettes).
- (3) A rubberised fabric purifying bag.

The briquettes and purifying bag are housed in the storage bag, the open end of which is folded and sealed with adhesive tape. Instructions for purifying sea water are printed on the outside of the storage bag and they must be followed implicitly. The amount of water which can be purified by one charge of briquettes is indicated by a line on the outside of the purifier bag. This bag contains a filter which prevents sediment, formed as the sea water is purified, from draining into the fresh water container. As the sediment is harmful and also clogs the filter, the bag should be cleaned after every operation, in accordance with the instructions printed on the storage bag.

Note...

If briquettes become damp, they will be reduced to powder; while this does not render them useless, care should be taken to keep them dry. Each charge is wrapped in double cellophane and a strip of paper around each charge prevents adhesion when they are packed. The amount of the charge MUST NOT be reduced in an endeavour to increase the supply of water, otherwise partially desalted water (harmful to those who drink it) will be produced.

5. Full details of the desalting apparatus will be found in A.P.1182E, Vol.1, to which reference should be made, as necessary, for information not contained in these paragraphs.

SOLAR STILL

6. The Solar still is another apparatus for producing drinking water from sea water by evaporation instead of chemical reaction. Direct sunlight is required to obtain maximum efficiency, but the still will operate with reduced efficiency if the sky is not too overcast. On dark days and at night the still will not operate. In temperate environments in summer time the still can produce about 3 oz. of drinking water per hour, and $1\frac{1}{2}$ pints per day. Production of drinking water will be related to climatic conditions and the volume of this water may exceed the value given in very favourable conditions.

7. Instructions for operating the still are provided in booklet form, a copy of this booklet being packed with the still. It is not proposed to reproduce these instructions here, but the following points should be noted:-

(1) Because the black cloth is close to the inside of the still, it almost touches it, and this cloth is always saturated with sea water, lifting or hauling of the still except by the towing line may result in contamination of the drinking water. **HANDLE THE STILL WITH CARE AND ALWAYS USE THE TOWING LINE.**

(2) In variable weather conditions, air and vapour pressure inside the still may vary from hour to hour. When these pressures fall the still will feel soft or even flabby and may contaminate the drinking water by the plastic pressing in upon the black cloth. When pressure rises excessively, the still will feel very hard and may cease to drip. Re-adjustment of pressure may, of necessity, be left to the discretion of the individual, but as a guide the question "Is it affecting the production or likely to contaminate the drinking water" should be used; if the answer is "no", leave well alone. Generally, always inflate when soft or flabby, but do not deflate unless it is absolutely necessary.

8. Full details of the Solar still will be found in A.P.1182E, Vol.1, to which reference should be made as necessary.

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RAIN WATER

9. Drinking water must be conserved as much as possible and it is a good plan to catch rain water on the apron of the dinghy and use it to supplement the supplies available. If the dinghy has been drifting for some time, it is advisable to discard the initial collection of rain water as it may be contaminated by salt deposits on the apron.

10. Rain water collected in this manner may be stored in any convenient container and should all be used before depleting the emergency supplies still further.

EMERGENCY RATIONS

11. There are several types of emergency flying rations in service use, varying from a small tin containing barley sugar tablets to a large tin containing quite a variety of foods. The Station Safety Equipment Section will supply a list of contents of the emergency flying rations used at the station. It should be noted that foods with a high protein content require a higher consumption of water.

FIRST-AID KITS

12. First-aid kits are designed for use in an emergency, e.g., after a crash landing or ditching. Instructions for use are included in the container, either on a separate sheet or in the wrapping of a particular item. FOLLOW THESE INSTRUCTIONS IMPLICITLY.

METHODS OF ATTRACTING ATTENTION

13. The methods of attracting attention which are available to a person drifting in a dinghy can be sub-divided into three main groups as follows:-

- (1) Radio/radar transmitters.
- (2) Pyrotechnics.
- (3) Miscellaneous.

RADIO/RADAR TRANSMITTERS

14. At present there is one type of transmitter available for use with an aircrew equipment assembly; it is known by the code name of S.A.R.A.H.

S.A.R.A.H.

15. S.A.R.A.H. (Search and Rescue and Homing) is an air-sea rescue beacon system, fully described in A.P.2554C, Vol.1, consisting of:-

- (1) A man-carried automatic distress beacon.
- (2) Airborne search equipment.
- (3) Rescue launch search equipment.

16. The man-carried equipment consists of a small pulse transmitter with a folding strip aerial. A speech unit enables two-way radio communication to be established between the survivor and the search craft; the early beacons, however, were not fitted with the speech unit. The beacon has an effective range of approximately 60 nautical miles over the sea (70-75 miles with later types of receiver) and about 40 nautical miles (42-45 miles with later types of receiver) over land, to a search aircraft flying at 10,000 ft., and approximately 6 nautical miles to a rescue launch (assuming a launch aerial height of about 30 ft.). The speech unit is a short-range facility which is used only when the search craft is heard or sighted. The power unit contains dry batteries and has a life of 20 hours beacon operation; this is reduced to 15 hours if the speech unit is used for one hour.

17. The beacon transmitter is brought into operation by removing the aerial cover. The aerial then springs to the erect position and a line from the aerial cover operates a plunger switch on the beacon unit.

18. The speech unit is brought into operation by pressing one of two buttons on the side of the unit; one button is labelled "LISTEN" and the other one "TALK".

19. The beacon signals are displayed on a cathode ray tube in the search craft and give the relative bearing and distance of the transmitter. Fixes from an altitude of 500 ft. are accurate to within ± 100 ft. and this is more than adequate for subsequent pick-up by helicopter or surface craft.

20. When the speech unit is in use, characteristic signals are shown on the cathode ray tube to indicate either the "Listen" or "Talk" condition of the beacon; homing can be continued in either case.

21. The beacons carried by crews of multi-seat aircraft are so coded that each member's beacon produces a slightly different trace on the cathode ray tube. Thus the search craft can receive several transmissions on the same tube and "home" on to each of them in turn. Although each survivor will be able to contact the rescue craft (using the speech unit) when it is in range, he will not be able to contact his fellow survivors. This is arranged deliberately in order to prevent unnecessary (and almost inevitable) conversation and consequent battery wastage.

PYROTECHNICS

22. The main pyrotechnic supplied for use in the dinghy is the day and night distress signal Mk.13, Mod.0. When this is not available, the two-star RED distress signal may be supplied in lieu. When a multi-seat aircraft has to be ditched, it is always a good plan (if time permits) to take the aircraft signal pistol and a supply of cartridges into the dinghy.

Day and night distress signal (Mk.13, Mod.0)

23. This signal has an orange smoke unit at one end (for daytime use) and a red flare unit at the other (primarily for use at night). Each unit is operated independently.

24. On a clear day in coastal waters, the smoke is visible for about 11 miles and the flare is visible for about $6\frac{1}{2}$ miles. At night, the flare is visible for about 28 miles. Both signals burn for approximately 20 sec.

25. The flare end of the signal is identified by a red band; a ring of raised beads around this end ensures positive identification by touch. The smoke unit end of the signal is identified by an orange band.

26. The body of the signal carries a label giving the operating instructions. These instructions are as follows:-

- (1) Remove the protective cap from the end to be used.
- (2) Unfold the pull ring; lever this ring with the thumb and forefinger until the seal snaps.
- (3) Pull the ring sharply away from the signal which will then ignite.
- (4) Hold the signal at arms length, pointed away from the body at 30 to 45 deg. to the vertical.

27. On rare occasions the smoke signal may give a flame. When this occurs, momentarily immerse the signal in water and smoke will again be emitted. After use, douse the signal in water and retain it until the other end is required.

Two-star RED distress signal

28. This type of signal consists of a metal tube, closed at one end with a screw cap on the other. When operated, it ejects a red star to a height of approximately 100 ft., followed (after a delay of 4-5 sec.) by another red star reaching a similar height. On a clear day, the signal can be seen for approximately 3 miles. At night, the signal is visible for up to 15 miles.

29. The body of the signal is painted red and the operating instructions are printed in black. The instructions are as follows:-

- (1) Place the signal in the canvas hand-grip supplied in the survival pack. If this hand-grip is not available, the signal should be held tightly in one hand.
- (2) Point the signal away from the body, unscrew the cap and unfold the firing ring.
- (3) Pull the firing ring across the end of the signal.
- (4) Hold the signal vertically at arm's length.

30. There may be a delay of up to 2 sec. before the first star is ejected, the second star following after a further interval of 4-5 sec. If one or both stars fail to eject, no attempt should be made to investigate. Continue holding the signal at arm's length for at least 30 sec. and then drop it into the sea.

31. When an aircraft or ship is sighted two signals should be fired, as there may be some doubt in the minds of the crew as to whether the first light that they observed was really a distress signal.

Rocket, signal, distress, No.1, Mk.1

32. This signal is provided for use by aircrews who force land or parachute into jungle country. It may, however, be used in a dinghy provided that it is held well clear of the dinghy during firing.

33. The signal consists of a cylindrical metal container with a screw cap at each end. The container houses a rocket-propelled single red star and an ignition assembly with a 30 in. operating cord. When the cord is pulled the rocket is ejected to a height of 750 ft. and, at this height, the red star is ejected a further 50 ft. and burns for approximately 9 sec.

34. The operating instructions and an arrow indicating the firing direction are printed on the outside of the container; the instructions are as follows:-

- (1) Hold the rocket in the middle with the left hand.
- (2) Remove BOTH COVERS and unwind the ignition cord without pulling.
- (3) Keep the left arm outstretched horizontally and point the rocket in the required firing direction (do NOT point the axis of the rocket towards the body).
- (4) Fire the rocket by giving a steady pull on the ignition cord, keeping the cord at an angle so that the hand is out of the line of the rocket efflux.

Note...

As very hot gases are discharged from the lower end of the rocket it is important when pulling the cord that this end is directed away from the hand and body.

MISCELLANEOUS AIDS

HELIOGRAPH

35. This is a stainless steel mirror 2 in. square, which is in sunny conditions, used for signalling to rescue craft. A cross is etched on to the surface of the mirror, the intersection of the cross coinciding with a hole in the centre of the mirror. A foresight is attached to the mirror by a length of cord. In clear weather the range of heliograph is limited only by the curvature of the earth's surface.

36. The method of use is as follows:-

- (1) Hold the mirror close to one eye, the etched side being away from the face.
- (2) Hold the foresight in the vertical position in front of the mirror at the full extent of its cord.
- (3) Look through the hole in the mirror and align the foresight so that the rescue craft is viewed through both the hole in the foresight and the hole in the mirror.

(4) Manipulate the mirror so that the reflection of the sun's rays falls on the foresight. The reflection of the cross should be centred on the hole in the foresight and, if the rescue craft is still visible through both holes, the reflected rays will strike it, thereby attracting attention.

37. The heliograph, which has the advantage over all other aids that it can be used indefinitely provided the sun is shining, is fully described in A.P.1182C, Vol.1

LIFE JACKET LAMP, TYPE A

38. The lamp is designed to enable rescuers to locate the user at night. The battery is fitted in a waterproof plastic container and becomes active when the container is filled with fresh or sea water. The bulb is fitted in a holder on a skull cap which can be worn on the bare head or over a helmet. There is no switch in the circuit and the battery has a useful life of about 16 hours. The method of operation is as follows:-

(1) Pull off the spring clip securing the bulb to the battery case. The bulb holder can then be removed (it is a very tight fit) together with the skull cap and the length of flex attached to it. Put on the cap.

(2) If in the water, replace the battery container in its pocket in the life jacket. If in the dinghy, drop the container over the side and ensure that it is still immersed. It will not be lost as it is attached to the life jacket by a cord.

39. The life jacket lamp, Type A, is fully described in A.P.4343E, Vol.1, Sect.16.

LIFE JACKET LAMP, TYPE B

40. This is very much smaller than the Type A and is intended for use primarily with life jackets, such as the Mk.4, which have no room for the larger type.

41. The battery is fitted in a blue plastic container and becomes active when four sealing plugs are removed and it is immersed in water. There is no switch in the circuit but the top of the battery (which contains a 2-pin plug) may be removed and the circuit to the lamp thus broken. The useful life of the battery is about ten hours at full brilliance plus two or three hours at diminishing brilliance. The life is similar for interrupted use within a period of 36 hours, but after that the battery will deteriorate. Thus it is possible to use the lamp for at least part of two successive nights.

42. The lamp housing consists of a filament lamp in a transparent, watertight, plastic dome which is secured to a polythene tab. The tab has a hole which enables the lamp to be fitted over a rubber button on the life jacket.

43. The method of stowing the lamp in the pocket of the life jacket and the method of operation of the lamp is as follows:-

(1) Stowing the lamp and battery:-

(a) Ensure that there is a $3\frac{1}{2}$ in. length of cord from the studs on the battery case and a $3\frac{1}{2}$ in. length of cord for use as a lanyard between the battery and the life jacket.

(b) Secure the free end of the $3\frac{1}{2}$ in. cord to the eyelet in the corner of the pocket and secure one end of the $3\frac{1}{2}$ in. length of cord to the same eyelet.

(c) Secure the free end of the $3\frac{1}{2}$ in. length of cord to the battery case.

(d) Stow the battery in the pocket (studded side forward) with the longer cord looped across the bottom of the case so that it will not snag when it is withdrawn. Hank the cable and stow it between the side of the battery and the wall of the pocket and place the lamp (flat side uppermost) on the top of the flex.

(2) Operating instructions:-

(a) Open the lamp pocket in the life jacket.

(b) Withdraw the lamp housing, cable and battery.

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- (c) Remove the studs from the battery and immerse the battery in the sea.
- (d) Attach the lamp housing to the button on the life jacket.

44. The life jacket lamp, Type B is fully described in A.P.4343E, Vol.1, Sect.16.

FLUORESCINE SEA-MARKER

45. The fluorescine sea-marker is contained in a small pack located on the life jacket. It contains a powerful dye which, when immersed in water, stains the surrounding area a yellowish-green colour. It is effective only in daylight and it is preferable to use it from the dinghy as it is poisonous; care should be taken to avoid swallowing contaminated water. The sea-marker should also be kept away from the eyes, drinking water, rations, etc.

46. To use the sea-marker, pull the rip-strip over the fluorescine pack housing on the life jacket and extract the pack. Lower it into the water until it is just awash and tie it to a convenient loop on the dinghy or life jacket so that it remains just below the surface of the water as it trails. If the pack is too low in the water, the coloured film that it produces will be partially obscured; if it is very low, the film may be totally obscured. The sea-marker takes approximately 15 minutes to develop a trail of sufficient size to be observed and it has a useful life of approximately two hours. It should, therefore, be used only when it is known that search aircraft are in the vicinity. Once immersed, it cannot be withdrawn and used again.

PERSONAL SURVIVAL PACKS

47. There are various types of personal survival packs in service but they all have the same function; to contain a single-seat dinghy and survival equipment. The type of pack specified for use in any particular aircraft will be stated in the appropriate chapter in this publication.

48. The personal survival pack may be carried within or outside the parachute harness. Those packs which are carried outside are fitted with a lowering line and, during a parachute descent, the pack is to be disconnected from the harness; the pack then falls to the full length of the lowering line (approx. 15 ft.), in which position it reduces oscillation of the parachute and minimises the possibility of injury to the survivor on landing.

49. Full details of all types of personal survival packs will be found in A.P.1182C, Vol.1, Sect.9.

SINGLE-SEAT DINGHIES

50. Several types of dinghies are available for use in personal survival packs. They are described in A.P.1182C, Vol.1, Sect.2, and are:-

- (1) Type SS Mk.2, 3, 4 and 5. One of this range will be found in most survival packs; A.P.1182C, Vol.1, Sect.9 refers.
- (2) Type K Mk.2. This is less bulky than the Type SS dinghies and is now only used when space restrictions in the aircraft necessitate the use of a smaller personal survival pack, or because the design of the pack itself requires a less bulky dinghy.

TYPE SS DINGHIES

51. Mk.2 and 3 dinghies are made of yellow fabric throughout; Mk.4 and 5 dinghies have flame orange fabric on the outside of the inflatable canopy and also have blue-grey fabric in other parts. In addition, the Mk.5 dinghy embodies a relief valve which allows excess pressure to pass out of the buoyancy chamber to atmosphere (this relief valve will be introduced into the Mk.2, 3 and 4 dinghies by modification action at a later date).

52. Initial inflation of the dinghy is provided by a manually operated CO₂ cylinder, Mk.9 (Q), the gas in the cylinder being released by pulling a webbing lanyard attached to a lever on the operating head. A small bellows-type inflator is used for topping up the buoyancy chamber to maintain full inflation. Protection against exposure in very cold weather is provided by an inflatable floor, canopy and hood; these are inflated by mouth through tubes fitted with special nylon valves.

Inflation

53. The method of inflation will vary slightly according to the type of personal survival pack; details will be found in the appropriate chapter of A.P.1182C, Vol.1, Sect.9.

Boarding

54. The dinghy is boarded over the stern (the small end) by grasping the handles on the buoyancy chamber and dragging the body inboard; kicking the legs vigorously may assist in this operation. When aboard, fasten the inflator to the topping-up valve and complete the inflation of the dinghy, if necessary. Bale out any water which has been shipped, pull in the packs containing the survival equipment and partially deflate the life jacket but DO NOT remove it.

55. Open the valve of the floor tube and inflate with three or four breaths; the floor should not be over-inflated, all that is necessary is that there should be a blanket of air to provide insulation between the body and the lower fabric of the floor which touches the water.

56. Commence fastening the canopy at the feet; the method of fastening is stencilled on the canopy and is as follows:-

- (1) Bring the two sides of the canopy together and fasten the mating press studs with the blue doublers on the inside.
- (2) Fold and roll the remainder of the canopy until the mating parts of the second row of press studs are in line and fasten them together.

57. When the lower half of the canopy has been fastened, pass the aerial unit of S.A.R.A.H. (if carried) through the tube in the canopy and fasten the unit to its mounting patch on the buoyancy chamber.

58. Before closing the neck of the canopy, open the valve and inflate the canopy and hood. Tuck in the visor, making sure that it does not fit too closely round the face, and complete the fastening of the canopy.

Note...

Over inflation of the floor will adversely affect the stability of the dinghy. The object of the double floor is to insulate the occupant from the cold water below the dinghy. Three or four deep breaths are all that are needed to obtain the required insulation. Similarly, the canopy should not be over inflated; it is sufficient to inflate until the quilted effect is well defined.

TYPE K, MK.2 DINGHY

59. The method of inflating and boarding this type of dinghy is very similar to that used for the Type SS dinghies, but differs in the following respects:-

- (1) Inflation. If a Mk.9 (K) cylinder is used with the dinghy, there will be a wheel-type handle on top of the operating head. A safety pin is removed from the handle, the wheel being turned to lift the valve off its seating and allow the gas in the cylinder to escape into the buoyancy chamber.
- (2) A single skin cape and apron are fitted to this dinghy. If the weather is not too cold, they will supply sufficient protection. The apron is fitted first by drawing it upwards from the feet and securing it in position with fabric tabs which are fitted into D-rings along the sides of the buoyancy chamber; the cape is placed over the head and shoulders and fastened to the apron by press studs.
- (3) In very cold weather, further protection is provided by an inflatable exposure suit and air cushion. The suit is donned in the dinghy and the cushion is inflated and placed under the buttocks.

INFLATABLE EXPOSURE SUITS

60. Two types of suits are available, the Mk.1 and Mk.2; a complete description of each will be found in A.P.1182E, Vol.1. A suit is worn over all items of clothing, except shoes, or boots, and helmet; no attempt should be made to remove any other clothing, even though it may be wet.

MK.1 EXPOSURE SUIT

61. The suit is made from two layers of yellow single-ply rubberised fabric, joined together by seams and anchorage patches to form a garment which covers the whole of the person except the hands and face. An inflation tube is fitted to the left sleeve, near the wrist and, after use, it is sealed by a small rubber plug. A drain hole is provided on the inside of each foot so that moisture can be drained from the suit. The drains are sealed by plugs when not in use. There is a rip-strip near the pocket in each leg of the suit; these provide an emergency method of emptying the suit should it become water-logged; the suit is still useful after the rip-strips have been used and should not be discarded. A urinating sleeve is fitted and is normally sealed by a rubber key and string, and an inflatable cushion is attached by a length of cord to the suit to provide a comfortable seat and to insulate the buttocks from cold water under the dinghy. The suit is waterproof and windproof.

62. Speed of donning (that is, getting into the suit) is of the utmost importance and it is recommended that potential users should practise donning in the confined space of a single seat dinghy as frequently as possible. The following is the recommended sequence of donning:-

- (1) Board the dinghy.
- (2) Remove the boots or shoes and fasten them to the dinghy.
- (3) Unfasten the fly-buttons of the trousers.
- (4) Open the pack containing the exposure suit.
- (5) Unfold the suit and lay it along the starboard side of the dinghy; the cushion can trail in the water.
- (6) PARTIALLY inflate the suit and insert the legs. Pull the suit up the legs so that the feet are fully home. Rest the shoulders against the buoyancy chamber, arch the back and pull the suit up under the buttocks. Resume the sitting position.
- (7) PARTIALLY deflate the life jacket but DO NOT remove it
- (8) Draw the suit up under the armpits, ensuring that there are no rolls of material trapped under the buttocks
- (9) Draw the suit over the shoulders, insert the arms, remove the flying helmet and put on the suit helmet.
- (10) Close the neck opening by pulling the draw cords simultaneously at both sides; tie the looped ends of the cords together and tuck them into the pocket at the front of the suit.
- (11) Tie the tapes at the front of the suit.
- (12) Inflate the suit.
- (13) Tie the tapes around the ankles of the suit, inflate the cushion and sit on it.

63. In the event of the wearer falling out of the dinghy, the suit will provide adequate buoyancy when inflated.

MK.2 EXPOSURE SUIT

64. This suit is similar in appearance to the Mk.1, but has the following differences:-

- (1) The helmet is fitted with a transparent visor made of thin polythene sheet which is tucked into the neck opening of the suit, thereby protecting the face.

(2) There are no rip-strips in the legs.

(3) There are two inflation tubes, one being fitted at each wrist. Each tube contains a valve which is virtually self-sealing and therefore no plugs are required. It is necessary, however, to double over the end of each tube and place it in the tunnel loops just above the tubes on each sleeve.

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LIGHTNING MK. 1
COVER PITOT HEAD
EB2-88-5111