COCHIN SHIPYARD - CT3370
70 T BOLLARD PULL ASD TUG -
OUTLINE TECHNICAL SPECIFICATION

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Revision No.	Date	Description	Sign
Rev.I	03 Sep 21	First Issue	ABK/HUR

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GENERAL

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GENERAL

A DESCRIPTIONS

Intent

The intent of this specification along with the accompanying documents is to describe the standards of workmanship and the overall requirements of an Azimuth Stern Drive (ASD) tug.

Propulsion considered for this vessel constitutes two steerable Z-drives located in the aft each driven by a diesel engine.

In cases where the Buyer requires alternate modes of propulsion or energy sources, separate design conforming to Buyer's requirement may be developed by the respective Builder/Designer. The workmanship and quality of the vessel set out by this specification shall be complied in such cases also.

Primary Functions

The vessel shall be primarily tasked for ship handling and towing operations.

The tug shall be able to perform the following operations:

- Berthing/ Unberthing
- Escort operations within harbour at speeds less than 6 knots (Ship assist operation)
- Pushing/Pulling
- Fire-fighting
- Emergency Towing Capability
- Oil Spill Response Operations (equipped with Oil Spill Booms)
- Personnel /Material Transfer
- Emergency assistance outside harbour areas

Area of Operation

The ship shall operate as a sea going vessel.

Operating Profile

The ship shall be designed for the following operating profile:

Sl. No.	OPERATIONAL REGIME	% of time of operation
1.	**Stand By**	35
2.	**Transit Low speed** (<50% max speed)	25
3.	**Transit High speed** (>50% max speed)	10
4.	**Low Bollard Pull Operation** (<50% Max bollard-pull)	20
5.	**Medium Bollard Pull Operation** (50-90% Max bollard-pull)	8

6.	**High Bollard Pull Operation** (>90 % Max bollard-pull)	2

The exploitation of the vessel shall be approx. 3500 hours/year.

Service Life

The vessel shall have an expected service life of 20 years.

B MAIN PARTICULARS

The principal design characteristics of the vessel shall be as follows:

Length overall	abt. 33.0 m
Length between perpendiculars	abt. 31.3 m
Breadth moulded	abt. 11.9 m
Depth midships	abt. 5.4 m
Hull draught	abt. 4.2 m
Navigational. draught	abt. 5.4 m
Gross tonnage	<500 GT

Navigational draught to be finalized based on the restrictions of the operating port.

C COMPLEMENT

The vessel shall be arranged with accommodation as shown in the General Arrangement drawing for a total complement of 14 persons.

D CAPACITIES

The capacity of fuel oil, lube oil and fresh water shall be designed commensurate with the endurance requirements of the vessel.

Minimum capacities to be provided are as given below:

Fuel Oil	-	approx. 170 m^3
Fresh Water	-	approx. 30 m^3

E PERFORMANCE

The vessel shall have a static ahead bollard pull of 70 tonnes at 100 % MCR of the engine.

The vessel shall achieve a speed of approx. 12 knots at design draught with clean hull at 90% MCR, with wind speed not exceeding BF 3.

Endurance

The vessel shall be designed for an endurance of 15 days with maximum of 18 hours operation per day and operating profile mentioned as per section A.

Environmental Conditions

Machinery shall be able to deliver its specified output and operate satisfactorily under tropical conditions as mentioned below:

- Sea water temperature max. 32° C

	min. 5° C
• Air temperature outside	max. 45° C
	min. 10° C
• Relative Humidity	max. 90%
	min. 50%

F CLASSIFICATION, REGULATIONS, CERTIFICATES

Classification

The Tug shall be built in accordance with the rules and regulations of the Indian Register of Shipping (IRS) and according to the following notations:

卐 SUL, 卐 IY, TUG, AGNI – 1 (2400 m^3/hr)

or equivalent notations of any other IACS member society. For any optional notations in addition to the above, including INWATER SURVEY etc., necessary changes in accordance with the respective class notations shall be made by the builder/designer.

Statutory

The Tug shall be designed and built as Sea Going Vessel complying to latest amendment of Indian MS Rules for sea going ship as applicable at the time of vessel construction.

In case the Vessel is to be designed as River Sea Vessel/Coastal Vessel, necessary changes as required by relevant statutory regulations as applicable are to be considered.

The vessel shall sail under Indian Flag.

Rules and Regulations

Tug shall be in compliance with all relevant International Standards as applicable at the time of construction, including (but not limited to) the following:

- Indian MS Rules for Seagoing vessels
- COLREGS - International Regulations for Preventing Collisions at Sea
- Load Lines, 1966/1988 - International Convention on Load Lines, 1966, as Amended by the Protocol of 1988
- MARPOL - International Convention for the Prevention of Pollution from Ships
- Tonnage - International Convention on Tonnage Measurement of Ships, 1969
- 2008 IS Code – International Code on Intact Stability, 2008
- International Labour Conference – Maritime Labour Convention, 2006
- IMO regulations A 468 (Noise levels) and ILO Recommendation R141 as far as practicable for tugs.
- International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001

Certificates

The Builder shall obtain following certificates/ equivalent and deliver to the Buyer at the delivery of the vessel.

a. Certificate of Classification for Hull and Machinery Survey
b. Bollard Pull Certificate
c. International Tonnage Certificate

d. Load Line Certificate
e. Ship safety Construction Certificate
f. Ship safety Equipment Certificate
g. Radio Telephone Certificate
h. Certificate of Anchors, Chains, Life Saving equipment and Fire Fighting equipment
i. International Oil Pollution Prevention Certificate
j. Builder's Certificate
k. Certificates of anchoring and mooring equipment
l. Certificates for Compass adjustment
m. Trim and Stability Booklet
n. MARPOL Annex IV Sewage Pollution Prevention Certificate
o. All other certificates as required by Class.

G BUILD METHOD AND WORKMANSHIP

Generally, all works shall comply with the requirements of the Classification Society and other Authorities governing this specification.

Steel work to be carried out in compliance with IACS Rec. 047 Part A "Shipbuilding and Remedial Quality Standard for New Construction".

All works shall be carried out in accordance with the approved drawings.

The electrical installation to be according to IEC norms.

All equipment and machinery to be installed according to manufacturer's instructions.

Due care and diligence shall be ensured in protection and cleanliness of all items and equipment being installed in the vessel.

- All materials intended for, or allocated for the construction of the vessel, shall be properly stored or protected from the weather immediately upon arrival at the Builder's yard.
- Electrical, electronic, and interior communication equipment shall be protected against dampness and condensation. Sensitive electronics shall be protected from extreme temperatures as recommended by the OEM.
- Heater elements of electric motors higher than 90 [kW) should be energized after installation onboard.

All workmanship for the vessel shall comply with global best shipbuilding practices followed for similar vessels, including the following:

- Pre-treatment of materials
- Flame cutting, bending, welding, welding sequence
- Assembling
- Use of tools
- Alignment, fairness, tolerances
- Launching, testing & fitting-out practice
- Temporary access openings
- Building sequence, application of modules, pre-outfitting, painting etc.

I MATERIALS

Materials used for building and construction of the vessel, shall be as described below:

- All materials, machinery, equipment, appurtenances, and outfit which are supplied by the Builder shall be new, good commercial quality, and carefully selected for the purpose they are intended to serve.
- Material and equipment shall be procured from recognized manufacturers and shall satisfy the requirement of the Rules and regulations in force.
- Neither asbestos nor asbestos containing material shall be used in construction of the vessel.
- Wherever stainless steel is mentioned, seawater resistant stainless steel such as 316L to be used.

J NOISE & VIBRATION CONTROL

Special consideration shall be given to limit the noise levels within the vessel to a level as prescribed in IMO regulations A 468 (Noise levels) and ILO Recommendation R141 as far as practicable for tugs, by means of suitable sound insulation and isolation. Special attention shall be paid to keep the noise levels within the prescribed levels for crew cabins adjacent/close to machinery spaces.

Vibration limits in accommodation spaces and other work areas shall conform to ISO 6954:2000 at free running speed, as applicable for this type of vessel. However, the requirements from the Buyer regarding vibration levels shall also be taken into consideration.

Special attention shall be taken to limit the local vibrations from main machinery and other equipment such that these vibrations do not cause any malfunction or damage to the equipment when the vessel is in service.

K DRAWINGS

General

Required documentation to Regulatory Authorities, Classification Society and Buyer shall be handled by the Builder.

All documentation shall be in English language. Method of drawing including the scales to suit Builder's standard practice.

Buyer Approval

Builder shall submit, to the Buyer a set of Classification Documents for their approval. The method of submission and schedule for the approval of the drawings shall be decided by the Buyer and Builder separately before commencing the project.

Classification Documents

Builder shall prepare and submit for approval to Classification Society all documents that mandate Class approvals. Builder is obligated to incorporate all comments and remarks made by Classification Society.

Documents to be provided at delivery of the vessel

The Builder shall hand over at least the following drawings and manuals to the Buyer at the time of delivery of the vessel.

- General Arrangement Plan
- Final Stability Booklet
- Midship Section
- Transverse Sections including bulkheads

- Shell Expansion Plan
- Profiles & Deck Plan
- Superstructures / Deck Houses
- Skeg Structure
- Docking Plan
- Machinery and Propulsion Arrangement
- Piping diagram schematic
- Navigation Lights and Sound Signals Plan
- Life Saving Appliances Plan
- Fire Fighting Plan
- Electrical Single Line Diagram
- Electrical Wiring Diagram
- Electrical Equipment Arrangement
- General Service and Radio Service battery load Analysis
- Electrical Load Analysis
- Wheel house Arrangement
- Accommodation Plan
- Sounding Tables
- Towing Arrangement
- List of Machinery, Equipment and Plants of Third Parties' Supply, with following Details: name of manufacturer, address, telephone no.

The list however, is non exhaustive and at the time of signing the Shipbuilding Contract, any additional documents, if found necessary by the Buyer may be included to firm up the final list of Delivery documentation.

In addition, any drawing that needs to be displayed on the vessel as per Class or Regulatory Authority guidelines shall be properly framed and placed onboard the vessel by the Builder.

Instruction Books

Instruction books of the vessel's major machinery, i.e., Main Engines, Azimuth Thrusters and Generators and other major equipment and systems shall be furnished to the Buyer. (The number of copies that needs to be furnished shall be finalized by the Buyer and the Builder at the time of signing the Ship Building Contract)

The builder shall also prepare data booklets of for Hull, Machinery and electric equipment giving the name/address of makers and references to such information as maintenance instruction books and/or spare parts list.

Spare part booklet for main engine & other equipment shall be submitted at the time of delivery along with the delivery documents.

L EQUIPMENT AND SPARES

Spare parts shall be supplied by the Builder according to the OEM Specifications, which are mandated by Classification Society and Regulatory Authority for the intended operation.
The list of inventories that needs to be supplied along with the ship shall be as finalized between the Buyer and the Builder.

MAIN GROUP 1

SHIP GENERAL

MAIN GROUP 1

SHIP GENERAL

10 SPECIFICATION, GEN. DESIGN, etc.

Measurements, calculations, etc. shall be in accordance with metric or decimal systems.

SI unit system shall be generally used throughout the vessel for drawings, scales etc.

The Builder is entitled to apply the following standards:

- Standards issued by International Organisation for Standardisation (ISO}/Norsk Standard(NS), Japanese Standards Association (JIS)/ German institute for standardisation (DIN) or other renowned standards.
- International Electrotechnical Commission (IEC) Publication No.60092 -"Electrical Installations in Ships"

101 MODEL TESTING & ANALYSIS

Model test may be conducted if deemed necessary.

The model test, if required, shall be performed in a reputed and recognized model testing facility conforming to ITTC standards of tank testing and extrapolation. The test shall be conducted in the presence of Buyer's representative for confirming the propulsive power, speed, bollard pull, etc. The scope of model test shall be finalized by the Buyer and the Builder. The test shall include the following:

a. Resistance test at designed draught
b. Self-Propulsion test at designed draught
c. Propeller open water test for designed propeller
d. Bollard pull test at designed draught

12 SHIP MODEL (OPTIONAL)

One off model of suitable scale in illuminated glass cabinets to be delivered by the Builder in case of requirement from the Buyer.

15 QUALITY CONTROL, INSPECTION, TESTS & TRIALS

All hull structure, machinery, electrical equipment and outfit shall be inspected and approved by the Buyer or their authorized representative according to normal shipbuilding practice during the construction of the vessel. The completed vessel with all machinery, outfit and equipment shall be tested by the Builder to demonstrate their efficient working and to confirm that all requirements of the specifications and plans are fully complied with.

The Buyer shall be intimated in advance on the dates of all major tests and trials including Sea Trials, FAT of major equipment, Inclining Experiment etc.

151 MACHINERY TESTING

All tests and trials shall be carried out in accordance with OEM recommendations, Class & authorities' requirements and as per Builder's standard practices. OEM recommended test & trial protocols shall be approved by Buyer, and Class wherever applicable.

Dock Trial

Builder shall demonstrate the complete workability and correct functioning of the vessel, its main engines and propulsion units, auxiliaries, generators, systems, equipment, etc. and notify/issue trial schedule to the Buyer. These dock trials shall be conducted in presence of representatives of Class, Buyer's representative(s) and other Regulatory Authorities where applicable.

152 INCLINING EXPERIMENT

The inclining experiment shall be conducted when the vessel is as nearly complete as possible, under the supervision of Classification Society, Regulatory Authority and the Buyer, to ascertain the lightship weight and vertical centre of gravity as per classification society requirements.

The inclining experiment report shall be submitted to the Buyer and Classification Society, showing calculation of metacentric height and other related characteristics as required.

Final Stability Booklet, incorporating the results of inclining experiment shall be submitted for approval to the Classification Society and Regulatory Authority.

In case of series vessels, inclining experiment shall be conducted on first vessel of the series only. For other vessels, lightship assessment shall be conducted as per Classification guidelines for completing the stability booklet.

154 SEA TRIALS

Sea trial shall be carried out when the vessel is substantially completed. Auxiliary machinery, deck machinery, life-saving equipment, electric system, communication system, piping system, etc. are tested, as to confirm their operation. All trials to be carried out as per Class Guidelines, OEM recommendations and Builder's standards/practices. The trial protocol shall be approved by Class and Buyer.

- Speed trials are to be carried out at 50%, 75%, 90% and 100% MCR of the engine at design draught of the vessel. The vessel's speed shall be measured by means of electronic measurement system (DGPS) for one double run. One double run shall consist of one (1) run in a direction on the course and one (1) run in the opposite direction. There shall be no correction on the results obtained up to sea state corresponding to BF3.

- The following manoeuvring tests shall be performed.
    i. Turning Circle Test
    ii. Zig-Zag Tests
    iii. Crash Stop Test - Ahead
    iv. Crash Stop Test - Astern

- Endurance trial is to be carried out at MCR RPM of the main engines for a period of not less than four hours. Throughout the period, readings of pressures and temperatures are to be recorded as per engine manufacturers' recommendation.
  Fuel oil consumption is to be recorded for both engines during endurance trial.

- Steering gear trials are to be carried out, in accordance with Classification Society requirements. The time taken to move the thruster and the thruster angle is to be recorded.
- Anchor trials are to be carried out in accordance with Classification Society requirements.
- Bollard Pull test

Bollard pull of the vessel has to be assessed during performance trials. The vessel is to demonstrate a minimum static bollard pull of about 70 tons in the ahead condition with vessel loaded to design draught.

During the bollard pull trials, adequate propeller immersion is to be ensured.

The depth of water below keel is not to be less than 2 times the maximum draught of the vessel.

Length of the tow ropes, measured between the stern of the vessel and the test bollard, shall be at least two times the length of the vessel.

Bollard pull shall be measured by a calibrated dynamometer.

16 GUARANTEE

The vessel shall be guaranteed for a minimum period of twelve (12) months after the official delivery date. This guarantee shall include all workmanship, material, machinery, equipment, outfitting, painting and other items.

However, damages resulting from mishandling of equipment or installation, or operation contrary to the instruction of the maker are excluded from the scope of this guarantee.

MAIN GROUP 2

HULL

MAIN GROUP 2

HULL

20 HULL MATERIALS, GENERAL HULL WORK, etc.

201 HULL MATERIALS

Structural Steel

The main hull shall be all welded steel construction conforming to classification society rules. The steel for hull construction shall be in general of Grade A. High tensile steel may be used as appropriate, as per the class approved drawings.

The materials used shall be of good international shipbuilding standards. Steel plates, forgings and castings shall be delivered with certificate according to the Classification Societies and Regulatory Authorities' requirements. Test marks and makers name shall be clearly stamped there on.

204 TESTING OF TANKS, BULKHEADS

Air pressure tests shall be done for all tanks as required by Classification rules.

Hose testing of doors, hatches and other shell side and deck openings shall be done according to Classification Society requirements. Hose testing shall be carried out on all watertight structures, which are not tested by water or air pressure.

Structural Testing

Structural testing (hydro-test) for tanks (except voids) shall be done as per class requirements.

The tests shall be performed in the presence of Class Surveyor and Buyer Representative. Also, the Buyer shall be intimated about the test schedule in advance.

Test reports shall be submitted to the Buyer.

205 NON-DESTRUCTIVE TESTING (NDT)

NDT shall be carried out as per Class requirements.

X-ray testing shall be carried out as per Classification Society requirements and class approved NDT Plan.

Ultrasonic or dye-penetration test of weld shall be carried out to the satisfaction of Classification Society where it is not possible to undertake X-ray testing.

207 WELDING

Welding shall be carried out in accordance with the requirements of classification society.

Welding of hull and all main structural elements shall be carried out only by welders qualified through standard welding procedures approved by Class.

21 AFT BODY

The thickness of the shell plating shall be in accordance with class requirements. Increased thickness may be considered if required i.w.o. thruster units, based on structural analysis and recommendations from supplier, if any.

Aft body shall be suitably stiffened to prevent vibration. The thrusters shall be supported by deep solid floors.

A double plate skeg of adequate size shall be fitted on the centre line. Skeg depth shall be finalized based on the navigational draught restrictions and dimensions of the selected thruster.

22 ENGINE & MIDSHIP AREA

Engine room area (especially i.w.o of engine foundations) shall be adequately stiffened so as to minimise the vibration effects.

223 ENGINE FOUNDATION

Adequate strengthening shall be ensured for structure i.w.o. of engine foundations.

The design of foundation shall be as per class requirement and in accordance with manufacturer's recommendations.

The design shall ensure good connection of the foundation with the supporting/connecting structure for load transfer.

226 BULKHEADS AND TANKS BELOW MAIN DECK

Bulkheads

Bulkheads shall be suitably stiffened in accordance with Class requirements.

Hull Tanks

Hull integrated tanks shall be arranged according to the general arrangement drawing.

Separate Service/Day tanks shall be provided for engine room as indicated in the GA drawing. The capacity of the day tanks shall be decided as per class/statutory requirement.

23 CARGO AREA

Deck loading in the aft working deck shall be 5 t/m^2 or as agreed between the builder and the buyer. The vessel shall have a working deck area of at least 65 m^2.

24 FORE BODY

General

Increase in plating thickness may be considered, if necessary, at near vicinity of anchor handling or where large local loads are expected, but need not be greater than class rule requirements.

Collision bulkhead shall be provided in accordance with class rules.

247 CHAIN LOCKERS

Chain locker for anchor chain cable shall be provided. The size of chain lockers shall be sufficient to accommodate full length of the chain.

25 DECK HOUSE AND SUPERSTRUCTURE

251 SUPERSTRUCTURE

The superstructure shall be arranged in accordance with the GA drawing approved by Buyer. The structural scantling shall be in accordance with class requirements.

253 MAST

A steel mast for navigation lights and antennae is to be fitted at the suitable location on the wheelhouse top deck at centreline.

Mast height and mast fittings including Navigation lights, signal flag yard, radar, antennae etc. shall be determined in accordance with relevant Class/Statutory Rules.

Adequate stays shall be fitted, if necessary, to reduce vibration.

The hull structure under the mast shall be stiffened suitably.

Masts to have rungs carried on top, arranged for access to light trays and necessary fittings. Safety cage to be fitted if necessary.

254 BRIDGE

The wheelhouse shall be designed and built with as near as possible 360° unobstructed visibility.

Bridge shall be provided with clear, wide and large size windows wherein each bridge window shall be fitted with a pull down/roll up sun screen shade and wipers. Suitable arrangement shall be provided for washing wheelhouse front windows.

Tinted sky windows are installed slantwise in the wheelhouse top deck, fitted in metal frames.

Additionally, the wheelhouse window may be provided with clear view screen (CVS), based on the requirement of the Buyer.

26 HULL OUTFITTING

261 HULL MARKINGS

All markings shall be as per best global standards.

The ship's name shall be marked with suitable materials and mounted on the superstructure port and starboard (P&S).

Other hull markings like Port of Registry, IMO number, Owner’s logo etc. shall be provided at appropriate locations, as agreed between the Builder and the Buyer, as per global best shipbuilding practice.

Draught marks shall be marked using weld beads/steel plates and shall be painted in white on bow and stern on P&S sides. Horizontal marks at every 100mm distance, metrical scale shall be followed.

The vertical extent of the draught marks shall be adequate to cover the draught of the vessel under all probable conditions of loading and corresponding trims with the vessel undamaged.

All machinery equipment, valves, hand wheels, levers, doors, ventilation etc. shall be indicated by name plates of plastic/suitable non corrosive metal with black letters in English.

Bottom plugs and manhole covers shall be marked with tank number and content using weld beads.

Water tight bulkheads, tank boundaries, number and contents shall be marked on hull and deck.

Loaded waterline shall be marked using appropriate paint as per global best shipbuilding practices.

262 BOTTOM PLUGS, BILGE WELLS ETC.

One (1) bottom plug each shall be supplied and fitted in hull tank, cofferdam, etc. where considered necessary.

The size and design shall be as per global best shipbuilding practices.

Water tanks shall have square and oil tanks shall have hexagonal sockets respectively.

Special attention shall be given to locate the bottom plugs as close as possible to the lowest point of each tank. The bottom plugs shall be kept clear of points designated for keel blocks as per docking plan.

Bilge wells and sea tubes shall be arranged as necessary at suitable places in the double bottom.

263 FOUNDATIONS

All auxiliary, deck machinery, electrical equipment etc. shall be erected on foundations.
As far as practicable, all deck machinery foundation shall be open type with accessibility for cleaning and painting works. Suitable reinforcements and insert plating shall be provided under the machinery, wherever necessary. Proper draining arrangement shall be provided to avoid accumulation of water.

264 FENDER, BILGE KEEL

Fender

Bow	– Cylindrical Fender with ~ 900 mm diameter – W fender: 480 mm wide x 300 mm thick
Stern	– Cylindrical Fender with ~ 900 mm diameter
All around the vessel	– D fender: 380 mm x 380 mm

Tyre fenders are to be fitted around the vessel such that 3 nos. large tractor/truck/earth moving equipment tyres arranged at the bow and heavy-duty air craft tyres abutting either side of the vessel.

Fendering arrangement specified above is indicative only. The final arrangement including the selection of fender types and size shall be decided based on Buyer's preferences on fender type and fender pressure.

Arrangements for fender cooling may be provided based on the requirement of the Buyer.

Bilge Keel

Bilge keels are to be provided on the vessel.

Welding of bilge keel is to be performed as per Class approved design drawings. Preferably, notch welding shall be applied iwo bilge keel and the bilge keel has to be welded on doubler plate against shell plating.

266 HAWSE PIPES

The hawse pipe with anchor pocket shall be fitted in such a way that free anchor fall is obtained. The anchor pocket shall be designed for accommodating stockless anchors

The hawse pipe shall have adequate diameter and length to easily house the anchor shank and shackle.

Chafing ring of steel bar shall be fitted at the lower edge of chain pipe for protection and smooth running of chains.

267 BULWARKS

Strong bulwarks of steel plate, suitably stiffened shall be fitted all round the vessel at main deck and forecastle deck.

The bulwark shall have tumble home and access doors shall be provided on both port and starboard side in the main deck level. Additionally, access may be provided on forecastle level for pilot boarding (Optional).

The height of the bulwark shall be 1.0 m and with stays spaced not more than 1.2 m apart.

The top of the bulwark shall be reinforced with a flat bar/ steel pipe of suitable dimension/thickness.

27 MATERIAL PROTECTION

271 PAINT SPECIFICATION

The paint system shall be of good quality marine grade. The final paint specification shall be mutually agreed between Builder and Buyer, as per the recommendations from the paint maker.

Final colour and decals to be confirmed by Buyer.

Paint in underwater hull, water ballast tanks, fresh water tanks to be guaranteed for five (5) years. All dry film thicknesses shall be as recommended by supplier for a five (5) year system.

Paint specification and surface preparation to be of high standard, wherein prior to fabrication, all steel work to be shot-blasted to SA 2.5 and shop-primed. The surface preparation and paint specification shall be in compliance with SOLAS with respect to toxic and environmental requirements. Surface treatment shall be given to all welds, sharp edges, undercuts, slag, etc.

Decks to be coated with high friction anti-skid paints, in alignment with the paint scheme.

All edges, corners, logs, weld seams, etc. to be stripe coated with brush or roller, between each layer according to paint maker's instructions.

Descaling, shop priming, de-rusting and painting works shall be carried out in accordance with the paint makers recommendation and yard practice.

In general, if in water-time before delivery exceeds 180 days (number of days shall be mutually decided between the Buyer and the Builder), a diver inspection shall be carried out and attended by a qualified paint maker.

All necessary remedial works as per the recommendations of the paint maker shall be carried out based on the observations during such inspections, including re-docking if necessary.

Paint Scheme

Painting scheme in general shall be as given below. Detailed paint scheme covering all areas of the vessel shall be prepared in consultation with paint manufacturer for a 5-year system.

LOCATION	PAINT SCHEME	DRY FILM THICKNESS

Underwater Hull	2 coats of tar free epoxy 1 coat of sealer 2 coats of tin free anti-fouling	DFT as per paint maker recommendation for 5-year life
Topsides	3 coats of Re-coatable epoxy	DFT as per paint maker recommendation for 5-year life
Inside machinery spaces/ Accommodation/ Thruster Room/stores etc.	2 coats of alkyd paints/as agreed between builder and buyer	DFT as per paint maker recommendation
Ballast Water & FW Tanks	As per paint maker recommendation for 5-year life	As per paint maker recommendation for 5-year life
Main deck/Raised Main Deck	As agreed between builder and buyer	As per paint maker recommendation
Super structure	As agreed between builder and buyer	As per paint maker recommendation
Funnel	As agreed between builder and buyer	As per paint maker recommendation
Void spaces	As agreed between builder and buyer	As per paint maker recommendation

278 EXTERNAL CATHODIC PROTECTION

Sacrificial Anodes

Ship's external hull shall have cathodic protection against corrosion for 5 years. Anodes of zinc with high degree of purity shall be used where applicable.

The current density of anodes shall be as follows:

Hull	– 35 mA/m^2.
Sea chests, Stern hull, Rudder	– 35 mA/m^2.
Propeller	– 500 mA/m^2.

MGPS/ICAF System for Sea Chests/Box Coolers

Marine Growth Prevention System (MGPS)/Impressed Current Anti-Fouling System (ICAF) may be installed for sea chests/box coolers (designed for 5-year life), based on Buyer's requirement.

MAIN GROUP 3

MISCELLANEOUS EQUIPMENT

MAIN GROUP 3

MISCELLANEOUS EQUIPMENT

30 SMALL HATCHES & MANHOLES

Manholes

Bolted manholes shall be provided, in number and location as necessary, as per class requirement for access to all compartments, tanks, cofferdams, voids and pockets not provided with other means of access.

Hatches

Hatches shall have steel covers.

Single wheel/lever and multiple clip action type weather-tight access hatches shall be provided on weather deck.

For the removal of main machinery during overhaul/ maintenance, flush type bolted hatches are to be installed on the main deck atop Engine room.

33 DECK CRANES FOR CARGO

Type	- Knuckle boom
Safe working load	- 3 T at min. 12 m working radius (or as per the requirement of the Buyer)
Power	- Dedicated electro-hydraulic power pack as per makers' standard

Requisite calculations, as mandated by the class for ensuring the stability of the vessels shall be performed and demonstrated by the Builder to the Class, if the crane size is different from the above.

MAIN GROUP 4

SHIP EQUIPMENT

MAIN GROUP 4

SHIP EQUIPMENT

41 NAVIGATION EQUIPMENT

Navigation equipment is to comply with the requirements as per the latest amendment of SOLAS applicable during the time of construction of the vessel.

411 RADAR PLANT

The following equipment to be installed in wheelhouse:

One (1) off Daylight, colour S-band (10 cm) ARPA radar, 96 N.miles. 21" LCD display and 12' scanner according to manufacturer's standard.

One (1) off Daylight, colour X-band (3 cm) True Motion radar, 72 N.miles. 21" LCD display and 6,5' scanner according to manufacturer's standard.

Both radars shall have gyro interface.

Radar inter-switch to be provided.

412 SATELITE NAVIGATOR

Two (2) off 12 channel DGPS Navigators to be installed.

413 GYRO PLANT, AUTOMATIC STEERING, COMPASS

Gyro plant

The Gyro plant to be as per class requirement.

One (1) off Autopilot system complete consisting of:
Control panel and Display with Operator Controls and built-in Digital repeater and digital Heading.
Electronic unit with connection for gyrocompass, magnet compass and rudders. Output to be analogous or solid-state type and alarm for off course and power failure to be included.

Compass

One (1) off Magnetic compass with min. 8" compass card and having good setting ability to be delivered and installed. Course detector for connection to autopilot to be included.
Certificates and deviation schedules to be delivered.

One (1) off Spare compass in a box to be delivered.

414 SPEED LOG & ECHO SOUNDER

One (1) off	Water-tracking Doppler speed log with necessary output for navigation equipment
One (1) off	Navigational echo sounder to be provided.

Gate valve may be considered for speed-log and echosounder if feasible, as mutually agreed between the Buyer and the Builder.

417 OTHER NAUTICAL EQUIPMENT

Automatic Identification System (AIS)

An automatic identification system shall be provided according to SOLAS requirements.

ECDIS

One (1)	Electronic Chart Display and Information System, ECDIS, is to be provided as main chart system. The system is to be compatible with Electronic Navigational Charts of latest S57 format specified by the IHO and for C-Map charts and to be type approved according to IEC 61174. Installed forward at Workstation for traffic surveillance/ navigation/ manoeuvring. Display to be 21”.
One (1)	Electronic Chart Display and Information System, ECDIS, is to be provided as backup chart system. The system is to be compatible with Electronic Navigational Charts of latest S57 format specified by the IHO and for C-Map charts and type approved according to IEC 61174. Installed forward at Workstation for Navigation support. Display to be 21”.

ECDIS shall consist of:

- 21” LCD industrial monitor forward
- Track ball and keyboard (may be integrated in one unit)
- CD-ROM for downloading of chart database
- Interface to DGPS, radar, echo sounder, gyrocompass and speed log.

Anemometer

One (01) set of anemometers to be installed

42 COMMUNICATION EQUIPMENT

Radio installation according to GMDSS Sea area A3 to be provided.

Spare parts and tools according to National requirements.

Radio Equipment Conforming to GMDSS

2 Nos.	VHF with DSC and watch receiver

1 No. MF/HF with DSC and watch receiver
2 Nos. INMARSAT C
1 No. Navtex
1 No. EPIRB
1 No. SART
2 Nos. Hand held VHF

425 CALLING, COMMAND AND TELEPHONE SYSTEM

Separate systems shall be provided for talk-back and loudhailer system.

Telephone System/PA System

Telephones to be provided in Wheel house, MSB room, Cabins etc. Number of telephones and their locations to be finalized during contract stage.

Loudspeakers for PA function to be mounted in public area such as corridors, mess/cabins, etc

427 LIGHT AND SIGNAL EQUIPMENT

Main Navigation light indication and control panel

A galvanic isolated 24V power supply system to be provided for navigation and signal lights. The primary power supply system to be from 230V main system and with changeover to emergency supply in case of failure in main system.

Whistle

Ship whistle with automatic controller to be fitted according to Regulatory requirements

Bell

One bell to be provided according to Regulatory requirements

Search Lights

2 off searchlights shall be provided as per the classification/regulatory requirements.

43 ANCHORING, MOORING & TOWING EQUIPMENT

General

Anchoring, mooring equipment and towing arrangement shall be provided as per Classification Society requirements.

431 ANCHORS WITH CHAIN & EQUIPMENT

Anchor and Chain Cable

Anchors and chains	- Two HHP stockless type anchors in pockets
	- Grade 2, stud link
Windlass	- Arranged in the forecastle deck as shown in General Arrangement
	- Anchor windlass shall be combined with forward towing winch
	- For details, ref. SFI No. 435.

434 MOORING EQUIPMENT

Mooring Capstan

Mooring equipment shall be provided as per class requirement.

Mooring rope, towing rope, heaving line, hawser lines as per applicable class rules shall be provided.

One (1) off Electric/hydraulic Mooring capstan with 5 tonne line pull & controls near the capstan.

Bollards & bitts shall be as shown in General Arrangement. Arrangement of mooring equipment to be finalized during contract stage.

435 TOWING EQUIPMENT

Forward Towing System

Equipped for ship assist operation with winch and staple.
In general, towing system to have a load rating of 70 tonnes.

Winch Type	- Anchor Towing Winch
Drive type	- Electro-hydraulic
Drum configuration	- Single drum
Towline force	- 70T, up to 5 m/min
Brake holding load	- minimum 175 tonnes at the first layer of drum
Safety features	- emergency quick release and other safety features in accordance with Class requirements

Hauling speed of anchor shall be at least 10 m/min.

Forward staple shall be fabricated steel pipe with stainless steel lining.

The controls shall be provided both locally and from wheelhouse.

Aft Towing Hook (Optional)

Towing Hook with quick releasing system, which can be operated from the wheelhouse and from the main deck near the hook, may be provided for aft towing based on the Buyers' requirement.

Safe working load - min.70 T

Sufficient rope guiding arrangements such as tow pin/gob eye may be provided on the aft deck based on requirement from the Buyer.

Aft Towing Winch

An electro-hydraulic towing winch shall be installed at the aft complete with double drums capable of doing independent operations, brakes, clutch etc. Brake holding capacity of the winch shall be at least 175 T. It shall be capable of generating a towline force of 70 T.

Minimum breaking load and towline length shall be as per the class requirements/guidelines.

The winch controls shall be provided both locally and from wheelhouse.

Aft staple fabricated in mild steel to be provided for guiding ropes from aft towing winch.

Provisions for Emergency Towing

Emergency Towing capability for the vessel, described in this section, may be considered based on the requirement from operating port(s).

Considerations for emergency towing, if required, to be finalized based on mutual agreement between the buyer and the builder. Relevant Class and Statutory requirements for emergency towing operations to be complied with.

The following provisions to be considered for emergency towing operation:

- A double drum aft towing winch, wherein each drum is capable of independent operation.
- Two set of towing wires of adequate strength and length. Out of these, the main towing wires shall be spooled onto one of the winch drums and the spare wire should be stowed on the other winch drum.
- At least two towing pennants having a breaking strength not less than the required breaking load of main towing wire.
- Adequate number of towing shackles having sufficient safe working load.

438 HYDRUALIC OIL SYSTEM FOR ANCHORING/MOORING/TOWING EQUIPMENT

One set of electro-hydraulic power unit consisting of hydraulic oil pumps and other necessary accessories shall be provided in engine room. This hydraulic power unit drives the towing and mooring equipment as applicable. Hydraulic Oil tanks of sufficient capacity shall be provided.

44 REPAIR/MAINTENANCE EQUIPMENT

Suitable lifting arrangements including lifting eyes shall be provided inside machinery spaces to enable removal of engine/DG Set parts and other auxiliaries.

48 OIL SPILL RESPONSE EQUIPMENT

Oil Spill Dispersant Arm

Oil Spill dispersant spraying arms installed on the main deck on both the sides.

Oil Spill Dispersant storage tank(s) with a total capacity of at least 5 m^3 shall be provided.

Oil Spill Containment Boom

The vessel shall be capable of handling near shore booms of total length of 1000m, stowed on adequate number of boom reels as per the OEM standards.

Out of this, one no. boom reel shall be carried on the aft deck of the vessel as indicated in the GA. Additional reels may be carried on the aft main deck based on operational demands

MAIN GROUP 5

SHIP EQUIPMENT FOR CREW

MAIN GROUP 5

SHIP EQUIPMENT FOR CREW

50 LIFESAVING EQUIPMENT

501 RESCUE BOAT

One (1) no. rescue boat of suitable type meeting SOLAS requirements shall be provided, such that the recovery time of the boat shall be less than 5 minutes.

502 LIFE RAFTS

One or more inflatable life rafts (SOLAS Pack B) with relevant certification shall be provided as required by latest amendment of SOLAS applicable at the time of construction of the vessel. They shall be mounted on either side with suitable supports.

All life rafts shall be in accordance with the latest SOLAS requirement and shall be provided with hydrostatic release arrangement.

The life rafts shall be stowed in self-launching cradles and secured with release lashing.

The location of life rafts shall be as per approved LSA plan/general arrangement drawing.

503 LIFE SAVING EQUIPMENT

The lifesaving equipment, as mandated by SOLAS, including the following, shall be catered for:

- 20 Nos. approved lifejackets out of which 2 nos. shall be child life jacket as per shall be provided as required by SOLAS.
- 8 Nos. Life buoys shall be provided out of which at least 3 shall be fitted with self-igniting lights. At least one lifebuoy on each side shall be fitted with buoyant lifeline of at least 30 m in length.
- 12 Nos. type approved parachute distress rocket signal shall be provided as per SOLAS requirements.

505 FIREFIGHTING EQUIPMENT

Firefighting equipment shall be provided on the vessel as in compliance with the requirements of latest amendment of SOLAS and Class requirements as applicable at the time of vessel construction.

FRP cabinet shall be provided for securing fire hoses and nozzles.

Sufficient number of fireman's outfit, breathing air compressor, etc. in compliance with AGNI 1 or equivalent notations to be provided on the vessel.

51 ACCOMMODATION – INSULATION, PANELS, DOORS, WINDOWS, LOCKERS

General

Class approved materials shall be used for the vessel as applicable, including fire retardant paints, curtains, linings, etc.

510 ACCOMMODATION

In general accommodation arrangement shall be provided as per the General Arrangement Plan. However, alternate arrangements may be adopted as agreed between the Buyer and the Builder.

For all compartments a minimum clear height of 2100 mm shall be ensured.

MLC requirements shall be complied.

The vessel shall be arranged with the following facilities in cabins:

Master/Chief Engineer Cabin

- Wooden berth with drawers
- Wooden Wardrobe with mirror
- Writing table with locker
- Upholstered arm chair
- One settee
- Document Locker/Shelf
- Coat hooks
- Flask & glass holder
- Book rack
- Wall mounted fans
- Attached Toilet

Other Cabins

- Wooden berth with drawers
- Wooden Wardrobe with mirror
- Writing table with locker
- Arm chair
- Coat hooks
- Flask & glass holder
- Book rack
- Wall mounted fans
- Attached Toilet (optional)

511 PARTITION BULKHEADS, PANELLING

In general, thickness of linings shall be 25 mm and that of partitions shall be 50 mm. The partitions shall be of Non-combustible panels having good quality surface finish.

Low flame spread sandwich panels shall be provided for ceilings.

Ceiling and partition panels in galleys shall be provided with stainless steel cladding sheets.

512 DOORS

In general, accommodation spaces shall be fitted with joiner doors and fire rated doors as applicable.

Weather tight doors are to be provided for exterior access to wheelhouse and lower deckhouse.

Watertight doors shall be provided on the main watertight bulkheads. All watertight doors are to be fitted with hinges and toggles in compliance with class requirements.

The wheelhouse doors shall be hinged and provided with glasses as shown in the General Arrangement for good visibility.

Sill height to be in accordance with the relevant Rules and Regulations.

515 WINDOWS

All accommodation areas are to be provided with windows/scuttles/skylights as per the requirements of Regulatory Authorities and Classification Societies.

All windows are to be made of hard glass and fitted in metal frames.

518 INSULATION

Insulation for fire, heat & sound shall be provided in accordance with class/statutory requirements, conforming to global best practices in tug construction.

52 DECK COVERING, LADDERS, STEPS, RAILINGS, GANGWAY ETC.

In general, floorings, ladders and other fittings shall be provided as described below:

a. Flooring in cabins, public spaces, corridors, stairways etc. shall be provided with suitable deck composition and laid with vinyl covering.

b. Flooring in engine control room, alleyways, mess room and wheelhouse shall be preferably of composite synthetic type.

c. Sanitary spaces and galley shall be laid with non-slip type tiles over cement.

d. Suitable flooring arrangement (Aluminium or Steel chequered floors) shall be provided in machinery spaces as agreed between the Builder and the Buyer.

e. Ladders, stairs and handrails shall be arranged in accordance with the General Arrangement Plan and where required. If it is impracticable to have either inclined or vertical ladder, the steps of square bar shall be directly fitted on the surface.

f. Galvanized steel handrails of suitable diameter shall be welded along the sides and front of the deckhouse.

g. One (1) set of aluminium alloy gangway (optional) of 4m length, 600mm clear breadth may be provided. Dimensions of the gangway to be as agreed between the Buyer and the Builder.

54 WHEEL HOUSE

The wheelhouse shall be arranged with all necessary equipment, as prescribed by the Classification and Statutory Regulations, which includes but not limited to the below.

- Consoles
- Chart table

- Flag locker
- Binocular holder
- Revolving Arm chair
- GMDSS Table

Special attention shall be given to the overall ergonomics while arranging wheelhouse items.

55 GALLEY/PANTRY EQUIPMENT, PROVISION PLANTS, LAUNDRY/IRONING EQUIPMENT

551 GALLEY

Galley shall be provided with the following equipment:

- Electric marine range with oven
- Full size refrigerator with freezer
- Stainless steel side board
- Water Boiler
- Stainless Steel Sink
- Stainless steel work table
- Canopy with electrically-driven exhaust fans

554 PROVISION STORE AND REFRIGERATION SYSTEMS

A provision store shall be provided in the main deck.

Deep freezers of adequate capacity shall be installed in provision store for carriage of meat, fish, vegetables, dairy products etc..

558 LAUNDRY

One marine heavy duty washing machine cum dryer shall be provided on lower accommodation deck.

Separate washing machine and drier units may also be considered based on Buyers' preference.

57 VENTILATION, AIR CONDITIONING & HEATING SYSTEMS

General

The air conditioning plant shall be designed for the following parameters:

External Temperature	**:** Maximum 45° C (RH-90%)
Internal Temperatures	: 24°C (R.H 50%).
	In all air-conditioned compartments (except Galley)

Design temperatures may be reduced suitably based on area of operation.

571 VENTILATION/AIR-CONDITIONING SYSTEMS FOR ACCOMMODATION, CONTROL SPACES ETC.

Entire accommodation area, wheelhouse and switch board room shall be air conditioned.

Standalone centralized unit (direct expansion) shall be considered for accommodation. Water cooled independent A/C shall be provided in MSB room and air-cooled split A/C to be provided Wheel House.

Other options such as chilled water system with fan-coil and fresh air handlers etc. may be considered as agreed between the Builder and the Buyer.

574 VENTILATION/AIR-CONDITIONING SYSTEM FOR MACHINERY SPACE

The machinery space shall be ventilated by a mechanical ventilating system.

The ventilating fans shall supply fresh air to the operating station and other necessary places in the engine room through air ducts. One off supply fan in engine room shall be reversible type.

The exhaust air from the engine room shall be led to the atmosphere through openings provided on the funnel.

The exhaust air opening and fresh air intakes for engine room shall be provided with emergency shut-off fire dampers operated from the outside of the engine room.

Mechanical ventilation shall be provided for service/machinery spaces including thruster room, CO2 room, battery room, workshop etc.

In addition, galleys and toilets shall also be provided with suitable arrangements for forced ventilation.

58 DRINKING AND SANITARY SERVICE SYSTEM FOR ACCOMMODATION

581 SANITARY SUPPLY SYSTEM

Fresh Water Service System

The system shall supply fresh water for sanitary services in accommodation, equipment in machinery spaces, galley and laundry.

FW Pressure set
- Primary and standby electrically driven pumps
- Diaphragm type hydrophore

Fresh Water Calorifier

Hot water requirements for accommodation and other consumers, if required, shall be supplied from one (1) electrical hot water calorifier. One (1) electric circulating pump shall be fitted at the return line of the calorifier, capable of circulating hot water at 65 deg C.

Sea Water Service System

Separate sea water system shall be provided for toilet flushing.

SW Pressure set
- Primary and standby electrically driven pumps
- Diaphragm type hydrophore

Alternate system for sanitary supply may be considered based on Buyer's preference.

582 SANITARY DISCHARGE SYSTEM

In general, sanitary discharge system shall consist of sewage treatment plant, sewage holding tank and shore discharge pump.

Sewage treatment plant shall be considered as mentioned in Para. 585.

Sewage holding tank shall be arranged as indicated in the GA.

Shore Discharge flange to conform to MARPOL 73/78, Annexure 4, Regulation 10.

583 SHOWERS AND TOILETS

Toilet spaces with showers shall be provided as shown in the general arrangement plan.

Toilets shall have gravity type discharge.

Alternate arrangement for toilets shall be considered based on Buyer's preference.

584 DRINKING WATER SYSTEM

Fresh water system for drinking shall be provided as per Para 581, Fresh Water Service System.

The drinking water system shall consist of filter, U V Sterilizer and Coolers.

585 SEWAGE TREATMENT PLANT (STP)

One (01) off sewage treatment plant of adequate capacity shall be provided.

In general, STP shall be of electrolytic type. Other types may also be considered based on Buyer's preference.

MAIN GROUP 6

MACHINERY MAIN COMPONENTS

MAIN GROUP 6

MACHINERY MAIN COMPONENTS

60 DIESEL ENGINES FOR PROPULSION

General

Propulsion system shall consist of 2 Nos of azimuth stern thrusters each driven by independent diesel engines.

Equipment

2 x Marine diesel engines, as per section 601
2 x Fixed pitch Z drive propeller units, as per section 634

601 MAIN DIESEL ENGINES

Four strokes, turbocharged, non-reversible, unidirectional, intercooled, direct injection, pneumatic or electric started, propulsion marine diesel engines each developing requisite power under all specified environmental conditions (as per Ch.0) wherein the vessel is designed to operate, shall be installed on the vessel to meet specified endurance and speed. Engines shall be resiliently mounted if required, to reduce vibration.

The engines shall be suitably rated to meet intended operations as per Ch. 0, para-E. (power of approx. 2050 kW each at abt. 1000 RPM). These values are indicative only and the final value of engine power and RPM shall be ascertained by the builder based on detailed powering calculations and OEM recommendations prior to construction.

Medium speed engines are used for the standard design. However, upon mutual agreement between the Builder and Buyer, if it is decided to opt for high-speed engines, the same may be done after performing necessary design modifications for propulsion system, stability and structural design or any other systems as applicable.

In general, engines shall be of IMO Tier 2 or as applicable at the time of vessel construction.

The grade of fuel to be used in the engine shall be finalized between the Buyer and the Builder. It is recommended to use Low Sulphur High Flash High Speed Diesel (LSHFHSD) oil.

Provision for PTO for external Fi-Fi pump to be provided on the engines, depending on the configuration of External Fire Fighting Pumps as per Para. 816..

63 THRUSTERS AND TRANSMISSIONS

634 FIXED PITCH Z DRIVE PROPULSION UNIT

Two numbers fixed pitch steerable rudder propeller units shall be provided with rating as below:

Rated input power	-	Approx. 2050 kW
Rated RPM	-	To suite Z-Drive.
Propeller Diameter	-	Approx. 2700 mm, to meet minimum Bollard Pull requirement

The above values are indicative only and the final value of propeller diameter and input power shall be ascertained by the builder based on detailed powering calculations and OEM recommendations prior to construction.

Thruster shall be designed to deliver adequate power so as to meet the intended operations as per Ch. 0, para-E.

Emergency steering of the vessel shall be as per statutory/class rules. Steering system shall comply with the class requirements.
Hydraulic unit for thruster units shall be as per makers' standard. The units along with hydraulic oil tanks of sufficient capacity shall be provided in thruster room.

Requirement for electric steering system for thrusters may be specially considered based on Buyer's requirement.

637 SHAFTING AND MAIN REDUCTION GEAR

Shafting system shall have sufficient strength as per the class rules to take maximum engine power when undertaking high bollard pull operations. The material of shaft shall conform to internationally accepted norms.

Cardan shafting i.w.o. bends, if required, shall be of sufficient strength meeting class requirements.

Adequate arrangement shall be provided for covering the shafts using chequered plate as per global best practices in tug construction

Main Reduction Gear

Gearbox having appropriate gear ratio shall be integrated with the thruster unit, as per thruster OEM design.

Flexible Coupling

A Flexible Coupling in accordance with requirements of the Main Engine OEM shall be provided. The flexible coupling provided for main engine shall be free standing type and can be removed without dismantling the Main engine/gearbox.

65 GENERATOR SET FOR MAIN ELECTRIC POWER

2 Nos. Diesel generators with an output power of approx. 160 ekW shall be provided. Final rating shall be as per electrical load calculation carried out during the contract stage. DGs shall be resiliently mounted if required, to reduce vibration.

66 OTHER AGGREGATES AND GENERATORS FOR MAIN AND EMERGENCY ELECTRIC POWER

664 RECTIFIER CUM BATTERY CHARGER

Emergency source of electrical power is an accumulator 24V battery.

One (1) off Rectifier cum battery charger of appropriate rating shall be installed. During normal condition it will be used for both charging batteries and feeding power supply to emergency consumer.

Upon failure of main source of electric power, accumulator battery shall feed power supply to emergency consumers through emergency switchboard

665 HARBOUR GENERATOR SETS

1 No. harbour DG of approx. 50 ekW shall be provided. Final rating shall be as per electrical load calculation carried out during the contract stage.

MAIN GROUP 7

SYSTEMS FOR MACHINERY MAIN COMPONENTS

MAIN GROUP 7

SYSTEMS FOR MACHINERY MAIN COMPONENTS

General

All machinery systems and components shall be of good marine quality as per international standards and arranged according to class requirements and/or OEM's recommendations.

Piping - General

Piping shall be designed as per best global standards and classification guidelines.

Piping shall be adequately supported.

Routing of pipes shall be done in such a way that, it permits free passage in walking areas, does not affect the performance of the crew. Special attention shall be taken to provide space for maintenance of ship's structure as far as practicable.

Piping Material Specification

Material for the piping, valves, flanges and fasteners for piping and other system related material shall be selected as per relevant class requirements.

Treatment of these pipes shall be done in accordance with the relevant class requirements.

In general, the materials for various systems shall be as follows:

- Bilge & Ballast - Galvanized Steel
- Sea Water - Galvanized Steel
- Fresh Water System - Copper or class approved plastic
- Exhaust - Tail pipes above funnel shall be of polished Stainless-Steel material. Mild steel to be used elsewhere.
- Fuel Oil System - MS Black Steel
- Lube oil system - MS Black Steel

70 FUEL SYSTEM

The fuel oil system shall consist of Fuel Oil Service System and Fuel Oil Transfer System.

Suitable bunkering arrangements as agreed between the Buyer and the Builder shall be provided on the main deck, with suitable connections for filling of the bunker tanks. Class approved sampling system shall be provided at the bunkering station.

701 FUEL OIL TRANSFER AND DRAIN SYSTEM

Storage tanks, service tanks, overflow tank and sludge tank shall be provided as per the GA drawing.

FO Transfer Pump

Fuel oil shall be transferred from fuel oil storage tank to each fuel oil service tank using two (one working and one standby) electrically driven screw type transfer pumps, installed in the engine room.

702 FUEL OIL PURIFIERS

One no. Fuel oil purifier rated at full power main engine fuel consumption shall be provided in accordance with the OEM recommendation.

703 FUEL OIL SERVICE SYSTEM

Fuel Oil Service System

Fuel oil shall be transferred from fuel oil storage tank through F.O. purifier (as applicable) to each fuel service tank. From the service tanks, overflow lines shall be led to FO Overflow tanks.

Fuel oil shall be transferred from service tanks to main engines/diesel generators with the help of integrated fuel oil service pumps.

71 LUBE OIL SYSTEM

Self-contained lubricating oil systems shall be installed for the main engines, gears and drives. The lube oil system shall be as per OEM recommendations of main and auxiliary machinery.

Closed circuit lubricating oil system engine driven pump shall be provided with standby electric motor driven pump. Automatic changeover to be provided for Lube oil standby pumps with Engine driven pumps with suitable alarm.

Dirty oil in the sludge tank shall be discharged by means of the dirty oil / sludge pump or via direct suction from the shore. The tank shall be provided with a high-level alarm.

Suitable number of lube oil tanks shall be provided by the Builder as hull tanks/loose tanks at appropriate locations based on the recommendations of OEMs of major machinery.

711 LUBE OIL TRANSFER & DRAIN SYSTEMS

LO Transfer pump

Two (2) off Lube oil transfer pumps (one working and one standby) of equal capacity and conforming to class and OEM requirements shall be provided for main engines.

A separate rotary hand driven LO transfer pump shall be provided for DGs.

712 LUBE OIL PURIFIERS FOR PROPULSION MACHINERY

One (1) or two (2) self-cleaning lube oil purifier(s) shall be provided as per OEM recommendation.

713 LUBE OIL SYSTEMS FOR TRANSMISSIONS

The gearbox lube oil system, if required, shall be as per OEM recommendations and complying to class requirements.

72 COOLING SYSTEM

Cooling system shall be provided for each propulsion machinery, D.G. sets, auxiliary machinery, HVAC and hydraulics. In general, the propulsion and auxiliary equipment cooling system are to be based on

shell and tube/plate heat exchanger. Any other type of cooling system including box coolers shall be specially considered based on Buyer's requirement.

In case box coolers are fitted, the sizing of Box coolers shall be finalized by the builder based on the requirements of engine and other machineries.

A fouling factor of 15% is to be considered for plate/tube type heat exchangers and in case of box coolers fouling factor shall be 30%.

73 COMPRESSED AIR SYSTEM

In case of pneumatic started engines, 2 nos. electrically driven starting air compressors and air receiver bottles with capacity and working pressure adequate for the selected diesel engines shall be provided complying to class rule requirements. Service air requirements shall be met by providing adequate number of reducing stations from the main receiver units.

If the engines are electrically started, a compressed air system of 8 bar pressure and having sufficient capacity shall be provided for the purpose of ship service air requirements. Air receivers of sufficient capacity shall be provided.

Service lines shall be provided for sea chest blow down, controls, and various equipment. A main deck service line shall also be provided.

74 EXHAUST SYSTEMS

The exhaust gas system for each engine/generator shall contain the following equipment:

- Exhaust silencer(approx. 35 dBA and 125 Hz - for main engines and Diesel Generators)
- Integral exhaust gas spark arrestor

The exhaust system shall be designed such that it provides maximum isolation of machinery vibration and exhaust noise. Removable blanket type insulations are provided for the exhaust gas lines. The entire system shall be resiliently mounted, if required.

79 AUTOMATION SYSTEMS FOR MACHINERY

792 ALARM SYSTEM

Comprehensive alarm with monitoring system shall be provided as per class and OEM's requirement for major machinery including Main engines, auxiliary engines and critical ship systems etc.

793 ENGINE AND AZIMUTH THRUSTER CONTROLS

Remote operation shall be so designed that the propulsion plant can be operated from the wheelhouse. Instrumentation/alarms shall be as per class rules/maker standard.

Engine controls shall be arranged in the wheelhouse as follows

- E/R control with main engine manoeuvring devices, auxiliary device, instruments etc.
- Generator/auxiliary engine alarm and control panels.
- Intercom station

Emergency control shall be provided, with which the engines can be controlled mechanically in case the remote-control system failure.

UPS shall be provided for Engine Control System.

795 DIESEL GENERATOR CONTROLS

The generator engine shall be speed controlled remotely by governor control switch on main switchboard and also controlled at engine side. Instrumentation/alarms as per class rules and OEM standards shall be provided.

Control power supply for the DGs shall be taken from 24V power supply provided onboard.

Local engine control panel with necessary alarms, indication lamps and control switches shall be provided.

MAIN GROUP 8

SHIP COMMON SYSTEMS

MAIN GROUP 8

SHIP COMMON SYSTEMS

80 BALLAST, BILGE & DRAIN SYSTEMS

801 BALLAST SYSTEM

Ballast is not considered in the standard design. However, if required, the same may be included adhering to relevant statutory/class requirements.

803 BILGE SYSTEM

The bilge system shall comprise of One (1) Bilge pump and One (1) Bilge/GS/Fire, both of capacity (35 m^3/h, 3 bar). The pumps are vertical centrifugal electric driven type. One (1) oily water tank of sufficient capacity shall be provided.

Bilge main system to be complete with suction from all watertight compartments. Engine room shall be provided with two nos. direct bilge suctions. Bilge alarms are to be installed in each watertight compartment.

Dedicated oily water and sludge tanks are provided as shown in the general arrangement. An electric driven oily water pump and a screw type sludge pump shall be provided for pumping out oily water and sludge respectively.

Oily Water Separator

One (1) Oily water separator of approx. capacity 0.1 m^3/hr meeting relevant regulatory requirements shall be provided.

81 FIRE FIGHTING AND EMERGENCY SYSTEMS

811 FIRE DETECTION SYSTEM

In general, fire detection system shall be provided adhering to relevant Class/Statutory Regulations.

This shall consist of an addressable fire & smoke detection system in all compartments, including the engine room and all stairways, corridors, escape routes within accommodation spaces, etc. The detectors shall be of smoke/heat or thermal type dependent on location of installation.

813 ONBOARD FIRE FIGHTING AND DECK WASH SYSTEM

The firefighting and deck wash system shall be supplied by a dedicated fire pump and a Bilge/GS/Fire pumps. The fire pumps shall be provided as below:

a. At least two fire pumps having a total capacity of not less than 70 m^3/hour. This shall be met by a fire pump and a bilge/GS/fire pump, each of 35 m^3/hr capacity.
b. There shall be an independently driven emergency fire pump having a minimum capacity of 25 m^3/hour

In addition, other firefighting equipment as per the requirements of class and regulatory bodies shall be provided.

815 ENGINE ROOM FIRE FIGHTING SYSTEM

A fixed gas-smothering type fire suppression or "CO_2" gas flooding fire extinguishing system shall be installed in the engine room, in accordance with the requirements of the Regulatory Bodies.

Other compact and environment friendly options such as FM 200 or NOVEC 1230 may be considered based on Buyer's preference.

816 EXTERNAL FIRE FIGHTING SYSTEM

An external fire-fighting system shall be fitted, comprising of engine driven PTO pumps, fire monitors and water spray system meeting AGNI 1 or equivalent notation.

Fire pumps may be arranged in any of the configurations below:

Configuration 1:
One no. fire pump connected to main engine PTO. During FiFi operation this engine will be declutched from thruster using On/Off clutch and vessel position is maintained using the other engine and thruster. The fire pump shall have a dedicated sea chest.

Configuration 2:
Two no. fire pumps connected to main engine PTO. Thrusters (in case of FPP) connected to engine through integrated medium duty slipping clutches. Each fire pump shall have dedicated sea chests which are interconnected.

Any other configuration may also be considered as mutually agreed between the Buyer and the Builder.

Fi-Fi Pumps

The FiFi pumps shall provide sufficient water to two fire monitors and water spray system.

- Type : Centrifugal
- Drive : Engine PTO
- Total Capacity : min. 2400 m^3/hr (meeting AGNI 1 or equivalent notation)

Foam System

Foam tank(s) of total capacity 10,000 litres, complete with necessary fittings shall be provided. The system shall be provided with line proportioner for foam mixing. The foam type shall be AFFF.

Fi-Fi Monitors

Two (2) single barrel dual purpose monitors each having capacity as per AGNI 1 notation shall be mounted on bridge deck as indicated in the General Arrangement drawing.

- Capacity : min. 1200 m^3/hr (meeting AGNI I or equivalent notation)
- Min. height of throw : 45 m
- Min. length of throw : 120 m

The fire monitors may be mounted either on the bridge deck (as shown in the GA) or on wheelhouse top.

Water Spray System

The vessel shall be provided with self-protection measures as required by AGNI -I or equivalent notation.

These measures shall include fixed water-spraying system for protection of all outside vertical areas of hull, superstructures and deckhouses including foundations for water monitors and other equipment.

The capacity of fixed water-spraying system shall be provided to meet class requirements. The capacity shall not be less than 10 litres per min. per [m^2] of the areas to be protected. For areas internally insulated to class A-60, however, a capacity of 5 litres per min. per [m^2] may be accepted.

The arrangement for water-spraying system is to be such that necessary visibility from the wheelhouse and the control station for remote control of the firefighting water monitors can be maintained during water spraying.

Fi-Fi Control System

Fire monitors shall have controls for both wheelhouse and local operations. Wherein, a fixed control panel shall be mounted in the wheelhouse with the operator having unrestricted view on the Fi-Fi monitors.

82 OVERFLOW, AIR & SOUNDING SYSTEM

General

Air vents shall be installed for all tanks having filling or suction connections.

Air vents in fuel oil tanks and sludge/oily water/sewage tanks (as applicable) having flammable hydrocarbon shall be provided with flame screen. Foam and dispersant tanks are to be given with P/V (Pressure/Vacuum) vent.

Diesel Oil bunker stations shall be arranged on both port and starboard side. Connectors for fuel oil filling shall be of camlock type. For fresh water filling, threaded type connectors shall be provided.

822 MANUAL SOUNDING

Sounding provisions shall be provided for all tanks as far as practicable. Manual Sounding system shall be in general of sounding pipe type. Sight glasses to be provided for small tanks, if possible.

823 AUTOMATIC/REMOTE SOUNDING SYSTEM

A Remote Tank Level Indications system shall be provided for FO Service tanks, in addition to local tank level gauge.

85 COMMON ELECTRONIC & ELECTRICAL SYSTEM

General

Electrical work in the ship shall be carried out in accordance with this specification, the Builder's standard and in compliance with classification rules. The type and construction of the electrical equipment shall be in accordance with the manufacturer's standard unless specifically stated.

The design of the electric plant including generators, motors and controllers shall be co-ordinated to ensure that the voltage dip, when starting the motor with highest inrush current shall not exceed 15% of the rated voltage.

Power Generation and Distribution

2 Nos. main generators, each catering for 100% load of the vessel shall be provided such that one of these generators will be standby.

Generators are to be provided with Floating neutral.

Electric power supplies available onboard:-

a) 415V,50 Hz, 3phase, 3 wire
b) 230V,50 Hz, 3 phase, 3 wire
c) 230V,50 Hz, 1 phase, 2 wire
d) 24V DC

86 ELECTRIC POWER SUPPLY

861 GENERATORS

Main Generators

Power Rating	: 160ekW(approx.)
Voltage	: 3x415 V, 50 Hz, 3 wire
Insulation	: Class-F/F
IP	: as per class rule
AVR	: Solid state design or as per maker standard
Excitation	: Self-excited, self-regulating type with brushless excitation system
Type of cooling	: Engine shall be FW/SW cooled : Alternator shall be air cooled or water cooled as per OEM Standard.

Generators shall be as per the norms of classification society rules. Generator ratings indicated are preliminary values. The builder shall carry out separate load calculations at the time of construction based on the actual electrical rating of equipment to arrive at final load rating of the generators.

Voltage and frequency tolerances shall be within the limits specified by the Class rules. Generator space heaters shall also be provided for each generator.

865 TRANSFORMERS

All Transformer shall conform to class rules.

One (1) off Transformer (415V/230V) as per requirements of lighting/services of sufficient capacity shall be connected main switchboard for catering the vessel's power supply requirements.

One additional transformer shall be provided for redundancy.

The final quantity & capacity of transformers shall conform to class requirements.

866 DC SYSTEM

24V Battery Charger & Distribution Board

One (1) battery charger with distribution board shall be provided for charging and discharging of battery. The battery charger shall be of dead front and self-supporting type and of such arrangement that battery may be float charged. Necessary number of feeder circuit for consumers with fuses/MCB shall be provided.

General use batteries

One (01) set of storage batteries shall be installed in case of electric started engines.

One (01) set of storage batteries for navigation & communication equipment shall be installed either in a battery room or inside dedicated battery boxes placed at suitable location.

Separate battery shall be provided for GMDSS.

The batteries shall be maintenance free, Lead acid type, 24V DC.

868 ELECTRIC SHORE SUPPLY

The vessel shall be provided with shore supply/ship alongside point as per class rules with suitable stowage arrangements for the shore supply cable.

Electrical interlocking of main generator breaker and shore connections breakers shall be provided in such a way that the shore connection breaker cannot be switched 'on' if anyone of main generator breaker is 'on' and vice versa. The shore supply cable shall be separate strand type and of adequate capacity to meet the harbour load.

Shore supply cable of 100 meters length shall be supplied by the builder.

869 ENERGY STORAGE SYSTEM(ESS) - OPTIONAL

Energy Storage Systems, consisting of battery banks can be provided for peak shaving/standby operations of the vessel as per Buyer's requirement.

In such cases, the respective builder/end-user shall carry out necessary design changes and classification approvals for incorporating ESS and associated systems into the design.

87 COMMON ELECTRIC DISTRIBUTION SYSTEM

871 MAIN SWITCH BOARD

The main switchboard shall be self-supported, steel plated and dead front type. The construction of the panel board shall be of IP 23. The panel boards shall be manufactured from 14 SWG primed steel

plate. The front shall be provided with hinged door locks and insulated hand rails. Oil resistant type mat shall be provided in the front of the switchboard.

Bus bar shall be of hard drawn high conductivity copper.

The entire bus bar system including supports and insulation shall be designed to withstand the thermal and magnetic stresses due to short circuit, up to maximum estimated fault level on main bus bar.

Provision for manual and semi auto synchronizing and paralleling of generators shall be arranged.

Breakers - MCCB/MCB's

- bus tie breaker

Instrumentation on MSB shall confirm to class rules.

874 EMERGENCY STOP

Emergency stop system complying with Classification Rules shall be provided.

875 DISTRIBUTION PANELS

All distribution panels shall be made of primed steel with a painted surface. Cabinets shall have hinged door with catch and lock arrangement. The panels shall be provided with approx. 10% spare capacity of breakers.

Distribution panels for 415V

Distribution panels for motors, fans, galley-laundry equipment, heating fans etc. MCB/MCCB shall be used.

Distribution panels for 230V

Distribution panels for general lighting, heating and other 230V equipment. MCB shall be used.

Distribution panels for 24V

Distribution panels for electronic equipment, remote control etc. MCB shall be used.

88 ELECTRIC CABLE

All power supply cables throughout the vessel shall be of 0.6/100kV or 250V grade insulation to meet the voltage to which the cables are subjected.

All cables shall be approved by the classification society (except special cables).

All cables to be of Halogen-free type.

The voltage rating of the cables shall not be lower than the nominal voltage of the circuit for which they are used.

0.6/1.0kV grade cables shall be used for all 415V installation an min 250V grade cables shall be used for all 230V and 24V power installation.

Cable in general to have copper conductor and XPLE or EPR conductor insulation.

Sizing of the cables shall be as per the Classification Rule requirement.

89 ELECTRIC CONSUMER SYSTEMS

891 GENERAL LIGHTING IN ER, ACCOMMODATION ETC.

All engineering machinery compartments shall be illuminated in accordance with Class Rules.

All lighting fixtures shall be provided with enclosures having IP ratings indicated below:

Light fixture in dry accommodation	: IP 20
Light fixture in galley, laundry etc	: IP 44
Light fixture in engine room etc	: IP 44
Light fixtures on open deck	: IP 56

Suitable number of sockets outlets, 230V, 15 A to be installed in engine room and workshop.

Non-water tight 230V, 5A sockets to be installed in cabins, public spaces, lockers etc.

Two sockets shall be fitted in each cabin.

Two off three phase sockets of suitable rating for welding machines are to be provided at suitable locations as agreed between the Buyer and the Builder.

Lighting

The following may be catered as per Class Rules in general:

- LED Based Light fittings for entire ship.
- Provision for emergency lighting.

Navigation lights shall be provided as per Class Rules/COLREGs.

Engine room

Engine room lighting shall be arranged to provide proper illumination as applicable as per Class Rules.

Suitable lighting shall be provided in workshops & outside of ship.

Emergency Lighting

24V DC operated Emergency light fittings shall be fitted to provide illumination to access ways and passageways. The emergency lighting system shall be as per class rules. In the event of failure of the ship's AC normal lighting 24V DC emergency lights to be switched on automatically.

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