TECHNICAL PROCUREMENT SPECIFICATION	SCOPE OF WORK	32472-02-PS-005 SW
		PAGE 1 OF 2 | Rev. 0

ITEM : Fabrication & supply of 1 no. self-propelled barge with bullet tanks for transportation of 400MT Sulphuric Acid

EQPT. No. :

(Space for Vendor's name, signature and seal)

The scope of work for the equipment listed above shall include design, preparing fabrication drawings, manufacture, procurement/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 supply of 1 no. self-propelled barge with bullet tanks for transportation of Sulphuric acid.				**14**	**PIPING, VALVES and PIPE SUPPORTS**		
1	Detailed design calulations & fabrication drawings of barge	√		a	Water ballast / Bilge System	√	
2	Detailed design calulations & fabrication drawings of cargo tank	√		b	Fuel Oil & Lubricationg Oil System	√	
3	Submission of documents as per VDR	√		c	Air escape & Sounding Pipes	√	
4	Procurement of all materials	√		d	Surface treatment & Cleaning	√	
5	Fabrication of the barge and tanks at contractors yard	√		e	Insulation of Pipes	√	
6	Mounting of tanks onto the barge	√		f	Pipe supports	√	
7	Assemby/ fitment of Piping & Instrumentation connected to the tanks	√		**15**	**MACHINERY**		
8	Providing Cannopy/Hood over the cargo bullet tanks	√		a	Main Engine	√	
				b	Gear Boxes	√	
9	Testing and inspection	√		c	Generator Set	√	
10	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	√	
11	Assistance in first to & fro voyage as mentioned in Special Requirements of Project	√		g	Twin Srew Remote Control	√	
				h	Bilge, ballast & Fire Pumps	√	
12	Two weeks basic training on operation	√		**16**	**ELECTRICAL**		
13	**HULL OUTFITTING**						
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	Accomodation 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

Sl. No.	Description	Reqd.	Offer from Vendor	Sl. No.	Description	Reqd.	Offer from Vendor
k	Search Lights	√		**21**	**DOCUMENTATION**		
l	Berth Lights	√		a	Certificates listed under clause 1.8.0 of Shipbuilding Specification	√	
m	Desk & Mirror Lights	√					
n	Instrument Lights	√		b	"As Built" Plans & Instruction Books listed under 1.11.2 of Shipbuilding Specification	√	
o	Emergency Lights	√					
p	Portable Lights	√		c	Documents as per VDR	√	
17	**SAFETY APPLIANCES**			**22**	**SPARE PARTS, TOOLS & ACCESSORIES**		
a	Life Saving Appliances	√					
b	Fire Fighting Appliances	√		a	Spare Parts, Tools & Accerssories as listed under clause 1.12.0 and Sec. XI of Shipbuilding Specification	√	
c	Shapes & Sound Signals	√					
d	Safety equipment for safe handling of Sulphuric acid (Refer Annexure - I)	√					
18	**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	√					
l	Cupboards and chair for crew	√					
19	**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	√					
20	**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	√					

PRE-QUALIFICATION CRITERIA

Tender No :

Name of Work: Fabrication & supply of 1 no. self-propelled barge with bullet tanks for transportation of 400MT Sulphuric Acid.

I PROJECT SYNOPSIS

The scope of work pertains to Fabrication and delivery of 1 no. self-propelled barge, as per terms and conditions of this tender documents.

II PRE-QUALIFICATION CRITERIA

NO CONSORTIUM IS ALLOWED

1. Bidders must have designed, built, tested and supplied at least one self Propelled barge/marine vessel of at least 400 MT displacement under class, during the last 7 years ending 31st March 2020.

2. Bidders must have built and supplied at least one marine vessel of cost at least Rs 600 lakhs during the last 7 years ending 31st March 2020.

   OR

   Bidders must have built and supplied at least two marine vessels of cost at least Rs 375 lakhs during the last 7 years ending 31st March 2020.

   OR

   Bidders must have built and supplied at least three marine vessels of cost at Rs 300 lakhs during the last 7 years ending 31st March 2020.

   The bidder should submit certificate(s) to this effect from the owner(s)

3. The bidder shall have an average annual financial turnover during the last 3 years i.e.2016-17, 2017-18 and 2018-19 ending on 31.03.2019 should be least Rs 225 lakhs.

4. In connection with the above PQ criteria tenderer has to submit the following in English language.

   i. Copy of Balance sheet for the last three years ending 31.03.2019, as documentary evidence of adequate financial standing.

   ii. Copy of audited financial reports (in full set)/Profit-Loss statement for the last three financial years ending 31.03.2019.

   iii. Solvency certificate from a nationalized / Scheduled bank dated, not earlier than 3 months from date of e-publishing of tender, indicating amount to which the bidder is solvent to a minimum value of **Rs 375** lakh to prove the financial capability to carry out the work tendered for.

   iv. Copy of work orders and copy of respective work completion certificates of jobs undertaken with final value in support of the above.

   v. Copy of GST registration certificate

5. FEW reserves the right to have the financial and other data/credentials claimed by the bidder verified independently, if necessary, by a third party. FEW also reserves the right to ask for any other documents in case considered essential in support of any of the PQ criteria or on the document submitted. If the data/credentials furnished are found to be incorrect, FEW further reserves the right to reject the particular tender. FEW also reserves the right to reject any tender submitted by a party if it comes to know suo moto of any adverse reports on the certified claim submitted by the tenderer.

6. The technical bids of the bidders not meeting the pre-qualification criteria will not be processed further and will stand rejected.

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TECHNICAL PROCUREMENT SPECIFICATION	32472-02-PS-005
	PAGE 1 OF 1

TPS No:	**32472-02-PS-005**
STATUS	ENQUIRY RELEASE
ORIGINATING DEPT.	PROJECTS AND PLANNING
P.O / W.O No:	
PROJECT	FABRICATION & SUPPLY OF 1 NO. SELF-PROPELLED BARGE WITH BULLET TANKS FOR TRANSPORTATION OF 400 MT SULPHURIC ACID.
LOCATION	CONTARCTOR'S OWN YARD
CLIENT	FACT ENGINEERING WORKS
PURCHASER	FACT – COCHIN DIVISION
VENDOR	

ITEM	QTY.
Design & Engineering, Procurement of Materials, Fabrication of barge, Fabrication of cargo bullet tanks, Installation of cargo bullet tanks, Installation of piping, Launching, Testing, Commissioning and Delivery of a self-propelled barge with bullet tanks for transportation of 400 MT Sulphuric Acid under classification of IACS classified member as per the tender documents attached.	ONE No.

CONTENTS

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 Sulphuric acid barge suitable for inland waterways.

1.1.1 For definitions of “bidder”, “Contractor”, “Builder”, “Maker” & “Owner”, refer document “Special Requirements of the Project”

1.1.2 It is regarded that “**Section I**" prevails over all other sections.

1.1.3 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.

1.1.4 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.

1.1.5 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.

1.1.6 Metric system shall be adopted for the design and construction of hull, machinery and equipment unless otherwise specifically stated in these Specifications.

1.1.7 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.

1.1.8 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.

1.1.9 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.

1.1.10 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”.

1.1.11 The draught of the vessel specified in these Specifications shall be of moulded figure unless otherwise specifically stated.

1.1.12 All plans, booklets, name plates, caution/identification plates and whatever documents required for implementation of the Specifications shall be in English.

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.	:	45 ^{0}C
Sea Water Temperature, max.	:	35 ^{0}C
Relative Humidity Max. / Non condensing	:	95%

1.3.0 MAIN PARTICULARS

1.3.1 The main particulars of the barge are as follows: -

LOA	:	50 m (shall not exceed 50 m)
Breadth	:	8.5m (shall not exceed 8.5 m)
Depth	:	2.75 m
Draft	:	1.75 m (shall not exceed 1.75m)
Speed, minimum	:	8 Knots
Main engine	:	2 nos (Power and capacity shall be designed by contractor)
No. of crew	:	6 persons
No. of cargo/bullet tank	:	2 nos, 200 MT capacity each
Type of the cargo tank	:	Independent bullet tanks
Cargo bullet tanks capacity	:	400 MT
Cargo carrying	:	Sulphuric acid

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.

1.4.0 CAPACITIES

F.O. :
F.W. :
} Shall be specified by contractor

1.5.0 ARRANGEMENT

1.5.1 The arrangement of the vessel shall be requirements of classification society and statutory rules. Sulphuric acid shall be carried in 2 independent bullet tanks of total 400 MT capacity.

1.5.2 Entire barge shall be of double skin construction with double hull type. The contractor shall confirm the stability of the barge considering all parameters while designing the barge.

1.5.3 Hull Subdivision

1.5.3.1 The hull shall be subdivided by adequate number of W.T. transverse bulkheads into the following spaces:

a) Fore peak
b) Forward Store
c) Cargo Hold (separate transverse bulk head shall be provided at midsection of the bullets)
d) Engine Room
e) Aft Peak

1.5.4 Cargo Hold Arrangement

1.5.4.1 2 nos. independent bullet tanks shall be located in cargo hold. The details of cargo bullet tanks are given in Sec. X. The filling and discharge pipes from each tank shall be as per the Piping & Instrumentation Diagram (P&ID) (No.32667-11-PD-003R2) attached. Supply of pumps required for unloading Sulphuric acid shall be in the scope of contractor.

1.5.3.2 Each bullet tank shall be placed on saddle supports which are efficiently secured to the hull. The saddle supports shall be approved design and hull shall have center girder, sufficient number of side girders, floor plates, stiffeners etc. to have sufficient strength for supporting the weight of the loaded bullet tanks and also withstand additional loads due to barge motions, especially accelerations induced by such motions including centrifugal accelerations due to turning. Saddle supports of the bullet tanks shall be efficiently secured to hull by suitable means so as to prevent relative motions of the bullet tank during transit.

1.5.3.3 Hatch covers shall not be provided. The hatches are protected all round by mild steel coamings as specified. 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. Engine room shall be located at aft of cargo hold.

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

1.6.0 SPEED

1.6.1.1 The free running speed at maximum continuous output of the main engines at the base line draft 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.

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.

1.8.3 Service life certificate of paint for a minimum period of 60 months certified by the paint manufacture.

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.

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/m^2. 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 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.

1.9.2.14 All timber shall be impregnated with anti-rot and anti-pest composition.

1.9.2.15 All plywood used shall be as per IS 710 and of marine quality.

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.

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/Builder.

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.

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

1.11.1.0 Detailed design calculation, Fabrication drawings, docking plan etc…of barge shall be submitted to classification agency for approval. Fabrication of barge shall be started only after approval of classification agency.

1.11.2 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".

1.11.3 The Contractor's standard Plans or Makers' Plans may be used as working Plans or Plans for approval

1.12.0 AS BUILT PLANS AND INSTRUCTION BOOKS

1.12.1.0 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, if any.

1.12.1.1 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 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.

1.13.0 SPARE PARTS, TOOLS AND ACCESSORIES

1.13.1 Spare parts, tools and accessories shall be furnished in accordance with the requirement of the Classification Society and the Regulatory Bodies.

1.13.2 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.

1.14.0 PROCESS DESIGN BASIS & PERFORMANCE GUARANTEES, PROCESS DATA SHEET AND P&ID

The requirement specified in FEDO documents: 32667-11-DB-002-R1, 32667-11-SE-CT201R1, 32667-11-SE-P201R2, 32667-11-SE-L201R1, 32667-11-PI-002R1, 326667-11-PD-003R2(18pages) shall also be part of the tender documents. If any of these requirements are in conflict with those mentioned elsewhere, the ones specified in document shall prevail.

-------- **END OF SECTION I** ---------

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 entire barge shall be of double skin construction with double bottom. The contractor shall confirm the stability of the barge considering all parameters while designing the barge.

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. 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.

2.1.1.6 The structural details in general shall be in accordance with and approved

by the Classification Society.

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.

2.2.0 WORKMANSHIP

2.2.1 After the cutting of steel plates, profiles / sections, the edges shall be cleaned 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.

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	-	Atleast 10 mm
Side Shell Plating	-	Atleast 8 mm

2.5.2 BILGE KEEL

2.5.2.1 Bilge keel, if any shall be as per the requirements of the classification society/statutory bodies.

2.5.3 BOTTOM PLUGS

2.5.3.1 One (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.

2.5.4 DECK STRUCTURE

2.5.4.1 The main deck plating is to be of the thickness necessary to obtain the required hull girder section modulus in accordance with the classification requirements.

2.5.4.2 The 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.

2.5.5 BULKHEAD STRUCTURE

2.5.5.1 Bulkhead plating shall be as per the requirements of classification society/statutory bodies. 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.

2.6.0 SUPER STRUCTURE

2.6.1 Super structure fabricated shall consist of a Galley, accommodation, Wheel house etc and Super structure shall be located at aft of cargo hold.

-------- **END OF SECTION II** ---------

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 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 center, 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 meter. 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.

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.

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.

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 ---------

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.

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

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

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/cm^2 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.

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.

4.9.0 PIPE PROTECTION

4.9.1 The 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.

4.10.0 SURFACE TREATMENT AND CLEANING

4.10.1 The 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.

4.10.2 The 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.

4.10.3 The 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.

4.10.4 For 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.

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.

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 shall not 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.

4.13.23 Asbestos as insulation material shall not 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.

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.

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 ---------

SECTION V

5.0.0 MACHINERY

5.1.0 MAIN ENGINES

Basic Specification

Make - Leyland / Cummins / Volvo

Capacity - Shall 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.

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 tacho-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

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.

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.

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.

5.8.4 A portable self-priming pump of power 0.5 HP shall be provided for pumping water from ballast tanks to general purpose tank.

-------- END OF SECTION V ---------

SECTION VI

6.0.0 ELECTRICAL

6.1.0 GENERAL

6.1.1 Electrical installation shall comply with Classification and Statutory requirements.

6.1.2 If 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.

6.1.3 In general, cable terminals shall be of solderless type. All electrical systems and equipment shall be easily accessible and clear of inflammable materials.

6.1.4 Lighting 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.

6.1.5 Navigation 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.

6.1.6 Power 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.

6.1.7 The power system of the vessel shall

- 415V, 3phase, 3wire, 50Hz
- 230V, 3/1phase, 3wire, 50Hz through 415/240V Transformer
- 24V DC, 2wire

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 nonflammable 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.

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

6.2.3.2.2 For Shore Power

- Shore supply power available

6.2.3.2.3 Bus bar

- 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 statuary 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

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.

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.

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

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

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 16A or above, 230V, 1phase. Minimum 16 nos. sockets shall be installed.

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.

- 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 (YELLOW)

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.

6.8.1.7 MIRROR LIGHTS

6.8.1.7.1 15W fluorescent light, drip proof with globe and bulkhead mounting type shall be provided for illumination of toilet, bath and outside wash basin & mirror.

6.8.1.8 INSTRUMENT LIGHTS

6.8.1.8.1 Instrument lights shall be provided for magnetic compass main engine revolution indicator, rudder angle indicator and fed through dimmer switch.

6.8.1.9 EMERGENCY LIGHTS

6.8.1.9.1 A 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.

6.8.1.10 PORTABLE LIGHTS

6.8.1.11.1 The 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 ---------

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.

7.3.0 SHAPES & SOUND SIGNALS

7.3.0.1 The 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. **DETECTION SYSTEMS**

Adequate ventilation and gas detection system is to be provided for all spaces in the cargo area.

7.5 **SAFETY REQUIREMENTS FOR CARRIAGE OF SULPHURIC ACID**

7.5.1 Additional safety requirements for carriage of Sulphuric acid is detailed in “Safety Requirements for Carriage of Sulphuric acid” and “MSDS for Sulphuric acid”

7.5.2 In 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 ---------

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.

m. Sufficient cupboards shall be provided inside wheelhouse for keeping necessary documents

n. One additional chair shall be provided in wheel house for mate.

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

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.

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 (5) 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.

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

9.3.2 The visible zinc salts on intact shop primed surface shall be thoroughly cleaned.

9.4.0 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.

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.

9.6.1.1 KEEL TO WATERLINE

PAINT TYPE	COATS	TOTAL DFT
HIGH BUILDEPOXY PRIMER	1	75
HIGH BUILD TAR FREE EPOXY	2	150
EPOXY TIECOAT	1	75
HB ANTIFOULING	2	100

9.6.1.2 WATERLINE TO DECK

PAINT TYPE	COATS	TOTAL DFT
HIGH BUILDEPOXY PRIMER	1	75
HIGH BUILD TAR FREE EPOXY	2	150
FINISH COAT (OWNER'S PREFERRED COLOUR)	2	75

9.6.1.3 WEATHER DECK

PAINT TYPE	COATS	TOTAL DFT
UNIVERSAL PRIMER	2	50
DECK PAINT NON SKID (OWNER'S PREFERRED COLOUR)	2	100

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 (OWNER'S PREFERRED COLOUR)	2	50

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

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 ---------

SECTION X

10.0.0 CARGO BULLET TANK DETAILS

10.1.0 SPECIFICATIONS FOR SULPHURIC ACID BULLET TANKS:

No. of bullet tanks required: 2 Nos. with each 200 MT capacity and total capacity of 400 MT

Type of Tank: Independent type, cylindrical bullet tanks with 2:1 ellipsoidal dished ends

Fluid Handled: 98.4% Sulphuric Acid

Specific Gravity of Fluid: 1.84

Operating Temperature: Ambient

Operating Pressure: Atmospheric

Design Pressure: As per Discharge pressure of the loading pump mentioned in the P&ID (No.32667-11-PD-003R2)

Hydraulic Test pressure: As per ASME SEC VIII Div.1

10.2.0 DESIGN OF BULLET TANKS

10.2.1 Bullet Tanks shall be designed and constructed as per codes and standards mentioned in ASME SEC VIII Div.1

10.2.2 Self-weight of bullet tanks, weight of cargo, weight of vertical submersible pumps, wind loads as per IS: 875, dynamic loads due to acceleration, thermal loads, pumping loads, shock loads, maximum vaccum condition inside the bullet tank while unloading Sulphuric acid etc.. shall be considered for designing bullet tanks.

10.2.3 Thickness of any part of the bullet tanks shall be atleast 8 mm.

10.2.4 An external corrosion allowance of 3 mm shall be considered for fabrication of bullet tanks.

10.2.5 Bullet Tanks shall be hydrostatically tested as per ASME SEC VIII Div.1

10.2.6 Sufficient ullage shall be considered while designing the bullet tanks. Minimum 10% of volume of 200 MT Sulphuric acid shall be considered as ullage of each bullet tank for Sulphuric acid. Each Bullet Tank including ullage shall be able to store and transport 200 MT Sulphuric acid.

10.2.7 Maximum Diameter of the bullet tanks shall not exceed 2400mm.

10.2.8 Maximum tan to tan length of bullet tanks shall not exceed 30000mm.

10.2.9 Dished ends shall be 2:1 ellipsoidal, minimum thickness shall be 8mm

10.2.10 Detailed design calculations and drawings of tanks shall be submitted to Classification agency for approval. Fabrication of bullet tanks shall be started on approval of the detailed design calculation and drawings of tanks by classification agency.

10.2.11 Sufficient number of nozzles for loading & unloading line, Manhole, nozzles for fixing vents and gauging instruments etc. shall be considered while designing the bullet tanks. Nozzle sizing shall be done based on allowable velocity for Sulphuric acid flow mentioned in NACE standards.

Nozzle pipes and its Reinforcement (providing pad plates, stiffeners etc.) shall be according to ASME SEC VIII Div.1.

10.2.12 The selection of the material for plates, flanges, nozzle pipes etc. shall be based on classification agency, which are compatible with Sulphuric acid service.

10.2.13 Cargo bullet tank MOC shall be IS 2062(Subject to approval of classification agency)

10.2.14 Flanges used for nozzles shall conform to ASME B16.5. All the flanges shall be forging & machined one.

10.2.15 Nozzle pipes shall conform to ASME B31.3.

10.2.16 Material Test Certificate (MTC) of Carbon steel plates, flanges and pipes etc shall be got approved from Classification agency.

10.2.17 Detailed Quality Assurance Plan (QAP) shall be as per codes and standards of ASME SEC IX and it shall be got approved from Classification agency.

10.2.18 All standard mechanical tests (tensile testing, Charpy impact test, Brinell hardness etc...) specified by classification agency shall be carried out on material of plates, flanges, nozzle pipes etc…

10.2.19 A separate Cannopy/ Hood shall be provided over the cargo bullet tanks to reduce moisture ingress in to the tanks through the vents.

10.2.20 Level Switch high (High), (Low) shall be provided on the Cargo bullet tanks as per the P&ID(No.32667-11-PD-003R2).

10.3.0 **BULLET TANK INSTALLATION**

10.3.1 Each tank shall have adequate number of saddle supports. Each saddle support shall be designed by taking into consideration of self-weight of tank, weight of cargo, weight of submersible pump, dynamic loads, wind loads as per IS:875 etc... Detailed design calculations and drawings of saddle supports shall be submitted to classification agency for approval.

10.3.2 A separate transverse bulkhead shall be provided at mid-section of bullet tanks for additional support to bullet tanks and hull of the barge

10.3.3 Saddle supports shall be **bolted** to the hull of the barge. Hull shall be designed and shall have enough number of center girder, side girder, plate floor etc.to support entire cargo load. Fabrication of hull and girders shall be started on approval of the detailed design calculation and drawings of tanks by classification agency.

10.3.4 Cargo bullet tanks are to be located atleast 800mm inboard of side shell plating and there shall be adequate space for building walkways/alleyways between shell plating and cargo bullet tank

Cargo bullet tanks shall be located at least 800mm above moulded line of bottom shell of barge.

Cofferdams of at least 800mm x 800mm shall be provided between the following parts of barge:

a) Between two cargo bullet tanks

b) Between cargo bullet tanks and ballast tanks

c) Between cargo bullet tanks and bulk head.

10.3.4 Bullets Tanks shall also be installed at a suitable location as per classification agency regulations and while installing, all the sides of tanks shall be accessible for maintenance & inspection. While fixing bullet tanks on saddle it should not create any hindrance for vision of barge operator in wheel house.

10.3.5 Bullet tanks shall be installed near to the Wheel house

10.4.0 **PIPING**

10.4.1 Piping shall be as per the Piping and Instrumentation Diagram (P&ID) (No.32667-11-PD-003R2). The selection of the material of the pipes, valves and other accessories mentioned in P&ID(No.32667-11-PD-003R2). shall be based on classification agency, which is compatible with Sulphuric acid service.

10.4.2 Material Test Certificate (MTC) of pipes, valves and other accessories mentioned in P&ID (No.32667-11-PD-003R2) shall be got approved from Classification agency.

10.4.3 Pipes and fittings shall conform to ASME B31.3, Gaskets shall conform to ASME B16. 20. Flanges shall conform to ASME B16.5. Material of

construction of pipes and fittings shall be SS316 (subject to approval from classification agency).

10.4.4 Valves shall conform ASME B16.34 & the material of construction valves shall be ASTM A 8290 CD4MCU (Subject to approval from classification agency). All shutoff valves provided shall be Ball valves. Size of the ball valves shall be same as the pipe. Loading & Unloading pipe lines and valves shall be designed as per the pressure rating and discharge of loading and unloading pumps.

10.4.5 Piping layout diagram shall be prepared for calculating the total length of pipe, type & number of fittings required for loading and unloading lines of Sulphuric acid in barge. Loading and unloading points of Sulphuric acid shall be near to wheel house. No piping shall be laid to create any hindrance for vision of barge operator in wheel house.

10.4.6 Adequate number of supports shall be provided, if required while preparing the piping layout diagram

10.4.7 Loading lines & Unloading lines shall be designed to accommodate a discharge rate mentioned in P&ID(No.32667-11-PD-003R2)

10.4.8 Loading & Unloading lines shall be designed as per the pressure rating of loading and unloading pumps mentioned in P&ID(No.32667-11-PD-003R2).

10.4.9 Quick Release Coupling (QRC) shall be provided for both the cargo bullet tanks at the shore connection as per the P&ID(No.32667-11-PD-003R2).

10.4.10 Separate shutoff valves shall be provided in loading lines and unloading lines to each bullet tank as per the P&ID (No.32667-11-PD-003R2) for controlling the flow of Sulphuric acid.

10.4.11 Flanges for loading and discharge connections are to be provided with shields, which may be portable to guard against the cargo being

sprayed. In addition to shields, dip trays are to be provided to guard against leakage on to the deck.

10.5.0 **PUMPS**

10.5.1 A vertical submersible pump along with motor shall be provided in each independent bullet tanks for unloading the Sulphuric acid. A sump shall be provided at the bottom of the bullet tank at which suction side of vertical submersible pump is placed to facilitate maximum discharge from tanks.

10.5.2 One standby vertical submersible pump along with motor shall also be provided. Stand by pump shall be placed on weather deck at a suitable location for easier accessibility. Stand by Pump shall be placed in a store room build over weather deck. Store room shall be provided accordingly.

10.5.3 Shutoff valves shall be provided at discharge lines of each pump as per the P&ID(No.32667-11-PD-003R2). Each pump can be isolated by closing shutoff valves in corresponding discharge lines.

10.5.4 Pump start/stop indication shall be provided at the panel inside the Wheel house

10.5.5 Discharge rate, Head, Temperature of operation, type of pump, Standard followed for construction of pump shall be as per pump data sheet attached with P&ID.

10.5.6 Material of construction of pump shall be Alloy 20 (Subject to approval of classification agency). Material test certificates (MTC's) for all parts of the unloading pump shall be furnished to classification agency for approval.

10.5.7 Unloading pump shall be designed for discharging the Sulphuric acid and pumping out water inside the bullet tanks, which is used for cleaning the internal surfaces of the bullet tanks

10.5.8 Provision is to be made for suitable arrangements/apparatus to detect leakage of cargo onto adjacent spaces. The cargo pump room bilge pumping and drainage arrangements are to be corrosion resistant materials.

10.6.0 **VENTING**

10.6.1 Vents shall be installed on each bullet tanks. Vents shall terminate in goose neck bend and are to designed / operated so as to ensure that neither pressure nor vacuum is created in the cargo bullet tanks during loading and unloading.

10.6.2 Sizing and design shall be as per codes and standards mentioned in API 2000.

10.6.3 Material of construction of vents shall be compatible with Sulphuric acid service and its MTC (Material Test Certificate) shall be furnished to classification agency for approval.

10.6.4 Shut off valves should not be fitted to the vents/breather valves.

10.7.0 **GAUGING**

10.7.1 A sounding pipe along with dip tape shall be installed on bullet tanks for level measurement of Sulphuric acid. Float, tape & sounding pipe shall be compatible with Sulphuric acid service.

10.8.0 The details which are not mentioned but essential for the cargo transportation shall be done in accordance with the Contractors' current practice and to the complete satisfaction of the Owner/Classification Society/Statutory Bodies.

-------- END OF SECTION X ------

SECTION XI

11.0.0 ANNEXURE A

LIST OF ACCESSORIES TO BE MAINTAINED IN BARGE

1. A suitable generator of required power rating shall be provided so as to operate auxiliary pumps, fire water pumps and all other accessories.
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
5. 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.

    Float switch: Vertical Mount Magnetic Switching with SS Float 2 nos of LED for 2 bilge tanks for indicate high level alarms
6. Life raft for accommodating 6 persons approved by DG Shipping with cradle, Lashing Assembly and hydrostatic Release Unit
7. 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. Structurals and fasteners shall also be provided by the contractor.

8. Rope ladder-1 no.
9. Search light- 1 no. of 1000 W each at port side, starboard side and bow.
10. 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.

11. Suitable fire proofing (fire blanket system (A60) of density 96 kg/m^3) between the engine room and cargo hold.
12. Overhead Drinking water / General Purpose tank of 1000 L to be provided
13. Portable fire water pump having minimum output 1300 LPM at 7 bar pressure.
14. 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.
15. Sufficient number of cupboards shall be provided in galley, wheel house, accommodation area etc… for crew members for documentation
16. One additional chair shall be provided in wheel house for mate.
17. Platform shall be provided for cleaning the front window glasses of the wheel house.
18. A separate fresh water tank along with two eye wash points shall be provided inside the barge.

All the accessories shall be class certified as applicable.

-------- END OF SECTION XI ------

PROCESS DESIGN BASIS AND PERFORMANCE GUARANTEES ON

400 MT Sulphuric Acid Barge

FOR

The Fertilisers And Chemicals Travancore Ltd.,
Udyogamandal – 683501, Kochi, India

PREPARED BY

FACT ENGINEERING AND DESIGN ORGANISATION
A Division of The Fertilisers And Chemicals Travancore Ltd.,
(A Government of India Enterprise),Udyogamandal – 683501, Kochi, India

Contents

1.0 Introduction and Common Requirements

FACT proposes to employ 1 no. of self-propelled barge for transporting 400 MT sulphuric acid through Udyogamandal canal and Champakkara canal of National Waterway No. 3 as defined in IWAI, using cargo tanks installed on the barge.

The barge shall be registered under the provisions of Inland Vessels Act, 1917,KIV Rules 2010, by Port Department,Government of Kerala.

For round the clock operation, the barge is to be fitted with red lights around the periphery of the barge (on the deck) to give notice to the other vessels in the vicinity so as to avoid collisions.

Each barge shall have two numbers cargo tanks of effective capacity of 400 MT (2x200 MT). The cargo tanks will be loaded using owner's pumps which will be connected to the barge at the owner's loading berths using set of hoses with Dry Disconnect Couplings (DDC) for quick and spill free connection and disconnection. After completion of loading, the barge shall transport the filled cargotanks to the respective destination points.

At the destination, each cargotank shall be unloaded to the owner's storage tanks in the plant premises. The cargo tanks shall be unloaded using submersible vertical pumps one in each cargo tank to the owner's storage tanks using set of hoses with Dry Disconnect Couplings (DDC) in the berth for quick and spill free connection and disconnection. Two pumps (one in each tank) will be working in parallel during unloading. After completion of unloading, the barges shall return to the loading point,thereby repeating the cycle.

Loading/ Unloading of each tank shall be carried out such that the liquid levels in both the tanks are same to preserve balance.

The loading and unloading hoses with the coupler part of the DDC on the hoses shall be provided by the bidder at all loading and unloading berths. The corresponding adapter units of the DDC's in the cargo tank side shall also be provided in the barge side for quick and spill free connection and disconnection. The required number of hoses and DDC's shall be provided accordingly by the bidder.

Regarding sulphuric acid, owner has captive sulphuric acid generation plants at CD and UC capable of producing the major requirement of sulphuric acid for their plants and the balance quantity has to be imported. Also captive phosphoric acid production plant in CD requires more than thrice the quantity of sulphuric acid which has to be normally met through imports. UC normally produces surplus sulphuric acid during normal operation

which has to be transported to CD. Accordingly 1 (one) sulphuric acid barge of 400 MT is normally envisaged.

The loading points for sulphuric acid will be at WI as well as UC and the unloading point will be at CD. However, in exceptional cases where UC acid plants are not productive, import sulphuric acid has to be unloaded at UC also. Hence in addition to loading point, unloading point for sulphuric acid will also have to be provided at UC.

The Specifications, P&ID and other documents indicate only the minimum requirements. The LSTK bidder shall review and confirm the specifications/ documents and the single pointresponsibility for the scope of work of the complete project shall rest with the LSTK bidder.

Certain items, clauses, stipulations etc by virtue of their importance may be repeated in the TPS / documents to avoid slippage under any circumstances. Also if any item(s) mentioned twice or more in the Technical Specification, it shall be understood that this item(s) shall be supplied and / or installed only once.

Metric system shall be normally adopted for the design and construction of the items unless otherwise specifically stated in the specifications.

2.0 Climatic Conditions

The vessel shall operate through-out the year including summer under peak ambient conditions as follows:

2.1 Weather Condition

Mid October to February	Winter (Mild Cold)
March to May	Summer (Hot & Humid)
June to Mid-October	Rainy (Monsoon)

2.2 Ambient Condition

Temperature

- Maximum : (+) 40^{o}C
- Minimum : (+) 17^{o}C

Rainfall

- Maximum : 1184 mm (August)
- Minimum : 15 mm (January)

Relative Humidity
- Maximum : 89% (July)
- Minimum : 66% (January)

2.3 Wind

Wind load design should be done as per IS 875 (Part 3): 2015

Design Wind Pressure: Pd= Kd x Ka x Kc x pz, N/m(Refer Clause No.7.2 of IS 875 (Part 3)-2015)^2

Where,

- Wind Pressure, p= $0.6Vz_z^2$

- Design Wind Speed, Vz= Vb x k1 x k2 x k3 x k4
- Basic Wind Speed, Vb= 39 m/s
- Probability Factor (Risk Coefficient), k1= 1.0 (assuming design life of 50 years)
- Terrain, Height & Structure Size Factor, k2 - based on terrain category-3 (Refer Table-2 of IS 875 (Part 3: 2015)
- Topography Factor, k3= 1.0
- Cyclonic Factor, k4= 1.0

Note: The values of Pd, however shall not be taken as less than 0.70pz
- Wind for Hydro Test = 25%

3.0 Brief Scope of work of the LSTK bidder

Design, supply, fabrication, QA, commissioning, certification, documentation performance guarantees, other guarantees of sulphuric acid barge (1 No.) as specified complete with cargo tanks, unloading pumps, piping, instruments, safety appliances, Dry Disconnect Couplings (DDC), hoses etc at the loading and unloading points up to the battery limits in all the loading and unloading points and other hardware applicable complete as per P&ID specifications, other documents etc in the TPS.

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4.0 Design Philosophy:

4.1 Velocity Criteria

The velocities for suction and discharge sides of pump are limited to the following values.

Suction	:	0.7 m/s
Discharge	:	1.3 m/s

Theabove lower velocities are taken considering protecting the $FeSO_4$ layer that forms on the piping material as protection layer.

5.0 Principle Codes & Standards

The design of the Barge cargo tanks shall be as per the following codes & standards:

5.1 American Society of Mechanical Engineers (ASME)

- ASME B31.3 - "Process Piping"

5.2 American Petroleum Institute (API)

- API STD 2000 - “Venting Atmospheric and Low-Pressure Storage Tanks”
- API STD 610 - “Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries”

5.3 Central Pollution Control Board (CPCB) norms

5.4 Kerala State Pollution Control Board (KSPCB) norms

6.0 Technical Details of Sulphuric Acid barge

The barge is fitted with two cargo tanks each and isto be suitably designed for safe navigation through the inland waterways, round the clock for a minimum of 330 days in a year. The barge is double hull type and the tanks are installed inside the inner hull, designed in such a way that structural design, strength and buoyancy of the barge shall be suitable to with stand any possible damage on account of grounding or collisions which will affect the capability of barges to float or expose tanks to any risk or damage. Speed of the barge will be in the range of 8 to 15 kilometers per hour. Design, engineering, construction, testing and acceptance trials of the barge comply with all the relevant Code and Rules applicable for barges deployed for transportation of Acids through inland waterways.

6.1 Cargo tanks for Sulphuric Acid barge

Definitions:

Recommended Filling Level(RFL)

The recommended filling level shall be the safe filling level up to which the cargo tanks are loaded with acid with the required freeboard for safe transportation as per applicable norms and unloading at the destinations.

Minimum Safe Level (MSL)

The Minimum safe level of operation of the unloading pump shall be the safe minimum level of acid in the cargo tank up to which the pump manufacturer certifies operation of the pump without any adverse effect on the pump or hardware.

Effective Capacity

The effective Capacity shall be the unloaded (or usable) capacity of acid available from both the cargo tanks excluding the dead volume at the bottom of the cargo tanks (corresponding to MSL- Minimum Safe level of unloading pump) and vapour space at the top (Corresponding to the Recommended Filling Level- RFL). The **Effective capacity as specified shall be guaranteed.**

Unloading time

The unloading time shall be the time taken for unloading the specified effective capacity of acid from the two cargo tanks. Two pumps (one in each tank) will be working**. Unloading time shall be guaranteed.**

Cargo Tanks (CT201 & CT202)

The barge shall be provided with 2 (two**) independent cylindrical cargo tanks having dished ends at both ends** with vertical submersible unloading pump on each cargo tank with unloading and recirculation lines. Both pumps shall be in parallel operation. All Piping MOC to be SS316L with 300# rating. Cargo tank MOC shall be IS 2062 or ASTM A516 Gr.70. Provision for level indication is to be provided on each cargo tank.

Loading facilities for loading acid to the cargo tanks shall be separately provided. Loading/ Unloading of each tank shall be carried out such that the liquid levels in both the tanks are same to preserve balance. Continuous monitoring of tank level is envisaged and the indication of level of both the tanks along with low level (low, low-low) & high level (high, high-high) alarms shall be provided at the panel inside the barge wheel house. Further to that, actuation of low-low alarm shall initiate the tripping of respective pumps (P201A/B). Radar (non-contact) type level measurement is preferred.

MOC of the pump shall be Alloy 20. There shall be one warehouse standby pump to take care of the exigencies of pump failure.

Ref P&ID no. 32667-11-PD-003,R2 & document no. 32667-11-SE-CT201,R2 enclosed for

further reference and detailing.

The unloading time for the cargo tanks is fixed as three (3) hours excluding coupling & decoupling time. Both the unloading pumps will be in parallel operation during unloading. Pumps are to be sized accordingly. Pump start/stop indication shall also be available at the panel.

Draining pump shall be made readily available in the barge by the bidder.

The entire barge shall be double skin and double hull type. The stability of the barge for the specified configuration is to be guaranteed by the bidder.

Dry Disconnect Coupling (DDC) shall be provided for coupling/ decoupling during unloading / loading operations as specified. The loading or unloading operations are to be carried out at owner's berths in Willingdon Island (WI), Udyogamandal Complex (UC) & Cochin Division (CD). The DDC for acid barge loading shall have a size of 100 NB and for unloading DDC shall have 80 NB size. The required number of hoses with the corresponding parts of DDC coupling shall be provided by the LSTK bidder in all the three berths so that coupling & decoupling operations can be carried out independently. All the hoses and DDC couplings (80 NB) provided in barge and berths of UC & CD for unloading shall be identical and suitable for interchanging among them. Likewise, all the hoses and DDC couplings (100 NB) provided in barge and berths of UC & WI for loading shall be identical and suitable for interchanging among them. Battery limits of FACT & Vendor are indicated in P & ID.

A separate fresh water tank along with two eye wash points shall be provided inside the barge for safety purposes. Also all other mandatory safety features shall be provided.

When barge is not in operation, the cargo tanks shall be preserved with nitrogen blanketing. FACT-CD shall arrange for facilities to provide nitrogen at the deck in CD.

Technical Details of the **Sulphuric Acid** Cargotanks:

Effective Capacity	:	**400 MT (2 X 200)**
Size*(Tentative)	:	…..M Long (T-T) x 2.4 M Dia
(*Shall correspond to effective capacity)		
Liquid handled	:	98.4% Sulphuric Acid
Specific gravity	:	1.84
Operating Temperature	:	40^0C
Design Temperature	:	65^0C
Operating Pressure	:	Atmospheric
Design Pressure	:	3.7 kg/cm^2
Empty weight	:	By the bidder
Material of Construction of major items in the barge		
Tanks	:	IS 2062 or ASTM A516 Gr.70.
Piping	:	SS 316L
Valves	:	Alloy 20

DDC couplings	:	Alloy 20
Vertical Submersible unloading pumps	:	Alloy 20 or superior for concentrated sulphuric acid service as certified by the pump manufacturer

6.2 Loading Philosophy

The loading point for Sulphuric acid is mainly at Willingdon Island. But provision for loading at UC is also envisaged. The current loading rate for Sulphuric acid at Willingdon Island is 300 MTPH. Accordingly, a pump (1W + 1S) of capacity 185 m^3/h is used for loading the barges with recirculation. The same system will be used for loading the new 400 MT Sulphuric acid barge at both UC and WI.

6.3 Unloading Pumps for Sulphuric acid cargo tanks

Data Sheet of Unloading pump (Doc no. 32667-11-SE-P201) is enclosed.

The pump used is vertical submersible type (2Working + 1 Warehouse Standby) vertically suspended centrifugal type VS-4/VS-5 as per API 610 with the specifications as per data sheet enclosed. The pump shall have a capacity of 40 m^3/h.
The pump capacity indicated in the datasheet (40 m^3/h) is tentative and the capacity shall be fixed after taking into consideration the specified unloading time, effective capacity etc. The power required by motor during unloading operations will be provided by owner at the battery limits. Facilities for providing connections from motor to the power source shall be under the scope of bidder.

Both the unloading pumps will be in line during unloading. Unloading of each tank shall be carried out such that the liquid levels in both the tanks are same to preserve balance.

The Minimum safe level (MSL) of operation of the unloading pump during the process of unloading shall be specified by the pump manufacturer in the data sheet.
The pumps are installed in a closed vessel so any leaks are contained in the vessel and do not pose a hazard to personnel. The shaft seal shall not be in contact with the acid but simply acts as a gas barrier. This feature is intended to eliminate the problem of leaks at the shaft seal that is a problem with horizontal centrifugal pumps.

6.4 Piping Specification for Sulphuric acid barge

Please ref P&IDs (32667-11-PD-003,R2) for details

Piping Material classification for Sulphuric acid barges : 3C4X

(3: Class 300, C: Stainless steel, 8: ASTM A 312 TP 316L, X: Special services-Use of Alloy 20 valves)

Alloy 20 valves and DDC Coupling Adapter (Cargo Tank Side) - Sulphuric acid barge : 3" & 4" ASA Flanged -drilled to 300 # ANSI B 16.5 , Material : Alloy 20

7.0 Performance Guarantee Test Run (PGTR) of the sulphuric acid barge

7.1 Procedure for PGTR

1. The Vendor shall carry out PGTR of barge by providing supervision services of competent personnel.
2. Vendor shall prepare detailed procedures for conducting guarantee test requirements beforehand in consultation with FACT so as to correctly evaluate the agreed guarantees.
3. After barges have operated steadily for a certain period, FACT and VENDOR shall decide the date of commencement of PGTR.
4. PGTR shall be conducted under normal operating conditions. Sufficient and necessary measurements shall be taken to ascertain the test results
5. PGTR shall be carried out for each barge for Five (5) or more consecutive cycles according to VENDOR's instruction and recommendation.
6. A cycle of operation of a barge for PGTR is envisaged to be loading operation at WI, transportation to CD, unloading at CD and journey back to WI.
7. As the above cycle of operation is envisaged to be the most frequently used one in future, this mode of operation shall form the basis for computation of the guaranteed works cost (OPEX) for evaluation and acceptance criteria.
8. During the PGTR, average results obtained during the period shall form the basis of comparison between actual performance and VENDOR's performance guarantees. The barges shall be deemed to have completed a successful GUARANTEE TEST RUN if these average results are equal to or better than the guarantees stated.
9. Successful completion of Guarantee Test shall not relieve VENDOR from obligation and responsibility in any manner with regard to modification / rectification / replacement to meet material and workmanship guarantee.
10. Deleted

11. During PGTR, vendor shall demonstrate that the effective capacity, unloading time and utility consumption of the unloading pumps, machinery/ engine for barges i.e power and diesel consumption shall be as specified in the specifications for phosphoric acid and sulphuric acid barges separately, as submitted by the vendor in the technical bid.
12. Make Good Clause:
    In case of any shortfall in the guaranteed performance within the limit, CONTRACTOR has the option to either replace or repair the BARGES to the extent required within areasonable time from test run, or opt for levy of damages wherever applicable.

However, if the guaranteed performance is not achieved during PGTR, CONTRACTOR shall carry out corrective action at no extra cost to the OWNER and demonstrate the guaranteed performance at least up to thelimit where performance deficiency damages is applicable, within a reasonable time frame.

However, if guarantees are not attained evenafter corrective action by CONTRACTOR, OWNER have option to undertake modifications/ additions for fulfillment of guarantees at the riskand cost of the CONTRACTOR and CONTRACTOR's liability in such caseshall be unlimited.

7.2 Guarantee on Effective Capacity of each barge

The effective Capacity shall be the unloaded (or usable) capacity of acid available from both the cargo tanks excluding the dead volume at the bottom of the cargo tanks (corresponding to MSL- Minimum Safe level of unloading pump) and vapour space at the top (Corresponding to the Recommended Filling Level- RFL).

Effective capacity of each barge as specified in the TPS shall be adhered to by the bidder in the PGTR without negative tolerances. Contractor will have to furnish the methodology for carrying out the guarantee test on effective capacity.

7.3 Guarantee on unloading time of each barge

The unloading time shall be the time taken for unloading the specified effective capacity of acid from the two cargo tanks. Two pumps (one in each tank) will be working**.**

The Unloading time of each barge as specified in the TPS shall be adhered to by the bidder in the PGTR without negative tolerances. Contractor will have to furnish the methodology for carrying out the guarantee test on unloading time.

7.4 Guarantee on Works Cost (OPEX)

7.4.1 Basis for Works Cost

Bidder will have to offer guaranteed rate of utility consumption for each specified utility for each barge per cycle of operation in the following table for working out the total guaranteed works cost per cycle of operation.

The works cost will be calculated on the basis of the guaranteed rates of utility consumption as well as unit prices for each specified utility indicated in the Table below. The Bidder shall have to adhere to the guaranteed rate of utility consumption for each specified utility

furnished in the offer. Guaranteed works cost for utility consumption shall be computed for one cycle of operation based on unit cost of utility and guaranteed rate of utility consumption.

A. Guaranteed Work Cost towards utility consumption for one cycle for Sulphuric acid barge (Bidder to quote)

Sl. No	Utility	Unit	Guaranteed Rate of consumption (By Bidder) (A)	Unit Rate of utility (B) Rs/unit	Works Cost per cycle (C= A*B) Rs/cycle
1.	Average Electric Power consumption during unloading per cycle	kWh		5.5	
2.	Average Diesel Consumption of the barge per cycle	Litres		67.17	
3.	Total Guaranteed Works cost for one cycle (Sulphuric Acid barge)				

The differential Works Cost (in comparison to Bidder quoting the lowest Works Cost) considering 600 Cycles per year (envisaged for the purpose of evaluation) will be calculated and will be discounted at rate of 4.05 % above SBI MCLR– 1 year, as on the date of opening of Part A Bid for a period of 15 years of operation starting from Final Acceptance. Such works costs shall be added to the Lump Sum price of respective BIDDERs to arrive at the Final Evaluated Price.

Price loading for bid evaluation purpose shall be in accordance with the following formula:

For Sulphuric Acid Barge (1 No)

Price loading = 1 x ((SCq (SB) – Scmin (SB)) x DF x 600

Where,

SCq (SB) = Total Guaranteed Works cost (Sulphuric Acid Barge) for one cycle quoted by the bidder

SCmin (SB) = The lowest Guaranteed total Works cost (Sulphuric Acid Barge) for one cycle quoted among the bidders

DF = Discounting factor to arrive at Net Present Value (NPV) based on number ofoperating years (in this case 15 years) at the rate of 4.05 % above SBI MCLR– 1 year, as on the date of opening of Part A Bid.

7.4.2 Actual Works Cost during PGTR

Actual works cost achieved will be calculated based on the rate of utility consumption for each specified utility in the table during PGTR for the total system supplied by the bidder.
Actual works cost achieved shall not exceed 104 % of the total guaranteed works cost. The work cost and above up to 104% of guaranteed work cost will beaccepted with penalty. For every1% increase (or part thereof) over guaranteed work cost, 0.75% of Total Order Value of the job will be deduced subject to a maximum of 0.75x4 = 3% of work order value shall be the penalty.

Beyond 104%, the Contractor shall have to modify the facility at his own risk &cost within a reasonable time. For details please refer 12th point of Clause 7.1

PROCESS DATA SHEET	BARGE CARGO TANK	32667-11-SE-CT201
		PAGE 1 OF 1 R1

	DESIGN DATA				BRANCHES & INTERNALS				SKETCH
1.	Equipment No.: **CT-201/202**			No. Of: 2 (Two)	**Tag**	**Description**	**Size(NB)**	**No**	
2.	Equipment Name: Sulphuric Acid Cargo Tank				A1	Inlet nozzle	150	1	
3.	Type: Cylindrical with dished ends-Gravity type				A2	Recirculation line	50	1	
4.	Material Handled: Sulphuric Acid[1]			Sp. Grt.: 1.84	B1	Outlet nozzle	100	1	
5.	Vapour Pressure: negligible	at	40	^{o}C	B2	Outlet nozzle spare	100	1	
6.	Op. / Design Pressure:	Atm. /	3.7	kg/cm^2	D1	Drain nozzle	50	1	
7.	Op. / Design Temp.:	40 /	65	^{o}C	L1	Level transmitter	100	1	
8.	Corrosion Allow. : ■ 3.2 mm		☐ As per code		M1	Manhole	600	1	
9.	Design Code: ASME Section VIII Div I				P1	Pump Flange	VTA	1	
10.	Inside Dia.: VTA[4]			mm	P2	Pump Flange spare	VTA	1	
11.	St. Height / Length: VTA[4]			mm	SN1/SN2	Spare nozzle	100	2	
12.	Effective Capacity: 2 X 200 MT (To be guaranteed)				V	Vent nozzle	200	1	
13.	**MATERIALS**				I1	Inspection Nozzle	150	1	Refer P & ID No. 32667-11-PD-003,R3 for cargo tank sketch
14.	Shell : IS 2062[2]	Lining: NA		Thk:					
15.	Heads: IS 2062[2]	Lining: NA		Thk:					
16.	Internal: IS 2062[2]	Lining: NA		Thk:					
17.	Nozzles: Carbon Steel[3]	Lining: NA		Thk:					
18.	Supports:	Brackets:			INTERNALS & ACCESSORIES				
19.	Pipes, Internal: Refer Piping Material classification	External: Refer Piping Material classification			1. Radar type level measurement shall be provided				
20.	Painting, Internals: NA	External: As specified			2. Platform shall be provided				
21.	Insulation Type & Thk.: NA				3. Colored silica gel in breather valve				
22.	Gaskets:Refer Piping Material classification								
23.	**Others (List):**				■ Breather Valve	☐ Flame Arrester	☐ Foam Chamber		Nominal Capacity: VTA[4]

Remarks:

1. 98.4 % Sulphuric Acid
2. Mild steel as per IS 2062 or ASTM A 516 Gr.70
3. Nozzles above 150NB shall be CS cladded with 3mm SS316L to prevent hydrogen grooving
4. VTA – Vendor to Advice (To suite effective capacity & stability

Rev	Details	By	Chkd.	Apprd.	Date
1	Comments incorporated	GKS	MV	KVR	02/06/2020
0	Issued for Comments	GKS	MV	KVR	25/05/2020

Project: P & ID for 400 MT Acid Barges

Client: M/s. FEW

FACT ENGINEERING AND DESIGN ORGANISATION

FEDO

11FT021/15

PROCESS DATA SHEET	PUMP	32667-11-SE-P201	
		PAGE 1 OF 1	R2

Equipment No.		P 201 A/B		
Equipment Name:		Sulphuric Acid Barge unloading Pump -Vertical Submerged		
No off: R2		2 working	1 Warehouse stand by	
Type of equipment		Vertically suspended Centrifugal pumps Type VS-4/ VS-5 (API 610) R2		
Operating conditions				
Fluid handled		Sulphuric Acid		
Analysis				
Pumping Temperature, ^{0}C		35^{o}C		
Density &Viscosity at Pumping Temperature		1840 kg / m^3 / cP		
Vapour pressure at P.T & pH value		negligible		
Operation level	unit	Normal	Minimum	Maximum
Capacity (Tentative)	m^3/h	40 R2	(See notes 2,3 and 4)	
Suction Pressure	kg/cm^{2}G	Flooded		
Suction Temperature	^{o}C	35		
Discharge pressure	kg/cm^{2}G	11.5 R2		
Differential pressure	MLC	60		
Minimum Safe Level (During unloading) (MSL)		By the pump manufacturer		
Net Positive Suction Head		MLC Available: Barge Vendor to specify	MLC Required: (From Mfr.)	
Duty		☐ Continuous / ■ Intermittent		
Drive		■ Electric Motor ☐ Turbine using……	……	
Capacity control		■ Local / ☐ Remote /	☐ Auto	
Location		☐ Indoor ■ Outdoor		
Area		■ Hazardous ☐ Non Hazardous		
Necessity to start against system pressure:		☐ Yes ■ No		
Materials of Construction				
Casing / Cylinders R2		Alloy 20		
Impeller / Pistons		Alloy 20		
Shaft		Alloy 20		
Packing / Mechanical Seal		To Seal the vapour in the tank		
Drive		Electric Motor		
Minimum Flow requirements ,m3/h		(From Mfr.)		
Shut-off head		(From Mfr.)		

Remarks:

1. Pumps shall be API 610 compliant.
2. The effective Capacity of Sulphuric acid in the two cargo tanks to be unloaded shall be 400 MT (2X200 MT) excluding the dead volume (corresponding to MSL) at the bottom of the cargo tanks and Vapour Space at the top (Recommended Filling Level-RFL).Effective capacity to be guaranteed
3. The unloading time for cargo tanks of effective capacity of 400 MT (2x200 MT) is fixed as three (3) hours. Two pumps (one in each tank) will be working in parallel. Unloading time to be guaranteed.
4. Pump capacity & discharge pressure shall be fixed accordingly.
5. Submerged bottom bushings may be used. Intermediate bushings for the pumps to be preferably avoided.

Rev	Details	Date	By	Chkd.	Apprd.	
2	Third Issue	02.06.20	GKS	MV	KVR	Project: Preparation of P&ID for 400 MT Acid Barges
1	Second Issue	23.05.20	MV	MV	KVR	
0	First Issue	20.05.20	MV	MV	KVR	Client: M/s FEW

11FT028/94

FACT ENGINEERING AND DESIGN ORGANISATION

FEDO

PROCESS DATA SHEET	LEVEL INSTRUMENTS	32667-11-SE-L201
		PAGE 1 OF 1 R1

Sl. No.	1	2
Tag No.	LT201	LT202
P&ID No.	32667-11-PD-003	32667-11-PD-003
Service / Location	Cargo tank / CT201	Cargo tank / CT202
Type	Radar	Radar
Mounting (L/P)	L & P	L & P
Fluid	Sulphuric Acid (98.4% Conc.)	Sulphuric Acid (98.4% Conc.)
Min. & Max. Level, mm	VTA	VTA
Pressure, kg/cm^{2}G	Atmospheric	Atmospheric
Temperature, ^{o}C	Ambient	Ambient
Density, kg/m^3	1840	1840
Range, mm	0 - 3000	0 – 3000
Material Of Construction	PTFE lined SS	PTFE lined SS
Nozzle Size & Spec.	100 NB & ASTM A 106 Gr.B	100 NB & ASTM A 106 Gr.B
Remarks		

Notes:

1. Level Instrument shall Indicate, Transmit & Alarm.
2. VTA – Vendor to Advice

						Project: P & ID for 400 MT Acid Barges
1						
0	Issued for Comments	GKS	MV	KVR	08/06/2020	**Client:** M/s. FEW, Kochi
Rev	**Details**	**By**	**Chkd.**	**Apprd.**	**Date**	

FACT ENGINEERING AND DESIGN ORGANISATION

FEDO

PROCESS DATA SHEET	PRESSURE INSTRUMENTS	32667-11-PI-002	
		PAGE 1 OF 1	R1

Sl. No.	Tag No.	P & ID No.	Service/Location	Type	Mounting (L / P)	Pressure kg/cm^2g	Operating Temperature ^oC	Range kg/cm^2g	Nozzle/Line Size & Spec.	Remarks
1	PG-201	32667-11-PD-003,R2	Sulphuric Acid Line / 100-SA-204-3C4X	Bourdon	L	11.5	35	0-20	.../ 100NB & 3C4X	
2	PG-202	32667-11-PD-003,R2	Sulphuric Acid Line / 100-SA-202-3C4X	Bourdon	L	11.5	35	0-20	.../ 100NB & 3C4X	

Notes:

Rev	Details	By	Chkd.	Apprd.	Date
0	After Comments	GKS	MV	KVR	03-6-20
0	First issue	MV	KVR	KVR	23-5-20

Project: Preparation of P&ID for 400 MT Acid Barges

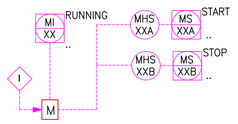
Client: M/s FEW

FACT ENGINEERING AND DESIGN ORGANISATION

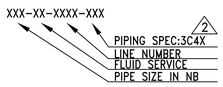
FEDO

11FT003/10

DETAIL " A" (2)



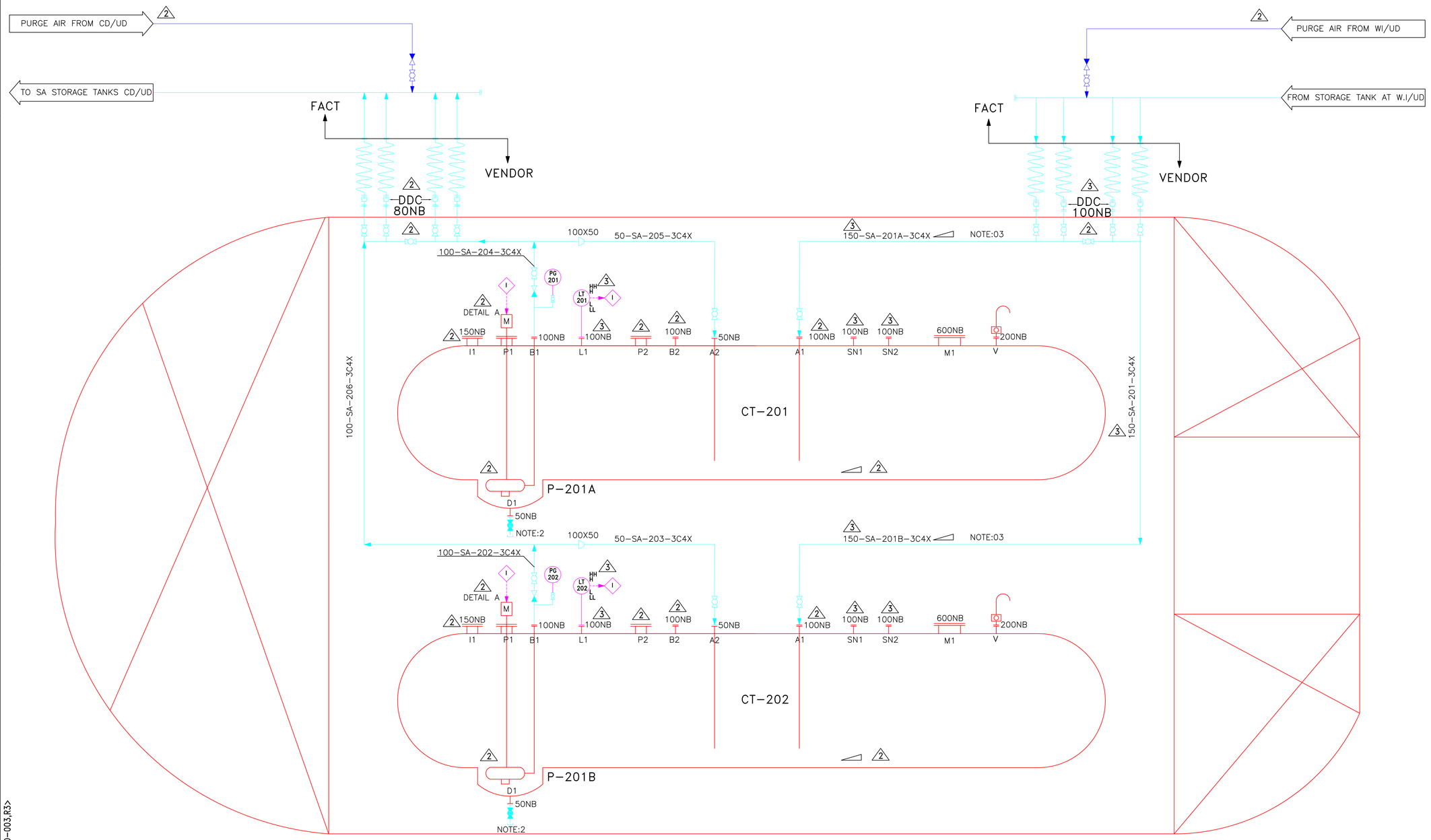
LINE IDENTIFICATION:



LEGENDS

(2) A1,A2	INLET	(2) P1,P2	PUMP NOZZLES	LT	LEVEL TRANSMITTER
B1	OUTLET	V	VENT	I	INTER LOCK
D1	DRAIN	QRC	QUICK RELEASE COUPLING	PG	PRESSURE GAUGE
(2) I1	INSPECTION NOZZLE	S.A	SULPHURIC ACID		BALL VALVE
L1	LEVEL TRANSMITTER	SN	SPARE NOZZLE	(2)	NON RETURN VALVE
M	MAN HOLE		SILICA GEL		NORMALLY CLOSED VALVE
			SLOPE 1:100		

FACT ↔ VENDOR : BATTERY LIMIT



SULPHURIC ACID BARGE

NOTES

GENERAL: (2)

3C4X -300 RATING,SS 316L,SPECIAL SERVICE-USE OF ALLOY20 VALVES. (2)

1. FIRE WATER HOSES SHALL BE PROVIDED WHEREVER NECESSARY.

2.DRAINING OF TANK SHALL BE CARRIED OUT USING TEMPORARY PUMP.

3.LOADING LINE TO THE CARGO TANKS SHALL BE PROVIDED WITH SUFFICIENT SLOPE,SUCH THAT LINES GET EMPTIED/DRAINED ON THE CLOSURE OF THE MAIN ISOLATION VALVE IN THE LOADING HEADER. (2)

4.VENT OF TANKS SHALL BE FITTED WITH SILICA GEL BREATHER.

5.DRY DISCONNECT COUPLING(DDC) SHALL BE PROVIDED AT INLET AND OUTLET HOSE CONNECTION.

6.DELETED. (2)

7.LEAD CLADDING FOR FLANGE CONNECTIONS SHALL BE PROVIDED.

8.OPERATION FOR A LONG TIME NITROGEN BLANKETING SHALL BE PROVIDED FOR THE CARGO TANKS. (2)

9.PUMP START&STOP INDICATION SHALL BE PROVIDED AT THE CONTROL PANEL AT THE WHEEL HOUSE. (2)

10.LEVEL TRANSMITTER WITH LOW LOW,LOW LEVEL&HIGH HIGH,HIGH LEVEL ALARMS SHALL BE PROVIDED AT THE CONTROL PANEL AND ACTUATION OF LOW LOW ALARM SHALL INITIATE TRIPPING OF CARGO PUMP. (3)

11.EYE WASH/SAFETY SHOWER WITH OVERHEAD TANK SHALL BE PROVIDED INSIDE THE BARGE. (2)

12.THE LOADING / UNLOADING OPERATIONS ARE TO BE CARRIED OUT IN THE OWNERS BERTHS IN WI, CD AND UC BY COUPLING / DECOUPLING OPERATION OF DDC. HENCE THE REQUIRED NUMBER OF HOSES WITH THE CORRESPONDING PART OF DDC COUPLINGS SHALL BE PROVIDED IN ALL THE THREE NOS OF OWNER'S BERTHS SO THAT THE COUPLING AND DECOUPLING OPERATIONS FOR LOADING AND UNLOADING CAN BE CARRIED OUT INDEPENDENTLY IN ALL THE THREE NOS BERTHS. ALSO ALL THE HOSES AND DDC COUPLINGS PROVIDED IN THE THREE BERTHS AND BARGE SHALL BE IDENTICAL AND INTERCHANGEABLE WITH EACH OTHER. (2)

13.LOADING/ UNLOADING OF EACH TANK SHALL BE CARRIED OUT SUCH THAT THE LIQUID LEVELS IN BOTH THE TANKS ARE SAME TO PRESERVE BALANCE. (2)

14.PUMP SPARE NOZZLE(P2) SHALL BE SUITABLE FOR PROVIDING WAREHOUSE STAND BY PUMP DURING EXIGENCIES. (2)

15.SUFFICIENT LIME SHALL BE STORED IN THE BARGE TO NEUTRALIZE THE ACID, IN THE EVENT OF A LEAK. (2)

16.BARGE PERSONNEL SHALL WEAR PPE DURING LOADING AND UNLOADING OPERATION OF ACID. (2)

A1

CLIENTS: M/s. FACT-CD

DRAWING NO.	TITLE	NO	ZONE	PARTICULARS	REVISED	CHECKED	APPROVED	DATE
REFERENCE DRAWING		3		AS MARKED	ST	MV	KVR	12/06/2020
		2	ZONE	AS MARKED	ST	AT	KVR	02/06/2020
		1	ZONE	AS MARKED	ST	MV	KVR	23/05/2020
		REVISION						

SCALE	NTS
DATE	16/05/2020
DRAWN	ST
CHECKED	MV
DESIGNED	MV
CHECKED	KVR
APPROVED	KVR

FACT ENGINEERING & DESIGN ORGANISATION
THE FERTILISERS AND CHEMICALS TRAVANCORE LTD
UDYOGAMANDAL KERALA

PROJECT NAME: PREPARATION OF P&ID FOR ACID BARGES — PROJECT No: 32667

TITLE: P&ID FOR SULPHURIC ACID BARGE

SHEET 1 OF 1 | DRG. No. 32667-11-PD-003 | REV. 2

<32667-11-PD-003,R3>
00FT004/10

TECHNICAL PROCUREMENT SPECIFICATION	VENDOR DATA INDEX	32472–02–PS–005 VDI	
		PAGE 1 OF 1	R 0

Fabrication & supply of 1 no. self-propelled barge with bullet tanks for transportation of 400MT Sulphuric acid	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	32472- 02-PS -005VDR
		PAGE 1 OF 2

Fabrication & supply of 1 no. self-propelled barge with bullet tanks for transportation of 400MT Sulphuric Acid

CLIENT : FACT Engineering Works, Palluruthy **TPS No.** : 32472-02-PS-005

STATUS [X] **TENDER** [ ] **COMMITMENT** **PO No.**

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 excecuted 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 & Monthly status report in excel format	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 annd Trails 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.

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
6.7	B	Fabrication drawing of the cargo tanks	3P	3P	4			3P+1S
6.8	B	Piping Diagram	3P	3P	4			3P+1S
7.0	C	**Final Documentation**						3P+1S

1. MAIN ENGINE

i) Ashok Leyland

ii) Cummins

iii) Greaves

iv) CAT

v) Volvo

2. STEEL PLATES

i) Steel Authority of India Ltd.

ii) Choudary Metal Distributors, Mumbai.

iii) Sanghvi Metals, Mumbai.

iv) The Tata Iron & Steel Co Ltd, Kochi.

v) TASC Engineers, Mumbai.

vi) Igawara Industrial Service and Trading PTE Ltd, Singapore.

vii) Metal Tube Industries, Mumbai.

viii) Steel Sales Company, Mumbai.

ix) Aristo Metal Industries, Mumbai.

3. GEAR BOX

i) Ghatge Patil

ii) PRM

iii) ZF

iv) Twin Disc

4. GENERATOR

A) PRIME MOVER

i) Simpsons

ii) Greaves

iii) Kirloskar

iv) Cummins

B) ALTERNATOR

i) Stamford

ii) IEC

iii) KEC

iv) KEL

5. VERTICAL SUBMERSIBLE PUMPS FOR SULPHURIC ACID

i) Chemlin Pumps & Valves Pvt Ltd

ii) Paul Bungartz Gmbh & Co KG

iii) Suzler Pumps AG

iv) Wilfley A R & Sons Inc

v) A R Wilfley India Pvt Ltd

vi) Chas-S-Lewis CO INC

vii) Suzler Pumps India Ltd

viii) Kishor Pumps Pvt Ltd

ix) Ensival Moret Belgium S.A

x) Friatec Aktiengesellschaft

6. HORIZONTAL CENTRIFUGAL PUMPS FOR WATER

i) Kirloskar Ebara Pumps Ltd

ii) Kirloskar Brothers Ltd

iii) Chemlin Pumps & Valves Pvt Ltd

iv) Best & Crompton Engg, Ltd

v) Jyothi Ltd

vi) KSB Pumps Ltd

vii) Mather & Platt (I) Ltd

viii) Sulzer India Ltd

ix) Sam Turbo Industry Limited

x) Kishor Pumps Pvt Ltd

xi) Voltas Limited

xii) Akay Industries Ltd

xiii) BE Pumps

xiv) Johnson

xv) Jabson

7. VALVES

i) BDK Marketing, Hubli.

ii) Fouress Engg, Mumbai.

iii) Intervalve (I), Mumbai.

iv) Kirloskar Brothers, Pune.

v) Larsen & Toubro, Chennai.

vi) Neco Schubert & Salzer, Nagpur.

vii) Nitone Valves, Mumbai.

viii) VIP Valves, Mumbai.

8. STEERING GEAR SYSTEM

i) Hydrive

ii) Kobelt

iii) Jastram

9. VHF

i) Icom

ii) Koden

iii) Furuno

iv) Garmin

10. DGPS

i) Garmin

ii) Koden

iii) Furuno

11. PAINTS

i) Akzo Nobel

ii) Jotun

iii) Hempel

****

MATERIAL SAFETY DATA SHEET – SULPHURIC ACID

1. CHEMICAL IDENTITY

Chemical Name :	Sulfuric acid	Chemical Classification :	Inorganic Acid
Synonyms :	Hydrogen Sulphate, Sulphuric Acid, Oil of Vitrol Battery Acid	Trade Name :	Sulfuric Acid
Formula :	H_2SO_4	C.A.S.NO :	7664-93-9
UN NO. :	1830		

2. PHYSICAL AND CHEMICAL DATA

Boiling Point :	330°C	Physical State :	Liquid
Appearance :	Colourless	Odour :	Odourless
Freezing point :	-1.1°C		
Vapour Pressure :	0.002mm Hg (@ 20°C)	Vapour Density :	3.4 (Air = 1)
Solubility in water @ 30°C :	Soluble		
Others :	Soluble in Alcohol		
Specific gravity :	1.843 @98.4% concentration		

3. FIRE AND EXPLOSION HAZARD DATA

Flammability of the Product :	Non-flammable.	Auto-Ignition Temperature :	Not applicable.
Flash Points :	Not applicable.	Flammable Limits :	Not applicable.
Products of Combustion :	oxides of sulfur	Explosion limits :	No data available

Explosive properties : Not applicable.

4. REACTIVITY DATA

CHEMICAL STABILITY : Stable under normal conditions.

MATERIALS TO BE AVOIDED:
Contact with organic materials (such as alcohol, acrylonitrile, chlorates, carbides, epichlorohydrin, fulminates, isoprene, nitrates and picrates) may cause fire and explosions. Contact with metals may produce flammable hydrogen gas. When diluting, add acid to water. Do NOT add water to the acid. Alkaline solutions; metals, metal powder; carbides; chlorates; fuminates; nitrates; picrates; strong oxidizing, reducing, or combustible organic materials. Hazardous gases are evolved on contact with chemicals such as cyanides, sulfides, and carbides.

CORROSIVITY: -
Extremely corrosive in presence of aluminum, copper, and stainless steel. Highly corrosive in presence of stainless steel (304). Non-corrosive in presence of glass.

CONDITIONS TO AVOID: -
Keep away from heat and sources of ignition. Avoid temperatures, which may have a negative effect on the materials of construction used in equipment.

HAZARDOUS REACTION PRODUCTS: -
Toxic gases and vapours (e.g. sulfur dioxide, sulfuric acid, vapours/mists and sulfur trioxide) may be released when sulfuric acid decomposes.

5. HEALTH HAZARD DATA

POSSIBLE ROUTES OF ENTRY :-

- Absorbed through skin.
- Eye contact.
- Inhalation.
- Ingestion.

EFFECTS OF EXPOSURE/ SYMPTOMS:-

INHALATION: Causes respiratory irritation and at high concentrations may cause severe injury, burns, or death. Effects of exposure may be delayed.

SKIN: Causes burns, and brownish or yellow stains. Concentrated solutions may cause second or third degree burns with severe necrosis. Prolonged and repeated exposure to dilute solutions may cause irritation, redness, pain and drying and cracking of the skin

EYES: Immediate pain, severe burns and corneal damage, which may result in permanent blindness.

INGESTION: Causes severe irritation or burns of the mouth, throat, and esophagus.

EMERGENCY TREATMENT: -

INHALATION: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Do not use mouth-to-mouth method if victim ingested or inhaled the substance: induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Give Cardiopulmonary Resuscitation (CPR) if there is no pulse AND no breathing. Obtain medical attention immediately.

SKIN CONTACT: Immediately flush skin with running water for a minimum of 20 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. Obtain medical attention immediately. Do not transport victim unless the recommended flushing period is completed or flushing can be continued during transport. Discard heavily contaminated clothing and shoes in a manner that limits further exposure

EYE CONTACT: Immediately flush eyes with running water for a minimum of 20 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention immediately. Do not transport victim until the recommended flushing period is completed unless flushing can be continued during transport.

INGESTION: do not induce vomiting. If victim is alert and not convulsing, rinse mouth and give ½ to 1 glass of water to dilute material. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water. IMMEDIATELY contact local poison control center. Vomiting may need to be induced but should be directed by a physician or a poison control centre. Immediately transport victim to an emergency facility.

6. PREVENTIVE MEASURES

ENGINEERING CONTROLS: Ensure sufficient air exchange and/ or exhaust in working areas
Use process enclosures, local exhaust ventilation or other engineering controls to keep airborne levels below recommended exposure limits. The most effective measures are the total enclosure of processes and the mechanization of handling procedures to prevent all personal contact with sulfuric acid. Safety showers and eyewash stations should be installed in storage and handling areas.

PERSONAL PROTECTECTIVE EQUIPMENT: -
Eyes: Chemical goggles and face shield.

Skin: Where there is a danger of spilling or splashing, acid resistant aprons or suits should be worn. Trouser legs should be worn outside (not tucked in) rubber boots.

Hands: Chemical-resistant, impervious gloves (i.e. neoprene) should be worn when handling sulfuric acid.

Respiratory: Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. A NIOSH/MSHA approved air-purifying respirator equipped with acid gas/fume, dust, and mist cartridges for concentrations up to 10 mg /m^3. An air supplied respirator if concentrations are higher or unknown.

ACCIDENTAL RELEASE PROCEDURES: -

Small Spill:
Cover with DRY earth, sand or other non-combustible material or absorb with an inert dry material and place in a loosely covered plastic or other appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate, lime, or other suitable neutralizing agent.
Large Spill:
Stop leak if possible without risk. Dike with dry earth, sand or other non-combustible inert material. Prevent entry into sewers or waterways. Consider neutralizing the residue with sodium carbonate, lime, or other suitable neutralizing agent. Ensure adequate decontamination of tools and equipment following clean up. Comply with Federal, Provincial/State and local regulations on reporting releases. Dispose of waste material at an approved waste treatment/disposal facility, in accordance with applicable regulations. Do not dispose of waste with normal garbage or to sewer systems

7. EMERGENCY AND FIRST AID MEASURES

FIRE FIGHTING MEASURES:-
Wear a NIOSH/MSHA approved self-contained breathing apparatus if vapours or mists are present and full protective clothing. For fighting fires in close proximity to spill or vapours, use acid-resistant personal protective equipment. Evacuate personnel to a safe area. Prevent unauthorized entry to fire area. Dike area to contain runoff and prevent contamination of water sources. Neutralize runoff with lime, soda ash or other suitable neutralizing agents (see Deactivating Chemicals, Section 6). Cool containers that are exposed to flame with streams of water until fire is out.

8. ECOLOGICAL INFORMATION

Ecotoxic Effects: Harmful to aquatic life in very low concentrations. May be dangerous if it enters water intake; Fish toxicity; 2.8 µg/L 96 hrs LC50 Rainbow trout. Products of Degradation: Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise. These products are sulphur oxides (SO2, SO3). Toxicity of the Products of Degradation: The products of degradation are more toxic than the original product..

9. DISPOSAL CONSIDERATION

Waste disposal: The generation of waste should be avoided or minimized wherever possible. Cleaned up material may be a hazardous waste on disposal due to the corrosivity characteristic. Disposal of this product and any by-products must comply with all local, state, and federal requirements. Consult your local and/or regional authorities.

Safety in the handling of sulphuric acid depends to a large degree upon effective employee education. A competent attendant must be on site whenever sulphuric acid is loaded, unloaded or transported. All Employees must be trained on the hazards that may result from improper handling of sulphuric Acid, 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.

1. SULPHURIC ACID LEAK

The most probable locations for an accidental spill are at the tanks, valves, pumps and pipelines carrying acid.

Tanks: Leaks of the tanks are mainly due to corrosion of material used for fabricating tank. Periodic checking of the plate thickness shall be carried out by using suitable NDT. In case actual thickness of the plate found to be below allowable thickness at any region of tank, transfer sulphuric acid to any other suitable buffer tanks. Provide reinforcements by welding pad plates at weak points of tanks or replace the tank with new one if there are many weak points.
Leaks can also happen if any portion of tanks gets damaged by means of external forces/factors. In such cases, transfer sulphuric acid to a suitable buffer tank and do correction works.

Valves: Leaks in valves are mainly due to faulty gland packing or due to passing of valves. Isolate sulphuric acid lines and remove valves with leak. Replace gland packing in case leaks are due to worn out gland packing. Replace valve if passing was observed in valves.

Pumps: Leaks in pumps are due to worn out seals of pump, worn out gaskets at casing, corrosion of casing, worn out gaskets at suction and discharge flanged joints. In case of excessive corrosion of casing replace the pump. If leaks are due to worn out, gaskets and seals shall be replaced with new one.

Pipelines: Leaks in pipelines are mainly due to corrosion of material of pipe, worn out gaskets at flanged joints of pipe etc.
If pipes got corroded replace the old pipes with new one. If leaks are due to worn out gaskets replace gaskets.

Operators on duty shall be always present during transfer operations and any leak that might occur is to be quickly controlled and corrected

2. 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 hazards, personal protective equipment must be well-maintained.

i. EYE PROTECTION

A pair of tight-fitting, indirect-ventilation splash goggles must be worn at all times when handling Sulphuric acid. A face shield (with safety goggles) may also be necessary. Contact lenses must not be worn when handling Sulphuric acid.

ii. RESPIRATORY EQUIPMENT

For concentrations up to 15 mg/m^3: Any supplied-air respirator operated in continuous-flow mode or any powered, air-purifying respirator with acid gas cartridge(s) in combination with a high-efficiency particulate filter.

For concentrations more than 15 mg/m^3: Any chemical cartridge respirator with a full face piece and acid gas cartridge(s) in combination with an N100, R100, or P100 filter; or Any air-purifying, full-face piece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter; or Any self-contained breathing apparatus with a full face piece; or Any supplied-air respirator with a full face piece.

For emergency or planned entry into unknown concentrations or IDLH (immediately dangerous to life or health) concentrations, any self-contained breathing apparatus that has a full face piece and is operated in a pressure-demand or other positive-pressure mode.

iii. SKIN PROTECTION

Where contact is likely, wear chemical-resistant gloves, a chemical suit, rubber boots, and chemical safety goggles plus a face shield. Eye wash facilities and shower must be available when handling this product.

iv. HAND PROTECTION

Wear appropriate chemical resistant gloves. Gloves impervious to the acid are recommended.

V. FIRE PROTECTION

Sulphuric acid is not considered to be a fire hazard. Contact with most metals causes formation of flammable and explosive hydrogen gas. Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep

fire exposed containers cool. If water is used, use in abundance to control heat and acid build-up.

3. POTENTIAL HEALTH EFFECTS

i. **Inhalation:** Not expected to be an inhalation hazard unless heated or misted. Very toxic, can cause death. Can cause severe irritation of the nose and throat. Can cause life-threatening accumulation of fluid in the lungs (pulmonary edema). Symptoms may include coughing, shortness of breath, difficult breathing and tightness in the chest. Long-term damage may result from a severe short-term exposure..

ii. **Ingestion:** Can burn the lips, tongue, throat and stomach. Symptoms may include nausea, vomiting, stomach cramps and diarrhoea. Permanent damage can result. Can cause death..

iii. **Eyes:** Corrosive. Contact causes severe burns with redness, swelling, pain and blurred vision. Permanent damage including blindness can result.

iv. **Skin Contact:** Corrosive. Contact can cause pain, redness, burns, and blistering. Permanent scarring can result. A severe exposure can cause death.

4. FIRST AID MEASURES

i. **Eye Contact**: Avoid direct contact. Wear chemical protective gloves if necessary. Quickly and gently blot or brush chemical off the face. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes, while holding the eyelid(s) open. If a contact lens is present, do not delay flushing or attempt to remove the lens. Neutral saline solution may be used as soon as it is available. Do not interrupt flushing. If necessary, continue flushing during transport to hospital. Take care not to rinse contaminated water into the unaffected eye or onto the face. Immediately call a Poison Centre or doctor. Treatment is urgently required. Transport to a hospital.

ii. **Skin Contact:** Avoid direct contact. Wear chemical protective clothing if necessary. Quickly take off contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Quickly and gently blot or brush away excess chemical. Immediately flush with lukewarm, gently flowing water for at least 30 minutes. do not interrupt flushing. If it can be done safely, continue flushing during transport to hospital. Immediately call a Poison Centre or doctor. Treatment is urgently required. Transport to a hospital. Double bag, seal, label and leave contaminated clothing, shoes and leather goods at the scene for safe disposal.

iii. **Inhalation:** Take precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). Move victim to fresh air. Keep at rest in a position comfortable for breathing. If breathing is difficult, trained personnel should administer emergency oxygen. Do not allow victim to move about unnecessarily. Symptoms of pulmonary edema may be delayed. Immediately call a Poison Centre or doctor. Treatment is urgently required. Transport to a hospital.

iv. **Ingestion** Have victim rinse mouth with water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Have victim rinse mouth with water again. Immediately call a Poison Centre or doctor. Treatment is urgently required. Transport to a hospital.

5. ACCIDENT RELEASE MEASURES:

Immediately evacuate personnel to safe areas. Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Avoid discharge into drains, water courses or onto the ground. Contact local authorities in case of spillage to drain/aquatic environment. If possible, dike well ahead of the spill to prevent runoff into drains, sewers, or any natural waterway or drinking supply. Prevent entry into waterways, sewer, basements or confined areas.

Methods for cleaning up:

Ventilate the area. Eliminate all ignition sources if safe to do so. Absorb spillage to prevent material damage. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.

Small Spills: Contain and absorb spilled liquid with non-combustible, inert absorbent material (e.g. sand). Dilute alkali with water and neutralize with acids (e.g. acetic acid / vinegar).

Large Spills: Prevent entry into waterways, sewer, basements or confined areas. If not recoverable, dilute with water or flush to holding area and neutralize. Remove with vacuum trucks or pump to storage/salvage vessels. Following product recovery, flush area with water. Clean surface thoroughly to remove residual contamination. Do not flush spill to drain.

6. HANDLING AND STORAGE:

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture, incompatibilities, and direct sunlight.

If product is transferred to another container, ensure new container is suitable for the product. Prevent accidental contact with incompatible chemicals. Since sulphuric acid is corrosive to mild steel, store in rhepanol lined or 316 stainless steel properly labelled containers. Do not wash out container and use it for other purposes. Regularly inspect for physical changes or signs of crystallization, damage or leaks. Protect the container from freezing.

When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing.

Refer the Material Safety Data Sheet attached for more details of Sulphuric Acid**.**

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