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Specification No. CQAE/1940/1548/g

Supersedes specification No. CQAE/1940/1548/f

GOVERNMENT OF INDIA

MINISTRY OF DEFENCE

(DIRECTORATE GENERAL OF QUALITY ASSURANCE)

SPECIFICATION NO. CQAE/1940/1548/(b)

FOR

BOAT ASSAULT PNEUMATIC LIGHT WEIGHT - 1A (BAPLW)

CAT / PART NO. 14/1940-000192



An ISO 9001 : 2008 Certified Estt

ISSUED BY

CONTROLLERATE OF QUALITY ASSURANCE

(ENGG EQUIPMENT)

AUNDH CAMP, PUNE – 411 027

Dt. Aug 2018

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29/10/18

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Specification No. CQAE/1940/1548/g

RECORD OF AMENDMENTS

AMENDMENT SL. NO.	DATE	DETAILS OF AMENDMENT	AMENDMENT CARRIED OUT BY (NAME & DESIGNATION)
4	26.04.06	Amendments carried out as per IAFO:2282 dt. 05.06.09. Specn advanced to CQAE/1940/1548/c &Test Schedule advanced to CQAE/TS/1426/c	
5	09.05.11	Amendments carried out as per IAFO:2282 dt. 05.07.2010. Specn advanced to CQAE/1940/1548/d &Test Schedule advanced to CQAE/TS/1426/d	
6	14.06.11	Amendments carried out as per IAFO:2282 dt. 31.01.2011 as below Add New points on page No. 18 i.e. (e), (f) & (g). Also add new page i.e. page No. 18/a. Specn advanced to CQAE/1940/1548/e &Test Schedule advanced to CQAE/TS/1426/e	
7	21.08.13	Amendments carried out as per IAFO:2282 dt. 21.08.2013 as below: Amended CI No 6.11 in Page No 09 also add page No ii(a) as a record of amendment. Specification advanced to CQAE/1940/1548/f &Test Schedule advanced to CQAE/TS/1426/f	

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AMENDMENT SHEET

NAME OF THE EQUIPMENT : BOAT ASSAULT PNEUMATIC LIGHT WEIGHT - 1A
SPECN NO. CQAE /1940/1548/g & TEST SCHEDULE NO. CQAE/TS/1426/g

Srl No.	Letter No. & Date	Details of Amendment	Authority No. & Date (DCI)	Amendment carried out by
8	<u>Following points to be amended in the Spec No. CQAE/1940/1548/f:-</u>		E5/E2/32q 29-10-2018	
(a) Para 2.1.1:			CQAE/FE-1/SPECN 26-10-2018	
(i) For : CQAE/4320/1521 Read : CQAE/4320/1521/2001				
(ii) For : Cat Part No. 14/1940-000030 Read : Cat Part No. E2/4320-000266				
(iii) For : IND/ENG/PROV/1193/d Read : IND/ENG/PROV/1193/d-2004				
(b) Para 2.4 :				
For : Existing Read : The copies of Defence specification / drawings free of cost.				
(c) Para 3.1(e) : Weight				
For : Existing Read : 74 kg (max) without floor & accessories 121 kg ± 5% with floor & accessories				
(d) Para 9.1.3 : Final QA				
For : Existing Read : A minimum <u>15 days</u> advance notice				
(e) Para 14.1 - Delete at line No. 3 : The technical literature in Hindi & English				
(f) Para 14.1.2 - Delete at line No. 4 : in bi-lingualHindi & English.				
(g) Add Note after Para 14.2 : Three copies of submitted to CQA(EE) at free of cos				
(h) Add Unit at Appx - B Para 1(c) : IRHD				
<u>Following points to be amended in the Test Schedule No. CQAE/TS/1426/f</u>				
(a) Add at Para 3.1-Raw Material Tests : For each new lot of raw material being used L bulk production , following raw material testing will be carried out by SQA(EE).				
(b) Add Note at end of Para 3.1 : If the same lot of raw materialstraceability of the sam				
(c) Enclosed complete list of parts including accessories				
Amendments carried out as per IAFD-2282 SPECN & TIS NO ADVANCE				
CQAE/1940/1548/g & TIS NO. CQAE/TS/1426/g.				
RESTRICTED				
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RESTRICTED

Specification No. CQAE/1940/1548/g

CONTENTS

<u>Sl. NO.</u>	<u>CLAUSES</u>	<u>PAGE NOS</u>
00	FOREWARD	1
01	SCOPE	3
02	RELATED SPECIFICATION & DOCUMENTS	3
03	STANDARD PATTERN	7
04	END USE	7
05	GENERAL DESCRIPTION	7
06	MATERIALS	9
07	WORKMANSHIP, PROCESSING & FINISH	11
08	PRE INSPECTION BY PRODUCER	12
09	QUALITY ASSURANCE	13
10	SAMPLING PROCEDURE	15
11	CRITERIA FOR CONFORMITY	15
12	TEST METHODS	15
13	IDENTIFICATION MARKING & PACKING	16
14	TECHNICAL LITERATURE / DOCUMENTS	17
15	WARRANTY	17
16	SUGGESTIONS FOR IMPROVEMENT	17
17	APPENDIX 'A' BASIC FABRIC FOR BUOYANCY TUBE & FLOOR	18
	APPENDIX 'B' POLYCHLOROPRENE SYNTHETIC RUBBER (NEOPRENE)	19
	APPENDIX 'C' COATED FABRIC FOR BUOYANCY TUBES	21
	APPENDIX 'D' COATED FABRIC FOR BAFFLE WALLS	22
	APPENDIX 'E' TAPING FABRIC	23
	APPENDIX 'F' FRP PANEL	23
	APPENDIX 'G' AIR LEAK PROOFNESS TEST	25
	APPENDIX 'H' PADDLES	25
	TEST SCHEDULE NO. CQAE/TS/1426/g	
18	GENERAL	26
19	QA OF PILOT/ADVANCE SAMPLE	27
20	QA OF BULK	29

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

BOAT ASSAULT PNEUMATIC LIGHT WEIGHT -1A (BAPLW)

00. **FOREWARD**
- 0.1 This specification has been prepared by the Controllerate of Quality Assurance (Engg Eqpt), Aundh Camp, Pune - 411027 on behalf of Director General of Quality Assurance, Ministry of Defence, New Delhi.
- 0.2 This specification supersedes earlier specification No. CQAE/1940/1548/f. This specification has been prepared to lay down general requirements. This would be used to guide manufacturing / Quality Assurance and procurement of Boat Assault Pneumatic Light Weight - 1A.
- 0.3 This specification consisting of 31 pages.
- 0.4 This specification shall be used for tender enquiry, procurement, manufacture and quality assurance purpose of the equipment covered in the specification.
- 0.5 This specification is restricted document and therefore should not be communicated to anyone who is not authorised to receive it.
- 0.6 This specification with accompaniments should be returned to issuing / purchasing authority on completion of tender formalities or completion of supply order.
- 0.7 The Controller, CQA(EE), Aundh Camp. Pune - 411027 is the Authority Holding Sealed Particulars (AHSP) and if any doubt, regarding any statement covered by this specification shall be referred to the AHSP who will clarify the same. In case any anomaly the AHSP's decision on technical requirement shall be final and binding on the supplier. Any legal or contractual condition shall be referred to the contract placing authority.
- 0.8 The Quality Assurance Authority for the item covered in this specification is the Controller, CQA(EE), Pune - 411027 and Quality Assurance Officer of the area concerned will be the Senior Quality Assurance Officer (SQAQO) of Senior Quality Assurance Establishments located at Mumbai, Kolkata, Chennai, New Delhi or an officer nominated by him. SQAQO shall carry out bulk Quality Assurance of the item.
- 0.9 Clause by clause reference of this specification should be confirm in writing along with tender enquiry documents / quotation otherwise the tender documents are liable to be rejected due to incomplete / inadequate details.
- 0.10 No deviation for stipulated parameter of specification / drawing will be accepted without the concurrence in writing by AHSP and no request will be entertained directly from sub-contractor, if any. The main contractor shall remain responsible for the quality of the product.

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

- 0.11 The contractor shall extend to the defence QA authority or his authorised representative all reasonable facilities for QA and testing of the equipment including gauges at free of cost. In order to ensure that the stores offered are produced strictly as per this governing specification, the contractor will provide free access from raw material to dispatch stage at the manufacturer's works at all times during the contract. If the need is felt he will also have free access to procurement document including books of accounts. In case, sub orders are placed on sub contractors, prior approval of sub contractors by AHSP shall be obtained and copies of sub contract shall be provided to AHSP and the QAO of the area concerned. All QA and test facilities shall be provided free of cost for the sub contracted items.
- 0.12 Advanced samples, if any, stipulated in the contract are required to be submitted to the QA Authority at CQA(EE), Pune - 411027 on door delivery (free transportation / handing cost) within stipulated delivery period for testing and approval before undertaking bulk manufacture of item. Bulk manufacture, if undertaken by the contractor, prior to issue of BPC (Bulk Production Clearance) will be at the risk and cost of the supplier / contractor. The bulk supplies will be effected strictly as per the approved advance sample including any improvement / modification suggested during evaluation of the advance sample.
- 0.13 Stage QA will be carried out right from raw material stage to dispatch of the stores and such stage QA shall not be construed as absolving the contractor of his responsibility in carrying out a comprehensive pre inspection on his own part and stage QA by defence QA agency i.e; without any prejudice to the right to reject the complete / offered article manufactured from such stage inspected components/sub assemblies/assemblies, if found not conforming to specified requirements.
- 0.14 If any defects, as notified during QA by QA agency of manufacturer shall not be rectified / repaired without prior approval of the defence QA agency.
- 0.15 The manufacturer / contractor is required to incorporate latest technology, state of the art manufacturing procedures and test methods in turning out the product in meeting the requirements of reliability, serviceability, interchangeability and durability of the product.
- 0.16 The warning / safety aspects of the stores have to be kept as per standard practice. Guidance in manufacture of the store shall be taken from patent or samples, if any available with the defence, authorities.
- 0.17 Copies of any national or international or any other specification, instructions or guides stipulated in this specification for reference shall be obtained from the publisher of the respective documents. The latest version of these documents shall be applicable.

RESTRICTED

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Specification No. COAE/1940/1548/g

- 0.18 This specification shall be used for the sole purpose of manufacturing and supplying the store to the defence indenter against specific contract only and not for any other purpose whatsoever.
- 0.19 The manufacturers / suppliers are required to provide all necessary technical information to fully identify the item. This information is required for defence codification purpose only and in no way jeopardize the commercial interest of the suppliers. Non-compliance of this requirement by contractor is likely to render his bid for supplying defence equipment being rejected.

1.0 SCOPE

- 1.1 This specification is intended to govern the General and technical requirement, material, manufacture, fabrication and quality assurance including test and performance of Boat Assault Pneumatic Light Weight-1A, used to carry 12 fully armed and equipped men including two crews.

2.0 RELATED SPECIFICATION & DOCUMENTS

- 2.1 **SPECIFICATION** : The following specification and standards have been referred while preparing this defence specification.

IS-190	Coniferous Sawn Timber (Baulks and Scantlings)
IS-380	French chalk, technical
IS-504	Methods of Chemical Analysis of Aluminium & its Alloys
IS-617	Aluminium and Aluminium alloy ingots and castings for general engineering purposes
IS-710	Marine plywood
IS-739	Wrought Aluminium & Aluminium alloy wire for general engg purposes
IS- 1285	Wrought Aluminium and Aluminium alloys - extruded round tube & hollow sections for general engineering purposes
IS-1424	Cotton canvas
IS-1503	Wooden packing cases
IS-1326	Non - coniferous sawn timber (baulks and scanting)
IS-1732	Steel bar round & square steel bars for structural & for general engineering purposes
IS-1954	Determination of length & width of Woven fabrics - Methods
IS-1964	Methods for Determination of Mass per Unit Length and Mass per Unit Area of Fabrics
IS-1969	Methods for determination of breaking load & elongation of woven textile fabrics
IS-2102	General tolerances for dimension

RESTRICTED

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Specification No. CQAE/1940/1548/g

IS-2500	Sampling inspection procedure inspection by attributes and by count of defects
IS-2673	Dimensions for Wrought Aluminium and Aluminium Alloys Extruded Round Tube - Specification
IS-3071	Wooden crates
IS-3536	Ready mixed paint, brushing, wood primer
IS-4227	Textiles - Braided nylon cords for aerospace purposes
IS-4229	Textiles - Nylon sewing thread for aerospace purposes
IS-4905	Random Sampling and Randomization Procedures
IS- 5192	Natural rubber compound
IS-5676	Moulded solid rubber soles and heels
IS-6488	Textiles - Cotton Webbing for Personal Web Equipment
IS-6662	Timber species suitable for wooden packaging
IS-7016 (pt-2)	Determination of breaking strength and extension at break
IS-7016 (pt-5)	Rubber or Plastic-coated Fabrics - Determination of Coating Adhesion
IS-7016(pt-7)	Rubber-or plastics-coated fabrics - Determination of resistance to penetration by water
IS-7016(pt-3)	Methods of tests for coated and treated fabrics tearing strength
IS-8982	Ready mixed paint finishing air-drying for war equipment O.G.
IS-3400(pt-1)	Methods of test for vulcanised rubber tensile stress-strain properties
IS-3400(pt-2)	Rubber, Vulcanized or Thermoplastic - Determination of Hardness (Hardness Between 10 IRHD and 100 IRHD)
IS-6746	Unsaturated polyester resin systems
IS-5746	Woven glass fiber fabrics for plastic laminates for aerospace purpose
IS-10476	Woven roving glass fabric for polyester glass laminates for aerospace purpose
IS-11551	Glass fiber chopped stand mat for the reinforcement of polyester resin system
IS-11320	Glass fiber roving for reinforcement of polyester and of epoxide resin systems
IS-11273	Woven roving fabric's of 'E' glass fiber
IS-2089	Common proofed canvas / duck & paulins (tarpaulins)
IS- 2753(pt-2)	Determination of Copper (in copper Organic Preservative Salt)

2.1.1 DEFENCE SPECIFICATION

- (a) CQAE/4320/1521/2001 specification for Foot Pump Single Nozzle (Cat Part No. E2/4320-000266)
- (b) IND/ENG/PROV/1193/d-2004 specification for Adhesive (Cat Part No. 8040-000138)

2.2 DRAWINGS : The following drawings pertaining to Boat Assault Pneumatic Light Weight-1A shall form a part of this specification. The latest issue is intended for reference to any specification.

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Specification No. CQAE/1940/1548/g

Srl	<u>Drawing No</u>	<u>Nomenclature</u>	
1.	IMGA-0101/B (sheet 1 of 2 sheets)	Schedule of drawings material & standard parts of Boat Assault Pneumatic Light Weight - 1A	
1(a)	IMGA-0101 (sheet 2 of 2 sheets)	Boat Assault Pneumatic Light Weight General Assembly	
2.	IMGA-0102	Pump inflating manual foot operated	
3.	IMGA-0109/B	Valve diaphragm stop air	
4.	IMSA-0238	Transom boat assault pneumatic Aluminium	
5.	IMSA-0239/A	Plank bow end	
6.	IMPD-1418/A	Hull upper	
7.	IMPD-1419/A	Hull lower	
8.	IMPD-1420	Plank large marine plywood	
9.	IMPD-1421	Floor board assembly FRP	
10.	IMPD-1422	Moulding rubber protection side	
11.	IMPD-1423	Moulding rubber protection bottom	
12.	IMPD-1424	Paddle Boat	
13.	IMPD-1425	Handle carrying	
14.	IMPD-1426	Plank small marine plywood	
15.	IMPD-1427	Cover transom	
16.	IMPD-1428	Eyelet Nylon	
17.	IMPD-1429	Pad cushioning head	
18.	IMPD-1430	Handle head carriage	
19.	IMPD-1431	Ring for connecting round	
20.	IMPD-1432	Cap, end seal, hull upper	
21.	IMPD-1433	Cap, end seal, hull lower	
22.	IMPD-1434/A	Pin Mooring, with cordage nylon	
23.	IMPD-1435/A	Valise, boat assault pneumatic light weight	
24.	IMPD-1436	Valise accessories	
25.	IMPD-1437	Valise kit repair	
26.	IMPD-1438	Valise floor assy FRP	
27.	IMPD-1439	Bailer, Boat collapsible	
28.	IMPD-1440	Tube upper Aluminium	
29.	IMPD-1441	Tube lower Aluminium	
30.	IMPD-1442	Tube small Aluminium	
31.	IMPD-1443	Tube bracket (Upper) Aluminium	
32.	IMPD-1444	Tube bracket lower Aluminium	
33.	IMPD-1445	Sheet side Aluminium	
34.	IMPD-1446/A	Plank Floor	
35.	IMPD-1447	Batten	
36.	IMPD-1448	Stopper	
37.	IMPD-1449	Outlet housing	

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RESTRICTED

Specification No. CQAE/1940/1548/g

38.	IMPD-1450	Adopter (Foot pump)
39.	IMPD-0441/A	Bottom plank
40.	IMPD-0442/A	Cover plate bottom
41.	IMPD-0443/A	Lower plank
42.	IMPD-0444/A	Spring with clips
43.	IMPD-0445/A	Upper plank
44.	IMPD-0446/B	Disc inner Inlet
45.	IMPD-0447/A	Inlet valve
46.	IMPD-0448/A	Washer plate
47.	IMPD-0449/A	Washer Inner outlet
48.	IMPD-0450/B	Disc outer outlet
49.	IMPD-0451/A	Cover plate top
50.	IMPD-0453/B	Valve flap type outlet
51.	IMPD-0455/A	Foot step
52.	IMPD-0456/A	Plate securing foot step
53.	IMPD-0457/B	Side skin
54.	IMPD-1749	Plugs screwed Boat Repair Rubber
55.	IMPD-1750	Patch round rubber with nylon cordage
56.	IMPD-1810	Flange assy
57.	IMPD-1811/A	Packing ring
58.	IMPD-1812/A	Diaphragm
59.	IMPD-1813/B	Body valve
60.	IMPD-1814	Strip cord fixing
61.	IMPD-1815/A	Stopper
62.	IMPD-1816/A	Cap valve

- 2.3 Copies of IS Specification can be obtained from the following address :-
Bureau of Indian Standards,
Manak Bhavan,
9, Bahadur Shah Zafer Marg
New Delhi-110002
- 2.4 The copies of Defence specification / drawings can be obtained from the CQA(E),
Aundh Camp, Pune-411027 at free of cost.
- 2.5 The specification and drawings mentioned above are latest on the date shall be referred.
- 2.6 The specifications and drawings obtained against the T/E, S/O are to be returned to issuing authority on completion of supply order / short closure / cancellation.

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Specification No. CQAE/1940/1548/g

3.0 STANDARD PATTERN

3.1 The boat is made out of Rubberised Nylon fabric having following salient features :-

Salient Features :

- (a) Overall length : 4.95 m
- (b) Overall width : 1.90 m
- (c) Hull diameter : 500 mm
- (d) Capacity : 12 fully armed men including two crews
- (e) Weight : 74 kg (max) without floor & accessories
121 kg \pm 5% with floor & accessories
- (f) Free board : 300 mm at 1200 kg load
250 mm at 1500 kg load
200 mm at 2000 kg load(in full capacity)

4.0 END USE

4.1 The boat is intended to carry 12 fully armed and equipped men including two crews. An OBM 35 to 45 HP or paddles can be used for propulsion of the boat at a free board of 250 mm (1500 kg load)

5.0 GENERAL DESCRIPTION

5.1 MAIN EQUIPMENT

5.1.1 Boat : The boat has a 'U' shaped hull having, two buoyancy tubes mode out of rubberised nylon. The upper main buoyancy tube has a diameter of 500 mm and the lower buoyancy tube has a diameter of 250 mm. The main buoyancy tube has been divided into six compartments each fitted with a valve for inflation and deflation. The lower buoyancy tube has got one inflation / deflation valve at the stem end. At the bottom of the upper buoyancy tube, a rubberised nylon fabric floor has been provided. For stiffening the fabric floor, floor plank of FRP has been provided. The stem of the boat is formed by an Aluminium alloy transom on which the OBM can be fixed. The boat carries a lifeline made out of 12 mm dia nylon cordage.

5.2 COMPONENTS OF BOAT

5.2.1 Valve : Valve (Drg No. IMGA-0109/B) is used for inflation/deflation. It 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. The inflation is done through the top portion with the help of a foot pump (Drg No. IMGA-0102). When the inflation is completed the valve is closed by the cap which is anchored on the boat hull.

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

- 5.2.2 **Transom** : The Aluminium transom (Drg No. IMSA-0238) is provided for mounting of OBM on the boat. The transom is made of Aluminium alloy square tube of 38.1 x 38.1 mm framework with welded construction. 1.63 mm thick Aluminium sheet is fixed at both ends to form a profile of inflated upper buoyancy tube. The transom is fixed to the buoyancy tubes by rubber adhesive. The transom is placed at an angle of 7° outwards for correct alignment of OBM. A piece of rubberised fabric cut to the same geometrical shape of transom is fixed to the frame to avoid entry of water into the boat.
- 5.2.3 **Floor** : A detachable rigid floor (Drg No. IMPD-1421) made out of FRP sections for superior mechanical strength has been provided for laying the same inside the boat. A pair of moulded FRP section is hinged by means of nylon cordage at certain places for easy folding / unfolding of the floor plank. One set of floor consist 04 FRP boards.
- 5.2.4 **Foot pump** : A foot pump (Drg No. IMGA-0102) is provided at the scale of three per boat for inflating the boat. The bellow of the pump is made of rubberised fabric joining two plywood places, one on the top and other on bottom with a cushion in between. The pump is fitted with a valve, foot rest and the rubber hose.
- 5.2.5 **Repair kit** : A repair kit comprising of the following items is provided with the boat for carrying out repair of the boat.
- | | |
|---|------------------------------|
| Adhesive in collapsible tube (250 gm) | : 1 No. |
| Rubberised Nylon fabric | : 1 m ² |
| Valve | : 4 Nos. |
| Sand paper rough No. zero 300x300mm | : 1 No. |
| Scissors 250 mm flat | : 1 No. |
| Brush, flat 127 mm x 27 mm | : 1 No. |
| Cloth cotton dasuthi | : 600 mm ² piece |
| Plugs rubber with serrations in different sizes (for repairs) | : 2 sets of 3 different size |
| Valise as per drawing No. IMPD-1435/A, IMPD-1436, IMPD-1437 & IMPD-1438 | : 4 Nos. |
| Bailer | : 1 No. |

NOTE : Minimum residual life of adhesive shall be 06 month from the date of supply.

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

6.0 MATERIAL

- 6.1 Coated Fabrics for buoyancy tubes : The basic nylon fabric shall be coated on both sides with polychloroprene rubber compound providing uniform coating on either side. The general requirements of basic fabric are given at Appendix 'A' for guidance to the manufacturer. The coated fabric shall be black in color and shall be free of coating defects such as thin coating, rough coating, crease or wrinkles, bagginess, lumps etc. The polychloroprene synthetic rubber compound (neoprene) used for coating the fabric and the coated fabric shall conform to the requirements specified in Appendix "B" & "C" respectively enclosed to this specification.
- 6.1.1 Coated Fabric for Floor : The basic nylon fabric shall be coated on both sides with polychloroprene rubber compound conforming the requirements given at Appendix 'A' providing a weight of coating of 275 gm \pm 50 gm per sq m. The fabric shall satisfy all the requirements of the coated fabric for buoyancy tubes except air leak proofness.
- 6.1.2 Coated Fabric for Baffle Walls : The coated fabric for baffle walls shall conform to the requirements laid down in Appendix 'D' enclosed with this specification.
- 6.1.3 Taping Fabric : The taping fabric shall conform to the requirements laid down in Appendix 'E' enclosed to this specification.
- 6.2 Adhesive : The adhesive required for joining the fabric of the boat shall conform to the specification No. IND/ENG/PROV/1193/d-2004.
- 6.3 Inflation & Deflation Valves : The inflation / deflation valves fitted on the buoyancy tubes shall be imported valves types FTU-50 or equivalent alternative valves of standard design / make.
- 6.4 Aluminium Alloy Tube : The extruded Aluminium alloy tube used for the fabrication of transom and the centre cross member shall be of size 38.1 mm square x 2.40 mm wall thickness and the alloy designation 63400 as per IS : 1285. The alloy shall be solution treated and subsequently precipitated (WP treatment).
- 6.5 Welding Electrodes (IS-739) : Welding electrodes shall be compatible to the parent materials. Welding rod for Aluminium alloy shall conform IS : 739
- 6.6 Floor F.R.P (Drg No. IMPD-1421) : The floor planks shall be made out of fibre glass reinforced plastic (FRP). The construction will be as per drg (IMPD- 1421). Quantity 04 Nos. of boards will be used for one boat. The panels shall conform to specification at Appendix 'F' enclosed.

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

- 6.7 **Marine Plywood (IS-710)** : Marine plywood 20 mm thick and 9.5 mm thick used for the plank bow end and plank large & small marine respectively shall conform to IS : 710. The faces veneer the core and cross bands shall be of Teak / Gurjan / Padauk / Mullelim.
- 6.8 **Nylon Cordage**: Nylon cordages of 4 mm, 12 mm and 15 mm dia used for valises, life line and mooring pin respectively shall be in OG color and shall conform to variety Nos. 3,4 & 5 of IS : 4227.
- 6.9 **Cotton Web Thick** : The cotton web used shall conform to specification No. IS : 6488.
- 6.10 **Eyelets Nylon (Drg No. IMPD-1428)**: The eyelets of size 20 mm dia used on the support life line shall be moulded out of nylon 6 materials.
- 6.11 **Foot Pump (Drg No. IMGA-0102)** : The foot pump should be made to drg No. IMGA-0102 and connected drawings and the materials used in foot pump shall conform to specification No. CQAE/4320/1521.
- 6.12 **Paddles (Drg No. IMPD-1424)** : The paddle wooden will be manufactured as per drawing No. IMPD-1424. The timber species used to manufacture paddles are Chaplash, Deodar, Kathal, Aini, Gamari, Teak, Padauk, Kail, and Champak as per IS : 1325 & IS : 399. The paddles shall govern the preservation / painting workmanship QA & testing as per Appendix 'H' enclosed.
- 6.13 **Thread Nylon (IS : 4229)**: The sewing thread for stitching of the rubberised fabric components with webbing etc and for seller and canvas valises shall be thread sewing nylon variety No. 2 of IS : 4229.
- 6.14 **Packing Material** : Packing materials should conform to the following specifications :-
- (a) **Valise for Boat** : The common proofed canvas, color OG as per IS : 2089 shall be used for valises. The common proofed canvas shall be made from cotton canvas confirming to variety No. 2 of IS : 1424. It should meet all the specification requirements of IS : 2089.
 - (b) **Hessian Cloth (IS : 2818 pt III)** : A good commercial hessian cloth confirming to IS : 2018 (pt III) and weighing 305 gm/m² will be used for packing.
- 6.15 **Paint** : Paint used for wooden items is as under :-
- (a) All timber members including plywood before being fixed to the boat be dipped, sprayed or brushed with NIC Copper Napthenate solution in mineral turpentine and allowed to dry for at least 24 hours.
 - (b) Ready mixed paint, brushing wood primer pink-The wood priming Aluminium confirm to IS : 3536.

RESTRICTED

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Specification No. CQAE/1940/1548/g

6.16 Preservative Treatment

- 6.16.1 All timber members including plywood, except portions of the various components shown in drawings shall be before being fitted to the Boats, be dipped, sprayed or brushed with NIC Copper Napthenate solution in mineral turpentine and allowed to dry for at least 24 hours.
- 6.16.2 After treatment as above, all timber parts excluding hatched portions of the various components shown in the drawings, before being fitted to the Boat, shall receive one over-all coat of paint ready for use, priming, Aluminium, water resistant, brushing/spraying to specification No. IS : 3585.
- 6.16.3 Upon completion of manufacturing of whole Boat, excluding Aluminium components and rubber components, shall receive two over-all coat of paint, ready for use, finishing war equipment, air drying brushing/spraying OG scamic 314 conforming to specification IS : 8982.
- 6.16.4 Ready mixed paint finishing air drying to war equipment : The paint RFU war equipment conforming to IS : 8982 will be used for final application over priming paint. It shall be brushing consistency to give smooth & semi glossy finish.

7.0 Workmanship, Processing & Finish

7.1 General

- 7.1.1 All workmanship on the Boat Assault Pneumatic Light Weight-1A shall be in accordance with the engineering production standard.
- 7.1.2 The non standard / special process employed during manufacture and fabrication shall have the approval of the AHSP.
- 7.1.3 All components shall conform to the shape and dimensions as shown in the drawings.
- 7.1.4 Sharp edges, burrs, and sharp corners likely to cause injury during handling shall be removed.

- 7.2 Tolerance : The manufacturing tolerances for various dimensions shall be as follows:- Tolerance on basic materials shall be as per relevant IS Specifications. Tolerance on the dimensions of the component shall be as mentioned in relevant drawings. The tolerance on dimensions shall conform to IS : 2102 Table-1, class extra coarse whenever the tolerances are not mentioned in drawings, relevant standards or in the specification.

7.3 Manufacturing

- 7.3.1 The area used for fabrication of boat shall be thoroughly cleaned, free from dust and foreign particles on the surface. The manufacturer shall be careful to avoid spilling of adhesive on other parts of the boat while joining is in progress. The following sequence may be adopted for guidance.

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Specification No. CQAE/1940/1548/g

- 7.3.2 The two portions to be joined shall be cleaned by using emery paper to roughen the surface slightly and to remove any foreign particles on the surface.
- 7.3.3 Preparation of adhesive for joining : Adhesive and cross linking agent are thoroughly mixed in a bowl in the required proportion as recommended by the manufacturer and kept ready for application.
- 7.3.4 Preparation of surfaces to be joined : The two surfaces shall be cleaned thoroughly using petrol to remove oil, dirt, dust & stains if any and allow the surfaces to dry.
- 7.3.5 Application of adhesive to the surfaces : Apply the prepared adhesive on the surface of the pieces to be joined by using a flat brush. When the adhesive becomes tacky, the two pieces should be joined together immediately. After joining the pieces, the overlapping portions of the joint shall be rolled with hand roller provided to remove kinks and air packets to ensure good contact.
- 7.3.6 Uniformity of overlap : There shall be uniformity of overlap portion throughout the length of every joints. The joints shall be straight and parallel to one another. The joints shall be free of kinks, wrinkles or loose portions.
- 7.4 **Curing of Joints** : Curing of the joints shall be done in a clear and covered area where dust and foreign particles do not enter. Jointed portion shall not be folded during curing. The curing shall be done for a period of at least 24 hours or for a period of at least 24 hours or for a period equal to the curing time of the adhesive as specified by the manufacturer, whichever is greater.
- 7.5 **Welding** : Welding of the components shall be done as per procedures laid down in IS : 823. The surfaces to be welded are prepared for welding to conform to this specification. The welding shall commence only after the parts to be welded are secured in an approved fixture to avoid distortion. Welds shall be free from the defects described in the relevant standards (IS : 823). All welding slag, splatter etc shall be removed.
- 7.6 **Dusting of French Chalk** : Each boat when completed & completely cured shall be thoroughly dusted with French chalk, well protected and stored until it is finally packed and dispatched.
- 8.0 **Pre Inspection by Producer**
The contractor shall have to submit one number of advance sample of Boat Assault Pneumatic Light Weight - 1A, complete in all respect manufactured from approved materials for clearance by QA Authority prior to commencement of bulk production.

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RESTRICTED

Specification No. CQAE/1940/1548/g

- 8.1 Manufacturer / contractors must satisfy themselves first, that the stores manufactured are in accordance with the contract and fully conform to the specification by carrying out thorough pre inspection of each lot/batch before actually tendering the store for QA to the Quality Assurance Officer nominated under the terms of the contract.
- 8.2 Declaration by the contractor that necessary pre inspection has been carried out on the stores tendered and the same are fit for QA. Test and performance shall be rendered along with the QA call letter. The declaration shall include the method followed in pre inspection, showing features checked/tested and the QA call letter will be accompanied by the test reports.
- 9.0 **Quality Assurance**
- 9.1 The Quality Assurance officer or his authorized representative is authorized to carryout QA checks of Boat Assault Pneumatic Light Weight - 1A at any stage of manufacture viz.
- (a).Pre production stage
 - (b) Production stage
 - (c) Stage of Preparation of delivery
- 9.1.1 **Pre Production QA** : The contractor shall intimate the Quality Assurance officer immediately after procurement of all the raw materials required for making the Boat Assault Pneumatic Light Weight - 1A. The QAO or his authorized representative will then draw samples at random of all the materials and carryout the checks / test as per relevant specification and the result will be recorded.
- 9.1.2 **Production Stage QA** : The Quality Assurance officer or his authorized representative will carry out stage QA of the items under production to ensure proper production and the items are as per respective drawings/specification.
- 9.1.3 **Final QA**: The Contractor shall issue a call letter alongwith a pre inspection report of the items to be inspected and keep all the items ready for QA. A minimum of 15 days advance notice should be given to the QAO for arranging the QA.
- 9.1.4 No part of the work shall be repaired or rectified without the approval of the QA authority.
- 9.2 **QA Facilities** : The contractor shall provide all facilities free of charge for carrying out the QA. The Contractors shall afford at his own expense the QA & testing facilities for satisfying himself that the stores are being or have been manufactured in accordance with the particulars for this purpose. The QAO shall have the full and free access at any time during the contract to the contractor's premises and may require the contractor to make arrangements for carrying out the QA of the stores at his premises or any other place and the contractor shall arrange similar facilities at his own expense as regards any sub contract he may order.

RESTRICTED

RESTRICTED

Specification No. COAE/1940/1548/g

- 9.3 **Payment of Testing Charges** : The contractor shall pay all cost connected with such tests and any other tests covered under quality control provisions & provide without extra charges. All materials, tools, gauges, labour and assistance of every kind which the QAO may consider necessary for any tests and examination, other than special or independent tests which he shall require to be made at the contractor's premises, and shall pay all the costs incurred there on. Failing to provide these facilities (in regard to which the QAO will be the sole judge) at his own premises for making the tests, the contractor shall bear the cost of carrying out such tests elsewhere.
- 9.4 **Quality Assurance** : Quality Assurance shall be carried out by QAO or his authorised representative to ensure that all the quality control requirements are met in the materials used, in the fabrication and workmanship of Boat Assault Pneumatic Light Weight - 1A.
- 9.4.1 **Testing** : The following tests are conducted to ensure quality, acceptability and the requirements as per related drawings / specification
- 9.4.2 **Conditions for Air Inflation Test**: Before conducting the test, it should be ensured that the boats are completed in all respect including all fittings. While conducting the tests, the temperature shall be kept as constant as possible throughout the test. For every degree Fahrenheit rise above the temperature at commencement of test, 2gm/cm² of water in monometer shall be subtracted from the final pressure reading. Similarly for every degree Fahrenheit fall in temperature, 2 gm/cm² is added to the final pressure reading. If the temperature variation during the period of test is greater than 5° 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.
- 9.4.3 **Preliminary Inflation Test**: After cleaning the area spread the boat on the floor and inflate the buoyancy tubes to a pressure of 140 gm/cm² (140 cm of water monometer) and leave it for 30 minutes. At the end of 30 minutes, check for any leakage.
- 9.4.4 **Pressure Test / Air Leak Proofness Test** : After preliminary inflation test and conforming that there is no leakage, all the buoyancy tubes are inflated to a pressure of 140 gm/cm² and left for one hour. The pressure drop corrected for change in temperature shall not exceed 6 gm/cm² (6.00 cm of water manometer). During the hour if the pressure drop exceeds this amount, the leak or leaks must be located using soap solution. Wherever the leakage is found should be marked using wax pencil and the leak is repaired after allowing the specified curing time for the solution to dry. The pressure test should be repeated to ensure that there is no leakage.

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

9.4.5 **Bulk Head Test Or Baffle Wall Test:** Inflate each chamber of the boat to a pressure of 141 gm/cm^2 (i.e. 141 cm of water manometer) and left for 80 minutes with all the other chambers remaining deflated . The pressure drop corrected for change in temperature shall not exceed 13 gm/cm^2 (i.e. 13 cm of water manometer) during this period. This test is repeated with other chambers and the readings noted.

9.4.6 **Floatation Test :** Each boat shall be inflated with 140 gm/cm^2 as specified pressure and all the accessories and FRP floor will be fitted and allow the boat to float in water with a load of 1200 kg evenly distributed over the floor boards and the boat is left floating in the water for 2 hours. After two hours, the Boat should be checked thoroughly and no leakage should occur and the free board should not be less than 300 mm. Any defect noticed during this test shall be rectified by the manufacturer.

10.0 **Sampling Procedure**

The QA Authority shall be the sole judge in deciding the sampling procedure that may be adopted. In the initial stages of the production, the samples will be subjected to 100% tests and material examination. If as a result of the tests carried out on the samples during the initial stages of production, it is revealed that the stores are not coming up to the required standard, further QA shall be suspended. Rejection of the samples by the QA Officer shall considered as final and binding on the contractor. The stores rejected by the QA Officer shall be replaced by the Contractor.

11.0 **Criteria for Conformity**

Aspects regarding criteria for conformity to the specification standards and tests to be conducted in detail has been laid down in the Test Schedule enclosed to this specification. The contractor must ensure that the detail tests, laid down have been studied by him before the Advance sample is tendered for QA to the QA Authority.

12.0 **Test Methods**

The method of tests and analysis to ensure consistency of the prevailing during any determination and reproducibility of results are given in Appendices enclosed to this specification.

The list of appendices enclosed are as under :-

	Appx
(i) Basic fabric for buoyancy tube & floor	'A'
(ii) Polychloroprene Synthetic Rubber (Neoprene)	'B'
(iii) Coated fabric for Buoyancy Tubes	'C'
(iv) Coated fabric for Baffle walls	'D'
(v) Taping fabric	'E'
(vi) Fibreglass Reinforced Plastic Panel (FRP Panel)	'F'
(vii) Air leak proofness test	'G'
(viii) Paddles	'H'

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

13.0 Identification, Marking & Packing

13.1 Identification

13.1.1 Identification Marking on each Boat : Each Boat on its transom right hand out side (when viewed from transom end) should have Aluminium name plate of suitable size fixed with following information engraved / stamped to identify each Boat

- | | | |
|----------------------------------|---|---|
| (a) Cat / Part No & Nomenclature | : | 14/1940-000192
Boat Assault Pneumatic Light Weight -1A |
| (b) S/O No & Date | : | |
| (c) Boat SI No / Total Qty | : | |
| (d) Month & Year of manufacture | : | |
| (e) Manufactures Name & Address | : | |
| (f) Warranty Expires on | : | |

13.1.2 Identification of Components : The Boat Assault Pneumatic Light Weight - 1A shall be marked with paint according to the number allotted for identification in the packaging schedule. The size of numbering will be decided by Quality Assurance Officer.

13.2 Packing

13.2.1 All components and accessories of Boat Assault Pneumatic Light Weight - 1A shall be packed as per commercial practice and in special packages where required as per the terms & conditions of this specification.

13.2.2 Packing of Boats : Each boat packed in valise shall be wrapped in a good commercial hessian cloth as per IS : 2818 part III before finally packing in cases / crates.

13.2.3 The Construction of Cases / Crates : The construction of case / crates shall be such that they are suitable for safe handling, transportation of the stores by Road. Rail & Air. The case / crates shall be made out of timber species as per IS : 6662 and the packing cases / crates as per IS : 1503 and IS : 3071 respectively.

13.2.4 Identification of Crates/Cases : Each crates / cases shall have the gross weight and identification No. of each boat packed in crate clearly painted in figures of 25 mm size. In addition, following information shall be suitably stamped or painted on each package.

- | | | |
|---|---|--|
| (a) Cat/Part No & Nomenclature | : | 14/1940-000192
Boat Assault Pneumatic Light Weight-1A |
| (b) S/O No & date | : | |
| (c) Boat SL No/Total Qty | : | |
| (d) Month & Year of manufacture | : | |
| (e) Manufacturers Name & Address | : | |
| (f) Weight of consignment | : | |
| (g) Any other particulars required by the QAO | : | |

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Specification No. CQAE/1940/1548/g

14.0 Technical Literature / Documents

- 14.1 For proper exploitation and maintenance of Boat Assault Pneumatic Light Weight - 1A, relevant literatures / documents as mentioned below shall have to be provided by the contractor. The technical literature i.e. UHB shall be supplied in bi-lingual i.e. in Hindi & English. The scale for provision of the documents shall be one set per Boat to consignee, 03 sets to CQA(EI)# and 01 set each to Order Placing Authority and concern SQA(EI) or as per the relevant contract clauses governing the contract / supply order.
- 14.1.1 **User Hand Book** : A User Hand Book as a guide to the crew for operation, maintenance and minor repairs, shall be provided in bi-lingual i.e. in Hindi & English.
- 14.1.2 **Parts Identification List** : This documents is required to help identifying and demanding spares. Hence the complete list with illustrations of exploded view of assemblies for easy identification of parts and cost of each component shall be provided.
- 14.2 The literatures shall be printed as per the Defence format i.e. as per JSJ : 0308, to be obtained from AHSP, on demand. The draft copies of the literatures must be got approved from AHSP prior to bulk printing. Three copies of draft literature to be forwarded to AHSP at free of cost for vetting & approval.
- # Note - Three copies of approved literature duly stamped by SQA(EI) of area concerned to be submitted to CQA(EI) at free of cost.
- 15.0 **Warranty** : Warranty clause will be applicable as per contract. However, if the same is not available in contract the following will be applicable :
- 15.1 Boat Assault Pneumatic Light Weight - 1A supplied against each lot of the order shall be deemed to bear a warranty of the contractor against all defects in material, workmanship, finish and performance for a period of 12 months from the date of receipt of stores at the consignee depot. If during this period, the stores supplied are found the consignee to be defective, then the purchaser shall be entitled to call upon the contractor to rectify / replace the defective store immediately / within such a period as may be fixed by the purchaser / QA Authority for the purpose. The stores so replaced / rectified shall be deemed to bear warranty period as mentioned above from the date of replacement / rectification.
- 16.0 **Suggestions for Improvement**
- 16.1 Any proposals / suggestions for improvement in the specification of the Boat or its components for design and manufacture will be welcomed and shall be addressed to the Controller, Controllerate of Quality Assurance (Engg Eqpt), Aundh Camp, Pune-411027. No deviation shall be made without the written approval from the Controller, Controllerate of Quality Assurance (Engineering Equipment), Aundh Camp, Pune - 411027

RESTRICTED

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Specification No. CQAE/1940/1548/g

Appendix – "A"

BASIC FABRIC FOR BUOYANCY TUBE & FLOOR

The basic fabric for buoyancy tubes & floor should satisfy the following requirements :-

- | | | | |
|-----|---|---|---------------------------|
| (a) | Material | - | 1260 Denier HT nylon yarn |
| (b) | Width | - | 135 cm (min) |
| (c) | Weight (determined as per IS-1964 | - | 350 gm (max) |
| (d) | Breaking strength (determined as per IS-1969) | | |
| | Warp | - | 450 kg (min) |
| | Weft | - | 450 kg (min) |
| (e) | Weave | - | Plain |
| (f) | Finish | - | Scoured and heat set. |

The construction of the basic fabric is left to the manufacturer. However, the construction shall be so chosen that the basic fabric satisfy the tearing strength and all other requirements laid down for the coated fabric. The basic fabric shall be properly heat set so that the shrinkage shall be less than 1% during coating and the width of the coated fabric shall be as per the specified requirements. The basic fabric shall be free from spinning, weaving and other defects. The processing of the fabric shall be such that the surface is free from wrinkles, creases, uneven shade, oil and other stains, pinholes, blisters etc.

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

Appendix – "B"

POLYCHLOROPRENE SYNTHETIC RUBBER (NEOPRENE)

1. The Polychloroprene Synthetic Rubber (Neoprene) should satisfy the following requirements :-

- (a) Tensile strength before ageing - 1.40 kg/mm² with a minimum elongation at break of 300%
when tested according to IS-3400-part-I
- (b) Tensile strength after ageing at temperature 70°C ± 1°C for 168 hrs testing shall be carried out at 27° C ± 2° C (kept minimum 16 hrs of the temperature) when tested according to IS -3400-part-I - The loss in tensile strength should not be more than 12% and the loss in elongation of break shall not be more than 15% from the observed value
- (c) Hardness according to - It shall be between 61 to 70 IRHD
- (d) Polychloroprene (Neoprene) rubber content weight in coated layers - 60% (min)
- (e) Procedure for determination of Polychloroprene rubber content in coated layers :-
 - (i) Scope : This method covers determination of Polychloroprene rubber content by sodium carbonate fusion method in rubber (not containing any other chlorine containing material)
 - (ii) Procedure : Separate the vulcanised rubber layers completely from the fabric, divide it into fine particles and weight accurately about 0.5 gm of sample. Prepare 4 such samples, 3 samples shall be tested and one sample shall be kept for audit / verification. Transfer the weighed rubber pieces into Platinum / Nickel crucible containing a bed of Na₂CO₃ (AR Quality) and completely cover the rubber particles with more quantity of Na₂CO₃ . Place another smaller Platinum / Nickel crucible (upside down) inside the larger Platinum / Nickel crucible (containing embedded rubber particles). Seal the gap all around the periphery of smaller crucible and top it up with Na₂CO₃. Ensure that Na₂CO₃ sealing is perfect so as to completely entrap the escaping gas.

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Specification No. CQAE/1940/1548/g

- (iii) Heat the Platinum / Nickel crucible on Bunsen Flame first gently for about 30 minutes and then vigorously to red heat for one hour or heat at 750 °C in a muffle furnace, to allow complete fusion of rubber with Na₂CO₃
- (iv) Remove the burner / remove from furnace and allow the crucible to cool down to room temperature. Transfer the crucible with contents to a one litre pyrex beakers. Dissolve the contents in distilled water and add HNO₃ (preferably 10 N to 15 N) to neutralize the excess of Na₂CO₃. Add few ml of HNO₃ in excess and filter the contents in another beaker. Wash the filter paper with distilled water. Remove the residue. To the filtrate add AgNO₃ (AR 10%) solution to precipitate AGCL. Complete the precipitation. Filter the contents through sintered glass crucible which is previously weighed to constant weight. Wash with the distilled water containing few drops of HNO₃ keep the crucible in oven at 105 °C to evaporate the moisture and dry it to constant weight. Determine the weight of silver chloride. The percentage Polychloroprene of the proofing shall be calculated as per following :

$$\frac{\text{Polychloroprene}}{\text{Rubber content (\%)}} = \frac{\text{Weight of AGCL ppt} \times 100 \times 35.5}{143.5 \times 0.37 \times \text{wt of sample taken}}$$

- (f) Alternatively, the Parr bomb peroxide combustion method (as per BS : 903) using Chloride free sodium peroxide should be followed. Usually a blank test will be necessary.
- (g) Alternatively Polychloroprene rubber contents in rubber coating of the fabric can be determined as per method described in "ASTM E 1131-08 standard test method for compositional analysis by Thermogravimetry". The testing shall be conducted at laboratory having NABL accreditation for the Thermogravimetry analysis (TGA). Testing shall be witnessed by CQA(EF) rep for Advance sample and SQAE(EF) rep for Bulk supply. The testing charges shall be borne by the firm.

All ingredients used shall be free from harmful substitute label to extraction by contact with water or which may cause development of undesirable color or discoloration. The total zinc oxide content shall not exceed 5% by weight of the polymer component of the compound when tested as per test described in ASTM Designation 297-61T. It however, the manufacturer dusted to provide a higher percentage of zinc oxide (upto 10%) to improve the heat resistance property by the QA officer on specific request from the manufacturer. The physical properties specified for the finished fabric shall however remain unaltered.

RESTRICTED

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Specification No. CQAE/1940/1548/g

Appendix – "C"

COATED FABRIC FOR BUOYANCY TUBES

The coated fabric for buoyancy tubes should satisfy the following requirements :

- (a) Width - 130 cm (min)
- (b) Weight (determined as per IS : 1964) - $1300 \text{ gm} \pm 50 \text{ gm per m}^2$
- (c) Breaking strength - (determined as per IS : 7016 part 2)
 - Warp - 400 kg (min)
 - Weft - 400 kg (min)
- (d) Tearing strength - (determined as per IS : 7016 part 3 Method A2)
 - Wrap - 30 kg (min)
 - Weft - 30 kg (min)
- (e) Adhesion of coating - 3 kg (min) (determined as per IS : 7016 part 5-constant rate of traverse)
- (f) Water proofness - Shall withstand 100 cm of water head for one hour (determined as per IS : 7016 Part 7)
- (g) Air leak proofness - No bubbles shall appear on the surface of the fabric (determined as per Appendix 'G' to this specification)
- (h) Accelerated ageing - The samples subjected to accelerated ageing at 70°C for 168 hours and after subsequent conditioning the same shall be tested for breaking and tearing strength. The loss in strength shall not be more than 35% from observed value.

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Specification No. CQAE/1940/1548/g

Appendix – "D"

COATED FABRIC FOR BAFFLE WALLS

The coated fabric for Baffle walls should satisfy the following requirement

- (a) Basic fabric shall be high tenacity nylon fabric having max weight of 225 ± 25 gm/m²
- (b) Coating of Polychloroprene Synthetic Rubber (Neoprene) as per BS-2752 grade, black in color, 200 gm/m² (max) on either side
- (c) Finished fabric will be as follows :-
 - (i) Width - 101 cm (min)
 - (ii) Weight - 600 ± 50 gm/m²
 - (iii) Breaking strength
 - Warp - 170 kg (min)
 - Weft - 170 kg (min)
 - (iv) Tearing strength - determined as per IS : 7016 Part-3 (Method A2)
 - Warp – 6kg (min)
 - Weft – 6kg (min)
 - (v) Air leak proofness - As per Appendix 'G'
 - (vi) Water proofness - 100 cm for 1 hour (IS: 7016 Part-7)
 - (vii) Adhesion of coating (determined as per IS : 7016, Part-5 constant rate of Traverse Machines) - 3 kg (min).
- (d) Resistance to high temperature - The coated fabric shall not show any sign of exudation or stickiness when exposed to a temperature of 100° C for 24 hours.
- (e) Resistance to low temperature - The coated fabric shall remain flexible after expose to temperature of -20° C for 48 hours.
- (f) Accelerated Ageing - The samples subjected to accelerate ageing at 70° C for 168 hrs and subsequent conditioning the same shall be tested for breaking and tearing strength. The loss in strength shall not be more than 35%.

RESTRICTED

RESTRICTED

Specification No. CQAE/1940/1548/g

Appendix – “E”

TAPING FABRIC

The finished fabric should have following requirement:-

- (a) Weight - $350 \pm 50 \text{ gm/m}^2$
- (b) Breaking strength
 - Warp - 70 kg
 - Weft - 70 kg
- (c) Elongation – 35% (max) at specified breaking strength.

Suitable nylon fabric to be selected for getting the required strength. Fabric will be coated with Polychloroprene vulcanised on one side and Polychloroprene gum layer on the other side.

Appendix – “F”

FIBREGLASS REINFORCED PLASTIC PANEL (FRP PANEL)

1. The floor panels shall be made out of fibreglass reinforced plastic (FRP) with inlaid continuous FRP Pultruded (pollarded) sections for superior mechanical strength.

Pultruded sections and rounds

2. Made by automatic Pultrusion technique using 70% fibreglass roving conforming to IS : 11320 set within a tough thermosetting resin matrix. The resin used should be Isophthalic.

Fibreglass Reinforcement

3. Fibreglass reinforcement to be used in the lay up shall be in the form of :-
 - (a) Chopped strand Mat of 300 gm/m^2 conforming generally to IS : 11551 type E
 - (b) Woven Roving Mat of 570 gm/m^2 conforming generally to IS : 11273 type 'E'
 - (c) Surface mat of 30 gm/m^2

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Specification No. CQAE/1940/1548/g

Surface treatment of Mats

4. Surface of the reinforcement mats shall be treated with $0.4 \pm 0.1\%$ of silane conforming to Union Carbide designation A-174 or other approved equivalent.

Resin System

5. Isophthalic resin used shall be conforming to IS : 6746. Styrene content of the resin shall not exceed 35-40%. The recommendation of the manufacturer in the proportions of the various materials used in the resin system shall be followed. Care is to be ensure accurate measurement and missing of the quantities of these materials

Catalyst and Accelerator

6. The catalyst used shall be methyl ethyl ketone peroxide. Accelerator used shall be Cobalt Napthenate. The type and quantity of the catalyst and accelerator are to be such that the resin shall set quickly and completely without the use of local heat. The setting time should generally not to exceed one hour, otherwise suitable precautions and adjustments are to be made to avoid excessive loss of styrene monomer. The amount of any exothermic additive is to be the minimum necessary to prevent serious drainage.

Lay up sequence

7. The laminate shall be constructed as per following lay up sequence :-
 - (a) 1 layer surface mat of Density 30 cm/m^2
 - (b) 1 layer chopped strand mat of Density 300 gm/m^2
 - (c) Reinforcement of pultruded section
 - (d) 1 layer Roving of Density 570 gm/m^2
 - (e) 1 layer chopped strand mat of Density 300 gm/m^2
8. The mechanical properties of the FRP laminate manufactured following above conditions in hand lay-up method shall be minimum as under :-
 - (a) Specific gravity – 1.4 to 1.7
 - (b) Tensile strength – 1000 kg/cm^2
 - (c) Tensile modulus – 70000 kg/cm^2
 - (d) Flexural strength – 1500 kg/cm^2
 - (e) Flexural modulus – 75000 kg/cm^2
 - (f) Water absorption for 24 hrs – 0.35% (max)
 - (g) Impact – 1.5 kg-m

Color

9. The color imparted to the FRP skin shall be olive green.

RESTRICTED

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Specification No. CQAE/1940/1548/g

Appendix – "G"

AIR LEAK PROOFNESS TEST

The fabric shall be suitably clamped so as to provide Air leak proof grip. Air at a pressure of 200 gm/cm² shall be applied to the rubberised fabric for 15 minutes. Soap solution shall then be applied all over the fabric under tension and the surface examined for presence of any pin holes. Appearance of bubbles on the surface indicates the presence of pin holes and such fabric is not suitable for pneumatic boats.

Appendix – "H"

PADDLES

1. Paddles for Boat Assault Pneumatic Light Weight - 1A will be used for manually propelling the boat. These are made out of a single piece of soft wood.
2. Paddles shall be manufactured from any of the following wood :-
(i) Chaplash (ii) Deodor (iii) Kathal (iv) Aini (v) Gamari (vi) Teak (vii) Padauk (viii) Kail (ix) Champak

Quality Assurance of Paddle Material Before Painting

3. The material used for paddles will be QA checked by QA authority before painting to ensure that it is free from knots, fungus, holes and other defects and shall be as per IS-190 for coniferous timber and IS-1326 for non-coniferous timber.
4. Dimensions will be as per drawing No IMPD-1424.

Preservative Treatment & Painting

5. The entire surface of the paddles shall be cleaned thoroughly and shall be dipped in 2% strength of copper naphthenate solution in mineral turpentine for preservation process as per IS : 401 for 20 minute and then allow to dry for atleast 24 hours. The paddles shall be painted with one coat of ready mixed paint brushing wood primer pink to IS : 3536 and then finished by two coats of O.G. paint as per IS : 168.

Load Deflection Test : The paddles shall be tested for load deflection test as follows :

6. Handle of the paddle will be gripped at 75 mm from end and the paddle will be fulcrummed at a point 230 mm from the grip. The paddle will be held in such a way that the blade will be horizontal. A distributed load of 18 kg will be gradually applied over a length of 600 mm of the blade. The paddles must be able to sustain the load without fracture or permanent distortion. The deflection at the end shall not be more than 80 mm when the full load is applied. The paddle will then be reversed and subjected to the same test.

Marking

7. Each paddle will be stamped with identification mark as indicated by QA authority.

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Specification No. CQAE/1940/1548/g

TEST SCHEDULE NO CQAE/TS/1426/g

FOR

BOAT ASSAULT PNEUMATIC LIGHT WEIGHT - 1A

1 GENERAL

- 1.1 This quality assurance acceptance process & test schedule lays down the quality assurance acceptance checks, test performance requirements of Boat Assault Pneumatic Light Weight - 1A.
- 1.2 This test schedule is issued to guide the manufacturer on the QA process and tests. Nothing in this schedule absolves the manufacturer his responsibility to ensure that the quality assurance requirements met with strictly as per the terms of the contract and BOATS supplied are up to the requirement of the contract specification, contract agreement and advance sample sentencing report.
- 1.3 During the application of this schedule, if it is found that further aspects which should advantageously be included in this schedule such aspects should be brought to the notice of the Controller, Controllerate of Quality Assurance (Engineering Equipment), Aundh Camp, Pune - 411027.
- 1.4 For proper conduct of checks / test, it is necessary that all the relevant standards, specification are studied properly, tests / recording procedure and computation of test results are properly understood. A detailed Quality Assurance (QA) check sheet for various checks and test and their systematic recording shall be prepared by the manufacturer and got approved before use. The pre-inspection report to be submitted by the firm along with each QA call letter during bulk supply of Boat Assault Pneumatic Light Weight - 1A.
- 1.5 The manufacturer shall extend all assistance and reasonable test facilities, like measuring instruments, various test rigs templates / gauges for checking the overall dimensions and shape to facilitate speedy QA and labor requirement for handing of the Boats, proper lighting and ventilation arrangement at QA bays at free of cost, so as to give reasonably comfortable working condition to the QA Authority i.e. Controller, CQA(E) or his authorised representative detailed for the Quality Assurance checks / test.

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Specification No. CQAE/1940/1548/g

2 Q.A. OF PILOT SAMPLE / ADVANCE SAMPLE

2.1 **Raw Materials:-** The firm shall submit 01 No of BAPLW as advance sample alongwith raw materials to CQA(EI) for their testing and clearance. Following raw materials as per qty mentioned shall be offered by the manufacturer for testing.

- | | | |
|-----|---|---|
| (a) | Neoprene coated fabric used for buoyancy tubes | : 3.5m each |
| | floor, baffle walls and taping fabric | |
| (b) | Rubber compound used for coating of basic fabric | : 300 x 300m |
| | | 2 slabs |
| (c) | Nylon cordage 4 mm 12 mm & 15 mm dia | : 10 m each |
| (d) | Thread nylon sewing | : 100 m |
| (e) | Nylon tape : 25 mm width x 2 mm thick | : 10 m |
| (f) | Nylon webbing : 40 mm width x 2 mm thick | : 10 m |
| (g) | Cotton web : 25 mm width x 2 mm thick | : 10 m |
| (h) | Adhesives # (Refer Note) | : 5.0kg with sufficient quantity of Cross Linking Agent (CLA) |
| | | # NOTE |
| (j) | Marine Plywood : 20 mm & 9.5 mm thick | : 1800 x 405 mm each |
| (k) | Timber | : 200 mm x 200 mm x 50 mm (2Nos) |
| (l) | FRP Sheet 300 mm x 300 mm x 3 mm thick | : 2 Nos |
| (m) | Cotton Canvas 1 m x 1 m | : 1 Piece |
| (n) | Al alloy tube 600 mm x 38.1 mm square x 2.40 mm thick | : 01 No |

#NOTE:- The supplier shall specify the ratio of mixing of CLA to Adhesive.

2.2 **Visual Inspection** :- The Boat duty inflated under normal pressure of 70 gm/cm² should be kept on the hard ground, preferably under shade, and then checked for completeness as per drawings and specification. The boat should be checked for satisfactory workmanship and components fitted on the boat must have identification marking for easy identification.

2.3 **Dimensional Checks & Weight** :- The inflated boat must be checked for following parameters:-

- (a) Centre to centre width
- (b) Overall length
- (c) Length up to transom
- (d) Hull diameter
- (e) Bow height at bow end

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Specification No. CQAE/1940/1548/g

- (f) Inside width at OBM end
- (g) Total weight of assembled boat without accessories & including accessories

2.4 Test for Boat :-

- (a) Preliminary inflation test as per clause 9.4.3 of specification
- (b) Pressure test / Air leak proofness test as per clause 9.4.4 of specification
- (c) Bulk head test or baffle wall test as per clause 9.4.5 of specification
- (d) Floatation test to be carried out as per clause 9.4.6 of specification

2.5 Raw Material Tests :- Following raw material for various components of the boat should be checked / tested in laboratory for various testing parameters:-

- (a) Finished rubber fabric
- (b) Adhesive
- (c) FRP sheet
- (d) Nylon cordages of various sizes (4 mm, 12 mm, 15 mm dia)
- (e) Cotton canvas
- (f) Nylon webbing & cotton webbing
- (g) Marine plywood of various sizes (20 mm, 9.5 mm thick)
- (h) Aluminium alloy tube
- (j) Nylon thread

2.6 Various Components of Boat:- All other main components of boat as follows should be checked for important dimensional check :-

- (a) Valve
- (b) Transom
- (c) FRP Floor
- (d) Foot pump single nozzle
- (e) Repair kit
- (f) Paddles
- (g) Valise

2.7 Performance / River Trial :- Boat are to be checked for performance / river trial as per Sampling plan given :-

- (a) Loading boat with full capacity
- (b) Free board checking at various loads as per clause 3.1(f) to specification No CQAE/1940/1538/g
- (c) Rowing / paddling by men
- (d) Performance with OBM fitted (35-45 HP)
- (e) Flotation of boat with alternate chambers inflated

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Specification No. CQAE/1940/1548/g

2.8 **Examination** : The boat shall be examined for the details listed below. Presence of one or more of the following defects shall be cause for rejection of the boat :

- (a) Dimension and weight not as specified
- (b) Missing parts or improper accessories
- (c) Incomplete or incorrect assembly
- (d) Materials not as specified
- (e) Preservative treatment and painting not as specified
- (f) Creases or wrinkles in the hull or on rubberised nylon fabric floor
- (g) Stitching being not sound
- (h) Fixing of row locks being not proper
- (i) The press buttons fitted not easily operable
- (j) Improper stitching of lifting ring
- (k) Poor finish
- (l) Dirty components

3.0 **Q.A. OF BULK**

3.1 **# Raw Material Tests:-** For each new lot of raw material being used for bulk production , following raw material testing will be carried out by SQA(EF).

- (a) Neoprene coated fabric for Buoyancy tube and floor
- (b) Neoprene coated fabric for baffle walls.
- (c) Taping fabric
- (d) Basic fabric for Buoyancy tube & floor
- (e) Polychloroprene Synthetic Rubber (Neoprene)
- (f) FRP Sheet
- (g) Marine plywood 20 mm & 9.5 mm thick
- (h) Adhesive
- (i) Nylon cordages of 4 mm, 12 mm & 15 mm dia
- (j) Cotton canvas
- (k) Aluminium alloy tube

Note : If the same lot of raw materials which was used for production of Advance Sample, is being used for bulk production then raw material testing is not required. Supplier has to produce traceability of the same.

3.2 **Visual Check** :- Each boat to be checked visually for its completeness as per specification requirement. Soundness of fabric stitching, joining by adhesive and fitments.

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Specification No. CQAE/1940/1548/g

3.3 **Testing:-** The following test are to be conducted to ensure quality acceptability and the requirements as per specification.

- (a) **Pressure Test / Air leak proofness test:-** To be tested as per clause 9.4.4 of specification.
- (b) **Bulk Head Test or Baffle wall test:-** To be tested as per clause 9.4.5 of specification for 30 minutes duration as per sampling plan:

01 to 25 Boats	1 Boat
26 to 50 Boats	2 Boat
51 to 75 Boats	3 Boat
76 to 100 Boats	4 Boat

- (c) **Floatation Test:-** Each boat shall be tested for floatation test as per clause 9.4.6 of governing specification for two hours duration & also check the free board. The repaired boat will also be subjected to this test till satisfactory results are obtained.
- (d) **Dimensional Check:-** Important dimensions to be checked in inflated condition of boat. Random samples shall be selected as per clause 3.3(b) above.
- (e) **Weighment Check:-** 5% of the lot offered to be checked of boat assembly and accessories are to be weighed and obtain the overage weight of each item. The average weight of the Boat including accessories shall be 121 kg \pm 5 %.
- (f) Accessories to be checked for preservative treatment, coating, painting and identification marking as per specification requirements.

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Specification No. CQAE/1940/1548/g

PART LIST

ITEM No.	DRG/ PART No	No to a SET	NOMENCLATURE
1	IMPD - 1418	1	HULL UPPER
2	IMPD - 1419	1	HULL LOWER
3	IMPD- 1420	2	PLANK, LARGE, MARINE PLYWOOD
4	IMPD- 1421	1SET (4 Nos)	BOARD ASSEMBLY FRP
5	IMPD- 1422	1	MOULDING RUBBER PROTECTION SIDE
6	IMPD- 1423	2	MOULDING RUBBER PROTECTION BOTTOM
7	IMPD- 1424	9	PADDLE
8	IMPD- 1425	7	HANDLE CARRYING
9	IMPD- 1426	1	PLANK SMALL MARINE PLYWOOD
10	IMPD- 1427	1	COVER, TRANSOM
11	IMPD- 1428	18	EYELET, NYLON
12	IMPD- 1429	3	PAD, CUSHIONING HEAD
13	IMPD- 1430	6	HANDLE HEAD CARRIAGE
14	IMPD- 1431	2	RING CONNECTING ROUND
15	IMPD- 1432	2	CAP END SEAL HULL UPPER
16	IMPD- 1433	2	CAP END SEAL HULL LOWER
17	IMSA- 0230	1	TRANSOM BOAT ASSAULT PNEUMATIC ALUMINIUM
18	IMSA- 0239	1	PLANK BOW END
19	IMPD- 1434	1	PIN MOORING WITH CORDAGE NYLON
20	IMPD- 1435	1	VALISE, BOAT ASSAULT PNEUMATIC LIGHT WEIGHT
21	IMPD- 1436	1	VALISE ACCESSORIES
22	IMPD- 1437		VALISE, KIT REPAIR
23	IMPD- 1438	1	VALISE, FLOOR ASSY FRP
24	IMPD- 1439	2	BAILER, BOAT : COLLAPSIBLE
25	IMGA -0102	3	PUMP, INFLATING, MANUAL FOOT OPERATED
26	-	1	SUPPORT, LIFE LINE FABRIC, NYLON RUBBERISED 220 x 8500 LONG
27	-	1	LIFE LINE, CORDAGE NYLON ϕ 12 x 15000 LONG
28	-	4	PADDLE RETAINER WEBBING NYLON 2 THICK
29	-	1	BOTTOM FABRIC NYLON RUBBERISED 1000 x 3600
30	-	1	CORDAGE NYLON FILAMENT ϕ 12 x 8500
31	-	2	SIDE FABRIC, RUBBERISED NYLON 350 x 4500
32	-	6	CORDAGE NYLON ϕ 4, 400 LONG
33	IMPD-1750	7	PATCH ROUND RUBBER WITH NYLON CORDAGE
34	IMPD-1749	3 x 2 SET	PLUGS SCREWED BOAT REPAIR, RUBBER

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