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NAVAL HEADQUARTERS
DIRECTORATE OF NAVAL ARCHITECTURE

N.C.D. SPECIFICATION

SPECIFICATION FOR INFLATABLE BOAT
(SILLINGER CRAFT)

NCD.....1104

ISSUE.....1.....

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ISSUING AUTHORITY
DIRECTORATE OF NAVAL ARCHITECTURE
(NAVAL HEADQUARTERS)

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NCD 1104

ISSUE 1

1997

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Promulgated by :

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PREAMBLE

1. This NCD specification is sponsored by the Indian Navy, Naval Headquarters, Director, Naval Architecture, Sena Bhavan, New Delhi 110 001.
2. It is to be applied as required by any Min. of Defence contract for manufacture of inflatable boat (Sillinger Craft).
3. If it is found to be technically unsuitable for any particular requirement the Sponsor is to be informed in writing of the circumstances with a copy to Director, Naval Architecture, Naval Headquarters, Sena Bhavan, New Delhi 110, 011.
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6. Unless otherwise stated, reference in this NCD specification to approval, approved, authorised or similar terms are by the Naval Headquarters.

SPECIFICATION FOR INFLATABLE BOAT (SILLINGER CRAFT)

1. SCOPE

0101 This specification covers the materials, manufacture, workmanship, quality test and packing of the Inflatable Rubberised Boat General Purpose (Sillinger Craft). The description and operation of this craft shall be as detailed or as close thereto as possible, in the relevant section of this specification.

2. REFERENCE OR RELATED DOCUMENTS

0201 Reference in this specification to any standard/ specification/document (un-dated) means, in any tender or contract the edition current on the date of such tender or contract.

0202 General Arrangement Drawing: No.OPF/DO/ME-292.

- 1983 ✓
- | | | | |
|------|--|----------------------|--------|
| 0203 | Polychloroprene coated Nylon Fabric
Double, Textured 130cms wide. | IND/ENG/Prov/1207(b) | Wk-600 |
| 0204 | Polychloroprene coated Nylon Fabric
Single Textured 130 cms wide. | -do- | Wk-200 |
| 0205 | Polychloroprene Adhesive Type A
Natural colour | IND/ENG/Prov/1193(a) | |
| 0206 | Toluene Industrial | IS : 536 | |
| 0207 | Polychloroprene coated Nylon Fabric
Strips Type A, 20mm wide | IND/ENG/Prov/1221 | Wk-7 |
| 0208 | Polychloroprene coated Nylon Fabric
Strip type B 50mm wide | -do- | Wk-7 |
| 0209 | Neoprene coated Nylon fabric 650gms
± 50 gms/sqr mtr width 101 cms | IND/ENG/Prov/0684(f) | |
| 0210 | Cordage Nylon Braided 12mm dia
BS 1200 Kg weight 7000 ± 50gm/100mtr | IS : 4227 | |
| 0211 | Cordage Nylon Braided 8mm dia
BS:800 Kg weight 4000 ± 40gm/100mtr | -do- | |
| 0212 | Velcrow Hook Tape Fastner OG 25mm
wide (1") | IS - 8156 - 1981 | |
| 0213 | Aluminium Alloy | IS : 737 | ✓ |
| 0214 | Stainless Steel Rod | IS : 6603 | |
| 0215 | Stainless Steel Plate | IS : 6911 | ✓ |

0216 Marine Plywood

IS : 710

0217 Teak Wood

IS : 1326

0218 Deodar Wood

IS : 1326

0219 Nylon Thread GC 100 HBL.

IS : 4229

(Sticking Thread - Refer 1808)

3. INSPECTOR

0301 The Inspector* nominated by the Director of Quality Assurance (Naval) New Delhi for inspection of the stores on his behalf is to be afforded all facilities, when such inspection is carried out within the Contractor's or Works. He is also to be afforded all facilities for testing of the stores at all stages of their manufacture and has the authority to reject stores which do not conform to the requirements of this specification. The contractor has, however, the right of appeal against any sentence by the Inspector to the Director of Quality Assurance (Naval), New Delhi and such appeals will be forwarded through the Inspector. The Inspector will, without prejudice, assist the contractor with all relevant information and technical advice pertaining to the stores whenever necessary. The cost of conducting tests and the material required for the purpose are to be borne by the Contractor.

4. RECORD

0401 The Contractor shall develop and maintain records that demonstrate the effective operation of his quality control system and shall make these records available for review to the inspector mentioned in the contract. Inspection records shall include explicit identification of the material, part sub-assembly, equipment, sub-system or system, the nature and number of observations made, the number and type of deficiencies found, the quantities approved or rejected, and the nature of the corrective action taken, as appropriate. Records shall be retained until disposal is directed by the Inspector. The contractor shall furnish a copy of any record to the Inspector, on request.

5. PRE-INSPECTION BY SUPPLIER

0501 Before tendering the stores to Inspector, the supplier shall carry a thorough pre-inspection of each delivery in order to satisfy himself that the stores fully conform to the specification/approved advance sample. The supplier will submit the pre-inspection report to the inspecting Officer in triplicate on the Inspection Report Form at the time of intimating readiness of stores. The inspection report form will cover all tests mentioned in Part IV and exact format may be mutually agreed upon between the supplier and the Inspecting Officer. The observations made during inspection will be noted in the same pre-inspection form by the Inspecting Officer. These will be signed both by Suppliers representative and the Inspecting Officer. One copy will be

handed over to the supplier, one copy retained by Inspecting Officer and the third copy will be forwarded to AHSP for records/scrutiny.

6. DOCUMENTATION

0601 The following documentation will be provided at the time of completion of supply with each craft.

- a) Detailed dimensioned drawings drawn in different views giving overall and all important dimensions and with efficient details so that all major sub-assemblies can be positively identified;
- b) Parts identification lists giving description and/sketch of various parts so that the parts can be positively identified;
- c) Comprehensive parts lists;
- d) Operating instructions giving detailed maintenance and repair instructions;
- e) A list of recommended spares which must be carried.

7. WARRANTY CLAUSE

0701 The stores supplied will bear a warranty of the contractor, against defective material, workmanship and performance for a period of 12 months from the date of despatch of the last consignment of the stores and during this period if any of the stores supplied is found defective the same shall be replaced by the contractor free of any charge at the consignee's place as soon as possible and in any case not later than 3 months from date of receipt of intimation by the contractor.

8. INSPECTION AUTHORITY

0801 Directorate of Quality Assurance (Naval), West Block No.5
RK Puram, New Delhi 110 022.

9. INSPECTING OFFICER

0901 Regional/Resident Inspector of Warship Equipment of the area concerned or his authorised representative.

10. PACKING INSTRUCTIONS

1001 The unit shall be suitably packed to the satisfaction of the Inspecting Officer to withstand the hazards of rail/road transit and with a view to avoid any damage during transit and safe arrival at consignee's address.

11. MARKINGS

1101 The packages shall be marked as follows:

- a) Order No. and date _____
- b) Craft Serial No. _____
- c) Date of Packing/Manufacture _____
- d) Inspection Note No. and Date _____
- e) Name of Manufacturer _____

To _____

Gross Weight _____

12. GENERAL DESCRIPTION

1201 Boat General Purpose inflatable (Sillinger Craft) consists basically of an inflatable U-shaped tube of polychloroprene coated Nylon Fabric which forms the sides and bow of the boat. The boat is reinforced with rubberised strips of polychloroprene Nylon fabric at various places. The buoyancy tube is divided into four air chambers each fitted with a valve for inflation and deflation. Boards made of wood and Keelson are used to keep the floor rigid. The boat assembly drawing is placed at Appendix A. The sectional drawings with different views is placed at Appendix B.

1202 The General dimensions of the craft are:

- i) Length overall - 4550mm to 4675mm.
- ii) Width - 1825mm to 1870mm.
- iii) Dia of buoyancy tube - 453mm (+13mm, -38mm)
- iv) Inside Length - 2980mm (+30mm, 0)
- v) Weight - 110Kg approx including floor accessories. ($\pm 10\%$)
amended 135.0 \pm 5%, kgs vide BNA M/TN/11. NC/0542 dt 5.12.01.

1203 The general description of the boat are as under:

- a) Boat: The boat has a 'U' shaped hull having buoyancy tube made of rubberised Nylon fabric coated with Polychloroprene. The buoyancy tube has a diameter of 453mm. The buoyancy tube is divided into four compartments fitted with a valve for inflation/deflation. The bottom floor of the boat is made of the same basic fabric as the buoyancy tube. KKGCV
- Reinforcement of the boat is provided using rubberised strips of Polychloroprene coated Nylon fabric. The stern of the boat is formed by a transom made of Marine Plywood on which OBM can be fitted.

- b) Inflation/Deflation Valve: The valve used for inflation/deflation is a two way valve made out of rubber moulding and plastic nylon material. It consists of two portions, the bottom portion is fixed to the buoyancy tube and the top portion is screwed into the bottom portion. When the inflation is completed, the valve is closed by the cap which is anchored on the boat hull by means of a nylon cordage.
- c) The material of inflation/deflation valves fitted on the buoyancy tube shall be of standard design/material.
- d) Transom: The transom board is fitted and securely bonded to the buoyancy tube and the floor soas to provide a water tight joint. The transom is made of Marine Plywood and suitably fitted out with engine mount made of alluminium alloy and chafing patch. Polychloroprene coated fabric is to be pasted completely on the surface area of the transom to prevent from damage as well as loosening from the tube body. Separate strip of size 0.2cm x 3.5cm x 1.8mtr has been provided on the bottom of the transom to minimise chances of damage.
- e) Floor: The floor of polychloroprene proofed Nylon Fabric is bonded to the underside of the buoyancy tube and the transom board. Special attention is paid to the attachment of the floor of the buoyancy tube to ensure that the resulting joint is water tight.
- f) Keelson: A keelson in three interlocking sections is made of Marine Plywood. The detailed drawing is placed at Appendix C.
- g) Wooder Platform: Wooden platform is made by connecting four pieces of Marine Plywood. Marine Plywood boards are used to make the platform rigid.

13. SEAWORTHINESS

1301 The gemini should have the following salient features:

- a) Excellent underpower
- b) Fuel efficient
- c) Exceptionally stable
- d) Excellent seaworthiness
- e) Fast, light and highly manoeuvrable
- f) More buoyant to provide stability in strong winds

See state of mind above

14. INFLATION/DEFLATION VALVE

1401 The valve used for inflation/deflation is a two way valve made out of rubber moulding and plastic nylon material. It consists of two portion, the bottom portion is fixed to the buoyancy tube and the top portion is screwed into the bottom portion. When the inflation is completed, the valve is closed by the cap which is anchored on the boat hull by means of a nylon cordage.

Amplified
GCI 1203(10)

15. DEFLATION AND DISMANTLING

1501 When deflated and dismantled the craft and components are stowed in four tot-proofed canvas valises as follows:

- a) Hull Valise - Hull
- b) Valises for wooden/
metallic accessories -
 - i) Keelson -3 Nos
 - ii) Wooden Platform-4 Nos
 - iii) Polygon -2 Nos
 - iv) U Channel -1 No.
 - v) Oars -2 Nos

Note: Lists of contents of each to be kept inside the bag so as to be available when the bag is opened. The list is to be sealed in a polythene envelope.

16. CONSTRUCTIONAL DETAILS OF BOAT, GENERAL PURPOSE, INFLATABLE

1601 The craft is to be constructed in accordance with the requirements and drawings stipulated in this specification. The boat has a 'U' shaped hull having buoyancy tube made of rubberised nylon fabric coated with polychloroprene. The buoyancy tube is divided into four compartments fitted with a valve for inflation/deflation. The bottom floor of the boat is made of the same fabric as the buoyancy tube. Reinforcement of the boat is provided using rubberised strips of polychloroprene coated nylon fabric. The stern of the boat is formed by a transom made of marine plywood on which OBM can be fitted.

1602 The principal components of the complete assembly are as follows:

- a) HULL : Comprising of:
 - i) Buoyancy tube, inflatable, in four compartments, as shown in the drawings. Complete with rubber conical flat ends.
 - ii) Bulkheads - Three numbers, dividing the buoyancy tube into 4 compartments.
 - iii) Inflation/Deflation valves of Schrader type or as approved - 4 Nos.
 - iv) Transom fitted with engine mount, anti chaf patch.
 - v) Floor in proofed fabric.
 - vi) Floor retaining strip at transom - 1 No.
 - vii) Keelson chafing strip 60mm wide - 1 No.
 - viii) Aft chafing strip - 1 No.

- ix) Keelson locating Blocks - 2 Nos.
- b) HULL FITTINGS: Comprising of:
- i) Keelson in 3 interlocking sections - 1 No.
 - ii) Bottom Boards, Mine clearance type
 - iii) Bow Rubbing strip - 1 No.
 - iv) Side Rubbing strip Aft - 1 Set
 - v) Carrying Handles (patch rubber with handle) - 5 Nos.
 - vi) Lifting Rings on Transom - 2 Nos.
 - vii) Stainless Steel Hook ON transom - 2 Nos.
 - viii) Stainless steel D rings - 2 Nos.
 - ix) Eyelet Brass (No.28) with washer - 40 Nos.
 - x) Pockets for stowage - 3 Nos.
(one for wireless set & one for inflation bellow pump)
- c) HULL EQUIPMENTS: Comprising of:
- i) Keelson in three interlocking sections - 1 No.
 - ii) Wooden platform in 4 parts - 1 No.
 - iii) Polygon (alluminium alloy) - 2 Nos.
 - iv) U Channel (alluminium alloy) - 1 No.
 - v) Cars - 2 Nos.
 - vi) Repair outfit (small) - Fabric patches 05, adhesive tube (Dendrite) 250gm. Spanners of required sizes.
- d) VALISES AND STORE BAGS: As follows:
- i) Valise for Hull - No.
 - ii) Valise for wooden bottom board, keelson and cars - 1 No.

Note - 1: Each of the packages must be capable of being passed through a hole 75cms in diameter.

Note - 2: List of the contents of each bag are to be placed inside the bag so as to be available when the bag is opened. Each bag is to be marked on the outside with the DS Cat No. and identification No. of the craft.

17. CONSTRUCTIONAL DETAILS

Buoyancy Tube

- 1701 The buoyancy tube is made from Nylon Fabric with Poly-chloroprene (Neoprene) compound proofing. The tube is U-shaped and divided into 4 air tight compartments by 3 baffles/bulk-heads. Each compartment is fitted with a combined inflation/ deflation valve. The valves are made out of rubber moulding and plastic nylon material.
- 1702 The ends of the tube, are conical and terminate in rubber conical flat ends. The two legs of the U are to be parallel and the width readings at the transom and at midship should not differ by more than 10mm.
- 1703 The seams in the buoyancy chambers are to have an overlap of 3cms width. They are to be stuck with adhesive and taped externally.
- 1704 External faying edges of transverse seams are to face aft and external faying edges of longitudinal seams are to be inboard. The panels or gores are to be cut such that when assembled and warp of the fabric runs circumferentially.
- 1705 The attachment of bulkheads in the buoyancy tube is to be such that each chamber is rendered air tight under specified pressure.

Floor

- 1706 The floor of proofed Nylon/terylene fabric to be bonded to the underside of the buoyancy tube and attached by a floor retaining strip to the transom board. It is strengthened on its underside in way of the keelson by a keelson chafing strip of 10cm (4 inches wide fabric). Chafing strips are also to be bonded to the underside at the after the ends of the tubes.
- 1707 Special attention is to be paid to the attachment of the floor to the buoyancy tube to ensure that the resulting joint is water tight. Special care is also to be taken that the floor is perfectly taut and smooth and has no puckers, when the craft is assembled and ready for use.

Transom

- 1708 The transom board is fitted and securely bonded to the buoyancy tube and the floor so as to provide a water tight joint. The transom to be made of marine plywood of appropriate thickness and to be suitably fitted out with engine mount made of Aluminium alloy plate (IS 737) and chafing patch. The transom is also to be suitably designed to help locate the after end of the keelson. Details regarding Craft identification No. etc., are to be stencilled in permanent ink on the innerside of the transom, starboard side. Lifting rings, cleat and 'U' bracket to be provided as per approved drawing.

Keelson

1709 A wooden keelson in three inter-locking sections is to be provided. It is to be made of marine plywood/well seasoned CP Teak. Drawing of keelson is placed at Appendix C.

Floor Boards

1710 The floor boards is to be made by connecting four pieces of marine plywood. Marine plywood boards are used to make the platform rigid.

1711 Stowage Pockets

✓ Stowage pockets, 3 in No. to be attached to the buoyancy tube in the forward in board side. Holes are to be provided at the bottom of the pocket to drain water. Size 340 x 280 x 90 mm.

1712 Rubbing Strips

✓ Rubbing strips of rubber/urethane foam enclosed by fabric are to be bonded to the craft for the protection of the buoyancy tube when coming alongside as follows:

- ✓ i) Bow rubbing strip.
- ✓ ii) Side rubbing strip aft - one each side.
- ✓ iii) Chafing patch for coxwain's position.
- ✓ iv) Chafing patch on Prow in the way of Bow Fair Head.

1713 Carrying Handles

✓ 4 carrying handles are to be provided as per drawing. These are to be of patch rubber with handle bonded to the buoyancy tubes.

1714 Towing Fittings

✓ One towing handle at the bow of the boat is to be provided. Two in no. Gun metal 'D' rings are also to be provided in the forward outboard side, one on each side.

1715 Gunmetal/Naval Brass Hooks

Lifting ✓ Two hooks of Gun metal/Naval Brass are to be provided on transom.

1716 Oar Securing Assemblies

The oar to be positioned 30° to the vertical on the inboard side of buoyancy tubes, above line of valves.

1717 Bellow Pumps

Bellow pump of suitable design to inflate the craft in approximately 20 minutes is to be provided.

1718 Fabric Fittings

Patches, doublers, anchorages, etc., are to be made and

positioned as shown on the drawing which indicates final size. Suitable tape/webbing reinforcement is to be used distribute stresses adequately.

10. WORKMANSHIP

1801 All workmanship on the genital are in accordance with the engineering production standard. Sharp edges, burrs and corners likely to cause injury during handling are removed.

Joining

1802 The area used for fabrication of boat are properly cleaned and free from dust and foreign particles. The following sequence is being adhered to:

- a) The two portions to be joined are cleaned on suitable roughening machine to roughen the surface slightly and to remove any foreign particles on the surface.
- b) Adhesive and cross linking agent in the required proportion is thoroughly mixed in a bowl.
- c) The two roughened surfaces are cleaned thoroughly using toluene to remove any dust, stains, etc. The surfaces are then allowed to dry.
- d) The adhesive is applied on the surface by means of a brush. When the adhesive becomes tacky, two portions are joined together.
- e) Immediately after joining, the overlapping portions of the joint are pressed by means of roller on a suitable rubber pressing knife to remove kinks and to ensure good contact.
- f) Uniformity of overlap throughout the length of every joint is maintained. The joints are straight and parallel to one another. The joints are made free from kinks, wrinkles or loose portions.

Curing of the Joints

1803 Curing of the joints are done in shade in a clear area where dust and foreign particles do not enter and fresh air is circulated. The curing is done for a period equal to the curing time of the adhesive as specified by the manufacturer of adhesive.

Packing Specification

1804 The packing shall be done as follows:

- a) Tube body will be packed in valise stitched from Duck cotton 475gm. This will be baled from laminated Hessian Cloth and packed in wooden box of

suitable size.

- b) All other accessories will be first wrapped and baled with laminated Hessian Cloth and then packed in wooden crates of suitable size.

Seam Overlaps

1805 The seam overlaps are to be made as follows:

- a) Proofed surfaces at ring into seam overlaps are to be cleaned by light abrasion with fine emery cloth Grade (FF) using firm finger pressure and giving 6-8 to and fro rubs on each section of length and the equivalent on shaped areas. If solvents are used, they are to be kept to a minimum the area to be stuck is to be rubbed with wet (not dripping) pad and the solvent is to evaporate for the adhesive is applied.
- b) The adhesive is to be applied to both surfaces to be stuck together in accordance with the makers recommendations and is to be left until the solvent smell is no longer discernable before the seam is made.
- c) The lap is to be rolled firmly and evenly. A maximum tolerance of plus or minus one sixteenth of an inch is permitted over short lengths only (not exceeding six-inches) of the laps.
- d) The inner edges of all buoyancy chamber seams are to be sealed further by brushing on one coat of adhesive, giving particular attention to seam junctions.
- e) All completed laps are to be dusted liberally with French chalk to specification DTD 527, or an approved substitute, special care being taken that this is done on the inside of the buoyancy chamber.

Taping

1806 Tape is to be applied to all external edges of seams. Where lengths of tape have to be joined the ends are to be overlapped by not less than two inches and the ends are to be rounded.

Before applying the tape, the surface of the fabric is to be cleaned and adhesive, applied in accordance with the manufacturer's instructions over an area corresponding to the full width of the tape. Apply adhesive to both surfaces to be adhered and allow solvent to evaporate before tape is applied. The tape to be applied without tension and well rolled to form close adhesion.

Chalking

- 1807 All seams and areas in the vicinity of stuck patches are to be dusted liberally with French chalk to specification DTD 527.

Stitching

- 1808 Thread is to be sewing thread Nylon OG 100 NBL to IS:4229 stitched by lock-stitching machine. The needles are to be as fine as is consistent with the thread, and there are to be not less than six and not more than ten stitches per 25mm length on fabric fittings and not less than four and not more than six stitches per 25mm length on floor fabric. Wavy stitching is to be avoided. In the event of breakage in thread stitchings is to be recommenced not less than 25 mm much beyond the point of breakage. Where stitching runs to the edge of the material, it is to be re-run not less than 5cm parallel to and as near to the main run as possible; any incorrect stitching is to remain in place.

Marking of the Fabric

- 1809 The marking of the fabric during manufacture is to be carried out only with the use of soft marking pencil (Yellow). The use of ball point pens and similar appliances is prohibited.

Tolerances

- 1810 General tolerances on all dimensions are to $\pm 1.5\text{mm}$ ($\pm 1/16"$) unless otherwise specified. The exceptions to this general limit are in respect of stuck-on components, length of webbing and cordage, and the overall dimensions of components, etc; these items are given a "sliding scale" tolerance which increases in accordance with the magnitude of the dimensions.

Production Damages

- 1811 Production damage may be repaired at the discretion of the manufacturer who will, if necessary, consult with the inspecting authority. The damage of the fabric involving loss of proofing shall be repaired by part panel replacement. Where a part panel replacement is not practicable, the same shall be repaired and internal strapping piece shall be applied in the area of damage.
- 1812 In carrying out repairs, with patches, on account of production damage, the following parameters will apply:
- a) All patches shall be circular in shape as far as possible.
 - b) No patch shall be less than 75mm in diameter and more than 150mm in diameter.

- c) In case of rectangular patches, the permissible dimensions shall be 150mm x 100mm and the corners shall be rounded.
- d) Any tear or hole exceeding 10mm in length or diameter shall only be repaired by part panel replacement.
- e) Not more than 1 patch shall be permitted in any buoyancy chamber and not more than 2 patches shall be permitted in any craft.
- f) No patch shall be put within 25mm of a seam.

1813 Where a part panel replacement is necessary, the following parameters shall apply:

- i) On the buoyancy tubes, not more than one part panel replacement will be permitted on each craft.
- ii) On the floor not more than one part panel replacement will be permitted on each craft, so, however, such panel replacement may be in addition to any "economy joint" that may have been used.

Economy Joints

1814 All efforts shall be made to minimise the use of economy joints.

19. MATERIAL SPECIFICATIONS

1901 The material specified below are to be strictly adhered to and no deviation is permitted without prior written permission of the AHSP. Any deviation granted will apply to a particular supply only. Materials referred to as approved are to be so approved by the Inspecting Officer/ AHSP.

1902 The colour of all exposed surfaces/material is to be dark steel grey to BSS 987C, shade no.12. Hidden surfaces are to be of a drab or natural colour.

Fabrics

✓ 1903 Material Specifications: The following are the details of the materials to be used:

a) Polychloroprene coated Nylon Fabric 130 cms width.

- i) Breaking strength : Warp : 4500 N
Weft : 4500 N
- ii) Tearing strength : 250 N
- || iii) Weight gm/m sqr : 1550 + 10%, - 5%

b) Wood:

- i) Marine Plywood

- ii) Teak
- iii) Plywood
- c) Stainless Steel
- d) Aluminium alloy

1904 The details of other materials/drawing nos. are appended below:

Polychloroprene coated Nylon Fabric	IND/ENG/Prov/1207 (b) <i>KKC</i>
Polychloroprene Adhesive Type A Natural colour	IND/ENG/Prov/1193 (a)
Toluene Industrial	IS : 536
Polychloroprene coated Nylon Fabric Strips Type A, 20mm wide	IND/ENG/Prov/1221
Polychloroprene coated Nylon Fabric Strap type B 50mm wide	-do-
Patch rubber with handle	Best Trade Quality
Neoprene coated Nylon fabric 650gms + 50 gms/sqr mtr width 101 cms	IND/ENG/Prov/0684 (f)
Cordage Nylon Braided 12mm dia BS 1200 Kg weight 7000 + 50gm/100mtr	IS : 4227
Cordage Nylon Braided 8mm dia BS:800 Kg weight 4000 + 40gm/100mtr	-do-
Velcrow Hook Tape Fastner OG 25mm wide (1")	IS - 8156 - 1981
Velcrow Loop Tape Fastener OG 25mm wide (1")	-do-
Inflation/Deflation valves	Best Trade Quality
Top End Rubberised Hemispherical	-do-
Rubberised patch 'D' Handle	-do-
'L' type rubber strip	-do-
Rubberised strips type-I Size 4.34 mtr x 16cms x 2mm	-do-
Rubberised strips type-II Size 3.0mtr x 15cms x 3mm	-do-
Rubberised strips type-III Size 3.62mtr x 8cm x 3mm	-do-
Rubberised strips type-IV Size 3.35mtr x 6cm x 2mm	-do-

Rubberised strips type-VI
Size 1.0mtr x 8cm x 2mm -do-

Rubberised strips type-V
Size 1.1mtr x 4cm x 5mm -do-

Set of valises (Duck cotton 610 gms) -do-

Alluminium Alloy	IS : 737
Stainless Steel Rod	IS : 6603
Stainless Steel Plate	IS : 6911
Marine Plywood	IS : 710
Teak Wood	IS : 1326
Deodar Wood	IS : 1326

20. ADHESIVE

- 2001 The adhesive is to be Neoprene based contact adhesive of good quality and to be suitable for service in tropical environments as per specification No.IND/ENG/PROV/1193(a).
- 2002 The adhesive shall consist of a dispersion of polychloroprene in a low boiling point solvent and may have additions of resins to promote 'building tack'.
- 2003 The adhesive shall consist of 2 components, Part 1 and Part 2, Part 1 being the basic neoprene dispersion and part 2, the accelerator (hardner).

21. STENCILING AND MARKING

- 2101 The following is to be stenciled in permanent black ink on inner side of the transom starboard side, DS Cat.No.1910-000162.

BOAT GENERAL PURPOSE
INFLATABLE NO. _____

DATE : _____

NAME OF
MANUFACTURER _____

- 2102 The letters are to be 50mm (2 inches) high, with a space of three inches clear between the lines.
- 2103 Stencil marking with manufacturer's identification craft number and year of manufacture are to be done.
- 2104 The following parts are to have the identification of the craft permanently marked on them:
- Bottom boards Stencil markings to be made.

Keelson	-	-do-
Oars	-	-do-
Stores bags	-	-do-
Valises		do

2105 The stenciling is to be in black ink, waterproof and of a quality non-injurious to the proofed fabric

22. TEST SCHEDULE FOR PROTOTYPE CRAFT /FIRST CRAFT

Physical and Chemical Tests

2201 Physical and chemical tests on samples of various type of fabrics, cordages in order to ensure that these conform to the required designed specifications.

Fabrics

2202 Prior to starting manufacture, the manufacturer shall submit samples of the fabric to the Inspecting Officer as follows:

Buoyancy Fabric Unproofed	-	1 Metre long full width.
Buoyancy Fabric Proofed	-	-do-
Floor Fabric Unproofed	-	-do-
Floor Fabric Proofed	-	-do-

2203 The testing of fabrics will be arranged at appropriate Defence Laboratories by the Inspection Authority/ Inspecting Officer.

Cordages

2204 Test certificates in respect of these items issued by an independent testing authority, where possible or by the manufacturer may be accepted. In case of doubt the

purchaser's Inspector may draw samples for testing at the Defence Laboratories.

Dimensions

2205 The dimensions of the craft will be measured with the craft inflated and completely rigged. During this test the craft will be supported on blocks, without the canvas securing straps. The sides of craft should not touch/bear upon the chock blocks.

2206 The diameter of the buoyancy chambers will be taken at 3 points along each parallel side. The width will be measured at the transom and at a point midship. The internal lengths will be measured between a plumb line from inner one of the buoyancy tube to the bottom end of transom along the floor boards.

Air Inflation Tests

2207 The undermentioned tests are to be carried out on the craft when completed with all fittings. During the tests draughts are to be guarded against and the temperature is to be kept

as constant as possible throughout the test.

0.14 Kg/cm² 1.0282
1.0282
0.032

For every 1°C (1 degree Fahrenheit) rise above the temperature at commencement of the test, 0.01 Kg/cm² (0.032 PSI or 7/8 inch of water) is subtracted from the final pressure reading and for every 1° Centigrade (1 degree Fahrenheit) fall in temperature 0.01 Kg/cm² (0.032 PSI) is added to the final pressure reading. If the temperature variation during the period of the test is greater than 2.5°C (50°F) the test is invalid and a further test is to be made under more constant temperature conditions. Accurate thermometer readings are to be taken.

Preliminary Inflation Tests

2209 The whole of the buoyancy tube is to be inflated to 2 PSI (55 inches of water) and left for 30 minutes. The pressure at the end of this test is not required to be noted, but craft examined for undue stretch or distortion.

2204)

Pressure Test

2210 The whole of the buoyancy tube is to be inflated to 0.14Kg/cm² and left for one hour. The pressure drop corrected for change in temperature is not to exceed 0.006 Kg/cm² during the hour.

Bulkhead Test

2211 Each chamber of the buoyancy tube is to be inflated to 0.14 Kg/cm² with all other chambers remaining uninflated and left for 30 minutes. Fall in pressure corrected for change in temperature is not to exceed 0.012 Kg/cm².

9/
red
it is
001.

— Blow off pressure max 205 FMM Seat pressure min 165mm without leakage.

2212 The tests stipulated in 2213 to 2216 below shall be carried out in calm conditions in smooth water. Service Floor Boards with additional 10 Kg weight may be used for the tests.

Floatation Test

2213 Each craft is to be inflated and assembled complete with Keelson and bottom boards. It is to be floated in water. A load of 800 Kg (1760 lbs) is to be distributed evenly over the floor boards and the craft left floating for 2 hours. No leakage of water is to occur. Any defects found at the conclusion of this test are to be made good by the builder.

Free Board

2214 The free board of the vessel when floating fully inflated in calm water and loaded with a test load of (1760 lbs) 800 Kg. shall not be less than 1/6 th the diameter of the main buoyancy tube, forming a side of the vessel, such free board being measured at mid length of the vessel.

Packing

1153
6

2215 The mode of packing in two valises as described in the relevant sections of this specification shall be successfully demonstrated. The actual weights of the valises and stowage bags will be checked as per clause 1501 and 1602 and recorded.

Marking

2216 Markings, weights and dimensions of various items as well as the completely assembled craft shall be recorded and proven to comply with the designed specifications.

Assembly/De-assembly

2217 It shall be proven that the craft can be assembled and de-assembled as per standard procedures.

Deflation

2218 Deflation tests shall be carried to prove that the craft can be successfully deflated.

Lowering and Hoisting Tests

2219 It shall be proven that the craft is capable of being lowered and hoisted with the dead load of 75 Kgs to represent the coxswain, and with the engine fitted on the transom. In case engine is not available, 46 Kg to represent engine may be used. The craft will be hoisted up through 1 metre, held in position for 5 minutes, swung through 30° to and fro and then examined for damages.

Damage Test

22 The craft shall be capable of supporting 800 Kg. (1760 lbs) with any two compartments deflated.

21 Stability in Static Conditions

The boat is to be inflated and assembled complete with Keelson and bottom boards. It is to be freely floated in water. A load of 800 Kg (1760 lbs) is to be distributed evenly over the floor boards (motor and fuel are not be embarked). After satisfactory completion of this, remove the added loading and observe the static angle of trim. Where applicable, locate the motor in its operating position. The fuel tank shall be filled, and in cases where the tank is separate from the motor, and has no stowage position specified by the manufacturer, it shall be filled and placed as far aft as possible. Observe the new angle of trim of the boat, estimating the change of trim to the nearest 1°.

Allow one person having a mass of between 75 kg and 80 kg to embark and seat himself normally at any point on the inflatable hull chambers. The person shall next take-up successive similar positions around the boundary of the seating area, without leaning outboard of the boat itself.

The boat shall not capsize during the above tests. There shall not be more than 10° change in the trim angle of the boat following the embarking of the motor and fuel.

2222 Stability: Self-Propelled

The tests set out in 2223 and 2224 shall be applicable only to boats suitable for motor propulsion and the following general requirements shall be fulfilled for each test:

- i) The power rating of the motor used shall be the maximum recommended by the manufacturer.
- ii) The boat shall be inflated to the working pressure.
- iii) The motor shall be securely clamped to its bearers and the fuel tank appropriately secured within the boat (where separate from the motor). Both motor and fuel tank shall remain so secured throughout the period of the test.
- iv) The fuel tank shall be filled, and the motor started and allowed to become thoroughly warmed before commencement of each test.
- v) All persons embarked shall be seated.

The minimum water/sea conditions in which these tests are conducted shall be as follows:

- i) Tests specified in 2223 in still water or calm sea.
- ii) Tests specified in 2224 in short sea conditions with observed/estimated min. waveheight of 900mm.

2223 Tests in Still Water Condition

- a) For the purposes of this test a coxswain only shall be embarked and the boat shall be positioned with its bows pointing into a wind having a strength approximately equal to Beaufort force 3. The motor controls shall then be moved so as to develop maximum ahead thrust on the boat and retained in this position for a period of test of not less than 30 minutes.
- b) During this period the following requirements shall be met:
 - i) There shall be no bending or twisting of motor bearers likely to lead to premature failure of the means of attachment.
 - ii) There shall be no tendency of the bow to hit in a manner likely to submerge the motor or overturn the boat.
- c) The test described in 2223(a) shall be repeated but with the maximum number of persons permitted embarked, and positioned uniformly within the 'seating' area.

expected to position himself during the normal operation of the boat.

- d) At the end of the test period specified in 2223(c) and without any change in loading, the motor shall be stopped until the speed of the boat has dropped to 0.5 knot or less.

During this period, the following requirements shall be met:

- i) There shall be no bending or twisting of motor bearers likely to lead to premature failure of the means of attachment.
 - ii) There shall be no flooding of water over the stern of the boat except where the boat is designed to be self-draining.
- e) When moving astern, with the boat loaded as specified in 2223(c), the following requirements shall be met:
- i) There shall be no flooding of water over the stern of the boat except where the boat is designed to be self-draining.
 - ii) The boat shall be manoeuvrable.

Tests in Waves

- a) The boat shall be tested in the manner described in below.
- i) Embark a coxswain only. The period of test shall be not less than 45 min with the motor controls set to develop maximum ahead thrust. During this period the boat shall be kept reasonably dry.
 - ii) The boat shall be headed successively on not less than six different courses of not closer than 30° bearing to each other, commencing with a heading directly into the waves. On each of these courses, a sharp turn to port and to starboard shall be made.
 - iii) The boat shall be closely examined at the end of the test period for any structural failure in the form of fracture, tear, etc. on any part of the hull or boat component, such as deck or thwarts, and including any boundary interface such as floor/hull.

Evidence of any of the referred-to structural failures shall be regarded as failure of the boat. Further, the boat shall not overturn.

- b) The test described in 2224(a) shall be repeated but with the boat loaded with maximum number of personnel

embarked uniformly within seating area. In addition to the requirements of 2224(a), all hand holds shall be clearly seen during the test.

2225 Towing Tests: The boat shall be tested in the manner described below in short sea conditions with observed/estimated minimum wave height of 900mm.

Embark the maximum number of persons reckoned and position them uniformly within the seated area.

Tow the boat by its towing point at a speed of not less than 4 knots, allowing a tow line length of 3 boat length.

Carryout manœuvres for not less than 15 min.

The boat shall be closely examined at the end of the test period for any structural failure in the form of fracture, tear, etc on any part of the hull or boat component, such as deck or thwarts, and including any boundary interface such as floor/hull.

✓ The point of attachment of the tow line shall remain secure during the period of the test.

Evidence of any of the referred-to structural failures shall be regarded as failure of the boat.

Righting Test

✓ 2226 The capsized craft shall be capable of being righted by two men with an average weight of 75 Kg. (165 lbs) each. For this test if two men each weighing 75 Kgs (165 lbs) are not available, then 3 men whose total weight does not exceed 150 Kgs (370 lbs) may be used. During this test, the craft shall be in its light condition with no engine and or other equipments fitted in the craft.

Power Trials

2227 Power trials with the out board engine will be conducted and performance curve under various loads shall be prepared and submitted.

Manœuvrability

2228 It shall be proved that the craft loaded with 800 Kgs (1760 lbs) can be oar propelled. The craft will be turned, brought alongside etc. The test will be conducted over 30 to 45 minutes and condition of attachment to tube will be examined for any damage.

23. TEST SCHEDULE FOR PRODUCTION CRAFTS

2301 Fabrics: Clause 2202 applies.

2302 Cordages: Clause 2204 applies.

2303 Dimensions: Clause 2205 applies.

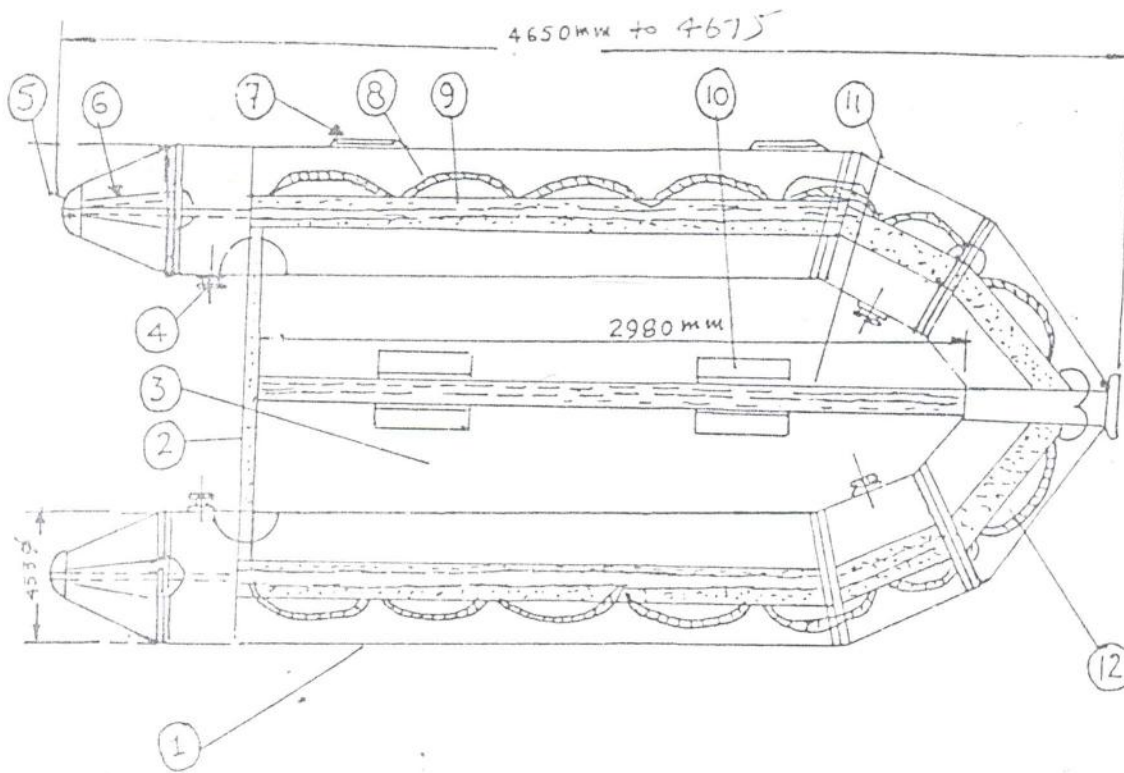
2304 Other Tests: Test prescribed in clauses 2209 to 2219 shall be carried out on all crafts.

2305 Tests at clauses 2220 to 2227 will be carried out on one craft out of every five crafts or part; crafts are to be selected at random by the inspecting officer.

24. COMPLETION

2401 The craft is to be completed in all respects to the satisfaction of the Naval Inspector. All items of equipment are to be checked. The craft is to be assembled on the shop floor and a check is to be made that the parts fit properly.

2402 On completion of all tests and examinations the hull and bottom boards, keelson, etc. are to be packed into their valises to the satisfaction of the Inspecting Officer, before despatch.

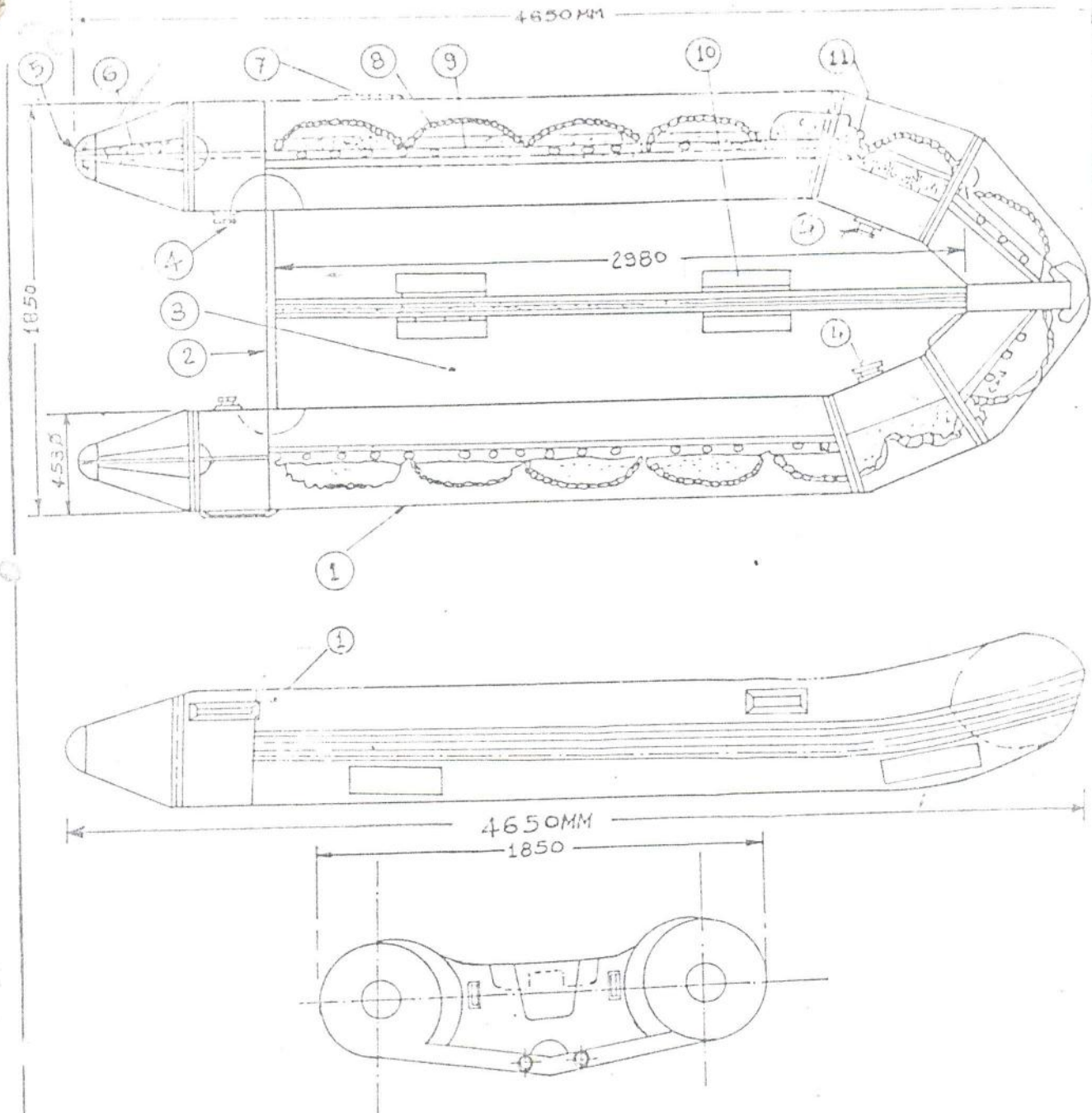


- 1. BUOYANCY TUBE
- 2. TRANSOM
- 3. FLOOR
- 4. INFLATION/DEFLATION VALVE
- 5. TOE END
- 6. RUBBER PATCH
- 7. CARRYING HANDLE

- 8. LIFE LINE FROM NYLON ~~TAPE~~ ROPE TAPE-12MM
- 9. EYE LET (SIZE-20)
- 10. L TYPE RUBBER STRIP
- 11. RUBBER STRIP ✓
- 12. RUBBER STRIP ✓

NOTE: DRG. TRACED FROM
DRG. NO. OPF/DO/ME-292

NAVAL HEADQUARTERS		
DTE OF NAVAL ARCHITECTURE		
ASSEMBLY	JRN	
DRAWING OF	TCD	R.K. VERMA
INFLATABLE -	CHD	
BOAT	APPD	
	SCALE	N.T.S.
DRG No NCD-1105	SHEET No-109	



STERN VIEW

NOTE: DRG. TRACED FROM
DRG. NO. OPF/DO/ME-292

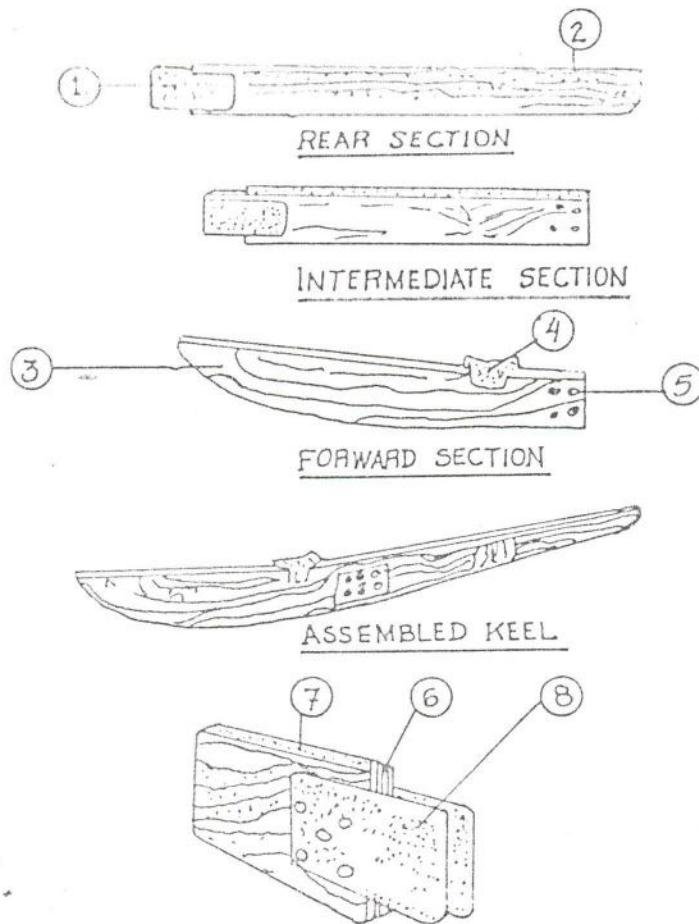
ITEM NO.	NOMENCLATURE	COMPONENT DRG. NO.
1	BUOYANCY TUBE	OPF/DO/ME-289
2	TRANSOM	" " " 288
3	FLOOR	" " " "
4	INFLATION / DEFL. VALVE	" " " "
5	TOE END	" " " 289
6	RUBBERISED PATCH	" " " 283
7	CARRYING HANDLE	" " " 282
8	LIFE LINE NYLON	" " " "
9	EYELET	" " " 290
10	'L' TYPE RUBBER STRIP	" " " 281
11	RUBBER STRIP	" " " "
12	RUBBER STRIP	" " " 269

NAVAL HEADQUARTERS
DTE OF NAVAL ARCHITECTURE

SECTIONAL
DRAWING OF
INFLATABLE
BOAT

DRN	
TCD	<i>Green</i>
CHD	
APPD	<i>26</i>
SCALE	N. T. S.
SH.No.	2 OF 3

DRG. NO. NCD 1105



1. STAINLESS STEEL COUPLING FLANGE SECURED BY FIVE BOLTS.
2. METAL BRACKET SCREWED AND COVERED BY NEOPRENE STRIP.
3. MARINE MULTI-SHEET PLYWOOD WITH UPPER EDGE PROTECTED BY NEOPRENE STRIP.
4. BOLTED TENSION ADJUSTED.
5. METAL BUSHING FOR ROD INSECTION.
6. MARINE MULTI-SHEET PLYWOOD.
7. EDGES PROTECTED BY NEOPRENE STRIPS.
8. STAINLESS STEEL PLATE.

NAVAL HEADQUARTERS		
DTE. OF NAVAL ARCHITECTURS		
KEELSON DRG INFLATABLE BOAT	DRN	
	TCD	M. SINGH
	CHD	
	APPD	
	SCALE	N.T.S
DRG. NO: NCD 1105 /	SHEET	3 OF 3

MATERIAL SPECIFICATION OF INFLATABLE CRAFT

1. The craft shall be made of hypalon coated fabric.
2. The material shall confirm to British standard BSMA 16.
3. The construction shall consist of basic textile support by a 10 x 10 count High Tenacity Polyester fabric to give basic mechanical properties (tensile and tear strength) covered with four calendered rubber sheets with optimal cohesiveness of rubber to give reliability about air tightness. The outer Hypalon sheet shall give weather resistance (fading and ageing) and chemical resistance. The inner Neoprene sheets shall give high gluability, reliable adhesion and air tightness.
4. The tube shall be made of Hypalon Neoprene material of 1670 Decitex. The material to be used is to be imported from reputed international manufacturer. The weight of the tube composite shall be 1500 g/sq.m.
5. Technical specifications are as follows :

(a) Textile Support :

Type : High tenacity Polyester
Yarn : 1670 Dtex
Count : 10 X 10

(b) Coating :

Outside Coating : Hypalon
Inside Coating : Polychloroprene

<u>Properties</u>	<u>Standard</u>	<u>Units</u>	<u>Value</u>
Surface mass	ASTM D 751 FSTM 191/5041	g/s qm	1500 ± 150
Resistance to Puncture	ASTM D 751/B FSTM 191/5102	daN/Sq cm	Warp ≥ 500 Weft ≥ 460
Tear Resistance (Pendulum Test)	ASTM D 751/A	daN	Warp ≥ 20 Weft ≥ 20
Tear Resistance (Tongue Test)	ASTM D 751/B FSTM 191/5134	daN	Warp ≥ 33 Weft ≥ 35
Permeability	NFG 37114	1/sqm day	≤ 2.5
Helium Adhesion (Peeling test)	ASTM D 751 FSTM 191/5960	daN/cm	> 3

Low temperature resistance	ASTM D751	°C	≤ pass
Heat Agening 7 days @ 70° C	FSTM 191/5850	-	Tensile strength unchanged
Hydrocarbon resistance	NFJ 37825	-	Tensile strength unchanged
Weft distortion	NFG 37119/1	cm	80% < 3cm

(c) Composite

<u>Characteristics</u>	<u>Test Method</u>	<u>Unit</u>	<u>Specification</u>
Useable width		mtrs	1.45 (min)
Weft distortion		cm	5 (max)
Weight	NFG 37102	g/s qm	1200 ±10%
→ Warp tensile	NFG 37103	daN/Sq cm	330 (min)
- Weft tensile	NFG 37103	daN/Sq cm	300 (min)
Warp Tear	NFG 37104C	daN	16 (min)
Face adhesion	NFG 46008	daN/ cm	3 (min)
Porosity	NFG 37114	1/sqm/day	3 (min)
Exterior abrasion	Homargy	sqm cm	0.11 (max)
Exterior colour	Xenotest	hrs	100 (min)

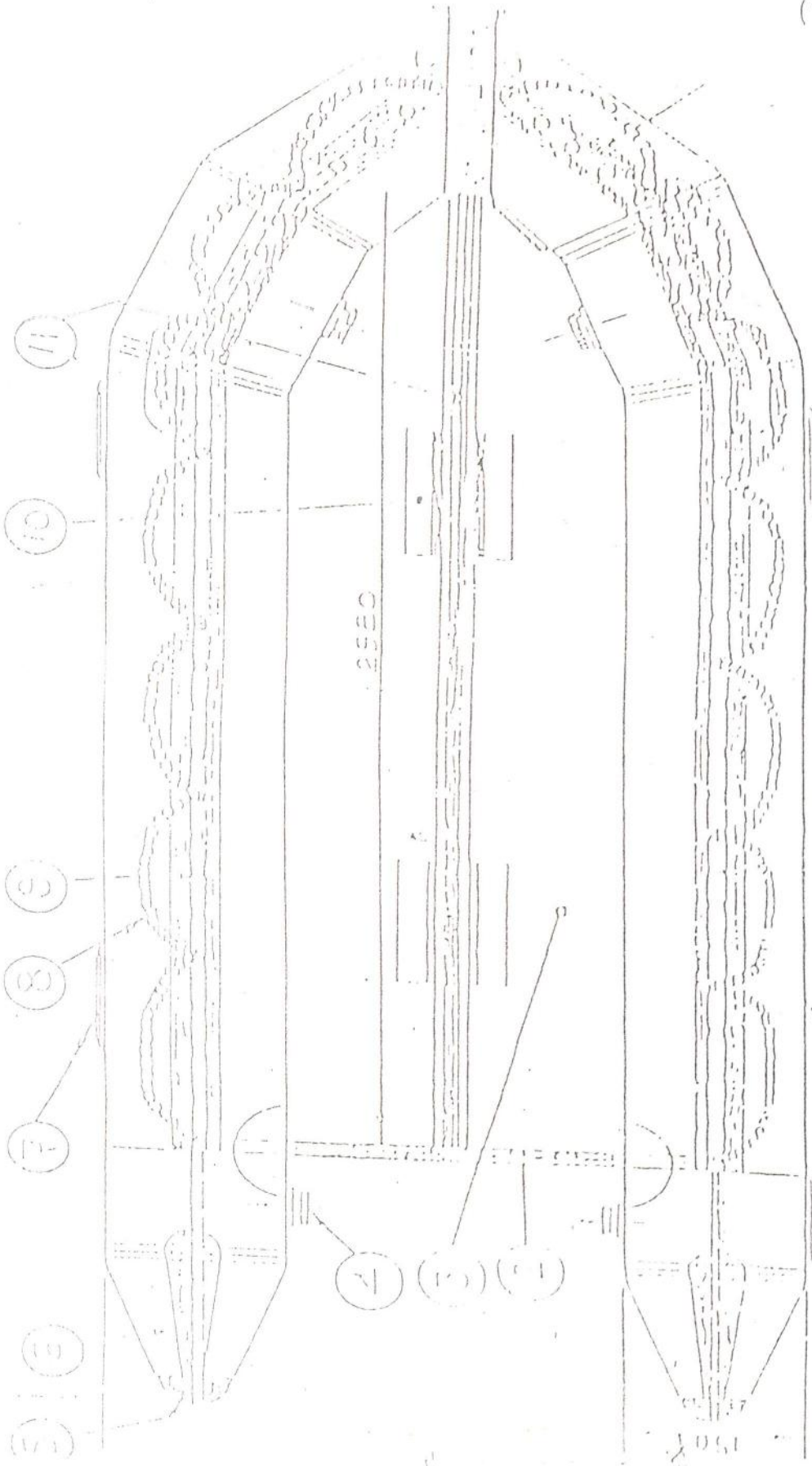
(d) Adhesive

Bostick 2402 Adhesive
 Bostikure D Curing Agent
 Bostik 9252 Primer
 Bostik Cleaner/Thinner M501

Typical Bond Characteristics

Temperature resistance	: from - 40°C to + 90°C
Water resistance	: Good
Oil, Petrol & Kerosene resistance	: Good
Acid & Alkali resistance	: Good. Virtually unaffected by 5N Sulphuric acid and 5N sodium Hydroxide
Humidity, resistance	: Good, after exposure to 100% RH @ 38° C for 14 days
Ageing	: Good

6. The tube shall be constructed with overlapping seam. Seam tapes shall then be placed on both the inside and outside of the tube.



- 1. Rubber Tube
- 2. Front Cover
- 3. Front Cover Gasket
- 4. Front Cover Seal
- 5. Front Cover O-ring
- 6. Inflation/Deflation Valve
- 7. Piston
- 8. Rubber Seal
- 9. Rubber Seal
- 10. Rubber Seal
- 11. Rubber Seal

(1)

AMENDEMENT NO- 3 TO NCD 1104 ISSUE-1. 1997

It is requested that following amendment be made to the above mentioned NCD earlier issued by this Directorate:-

1. Refer to clauses 0203, 0204, 0207, 0208, 1201, 1203, 1601, 1701 and 1904.
2. For "Existing Fabric material specified for the construction of the craft Polychloroprene coated Nylon Fabric", read "Hypalon (Outer layer) and Neoprene Fabric (Inner layer)" composite material as per specification placed at Appendix D (enclosed).
3. Elsewhere in the NCD wherever Fabric material specified for the construction of the craft is "Polychloroprene coated Nylon Fabric" read "Hypalon (Outer layer) & Neoprene Fabric (Inner layer)".



(P Shrivanth)
Commander
JDNA

Encl : As above

Date : 13 Sep 07

AMENDMENT NO. 2 TO NCD 1104 ISSUE-1, 1997

Following amendments are to be made to the above mentioned NCD earlier issued by this Directorate:-

1. Clause 1202(v)

For "Weight 110 Kgs"

Read "Weight 135 Kgs \pm 5 % including floor boards and accessories."

2. Note 1 at the end of clause 1602

For "existing"

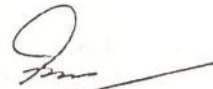
Read

"(a) For Inflatable crafts meant for INS Abhimanyu, MARCOS (East) and MARCOS (PB) the packages must be capable of being passed through a hole of 75 cms in diameter (in this case floor boards may be made of 05 pieces).

(b) For Inflatable crafts meant for all other ships / establishments, the package be capable of passing through a hole of 82 cms \pm 05 cms in diameter (in this case floor boards are to be made of 04 pieces only).

(c) The manufacturer is to mark the relevant diameter and number of floor board pieces on the package and inner side of the transom."

3. "Elsewhere in the NCD" Wherever material of fittings specified as stainless steel in the specifications the same is to be read as SS to AISI-316 L.



(RS Sundar)
Captain, I.N.
Director Naval Architecture

Date: (7 Jan 05