

TECHNICAL PROCUREMENT SPECIFICATION		32472-02-PS-003	
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TPS No:	32472-02-PS-003		
STATUS	ENQUIRY RELEASE		
ORIGINATING DEPT.	PLANNING AND PROJECTS		
P.O / W.O No:			
PROJECT	FABRICATION OF 1 NO. SELF-PROPELLED BARGE (EXCLUDING THE FABRICATION OF BULLETS) FOR TRANSPORTATION OF LIQUEFIED AMMONIA GAS (LAG)		
LOCATION	CONTARCTOR'S YARD		
CLIENT	FACT ENGINEERING WORKS		
PURCHASER	FACT - CD		
VENDOR			
ITEM		QTY.	
Detailed Design & Engineering, Procurement of Materials, Fabrication of barge, mounting of Bullets, Installation of piping, Application of cold insulation, Launching, Testing, Commissioning and Delivery of a self-propelled Barge (excluding Fabrication of Bullets) under classification of IACS classified member for the transportation of LAG (Liquefied Ammonia Gas) as per the TPS, drawings and tender documents attached.		ONE No.	
0	First Issue	SKG	ANS 10.01.2020
<u>Rev</u>	<u>Details</u>	<u>Approved</u>	<u>Date</u>
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ITEM :		Fabrication and delivery of 1 no. self-propelled barge (excluding fabrication of bullets) for transportation of Liquified Ammonia Gas (LAG)				(Space for Vendor's name, signature and seal)	
EQPT. No. :							
The scope of work for the equipment listed above shall include design, manufacture, supply of material and engineering work as tick marked below. Vendor shall fill in the column marked as "offer from vendor" and return the same along with the offer, without which the offer will be considered as incomplete.							
Sl. No.	Description	Reqd.	Offer from Vendor	Sl. No.	Description	Reqd.	Offer from Vendor
Fabrication and delivery of 1 no. self-propelled barge (excluding fabrication of bullets) for transportation of Liquified Ammonia Gas				12	PIPING, VALVES and PIPE SUPPORTS		
1	Detailed design calculations & fabrication drawings of barge	✓		a	Water ballast / Bilge System	✓	
2	Submission of documents as per VDR	✓		b	Fuel Oil & Lubrication Oil System	✓	
3	Procurement of all materials	✓		c	Air escape & Sounding Pipes	✓	
4	Fabrication of the barge at contractors yard	✓		d	Surface treatment & Cleaning	✓	
5	Mounting of bullets fabricated by FEW onto the barge	✓		e	Insulation of Pipes	✓	
6	Assembly/fitment of Piping & Instrumentation connected to the bullets	✓		f	Pipe supports	✓	
				13	MACHINERY		
7	Polyurethane Foam (PUF) Insulation of bullets & Connected Piping	✓		a	Main Engine	✓	
				b	Gear Boxes	✓	
8	Testing and inspection	✓		c	Generator Set	✓	
9	Assistance in obtaining approvals from Classification Society, Inland Water authority, etc as mentioned in Special Requirements of Project	✓		d	Stern Gear & Propellers	✓	
				e	Rudder & Rudder Stock	✓	
				f	Steering Gear	✓	
10	Assistance in first to & fro voyage as mentioned in Special Requirements of Project	✓		g	Twin Srew Remote Control	✓	
				h	Bilge, ballast & Fire Pumps	✓	
11 HULL OUTFITTING				14 ELECTRICAL			
a	Anchors, Chain Cable, Mooring Ropes	✓		a	Main Switchboard	✓	
b	Bollards	✓		b	Fuses	✓	
c	Railings	✓		c	Meters & Indications	✓	
d	Access Hatches, Manholes & Watertight Doors	✓		d	Breakers	✓	
e	Windows & Scuttles	✓		e	24V DC Switchboard	✓	
f	Accommodation for Crew	✓		f	Cable & Cable installation	✓	
g	Ventilation	✓		g	Earthing	✓	
h	Lining & Insulation	✓		h	Interior & Exterior Lighting	✓	
j	Draught & Hull Markings	✓		i	Navigation & Signal Lights	✓	
k	Sewage System	✓		j	Daylight Signal Light	✓	
REV.		DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED	
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Sl. No.	Description	Reqd.	Offer from Vendor	Sl. No.	Description	Reqd.	Offer from Vendor	
k	Search Lights	✓		16	DOCUMENTATION			
l	Berth Lights	✓		a	Certificates listed under clause 1.8.0 of Shipbuilding Specification	✓		
m	Desk & Mirror Lights	✓			b	"As Built" Plans & Instruction Books listed under 1.11.2 of Shipbuilding Specification	✓	
n	Instrument Lights	✓		c		Documents as per VDR	✓	
o	Emergency Lights	✓						
p	Portable Lights	✓						
15	SAFETY APPLIANCES			17	SPARE PARTS, TOOLS & ACCESSORIES			
a	Life Saving Appliances	✓		a	Spare Parts, Tools & Accesssories as listed under clause 1.12.0 of Shipbuilding Specification	✓		
b	Fire Fighting Appliances	✓						
c	Shapes & Sound Signals	✓						
d	Safety equipment for safe handling of Ammonia (Refer Annexure - I)	✓						
16	WHEELHOUSE FITTINGS							
a	VHF Set	✓						
b	G.P.S	✓						
c	Rudder Angle Indicator	✓						
d	Clinometer	✓						
e	Marine Clock	✓						
f	Electric Window Wiper for all forward facing windows	✓						
g	Whistle / Horn, Alarm Bell	✓						
h	Battery operated Loud Hailer	✓						
i	Wheel House Console	✓						
j	Navigation Ligt Panel	✓						
k	Wooden Grating for Helmsman	✓						
15	PAINTING, PRESERVATION & PROTECTION							
a	Primary Surface Preparation	✓						
b	Secondary Surface Preparation	✓						
c	Surface Cleaning before Overcoat	✓						
d	Painting as per Painting Schedule listed in Shipbuilding Specification	✓						
e	Cathodic Protection	✓						
16	INSPECTION, TESTS & TRAILS							
a	Stage-wise & final inspection/trails of all items	✓						
b	Statutory inspections & tests	✓						
c	Dock Trails	✓						
d	Official Sea Trails	✓						
e	Inclining Experiment, Trim & Stability	✓						
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SECTION I 1.0.0 GENERAL 1.1.0 It is the intent of these specifications and accompanying plan(s) to describe and set forth the details of technical matters such as performance, capacities, construction, equipment, material, etc., required for building, a twin screw, diesel engine driven Ammonia barge suitable for inland waterways. 1.1.1 Design & construction of the ammonia storage bullets is excluded from the bidder's scope. Construction details of ammonia storage bullets are not part of this specification. 1.1.2 For definitions of "bidder", "Contractor", "Builder", "Maker" & "Owner", refer document "Special Requirements of the Project" 1.1.3 It is regarded that "Section I" prevails over all other sections. 1.1.4 The details which are not mentioned in these Specifications but which are essential for a vessel of this class shall be furnished in accordance with the Contractor's current practice and to the complete satisfaction of the Owner/Classification Society/Statutory Bodies. 1.1.5 If any item(s) is mentioned twice or more in these Specifications, it shall be understood that this item (s) will be supplied and/or equipped only once. 1.1.6 In the event of conflict or inconsistency between the terms of the parts of the Specifications, the Hull part shall prevail in respect of hull items, the Machinery part in respect of machinery items, and the Electrical part in respect of electrical items.			
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1.1.7 Metric system shall be adopted for the design and construction of hull, machinery and equipment unless otherwise specifically stated in these Specifications. 1.1.8 The vessel shall be designed and built as per the attached drawing, for transportation of Liquefied Ammonia Gas (LAG) in bullet tanks through inland waterways including NW3. 1.1.9 The vessel shall be designed and built under class and in accordance with the rules and regulations of the Classification Society and assigned the appropriate Class notation for operation in Indian inland waters. 1.1.10 In addition, the vessel, as designed and built, shall meet the requirements of:- a) The Inland Vessel Act 1917 and amendments thereon under the statutory authority of IWT Directorate, b) Directorate of Ports, Govt. Of Kerala, c) IWAI, d) Cochin Port Trust, e) Any other statutory authority as applicable. 1.1.11 The vessel shall be of steel, fully welded, chine construction with raked stem and transom stern. The vessel shall be a twin-screw with twin rudders designed for a speed of 8.00 knots. 1.1.12 The Contractor shall furnish the vessel with all items required by the Rules and Regulations as specified in Section 1.7 "CLASSIFICATION, RULES AND REGULATIONS", except those items specifically stated herein as "Supplied / free-issue by the builder".			
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1.1.13 The draught of the vessel specified in these Specifications shall be of moulded figure unless otherwise specifically stated. 1.1.14 All plans, booklets, name plates, caution/identification plates and whatever documents required for implementation of the Specifications shall be in English. 1.1.15 For dimensions not mentioned in the drawing, detailed design shall be in the scope of contractor. 1.2.0 SITE CLIMATIC CONDITIONS 1.2.1 The vessel shall operate through-out the year including summer under peak ambient conditions as follows: - Ambient Air Temperature, max.			

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<i>Note: Minor deviations in the main dimensions shall be permitted, subject to the route constraints, for meeting and / or improving the performance and / or functionality of the vessel, with prior approval of the Builder.</i>								
1.4.0 CAPACITIES <table><tr><td>F.O.</td><td>:</td><td rowspan="2">} Shall be specified by the contractor</td></tr><tr><td>F.W.</td><td>:</td></tr></table>				F.O.	:	} Shall be specified by the contractor	F.W.	:
F.O.	:	} Shall be specified by the contractor						
F.W.	:							
1.5.0 ARRANGEMENT 1.5.1 The arrangement of the vessel shall be as per General Arrangement drawing attached. The barge shall be as per the attached drawings. Liquefied Ammonia will be carried in 4 nos. bullets. The bullets shall be bolted to the ship through cradles. 1.5.2 Hull Subdivision 1.5.2.1 The hull shall be subdivided by 6 nos. W.T. transverse bulkheads into the following spaces: • Fore peak • Forward Store • Cargo Hold 1 • Cargo Hold 2 • Engine Room • Aft Peak 1.5.3 Cargo Hold Arrangement 1.5.3.1 2 nos. Independent bullet storage tanks shall be located in each cargo hold, making a total of 4 bullet tanks. Each bullet shall be insulated by 100 mm thick PUF insulation. The filling and discharge pipes from each bullet tank								
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shall be led to a central manifold located at side, at mid length of the cargo hold. 1.5.3.2 Each bullet shall be supported by sufficient number of cradles that are efficiently secured to the bottom structure of the ship by bolting. The cradles shall be of approved design and shall have sufficient strength to support the weight of the loaded bullets and also withstand additional loads due to barge motions, especially accelerations induced by such motions including centrifugal accelerations due to turning. Each bullet shall be efficiently secured to its cradle by suitable means so as to prevent relative motions of the bullet during transit. 1.5.3.3 Hatch covers shall not be provided. The hatches are protected all round by mild steel coamings as specified in the drawing. It shall be ensured that the coamings are discontinuous so that the coaming plates are not stressed due to the longitudinal bending of the barge. 1.5.4 Engine Room Layout 1.5.4.1 The main and auxiliary machinery with their associated piping and fittings shall be located in the engine room, along with the bilge, ballast and fire pumps. 1.5.5 Superstructure 1.5.5.1 The superstructure shall be located aft of the cargo hold. It shall consist of the following spaces: • A raised wheel house with all-round view • Galley • Dry provision store • Dining area • Sleeping accommodation for a total of 6 crew with 2-tier bunks • Toilet • Bath			
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The wheel House shall be located fwd of the ship for the good field of vision. In addition there must two cameras installed at the aft, covering the aft and sides as much as possible. The feed from these must be visible at monitors in the console. The wheel House shall be located fwd of the ship for the good field of vision. 1.6.0 SPEED 1.6.1 The free running speed at maximum continuous output of the main engines at the base line draft as given in the attached drawing with clean bottom in calm and deep water shall be at least 8 knots. 1.7.0 CLASSIFICATION, RULES AND REGULATIONS 1.7.1 CLASSIFICATION 1.7.1.1 The vessel including its hull, machinery and equipment shall be built under the survey of the IACS member with Class Notation + (Swastika symbol) IW, Zone 3 + (Swastika symbol) IY or equivalent notation of any International Association of Classification Societies (IACS) member. 1.7.2 RULES AND REGULATIONS 1.7.2.1 The vessel shall be registered under the Kerala I.V. Rules and be built in compliance with the following Rules and Regulations which are in force at the date of signing of the contract. 1.7.2.1.1 Rules for Inland Vessels applicable to such vessels as per Mercantile Marine Department. 1.7.2.1.2 Machinery as per Classification Society rules for inland water ways vessels. 1.7.2.1.3 International Regulations for the Prevention of Collisions at Sea 1972.			
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1.7.2.1.4 Electrical installation shall be in accordance with Classification and IEC standards. 1.7.2.1.5 Kerala Inland Vessels Rules. 1.8.0 CERTIFICATES 1.8.1 The Contractor shall provide the following certificates to the builder at the time of delivery of the vessel:- 1.8.1.1 Tonnage Certificate as per Kerala I.V. Rules. 1.8.1.2 Certificate / Letter from Class for Compliance with Load Line rules. 1.8.1.3 Ship Safety Equipment Certificate as per Kerala I.V. Rules. 1.8.1.4 Ship's Radio Station License, if required for operation of VHF radiotelephone. 1.8.1.5 Manning Certificate as per Kerala I.V. Rules. 1.8.1.6 Certificate of inspection and approval / Type Approval for all Life Saving Equipment 1.8.1.7 Certificate of Inspection and approval of Fire Fighting Equipment. 1.8.1.8 Stability Information and Limitations, as endorsed by statutory authority. 1.8.1.9 De-Ratting Exemption Certificate. 1.8.1.10 Anchors and Cable / Wire Rope Certificates. 1.8.1.11 Certificates of Navigation Lights. 1.8.1.12 EIAPP Certificate. 1.8.1.13 Certificate from Pollution Control board. 1.8.1.14 All other Certificates as required by Class/statutory bodies. 1.8.2 One (1) original and two (2) copies of each certificate shall be provided.			
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1.8.3 Service life certificate of paint from paint manufacturer, for a validity of minimum 60 months. The name of the vessel and period of paint application should be mentioned in the certificate.			
1.9.0 STANDARDS, MATERIAL AND WORKMANSHIP			
1.9.1 STANDARDS			
1.9.1.1 Bureau of Indian Standards or equivalent DIN / BS / JIS standards shall be used in the construction of the vessel. Uniform standards shall be applied for all components / equipment. Use of multiple standards shall be avoided to the extent possible.			
1.9.1.2 Shipyards standards or branch related standards with respect to construction details and hull fittings may be used, subject to prior approval of the Builder.			
1.9.2 MATERIAL			
1.9.2.1 All material, machinery, equipment, appurtenances and outfit shall be of first class commercial standard, suitable for marine use and shall be of good shipbuilding and marine engineering quality, tested, inspected and certificated as and when required by the Classification Society and Regulatory Bodies concerned.			
1.9.2.2 Welding shall be approved by the Classification Society and all welders shall be Classification Society Certified. Tack welding shall be carried out only by Class approved welders.			
1.9.2.3 Physical dimensions, mechanical properties and chemical composition of material, equipment, machinery, etc. shall generally be in accordance with BS / JIS / BIS / DIN / equivalent standards, the Contractor's standard and the Maker's standard as long as the standards are not inconsistent with the requirements of these Specifications.			
1.9.2.4 All plates, bars and sections shall be well and cleanly rolled to the full sections and be free from cracks, surface flaws, laminations roughness and other defects. They shall be straight within appropriate limits and have a smooth surface.			
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1.9.2.5 Before any steel material is used in the construction, rust and mill scale shall be removed by means of grit / copper slag blasting according to Swedish Standard SA2½. Thereafter a coat of approved shop primer with a thickness of 20~25 microns shall be applied as a temporary protection with a minimum life time of 6 months. 1.9.2.6 Grease nipples shall be of stainless steel ball type (JIS B 1575 A-PT 1/8 or equivalent type). 1.9.2.7 Stainless steel in general shall be of AISI 316 quality, unless specified otherwise. 1.9.2.8 All WT doors, access hatches, manholes, port holes, ladders, drain plugs, bollards, fairleads, etc. shall be as per the appropriate BIS / JIS / BS / equivalent standards. Any deviation from the above shall be submitted to builder for approval. 1.9.2.9 All holding bolts of equipment nuts, studs, pins etc. used on the exposed decks shall be of SS. 1.9.2.10 All FW/SW, air, sounding and filling pipes of FW / ballast water tanks shall be galvanized after fabrication. 1.9.2.11 All galvanizing shall be done with best virgin smelter containing not less than 98% of pure zinc. All galvanizing shall be carried out by the hot dip process and weighing not less than 350 gm/m². Alternative galvanizing methods may be considered in special cases subject to approval of the builder. 1.9.2.12 All galvanized materials or pipelines shall be taken out and re-galvanized after proper re-treatment in all cases where the material of pipe lines have been subjected to heat by welding, for example, in case of making last minute connections. 1.9.2.13 Copper and copper alloys <u>shall not</u> be used for construction of equipments that could be exposed to ammonia vapor.			
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1.9.2.14 All timber used in the vessel shall be new, well seasoned, straight, free from warps and cracks, sapwood, knots, worm holes and other defects which render it deficient in strength for the purpose required. 1.9.2.15 All timber shall be impregnated with anti-rot and anti-pest composition. 1.9.2.16 All plywood used shall be as per IS 710 1.9.3 WORKMANSHIP 1.9.3.1 The vessel shall be built in accordance with the best shipbuilding practice and workmanship, which has been approved as required by the Classification Society & builder and as described elsewhere in the specifications. 1.10.0 INSPECTION, TESTS AND TRIALS 1.10.1 All equipment shall be tested at the maker's works / shipyard workshop prior to installation to demonstrate satisfactory workmanship, suitability for the purpose intended and compliance with the specification. The inspection, tests and trials during construction of the vessel shall be carried out by the contractor and / or the maker at the maker's shop or onboard in accordance with the requirements of the Classification Society and / or the Statutory Authorities concerned in the presence of the Surveyors of the Class / Statutory Authorities as far as they are concerned and in the presence of the builder's representative. 1.10.2 TESTS AND TRIALS 1.10.2.1 Tests and trials shall be carried out to demonstrate the satisfactory performance of required functions of the equipment and devices as per the Rules, Regulations and builder's requirement. 1.10.2.2 The testing schedule and items shall be set up by the contractor to suit its building program and shall be submitted to the builder.			
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1.10.2.3 The Contractor shall give a notice of 2 weeks along with schedules for the tests and trials to the Builder. The protocol of test and trial shall be submitted to the Builder, 4 weeks in advance. 1.10.2.4 The Builder shall inform the Contractor of the machinery which requires the Builder's/Owner's attendance at the Maker's shop and the Contractor shall inform the Builder of the shop test schedule when finally confirmed. 1.10.2.5 The Builder /Owner's representative, on receipt of the information; shall not delay unreasonably to attend the inspection, test or trial to the extent that the Contractor's construction schedule is affected. The results of these inspections, tests and trials shall be submitted to the Builder. 1.10.3 DOCK TRIALS 1.10.3.1 Dock side trial of the main engine shall be carried out prior to the sea trial on a suitable draught while the vessel is moored. A programme of these trials shall be submitted to the Owner. 1.10.3.2 Before the completion of the Vessel, the following trials shall be carried out to the satisfaction of the Owner and as required by the Classification Society. a) All piping systems and pumps shall be fully tested. b) Genset together with all lights and electrical loads. c) Main and auxiliary machinery and associated alarms. d) All deck machinery. e) Steering system. f) Bilge and Ballast systems. g) Fresh water and sanitary systems test. h) Fuel oil system, including transfer.			
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i) All set points on alarms shall be verified prior to testing 1.10.4 OFFICIAL SEA TRIALS 1.10.4.1 When the vessel is substantially complete, official sea trials shall be carried out by the Contractor in accordance with the sea trial schedule and test procedures submitted to the Builder prior to sea trial. 1.10.4.2 The sea trial shall be carried out at full load draught. 1.10.4.3 The speed at the sea trial shall be measured by a conventional measured mile course or GPS. The speed and RPM curves and a complete report of the trials shall be furnished to the Owner. Details of Contractor's standard analysis of speed and correction procedures shall be submitted to the Builder for approval 1.10.5 INCLINING EXPERIMENT, TRIM & STABILITY 1.10.5.1 Inclining experiment shall be carried out upon completion of the vessel with system liquids filled, in the presence of the Classification Society's Surveyor and the Builder/Owner's Representative. 1.10.5.2 The results shall be presented to the Builder together with all necessary information for the calculation of the trim and stability under varied loading conditions, as well as for the measurement of the lightship weight and resulting deadweight. 1.10.5.3 A general trim and stability booklet containing the results shall be submitted to the Classification Society/Statutory Body for approval. 1.11.0 PLANS FOR APPROVAL 1.11.1 Three (3) copies of the Contractor's key plans and the major maker's plans shall be submitted to the Owner for approval in accordance with "LIST OF DRAWING FOR APPROVAL".			
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1.11.1.1 The Contractor's standard Plans or Makers' Plans may be used as working Plans or Plans for approval 1.11.2 AS BUILT PLANS AND INSTRUCTION BOOKS 1.11.2.1 AS BUILT PLANS a) At the time of delivery of the vessel, three (3) copies of the final plans shall be furnished to the Builder by the Contractor, in accordance with 'LIST OF AS BUILT PLANS'. In addition to the above, all drawings to be also provided in AutoCAD format on CD. b) In addition, one each of the following plans shall be furnished in a frame and placed on board the vessel:- 1) General Arrangement Plan. 2) Capacity Plan. 3) Safety Plan (Fire Control Plan + Life Saving Plan). 4) Instructions for donning of life jacket. 5) Instructions for launching of life raft. 6) Muster List (list to be provided by Builder). 7) Instruction for using emergency equipment during ammonia leak 1.11.2.2 INSTRUCTION BOOKS a) Three (3) copies of instruction books of the vessel's major machinery, equipment and system (with details of make, model, contact details of dealer/ service center, etc) shall be furnished to the Builder in accordance with "LIST OF FINISHED PLANS". b) The Contractor shall also prepare three (3) sets of data booklets for the hull, machinery and electric equipment giving the serial no., type / model			
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no., name & address of makers and references to such information as maintenance instruction books and / or spare parts list. c) Spare part booklet for main engine other equipment shall be submitted at an early stage. d) Soft copies of manuals of all machinery to be obtained from the respective Maker / Supplier and handed over. 1.12.0 SPARE PARTS, TOOLS AND ACCESSORIES 1.12.1 Spare parts, tools and accessories shall be furnished in accordance with the requirement of the Classification Society and the Regulatory Bodies. 1.12.2 All tools including special tools necessary for the complete dismantling and re-assembling of the main engines, rudder / rudder stock, propeller / stern gear including pullers for stern tube bushes and rudder stock bushes shall be provided. ----- END OF SECTION I -----			
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SECTION II 2.0.0 HULL 2.1.0 MATERIAL AND SCANTLINGS 2.1.1 GENERAL 2.1.1.1 All steel work of the vessel shall be of grade 'A' steel approved by the Classification Society. Material of hull construction shall be of mild steel in general and shall be strong enough for severe working conditions 2.1.1.2 All frames, beams and stiffeners shall be of rolled section, built-up section or flat bar. 2.1.1.3 The cargo region of the hull shall be of double skin construction. 2.1.1.4 The hull shall be a rigid structure with additional reinforcements, where large forces are introduced to the vessel's structure, in order to prevent main structural damages during operations. 2.1.1.5 In way of hawse pipes, deck machinery, mooring and towing fittings, sea inlets, pad eyes and other heavy concentrated loads, the hull shall be adequately strengthened by means of insert plates of heavier thickness and carlings under the deck as required. Doublers are to be avoided as far as practicable. 2.1.1.6 Adequate drain holes and air courses shall be provided in the internal structural members to ensure free movement of contents to suctions and of air to vents. The reinforcement for docking shall be carried out according to the requirement of the Classification Society. 2.1.1.7 The structural details in general shall be in accordance with and approved by the Classification Society.			
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2.1.2	SCANTLINGS		
2.1.2.1	The scantlings shall be based on the design draught of the vessel and to the requirements of the Classification Society. The scantlings not specified by the Classification Society may be in accordance with the Contractor's practice. Minimum scantlings shall be as per midship section attached.		
2.2.0	WORKMANSHIP		
2.2.1	After the cutting of steel plates, profiles / sections, the edges shall be clean without burrs and must be ground thereafter.		
2.2.2	Parts of members to be welded shall be prepared prior to welding in order to obtain good results.		
2.2.3	Welding shall be executed in accordance with the Contractor's practice approved by the Classification Society. Inspection of welded joints shall be by Radiographic inspection with number and location to class requirements. Welding shall be performed for the entire hull structure by manual, gravity, electro slag or any other automatic welding including one-side welding. Loose mill scale and excessive rust shall be removed from the steel surface where welding is applied. All welding shall be continuous except in dry space where intermittent welding is adopted. Corrective measures for mis-cut holes, the lack of alignment of joints and excessive gaps between surface of edges, etc., shall be applied subject to approval by the Classification Society and Builder.		
2.2.4	The tolerance limits shall be as per limits specified by International Association of Classification Societies (IACS) guidelines.		
2.2.5	The Builder / Owner's supervision in no way relieves the Contractor from his obligation to ensure that the vessel is built under the best possible conditions by competent skilled workmen.		
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2.3.0 ACCESS OPENINGS AND TEMPORARY PIECES			
2.3.1 Provisional openings may be cut where required for access, communication and/or ventilation, etc. for Contractor’s workers during the construction and shall be closed by insert plate after completion of the work concerned. Lifting lugs and their reinforcements, in the engine room and steering gear compartment, considered neither inconvenient nor intrusive for future service may remain to facilitate maintenance.			
2.4.0 LEAK AND STRENGTH TEST FOR HULL TANKS			
2.4.1 In general, the leak test shall be carried out by air using detective reagent soapy water on the building berth except shop fillet joints and erection butt joints where on-block air compression test and vacuum test can be done respectively.			
2.4.2 The structural strength test shall be carried-out for tanks selected by the Classification Society, by filling with water during the construction or afloat at the Contractor’s convenience to ensure integrity of tank boundary.			
2.5.0 SHELL AND APPENDAGES, ETC.			
2.5.1 SHELL PLATING			
2.5.1.1 The shell plate shall be transversely framed. The bottom forward shall be strengthened for rough sea based on the normal ballast condition in compliance with the requirements of the Classification Society.			
2.5.1.2 The following scantlings to be generally adopted.			
Keel, Bottom & Bilge Plating - } Refer drawing attached			
Side Shell Plating - }			
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2.5.2BILGE KEEL 2.5.2.1Please refer drawing for details. 2.5.3BOTTOM PLUGS 2.5.3.1One (1) bottom plug of stainless steel 316L shall be supplied and fitted for hull tank, cofferdam, etc. where considered necessary. Bottom plugs shall be fitted as close as possible to the lowest point of each tank and shall be kept clear of points where the keel blocks are laid beneath in dry dock. Two spanner wrenches for each type of bottom plug shall be supplied for opening/closing of bottom plugs. Water tanks and oil tanks shall have square and hexagonal sockets respectively. 2.5.4DECK STRUCTURE 2.5.4.1The main deck plating shall not be less than the thickness mentioned in the attached drawing. 2.5.4.2The main deck shall have a straight line camber and transverse framing supported by girders. The girders shall be supported by bulkheads, pillars and/or heavy deck beams. The deck plating thickness shall be increased locally in way of deck machinery, hawse pipe and other area of heavy loading. No doubler plates are to be used. 2.5.5BULKHEAD STRUCTURE 2.5.5.1Bulkhead plating <u>shall not</u> be less than thickness mentioned in the attached drawing. Transverse bulkheads to extend from bottom to the main deck welded directly to the side shell, deck and bottom plating. Stiffeners of bar / angle / built up sections to be welded at the inside of tank spaces as far as practical. 2.5.5.2Bulkhead separating the cargo bay (in-between the two bullets) shall be provided.			
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2.6.0 SUPER STRUCTURE 2.6.1 Super structure fabricated shall consist of a Galley and accommodation. And the Wheel house is located at the forward section. ----- END OF SECTION II -----			
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SECTION III 3.0.0 HULL OUTFITTING 3.1.0 ANCHORS, CHAIN CABLE, MOORING ROPES 3.1.1 Anchors, 2 nos. of weight as required by Class and Stud Link chain cable of adequate length shall be provided as per Class requirements. Mooring ropes as per rules shall also be provided. A Power Operated Twin Gypsy Windlass with twin warping drums complying with Classification requirements shall be provided. 3.2.0 BOLLARDS 3.2.1 Twin bollards as per the attached drawing complying with Classifications society requirements shall be fitted on the Port and Stbd. sides for'd, midship and aft. 3.2.2 Two Towing Bitts at the centre, one forward and one aft shall be provided. 3.2.3 Bollards shall be as per BIS / BS / JIS / DIN standards. 3.3.0 RAILINGS 3.3.1 Railing shall be provided all round the vessel consisting of, ERW, Class C pipe at the top and, round bars mid and bottom, adequately supported by flat bar stanchions at every one metre. Height of railing, number of rungs, spacing between rungs shall be as per Load line regulation. Minimum height of railing shall be 1000 mm. 3.4.0 ACCESS HATCHES, MANHOLES & WATERTIGHT DOORS 3.4.1 Access hatches, manholes and water tight doors provided shall be as per approved standards such as BIS/ BS / JIS / DIN. Manholes shall be of flush type and provided with SS studs and nuts. Height of coamings shall be as per statutory / Class requirements. FACT ENGINEERING WORKS  FEW			

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3.5.0 WINDOWS & SCUTTLES 3.5.1 Anodized aluminium windows with toughened glass shall be provided. Scuttles shall be of weldable type. 3.6.0 ACCOMMODATION 3.6.1 Accommodation for 6 crew; complete with sanitary and cooking spaces shall be provided. 6 bunk fans in the accommodation for crew, 2 fans in sitting accommodation, 2 fans shall be provided in the Wheel house and 1 fan at the dining area. Crew accommodation and wheel house shall be fitted with decorative lining of pre-laminated boards. 3.6.2 Galley shall be provided with shelves for provision storage space, sink and an electric cooking stove. 3.6.3 Dining area shall have a table with seating capacity for six persons. 3.6.4 Separate toilet and bath shall be provided. Toilet shall be provided with one western type water closet, automatic flush, and water tap. Bath shall be provided with shower, water tap, towel rod, soap tray, mirror. A wash basin and mirror shall be provided outside the accommodation on the aft bulkhead. 3.7.0 VENTILATION 3.7.1 Natural ventilation for Engine Room / Crew Accommodation and fans as mentioned earlier in the specification shall be provided. 3.7.2 The engine room shall be adequately naturally ventilated by 3 cowl vents of suitable size as required. 3.7.3 In addition to the normal skylight provided behind the wheel house another skylight at the deck level shall be provided. 3.7.4 The galley shall be provided with 1 No. 150 mm cowl type exhaust vent.			
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3.7.5	The toilet and bath shall be provided with 1 No. 150 mm cowl type vent.		
3.7.6	The cabins shall be provided with natural ventilation suitably.		
3.7.7	1 No. exhaust fan each shall be provided in the kitchen and dining area		
3.7.8	Wheelhouse is to have a split air conditioner of capacity 1.5 Tonnes.		
3.7.9	A split air conditioner of capacity 1.5 Tonnes is to be fitted in the middle of crew accommodation cabins.		
3.8.0	LINING & INSULATION		
3.8.1	The floors in all the accommodation spaces shall be deck composition covered with VINYL type flooring and galley and bathroom's laid with deck composition and tiles.		
3.8.2	The exposed section of exhaust pipes shall be lagged and properly insulated.		
3.8.3	In the crew accommodation and wheel house spaces; 8 mm / 9 mm thick marine plywood paneling shall be used. Comfort insulation is to be provided for wheelhouse and accommodation.		
3.8.4	Asbestos shall not be used as an insulating material anywhere on the Vessel. Insulation material used shall be asbestos free.		
3.9.0	DRAUGHT AND HULL MARKINGS		
3.9.1	Draught shall be marked at forward, midship and aft on the port and starboard side of the barge conforming with IS specification.		
3.9.2	Hull markings such as ship's name and KIV registration number shall be marked as per statutory requirements.		
3.10.0	SEWAGE SYSTEM		
3.10.1	A bio-tank of suitable capacity and discharging arrangements complying with statutory requirements shall be provided.		
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3.10.2 Relevant certificates for the sewage system shall be obtained from the Pollution Control Board. 3.10.0 PLATFORM AND WALKWAYS 3.10.1 Pipe supporting platforms and walkways required for the operation/maintenance access shall be provided by the contractor. Railings, if applicable shall be provided. -----END OF SECTION III -----			
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SECTION IV 4.0.0 PIPING & VALVES 4.1.0 GENERAL 4.1.1 The general requirements for the piping systems contained herein are particularly applicable to the hull piping systems unless specifically stated otherwise. For the detailed and/or the specific requirements of a particular system, refer to that section which describes the system and to the applicable Rules and Regulations. 4.1.2 All pipes other than oil pipes shall be GI, ERW Class C, of reputed make like Tata / GST / Ambika. 4.1.3 Pipes used for FO, LO and hydraulic oil shall be MS black pipes. 4.1.4 All pipes shall be new and free of corrosion, pitting, manufacturing defects etc. 4.1.5 Hydraulic pipes shall be seamless pipes of required thickness. 4.1.6 All skin fitting valves shall be of SS construction & Class approved. 4.1.7 Exhaust pipes shall be suitably lagged and GI cladding shall be provided. 4.2.0 PIPING MATERIALS AND WORK 4.2.1 PIPE 4.2.1.1 The materials and wall thickness of pipes shall be in accordance with Section 4.12.0 "MATERIAL SPECIFICATION FOR PIPING" and shall meet the requirements of the Classification Society. 4.2.1.2 The specification of pipes forming a part of machinery or equipment supplied by the Maker as a package shall be of the Maker's standard.			
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4.2.1.3 Pipe bore shall be decided so as to accommodate given flow quantity and corresponding pumping pressure. As far as practicable, the pipe lines shall be led directly with a minimum number of bends and the arrangements to avoid well part where drains are likely to stay. 4.2.1.4 Suitable draining arrangement of minimum 15 mm dia. valve or drain plug shall be provided for the following locations and the surface treatment of drain pipes shall be same as that of connected pipe. 4.2.1.5 Liquid pipe lines shall be kept away from the switchboard and the electrical appliances. Where the piping is unavoidably led above the electrical appliances, the welded joint shall be provided. 4.2.1.6 Where the piping penetrates girders or any structural element, the compensation, if necessary, shall be provided in accordance with the requirements of the Classification Society and the Contractor's standard. 4.2.1.7 The arrangement of piping shall be designed in consideration of convenience in painting, taking on fuel and fresh water and Class requirements as far as practicable. 4.2.1.8 Piping shall be designed to release the excessive stress due to thermal expansion /contraction and deflection of the ship's structure. 4.3.0 VALVES 4.3.1 In general, the valve size shall be of the same nominal bore as that of the pipes connected except automatic control valves. In general, globe valves shall be fitted for small bore pipes and butterfly valves for large bore pipes of 100 mm and above. 4.3.2 Use of gate valves shall be limited by the requirements of the Classification Society. Gate valves shall be of non-rising stem type and			
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shall have solid wedge disc. Cast steel or ductile cast iron valves shall be fitted to such locations as required by the Classification Society. 4.3.3 Installation of the ship side valves shall be in accordance with the Classification Society's Requirements and shall be fitted directly to the shell on a pad as far as practicable. 4.3.4 Valve name plates of SS shall be fitted to the valves on handle or other suitable place. Name plates shall be in English. 4.4.0 PIPE JOININGS 4.4.1 Unless specified otherwise, the welding joints of outside sleeve type, butt welding and flange connections generally shall be applied to the pipe connections with valves, fittings, machinery and where necessary. 4.4.2 The material of pipe connections shall be of same material or similar to that of pipe, unless otherwise specified. In general, the flanges shall be of steel slip-on welding type for steel piping. Where the flange joint of large size stainless steel shall be applied, the inner ring of composite flange shall be of the same material as the pipes connected and the outer flanges shall be of hot dip galvanized mild steel. All flanges shall be finished with plain contact surface. Steel pipe flanges for liquid handling shall have seal weld at the pipe inside, but protection pipes for electric cable shall have weld outside only. 4.4.3 Preformed welding sockets shall be used for high pressure steel pipe such as hydraulic oil lines, etc. Butt welded joints shall be applied for elbow, reducer, tee and others except otherwise specified. Bite type unions or welded type unions may be used for small bore steel pipes. Sliding type coupling joints shall be generally used for fire main, fuel oil transfer, cable protection lines, etc., where necessary, to compensate the pipes from expansion and contraction. Packing for sliding type coupling joints shall be			
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	of neoprene rubber in general. Sleeve type coupling joints with gland packing shall be applied to the high temperature pipe lines as required by the Classification Society. 4.4.4 Offset expansion bends (loop) may be applied to high pressure hydraulic oil lines and wherever practicable. 4.5.0 BULKHEAD AND DECK PENETRATIONS 4.5.1 Where the piping passes through watertight or oil tight bulkheads and decks, the bulkhead or deck shall be sufficiently compensated, where necessary, in accordance with the requirements of the Classification Society, and the connection shall be made tight by means of spool piece, direct welding or sleeve reinforced pipe piece according to the Contractor's practice. 4.5.2 The connections through the insulated bulkheads shall be of sufficient length to permit access to the flange connections without disturbing the insulations. For copper and copper alloy pipes, steel made deck penetrating pieces shall be fitted directly to the bulkhead and/or deck by welding through which those pipes run with proper tightening means. No ballast, bilge or water line shall in any condition pass through fuel oil and lube. oil tank in engine room. 4.6.0 BRANCHES, BENDS AND OTHER FITTINGS, ETC. 4.6.1 Branch pipes for the low pressure piping up to 16 Kg/cm² shall be welded to the main pipe. Elbow pieces and reducers shall be of fabricated steel made by electric arc welding. 4.6.2 Fittings forming a part of pipe shall be of the equivalent material as adjoining pipes in general.		
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4.6.3	As a standard for steel pipes, the pipe bending shall be carried out by means of a cold bending machine with bending radius of approximately 3 times the outside pipe diameter. Hot bending process may be limitedly adopted in special cases, if unavoidable, such as adjustment of pipe alignment, etc.		
4.7.0	GASKETS AND PACKING		
4.7.1	Asbestos-free sheet gasket packing of anti-sticking surface shall be applied in general.		
4.7.2	The thickness of gasket packing shall be of minimum 1.5mm. The material of packing for the valve stem shall be of valve Maker's standard.		
4.8.0	PIPE SUPPORTS		
4.8.1	The piping shall be properly supported and braced as per good shipbuilding practice to avoid damage, vibrations and movement due to thermal and / or ship's deflection.		
4.8.2	Support for stainless steel pipe shall be inserted with similar stainless steel sheet metals and/or similar stainless steel metal hanger so that steel shall not be directly in contact with the pipes. Fixing supports shall be provided for preventing floated pipe from excessive free movement, where required.		
4.8.3	For clamping, 'U' shape steel round bar, bolt clips shall be used for steel pipes and flat bar band clips for non-ferrous pipes.		
4.8.4	U - bolts shall be secured to the supports by means of double nuts (each one on both sides of the support) for pipes of 100mm in nominal diameter and above, and single nut with spring washers for 80 mm and below. But all hydraulic pipes shall be secured by means of double nuts.		
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4.9.0PIPE PROTECTION 4.9.1The piping works shall be protected from mechanical damage, where necessary and the protection shall be constructed with steel angles, plates or channels as per good shipbuilding practice. 4.10.0SURFACE TREATMENT AND CLEANING 4.10.1The surface treatment and coating of the machinery, loose fittings and valves shall be carried out in accordance with Maker's standard for the intended purpose, and no special surface treatment shall be made exceeding the Maker's standard unless otherwise specified. 4.10.2The pipe fittings whose function is to join branches of the system (such as tees, Y-pieces, elbows, flanges, unions, sleeve joints, etc.) shall be painted same as connected pieces. 4.10.3The loose fittings other than above pipe fittings supplied by Maker's (such as expansion coupling, filters, strainers, traps, separator, rose boxes, nozzles, plug, orifice, etc.) shall be painted in accordance with the Maker's standard unless otherwise specified. 4.10.4For hot dipped galvanized pipe in such case that welding after galvanizing is unavoidable as mentioned below, the external of the damaged parts shall be touched up with one (1) coat of zinc primer, and internal parts shall be touched up with the same paint as far as practicable. a) Welded sleeve joints fabricated on-board. b) Flanges of pipes adjusted on-board. c) Flanges of bulkhead/deck penetrating piece. d) Anchoring pieces welded on galvanized pipes after adjusting on-board.			
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e) Butt weld joint adjusted on-board. 4.10.5 The lubricating oil and hydraulic oil pipes shall be pickled before installation. After installation on-board, the pipes shall be flushed and cleaned prior to being connected to machinery. 4.10.6 Where the acid pickling is necessary for pipes, the acid pickling shall be done and inside shall be treated with oil to prevent rust before installation on-board. 4.11.0 INSPECTIONS AND TESTS 4.11.1 All the tests and inspections of pipe lines shall be carried out in accordance with the requirements specified in the specification and/or the Rules and Regulations and the Contractor’s standard. 4.11.2 VISUAL TEST 4.11.2.1 The dimensions, scantlings, locations, surfaces finishing, welding, fastenings, joints, etc. shall be visually inspected where necessary. 4.11.3 LEAKAGE TEST (FLOW TEST) 4.11.3.1 The pipes which are to be occasionally filled up by gravity or pipes through which liquid flow without pressure during the actual service shall be tested by free flow of water to confirm tightness of the pipe lines. 4.11.4 PRESSURE TEST 4.11.4.1 Hydraulic pressure test shall be carried out in accordance with the requirements of the Classification Society and Regulatory Bodies where applicable. During the pressure test, a blank flange shall be provided at the open ends with the valves and/or any other means of closing on the piping fully open.			
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4.12.0	MATERIAL SPECIFICATION FOR PIPING AND VALVES		
4.12.1	The following material specification shall be intended as a guide in the preparation of hull piping schedules for the vessel and represents minimum requirements or recommendations. The wall thickness of pipes shall be as required by Classification Society requirements.		
4.12.2	Hull pipes shall be to JIS or equivalent. For pipes passing through tanks, pipe scantlings may be increased to meet Classification requirements.		
4.12.3	Application / Material / Type & Grade		
	Application	Material	Type & Grade
	Bilge & Ballast	Galvanised steel	Heavy Gauge (Class C)
	Sea water cooling	Galvanised steel	Heavy Gauge (Class C)
	Fire & Washdeck	Galvanised steel	Heavy Gauge (Class C)
	Sanitary & Fresh Water	Galvanised steel	Heavy Gauge (Class C)
	Soil Pipe	To suit	Heavy Gauge (Class C)
	Air and Sounding	To suit	Heavy Gauge (Class C)
	FO	MS Black	Heavy Gauge (Class C)
	LO / HO	SS 316	Schedule 40S
4.12.4	Where galvanising is specified, this shall be hot dipped and carried out after fabrication. Piping <u>shall not</u> be led through tanks as far as practicable.		
4.12.5	VALVES		
4.12.5.1	All valves shall be of SS. Ship-side valves shall be of the approved type.		
4.13.0	INSULATION OF PIPES		
4.13.1	Insulation shall be as per Class requirement.		
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4.13.23	Asbestos as insulation material <u>shall not</u> be used anywhere on the Vessel.		
4.14.0	WATER BALLAST / BILGE SYSTEM		
4.14.1	Individual filling/suction valves for each ballast tank or compartment shall be located in the engine room in a combined valve manifold. The sea water shall be drawn from the vessel's sea chests.		
4.15.0	FUEL OIL & LUBRICATING OIL SYSTEM		
4.15.1	FUEL OIL FILLING SYSTEM		
4.15.1.1	Two (2) shore connections with a butterfly/gate valve shall be provided, one on each side of the ship. The shore connections shall be placed at the aft end of the wheel house / deckhouse and shall be connected to the diesel oil deck main line leading to each diesel oil tank.		
4.15.1.2	One (1) fuel oil transfer pump of SR hand type shall be provided for transferring fuel oil from tanks to daily service tank.		
4.15.1.3	One (1) duplex filter system shall be installed.		
4.15.1.4	Sampling cocks shall be fitted at a position near the deck filling connection for the diesel oil line.		
4.15.1.5	The FO daily service tanks shall be fitted with gauge glass and a graduated brass scale, to indicate the level of oil in the tank.		
4.16.0	AIR ESCAPE AND SOUNDING PIPES		
4.16.1	AIR ESCAPE PIPES		
4.16.1.1	Air pipes shall be arranged to all spaces as required by the Rules and Regulations.		
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4.16.1.2 One (1) or two (2) air pipes shall be fitted so that the total sectional area of air pipes shall be not less than 1.25 times of the sectional area of the filling pipe connected to the tank. 4.16.1.3 Air pipes shall be located at the highest point in tanks as far as practicable. Float type air pipe head shall be fitted on the top of the air pipe. 4.16.1.4 Air pipe for the oil tanks and fresh water tanks shall have a removable stainless steel wire net screen. 4.16.1.5 Oil spill trays shall be provided around the air pipe of oil tanks. Height from the deck and the thickness of the air pipes shall meet the requirements of the Classification Society. 4.16.1.6 Name plates of SS shall be fitted to the air pipe head. 4.16.2 SOUNDING PIPES 4.16.2.1 A sounding pipe shall be fitted to each engine room tank, bilge well, oil tank, water ballast tank, chain locker and cofferdam as required by the Classification Society. 4.16.2.2 Sounding pipes shall be led as vertical as practicable. If inclination cannot be avoided, such inclination should not exceed 10 degrees from vertical line. 4.16.2.3 Sounding pipes shall be installed as close as practicable to the suction pipe. 4.16.2.4 Sounding pipe for the oil tanks shall be black steel pipe and the others shall be of galvanized steel pipe and shall be fitted with stand type or deck flush type sounding cap on each pipe top in accordance with the Contractor’s standard design.			
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4.16.2.5 A strike protector of steel piece shall be fitted at the bottom end of each sounding pipe. 4.16.2.6 Equalizing holes (at least two) shall be provided on each sounding pipe at uppermost level in tank. 4.16.2.7 Thickness of the sounding pipe shall meet the requirements of the Classification Society. 4.16.2.8 Two (2) sounding tapes, one (1) for fuel oil tanks and one (1) for bilge and ballast tanks shall be furnished. 4.16.2.9 Name plate of SS shall be fitted on the top of sounding head. 4.16.2.10 A levelling cock shall be provided on the top of sounding head. 4.16.2.11 A glass level gauge with protection cover shall be provided for each fresh water tank instead of sounding pipe. Inspection steps shall be provided near each glass level gauge if required. ----- END OF SECTION IV -----			
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SECTION V 5.0.0 MACHINERY 5.1.0 MAIN ENGINES - Basic Specification Make - Leyland / Cummins / Volvo Capacity - To be designed by contractor Approval - Classification Society Requirements 5.1.1 The main propulsion engines shall be complete with flywheel, flywheel housing, front and rear engine supports, vibration damper, safety controls (alarms) for LLOP and HCWT, set of electrical gauges for mounting in the wheel house consisting of LO temp. gauge, FW temp. gauge, hour meter, tachometer, LO pressure gauge, audio-visual alarm panel consisting of LLOP alarm and trip, HCWT alarm and trip, over speed trip. 5.1.2 The main engines shall be approved by Classification Society. Approval certificates with test bed reports witnessed by Classification Society shall be furnished. 5.1.3 Torsional vibration calculations; obtained from the Main Engine manufacturers shall be submitted to Classification Society for approval. There shall be no barred ranges of RPM. 5.1.3 The following accessories shall be provided. 5.1.3.1 Air Intake System; complete with air filter, air intake manifold, vacuum indicator mounted on intake piping, and after cooler. 5.1.3.2 Exhaust System; complete with dry type exhaust manifold, turbo charger, 10" long flexible connection with mating flange, exhaust silencer dry type with spark arrestor.			
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5.1.3.3	Fuel System; shall include Fuel filter of the duplex type, PT fuel pump with MVS Governor, Fuel shut off solenoid valve, 24 V DC, mounted on fuel pump, non return check valves on fuel supply and return lines, wire braided hose between filter and fuel pump.		
5.1.3.4	Cooling System; shall include a Thermostat installed in the engine coolant outlet, engine driven fresh water pump 1 no., heat exchanger and expansion tank with pressure cap, engine driven sea water pump, 1 no., corrosion resistor, all engine mounted.		
5.1.3.5	Lube oil System, shall include a LO sump, LO pump, gear type, engine driven, LO cooler FW cooled, integral with engine cooling circuit, LO filter tube with cap and LO dip stick oil level check, LO filter Duplex, mechanical LO priming pump.		
5.1.3.6	Engine Starting System, shall consist of 24 V DC electrical starter motor and 24 V DC battery charging alternator.		
5.1.3.7	Engine Instruments and Control Panel, shall consist of LO pressure gauge (mechanical), LO temperature gauge (mechanical), FW temp gauge (mechanical), Tachometer and tachometer-hour meter, ignition switch, battery charging ammeter.		
5.1.3.8	Engine Safety, shall consist of LLOP switch, HCWT switch, over speed trip switch only. Both; alarms and trips shall be provided for LLOP and HCWT.		
5.2.0	GEAR BOXES - Basic Specification Type : Hydraulic Reverse Reduction Ratio : Suitable to achieve the required propeller RPM as per propeller design		
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5.2.1	The gear box to be complete with mounting legs, oil cooler, flexible coupling to connect to the main engine, counter flange to suit intermediate shaft / propeller shaft, selector valve to select direction of rotation etc. The gear boxes shall be Classification Society approved and test bed reports duly witnessed by Classification Society along with certificates are to be provided.			
5.3.0	GENSET - Basic specification Qty : 1 no. Capacity : Diesel Engine Alternator : Minimum 25 KVA, 415 V, 50 Hz, 3 phase, 0.8 PF, AC, Brushless Make : Prime Mover - Kirloskar / Greaves / Simpson Alternator - Crompton / Kirloskar			
5.3.1	The diesel engine shall be electrically started by 24 V batteries, fitted with battery charging alternator to charge its starting battery and flexibly coupled to the alternator.			
5.3.2	The engine and alternator shall be mounted on a common base frame.			
5.3.3	The complete genset shall be flexibly mounted on cushy foot mountings.			
5.4.0	STERN GEAR & PROPELLERS			
5.4.1	Water Cooled Stern Gear complete with stainless steel (AISI316 / equivalent) propeller shaft, stern tube, aft & for'd stern tube bosses and GM bushes fitted with rubber Cutlass Bushes, W.T glands and G.B coupling flange, coupling bolts etc. approved by Classification Society shall be provided.			
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5.4.2	Suitably designed and approved Manganese Bronze Propellers duly bedded to shafts shall be fitted with rope guards. The propellers shall be statically balanced and to be manufactured to ISO tolerance Grade 3.		
5.5.0	RUDDER & RUDDER STOCKS		
5.5.1	2 nos. single plate, spade type, under hung rudders of adequate area shall be provided; connected to SS 316 Steel rudder stocks working in GM rudder bushes.		
5.5.2	Water tight gland, jumping collar etc shall be fitted.		
5.6.0	STEERING GEAR		
5.6.1	A power hydraulic steering gear of sufficient capacity and certified by Classification Society shall be provided. The hydraulic cylinders in the steering gear compartment are to be actuated by a main engine driven hydraulic pump through joystick / joywheel and an emergency rotary hand helm pump fitted with wooden / SS wheel, from the wheel house.		
5.6.2	Rudder angle indicator shall be provided in the W/H console.		
5.6.3	The tiller arms of both the rudders shall be connected by a synchronizing bar.		
5.6.4	The hydraulic piping shall be of seamless type as per Class requirements.		
5.6.5	2 nos. steering lock valves shall be fitted on the power pack and helm pump to lock the rudder from movement from the position in which it has been left.		
5.6.6	2 nos. surge protection safety valves / relief valves shall be provided in the steering system to protect the system from heavy surge pressures generated in the system or externally induced.		
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5.6.7	2 nos. high pressure SS ball type shut off valves shall be provided for isolating the system and both the hydraulic cylinders during maintenance.		
5.6.9	Necessary alarm panel in line with Classification Society requirements shall be provided.		
5.6.10	The entire system shall be approved by Classification Society.		
5.7.0	TWIN SCREW REMOTE CONTROL		
5.7.1	Twin Screw Mechanical Remote Control of engine speed and gear box selector valve from bridge shall be provided in addition to local controls provided on the main engines and gear boxes.		
5.7.2	The remote control system shall be of the combination type using both wire ropes and push pull cable, Heavy Duty, Single Lever operation for each Main Engine and Gear Box		
5.8.0	PUMPS		
5.8.1	Bilge and fire pumps shall be provided as per Class and/or Statutory requirements. However, minimum of two power-driven pumps shall be provided. One of the pumps may be main engine driven.		
5.8.2	One no. GS / Bilge / Fire / Ballast pump of minimum capacity 25 m ³ / hr at 15 MWC capacity and as per rules, driven by the main engine through pulley and V belt shall be provided. The bilge pump shall be with CI casing, GM internals and SS316/ eqv. shaft and key.		
5.8.3	Bilge pump in bronze construction for bilging out chain locker / for'd bilges, hand pumps for FW & FO transfer; of CI/GM construction shall be provided.		
----- END OF SECTION V -----			
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SECTION VI 6.0.0ELECTRICAL 6.1.0GENERAL 6.1.1Electrical installation shall comply with Classification and Statutory requirements. 6.1.2If any items in the machinery or hull specification necessitate the installation of electrical equipment not mentioned in this specification, such equipment shall be provided by the Contractor in accordance with similar equipment mentioned in this section. 6.1.3In general, cable terminals shall be of solderless type. All electrical systems and equipment shall be easily accessible and clear of inflammable materials. 6.1.4Lighting system shall be separated into deck part lighting system and engine room lighting system, and lighting fixtures shall be connected to distribution boards fed from main switchboard or emergency batteries. 6.1.5Navigation lights shall be connected to the navigation light indicator panel which is capable of being fed from the main switchboard directly and from the emergency batteries. 6.1.6Power supply shall be minimum one no. 20 KVA, 415 V, 3 phase, 3 wire,50 Hz., AC, genset and emergency supply 24V DC , 180 AH. batteries located in the Engine Room/Wheelhouse top in addition to engine starting batteries in engine room. 6.1.7The power system of the vessel shall 415V, 3phase, 3wire, 50Hz 230V, 3/1phase, 3wire, 50Hz through 415/240V Transformer 24V DC, 2wire			
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6.2.0 MAIN SWITCHBOARD 6.2.1 GENERAL 6.2.1.1 Switch board shall be constructed in accordance with the Classification rules, national and international standards. The main switchboard shall be self supported steel plated and dead front type metal enclosed and drip proof. 6.2.1.2 Insulation monitor, necessary meters, instruments, indicators shall be provided. The main switchboard shall be constructed with enclosed non flammable and non hygroscopic material. 6.2.1.3 The main switchboard shall consist of substantial angle steel framework and steel plate and shall be enclosed with the following:- a) Hinged doors (front) screw on panel (rear) fitted with quick release screws for access to inside equipment. b) Louver boards for ventilation. c) Cable entry from the bottom. d) Surface of panel to be finished with epoxy paint. e) A metal hand rail covered with insulating material shall be provided as necessary in front of the switchboard. f) Adequate space shall be provided for maintenance. 6.2.1.4 Necessary lights shall be installed in front of the switchboard. 6.2.1.5 Floor in front and rear of the main switchboard shall be covered with rubber mat.			
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6.2.1.6	All bolts, screws, etc. used in connection of current carrying conductors shall be adequately locked with locknuts and spring washers.		
6.2.1.7	The entire bus bar system including supports and insulation shall be designed to withstand the short circuit thermal and magnetic stresses to maximum estimated fault level on main bus bar. Bus bar shall be of hard drawn high conductivity copper.		
6.2.2	FUSE		
6.2.2.1	All Fuses shall be of the no-renewable type. In general, the fuses are not to be used for main circuit protection, they are to be breakers. The fuses can be used for control circuits, alarm circuits and indicating circuits, etc.		
6.2.2.2	Fuse shall be of replaceable type marked with particulars such as rated current and rated voltage etc.		
6.2.3	METERS & INDICATION		
6.2.3.1	The meters fitted on the motor control gears, main switchboard, etc., shall be of standard types and sizes, readily available in India.		
6.2.3.2	The following shall be provided in the main switchboard.		
6.2.3.2.1	For Generators:- • Voltmeter • Ammeter • Frequency meter • Kilowatt meter • Generator power available • Generator circuit breaker status indication • Generator heater on indication • Ground fault detection		
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6.2.3.2.2	For Shore Power Shore supply power available		
6.2.3.2.3	Busbar Bus bar 3phase supply on indication lamp		
6.2.3.3	The voltmeter and Frequency meter shall be marked with rated system rating indication with red mark in the meter.		
6.2.4	NAME PLATES		
6.2.4.1	Name plate indicating service of panels and feeders shall be provided on panels. In name plates for feeders, name of feeder, frame size, setting value of trip and, in case of moulded case circuit breaker, size of cable shall be written.		
6.2.4.2	Name plates shall be of engraved laminated plastic or equivalent on interior locations and SS on exterior.		
6.2.5	BREAKERS		
6.2.5.1	The Main breaker for Generator shall be MCCB with plug type. The shore supply breaker shall be fixed type MCCB. All outgoing breaker shall be MCB type. The Generator breaker shall be provided with all statutory protection requirements of Class.		
6.3.0	24V D.C SWITCHBOARD		
6.3.1	One (1) battery switchboard shall be provided for charging and discharging of battery, and distributing DC 24V source to battery light and interior communication equipment. The final battery and battery charger/DC rectifier capacity to be determined by DC load analysis.		
6.3.2	The battery switchboard shall be of dead front and self-supporting type and of such arrangement that one battery may be float charged. One battery charger/DC rectifier shall be provided to feed DC load of vessel		
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	as well as to charge the battery. The battery charger/DC rectifier shall be sized accordingly during design phase. 6.3.3 The board shall be fitted with the following instruments and device. a) One (1) DC voltmeter b) One (1) DC ammeter for discharging current /charging current c) One (1) Source pilot lamp d) One (1) A.C ON/OFF test pushbutton. e) Necessary number of feeder circuit with fuses shall be provided. 6.4.0 CABLE AND CABLE INSTALLATION 6.4.1 GENERAL 6.4.1.1 In general, electric cable shall be marine cables, manufactured and tested in accordance with BS / IEC standard, which has been approved by the Classification Society (except special cables). 6.4.1.2 All electrical cables shall be of the heat resistant, oil resistant and flame retardant type, duly approved by IRS for use on ships and shall meet the requirements of IEC 92-3. 6.4.1.3 660V cables shall be used for A.C. 415V and 240V circuits, and 250V cable shall be used for-D.C. 24V circuit. 6.4.1.4 Use special cables; if specified by equipment manufacturers, for radio, Communication/ Navigations systems etc. 6.4.2 CONSTRUCTION OF CABLES 6.4.2.1 Tinned, annealed copper wire, stranded, colored or numbered for distinguishing core and with plastic filler shall be used.		
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6.4.2.2	Electric cable in general shall be ethylene propylene rubber insulated or XLPE insulated; PVC sheathed and galvanized steel wire braided cable.		
6.4.3	CABLE INSTALLATION		
6.4.3.1	GENERAL		
6.4.3.1.1	In general cable installation shall be done in accordance with class rules.		
6.4.3.1.2	Electric cable shall be laid avoiding places of high temperature and high humidity and shall be protected in places where it is likely to receive mechanical damage.		
6.4.3.1.3	Cable-run in groups shall be supported with steel hangers or hot dipped galvanized trays or ladders or on MS flat bars. Hanger shall be fitted with proper space from hull structure as to easily permit painting of the hull structure.		
6.4.3.1.4	Cables shall be fixed with stainless steel ties or nylon ties.		
6.4.3.1.5	Where cable penetrates a watertight deck or bulkhead, watertight cable gland or approved type compound shall be applied.		
6.4.3.1.6	Where cable penetrates non watertight deck, coaming or cable pipe without cable gland shall be used for protection of the cable.		
6.4.3.1.7	Where cable penetrates fire tight deck or bulkhead, cable gland or coaming shall be used for protection of the cable, and filled with fire retarding compound where necessary.		
6.4.3.1.8	Cable runs shall be so arranged to prevent the propagation of fire and shall be approved by Classification Society.		
6.4.3.1.9	Cables shall be protected during painting so as to prevent them from being coated.		
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6.4.3.1.10 Cables shall be installed under engine room floor plates only where alternative routing is not practical. Use galvanized steel conduit to protect such cables. 6.4.3.1.11 Cables shall run from point to point without splices or joints. 6.4.3.1.12 Instrument and communication cables installation shall be separated from power cables. 6.4.3.1.13 Where paneling is applied over the hull structure in accommodation, concealed wiring shall be carried out as far as practicable and exposed wiring to be carried out at all other spaces. 6.4.3.1.14 Exposed cables in cabins with paneling shall be covered with decorative cover. 6.4.3.1.15 Where cable is exposed to the danger of some mechanical damage, it shall be protected with steel plate, galvanized steel pipe, flexible cable conduit or other equivalent means. 6.4.3.1.16 Cable on exposed deck shall be protected with galvanized steel pipe and several expansion boxes to be fitted. 6.4.3.1.17 Cable along the mast shall be protected with stainless steel pipe or painted steel plate or shall be installed inside of mast with cable hanger. 6.4.3.1.18 All cable glands and termination shall be done on to the bottom of equipment/panels as far as possible. 6.4.3.1.19 Metal casing for mechanical protection of cables should be protected against corrosion. 6.4.3.1.20 Sleeve type markers shall be used to identify all control cable conductors at each termination in accordance with drawings. 6.4.4 EARTHING			
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6.4.1	Earthing shall comply with the Classification Rule requirement.		
6.4.2	All non-current carrying exposed metal parts of electrical machines or equipments shall be effectively earthed.		
6.4.3	The metallic sheaths of cables other than the instrument cables shall be earthed at their two ends.		
6.5.0	LIGHTING AND FITTING		
6.5.1	General		
	• Illuminate the vessel with marine type fluorescent, CFL and LED lighting fixtures. Avoid using incandescent lighting fixture as possible. • In general energy efficient lighting fixtures shall be used. • Lighting fixtures fitted under the risk of mechanical damages shall be protected with guards for incandescent lights and polycarbonate globes for fluorescent lights. • Lighting fixtures in space where inflammable gas is likely accumulated shall be of explosion proof type. • All light fittings shall be of the intrinsically safe, explosion proof type where the area accumulated with oil fumes, paint store and other inflammable area.		
6.5.2	Interior Lighting		
6.5.2.1	Provide fixtures suitable for operation in marine environment, preferably all non-corroding type. IP rating of the equipment according to class requirement.		
	Wheel House	: fluorescent 2x20W, 220V	
	Deck /Accommodation	: fluorescent 2x20W, 220V	
	Machinery Space	: fluorescent 2x20W, 220V	
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6.5.2.2	The frames of the Florescent Light (FL) fittings shall be powder coated and fitted flush with the ceiling panels. Spring washers shall be provided for all nut-bolts and screws in the FL fittings. The cover of the FL fittings shall be of anti-glare type in Wheel house & accommodation and of the clear type in the Engine Room.		
6.5.3	Exterior Lighting		
6.5.3.1	All lighting fixture shall be weatherproof/water tight and according to Class rules.		
6.5.3.2	The lighting fixtures fitted in the spaces exposed to weather shall be water-proof and to have the bodies of stainless steel or synthetic resin. Deck Light: fluorescent 2x20W, 230V Flood Light: 250W, 230V, and 4nos.		
6.6.0	LIGHTING SWITCHES & SOCKETS		
6.6.0.1	Switches used for lighting branch circuit shall be of synthetic resin framed.		
6.6.0.2	Switches fitted in wheel house and accommodation shall be non watertight type and ones fitted in other places to be watertight type.		
6.6.0.3	Switches used for lighting branch circuit shall be double pole type.		
6.6.0.4	Switches shall be of flush mounting type as far as practicable.		
6.6.0.5	Switches for berth lights and desk lights shall be fitted on the lighting fixtures themselves.		
6.6.0.6	Switches for explosion-proof lights shall have key handle for maintenance of explosion proof lights.		
6.6.0.7	Current rating of all switch socket outlets shall be of 16 A or above, 230V, 1phase. Minimum 16 nos. sockets shall be installed.		
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6.7.0	LIGHTING CONTROL		
6.7.1	Control of lights shall be as per detailed in paragraphs below		
6.7.1.1	Floodlights, Funnel Lights: Floodlight for deck illumination, shall be controlled from wheelhouse.		
6.7.1.2	Engine Room Lights: The lights installed in the engine room shall be controlled by switch installed in the engine room.		
6.7.1.3	Ceiling Lights: In general, ceiling lamps in the cabins, the stores, etc., shall be operated by double pole-switches located close to the entrance doors.		
6.7.1.4	Bed Lamp, Desk Lamp, Etc.: Bed lamps and desk lamps shall be operated by a switch fitted to each lighting fixture.		
6.7.1.5	Passage Lamp: Inside and outside passage lamps shall be operated by switch adjacent to common entrance.		
6.7.1.6	Navigation Lights: All Navigation light shall be controlled from Navigation light indicator panel mounted on the wheelhouse console.		
6.8.0	LIGHTS		
6.8.1	NAVIGATION LIGHTS AND SIGNAL LIGHTS		
6.8.1.1	Navigation lights, panel shall be supplied with the source of 24 V from the main switchboard, and in emergency shall be supplied from the emergency batteries automatically. Voltage of day light signal light shall be 24 V DC, and shall be supplied from its own 24 V DC storage battery.		
6.8.1.2	NAVIGATION LIGHTS		
6.8.1.2.1	The minimum requirements for Navigation lights are as follows		
	Type : Single-tier lens, 24V DC.		
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• One (1) masthead - White • One (1) port - Red • One (1) starboard - Green • One (1) stern - White • One (1) anchor - White • Two (2) NUC - Red • One (1) Navigation light indicator panel of graphic type in wheelhouse			
6.8.1.2.2 All lights shall have audio-visual alarms for failure.			
6.8.1.3 DAYLIGHT SIGNAL LIGHT			
6.8.1.3.1 The minimum requirements for Navigation lights are as follows • One (1), 60W portable type daylight signal light (150 mm Aldis type). • One (1) Receptacle of DC 24V.			
6.8.1.4 SEARCH LIGHTS			
6.8.1.4.1 One (1) - 1000 W search lights swivel mounting type shall be provided, capable of being operated from inside the wheelhouse.			
6.8.1.5 BERTH LIGHTS			
6.8.1.5.1 8W fluorescent light, non-watertight without globe and bulkhead mounting type shall be provided over the bed head of each cabin.			
6.8.1.6 DESK LIGHTS			
6.8.1.6.1 15W fluorescent light, non-watertight without globe and bulkhead mounting type shall be provided in crew's cabin.			
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6.8.1.7MIRROR LIGHTS 6.8.1.7.115W fluorescent light, drip proof with globe and bulkhead mounting type shall be provided for illumination of toilet, bath and outside wash basin & mirror. 6.8.1.8INSTRUMENT LIGHTS 6.8.1.8.1Instrument lights shall be provided for magnetic compass main engine revolution indicator, rudder angle indicator and fed through dimmer switch. 6.8.1.9EMERGENCY LIGHTS 6.8.1.9.1A system of emergency lighting 24 V DC shall be provided and fed automatically from storage battery on failure of A.C. main power supply. The following emergency lights shall be provided. • Passage : 2 nos. • Back of main switchboard : 2 nos. • In front of main switchboard : 2 nos. • Crew Cabin : 2 nos. • Wheel House : 2 nos. 6.8.1.10PORTABLE LIGHTS 6.8.1.11.1The following portable lights of 220V AC, 60W shall be provided. • Two (2) Watertight with 15m cord (Intrinsically safe). • Two (2) Non-watertight with 10m cord. ----- END OF SECTION VI -----			
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SECTION VII			
7.0.0	SAFETY EQUIPMENT		
7.1.0	LIFE SAVING APPLIANCES		
7.1.1	The following minimum Life Saving Appliances; complying with the requirements of Class and/or Statutory Bodies shall be provided:- • Buoyant Apparatus, 6 Persons capacity, MMD approved - 2 nos. • c/w cradle, HRU, securing straps etc. • Life buoys with lanyards and retro reflective tapes - 2 nos. • Life buoys without fittings - 2 nos. • Life jackets with retro reflective tape, light and whistle - 6 nos.		
7.2.0	FIRE FIGHTING APPLIANCES		
7.2.1	The following minimum Fire Fighting Appliances complying with the requirements of Class and/or Statutory Bodies shall be provided:- • 9 Ltrs. Foam type fire extinguisher - 2 nos. in Engine Room • 9 Ltrs. Soda Acid type fire extinguisher - 2 nos. in accommodation • 4.5 Kg DCP - 1 no. in Wheel house & 1 no. in Engine Room • Fire hydrants - 1 no. in E.R. & 1 no. on Main deck • Fire buckets - 4 nos. on main deck • Sand Box with scoop - 1 no. in Engine Room • Fire Man's Axe - 1 no.		
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7.3.0SHAPES & SOUND SIGNALS 7.3.0.1The following shapes and sound signaling devices complying with the requirements of Class and/or Statutory Bodies shall be provided:- - Black balls - 3 nos. - Diamond - 1 no. - Cone - 1 no. - Cylinder - 1 no. - Whistle / Horn - 1 no. - Brass Bell - 1 no. with name of Vessel engraved 7.4.0Safety Requirement for Carriage of Ammonia 7.4.1Additional safety requirement for carriage of liquefied ammonia is detailed in “Safety Requirements for Carriage of Ammonia”. 7.4.2In addition to the Safety equipment listed vide 7.1.0 through 7.3.0 above, Safety equipment as per class certification and KIV rules shall be provided. ----- END OF SECTION VII -----			
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SECTION VIII**8.0.0 WHEEL HOUSE FITTINGS****8.1.0 WHEEL HOUSE**

8.1.1 The following shall be provided in the Wheel house.

- a. VHF set - 1 no.
- b. Magnetic compass table top mounting type near steering column
- c. G.P.S - 1 no.
- d. Rudder angle indicator - 1 no.
- e. Clinometer - 1 no.
- f. Marine Clock - 1 no.
- g. Electric window wiper for all forward facing windows.
- h. Whistle / Horn, Alarm bell etc.
- i. Loud Hailer, Battery Operated, 1 no.
- j. Wheel house console with Main Engine alarm panels, switches for external lighting, Flood lights & Search Light
- k. Navigation light panel with audio visual alarms for lamp failure
- l. Wooden grating for helmsman.

----- END OF SECTION VIII -----

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SECTION IX			
9.0.0	PAINTING, PRESERVATION & PROTECTION		
9.1.0	PAINTING		
9.1.1	GENERAL		
9.1.1.1	Approved list of paint manufacturers is specified in the List of Makers attached with this specification.		
9.1.1.2	De-scaling, shop priming, de-rusting and painting works shall be carried out as outlined below and in accordance with the paint maker's recommendation and under the supervision of the paint Maker's coating advisers.		
9.1.1.3	Colors of finish for the vessel shall be in accordance with the Builder's color scheme.		
9.1.1.4	Fillet welding joints and erection seams/butts forming tank boundary shall be painted after the joint has been examined either by compressed air test, vacuum test or tank air test as appropriate.		
9.1.1.5	Adhesive tape may be used to protect the fillet joint and erection seams/butts waiting for leak test from contamination by surrounding painting.		
9.1.1.6	Machinery, electrical equipment, fittings, valves, deck machinery, navigation equipment, furniture, etc., shall be painted in accordance with the Makers' standards unless otherwise specified.		
9.1.1.7	In general, the steel out fittings including pipes shall be painted with one(1) coat of epoxy primer (exposed parts; 100 microns, enclosed parts : 75 microns) and one (1) coat of finish paint same as surroundings unless otherwise specified in these specifications.		
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9.1.1.8	Painting shall not be carried out during the periods of rain, fog or mist in the open air and also not when the weather conditions may cause condensation i.e., when the relative humidity is above 85% and the steel temperature is lower than 3 degrees in centigrade above dew point except the case that paint maker has confirmed in writing that a particular paint can be applied at such weather conditions.		
9.1.1.9	The painting scheme, surface treatment and paint application shall be in accordance with the recommendations of the paint Maker and be suitable for a three (3) year period between dry dockings.		
9.2.0	PRIMARY SURFACE PREPARATION		
9.2.1	At Shop: - All new plates and sections shall be grit blasted to SA 2.5 Swedish Std. and primed with one coat of inorganic zinc silicate primer of 25 microns DFT.		
9.2.2	At Site: - All welds, burnt, damaged and corroded areas shall be spot blasted to SIS SA 2.5. Underwater areas shall be grit blasted to SIS SA 2.5 for best performance. Internal areas where blasting not feasible, power tool cleaning to ST 3 standard shall be carried out.		
9.2.3	The steel surface of fittings such as pipes, masts, pipe supports, grating supports, auxiliary machinery seats, etc. shall be generally power tool cleaned with wire brush or disc sander or pickled in accordance with the Contractor's practice.		
9.3.0	SECONDARY SURFACE PREPARATION		
9.3.1	Before the first coat is applied, damaged area of shop primer due to welding, burning, rubbing, etc., and the rusted steel surface shall be power tool cleaned in accordance with the following table.		
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<table><tr><td></td><td>AREA</td><td>SIS GRADE</td></tr><tr><td></td><td>Bottom and boot top</td><td>SIS ST 2.5</td></tr><tr><td></td><td>Topside</td><td>SIS ST 2.5</td></tr><tr><td></td><td>Weather deck</td><td>SIS ST 3</td></tr><tr><td></td><td>Deckhouse exterior</td><td>SIS ST 3</td></tr><tr><td></td><td>Deckhouse interior</td><td>SIS ST 2</td></tr><tr><td></td><td>E/R interior</td><td>SIS ST 2</td></tr><tr><td></td><td>Water ballast tanks</td><td>SIS ST 2.5</td></tr><tr><td></td><td>F.W. tanks</td><td>SIS SA 2.5</td></tr><tr><td></td><td>F.O. tanks</td><td>Contractor's Practice</td></tr></table>					AREA	SIS GRADE		Bottom and boot top	SIS ST 2.5		Topside	SIS ST 2.5		Weather deck	SIS ST 3		Deckhouse exterior	SIS ST 3		Deckhouse interior	SIS ST 2		E/R interior	SIS ST 2		Water ballast tanks	SIS ST 2.5		F.W. tanks	SIS SA 2.5		F.O. tanks	Contractor's Practice
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	Water ballast tanks	SIS ST 2.5																															
	F.W. tanks	SIS SA 2.5																															
	F.O. tanks	Contractor's Practice																															
9.3.2	The visible zinc salts on intact shop primed surface shall be thoroughly cleaned.																																
9.4.1	SURFACE CLEANING BEFORE OVERCOATING																																
9.4.1	The surfaces shall be cleaned of oil, moisture, dust and other foreign materials with thinner, fresh water, wire brush, or compressed air prior to coating. If over-coating time is expired, the surface shall be sufficiently roughened after consultation with paint supplier prior to subsequent coats.																																
9.5.0	APPLICATION OF PAINTING																																
9.5.1	The painting shall be carried out by airless spray, in general. Where spraying is impracticable, brush or roller shall be used.																																
9.5.2	Mixing and thinning of the paint material and interval of painting shall be in accordance with the Maker's recommendation.																																
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9.5.3	The painting schedule specified hereunder may have alteration in number of coats and the dry film thickness in accordance with standard specification of the paint Maker selected.		
9.5.4	In the edges of small holes such as slots, scallops, drain holes, air holes, etc. and corners of flame burnt free edge of structural members, one (1) additional coat shall be applied after first coat has been applied except in way of water ballast tank where two (2) additional coats shall be applied.		
9.5.5	The painting of the exposed structural steel surface such as outsides of shell, deckhouse, funnel, etc. shall be free from sags and runs.		
9.5.6	After the specified coating is applied, the damaged parts of paint film shall be repaired at proper time. When such damage reaches the steel surface and rust occurs, the surface shall be cleaned by the wire brush and/or disc sander and shall be coated as originally specified. When such damage does not reach the steel surface, the surface shall be touched up to the specified thickness.		
9.5.7	The dry film thickness specified in the painting schedule shall be attained on at least 95% of the measuring points and at least 90% thickness of specified one to be attained on remaining 5% measuring points. Dry film thickness shall be measured after completion of each coat and a record maintained. DFT measurements shall also be carried out after anti-corrosive coating or final coating.		
9.6.0	PAINTING SCHEDULE		
9.6.1	The painting scheme as described below shall be followed.		
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9.6.1.1	KEEL TO WATERLINE		
	PAINT TYPE	COATS	TOTAL DFT
	HIGH BUILD EPOXY PRIMER	1	75
	HIGH BUILD TAR FREE EPOXY	2	150
	EPOXY TIE COAT	1	75
	HB ANTIFOULING	2	100
9.6.1.2	WATERLINE TO DECK		
	PAINT TYPE	COATS	TOTAL DFT
	HIGH BUILD EPOXY PRIMER	1	75
	HIGH BUILD TAR FREE EPOXY	2	150
	FINISH COAT	2	75
	(OWNER'S PREFERRED COLOUR)		
9.6.1.3	WEATHER DECK		
	PAINT TYPE	COATS	TOTAL DFT
	UNIVERSAL PRIMER	2	50
	DECK PAINT NON SKID	2	100
	(OWNER'S PREFERRED COLOUR)		
9.6.1.4	SUPERSTRUCTURE, MAST, FUNNEL, DECK FITTINGS & DECK MACHINERY		
	PAINT TYPE	COATS	TOTAL DFT
	UNIVERSAL PRIMER	1	50
	HIGH BUILD PRIMER	1	75
	UNDER COAT	1	50
	FINISH COAT	2	50
	(OWNER'S PREFERRED COLOUR)		
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9.6.1.5	BEHIND LINING & INSULATION OF SUPERSTRUCTURE		
	PAINT TYPE	COATS	TOTAL DFT
	BITUMINOUS BLACK	1	200
9.6.1.6	MACHINERY SPACE, STORES & ACCESS PASSAGE		
	PAINT TYPE	COATS	TOTAL DFT
	UNIVERSAL PRIMER	2	35
	UNDER COAT (ALKYD BASED)	1	50
	FINISHING COAT WHITE	2	40
9.6.1.7	POTABLE WATER TANKS		
	PAINT TYPE	COATS	TOTAL DFT
	UNIVERSAL PRIMER	1	50
	HIGH BUILD EPOXY SUITABLE FOR F.W (WHITE / LIGHT GREY)	1	200
	Primer and coating should have FW compatibility certificate.		
9.6.1.8	BALLAST TANKS, VOID SPACES & CHAIN LOCKERS		
	PAINT TYPE	COATS	TOTAL DFT
	HB EPOXY BALLAST TK COATING, LIGHT COLOR	1	150
	HB EPOXY BALLAST TK COATING, LIGHT COLOR	1	150
9.6.1.9	FLOORS OF MACHINERY SPACES & OTHER SPACES		
	PAINT TYPE	COATS	TOTAL DFT
	UNIVERSAL PRIMER	2	40
	MOD. EPOXY FINISH COAT, LIGHT GREY	2	40
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9.6.1.10	ENGINE ROOM UPTAKES		
	PAINT TYPE	COATS	TOTAL DFT
	UNIVERSAL PRIMER HR	2	35
	ALUMINIUM PAINT HR	2	25
9.6.1.11	FUNNEL INTERNAL		
	PAINT TYPE	COATS	TOTAL DFT
	UNIVERSAL PRIMER	2	40
	ALUMINIUM PAINT HR	2	25
9.6.1.12	CABLE & ANCHORS		
	PAINT TYPE	COATS	TOTAL DFT
	COAL TAR EPOXY	2	40
9.7.0	CATHODIC PROTECTION		
9.7.1	Zinc anodes shall be fitted to provide corrosion protection for the immersed hull, sea chests and water ballast tanks for a life span of three (3) years.		
9.7.2	The number and disposition of the Sacrificial Anodes shall be subject to the Builder’s approval.		
----- END OF SECTION IX -----			
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10.0.0 <u>ANNEXURE A</u> LIST OF ACCESSORIES TO BE MAINTAINED IN BARGE 1. Ammonia sensors Fixed Ammonia Gas Detection System Comprising Of Ammonia Detector Controller Unit Integrated Panel With Display Ip65 24v & Two Ammonia Detection Sensors, Sensing Range: 10 - 100 Ppm With Audible And Visual Alarm. NH3 Detector alarm panel Rittal make LP 65 rated RAL 7035 Enclosure 2 Numbers of autonics make with indicator & Pushbutton for Mute and Reset 1 number Hooter with flasher NH3 Detector with MQ137 Sensor inside a IP rated Enclosure Supply voltage: 24 VDC Quantity- 1 No. each at the crew accommodation and cargo hold. 2. Fire alarm System consist of following: a. Zone Fire alarm Monitoring panel -1 No. b. Conventional type Heat Detectors Qty 2 Nos. c. Conventional type Smoke Detectors Qty 2 Nos. d. Conventional type Manual Call Point Qty 1 No. e. Hooter with Flasher Qty 2 Nos. 3. Smoke sensor- 1 no. each at the kitchen and engine room 4. Bilge alarm Bilge Alarm Unit In IP 66 Aluminum Enclosure Made of Al Si 12, RAL 7001 Silver Grey, Powder Coated of size 160 x 260 x 90 mm Panel will have LED indication on High alarm from bilge with Acknowledge Push button Alarm Reset and Hooter Mute Push Buttons will Be Provided One Potential free Contact will be provided for External Alarm/Hooter Magnetic reed switch, vertical mount type Class Approved & IP Rated Bilge Float with manual test Lever Qty-2 nos.			
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Float switch: Vertical Mount Magnetic Switching with SS Float 2 nos of LED for 2 bilge tanks for indicate high level alarms 5. Life raft for accommodating 6 persons approved by DG Shipping with cradle, Lashing Assembly and hydrostatic Release Unit 6. LION brand DD fender of size 150mmx150mmx75mmx75mm of hollow section and maximum length 3m long made of natural rubber of hardness 72 +/- 3 degree SHORE-A, black colour shall be provided around the barge on 150 ISMC(channel) for cushioning purposes as per the rules of classification society. Structural and fasteners shall also be provided by the contractor. 7. Rope ladder-1 no. 8. Search light- 1 no. of 1000 W each at port side, starboard side and bow. 9. Portable emergency light- 1 no. Portable inflatable emergency lighting system, consisting of 1200 VA genset (Min) with 8 liter fuel tank capacity, 400W Metal Halide lamp with min: 42000 lumen light output, 4.5 m inflatable tower height. 10. Suitable fire proofing (fyre blanket system (A60) of density 96 kg/m3) between the engine room and cargo hold. 11. Overhead Drinking water tank of 1000 L to be provided 12. Portable fire water pump having minimum output 1300 LPM at 7 bar pressure. 13. Any accessories/equipments/features not covered in the TPS, but required to be provided for certification from the classification agency/registering authority shall be in the contractor's scope at his own cost. 14. Docking plan with necessary drawings and calculations shall be submitted by the contractor at the time of delivery in soft copy. <u>All the accessories shall be class certified as applicable.</u>			
FACT ENGINEERING WORKS			

PROFILE

Non-Weathertight Hood

Non-Weathertight Hood

LAG BULLET (P&S)

CARGO HOLD 1

LAG BULLET (P&S)

CARGO HOLD 2

Aft Peak Tank (P&S)

Tank (P&S)

Engine Room

Store

Chain Locker

500

DWL

BL

1000

Wheelhouse

Accommodation space above engine room

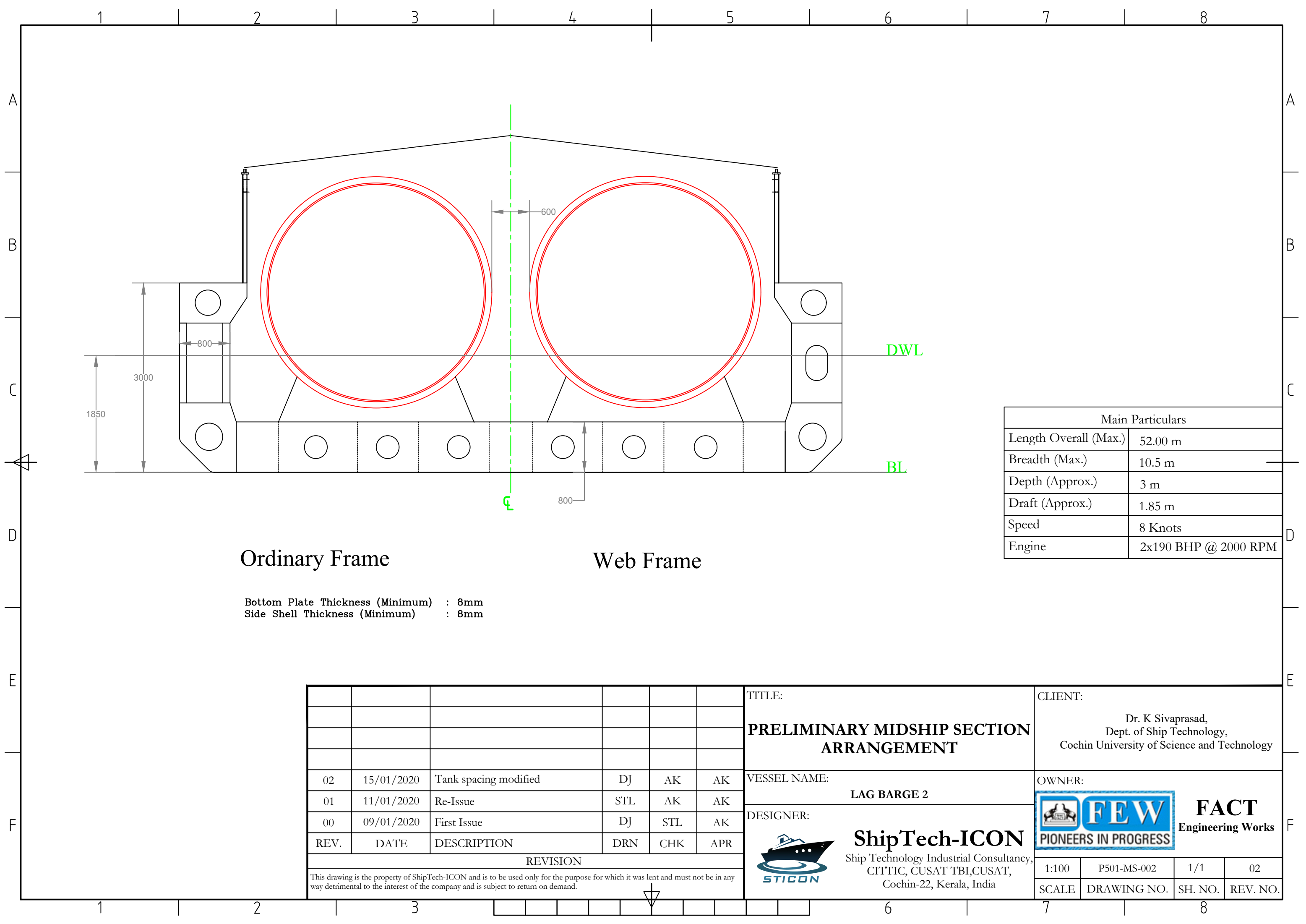
500

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Technical drawing of a ship's hull cross-section. The drawing shows the waterline (DWL) and the baseline (BL). The centerline is labeled 'CL'. The hull is divided into two main sections, each containing a circular hull form. The drawing includes dashed lines for the hull form and solid lines for the waterline and baseline. The drawing is oriented with the bow to the left and the stern to the right.

Main Particulars	
Length Overall (Max.)	52.0 m
Breadth (Max.)	10.5 m
Depth (Approx.)	3 m
Draft (Approx.)	1.85 m
Speed	8 knots
Engine	2x190 bhp @2000 rpm

						TITLE: PRELIMINARY GENERAL ARRANGEMENT	CLIENT: Dr. K Sivaprasad, Dept. of Ship Technology, Cochin University of Science and Technology				
02	15/01/2020	Details Added	DJ	AK	AK		VESSEL NAME: LAG BARGE 2	OWNER:  FEW FACT Engineering Works PIONEERS IN PROGRESS			
01	11/01/2020	Revised Submission	STL	AK	AK			DESIGNER:  ShipTech-ICON Ship Technology Industrial Consultancy, CITTC, CUSAT TBI,CUSAT, Cochin-22, Kerala, India	1:100 P501-GA-001 1/1 02		
00	09/01/2020	Initial Submission	DJ	STL	AK		SCALE DRAWING NO. SH. NO. REV. NO.				
REV.	DATE	DESCRIPTION	DRN	CHK	APR						
REVISION											
This drawing is the property of ShipTech-ICON and is to be used only for the purpose for which it was lent and must not be in any way detrimental to the interest of the company and is subject to return on demand.											



Main Particulars	
Length Overall (Max.)	52.00 m
Breadth (Max.)	10.5 m
Depth (Approx.)	3 m
Draft (Approx.)	1.85 m
Speed	8 Knots
Engine	2x190 BHP @ 2000 RPM

Ordinary Frame

Web Frame

Bottom Plate Thickness (Minimum) : 8mm
Side Shell Thickness (Minimum) : 8mm

02	15/01/2020	Tank spacing modified	DJ	AK	AK
01	11/01/2020	Re-Issue	STL	AK	AK
00	09/01/2020	First Issue	DJ	STL	AK
REV.	DATE	DESCRIPTION	DRN	CHK	APR
REVISION					
This drawing is the property of ShipTech-ICON and is to be used only for the purpose for which it was lent and must not be in any way detrimental to the interest of the company and is subject to return on demand.					

TITLE: PRELIMINARY MIDSHIP SECTION ARRANGEMENT		CLIENT: Dr. K Sivaprasad, Dept. of Ship Technology, Cochin University of Science and Technology	
VESSEL NAME: LAG BARGE 2		OWNER:  FACT Engineering Works	
DESIGNER:  ShipTech-ICON Ship Technology Industrial Consultancy, CITTIC, CUSAT TBI,CUSAT, Cochin-22, Kerala, India		1:100	P501-MS-002
		SCALE	DRAWING NO.
		SH. NO.	REV. NO.
		1/1	02

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6.0.0	PIPING INSULATION
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9.0.0	INSULATION CAST - IN - SITU
10.0.0	SAFETY
11.0.0	GUARANTEE
12.0.0	APPLICATION DETAILS

PRPD.BY:- CK	CHKD.BY:- GPN	APPRD. BY:- KV	ISSUED ON:- 24-7-97
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1.1.0 SCOPE This specification covers the requirements for the supply and application of external, self extinguishing type thermal insulation of equipment and piping for cold service conditions. 1.1.0 REQUIREMENT OF COLD INSULATION 1.1.1 Requirement of cold insulation of any equipment or piping shall be as specified in any of the following documents. a. Equipment data sheets / drawings b. Piping line schedule c. Design basis for package items d. Insulation schedule 1.1.2 Cold insulation is required to be provided on Pressure vessels, Heat Exchangers, Columns, Tanks other process equipment and Piping to meet the following requirements. a. To maintain process / operating temperature. b. To prevent ingress of heat from external source/atmosphere. c. To avoid surface condensation. 1.1.3 Insulation requirement to maintain process/operating temperature shall be as indicated in documents referred to in 1.1.1. 1.1.4 Insulation for preventing ingress of heat from external source/atmosphere and to avoid surface condensation shall be provided on all equipment and piping operating below 20° C. 1.2.0 Limits of Application. 1.2.1 The following items shall not be insulated unless otherwise specified. a. Bonnets of valves above packing glands b. Nameplates and data plates of equipment.	1.2.2 All attachments and projections such as supports, structures attached to equipment pipe hanger supports, Instrument lead lines, branch lines like vents and drains and instrument connections connected directly to cold insulated equipment and piping shall be cold insulated up to a distance of 5 times the adjoining insulation thickness. 2.0.0 INSULATION MATERIALS 2.1.0 The material of insulation shall be as specified in the documents indicated in 1.1.1 and shall be one of the following. a. Polyurethane foam b. Expanded Polystyrene 2.2.0 Material of insulation shall be non-absorbent with a closed cell structure to ensure non-permeability of moisture / water vapour. 2.3.0 Material of insulation shall be fungus and vermin proof. 2.4.0 Insulation material shall not contain chemicals, which may be harmful to the equipment or piping or to the protective coating at ambient or service temperatures in wet or dry condition. 2.5.0 Insulation material used for austenitic steel equipment and piping shall be free from water-soluble chlorides and other harmful chemicals. 2.6.0 POLYURETHANE FOAM (PUF) 2.6.1 Polyurethane foam (PUF) may be used for insulation of equipment and piping either as preformed sections or cast-in-situ. 2.6.2 Polyurethane foam shall be of rigid preformed cellular urethane foam and self-extinguishable type in accordance with ASTM-C 591, Type II, Gr.2.	
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2.6.3	The foam shall be formulated in such a way that it shall be of self-extinguishing quality which shall not cause fire to spread under any circumstances.			2.7.5	Thermal conductivity of finished EPS shall be as given below:
2.6.4	The finished foam, in the form of sections, slabs or cast-in-situ, shall be of uniform closed cell structure, free from unreacted material, shrinkage and distortion.			Density Thermal conductivity Kcal/m.hr. °C 0°C10°C	
2.6.5	Density of finished foam shall be approximately 45 Kg/m³.			18 0.028 0.031	
2.6.6	Thermal conductivity of the finished polyurethane foam shall not exceed 15 Kcl/hr deg C at 10 deg C mean temperature after ageing.			20 0.027 0.030	
2.6.7	Closed cell content of finished PUF shall be at least 95% by volume.			22 0.026 0.029	
2.6.8	Maximum permeance of finished PUF shall be 4.0 gms/m. 24h.mm Hg.			2.7.6	Maximum permeance of finished EPS shall not be more than 4.0 gms/m. 24 hr.mm.Hg.
2.6.9	Resistance of 10% compression of finished PUF at ambient temperature shall be 1.5 Kg/cm			2.7.7	Finished EPS shall be free from leachable chlorides.
2.7.0	EXPANDED POLYSTYRENE (EPS)			3.0.0	ANCILLARY MATERIALS
2.7.1	Expanded polystyrene (EPS) may be used for insulation of equipment and piping in the form of preformed sections or slabs.			3.1.0	Wire netting; Lacing & Stitching
2.7.2	Expanded polystyrene shall be of self-extinguishing type with closed cell structure in accordance with IS-4671 type 2.			Wire netting of preformed sections and slabs shall be of 24 swg x 20 mm GI. Lacing and stitching wires shall be of 20 swg and 22 swg GI respectively.	
2.7.3	Finished EPS shall be free from shrinkage distortion and unreacted materials.			3.2.0	BANDS
2.7.4	Density of finished EPS shall be given below:			Aluminium bands of size 20mm width x 24 swg shall be used for securing insulation sections and slabs in place.	
		Preformed sections	20 to 22 Kg/m³	3.3.0	METAL CLADDING
		Slabs	18 o 20 Kg/m³	Commercial quality duminium jacketing conforming to IS 737 shall be used for all equipment and piping. Thickness of cladding sheets shall be as indicated in table. 1.	
				3.4.0	SELF TAPING SCREWS
				Self tapping screws to be used for securing the metal cladding shall be 6mm dia cadmium plated or galvanised, and best quality.	
				3.5.0	SEALING COMPOUND

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3.5.1 To ensure perfect water proofing, cladding joints shall be packed with sealing materials, which may either be in the form of bituminous mastic sealing compound or fibre based bituminous felt strips. 3.5.2 Sealing compound shall be suitable to withstand the temperature of insulation to seal the joints. 3.6.0 MASTIC BEDDING Insulating sections and slabs shall be bedded in non-setting mastic to eliminate air pockets. The same mastic shall be used for ensuring vapour tight joints between adjacent sections/slabs. 3.7.0 HARD SETTING PLASTER Hard setting plaster (mixture of sand & cement or asbestos & cement shall be applied over wire netting on piping subjected to foot traffic. 3.8.0 BITUMINISED SELF-FINISHING ROOFING FELT. Bituminised self-finishing roofing felt shall conform to IS 1322 Type 3 Gr. 1. 3.9.0 VAPOR BARRIER 3.9.1 Sealing mastic for the vapour barrier shall be fire retardant mastic, bituminous emulsion mastic or elastomeric polymer mastic. 3.9.2 Instead of sealing mastic, aluminium foil of about 0.025mm (25 microns) thick glued to craft paper using polyethylene glue or aluminium foil (.025mm thick) coated with polyester may also be applied as vapour barrier. 4.0.0 INSULATION THICKNESS 4.1.0 Insulation thickness shall be as specified in the equipment data sheet/piping line schedule/insulation schedule. 4.2.0 For package items, the insulation thickness as per table 2 may be used as	a guidance for selecting the minimum thickness of insulation required. The vendor shall check the same for process adequacy. 5.0.0 APPLICATION 5.1.0 GENERAL 5.1.1 The surfaces to be insulated shall be thoroughly cleaned by wire brushing to remove dirt and loose scale. Equipment and piping which have received primer / painting shall be cleaned well, without disturbing the surface treatment already received. 5.1.2 Unprimed carbon and low alloy steel surfaces shall be thoroughly cleaned by wire brush and one coat (30 microns) of epoxy based zinc phosphate primer shall be applied before starting cold insulation. Sufficient curing time shall be allowed for surface treatment. 5.1.3 Stainless steel and other non-ferrous surfaces shall not be primed. 5.1.4 The equipment drawings indicate the extend of insulation and location of insulation supports. However, the insulation contractor shall recommend, furnish and install any additional supports and anchorage that may be required to adequately support the insulation. Field welding of clips and supports shall be carried out only with the prior approval of the Engineer-in-charge. 5.1.5 All insulating and ancillary materials shall be new and unused and shall be free from contaminating materials, dust and dirt. 5.1.6 All insulation materials shall be stored in covered areas protected from moisture and dust. Insulation materials shall not be stacked directly on ground. Insulation materials showing any evidence of absorption of moisture shall not be used.	
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5.1.7	Insulation work shall be carried out only after hydrostatic testing of equipment / piping have been completed.	over the glass fibre mesh to obtain a thickness of 2.5 mm when dry.
5.1.8	Insulation of flange joints shall be come only after they have been proved to be leak tight.	5.3.4 Alternative type of vapour barrier as described in 3.9.2 may be applied instead of that given in 5.3.3, in which case all joints shall be completely sealed and shall leave an overlap of at least 100 mm. Sealing of joints shall be done by using airtight and waterproof adhesive tape.
5.2.0	MULTILAYER INSULATION	5.4.0 WIRE NETTING & BANDING
5.2.1	When thickness of insulation exceeds 60mm, the insulation may be applied with multi layers, with all joints staggered. Each layer of insulation shall be secured by metallic banding.	5.4.1 Aluminium bands as specified in 3.2.0 shall be fixed over insulation blocks at an interval of 300 mm.
5.2.2	All cracks and voids in the insulation shall be completely sealed by using the mastic bedding indicated in 3.6.0.	5.4.2 Before application of vapour barrier, the insulation sections and slabs shall be completely covered by wire netting, laced and stitched by using wire nets, lacing and stitching wire specified in 3.1.0. The bands shall be sufficiently tightened to keep the insulation sections/slabs firmly in place without deforming the insulation.
5.2.3	No. of layers to be employed shall determined as given below: Insulation thickness No. of layers Up to 60 mm	

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water. Joints shall be offset between pieces. 5.6.4 Cladding shall be secured to aluminium bands of size 20 x 3 mm. Which are provided at a gap or 450 mm along the circumference. 5.6.5 All joints in the cladding shall sealed water tight by using seating compound or tapes as described in 3.5.0. 5.6.6 Jacketing for dished heads shall be fabricated radial segments with an overlap of 50mm. The sheeting shall be secured in position by radial tensioned metallic bands stretched over the heads. One end of each band is anchored to the circumferential band with shell, while the other is fastened to a floating ring fabricated in the form of a ring. The sheet metal bands may be held in place by using pop rivets. 5.7.0 FLASHING 5.7.1 Openings in metal jackets for nozzles, manholes, brackets shall be cut as close as possible for a snug fit. 5.7.2 All openings through insulation finish shall be flashed weather tight by an approved sealant particularly where connections are not insulated. 5.7.3 Skirt supported vessels shall have the skirt insulated inside and outside for at least 600 mm below the tangent line. 5.7.4 Unless otherwise specified no insulation shall be applied to the inside of the skirt, which are externally, fire proofed. 5.7.5 For leg-supported vessels, insulation shall be provided to a length of at least 5 times the insulation thickness minimum. 5.8.0 VERTICAL VESSELS 5.8.1 Cylindrical Shell 1. Slabs/sections in handy sizes shall be applied resting on to the supports with joints tightly butted, staggered and	adhering to each other with specified adhesives. 2. The slabs/sections are to be secured in position by circumferential metallic bands at an interval of 300mm. When multi layer insulation is applied each layer shall be banded separately. 5.8.2 Top Heads 1. Insulating material shall be properly shaped and tightly pressed on the top head. 2. The insulation shall be held in position by using metallic bands one end of which shall be fastened to the floating ring and the other end shall be anchored to the circumferential band laced on shell near the head. 3. Radial bands shall be spaced at 300 mm gap measured along the circumference of the vessel. 4. The final layer of insulation shall be held in position by metallic wire net laced at the top vortex nozzle by about two to three loop of 10 swg galvanised iron wire and the wire net over the insulation of the shell close to the head. 5. When there are no top vertex nozzles, the insulation shall be held in position by wire netting and metallic bands stretched over the head and anchored on the cylindrical section close to the head by circumferential metallic band on the shell near the head. 5.8.3 Bottom Heads 1. Preformed and shaped insulation sections shall be used for insulating the bottom head. 2. Preformed and shaped insulation sections shall be held in place in the same manner as for top heads. 3. While one end of the metallic bands shall be fastened to floating ring if a bottom vortex nozzle is present, the other end shall be anchored to the	
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insulation support ring provided inside the skirt support. 4. Radial bands shall be spaced at 300mm pitch measured along the circumference. 5. In case of absence of a bottom vortex nozzle, the metallic bands shall be stretched across the bottom head and anchored at the ring inside the skirt. 5.9.0 HORIZONTAL VESSELS 5.9.1 Insulation of horizontal vessels shall be carried out by using preformed and shaped insulation blocks/sections. 5.9.2 Insulation material shall be held in place by using metallic bands a spacing of 300 mm. 5.9.3 Final layer of insulation shall be provided with netting, laced and stitched. 5.9.4 Each layer of insulation shall be banded separately and bands of successive layers shall be staggered. 5.9.5 Insulation blocks/sections shall be held in position by metallic bands at radial pitch of 300mm on the heads and anchored to the circumferential metallic bands on shell near the head. 5.10.0 HEAT EXCHANGERS 5.10.1 Insulation of vertical heat exchangers shall be carried out in the same manner as in 6.0.0. 5.10.2 Insulation of horizontal heat exchangers shall be carried in the same manner as in 7.0.0. 5.10.3 Exchanger channels and channel covers including bolting flanges shall be insulated with removable aluminium covers lined with insulation sections/blocks of specified thickness. 5.11.0 SPHERICAL VESSEL 5.11.1 Shaped insulation block shall be used for spherical vessels. 5.11.2 All joints shall be sealed well by approved joint sealant.		5.11.3 Inner layers of insulation shall be held separately in place by metallic bands at 300 mm pitch at equator. 5.11.4 The bands shall be tied up with floating rings of 20mm O/D made of 15 SS rod at the poles of the sphere. 5.11.5 The bands on the successive layers shall be staggered and the clip ends are to be bent and recessed in to the insulation. 5.11.6 Outer layer of insulation shall be secured in place by wire netting, laced and stitched together. 5.12.0 STORAGE TANKS 5.12.1 Insulation of storage tank shell shall be carried out in the same manner as described in 6.0 5.12.2 Where tank fabricator has provided support rings and vertical flats on the tank shell, the insulation contractor shall provide additional rings at a pitch of 900 mm. These additional rings shall be tack welded only to the support rings and vertical flats. No welding shall be permitted on the tank surface. 5.12.3 Metal cladding of tank shell shall be with 22 swg corrugated aluminium sheet. All points shall be staggered by 300mm and shall be sealed water proof with approved sealing material. 5.12.4 Tank Roof 1. Tank roof shall be thoroughly cleaned of all dirt and rust and other contaminants. 2. Preformed insulation sections/slabs shall be laid over one coat of adhesive mastic and pressed well. All joints shall be sealed with adhesive mastic to make it airtight. 3. When multi layer insulation is applied of successive layers shall be staggered and sealed with adhesive mastic. 4. Each lay of insulation shall be secured with bands and wire netting laced and stitched as detailed in 5.8.2.	
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5. Vapour barrier shall be applied as specified in 5.3.0. 6. Fix a shed water shroud constructed from 20 swg GI plain sheets at the periphery of the tank. 7. Apply a 20mm thk hard setting non-conductive plaster made from asbestos fluff and Portland cement troweled to a smooth and even finish. 8. When hard setting plaster is completely dry apply a standard 4 course bitumen felt as per IS 1346. Aluminium cladding shall be applied over this. 6.0.0 PIPING INSULATION 6.1.0 GENERAL 6.1.1 External surfaces of pipes shall be cleaned well with wire brush (CS brush for CS pipes and SS brush for SS pipes) to remove all dirt rust and contaminating material and wiped well. 6.1.2 If painting is provided for specific reasons the insulation contractor shall not carry out any harsh cleaning and shall ensure that painting is undisturbed. 6.1.3 All pipes and supports shall be permanently set before commencement of insulation. Disturbed pipes and supports shall be restored to their original location and alignment when insulation is complete. 6.1.4 All insulation shall be applied when piping is at ambient temperature. 6.1.5 Spacer rings for supporting metal cladding shall be installed by the contractor. 6.1.6 Insulation in the form of preformed pipe sections shall be applied over the pipe without spacer rings. On top of each layer wire netting shall be applied and tightly butted against each other so that the wires interlock both longitudinally and circumferentially. The wire net joints shall be stitched with 20 swg soft galvanised iron wire.	6.1.7 At un-insulated flanges, insulation shall be terminated at suitable distance from the flange so that the flange bolts can be withdrawn without disturbing the insulation. 6.1.8 In case of vertical piping, insulation supports shall be installed by the insulation contractor. These shall consist of spacer rings at 4 metres intervals clamped to the pipes. 6.1.9 Insulation of piping shall be complete with mastic bedding, sealing compound, vapour barrier, filling of voids and metal cladding as described earlier in the specification. 6.1.10 Insulation of flanges and valves shall be provided only when specifically mentioned in the line schedule/work order. When specified, removable covers shall be provided over all flanges and valves. The insulation shall be preformed, filled in aluminium sheet boxes, and fitted with quick release clips. 6.2.0 INSULATION OF PIPING FOR FOOT TRAFFIC 6.2.1 After application of insulation including vapour barrier the insulation sections are to be held together with GI wire netting and joints laced with GI wire. 6.2.2 Wire netting shall be held together with 20mm wired hoop iron bands at 300mm spacing. 6.2.3 Apply hard setting plaster as per 3.7.0 of 20mm thick-troweled smooth. 6.2.4 After the hard setting plaster has dried wrap bituminised self-finishing roofing felt over the plaster with an overlap of 50mm both longitudinally and circumferentially. 6.2.5 The roofing felt shall be secured with 24 swg x 20mm GI wire netting and all joints are to be laced with 20 swg GI wire.	
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6.2.6	Apply 3mm thick bituminous emulsion mastic compound for water and weather proofing.	item to be insulated for the approval of Engineer-in-charge.
6.2.7	When bitumen emulsion has completely dried the surfaces shall be painted with bitumen based aluminium paint.	
6.3.0	PIPING INSPECTION WINDOWS	
6.3.1	Plug type inspection windows shall be provided on all insulated pipelines having size 50 mm and above.	
6.3.2	The size of the inspection windows shall be as indicated below:	
	Pipe dia (mm) Window dia (mm)	
	50 35	
	80 45	
	100 75	
	150 and above 100	
6.3.3	Inspection windows shall be provided at the bottom of the pipelines.	
6.3.4	There must be at least one inspection window within a span of 10m.	
6.3.5	At least 50% of the bends shall be provided with inspection windows.	
6.3.6	In case of critical pipelines, more number of inspection windows may be provided at the discretion of the Engineer-in-charge.	
6.3.7	Sheet metal covering of inspection windows shall be of the same gauge as that of insulation cladding. These covers are to be fixed on with 6 mm self-tapping screws.	
6.3.8	The plug shall be of perfect fit into the inspection window and shall ensure leak tightness.	
7.0.0	MACHINERY ITEMS	
	in general PUF/EPS filled removable prefabricated sheet metal boxes shall be adopted for insulation of machinery items. The contractor shall submit insulation details of individual items of equipment depending on the nature of	
		8.0.0 INSTRUMENTATION & MISCELLANEOUS ITEMS
		8.1.0 Drain and vent piping up to the first valve on insulated equipment shall be insulated with similar type of insulation and finish as the equipment to which it is attached.
		8.2.0 Headers, branch lines sample connections and pipelines to instruments shall be insulated with similar type of insulation and finish as the connected piping.
		8.3.0 The thickness and type of insulation for all lines mentioned before shall be determined from piping like schedule for corresponding temperature and pipe sizes. Thickness of insulation for the parts not mentioned shall be as specified by Engineer-in-charge.
		9.0.0 INSULATION CAST-IN-SITU
		9.1.0 Large vessels and equipment may be insulated using polyurethane foam, foamed in situ.
		9.2.0 Before commencement of foaming-in-situ, the contractor shall demonstrate the foaming procedure to the approval of Engineer-in-charge to check for the presence of voids after formation.
		9.3.0 3 samples of PUF per shift shall be foamed in transparent polyethylene bags in presence Engineer-in-charge. Insulation work shall commence only after the approval of samples by the Engineer-in-charge.
		9.4.0 Both the surface of equipment to be insulated and the cladding shall be free of rust, dirt and other contaminating matters.
		9.5.0 The sheet metal cladding shall be adequately strapped and braced to withstand pressures developed during foaming, without distortion or failure. All joints of cladding shall be made leak

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proof by using impermeable mastic sealing compound. 9.6.0 Air escape holes provided in the cladding shall be sealed well after foaming. 9.7.0 The annular space between the equipment and the cladding shall not be less than the thickness of insulation specified and shall be maintained uniform throughout by use of performed Polyurethane spacers, which will remain embedded in foam. 10.0.0 SAFETY The insulation contractor shall provide adequate protective appliances, like gloves, masks, glasses and clothing to workmen carrying out the insulation work for protection against any hazardous / toxic chemicals and gases. Sufficient for protection methods / gadgets shall also be deployed at the place of insulation. 11.0.0 GUARANTEE 11.1.0 The insulation contractor shall furnish authentic test certificates to confirm that all materials offered conform to the requirements of this specification and standards mentioned therein. 11.2.0 All insulation works shall be guaranteed against defective materials and bad workmanship for the period specified in enquiry / order. 12.0.0 APPLICATION DETAILS Refer the following details attached to this specification for application of insulation of various parts.	Table 1 Thickness of Aluminium cladding sheets Table 2 Thickness for Cold Insulation Fig.1 Insulation of Vertical Vessels Fig.2 Insulation of Exchanger Shell & Head Fig.3 Expansion joint for Rigid Insulation Fig.4 Support for Vertical Insulated Piping Fig.5 Welded Elbow Insulation Fig.6 Tee Insulation Fig.7 Bottom Head Insulation for Vertical Vessels Fig.8 Flange Insulation Fig.9 Valve Insulation Fig.10 Flashing at Nozzles & Other Projections. Fig.11 Uninsulated Flange Fig.12 Tank shell insulation-Details Fig.13 Support detail for metal covering of insulation. Fig.14 Man hole Insulation Fig.15 Details of Corrugated sheet overlapping Fig.16 Details of Tank Roof Insulation supports. Fig.17 Details of Tank Top setting Plaster Finish Fig.18 Single layer Insulation for Piping Fig.19 Multiple layer Insulation for Piping.	

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TABLE 1 – THICKNESS OF ALUMINIUM CLADDING SHEETS

Item	Size (mm) Or Dia	Type of aluminium sheeting	
		Vertical	Other portions
Equipment	< / = 350 NB	24 SWG plain	24 SWG plain
	>350 NB	22 SWG Corrugated	24SWG plain
	Tanks	22 SWG Corrugated	22 SWG plain for roof and 24SWG plain for other parts
Piping	< / = 350 NB	24 SWG plain	22 SWG plain
	> 350 NB	24 SWG plain	24 SWG plain
	Valves, flanges etc.	24 SWG plain	22 SWG plain

TABLE 2 – THICKNESS OF COLD INSULATION

Nom: Dia < / =	Insulation Thickness (mm) for Temperature Deg.C						
	-40	-30	-20	-10	0	10	20
20	60	60	60	50	50	40	40
65	70	70	70	60	60	50	50
80	80	80	80	70	70	50	50
150	90	90	90	80	80	50	50
400	100	100	100	80	80	50	50
500	110	110	110	80	80	50	50
900	120	120	120	80	80	50	50
Above 900	130	130	130	80	80	50	50

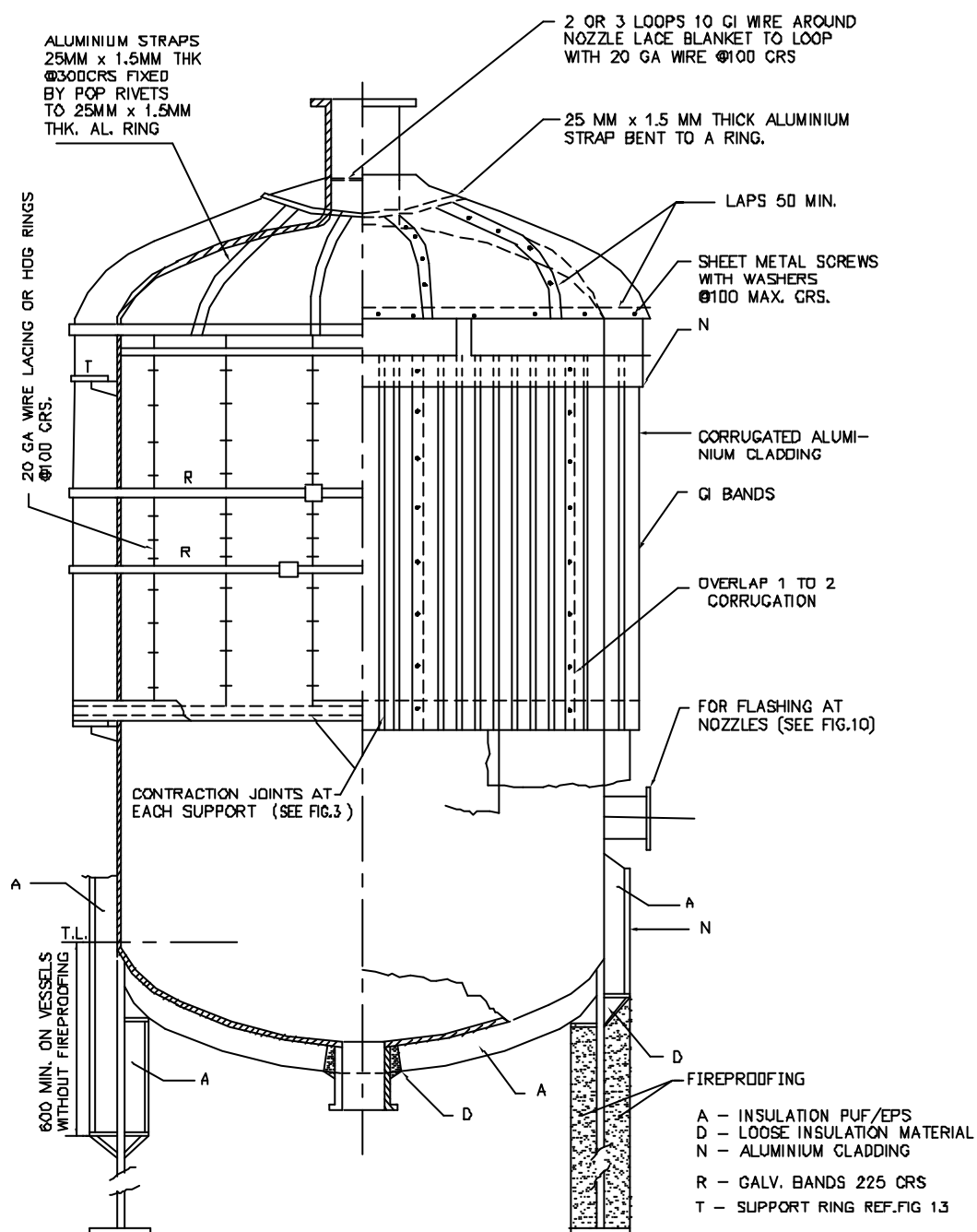


FIG. 1- INSULATION OF VERTICAL VESSELS

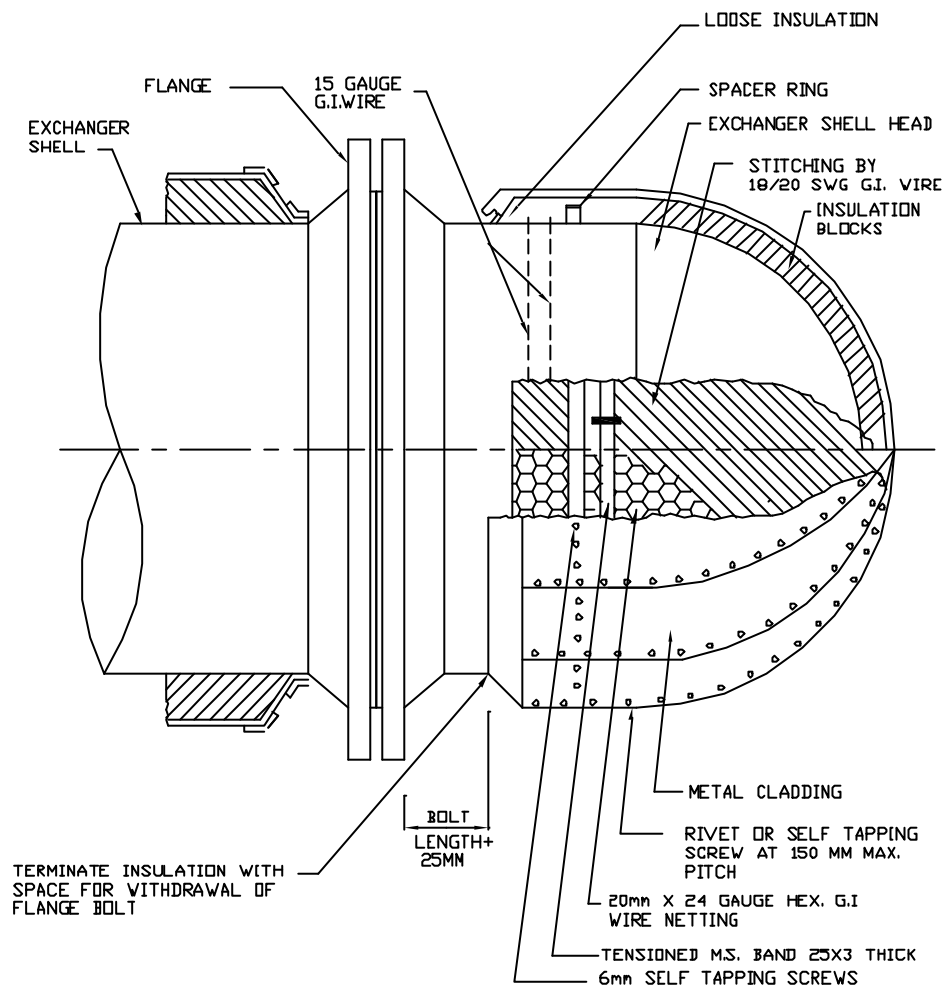


FIG.1 INSULATION OF VERTICAL VESSELS

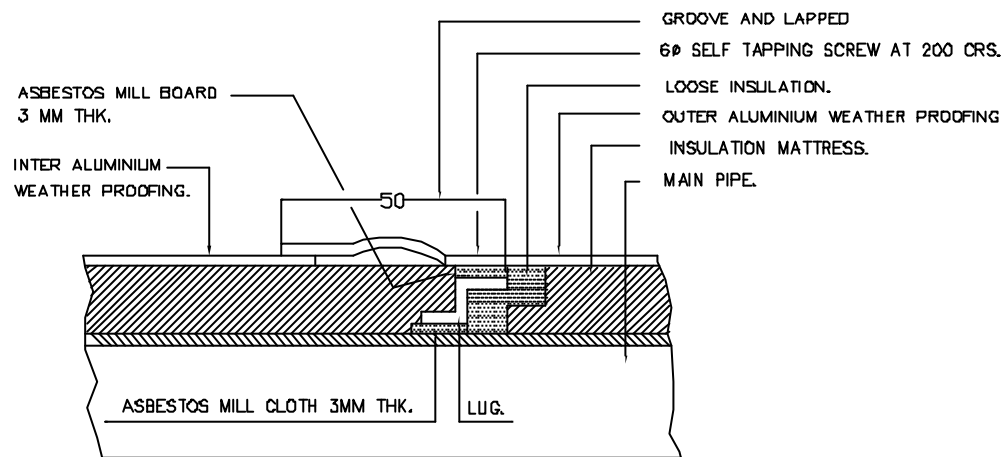


FIG.3 — EXPANSION JOINT FOR RIGID INSULATION.

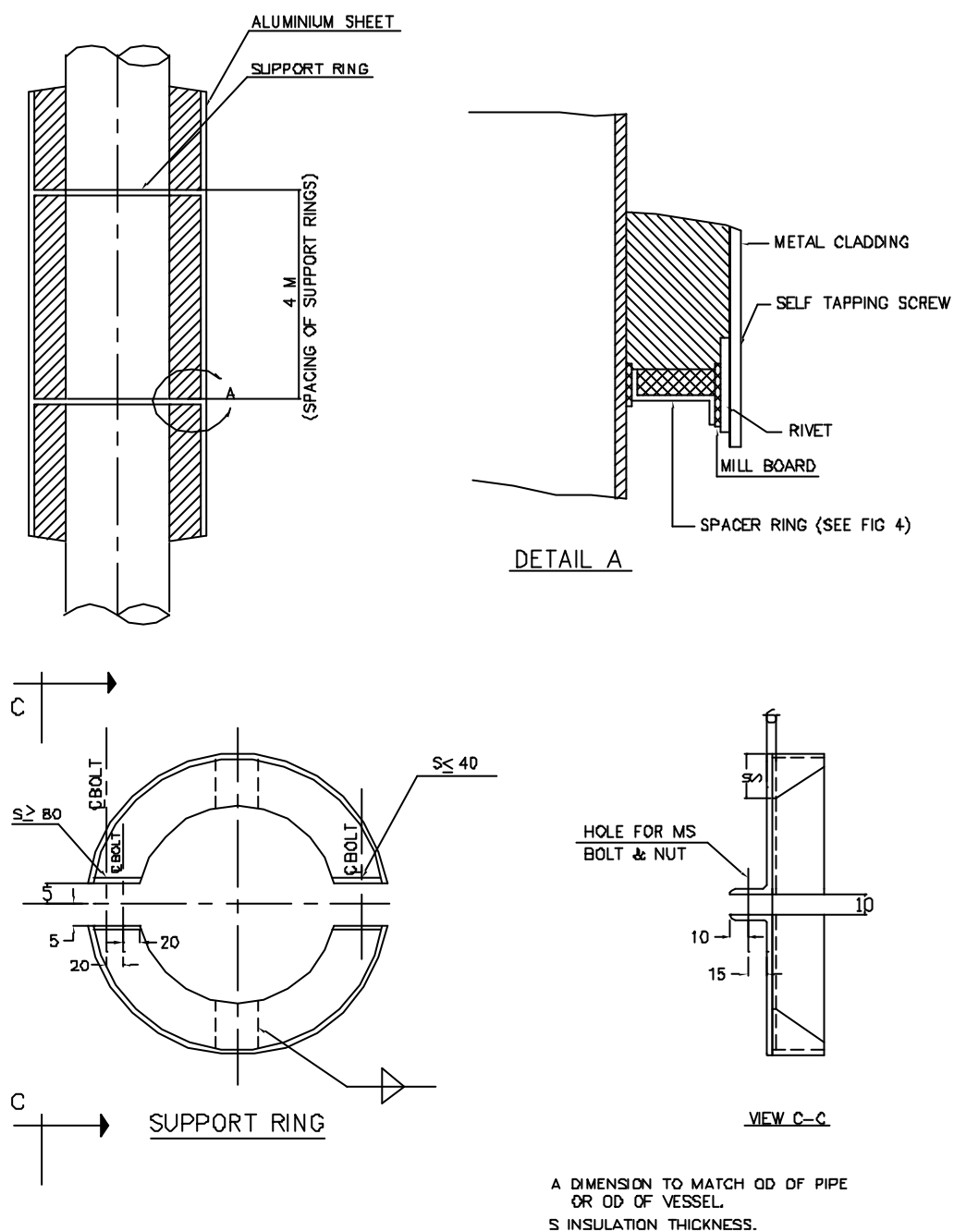


FIG.4 - SUPPORT FOR VERTICAL INSULATED PIPING

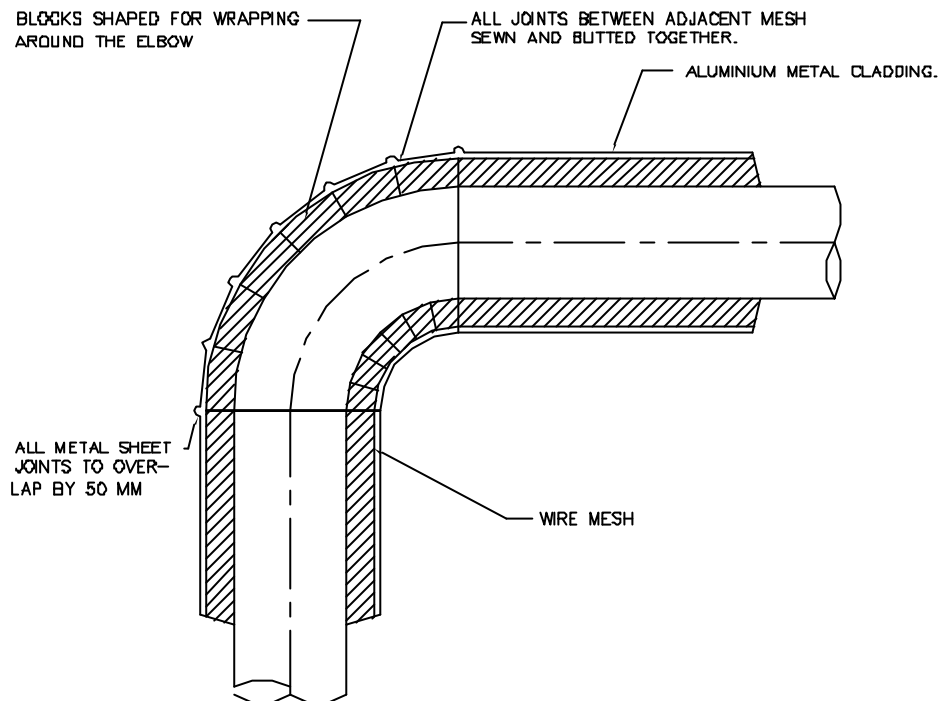


FIG 5 WELDED ELBOW INSULATION

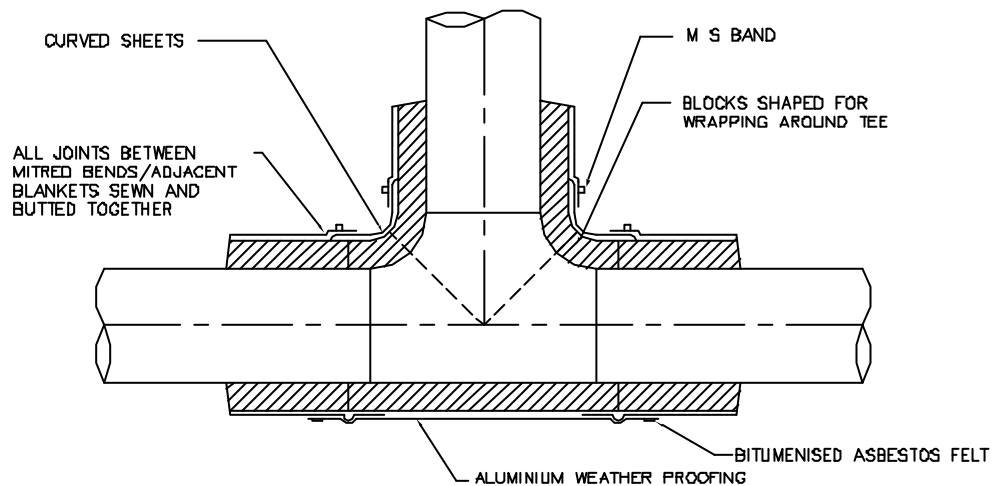


FIG 6 – TEE INSULATION

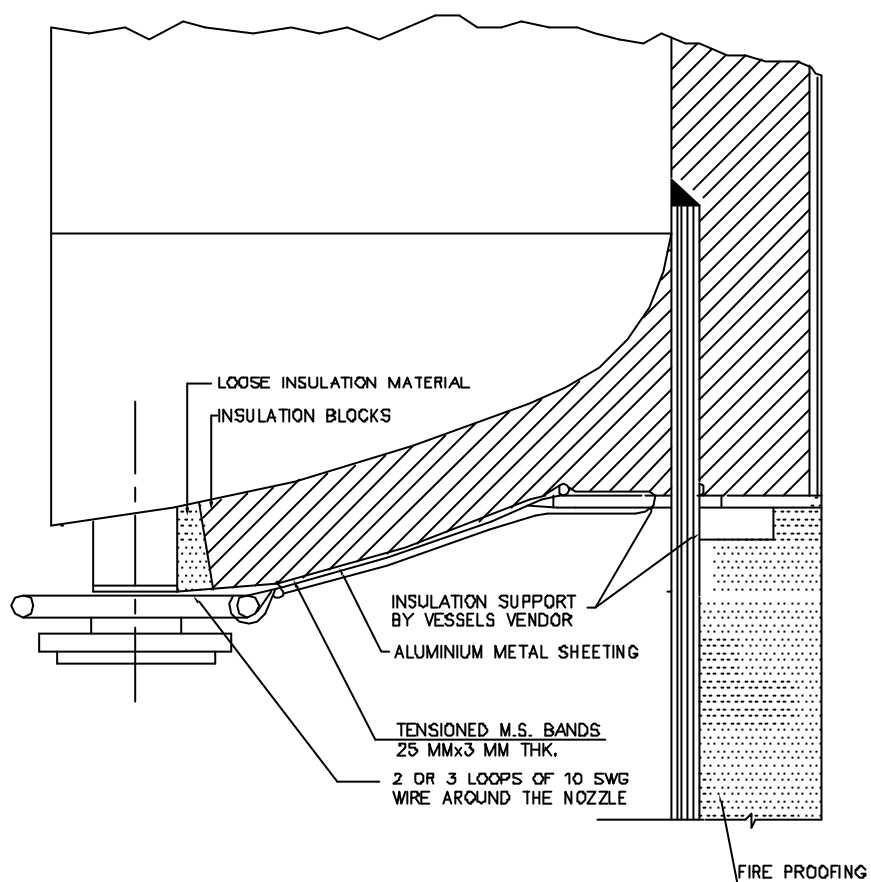


FIG. 7 – BOTTOM HEAD INSULATION FOR VERTICAL VESSELS

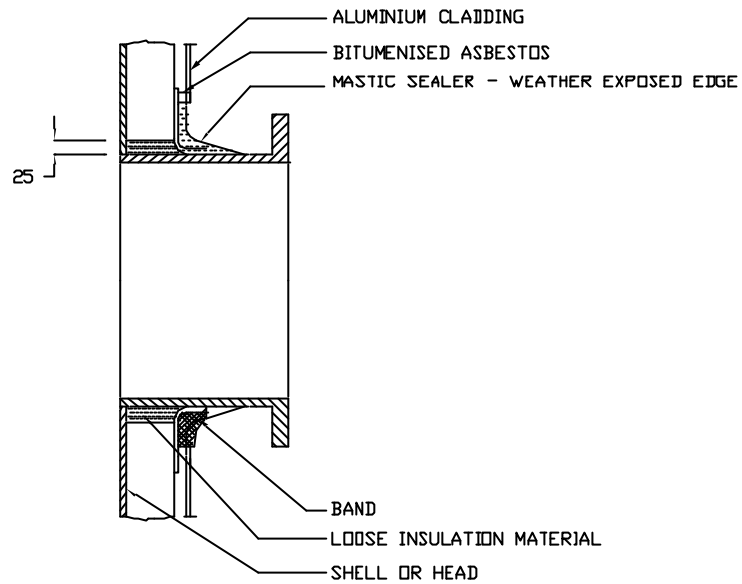


FIG. 10

FLASHING AT NOZZLES & OTHER PROJECTIONS

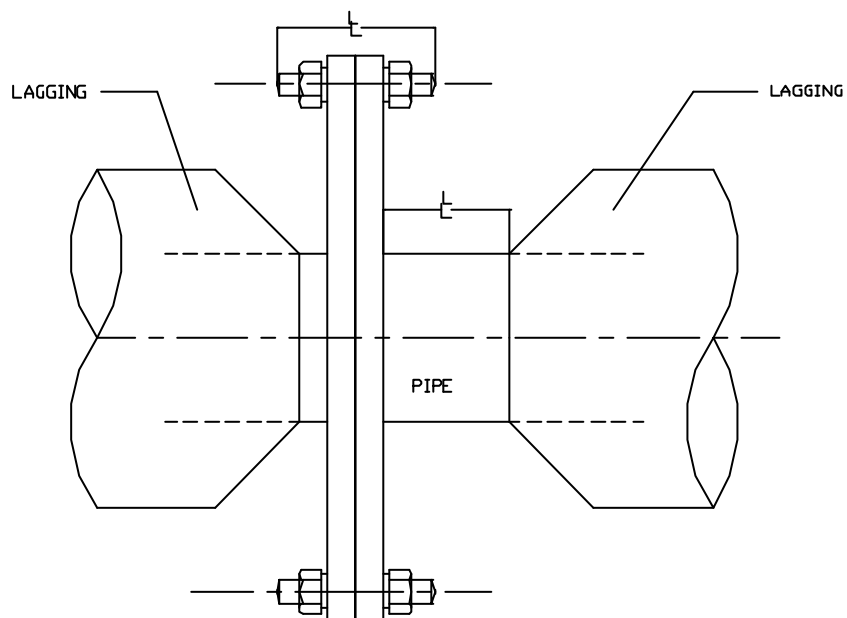


FIG. 11 UNINSULATED FLANGE

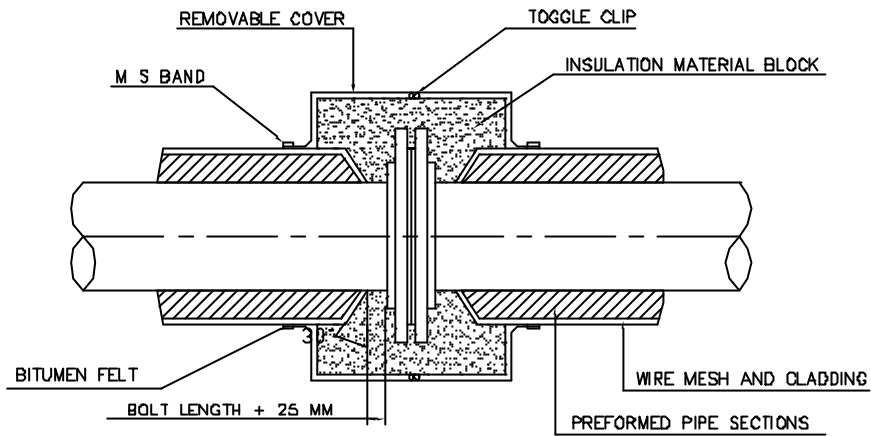


FIG 8 - FLANGE INSULATION

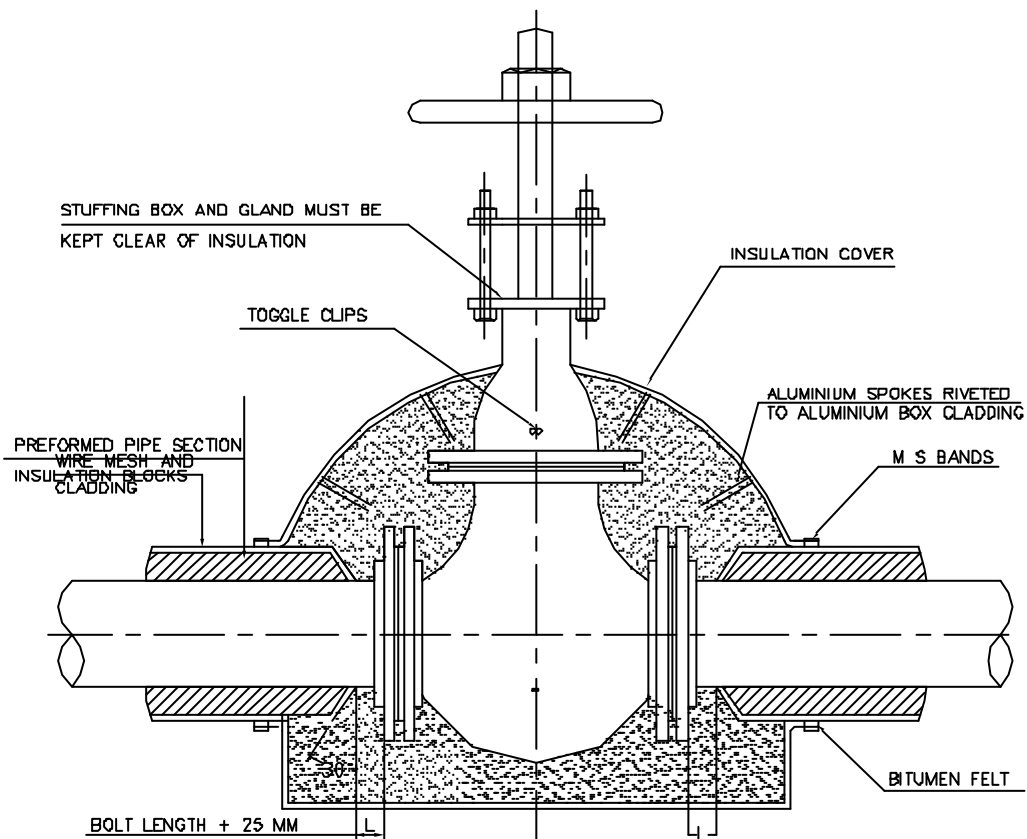


FIG 9 - VALVE INSULATION

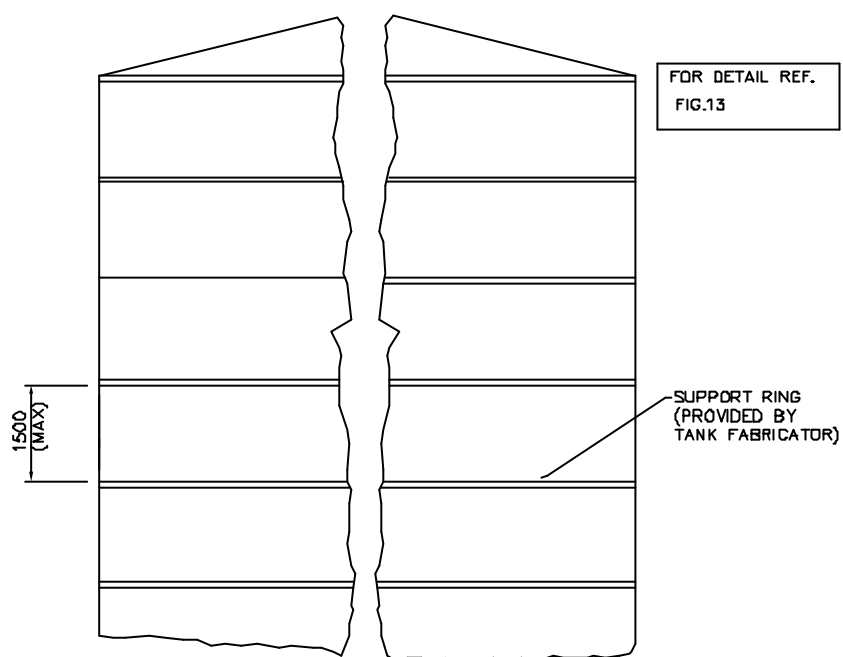


FIG. 12 – TANK SHELL INSULATION – DETAILS

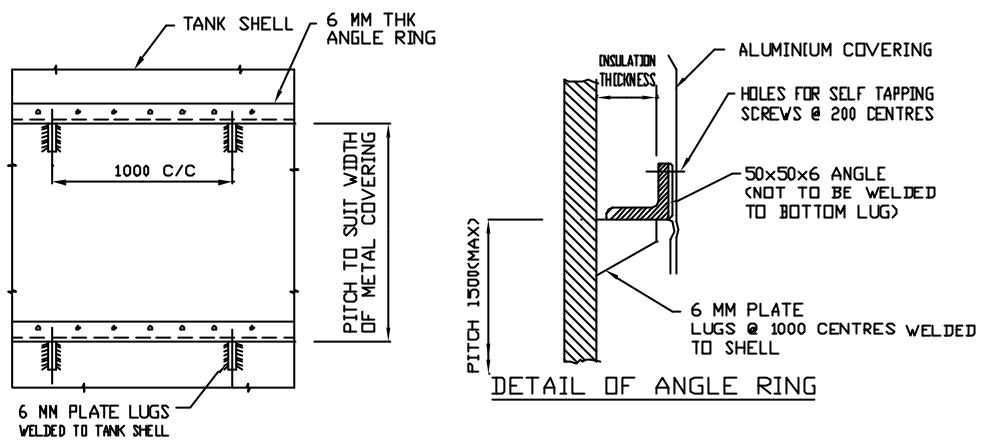


FIG.13 — SUPPORT DETAIL FOR METAL COVERING OF INSULATION

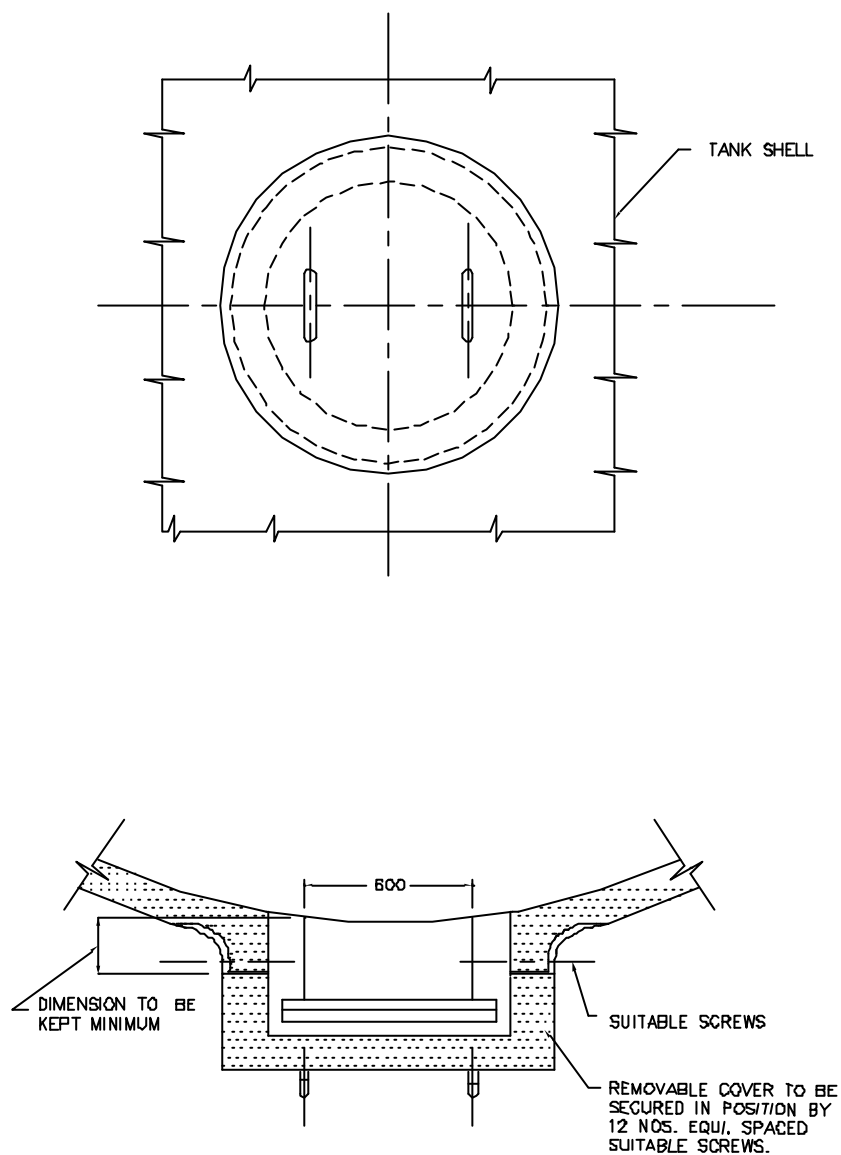


FIG. 14 - MANHOLE INSULATION

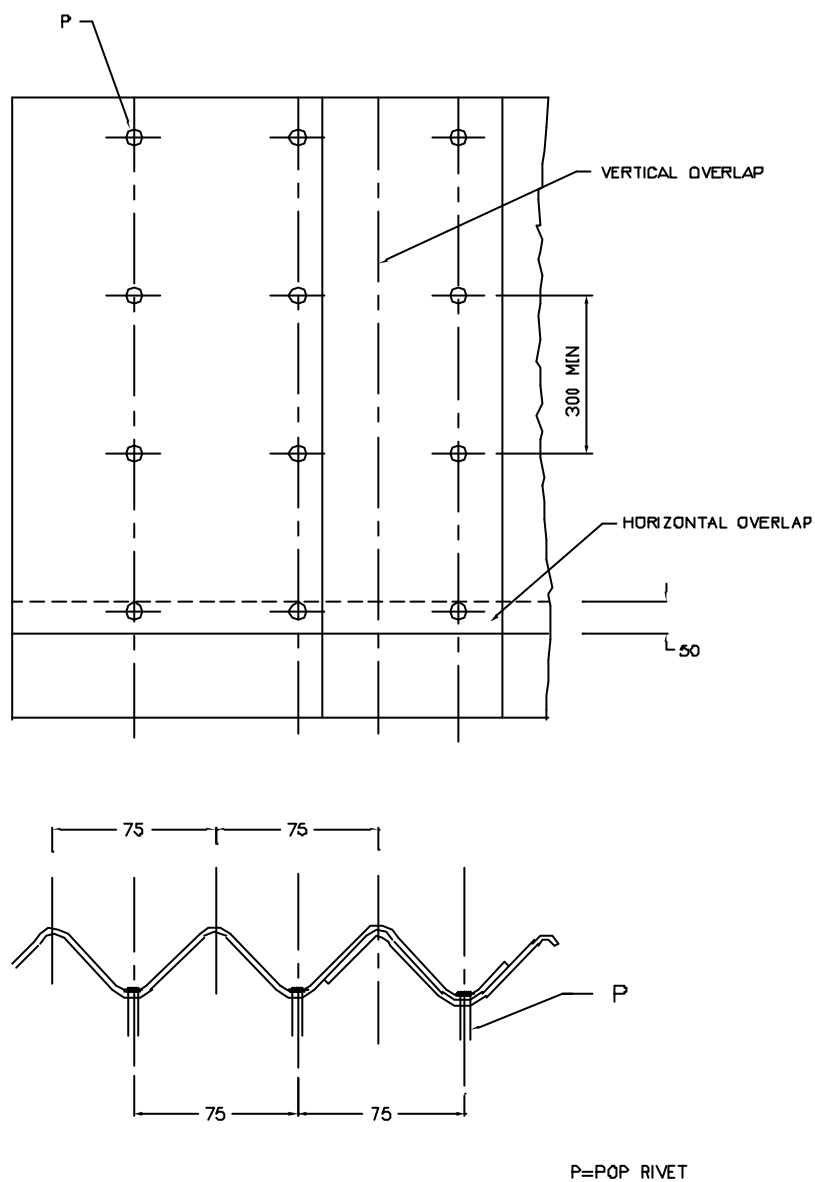


FIG. 15 – DETAILS OF CORRUGATED SHEET OVERLAPPING

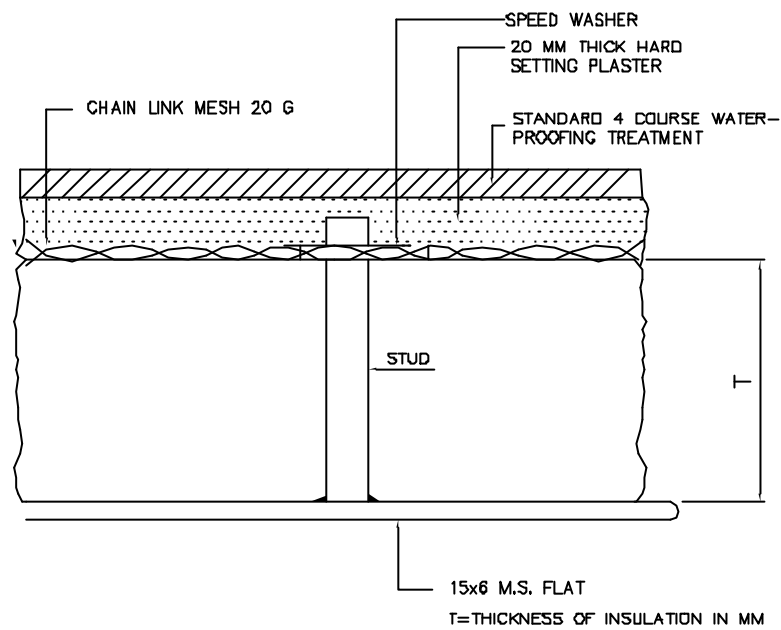


FIG. 17 – DETAILS OF TANK TOP SETTING PLASTER FINISH

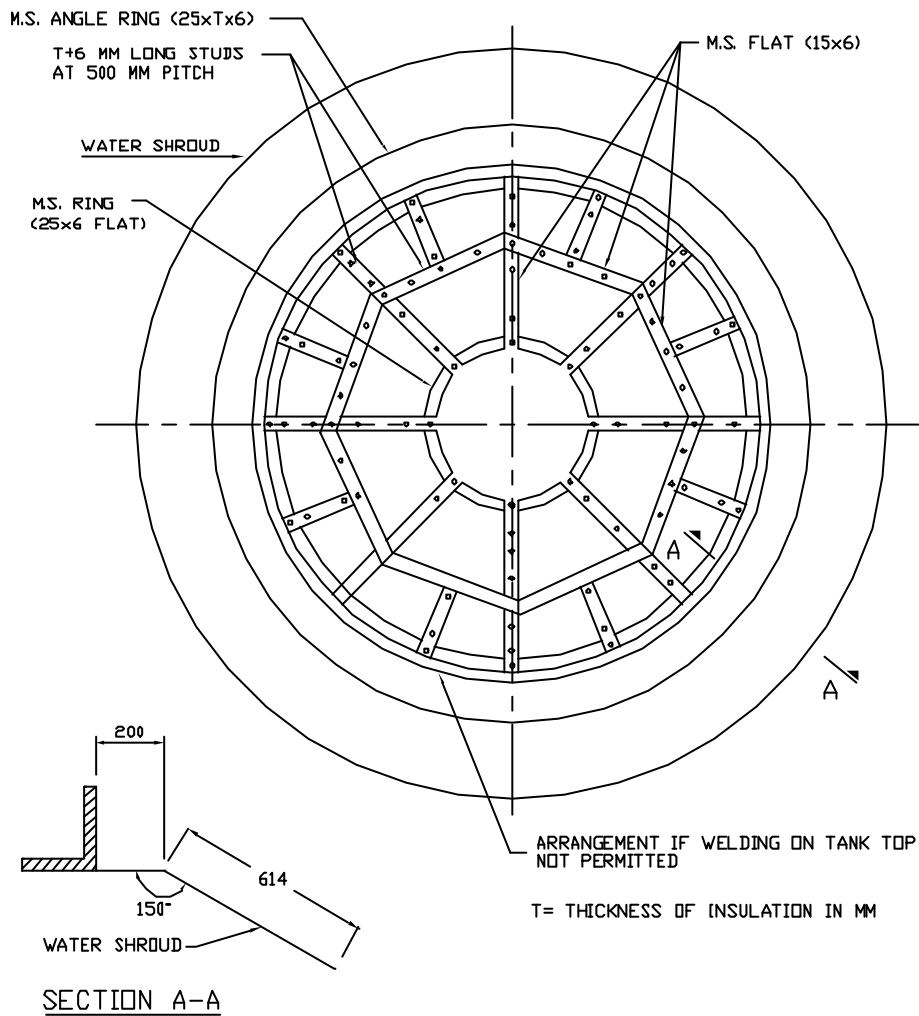


FIG.16 - DETAILS OF TANK ROOF INSULATION SUPPORTS

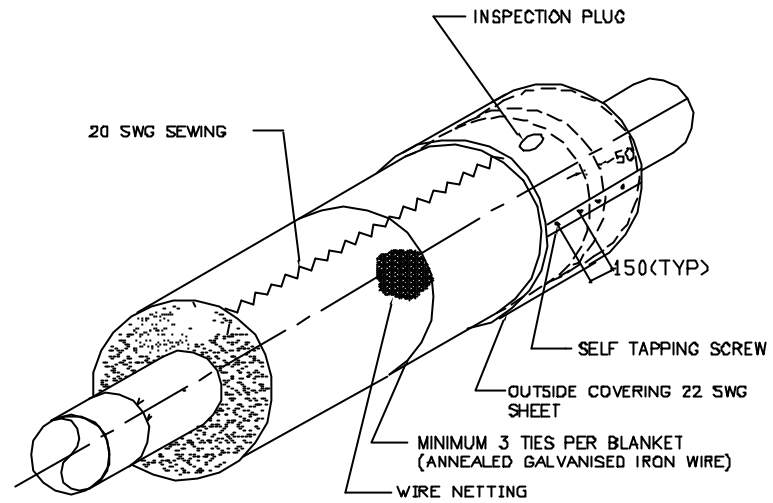


FIG.18 - SINGLE LAYER INSULATION FOR PIPING

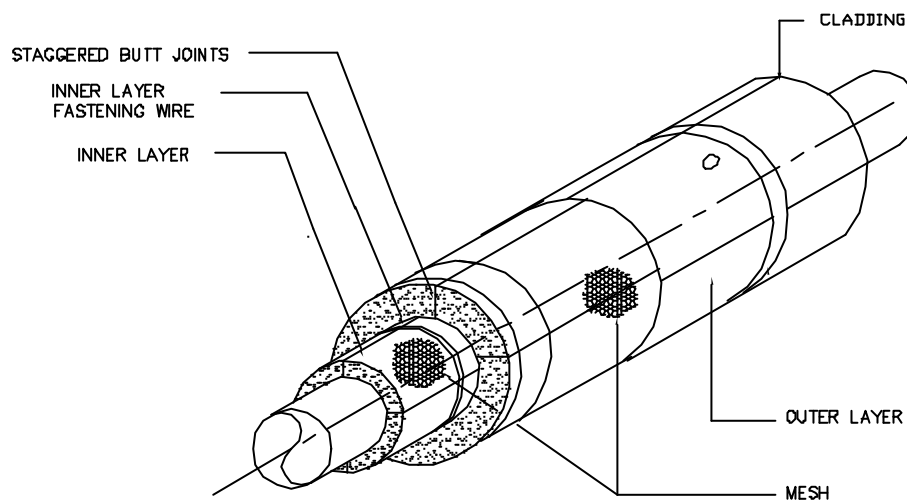
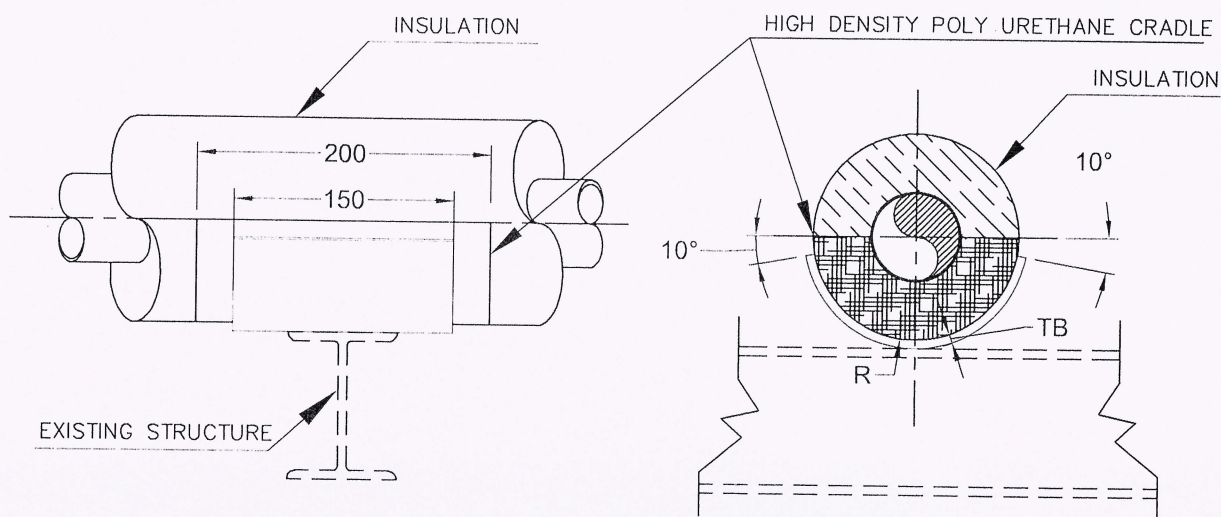


FIG.19 - MULTIPLE LAYER INSULATION FOR PIPING

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NOMINAL PIPE SIZES (NB)	BEARING PLATE THICKNESS 'TB' MM
15 TO 80	6
100 TO 150	8

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. FOR GENERAL NOTES SEE DRG. NO. SP 6600.
3. DIM. R EQUALS PIPE OD/2 + INSULATION THICKNESS

SCALE: NTS						TITLE SUPPORTS FOR COLD INSULATED PIPE 15NB TO 150NB	DOC NO. SP 6610-S	SHEET OF 1	REV. 0
	NO.	DESCRIPTION	DRAWN	CHKD	APPRD.	DATE			

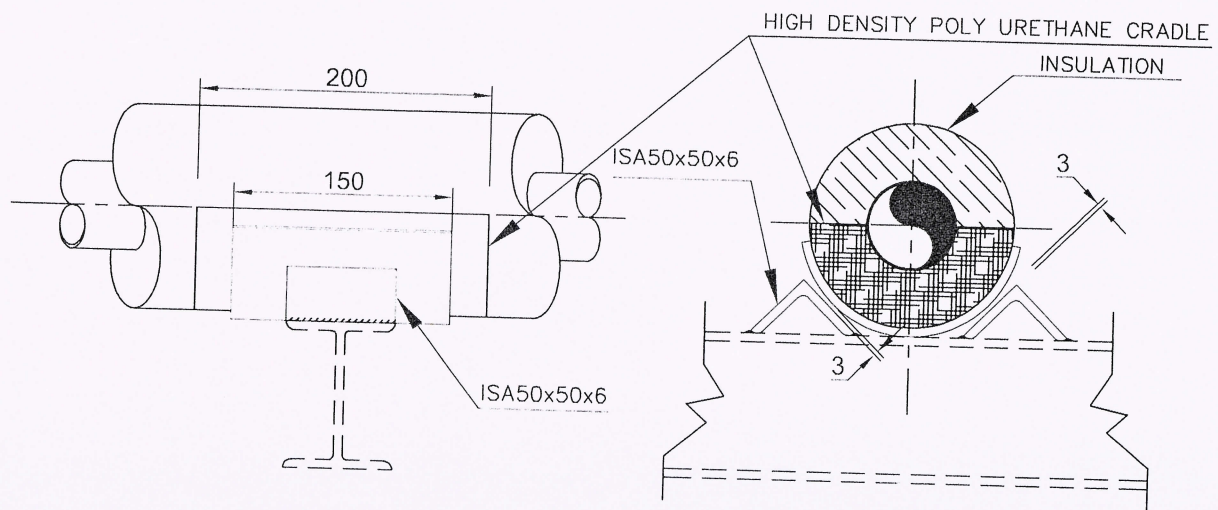
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KERALA



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NOMINAL PIPE SIZES (NB)	BEARING PLATE THICKNESS 'TB' MM
15 TO 80	6
100 TO 150	8

NOTE:

1. ALL DIMENSIONS ARE IN MM
2. FOR GENERAL NOTES SEE DRG. NO. SP 6600.
3. DIM. R EQUALS PIPE OD/2 + INSULATION THICKNESS

SCALE: NTS

NO.	DESCRIPTION	DRAWN	CHKD	APPRD.	DATE

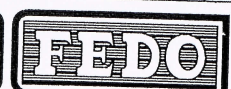
TITLE
SUPPORTS FOR COLD INSULATED PIPE
15NB TO 150NB

DOC NO. SP 6610-G

SHEET	REV.
1 OF 1	0

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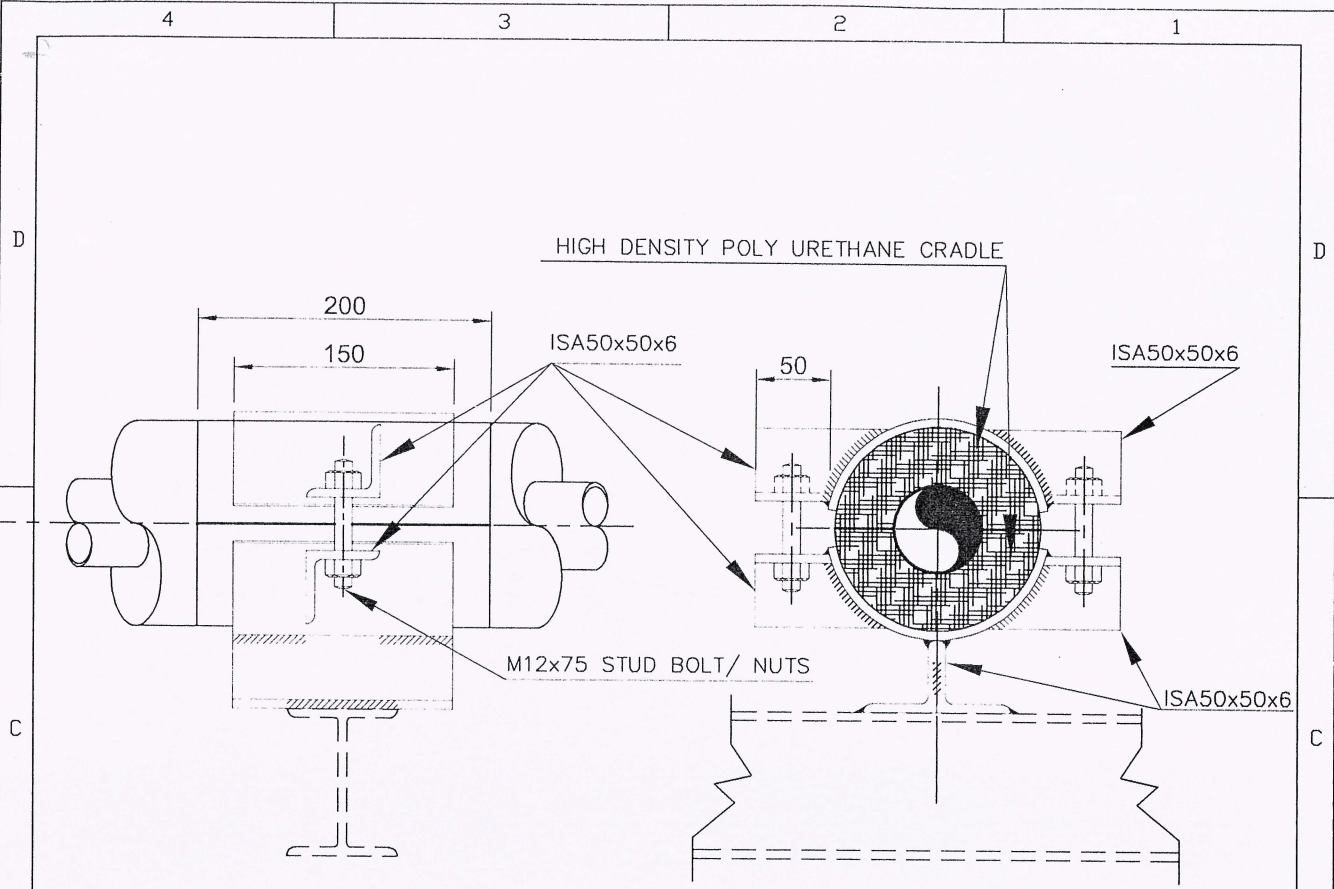
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NOMINAL PIPE SIZES (NB)	BEARING PLATE THICKNESS 'TB' MM
15 TO 80	6
100 TO 150	8

- NOTE:
1. ALL DIMENSIONS ARE IN MM
 2. FOR GENERAL NOTES SEE DRG. NO. SP 6600.
 3. DIM. R EQUALS PIPE OD/2 + INSULATION THICKNESS

SCALE: NTS						TITLE			
						SUPPORTS FOR COLD INSULATED PIPE			
						15NB TO 150NB			
						DOC NO. SP 6610-A		SHEET	REV
	NO.	DESCRIPTION	DRAWN	CHKD	APPRD.	DATE	1 OF 1		0

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MATERIAL SAFETY DATA SHEET - AMMONIA

1. CHEMICAL IDENTITY

Chemical Name : AMMONIA		Chemical Classification : Inorganic Compound	
Synonyms	: Liquid Ammonia, Ammonia Gas, Ammonia Anhydrous.	Trade Name	: Ammonia
Formula	: NH ₃	C.A.S.NO	: 7664-41-7
UN NO.	: 1005		
Regulated Identification			
Shipping Name	: Ammonia		
Codes/Label	: Non Flammable Gas, Class 2		
Hazardous waste I.D. No	: 17		
Hazchem Code	: 2 PE		
HAZARDOUS INGREDIENTS		C.A.S.NO.	
1. Ammonia		: 7664-41-7	

2. PHYSICAL AND CHEMICAL DATA

Boiling Point/Range	: -33.4°C	Physical State	: Liquefied Compr.Gas
Appearance	: Colourless	Odour	: Strong Pungent Odour
Vapour pressure @ 35°C	: 7600 mm Hg	Melting / Freezing Point	: -77.77°C / 25.7°C
Solubility in water @ 30°C	: Very soluble	Vapour Density(Air = 1)	: 0.60
Others	: Moderately soluble in Alcohol		
Specific Gravity @ 0°C (Water = 1)	: 0.771	pH	: 1 N aq. Sol. 11.6

3. FIRE AND EXPLOSION HAZARD DATA

Flammability	: No	LEL	: 16.0 %	Flash Point °C	: Not Pertinent (OC)
TDG Flammability	: NA	UEL	: 25.0 %	Flash Point °C	: Not Pertinent (CC)
Auto ignition Temperature °C	: 651.0				
Explosion Sensitivity to Impact	: Stable				
Explosion Sensitivity to Static Electricity	: Not available				

MATERIAL SAFETY DATA SHEET - AMMONIA

Hazardous Combustion products			:	Emits toxic fumes of NH ₃ & NO _x				
Hazardous Polymerization			:	Does not occur.				
Combustible Liquid : Yes		Explosive Material :		No		Corrosive Material :	No	
Flammable Material : No		Oxidiser		:	No		Others	
Pyrophoric Material : No		Organic Peroxide		:	No			

4. REACTIVITY DATA

Chemical Stability	Stable
Incompatibility with Other material	Strong Oxidisers, Calcium hypochlorite, Gold, Mercury, Silver, Halogens, Acetaldehyde, Acrolein.
Reactivity	Reacts with Silver chloride, Silver nitrate, Silver azide, chlorine, bromine, iodine, heavy metals and their compounds, Incandescent reaction when heated with Calcium.
Hazardous Reaction Products	Reacts with Silver chloride, Silver nitrate, Silver Azide and Silver Oxide form explosive silver nitride.

5. HEALTH HAZARD DATA

Routes of Entry	Inhalation, Skin or Eyes			
Effects of Exposure/ Symptoms	700 ppm causes eye irritation and permanent injury may result if prompt medical remedial measures are not taken. 5000 ppm may cause death from spum inflammation or edema of the larynx. Contact of the liquid with skin freezes the tissues and causes the caustic burns.			
Emergency Treatment	Inhalation: Remove the victim to fresh air and provide artificial respiration or oxygen, if needed. Skin and Eyes : Wash the affected area with plenty of water for 15 mins. Seek Medical Aid.			
Permissible Exposure Limit	25 ppm	18 mg/m ³		
Odour Threshold	46.8 ppm	32.53 mg ³		
L.D ₅₀ (Oral-Rat)	-	350 mg/kg		
TLV (ACGIH)	25 ppm	18 mg/m ³		
STEL	35 ppm	27 mg/m ³		
NFPA Hazard Signals	Health	Flammability	Reactivity	Special

MATERIAL SAFETY DATA SHEET - AMMONIA

2	1	0
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6. PREVENTIVE MEASURES

Personal Protective Equipment	Avoid contact with liquid or vapours Provide rubber boots, safety goggles, self-contained breathing apparatus, gas mask and protective clothing in case of liquid ammonia.
Handling and Storage Precautions	Avoid storing along with oxidizing materials and away from all possible sources of ignition. Store in well ventilated flame resistant locations.

7. EMERGENCY AND FIRST AID MEASURES

FIRE	Fire Extinguishing Media	Stop flow of gas. Use water spray or fog.
	Special Procedure	Keep the containers cool by spraying water if exposed to heat or flame.
	Unusual Hazards	Gas is suffocating.
EXPOSURE	First Aid Measures	Inhalation : Remove the victim to fresh air area, provide artificial respiration or oxygen, if needed. Skin : Remove the contaminated clothes and wash the affected area with plenty of water and soap. Eyes : Flush with plenty of water for 15 mins. Seek medical aid.
	Antidotes/Dosages	Not available.
SPILLS	Steps to be taken	Contain leaking liquid on sand or earth, allow to evaporate. Dilute the vapours with plenty of water.
	Waste Disposal Method	Put into a large vessel containing water, neutralise with HCl And discharge into sewer with sufficient water.

8. ADDITIONAL INFORMATION/REFERENCES

LC50: 30,000 ppm/5M (ihl-hmn). A human poison by an unspecified route. Difficult to ignite. NH₃ and air in a fire; can detonate. Potentially violent or explosive reactions on contact with interhalogens. Forms sensitive explosive mixture with air and hydrocarbons. Those affected with eye and pulmonary diseases should avoid exposure to Ammonia.

Safety in the handling of ammonia depends to a large degree upon effective employee education. A competent attendant must be on site whenever ammonia is loaded, unloaded or transported. All Employees must be trained on the hazards that may result from improper handling of ammonia, emergency response procedures, including education, emergency repairs, the locations of safety showers, eye wash stations and the closest source of water, and correct use of respiratory protective devices and other protective equipment, and recognizing equipment failures and reporting them without delay.

AMMONIA LEAK

Spill or leak should be approached from upwind whenever possible. To minimize the gas cloud, water should be sprayed on the point of discharge, not just on the tank. Repairs must be made by trained personnel using approved protective equipment and clothing. All other personnel must be sent upwind of a leak. Water or water spray must be used to control and absorb serious ammonia leaks. Since it may contain high concentrations of absorbed ammonia, this water should not be discharged into sewage systems.

Detection of Minor leaks

1. By Ammonia test paper. Phenolphthalein or litmus paper will change colour in the presence of ammonia.
2. By Dilute hydrochloric acid. The fumes will produce a dense white fog if ammonia is present.
3. By Sulphur dioxide gas. Available in aerosol containers, it produces a dense white fog if ammonia is present.

PROTECTIVE EQUIPMENT

Where appropriate, the following equipment must be kept on hand, readily accessible and properly maintained. Suitable protective equipment including eye protection is to be provided for protection of crew members engaged in loading and discharging operations. Due to the seriousness of exposure to anhydrous ammonia, personal protective equipment must be well-maintained. This

includes unvented goggles, rubber gloves, respirator, long-sleeved shirt, and long pants

Eye Protection

A pair of tight-fitting, indirect-ventilation splash goggles must be worn at all times when handling ammonia. Contact lenses must not be worn when handling ammonia.

Respiratory Equipment

1. For concentrations up to 250 ppm: A half-face piece chemical- cartridge respirator with cartridges providing protection against ammonia, may be used as a minimum if eye protection is also supplied.
2. For concentrations between 250 and 300 ppm: A full-face piece chemical cartridge respirator is required, with cartridges that provide protection against ammonia.

Note: *These type of respirators does not have the capacity to protect a person from high-level exposures.*

3. For emergency or planned entry into unknown concentrations or IDLH (immediately dangerous to life or health) concentrations, i.e. over 300 ppm a self-contained breathing apparatus (SCBA) with a full face piece and operated in a pressure-demand, or other positive-pressure, mode should be used.

Protective Clothing

Clothing should be heavy duty and of a tightly woven fabric. Light weight, thin fabrics will not slow down or prevent anhydrous ammonia from passing through. The clothing should be tightly closed at the cuffs and collar to restrict the entry of anhydrous ammonia. Rubber gloves must always be worn when handling ammonia. In spill situations, both the person entering the spill area and a back-up/rescue person must wear a gas-tight suit in addition to the full-face piece positive-pressure SCBA that is required for emergency or planned entry into unknown concentrations or IDLH (immediately dangerous to life or health) concentrations.

Note: *Protective equipment should never be used as a substitute for safe work practices.*

All ammonia handling stations (loading/unloading) and barge shall have on hand, at minimum, the following equipment for emergency and rescue purposes.

- One self contained breathing apparatus
- One pair of protective gloves impervious to anhydrous ammonia
- One pair of protective boots impervious to anhydrous ammonia
- One protective slicker and /or protective pants and jacket, all impervious to anhydrous ammonia
- An easily accessible emergency shower and eye wash unit
- Chemical spill goggles.

FIRE PROTECTION

Water is the best extinguishing medium because anhydrous ammonia is highly soluble in water. The spread of escaping gas can be readily controlled by water spray. Portable fire extinguishers must be available for extinguishing fires in electrical motors.

FIRST AID MEASURES

Inhalation : Remove the victim to fresh air area, provide artificial respiration or oxygen, if needed.

Skin : Remove contaminated clothes and wash the affected area with plenty of water and soap.

Eyes : Flush with plenty of water for 15 mins. Seek medical aid.

Refer the Material Safety Data Sheet attached for more details of ammonia.

TECHNICAL PROCUREMENT SPECIFICATION		VENDOR DATA INDEX										32472-02-PS-003 VDI			
												PAGE 1 OF 1		R 0	
Fabrication of 1 no. self-propelled barge(excluding the fabrication of bullets) for transportation of Liquefied ammonia Gas(LAG)						TENDER NO. :				VENDOR:					
						P.O NO.:				DATE:					
Sl. No.	Doc. / Drawing No.		Description			Rev. 0 Date	Rev. 1 Date	Rev. 2 Date	Rev. 3 Date	Rev. 4 Date	Rev. 5 Date	Relevant to This issue			
ISSUE NO.															
DATE															
SIGNATURE															
FACT ENGINEERING WORKS															

TECHNICAL PROCUREMENT SPECIFICATION	VENDOR DATA REQUIREMENTS LAG TRANSPORTATION BARGE USING BULLETS					32472- 02-PS -003VDR PAGE 1 OF 2		
Fabrication of 1 no. self-propelled barge(excluding the fabrication of bullets) for transportation of Liquefied ammonia Gas(LAG)								
CLIENT : FACT ENGINEERING WORKS, Palluruthy STATUS ☒ TENDER ☐ COMMITMENT PO No. TPS No. : 32472-02-PS-003								
Sl. No.	Grp. Code	Description	Offer	After Commitment			Final @@	
			Qty.	Qty.	Lead time in weeks		Qty.	
					Reqd.	Prop@	Agrd	
1.0	B	Vendor data index		3P	4			3P+1S
2.0	C	List of similar jobs executed by the Vendor	3P					
3.0	A	Responsibility Matrix	3P	3P	4			
4.0	B	Schedule of execution in the form of Bar Chart	3P	3P	4			
5.0	B	PERT Chart	3P	3P	4			
6.0		Following drawings & design calculations :-						
6.1		BASIC						
	B	Lines Plan		3P	4			3P+1S
	B	Frame Offset Table		3P	4			3P+1S
	B	General Arrangement	3P	3P	4			3P+1S
	B	Preliminary Stability Estimation	3P	3P	4			3P+1S
	B	Resistance & Power Curve		3P	4			3P+1S
	B	Engine Room Arrangement		3P	4			3P+1S
	B	Wheel House Arrangement		3P	4			3P+1S
	B	Stability Booklet (after inclining*)		3P	*			3P+1S
	B	Equipment Number Calculation		3P	4			3P+1S
	B	Tonnage Calculation	3P	3P	4			3P+1S
	B	Life Saving Appliances		3P	6			3P+1S
	B	Fire Fighting Appliances		3P	6			3P+1S
	B	Nav.Lights, Sound Signals and Shapes		3P	6			3P+1S
	B	QA Plan	3P	3P	4			3P+1S
	B	Test and Trials Protocol		3P	6			3P+1S
6.2		STRUCTURAL DRAWINGS						
	B	Transverse Section		3P	6			3P+1S
	B	Profile and Deck Plan		3P	6			3P+1S

Legend : Group code : A - For review and detailed engineering, B - For review, C - For information and records

Document type : : P - Print S- Soft copy

Notes : @ Vendor shall fill in proposed lead time if different from the required lead time.

@@ Each set of final documents shall be submitted in a folder. Two such folders shall be packed and despatched with the equipment. Balance folders shall be forwarded to FEDO, on completion of fabrication.

FACT ENGINEERING WORKS

TECHNICAL PROCUREMENT SPECIFICATION		VENDOR DATA REQUIREMENTS			32472- 02-PS -003VDR			
		LAG TRANSPORTATION BARGE USING BULLETS			PAGE 2 OF 2			
Sl. No.	Grp. Code	Description	Offer	After Commitment			Final @@	
			Qty.	Qty.	Lead time in weeks		Qty.	
					Reqd.	Prop@	Agrd	
	B	Shell Expansion		3P	6			3P+1S
	B	Engine Foundation		3P	6			3P+1S
	B	Forward End Construction		3P	6			3P+1S
	B	Aft End Construction		3P	6			3P+1S
	B	Super Structure		3P	6			3P+1S
	B	Rudder and rudder stock		3P	6			3P+1S
	B	Sea chest construction		3P	6			3P+1S
6.3		Piping Schematics						
	B	Bilge /Fire/Ballast Schematic		3P	8			3P+1S
	B	FO Schematic		3P	8			3P+1S
	B	SW Cooling		3P	8			3P+1S
	B	FW Domestic		3P	8			3P+1S
	B	Air pipes and Sounding Pipes		3P	8			3P+1S
	B	Engine Exhaust		3P	8			3P+1S
	B	Ventilation Arrangement		3P	8			3P+1S
	B	Hydraulic line schematic		3P	8			3P+1S
6.4		Machinery						
	B	Shaft and Stern Gear Arrangement		3P	8			3P+1S
	B	Propeller		3P	8			3P+1S
	B	Steering Gear system		3P	8			3P+1S
	B	Engine control system		3P	8			3P+1S
6.5		Outfit						
	B	Accommodation Plan		3P	8			3P+1S
	B	Doors & Windows		3P	8			3P+1S
	B	Skylights		3P	8			3P+1S
	B	Handrails & Bulwarks		3P	8			3P+1S
	B	Deck Fittings		3P	8			3P+1S
	B	FO Service Tank Construction (Loose)		3P	8			3P+1S
	B	Insulation and Deck Covering		3P	8			3P+1S
	B	Mast		3P	8			3P+1S
	B	Fender Fitment		3P	8			3P+1S
	B	Painting Scheme		3P	8			3P+1S
	B	Distribution of Anodes		3P	8			3P+1S
	B	Minor Equipment Foundations		3P	8			3P+1S
6.6		Electrical						
	B	Electrical Load Calculation		3P	8			3P+1S
	B	Electrical Wiring Diagram		3P	8			3P+1S
	B	MSB Construction		3P	8			3P+1S
	B	ESB Construction		3P	8			3P+1S
7.0	C	Final Documentation						3P+1S
FACT ENGINEERING WORKS					 FEW			

TECHNICAL PROCUREMENT SPECIFICATION	LIST OF MAKERS	32472-02 -PS-003LM	
		Page 1 of 3	R0
1. MAIN ENGINE i) Ashok Leyland ii) Cummins iii) Greaves iv) CAT v) Volvo 2. GEAR BOX i) Ghatge Patil ii) PRM iii) ZF iv) Twin Disc 3. GENERATOR A) PRIME MOVER i) Simpsons ii) Greaves iii) Kirloskar iv) Cummins B)ALTERNATOR i) Stamford ii) IEC iii) KEC iv) KEL 4. PUMPS i) BE Pumps ii) Johnson			
FACT ENGINEERING WORKS		 	

TECHNICAL PROCUREMENT SPECIFICATION	LIST OF MAKERS	32472-02 -PS-003 LM	
		Page 2 of 3	R0
iii) Jabson iv) Kirloskar 5. STEERING GEAR SYSTEM i) Hydrive ii) Kobelt iii) Jastram 6. VHF i) Icom ii) Kodan iii) Furuno iv) Garmin 7. DGPS i) Garmin ii) Kodan iii) Furuno 8. PAINTS i) Akzo Nobel ii) Jotun iii) Hempel 9. POLYURETHANE FOAM INSULATION (Supply & Application) i) Fortifori Plastics Pvt. Ltd., Bengaluru ii) Pentafoam India Pvt. Ltd., Pune			
FACT ENGINEERING WORKS		 FEW	

TECHNICAL PROCUREMENT SPECIFICATION	LIST OF MAKERS	32472-02 -PS-003 LM	
		Page 3 of 3	R0
iii) Nova Insulation Pvt. Ltd., Chennai iv) Andhra Expanded Polystyrene Pvt. Ltd., Hyderabad v) Kromatik & Insulants Pvt. Ltd., Chennai vi) Kaefer Punj Lloyd Ltd., New Delhi vii) Beardsell Ltd., Kochi viii) M/s Lloyd’s Insulation (India) Ltd., Chennai/Kochi *****			
FACT ENGINEERING WORKS			

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