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# **LANDING CRAFT TANK** **TENDER SPECIFICATION**

## **BANGLADESH NAVY**

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**LIST OF ABBRIBIATIONS**

ABS	: American Bureau of Shipping
AFFF	: Aqueous Film Forming Foam
APC	: Armoured Personnel Carrier
AVR	: Automatic Voltage Regulator
BA	: Breathing Apparatus
BN	: Bangladesh Navy
BOB	: Bay of Bengal
BR	: Book of Reference
BV	: Bureau Veritas
CFD	: Computational Fluid Dynamics
COLREG	: Convention on the International Regulations for Preventing Collisions at Sea
CS	: Classification Society
DC/FF	: Damage Control and Firefighting
DG	: Diesel Generator
DNV-GL	: Det Norske Veritas and Germanischer Lloyd
ELSA	: Emergency Life Support Apparatus
EMI	: Electromagnetic Interference
EPIRB	: Emergency Position Indicating Radio Beacons
FAT	: Factory Acceptance Test
FPP	: Fixed Pitch Propeller
FW	: Fresh Water
GA	: General Arrangement
GPS	: Global Positioning System
GRP	: Glass Reinforced Plastic
HADR	: Humanitarian Assistance and Disaster Relief
HF	: High Frequency
HMI	: Human Machine Interface
HSD	: High Speed Diesel
IACS	: International Association of Classification Societies
IMO	: International Maritime Organization
LCT	: Landing Craft Tank
LO	: Lubricating Oil
LR	: Lloyd's Register
MARPOL	: International Convention for the Prevention of Pollution from Ships
MCR	: Machinery Control Room
MS	: Mild Steel
NBC	: Nuclear, Biological, Chemical
NHQ	: Naval Headquarter
NVR	: Network Video Recorder
OEM	: Original Equipment Manufacturer
PIT	: Project Implementation Team

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PMS	:	Power Management System
PSI	:	Pre Shipment Inspection
RH	:	Relative Humidity
Rx	:	Receiver
SAL	:	Spares Allowance List
SART	:	Search and Rescue Transponder
SOLAS	:	Save Our Life at Sea
Tx	:	Transmitter
UHF	:	Ultra-High Frequency
VHF	:	Very High Frequency
WOSEF	:	Warrant of System/ Equipment/ Fittings

**SECTION – I**

**INTRODUCTION, DESIGN AND GENERAL PROVISIONS**

0101. **Preamble.** Bangladesh Navy intends to build Landing Craft Tanks (LCTs) at Local Shipyards to meet its current requirement. The LCTs will be operated in the Bay of Bengal (BOB) to meet both wartime and peacetime requirements along the coast from Chattogram to St Martins and Mongla. Hence, it shall be built according to this “Tender Specification” fulfilling all the requirement of quality and quantity specified.

0102. **Functions/ Role.**

a. **Primary.** The LCTs shall have the primary function of carrying out amphibious operations in the coastal areas of Bangladesh and for transporting Landing Force/ Contingent. The LCTs shall be capable of beaching in Coastal Waters of BD along with loaded tanks, transports, equipment and stores.

b. **Secondary.** During peacetime, LCTs mission will be to transport relief goods and personnel for Humanitarian Assistance and Disaster Relief (HADR) within Bangladesh and adjacent coastal areas of the Bay of Bengal. They shall also perform the role of Logistic Ship/ Mother Vessel in addition.

0103. **General Descriptions.** Total 3 (three) LCTs will be built to carry out their designed primary and secondary functions/ role. LCTs are to be equipped with the necessary machinery and equipment in accordance with the specification set out in this document. Propulsion systems and machineries, sensors, power generation systems, radio sets are to be as specified in this tender specification. Country of origin and manufacturer of all other machinery/ equipment/ items are to be mentioned. The normal Refit/ Docking interval of the LCTs will be once in every 3 (three) years, while their Service life is expected to be a minimum of 25 (twenty five) years. The ships should be able to operate in tropical and muddy water conditions.

0104. **Place of Construction.** The LCTs will be built in a local shipyard having experience in building Landing Crafts for BN with good workmanship.

0105. **Design Philosophy.** Each LCT is to have a steel hull with the following main features:

- a. Enhanced survivability.
- b. Good sea-worthiness.
- c. Easy and simplified operation.
- d. Easy maintenance.
- e. Increased availability of operation.
- f. Lower acquisition and life-cycle cost.
- g. Modular design.

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- h. Smooth loading-unloading-operation of payloads of all types both at day and night.
- j. Must be capable to carry and replenish logistics for the fleet.
- k. Effective beaching capability.
- l. Troops carrying including habitability considering the state of daily basic needs.

0106. **Displacement At Full Load.** To be mentioned (Approximately 1000 tons) ( $\pm 10\%$ ).

0107. **Basic Dimensions and Principal Particulars of the LCT.** The basic dimensions and principal particulars of the LCT shall be:

Length overall	Not Less than 60 m
Breadth (Maximum)	Not Less than 12.5 m (Minimum working space Breadth 11 m and 0.75 m with free space allowance on both sides)
Draught Forward (Max)	1 m
Draught Aft (Max)	Not more than 2.2m in full load displacement including all underwater projections.

0108. **Speed.** As per following details:

- a. Maximum speed: To be mentioned.
- b. Cruising speed: Not Less than 12 knots.
- c. Economic speed: To be mentioned.

0109. **Endurance.** The crafts should be capable of traversing more than 1200 nautical miles at economic speed.

0110. **Seaworthiness.** The stability of the LCTs is to comply with the requirement of the international Stability criteria of IMO/SOLAS regulation. Following criteria are to be fulfilled:

a. **Stability.** The compliance with intact and damaged stability criteria will be as defined by Classification Society for appropriate category of naval ship.

(1) **Intact Stability.** Comply with the requirement of stability criterion of the rules of the "International Classification Society" and IMO Intact Stability Code.

(2) **Damaged Stability.** The LCTs are to be capable of remaining in stable (with/ without payload condition), even if any 2 adjacent main transverse watertight subdivisions are flooded. The ship's buoyancy is to be ensured and are to provide unrestricted service even if 3 adjacent aft and fore extreme compartments are flooded. The LCTs should fulfil the Probabilistic damage stability requirement by SOLAS.

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(3) Flooding of Cargo deck must be included in damaged stability and is to be designed accordingly.

(4) All stability data and hydrostatic curves are to be provided during the delivery with each LCT in detail.

b. **Sea Keeping.** The sea keeping stabilities of the ships will be as follows:

(1) Continuous Efficient Operation.

(a) To be effective Operable at Sea state 4 (Significant wave height 2.5 m, wind velocity 30 knots) with the effective operation of all system.

(b) Steering design is to fulfil the criterion of maintaining effective headway.

(c) Must sustain Operational effectiveness without serious damage to essential subsystem.

(d) Must be Sustainable at Sea state 5, (Significant wave height 4 m, wind velocity 60 knots).

0111. **Complement.** The total complement in each ship will be 60.

0112. **Construction.** As per rules of an international classification society (which is a member of International Association of Classification Societies) and which is acceptable to buyer:

a. The LCTs (in all aspects except weapons) are to comply with the rules for Naval ship design and standard of a renowned western Classification Society (DNV, BV, LR and ABS) and various requirements mentioned in this specification. Where the requirements vary, the higher configuration is to prevail so that both criteria are fulfilled.

b. Name of classification society is to be mentioned. Mentioned classification society is to be acceptable by BN. Classification Society will need to approve all designs and drawings as per their rules, regulations and practices.

c. Classification Society is to supervise the whole construction and installation process including periodic supervisions at the site as deemed necessary by them.

d. All costs related to Classification Society are to be quoted and borne within the quoted price by the supplier.

e. In the case of weapons, the requirements of the concerned Original Equipment Manufacturers (OEM) are to be fulfilled. Strength and scantlings of armament bases, decks, other related fittings etc. are also to be the responsibility of the concerned Classification Society. In case of doubt as to the standard, the matter is to be mutually agreed upon amongst BN, OEM, Classification Society, Designer and Supplier.

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f. The appropriate class notations are to be mentioned in the technical offer in addition to standard format that will fulfil the requirements mentioned in the tender specification (which will be accepted after receiving by the buyer).

0113. **Certificates from Classification Society.** Shipbuilder needs to provide all required certificates from classification society related to the above class notation.

0114. **Design.** The design of the LCTs shall either be- a proven one (with no change in principal particulars and hydrostatic particulars) or shall be based on a proven hull from design that is already in service in any navy/ government agency in the world. In case of variation from a proven design or proven hull from design (acceptable to BN), the offered design must be class approved and proved by CFD analysis and model tank test results (accepted by BN).

0115. **Design Criteria.**

a. Each LCT is to be designed and constructed in accordance with the latest naval ship design criteria and standards of Classification Society concerning subdivision, stability, structures, shock, vibration, noise, EMI, NBC protections, fire fighting and vital systems.

b. Vital systems such as propulsion, electric plants, navigational and communication systems are to comply with the rules of the Classification Society design criteria and standards where practicable. The offer is to be acceptable by BN.

c. All design, construction and workmanship standard have to be covered by the rules of the "Classification Society".

d. Commercial equipment (if any), are to be of Marine type.

0116. **Special Features.**

a. Power operation along with, manual operational arrangement is to be offered for opening and closing ramp from a suitable side.

b. Special underwater protective arrangement is to be made as per standard design so as to enable safe beaching operation and to protect the underwater propulsion system from any accident.

0117. **Miscellaneous.** Any requirement, not mentioned to fulfil the standard construction of the LCTs as per the classification society standard or appropriate category of naval ship building standard are to be offered.

**SECTION – II**

**HULL AND STRUCTURE**

**PART – I HULL**

0201. **General.** This section describes some of the requirement of hull and structures. Anything not mentioned herein shall not relieve the shipbuilder from their obligation to construct the LCTs as per Classification Society Standard for appropriate category of naval ship building.

0202. **Hull and Structure Design.** The ship is to be designed with minimum magnetic, acoustic, and thermal signature. The magnetic, electromagnetic and thermal signatures are also to be mentioned. Hull is to be protected to ensure a prolong deployment period without maintenance (duration for hull maintenance period is to be mentioned). Appropriate transverse and longitudinal framing systems for strengthening the hull and structure are to be adopted to withstand heavy impact forces. The longitudinal structural elements will consist of the plating/moulding of bottom, sides and main-deck of central keelson, bottom side girders, side stringers, main-deck girders, bottom longitudinal, bilge, ship's sides, main-deck etc. The transverse main structure will consist of appropriate number of watertight bulkheads and of strong web-frames supporting the longitudinal elements. In designing the framing system, consideration will be given to good drainage of water, ballast and accessibility. The building works are not to be boxed in pockets collecting water. Maximum frame spacing is to be mentioned. The hull structure should be able to withstand following conditions:

- a. Mechanical loads like wave impact, erosion, and hydrostatic pressure.
- b. Physical degradation caused by differential swelling (due to moisture) and thermal effects.
- c. Corrosion of material due to sea water.
- d. Biological attack due to fouling and biologically induced corrosion.
- e. Swelling in the surface due to leaching out of material.
- f. Cracking and delamination.

0203. **Material for Hull and Structure.** All steel materials used for the structural construction are to be of "Marine Grade" MS Plate Grade AH 36 (certified by ABS, BV, DNV-GL or LR). The types and constituents of MS Plate Grade AH 36 shall be mentioned with appropriate design concept (approved by Classification Society for appropriate category of naval ship). The quality of other materials (wood, GRP, glass where applicable) for hull and structure shall be in accordance with Classification Society standard for appropriate category of naval ship. Appropriate joining techniques approved by the Classification Society for MS Plate Grade AH 36 shall be used. Generally, electrical arc welding shall be used throughout. Welding shall be carried out under dry, clean and weather protected condition as far as possible. Welding consumables used are to be suitable for the parent metal that will be welded. Ship's hull and superstructures must be welded with continuity without any flaws. The welders should possess 4G welding certificates from the Classification Society.

0204. **Scantling and Materials of Plates, Frames, Girders and Stiffeners.** Scantling of whole ship must be done in accordance with CS requirements and related certificates from CS is to be submitted in due time. The material for plates, frames, girders, and stiffeners throughout the ship are to be used as per approved standard of classification Society. Plate certificates is to be provided during shipment. Storage of plates and raw materials during construction is to be in accordance with storage regulations of CS.

0205. **Side Longitudinal and Deck Longitudinal.** The side longitudinal, deck longitudinal, all beams, girders, stringers etc. are to be constructed as per the Classification Society's standard.

0206. **Bulkheads and Bulkhead Stiffeners.** The bulkheads are to be watertight. Bulkhead stiffeners and all joints are to be constructed as per standard of Classification Society.

0207. **After Body Construction.** The underwater hull is to be designed to obtain adequate clearances for the propellers and to support the rudders as per Classification Society Standard for appropriate category of naval ship building.

0208. **Payloads Capacity.** The offered LCT will carry either Cargo or Person or Tank and Vehicle or combination of any of these as the space and weight constrains permit:

- a. **Cargo.** Not less than 350 tons; or
- b. **Person.** Not less than 350 soldiers when not carrying any vehicles. Troops carrying arrangements are to be mentioned by bidder; or
- c. **Tank and Vehicle.**

Payload	Quantity	Length (m)	Breadth (m)	Height (m)	Unit Weight (ton)
Tank (MBT-2000)	6	10.3	3.6	3.2	48-50

or,

Payload	Quantity	Length (m)	Breadth (m)	Height (m)	Unit Weight (ton)
Guns (155 mm How M-94)	5	11.2	2.415	2.16	34-36

or,

Payload	Quantity	Length (m)	Breadth (m)	Height (m)	Unit Weight (ton)
APC (BTR-80)	12	7.7	3	2.42	15-18

or,

Payload	Quantity	Length (m)	Breadth (m)	Height (m)	Unit Weight (ton)
Military Truck	18	6.75	2.5	2.9	6-7

0209. **Vehicle Securing Arrangement**. Appropriate built-in hard points with accessories for securing cargo, truck and wheeled vehicles should be arranged for various loading situations and flexibility of operation. Design and type of securing points to be mentioned.

0210. **Ramp**.

- a. **Bow Ramp**. One bow ramp with sufficient space for loading and unloading of Payloads (any kind) during beaching operation is to be constructed as per standard of classification society.
- b. Ramp should be capable to withstand the impact of payload (for loading/unloading) and to be built as per standard of classification society.
- c. Ramp opening and securing arrangement should consider both automatic and manual mode of operation. Type and method of securing is to be mentioned.

0211. **Propulsion and Auxiliary Machinery Seating**. Propulsion and auxiliary machinery seating are to be done as per the requirement of the Classification Society standard for appropriate category of naval ship. The base and seating arrangements shall comply with the OEM requirement of the concerned machine and equipment.

0212. **Engine/Machinery Removal**. Facility is to be incorporated for easy removal of main and auxiliary machinery from engine room without cutting the structural members.

0213. **Sea Chests and Bottom Openings**. All underwater openings, sea chests are to be designed according to the SW system of ship and the hull plate is to be strengthened as required by CS.

0214. **Weapons**. Following weapons will be provided by BN:

- a. Type : 2 × 12.7mm HMG
- b. Brand : CIS
- c. Model : 322H CIS
- d. Manufacturer : CIS Singapore
- e. Small arms as required.

0215. **Foundation for Weapons**. Foundations for small calibre gun (12.7 mm HMG) or similar are to be made for installation which is to withstand generated thrusts to avoid distortion of the structure. Foundations are to be made as per Classification Society standard for appropriate category of naval ship.

0216. **Cable Locker**. Self-stowing chain/ Cable locker of sufficient capacity are to be arranged to stow the cables well clear of the deck. The locker is to be fitted with a bilge well. Suitable access is to be arranged for inspection of locker and cables. Chain cables are to be secured by quick released type bitter end fittings in locations for easy access. The structure is to be adequately stiffened in way of bitter ends and provide with all necessary fittings.

0217. **Hawse Pipe.**

- a. Two anchors are to be stowed in recessed pockets in suitable location at bow (port and starboard side) in the shell.
- b. One anchor is to be stowed in stern extended from shell for facilitating beaching operations.
- c. The hawse pipe of adequate diameter and length are to be fitted/constructed/ in such a way that free fall of anchor and easy housing of the anchor shanks and shackles are ensured. The rims of the hawse pipes are to be protected with round bars or castings of good quality.
- d. Anchor cable cleaning facility is to be supported by the hawse pipe arrangement.
- e. Castings to be of good quality and projections to be trimmed off with smooth ground. All arrangements for securing anchors are to be as per the standard of CS.

0218. **Construction of Tanks.** The fuel oil, lub oil, fresh water, dirty lub oil, sewage tank, ballast tank, etc are to be integral part of the hull as far as possible and are to be constructed and tested in accordance with the regulation of the Classification Society for appropriate category of naval ship building. Each tank and cofferdam etc are to be fitted with one bottom plug as close as possible to the lowest point of each tank and to be kept clear of points where keel blocks are laid beneath in dry dock.

0219. **Capacity of Tanks.** Tanks capacity are to commensurate with requirements of complement and endurance. Total fuel capacity will be summation of allowable consumable fuel capacity and fuel to be stored compulsorily for stability. Allowable consumable fuel capacity (consumption of which will not affect stability of the ship adversely) should be sufficient enough to operate all machineries according to endurance, without compensating or ballasting fuel tanks. Separate dirty oil tank should be included in the design as well. The minimum capacity of mentioned tanks should be as follows:

- a. Fuel Tank (Capacity and Number): To be mentioned.
- b. Fresh Water/ Portable Water : Minimum 60 tons.
- c. Lub Oil : To be mentioned.

0220. **Deck Fittings and Other Appendage.** Upper deck fittings and other appendages are to be as per LCT standard. Following items should be made of Aluminium or Nonmagnetic material:

- a. Guard rail, horse rail, foot rail (Removable).
- b. Nuts, bolts and screws.
- c. Handle of Ladder.

0221. **Insulation and Deck Coverings.**

- a. **General.** Living and control spaces are to be fitted with thermal insulation as appropriate. Exposed side of insulation is to be finished with appropriate insulating material where not covered with joiner lining or ceiling panel. But the concealed space by sheathing is to be finished with aluminium foil. The insulation material is to be appropriate one.

b. **Insulation.** Mineral wool will be laid on tops and side walls of the living accommodation rooms in main hull, crew rooms, bridge and dining room except galley in the deckhouse. The tops and walls of engine room, machinery control room, galley and bulkhead of Ammunitions will be laid with flame-retardant material. SO curves.

c. **Face Plate/ Lining.**

(1) The bulkhead and ceilings of messes, cabins and offices will be laid with fireproof plastic coated marine quality panel boards/ any other modern material with light decorative colour approved by purchaser. The spaces include:

- (a) Officers cabin.
- (b) Wardroom and Mess rooms.
- (c) Sick-bay.
- (d) Galley and Wardroom Pantry.
- (e) Refrigerated and frozen provision storeroom.
- (f) Toilet and shower spaces.
- (g) Laundry.
- (h) Ops Room / Conference room.

(2) Officers cabin, mess-room and sickbay will be fitted with honeycomb sandwich panel as lining material. And bulkhead between two lined cabins will be fitted with two-side composite rock panel.

(3) Moist cabins such as WC, washroom and bathroom will be fitted with honeycomb sandwich panel as lining material. And bulkhead between two lined cabins will be fitted with two-side composite rock panel.

(4) Galley will be fitted with composite rock panel as lining material. Refrigerated and frozen provision storeroom will be fitted with polyurethane insulation panel as lining material. Ventilation/ Exhaust fan for Wardroom Pantry will be fitted.

d. **Deck Coverings.**

(1) Within galley, wash places, toilets and other wet accommodation spaces, deck coverings are to be of non-skid polyurethane or latest deck covering scheme in use.

(2) In other accommodation spaces, offices, lobby, etc. deck coverings are to consist of suitable underlay covered with polyurethane or latest deck covering materials in use.

(3) The floors of battery room, ammunition magazine, switch board room will be covered with rubber mat.

0222. **Hull Designation and Markings.**

a. **Access Closure Numbering.** All compartment, doors, hatches, manholes and scuttles are to be numbered in accordance with basic location numbers according to British Navy's BR 2170 (RN) system as practiced in BN.

- b. **Draught Marks.** Draught marks are to be placed at a suitable place at both sides of the bow and the stern.
- c. **Ship's Number and Distinguishing Marks.** The ship's number and distinguishing marks are to be provided. Name box in Bengali and English are also to be provided.
- d. **Shipbuilder's Data Plaque.** Two in number bronze plaque in English and Bengali cast or engraved are to be supplied.
- e. **Benchmarks.** Ship's structure is to be scored with suitable trim and benchmarks to aid on accurate alignment of gyrocompass, armament etc. and the same are to be recorded. The position of rudder amidships is to be permanently marked on structure.
- f. **NBCD Marking.** NBCD and gas tight markings are to be as per British Navy's BR 2170 (RN) system as practiced in BN.
- g. **Warning, Operating and Instruction Plates.** In addition, plates required for particular applicable specifications, warning operating and instruction plates are to be installed as required.

0223. **Jack Staff and Ensign Staff.** Collapsible jack staff and ensign staff with necessary fittings are to be provided at bow and stern respectively. Hooks are to be made and fitted with staffs for rigging dressing lines.

0224. **Navigation Light Boxes.** All navigation light boxes of the ship should be fixed on the appropriate locations according to COLREG 1972.

0225. **Bollards.**

- a. Appropriate number of double head type bollards are to be fitted on the fore and aft deck on either side for 4 (four) quadruple ropes. It is to be constructed with suitable foundation from deck.
- b. All bollards are to be provided with suitably placed fairleads of good quality casting.
- c. Bollard pull is to be mentioned.

0226. **Shore Gangway/ Brow.** Shore gangway/ brow and ship to ship brow of suitable size fitted with handrail, stanchions, wheels, lighting arrangements etc. is to be provided. The gangway is to have a shore roller with neoprene tire at the shore end and hook at the other end. Footplates of brow should be made non-slippery (both way, entry and exit). Quarter Master's (QM) Hut should be placed near the Gangway enclosed with side screen and equipped with QM table and State Board.

0227. **Stair and Ladder.** Suitable stairs and ladders (Numbers to be mentioned) for embarking and disembarking of personnel are to be fitted in accommodation, machinery space and other spaces. Ship stairs should have a safe climbing angle between 50 and 70 degrees and have safety rails on both sides.

0228. **Ship's Boat and Davit.** Ship should have a suitable radial davit to lower and hoist the ship's boat with lifting capacity of 2.5 tons. Suitable place for 1 (one) inflatable rubber boat with outboard engine is to be provided. Foundation of davit base is to be built as per CS requirement.

0229. **Special Features.** Special under water protective arrangement is to be made as per standard design so as to enable safe beaching operation and to protect the underwater propulsion system from any accident.

## **PART – II SUPERSTRUCTURE**

0230. **Superstructure.** Superstructure shall be constructed by "Marine Grade" MS Plate Grade AH 36 and be designed and constructed in accordance with the Classification Society Standard for appropriate category of naval ship. It should satisfy following:

- a. The superstructure including bridge is to be designed and constructed in accordance with standard classification society for appropriate category of naval ship building.
- b. Superstructure is to be transversely stiffened and inside division bulkheads will be of vertically stiffened flat type or wedged type where suitable as per the requirement of Classification Society for appropriate category of naval ship.
- c. Arrangement of internal webs, pillars and bulkheads will be specially considered to minimize vibration as per requirement of Classification Society.
- d. Deck plating is to be thick as per standard of Classification Society for appropriate category of naval ship building. Bulkhead plates are to be as thick as per standard Classification Society requirement.

0231. **Mast.** One fabricated marine grade folded mast, strong enough to carry navigational radars and communication equipment with necessary blocks, yardarm, hooks, fittings, etc. is to be erected at the after side of the bridge top deck. The deck structure is to be sufficiently stiffened to bear the load and vibration. Mast should be able to be folded during crossing under bridges.

## **PART – III CONSTRUCTION STANDARD**

0232. **Design Concept and Construction Procedure.** The hull is to be constructed as per rules of an International classification society. The material of the hull should be characterized with light weight, high strength and appropriate stiffness, corrosion resistance, and fatigue-resistant properties. Degradation of material due to environmental effect (temperature, humidity, rainfall, wind effect) appropriate for tropical condition are to be mentioned. Detail fabrication methods for sections of hull and structures are to be mentioned.

0233. **Joining of Blocks and Temporary Pieces.**

- a. All structures (plates, frames, girders, stiffeners) are to be continuously joined by welding in accordance with Classification Society standard. The welders must possess 4G welding certificates from the classification society.

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b. Excessive distortions of hull structures due to joining are to be avoided and rectified as per standard means if needed.

c. Lifting lugs, staging pieces or the other temporary pieces fitted to the inner hull structures for construction may be left unless they are inconvenient for the service of the vessel.

0234. **RADAR Cross Section (RCS)**. The ship should be designed to minimize the RADAR cross-section as practicable.

0235. **Shock and Vibration**. The equipment shock qualification shall be achieved by testing, calculations or test extension, as applicable and/or appropriate.

0236. **Noise & Vibration**.

a. The hull shall be free from abnormal noise and vibrations caused by unacceptable resonance due to coincidence of the propeller and hull natural frequencies. The resilient mounts and flexible joints shall be provided to minimize the noise due to the machinery and equipment, which is transmitted to the hull causing radiation into the water.

b. The ship shall be built to achieve both in hull design structure and the selection machinery for minimizing self and radiated noise. All compartments are to be acoustically insulated and airborne noise levels of equipment are to be adequately silenced and are not to exceed values specified in MILS-740. All noise critical auxiliaries are to have suitable measures to reduce the structure borne noise level.

0237. **Surface Preparation and Priming**. All surfaces should avoid pinholes and blisters as per Classification Society Standard.

0238. **Painting**.

a. All rust and dirt of MS plates for Hull and Superstructure are to be cleaned with appropriate blasting method and painted with suitable primer before fabrication.

b. Suitable Paint (scheme to be mentioned) free of Lead, toxic ingredient and self-polishing/ glossy anti fouling as per requirement of ship will be applied in the underwater area. Hull top and superstructure are to be applied with suitable paint. Suitable Epoxy/ Conventional paint is to be used as acceptable to purchaser.

c. The paint scheme and dry film thickness, thinning ratio, atmospheric temperature, humidity, re-coating interval and drying time will be as per recommendation of the paint manufacturer for newly built naval ship.

d. Detail paint schedule for different areas of the LCT is to be proposed by Supplier and approved by the CS.

e. Fuel oil and Lub oil tanks are to be painted with appropriate naval modern paint scheme as per requirement of Classification Society.

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- f. Magazine is to be painted internally with non-inflammable paint in accordance with as CS requirement.
- g. Colour shade of external and internal painting of the ship's hull and structure will be proposed by supplier and approved by purchaser.
- h. For hull appendage (rudder, propeller shaft bracket, fin stabilizer, bilge keel, sea suction valve) below waterline, modified paint scheme will be used as appropriate and valid period will be no less than 6 years.
- j. For freeboard of main hull, external surface of shell plate on the superstructure, exposed deck (external waterline and zone where water will be easy to accumulate), modified appropriate paint scheme will be used.
- k. For freshwater tank, refrigerated/ freezing cabin, dry provisions storeroom pure appropriate food grade paint scheme with qualified certificate will be used which valid period will be not less than 6 years. Fresh water tanks should be painted with appropriate food grade paint scheme recommended by classification society for appropriate category of naval ship building.

0239. **Anti-Sabotage Arrangement.**

- a. All ventilation trunks are to be arranged to prevent the passage of articles or liquids into the compartment.
- b. Natural exhaust outlets are to be of anti-sabotage construction.
- c. All suction, sounding, filling tubes/ pipes that terminate in or adjacent to or pass through a magazine are to be of fitted with lockable cap.

**PART – IV ACCOMMODATION**

0240. The accommodations shall be provided for the following:

Officers	: 07
Other Ranks	: 54

0241. **CO's Cabin.** One in no cabin (with attached Toilet and Bath) for the Commanding Officer.

0242. **Officer's Cabin Two Berth.** One in no Officer's Cabin of 2 Berths with common attached toilet and bath.

0243. **Officer's Cabin Four Berth.** Two in no Officer's Cabin of 4 (four) berth (two storied) with common attached toilet and bath.

0244. **Senior Sailor's Mess.** Two in no Mess for 14 senior rates (total bunk to be 16).

0245. **Junior Sailor's Mess.** Two in no Mess for 40 junior rates for both messes (total bunk to be 42).

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0246. **Common Washroom and Lavatory**. Separate Common Washrooms and Lavatories for officers, senior sailors and junior sailors are to be made close to respective accommodation.

### **PART – V MESSING AND RECREATION**

0247. **Wardroom**. Wardroom with pantry facilities for officers with suitable space having the dining and recreation facilities.

0248. **Dining for Sailors**. Dining with recreation facility for sailors (with temporary separation). Adjustable temporary separation should be designed according to the modular design concept of appropriate category of naval ship.

0249. **Galley**. A galley with the facility to cook food for 150 peoples is to be incorporated in the design at suitable location.

0250. **Provision Store (Dry and Fresh)**. The dry and fresh provision stores to be made to store dry provisions, fresh provisions and tin provisions for 15 days, 7 days and 3 days respectively for 60 persons.

### **PART – VI ICCP**

0251. **ICCP and Antifouling System**. Standard ICCP package for the corrosion protection of whole underwater part of the ship should be available. As secondary, necessary amount of Zinc Anode according to the hull shape should be provided for cathodic protection of hull. Moreover, antifouling system is to be fitted to reduce corrosion and marine growth in the underwater suction/strainers.

### **PART – VII MISCELLANEOUS COMPARTMENT**

0252. **Bridge**. A standard bridge arrangement is to be designed and constructed. Bridge design will have to satisfy all IMO and SOLAS regulations. Open bridge wings are to be constructed on both sides of the bridge.

0253. **Machinery Control Room**. A machinery control room (MCR) adjacent to engine room is to be constructed. MCR is to be soundproof. Adequate insulation is to be provided for preventing heat transfer from engine room to MCR. MCR should have full view of Engine Room through heat and sound resistant glass. Engine control system, main switch board and other machinery control system should be installed in MCR. MCR should have sufficient air conditioning system for maintaining main switchboard.

0254. **Offices**. Following offices is to be accommodated in maximum 3 (three) compartments ensuring required ventilation:

- a. Ship's office.
- b. Seaman office.
- c. Engineering office.
- d. Electrical office
- e. Main Communication Office.

0255. **Ops Room/ Conference Room**. A compartment is to be designed in suitable location with required ops room facilities for amphibious operation. This compartment should also be used as conference room when necessary.

0256. **Stores**. Required stores are to be made to store miscellaneous naval store item, engineering and electrical spares. The stores are to be fitted with shelves, racks, bins and other facilities as required. Following stores are to be made available ensuring required ventilation and storage space:

- a. Naval store.
- b. Engineering and Electrical Store.
- c. Bos'n store.

0257. **Lockers**. Following lockers are to be made in required places ensuring adequate storage space:

- a. Gunnery and ordnance locker
- b. Ready use ammunition lockers.
- c. Pyro Technique Locker.
- d. ELSA Lockers as required.

0258. **Armory and Magazine**.

a. Magazine room for stowage of sufficient quantity of ammunitions (as per BN requirement) for guns is to be made as per standard of classification society for appropriate category of naval ship building. In the design of ammunition storage system, full consideration to be given to safety, strength, rapidity of handling, weight saving, economy of space and elimination of features that may damage the ammunitions. The arrangement will ensure that the ammunitions will be safe when the ship is rolled up to angle of no return. Portable vertical and horizontal battens will be fitted with the devices to secure them in their position. All ammunition in stowage will be safe in normal ship operation condition. Special fireproof shielded cables and explosion proof lights and fittings are to be fitted inside the magazine as per appropriate category of naval ship standard. It is to have flooding and sprinkler system for fire fighting as per standard. In the magazine, recommended fire retardant paint scheme is to be applied. Armory and magazine should have air condition facilities.

b. Small arms locker equipped with suitable stowing facility with accessories are to be made as convenient. It is to have fire fighting arrangements (including portable fire extinguisher) as per standard.

0259. **Keyboards**. One in number armament keyboard with key hooks and identification tags shall be fitted in Captain's cabin. A general keyboard shall be fitted in the wardroom. One in number radiation hazard keyboard shall be fitted in suitable place.

0260. **Damage Control Stations**. Standard damage control System with gears to be provided. The ship shall be constructed and equipped to a consistent set of accepted naval standards for damage control. In the Damage Control Stations, the following functions shall be included:

- a. Fire Detection (i.e., detection of smoke, flames and temperature rise).

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- b. Sea Water Fire fighting.
- c. CO<sub>2</sub>/ AFFF/ Portable Fire fighting arrangement.
- d. Flooding.

0261. **Laundry Facilities.** Two sets of washer and dryer (one set for officers and one set for sailors) are to be provided. Washers and dryers are to be installed in a suitable location in washrooms.

0262. **Sickbay.** A sickbay with necessary arrangement is to be arranged. Medical equipment and instruments are to be made of western origin (USA/ UK/ Germany/ France/ EU/ Japan). The sick bay is to be fitted with following:

- a. Hospital berth (Single tier).
- b. Medicine Locker.
- c. Sterilizer.
- d. Book rack and desk with chair.
- e. Refrigerator.
- f. Wash basin and water closet.

0263. **Diving Equipment.** Standard diving equipment comprising four in number diving sets, one portable air compressor along with associated diving accessories for a complete diving team of each LCT are to be provided. One air conditioned diving store to be made for storage of all diving equipment. The diving store should have facilities for charging the diving sets with compressed air supplied from the portable air compressor. The diving sets, portable air compressor and associated diving accessories should be of western origin (USA/ UK/ EU).

0264. **Life Saving Equipment.** Standard Life saving equipment as per SOLAS standard to be provided. Appropriate foundation and points for life saving equipment (life raft, life buoy etc) should be considered designing the upper deck layout.

**SECTION – III**

**ENGINEERING MACHINERY, EQUIPMENT AND SYSTEMS**

0301. **General.** All propulsion, auxiliary machinery and systems are to be rigorous and as per Classification Society Standard. The facilities for easy lifting and removal of all propulsion, auxiliary and system should be available as per IACS standard. The layout of machinery is to be such as to provide easy access for routine and onsite maintenance. In addition, they are to meet the requirements described in the subsequent paragraphs.

0302. All machinery and equipment are to comply the followings:

- a. Must be Marine type.
- b. Must be Certified by Classification Societies.
- c. All generators and propulsion engines should have lifting eyes for chain blocks on top for removal and re-installation of heavy components. Necessary I-beams and rails should be there for the purpose of this.

**PART – I PROPULSION**

0303. **Propulsion System.** The propulsion system of each LCT is to be consisted of the followings:

Ser	Propulsion Machinery	Quantity	Remarks
1.	<b>Main Engine.</b> Two in number four stroke marine diesel engines capable of developing sufficient power required to attain the maximum ship's speed.	2	Details to be mentioned
2.	<b>Number of Shafts.</b> Two in number shafts with accessories. Propulsion system should be FPP with reduction gearbox.	2	Details to be mentioned
3.	<b>Reduction Gearbox.</b> Two in number reduction gearboxes compatible with Diesel Engines.	2	Details to be mentioned
4.	<b>MCMS.</b> Machinery Control and Monitoring System including (one) remote control position.	1	Details to be mentioned
5.	<b>Steering System.</b> Electro hydraulic Steering as preliminary and secondary Mechanical steering with redundancy/ emergency provision, to be western origin and manufactured are to be supplied.	1	Details to be mentioned

- a. The propulsion machinery such as diesel engines, reduction gears, shafting/ propeller including their attached pumps shall have a proven record of shock resistance in accordance with the standard of Classification Society to meet the LCT requirement.
- b. The shafting system shall accommodate all excursions of the resiliently mounted propulsion unit under shock with no degradation in performance.
- c. The machinery plant shall operate in a satisfactory manner, over its entire operating range, without exceeding the specified noise and vibrations limitations.

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- d. Two propulsion system consisting of one Main Engine per system capable of developing sufficient total power required to attain the maximum continuous ship's speed in all-weather condition in sea areas of Bangladesh and Bay of Bengal.
- e. The propulsion system is to consist of two independent systems, one port and one starboard. Each propulsion system should consist of one identical diesel engines, one reduction gear, necessary clutches/ flexible couplings, fixed pitch propeller and necessary shafting arrangement as per Classification Society Standard for appropriate category of naval ship building.
- f. Shaft between the FPP and gear box shall be adequately supported with support bearing.
- g. Each shaft is to be driven independently.
- h. Shaft locking gears are to be provided for each shaft. Arrangements should be made such that, if one shaft is not used, it may be locked properly or may be allowed to rotate without any difficulty.
- j. Each of the Diesel engines should be used as cruising engines selectively.
- k. The propulsion engines are to be appropriately connected to the suitable gearboxes. Gearbox should have trailing capability for unlimited period.
- l. The propulsion control system should be able to provide remote monitoring and control from Bridge and Machinery Control Room (MCR). Local Control and Monitoring Panel is to be available in engine room. Provision will be kept for operating and engaging engines with gearbox manually in the engine room.
- m. Computer based maintenance and fault diagnosis system is to be supplied with necessary software and training.

0304. **Technical Specification of Engine.** To be provided according to following technical specification:

- a. Model / Type of engine : Brand: Caterpillar/ SEMT Pielstic/ MAN/ MTU  
Type: Marine Diesel
- b. Name of the Manufacturer : Caterpillar (USA)/ MAN (Germany)/ MTU (Germany)/ SEMT Pielstic (France).
- c. Year of Manufacture : 2021 or later.
- d. Country of Origin : USA/ UK/ France/ Germany.
- e. Country of Manufacture : USA/ UK/ France/ Germany.
- f. Cycle : 4 Strokes.
- g. Aspiration : Turbo charged and intercooled.
- h. Fuel Injection : Direct fuel injection.
- j. Cooling : Freshwater cooling. Freshwater being cooled by seawater through appropriate heat exchanger. Lub oil should also be fresh water cooled.
- k. Numbers of Cylinders and Arrangement : To be mentioned.

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- l. Bore and Stroke : To be mentioned.
- m. RPM : To be mentioned.
- n. Maximum Continuous Power : To be mentioned for each engine, at 45°C air and 32°C seawater temperature.
- p. Maximum power output : To be mentioned.
- q. Brake Mean Effective Pressure (BMEP) : To be mentioned.
- r. Idling RPM : To be mentioned.
- s. Time between Major Overhauls : Not less than 15000 hours.
- t. Time between Top Overhauls (if applicable) : Not less than 7500 hours.
- u. Fuel oil to be used : NATO F-76/Dieso F-76.
- v. Lub oil to be used : To be mentioned.
- w. Dry and Wet weight in kg : To be mentioned.
- x. Dimension : To be mentioned.
- y. Specific Fuel Consumption : To be mentioned.
- z. Maximum Operating Angle:
  - (i) Pitch
  - (ii) Roll athwart ships
- aa. Crank case safety system to be incorporated to avoid crankcase Explosion using modern technology and relevant feature : Details are to be mentioned.
- ab. Diesel engine, is to be in compliance with IMO MARPOL regulation, Annex VI, tier 2, in force for NOx emission : Details to be mentioned.

0305. **Ambient Condition.**

- a. Air intake temperature : + 45<sup>0</sup> C (Max).
- b. Sea water temperature : + 32<sup>0</sup> C (Max).
- c. Humidity : Up to 98% (non-condensing).
- d. Sea water condition : Muddy.
- e. Suspended Solids : Up to SW 20,000 ppm.
- f. Salinity : Up to 34 gm/ltr.

0306. **Design and Record of Sales.**

- a. The engines will be of new construction, latest proven model and up to date design.
- b. Record of sales of quoted model indicating user and type of ship is to be mentioned with the quotation.

0307. **Sensors, Indicators and Gauges.** Required temperature, pressure and speed measuring devices (Sensors, indicators, gauges) and any other instruments/devices recommended by the respective manufacturers are to be suitably positioned on panels mounted on/near each of the propulsion machinery and these are to be as simple as possible and easily replaceable. Few mechanical gauges which will indicate important parameters of prop machineries should also be available in MCR parallel to digital displays (like main engines LO pressure, LO temperature, fuel pressure, FW pressure, exhaust temp, fire line pressure, auxiliary sea water pressure etc.).

0308. **Operating Instructions.** Starting and stopping procedures of machinery shall be clearly provided near the equipment concerned. Special cautionary signs are to be posted where necessary.

0309. **Maintenance Facility.** Following maintenance facilities are desirable:

- a. All engines, gear boxes and accessories will be facilitated for easy removal and re-installation inside the ship.
- b. The layout of all machinery and system will be such that they provide easy access for routine and onsite maintenance.
- c. All propulsion engines and generators are to have lifting eyes on top for using chain blocks for removal and re-installation of heavy components. Necessary 'I'-beams and rails are to be provided above the engines.
- d. Computer based maintenance and fault diagnosis system is to be supplied with necessary software and training.

0310. **Fuel Oil Tank and System.** Total fuel capacity and allowable consumable fuel capacity (consumption of which will not affect stability of the ship adversely) should be sufficient enough to operate all machineries according to endurance (Endurance not less than 1200 nm at economic speed) at economic speed, without compensating or ballasting fuel tanks. The fuel oil tanks will be connected via pipes and valves. The system is to consist of the following:

- a. Required number of fuel transfer pumps (with 1 pump as redundancy) to transfer fuel oil between the tanks. Each pump is also to be capable of discharging fuel from designated fuel tank to discharge point placed on deck, in order to empty the tanks for repair or supply fuel to the alongside ship.
- b. Required number of strainers of simplex type at suction side of each pump. (Details to be mentioned during submission of quotation).

- c. The service system shall be arranged in accordance with requirements of engine manufacturer.
- d. Provision for controlling the fuel oil tank valves remotely from the main deck (emergency stopping) is to be made.
- e. The specifications of the fuel oil transfer pump should be as follows:
  - (1) Number : To be specified.
  - (2) Type : Gear.
  - (3) Capacity : 25 m<sup>3</sup>/h (at least).
  - (4) Pressure head : Must be compatible with system.
  - (5) Drive : Electric motor.
- f. **Purifier.** Required number of purifiers (fuel – water and dirt separator) are to be provided. Total number is to be mentioned.
- g. Separate storage facility for gasoline (petrol) for ship's boat (approximately 120 litres).

0311. **Specific Fuel Consumption (SFC).** Engine characteristic curves (moment versus rpm: incorporating SFC, maximum continuous rating, maximum exhaust temperature, related propeller curve etc.) are to be provided. Specific fuel consumption at following ratings is to be specified:

- a. Maximum power.
- b. Maximum Continuous Rating (MCR).
- c. 75% of MCR.
- d. 50% of MCR.
- e. 25% of MCR.

0312. **Fuel System.** High Speed Diesel (HSD) will be the fuel for the main engines. Engine mounted fuel injection pumps are to be fed from fuel oil header tanks via duplex filters and fuel boost pumps driven by engines. Fuel oil header tanks will be replenished from fuel oil service tanks by fuel oil circulating pumps. Leakage fuel from the fuel injection pumps and injectors is to be led to dirty oil tanks situated in the engine rooms. As a secondary option to replenish the header tanks (in case of failure of the fuel oil circulating pump), a hand pump is to be provided. Arrangements are to be made to empty the header tanks and purge the fuel system easily. Fuel flow meters are to be included with the system.

0313. **Main Machinery Lubricating Oil (LO) System.** The main purpose of LO system will be to lubricate the engine bearing and wear points by forced lubrication, based on either by dry sump or wet sump principle. LO tank arrangements and fittings of LO pumps are to be done according to the dry sump or wet sump principle. Required number of LO coolers, pumps, suction strainers, valves (suction and discharge valves, relief valves, pressure reducing valves, non-return valves etc.) and filters are to be provided in the system. Separate LO pump is to be provided, in order to prime the LO systems prior

starting main engines, of each main engine. As the redundancy to LO priming pumps, required numbers of hand operated priming pumps are to be provided.

0314. **Lubricating Oil Tank and System**. Propulsion engines, diesel generator engines and gearboxes are to use same type of lubricating oil (SAE 40 or equivalent, which must be available in Bangladesh local market). One lubricating oil tank of adequate capacity is to be built in the engine room with a steel filling and de-aeration pipe to the main deck and a sounding pipe in the engine room. The de-aeration pipe is to be provided with a flame arresting cap. Dirty lubricating oil from engine sump will be discharged via a hand pump to a Dirty Lub Oil Tank. The lub oil system for diesel engines, generators and reduction gears will be arranged in accordance with the requirement of manufacturer. Required number lub oil transfer pump of adequate capacity is to be incorporated in the system with additional one for redundancy. Required number of purifiers (lub oil – water and dirt separator) are to be provided with the LO system.

0315. **Filling, Sounding and De-aeration System**. The fuel and lub oil tanks are to be provided with filling and de-aeration piping with flame arresting caps. Fresh water filling pipes should have bronze caps secured by chains. The fresh water sounding pipes are to be located in the accommodation compartments. Fresh water filling pipes should have bronze caps secured by chains. There should be shore filling points in both port and starboard side, at suitable locations of the ship.

0316. **Starting System**. Engine is to be started by compressed air. Adequate number of starting air compressors and reservoir with appropriate capacity and redundancy is to be provided.

0317. **Shutdown System**. Engine shutdown system may include the followings:

- a. Normal shut down via injection pump both with the engine and at the remote control panel (if provided).
- b. Emergency shutdown via emergency air shut-off flaps, by stopping combustion air supply or fuel cut off or any other method recommended by the engine manufacturer.
- c. System should be available with engines, in MCR and Bridge.

0318. **Combustion Air System**. This system will be designed to have minimum noise level with shock and vibration damping facilities as per “Navy Standard”. Combustion air system should be as such, sufficient (surplus) air is available for the engines even at highest loading condition.

0319. **Exhaust System**. Dry exhaust system is to be used in the LCT. This system will be designed to have minimum Infrared (IR) signature as per “Navy Standard”. Among other, the system will have the followings:

- a. Provisions for monitoring exhaust temperature of combined cylinders/ individual cylinder and supply of temperature gauge for turbo-charger.
- b. Expansion between turbocharger and main exhaust pipe.
- c. Exhaust silencers.
- d. Exhaust flaps.
- e. Exhaust funnel should be placed in suitable position.

0320. **Mountings**. The LCT must be capable of withstanding under water shock resulting from explosion. The limit of shock resistance of the offered LCT is to be quoted. Engine mountings are to be as per the recommendations of engine manufacturer. The mountings will absorb shock and vibrations resulting from engine operation without suffering disproportionate distortion.

0321. **Torsional Vibration Damper**. All the rotational machinery and the engines are to be fitted with Torsional Vibration Damper or any other mechanism as applicable (incorporated by the manufacturer) to suppress torsional vibrations.

0322. **Power Transmission**. Engine power should be transmitted through:

- a. Heat resistant and torsion resilient coupling approved by the Classification Society.
- b. Coupling is to be integrated and aligned with engine and gearbox with necessary connecting hardware.

0323. **Instruments to be Mounted on Engine**. The following instruments along with piping and cables are to be supplied and fitted with the local control panels which in turn are to be mounted on or near to each of the main engines (also refer to Art 0326):

- a. Sea water pressure gauge and displays.
- b. Sea water temperature gauge and displays.
- c. Fresh water pressure gauge and displays.
- d. Fresh water temperature gauge and displays.
- e. Fuel delivery pressure gauge and displays.
- f. Fuel filters differential pressure gauge and displays.
- g. Lubricating oil pressure gauge and displays.
- h. Lubricating oil temperature gauge and displays.
- j. Lubricating oil filter differential pressure gauge and displays.
- k. Exhaust temperature gauge (for combined/individual cylinder) or displays.
- l. Engine speed indicator (Tachometer).
- m. Engine's running hour meter (Hour counter).
- n. Low lubricating oil pressure alarm (visual and audio) for main engine with trip mechanism.
- p. Low lubricating oil pressure alarm (visual and audio) for gearbox.
- q. High freshwater temperature alarm (visual and audio) with trip mechanism.

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- r. Low freshwater pressure alarm (visual and audio).
- s. Engine over speed alarm (visual and audio) and trip mechanism.

0324. **Classification.** Type approval certificates from Classification Society for the engines, gearboxes and auxiliaries are to be provided. All underwater overboard Valves need to be approved by classification society.

0325. **Engine Load Test.**

- a. Engine load tests up to maximum overload limit and time are to be carried out in the factory premises as per requirement of the Classification Society in presence of purchaser's representative.
- b. All documents related to engine load test are to be provided.

0326. **Emergency Protection Devices.** The machinery will have following protection devices (refer to Art 0323):

- a. All propulsion engines, prime movers and other equipment are to be provided with normal protection devices for warning of malfunction and for emergency shutdown. Main propulsion machinery is to be provided with audio and visual warnings.
- b. Automatic shutdown is to be arranged for high water temperature, low lub oil pressure and engine over speed.
- c. Audio and visual alarm for high water temperature, low lubricating oil pressure and engine over speed are to be provided.
- d. Manual over speed trip gear/emergency shut off device.

0327. **Gearbox.** Two in number reduction gearboxes (origin and made in Germany/ France) compatible with Diesel Engines to be supplied. Details of gearbox are as follows:

- a. Brand: Renk AG/ Reintjes GmbH/ ZF AG Marine/ Masson Marine/ MTU  
Type: Reduction Gear Box  
Manufacturer : Germany/France.
- b. The gear boxes are to be appropriately connected to the engines to prevent transmittal of torsional vibration/shock during its operation. It will ensure smooth transmission of power.
- c. A marine reduction gear box should be coupled through flexible coupling/ suitable modern arrangement to each main engines as per recommendation of engine maker and gear box manufacturer.
- d. The details of gearbox with reduction ratio is to be specified.
- e. The gearboxes are to have the provision for unlimited trailing operation.

- f. Where applicable, each clutch is to be operated remotely and emergency clutch control mechanism will also be provided on the gear box.
- g. The transfer from cruise to sprint mode shall be done easily from one mode to the other without substantially reducing speed (below cruising speed).
- h. **Mounting of Gearbox.** Mounting for the gearbox housing is to be of rigid mounting type and as per class and manufacturer's recommendation.
- j. **Control and Monitoring.** Standard Control, Monitoring and Alarm systems are to be provided in the vicinity of the gearboxes, bridge and in MCR console as per standard of classification society for appropriate category of naval ship building.
- k. **Standard Attachments and Monitoring.** Standard attachments (e.g., gear lubricating oil pumps, lubricating oil coolers, inspection facilities, gear turning facilities etc) are to be provided. Standard monitoring devices are to be provided.
- l. **Turning Device.** Electric motor driven turning gear is to be fitted on the gear box to lock the propeller. This is also to serve to rotate the propeller slowly for maintenance. The locking device should have capability to hold the trailing shaft up to maximum ship speed in single shaft operation.
- m. **Design and Record of Sales.** The gear box will be proven model and up to date design. Record of sales of quoted model indicating user and type of ship is to be mentioned with the quotation. Type approval certificates from Classification Society are to be provided.

0328. **Propeller Shaft with Accessories.** Two in number shafts (origin and made in UK/ Germany/ France/ USA/ EU/ Japan) with accessories. Technical particulars of propeller shafts are to be as follows:

- a. **Shaft.** Shafts are to be made as per latest technology and in accordance with the requirements of the classification society. The shaft should have sufficient strength to transmit power of the engines during ship's entire life. The shafts should have arrangement of easy removal during docking.
- b. **Shaft Gland and Brackets.** Each of the shaft glands is to be constructed of thick walled piping arrangements to support the propeller. The gland seals are to be sea water cooled provided with necessary rubber sealing glands or the appropriate cooling arrangements as per classification society standard for FPP propeller for appropriate category of naval ship.
- c. **Shaft Gland Sealing.** Commercially available appropriate shaft gland sealing is to be provided as per class rules. Type/model of packing (if any) is to be mentioned.
- d. **Shaft Gland Lubrication.** Preferably the gland is to be seawater lubricated. However, the exact lubrication method is to be specified.
- e. **Brake and Locking Gear.** Each shaft is to be provided with necessary brake and locking gears.
- f. **Turning Device.** Arrangement is to be made to turn propeller shaft.

0329. **Thrust Block and Bearing.** Arrangement is to be made to absorb the propeller thrust for ahead and astern movement of ship in accordance with the relevant class rules.

0330. **Fixed Pitch Propeller.** Appropriate fixed pitch propellers are to be installed with respective shaft to attain the required speed.

0331. **Machinery Control and Monitoring System.** Each LCT is to be fitted with one Machinery Control and Monitoring System (origin and made by Atlas Elektronik GmbH, Germany/ Noris Automation, Germany/Servo Watch System Ltd, UK/LOGIMATIC International, Denmark/Japan) including one control position with one remote facilities for running propulsion plants. In fully automatic control mode, the ship is to be controlled from MCR or pre-selected from the Bridge control console fully automatically via control levers. The electronic features of the Propulsion Control are to be separated for each shaft system. Manual remote control system is also be catered in case of failure of automatic control. The Propulsion Control system is to allow operating both plants from Engine Room (local control mode), Machinery Control Room (MCR) and Bridge (remote control mode). Local MCM panel of each engine is to be located adjacent to it. Details of propulsion control and monitoring system are given below:

a. **Propulsion Control.**

(1) Arrangement is to be provided to control the propulsion machinery from Engine Room, MCR and Bridge throughout the range of power ahead and astern as appropriate.

(2) The propulsion diesel engine speed control throttle and gearbox control are to be arranged for operation from MCR and Bridge. Selection of machinery control position (MCR or bridge) is to be provided at MCR.

(3) Local control of the propulsion diesel engines and gearboxes is to be provided on the machinery for emergency operation, in case of failure of machinery control and alarm system.

(4) Provision is to be made for starting and stopping the propulsion diesel engines from MCR with local starting and stopping facilities. Emergency stop system of engines is to be provided in the MCR, Bridge and on the engines (Locally).

(5) The mechanical local control of engine/machinery is to be independent of remote control system.

(6) The mechanical MCR control of engine is to be incorporated for emergency control of propulsion system from MCR.

b. **Propulsion & Machinery Monitoring and Indication System.** The monitoring and indication system will comprise a number of alarms for the engines and auxiliary machinery and are to be located in the Engine Room, MCR and Bridge. Each alarm will be presented by audible and visual signal with a test and acceptance push-button. Safety devices will include the followings:

(1) Low lub oil pressure alarm (audio and visual) and auto shut down.

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- (2) High cooling water temperature alarm (audio and visual) and shut down.
- (3) High lub oil temp alarm.
- (4) Low cooling water pressure alarm (audio and visual).
- (5) Engine over speed alarm and auto shut down device/over speed trip gear.
- (6) High exhaust temp alarm (audio and visual).
- (7) Manual emergency shut off device.
- (8) Low lub oil pressure alarm of turbocharger (audio and visual).

c. **Power Management System (PMS)**. A power management system is to be provided for smooth operation/ control, monitoring and automatic load management of electrical power distribution system. The real-time data including graphical representation of the total power distribution system is to be displayed main switchboard using appropriate HMIs.

0332. **Remote Control from MCR**. In relation with engines and gear boxes control console in MCR is to be equipped at least with the following:

- a. Telegraph transmitters for both propulsion plants.
- b. Engine speed control throttles/levers or switches.
- c. Engine rpm indicators (independent and direct reading).
- d. Engine stop switches.
- e. Engine freshwater temperature gauge (independent & direct reading).
- f. Engine lub oil pressure gauge (independent and direct reading).
- g. Gearbox lub oil pressure gauge.
- h. Engine exhaust temperature (combined) gauge.
- j. Control levers/ switches for ahead/astern/neutral position of both gearboxes.
- k. Changeover switches to shift throttle contract from engine local control to MCR vice versa and from MCR to wheelhouse vice versa.
- l. Alarm (Visual and audio) in case of:
  - (1) Engine over speed.
  - (2) Low engine lub oil pressure.

- (3) Low gearbox lub oil pressure.
- (4) High engine coolant temperature.
- m. Shaft rpm indicators.

0333. **Remote Control from Bridge.** Control console for both engines and gearboxes are to be positioned in the wheelhouse of the ship. The control console is to be equipped with the following instruments:

- a. Engine speed control throttles/levers.
- b. Main engine rpm indicators.
- c. Shaft rpm indicators.
- d. Gear box control levers for ahead, astern and neutral position for both gearboxes.
- e. Engine stop switches.
- f. Alarm (visual and audio) and emergency shutdown in case of:
  - (1) Engine over speed.
  - (2) Low engine lubricating oil pressure.
  - (3) Low gearbox lubricating oil pressure.
  - (4) High engine coolant temperature.

## **PART – II STEERING SYSTEM**

0334. **Steering Gears.** One electro-hydraulic steering gear as preliminary and secondary manual steering system(origin and made in UK/ Germany/ France/ USA/ EU/ Japan) according to internationally recognized classification society's requirement for double plated twin rudders is to be installed in the steering gear room. Details as follow:

- a. The system will have at least 2 (two) steering pumps of appropriate capacity for redundancy. The system is to be reliable, durable and complete in all respect for trouble free operation. The steering system is to be operated with ship's main power supply. Primary steering is to be from bridge with secondary steering position located in the steering gear room. The steering system is to be also operated with ship's backup power supply. The specification of the steering system is to be stated in detail.
- b. Appropriate steering wheel and a joystick for electrical operation will be situated on the ship's centre line in the bridge.
- c. Necessary arrangements will be fitted for emergency mechanical steering with hand pump in case of system failure as per class requirement to

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commensurate with main steering system. Remote gyro/ magnetic repeater to be provided at secondary steering position to maintain ordered ship's head.

- d. Facility for using magnetic compass to be incorporated with the navigation equipment as alternate of main gyro compass.
- e. Rudder shift from +35° to -35° is to be by within 28 seconds.

0335. **Rudders.** Suitable 2 (two) in number rudders centre aligned with propeller shaft is to be fitted. Rudders should be designed to operate in the maximum loading condition without any performance deterioration. The rudders should have arrangement of easy removal during docking.

- a. **Shaft Gland Sealing.** Commercially available appropriate rudder gland sealing is to be provided as per class rules. Type/model of packing (if any) is to be mentioned.
- b. **Rudder Gland Lubrication.** Rudder gland is to be seawater lubricated.
- c. **Brake and Locking Gear.** Each rudder is to be provided with necessary brake and locking gears.

0336. **Thrust Block and Bearing.** Arrangement is to be made to absorb the rudder thrust for vertical direction due to the movement of ship in accordance with the relevant class rules.

### **PART – III AUXILIARY SYSTEM**

0337. **Ship's Fresh Water Generation and Drinking Water System.**

- a. **Fresh Water Hydrophore System.** Freshwater will be supplied through a hydrophore system consisting of two pumps with one hydrophore tank. It should be arranged to provide a continuous supply from storage tanks to general water supply system and machinery feed water system throughout the ship. One pump and hydrophore tank should serve as main and another pump will remain as standby.
- b. **Fresh Water Generation System.** The system shall consist of freshwater generation plant, pumps, hydrophore tank, UV Sterilizer etc with minimum capacity of 20 ton/day and shall be arranged to provide continuous supply for storage tank, to portable water system, hot water system and machinery feed water system throughout the ship.
- c. **Fresh Water Filling Point.** Deck filling connections shall be located at port and starboard side on carrier deck with filling line connected to freshwater tank. The piping arrangement should be as such that, while filling fresh water onboard, the normal supply throughout the ship should not be hampered.
- d. **Fresh Water Distribution Point.** Fresh water supply is to be given to galley, sanitary spaces, dining space, engine room and upper deck. A freshwater point should be located at port and starboard side on carrier deck for troops.

0338. **Domestic Sea Water Hydrophore System.** Sea water is to be supplied to the lavatories, water closets, bathrooms, galley and engine room through a sea water hydrophore consisting of pressure tank of required capacity and 2 (two) in no electrical pumps. The specification of the seawater pumps and hydrophore tank are to be mentioned. The hydrophore tank is to be off corrosion resistant material. The origin and manufacturer should be western. Details capacity, type to be mentioned.

0339. **Air Conditioning System.** The Air Conditioning system should be of "All air system" i.e., cooled air will be circulated through AHU by ducting and louver Central Air conditioning plant (based on indirect method / chilled water circulation system) for whole ship to be installed on board the LCT. It should also include air handling unit and ducting to provide conditioned air for operational and living spaces including accommodation spaces, messes, closed bridge, ops room, MCO, machinery control room, office spaces, sophisticated stores, important equipment room, armoury and diving store etc. The compressors should be reciprocating and condensers should be shell and tube type suitable for muddy, sandy and dirty sea water. The AC plant should be designed to perform following conditions:

a. **Environmental Conditions.**

- (1) Dry bulb temperature : 35-45<sup>0</sup> C.
- (2) Relative Humidity : Up to 98%.

b. **Desired Conditions.**

- (1) Dry bulb temperature : 18<sup>0</sup> C to 27<sup>0</sup> C.
- (2) Relative Humidity : 50%.

c. **Details.** The plants (origin and made in UK/ Germany/ France/ USA/ Japan) are to have temperature control mechanism for each section/ compartment. Details (Maker/ brand, manufacturing country, type, model, of AC plant, compressors and condensers, number of air handling unit, overall dimension, weight etc.) of central air conditioning plant are to be mentioned. The AC plant should have minimum 2 (two) compressors where single compressor can take load of whole ship. Detail load calculations are to be submitted by bidder. Gas should be International standard, environment friendly, CFC free and locally available. Additional compressor and cooling pump should be provided as redundancy.

0340. **Ventilation System.**

a. **Ventilation of Living Space.** Adequate ventilation arrangement is to be provided in living spaces. Requirement of supply blowers of adequate capacity needs to be ascertained by the Supplier as per the design and location of various compartments. Exhaust blowers of adequate capacity are also to be fitted in convenient places. Number of supply and exhaust blower with size and capacity are to be specified.

b. **Ventilation of Engine Room.** Appropriate arrangement is to be there for engine room ventilation (considering ambient condition). Requirement of supply blowers needs to be ascertained by the Supplier as per the aspiration need of

proposed engines and to be provided. Exhaust blowers of adequate capacity are also to be fitted in convenient place in each engine room. Number of supply and exhaust blower with size and capacity are to be specified.

c. **Ventilation of Galley, Sanitary Spaces and Magazine Rooms.** Supply and exhaust blowers of adequate capacity are to be fitted in convenient places for proper ventilation of galley, sanitary spaces, magazine rooms etc. (i.e., the spaces which are not air conditioned). Number of supply and exhaust blower with size and capacity are to be specified.

d. **Ventilation in other Spaces.** Adequate ventilation arrangement is to be provided in other machinery and workspaces.

e. **Air Inlet Gratings and Air Dust Covers.** The engine room, ventilation air inlet gratings and outlet gratings are to be installed. Arrangement for closing the inlet and outlet gratings for ventilation of engine room is to be made with watertight covers.

0341. **Air Suction and Exhaust Arrangement.**

a. The turbochargers are to obtain air suction via air filters from the well ventilated engine room.

b. Exhaust gases from main engines and diesel generators are to be led to the atmosphere via a dry type of exhaust silencer to ships side.

c. Expansion pieces are to be arranged for exhaust systems where necessary. The exhaust system is to be insulated with about 50 mm thickness mineral wool with galvanized steel with suitable portable arrangement in way of flanges and expansion pieces.

d. Drain outlets are to be arranged at silencers.

e. Suitable thermometers/pyrometers are to be fitted into the air inlet and exhaust lines.

f. An exhaust flap is to be fitted with each exhaust pipe.

g. Each main diesel engine and diesel generator will be fitted with separate exhaust flap.

0342. **Refrigeration System.** One refrigerating plant (origin and made in UK/ Germany/ France/ USA/ Japan) is to be fitted in each LCT and will have sufficient capacity to refrigerate fresh provision of at least 7 days. The plant should have redundancy in pumps and compressors. The plant is to be compatible with ship's electrical supply and separate cooling pumps are to be used for the plant. In addition, the refrigerating plant should be operable to run with shore supply voltage. Two separate compartments are to be arranged: one for freezer (meat/fish) and one for refrigerator (for vegetable and dairy products. Main fridge plant to have enough capacity to maintain appropriate temperature - 15°C to -18°C for cold room and +3°C to +4°C for cool room of cold room and cool room at

full load. Detailed specification of the refrigerating plant is to be submitted considering following points:

- a. **Alarm and safety arrangements.** Permanent illumination is to be incorporated on alarm bell switch. Provision shall be made for double locking arrangements and a distress alarm bell operable from within the compartments.
- b. **Drainage arrangements.** Proper drainage facilities shall be provided for both cold and cool room with discharges leading to the waste tank.
- c. **Refrigerant.** It should be as per International standard, environment friendly, CFC free and locally available.

0343. **Pollution Control System.** The LCT will have IMO approved means for disposal of garbage, oily water, sewage and other wastes. Pollution Control System must include the following machinery and system:

- a. **Oily Water Separator.** Oily Water Separator of appropriate capacity is to be offered.
- b. **Sewage Treatment Plant.** Sewage vacuum collection and treatment plant of appropriate capacity to fulfil the latest MARPOL requirement.
- c. **Garbage Compactor.** Garbage Compactor with appropriate capacity is to be offered.

0344. **Sewage Treatment System.** The STP (origin and made in UK/ Germany/ France/ USA/ Japan) system will be used for collecting, treating and discharging sewage of washroom, galley, medical room, ward and toilets. Sewage Treatment Plant will comprise of standard arrangement which will serve the MARPOL international regulations. The plant should have redundancy in vacuum pumps and other pumps as necessary. The plant should conform modern vacuum pumps, bio-chemicals, dosing pumps, treatment unit, sewage storage and discharging facilities both to sea and shore, etc. The rated capacity of plant should conform to the complement plus 30 percent of the ship. The maximum capacity of plant should conform to at least 400 (four hundred) persons for 1 (one) day. Details of the system are to be mentioned.

0345. **Waste Disposal System.** Two waste disposal system of sufficient capacity is to be installed onboard as per Class standard. Details of the plant are to be provided.

0346. **Corrosion Protection System.** Appropriate corrosion protection system should be provided with all equipment and machine, where sea water operates.

0347. **Cold and Hot Water Circulating System.** Cold and hot water circulating system for domestic use is to be provided in galley, lavatories, washrooms and carrier deck. Electric calorifiers are to be fitted to meet all hot water requirements for the ship's domestic use. The calorifiers are to be compact and to be able to produce enough hot water requirements for the whole ship. Running of the calorifier will be completely automatic.

0348. **Ship's Compressed Air System.** A suitable high pressure and a low pressure compressed air systems are to be provided to supply compressed air for starting

engines/prime movers (may be via starting air compressor through reducing valve) as well as for ship's services, maintenance and charging diving gears. Necessary reducing valves are to be arranged as necessary.

- a. Brand: Reavell/ Gardner Denver/ Bauer/ Quincy/ Deno Compressor.
- b. Type: Air compressor.
- c. Manufacturer: USA/ UK/ Germany/ Netherland.

0349. **HP and LP Air Charging System.** There should be a compressor (origin and made in (UK/Germany/USA/Netherland) capable of running the system alone with an additional same HP compressor for redundancy. LP air should be produced by reducing valves, if necessary, from the same compressor. Details of the compressor are to be mentioned.

0350. **Diving Air Compressors.** There should be arrangement of fuel driven portable diving air compressors in suitable place of upper deck for charging breathing apparatus (firefighting and diving set). Details of the compressor are to be provided.

- a. Brand: Reavell/ Gardner Denver/ Bauer/ Quincy/ Deno Compressor
- b. Type: Air compressor
- c. Manufacturer: USA/ UK/ Germany/ Netherland

0351. **Sea Water Cooling System.** Sea water cooling is to be provided by engine driven sea water pump drawing water from the sea via high/ low sea inlet boxes. The system is to be fitted with required valves, gauges, sight glasses etc. The sea water system will have a feed from general service or other sea water systems located in the engine room, so that the system works in case of failure of engine driven SW pump. Sea water is supplied to be to the engine room through at least one sea water hydrophore system (consisting of pressure tank of required capacity and two electrical pumps).

0352. **Heat Exchangers.** Heat exchangers should meet following requirements:

- a. **Engine Fresh Water Cooler.** Tubular heat exchangers of adequate capacity suitable for tropical environment are to be installed with each main engine and diesel generator. The heat exchangers should have sea water supply from the sea chests. Provisions of opening the chests for inspection are to be made. Detailed information about the type of cooler is to be provided.
- b. **Lubricating Oil Coolers.** Lubricating oil coolers of adequate capacity are to be incorporated in each engine layout and gearboxes.

0353. **Bilge and Deck wash System.** The engine room, steering gear compartment, accommodation compartments below deck and void tank are to be provided with a suction line, each connected to the fire and bilge manifold in the engine room. The fire and bilge pumps will have suction connections on a sea water inlet and is to be provided at the pressure side with one storm valve in the engine room, at the main deck and at the fox'ldeck for firefighting/ deck wash purpose. The bilge suction will be fitted with

galvanized suction strainer. Same pumps will be used to maintain pressure in the fire main line.

0354. **Sea Chests/ Sea Inlets.** Appropriate numbers of sea chests are to be integrated in the hull bottom construction in the engine room. Separate sea chests/ sea inlets shall be provided for Main Engines, DGs and other systems (one for each Main Engines, one for each DGs and one or more for other systems). The sea chest is to be of welded steel construction with a dis-mountable galvanized grating flush attached with the bottom. Each sea chest is to be provided with vent hole at topside as well as drain hole at bottom side. There should be duplex strainer in sea water lines from sea chests.

0355. **Piping.** Piping of various systems will meet following requirements:

- a. All piping of different systems is to be installed and tested by the builder in accordance with the relevant rules of classification.
- b. The dimension of pipes, valves and fittings are to be in accordance with the relevant rules of classification standards unless otherwise specified.
- c. Adequate pipe supports are to be suitably located to take the weight of the piping, insulation/ lagging. Supports should carry the loads imposed by expansion/contraction of the piping and prevent excessive vibration under all operating conditions.
- d. Gauges, thermometers and their respective connection for local or remote reading are to be provided as necessary to indicate pressure and temperature of individual and combined units of associated equipment.
- e. Gauges and thermometers are to be installed in such a manner that their removal will not interfere with operation of the system. Shut-off valves may be used for this purpose.
- f. Where piping runs over equipment, proper protection of said equipment will be protected from leaks or dripping through the piping for any damage.
- g. Unless absolutely necessary, flanges or screwed joints should not be located over electrical equipment.
- h. Where piping is placed in way of machinery and equipment that require dismantling for periodic overhaul or excess to other system, removable sections are to be arranged in those cases. Section wise isolation facility should be present to facilitate repair work without stopping the full circuit.
- j. Where piping or its components penetrate watertight or oil-tight structure, suitable bulkhead pieces are to be arranged.
- k. All gaskets are to be of such material that resists attack by the fluid carried in the pipeline, they are to be strong enough to hold the pressure and perform purpose intended.
- l. Pipes are to be marked with colour bands for identification. Flow direction of gas and liquids are to be marked in pipes.

m. Insulation on piping is to be provided where necessary. Insulation of chilled water (air conditioning system) pipes should be designed considering the high humidity of operating area (approximately 98% humidity).

n. All valves are to have brass name plates suitably engraved to clearly indicate the function of the valve. Engraved letters shall be filled with black or red enamel paint.

p. Temporary strainers are to be installed in the lub oil piping for cleaning and flushing the system.

q. Sharp/right angled bending of pipes are to be avoided.

r. All piping should be seamless and materials of different piping system are to be as follows:

(1) Fresh water system: Seamless Copper-nickel (MIL-T-16420).

(2) Scupper and drains: Seamless ASTM Galvanized carbon steel (A 106/ A106 M).

(3) Fire main system, Bilge systems, domestic sea water systems, ballast systems, sprinkler systems: Seamless Cu-Ni pipes (90-10 or 70-30 applicable docs MIL-T-16420).

(4) Fuel oil system : Seamless carbon steel pipe (MIL-P-24691/1, Grade B or ASTM A 106/ A 106 M, Grade B).

(5) Lub oil system : Seamless carbon steel pipe (MIL-P-24691/1, Grade B or ASTM A 106/ A 106 M, Grade A or B).

(6) Hydraulic system: Seamless carbon steel pipe (MIL-P-24691/1, Grade B or ASTM A 106/ A 106 M, Grade B).

0356. **Auxiliary System Control and Monitoring Console.** Auxiliary Machinery and System Control and Monitoring Console is to comply following requirements:

a. **General.**

(1) Major Auxiliary Machinery (e.g., Air conditioning plant, Main fridge, Fire pumps, Bilges pumps, Blowers etc.) will have appropriate Control (ON/OFF), Monitoring (temperature, pressure and other parameters) and indication facilities both in MCR console and locally in the engine room or near to the machinery. The list of machinery with such facilities is to be provided.

(2) Other Auxiliary Machinery (e.g., Compressors, Domestic pumps etc.) will have Control, Monitoring and indication facilities near to the machinery. Only the ON/OFF indications of such machinery are to be provided in the MCR. The list of machinery with such facilities is to be provided.

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(3) Options (selector switch) will be incorporated to shift the control of any machinery from one location to the other.

b. **Control.** Control is to be provided in MCR at least for the followings:

- (1) Air Conditioning plant.
- (2) Main Fridge plant.
- (3) Fire and bilge pumps.
- (4) Ventilation/Air supply blowers to the engine rooms.

c. **Running Indication.** Level or running indications are to be provided in MCR at least for the followings (in addition to the machinery stated above):

- (1) Fuel oil tank level.
- (2) Fresh water tank level.
- (3) Sewage treatment tank level.
- (4) Pumps for domestic use.
- (5) Ventilation fans.
- (6) Air compressors.
- (7) HP air reserve bottle pressure.
- (8) Steering gear.

### 0357. **Integrated Platform Management System (IPMS) with CCTV Arrangement.**

Each LCT is to be fitted with Integrated Platform Management System (designed and manufactured in western country). This control system should be an integrated solution for propulsion, electrical, HVAC, auxiliary and damage control systems. The Machinery Control and Monitoring (MCAM) System and Auxiliary System Control and Monitoring Console should be an integral part of this system. There should be facility of CCTV in various important spaces for vehicle loading/unloading, NBCD, fire fighting and machinery spaces for unmanned engine room monitoring.

## **PART – IV FIREFIGHTING SYSTEM**

0358. **Fire Fighting Arrangement.** Ships are to be equipped with standard firefighting equipment, system and gears as per the appropriate category of naval ship standard for fire fighting as per BR-2170 and BR-1007, IMO and SOLAS. Standard fire fighting system including fire and smoke alarm with gears for both machinery and general spaces including the flooding and spraying system for magazines are to be arranged. The fire fighting system should include a fire detection system from where specific compartment of the fire/smoke can be identified. Appropriate fire-fighting arrangements (CO<sub>2</sub> fire extinguishing system, Foam system, Sprinkler system etc) including sensors are to be provided for engine room, machinery spaces, ammunition store, magazine and other hazardous places as per standard for Classification Society for appropriate category of naval ship building.

a. **Fixed Fire Fighting System for Engine rooms.** The engine rooms and other hazardous room (like Paint, Inflammable store) are to be provided with fixed fire fighting system (to be mentioned), which can be operated from the remote. Type, Number of bottles and their capacity are to be specified.

b. **Fire Main System.**

(1) The fire main system will be of 'dry type'. Fire main system is to be fitted with a single main line served by 2 × fire and bilge pumps fitted in machinery space. The fire and bilge pumps are to draw suction from sea chest via strainer and discharge to the fire main with an isolating valve.

(2) The fire main system should always maintain at least 6-7 bar pressure when running. A pressurized sea water fire main system with sufficient number of fire hydrants is to be laid in the LCT with at least two dedicated fire and bilge pumps (to use alternately) attached with hydrants so as to provide seawater for the

- (a) Fire hydrants running throughout the ship.
- (b) Sprinkler system for ammunition store/magazine/armoury.
- (c) Emergency cooling system of required machinery.
- (d) Sprinkler system for vehicle deck.

(3) The fire main pressure and actual number and location of fire hydrants are to be specified. The fireman system will be able to provide emergency sea water cooling supply to the auxiliary systems. Additional arrangement should be there to supply sea water directly from sea with portable diesel pumps to the Fire main line. This should give the capability of energizing fireman line when electric power is not there.

c. **Fire Hose and Nozzles.** Every fire hydrant is to be provided with adequate length of fire hose with end couplings and combined spray-jet nozzle stored in boxes in suitable place nearby.

d. **Portable Fire Extinguishers.** Required number of portable fire extinguishers and refills for extinguishing solid, liquid and electric fire are to be provided according to RN standard.

e. **Breathing Apparatus.** As per Classification Society's rules necessary number of apparatus (BA) [minimum 16 (sixteen) in number] with spare bottle and extension harness are to be supplied. Addition apparatus should be there for providing FF training to the ship's crew. BA should have wireless communication facility and fire fighters' helmet fitted with unidirectional light.

f. **Fire Fighting Suit.** As per Classification Society's rules necessary number of fire fighting suits for fire fighters are to be supplied. Addition suits should be there for providing FF training to the ship's crew.

g. **Portable Fire Fighting Pump.** As per Classification Society's rules necessary number of diesel fire fighting pumps of adequate capacity with accessories is to be supplied.

h. **Foam Making Branch Pipe and Foam Gun.** As per Classification Society's rules necessary portable foam guns, foam making apparatus and foam tanks with adequate accessories are to be supplied.

j. **Flooding and Sprinkler System.** Flooding and sprinkler system is to be provided for each magazine/ ammunition store.

k. **Fire & Smoke Detector.** One suitable fire and smoke detection system will be fitted. All working, accommodation and machinery compartments should have sensors as appropriate. The monitor of the system will be located at MCR, bridge, any suitable place near gangway and Engineer Officer Cabin.

### **PART – V DAMAGE CONTROL SYSTEM**

#### 0359. **Damage Control Equipment.**

a. Ships are to be equipped with Standard damage control system, equipment and gears as per the appropriate category of naval ship standard for damage control, BR-2170 and BR-1008, IMO and SOLAS. DCHQ will be located in MCR/Junior rating dining room and fitted with good communication facilities. Following Communication facilities shall be included:

- (1) Intercom.
- (2) General Broadcast System.
- (3) SPT.
- (4) Auto Telephone.

b. In addition, damage control arrangement for major compartment including engine room, steering compartment, ramp door and MCR are also to be provided. Following additional damage control equipment are to be supplied:

- (1) Two sets of damage control equipment, tools and materials as per "Navy Standard".
- (2) De-smoking (extraction of smoke generated from fire) arrangement should also be incorporated.
- (3) Eight in no portable emergency lamps.
- (4) Thermal Imaging Camera (TIC) complete with battery, carrying case, and 2 set of spare battery for each LCT.
- (5) The DCHQ shall be provided with sufficiently large erasable Perspex boards (user defined):
  - (a) 1 × Incident Board.
  - (b) 1 × Counter Flooding Board.
  - (c) 1 × Main Service Board.
  - (d) 1 × Electrical State Board.

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0360. **De-flooding Pump.** Four electrically driven (as per generator's output voltage and frequency) submersible pumps of adequate capacity with accessories:

- a. One in no 10 (ten) ton/ hour.
- b. One in no 20 (twenty) ton/ hour.
- c. One in no 30 (thirty) ton/hour.
- d. One in no 40(forty) ton/hour.

**PART – VI MISCELLANEOUS**

0361. **Warning, Operating and Instruction Plates.** Warning and operating instruction engraved on brass plate in suitable font size are to be fixed in the vicinity of all major machinery and system.

0362. **POL and Chemicals.** Sufficient quantity of the following items is to be provided to run the machinery for test-trial, handing over to BN and till reach designated BN base after satisfactory trials/hand over:

- a. Fuel oil for all machinery/engines/generators.
- b. Lub oil for Main engines, Diesel generators and Gearboxes.
- c. Lub oil and refrigerant for air conditioning and refrigerating plants.
- d. Special purpose greases.
- e. Cooling water inhibitor for main engines and diesel generators.
- f. Hydraulic oil for different hydraulic systems.
- g. Lub oil test kit and chemicals.

0363. **Manuals and Drawings.** All manuals/ catalogues/ publications are to be provided free of cost. The following manual sand drawings (3 copies of each in English as hard copy and 3 sets of soft copy in electronic storage) are to be provided:

- a. Complete operation and maintenance manuals of all propulsion engine, auxiliary machinery and equipment.
- b. Parts catalogue (with identification diagram) of all propulsion, auxiliary machinery and system component.
- c. Installation drawings and diagrams for main engines, gear box and their local and remote controls.
- d. Workshop level repair manual.
- e. Both base/ depot and onboard tools and test equipment list included in offer.
- f. Maintenance schedules of all propulsion and auxiliary machinery/ equipment.
- g. System layout drawings of all systems and necessary drawings.

0364. **Shock and Vibration.** The shock and vibration requirement of all engineering machinery, equipment and system are as follows:

- a. **Shock Testing Requirements.** Machinery and Equipment that need to be shock-test qualified by shock testing shall be in accordance with CS standard or equivalent acceptable standard.

b. **Foundations.** Foundations shall be assigned the same shock grade as the supported item and shall satisfy the applicable shock requirements contained in this Section.

c. **Mechanical Vibration.** The machinery and system components shall be free from excessive vibration. Vibration is excessive when it results in damage or danger of damage, to ship structure, machinery, equipment or systems, or when it interferes or threatens to interfere with, the proper operation of any ship component. Vibration is also excessive when it threatens to interfere or interferes with personnel safety, comfort or proficiency. The mechanical vibration requirements for machinery and equipment shall be in accordance with CS standard or equivalent recognized standard. The equipment, as-installed, shall not induce damaging vibration in other ship's equipment or structure, nor shall its vibration interfere with the operation of the ship's combat system or degrade the accuracy or sensitivity of the ship's sensors.

**0365. Factory Acceptance Test (FAT)/ Pre Shipment Inspection (PSI) for Main Engine, Gearbox and Propulsion system.**

a. Provisions to be kept for FAT/ PSI for the Main Engines, Gear boxes and propulsion system before shipment from manufacturer country as per conditions mentioned in Section-X, Art-1008 of this specification.

**SECTION-IV**

**ELECTRICAL EQUIPMENT, MACHINERY AND SYSTEM**

0401. **General.**

- a. All electrical systems, equipment, machinery, fittings, fixtures, items, cables, wiring etc are to comply with recognized marine standard.
- b. Electrical equipment is to be appropriate for tropical environment and shall have Class F insulation unless otherwise stated. The maximum allowable temperature rise on all electrical equipment and wiring shall be based on an ambient temperature of 45°C (dry bulb) and humidity of about 95% RH.
- c. Machinery temporarily or permanently exposed to the outside atmosphere or water are to have minimum IP56 rating or as mentioned specifically.
- d. Electrical equipment is to be designed and located for easy access for repairs and removals. Moreover, all electrical systems, sensors and equipment designed for use in the vessel should comply with Mil-Standard 1399, Mil-Standard 1310, Mil-Standard 461 and Mil-Standard 810.
- e. All electrical machine/equipment are to be properly earthed (grounded) and earthing points are also to be provided for portable electrical equipment as per manufacturer's requirement and Mil-Standard 1310 and Mil-Standard 461 to reduce EMI.
- f. All wiring, cables, breakers, distribution panels, machines etc are to be clearly labelled and systematically coded for ease of identification. Recognized appropriate category of naval ship standard of "Procedure of Identification of Electrical Circuit in appropriate category of naval ship" is to be followed.
- g. Necessary documents, drawings and circuit diagrams of all electrical and electronic items including the detailed description of the items are to be provided.
- h. Red, Yellow and Blue colours are to be used to identify 3 phases of cables, busbars and terminals etc of AC circuit.
- j. Red and Black colours shall be used to identify positive and negative polarity of cables, busbar and terminals etc of DC circuit.

0402. **Ship's Main Power System.** The main power supply system is to be designed and developed as a complete solution for the vessel to run at full efficiency both at sea on own power of 415V, 50Hz, 3 Phase (without conversion) and at harbour on national power supply system of 400V±5%, 50Hz, 3 Phase. Accordingly, all electrical machineries are to be designed to run satisfactorily both at sea and harbour using these power sources.

0403. **Electrical Load Analysis.** The necessary load calculation and load management information for sea and harbour are to be submitted with the offer. The final electrical load analysis is to be provided showing following in details. It shall be provided before construction work for approval of BN:

- a. Maximum operational load (when all systems are operating).
- b. Cruising load.
- c. Load at anchor.
- d. Shore load.
- e. Emergency load.

0404. **Schematic Diagram.** Detail schematic diagram of the electrical distribution system as a whole including wiring diagram, equipment installation diagram, connection diagram and other diagram required is to be provided during the delivery of the LCTs.

0405. **Provision of Power for Future Equipment.** 10% reserve provision of electrical load for each generator is to be kept for future installation of machinery/equipment.

0406. **Equipment and Items of Electrical System.** Equipment and items of the electrical system, which are to be supplied, are as follows:

- a. Two in number Main Generators with appropriate capacity (415V, 50Hz, 3 Phase) and associated accessories including paralleling system for automatic load sharing without interruption. Each main generator is to be capable of taking full operational load of the LCT.
- b. One in number Main Switchboard with synchronizing panel and necessary meters.
- c. Distribution Panel/ Switches as required.
- d. Required number of motors, pumps, supply & exhaust fan and auxiliary machineries as required as per international standard for appropriate category of naval ship.

0407. **Main Diesel Generator Sets.** An electrical power generation system consisting of 02 (two) identical marine type three-phase main generators is to be installed. One main generator set shall be capable of taking full load (Operational). The main Generators shall be suitable to run continuously in parallel condition. The generator sets are to be fitted with western origin power management system (PMS) for paralleling and load sharing operation. It shall also be fitted with instrument panels and all standard safety devices including emergency shutdown devices. The specifications of the generator are outlined below:

<b>Description of Diesel Generator</b>	
Complete Generator Set	(1) Type : Marine Type (To be mentioned). (2) Brand : Caterpillar/ SEMT Pielstic/ MAN Diesel/ MTU/ Moteurs Baudouin (To be mentioned). (3) Model : To be mentioned. (4) KVA Ratings : To be mentioned.
Prime Mover	(1) Type : To be mentioned (2) Brand : Caterpillar/ SEMT Pielstic/ MAN diesel/ MTU/ Moteurs Baudouin. (3) Model : To be mentioned. (4) Country of Origin and Manufacture: USA/ UK/ France/ Germany.

<b>Description of Diesel Generator</b>	
	<p>(5) Year of Manufacture : 2021 or later.</p> <p>(6) Aspiration : Turbo-charged and after cooled.</p> <p>(7) Maximum continuous rating : To be mentioned.</p> <p>(8) Overload rating: 110% of max continuous rating (1 hour within 12 hours).</p> <p>(9) Minimum allowable continuous load: To be mentioned.</p> <p>(10) Number of cylinders and arrangement: To be mentioned.</p> <p>(11) Bore and Stroke : To be mentioned.</p> <p>(12) Compression ratio : To be mentioned.</p> <p>(13) Combustion : Direct fuel injection.</p> <p>(14) RPM : To be mentioned</p> <p>(15) Specific fuel consumption: To be mentioned.</p> <p>(16) Specific lub oil consumption: To be mentioned.</p> <p>(17) Combustion air requirement: To be mentioned.</p> <p>(18) Governor: Electronic (To be mentioned).</p> <p>(19) Turbocharger: Make and model etc are to be specified.</p> <p>(20) Fuel Oil to be used: NATO F-76/ Dieso F-76 (Sulphur content less than 1.0% by weight).To be mentioned.</p> <p>(21) Lub oil to be used: SAE 40 or equivalent available in local market of Bangladesh.</p> <p>(22) Starting System: The prime movers shall be started by battery. The engines will be fitted with self-starter and dynamo for charging the batteries (To be mentioned).</p>
Alternator	<p>(1) Type : To be mentioned</p> <p>(2) Classification Standard : To be mentioned</p> <p>(3) Manufacturer : To be mentioned</p> <p>(4) Year of Manufacture: 2021 or later.</p> <p>(5) Country of origin : France/ UK.</p> <p>(6) Brand : Leroy Somer/ Stamford</p> <p>(7) Model : To be mentioned.</p> <p>(8) Number of poles : To be mentioned.</p> <p>(9) Maximum continuous rating : Sufficient to cater for operational (MCR) load.</p> <p>(10) Overload rating : 110% for 1 hour.</p> <p>(11) Power factor : 0.8 lagging.</p> <p>(12) Rated Terminal Voltage : 415V.</p> <p>(13) Frequency : 50 Hz.</p> <p>(14) No of phases : 3 (three).</p> <p>(15) Speed : To be mentioned</p> <p>(16) Rotor : Dynamically balanced.</p> <p>(17) Stator :Durable winding in star configuration.</p> <p>(18) Connection : 3 wire, star connection, neutral ungrounded.</p> <p>(19) Excitation : To be mentioned.</p> <p>(20) Ventilation: Self ventilated, air cooled.</p> <p>(21) Insulation : F</p>

<b>Description of Diesel Generator</b>	
	(22) Temperature rise : To be mentioned. (23) Enclosure : To be mentioned. (24) Number of Bearings: Single/ Double bearing. (25) Anti-condensation heaters: To be mentioned. (26) Stator temperature detector :To be mentioned. (27) Parallel operation: Auto parallel and load sharing facilities. Details to be mentioned.
AVR, Local control panel, Generator control Panel and Synchronizing Panel	(1) Country of Origin and Manufacture: USA, UK, Canada, EU Countries.  (2) Details to be mentioned.
General Features	(1) Time Between Overhauls: To be mentioned. (2) Dimension and Weight: To be mentioned.
Standard and Classification	To be mentioned

a. **Capacity.** The Genset should be of sufficient capacity to independently cater for full (100%) electrical load plus 10% reserve for future installation of machineries / equipment.

b. **Performance.** The Genset should be suitable to run simultaneously and continuously in parallel condition.

c. **Generator Control and Monitoring Panel.** All necessary meters/ gauges (digital/ analogue readout display) including kilowatt meters are to be fitted in the control panel.

d. **Loading Condition.** The generators and AVR system must be highly responsive and should meet the following condition as per ISO 8528-5 (2005) Standard Grade 3:

(1) **Voltage.**

- (a) Voltage transient tolerance:  $\pm 20\%$ . (To be mentioned).
- (b) Voltage transient recovery time: 2 sec (To be mentioned).
- (c) Voltage regulation:  $\pm 5\%$ . (To be mentioned)

(2) **Frequency.**

- (a) Frequency transient tolerance:  $+10\%$ . (To be mentioned).
- (b) Frequency transient recovery time: 2 sec (To be mentioned).

(3) **Other Features.** The above transient conditions must be maintained under following load change:

- (a) Load Changes from 0 to 50%.
- (b) Load Changes from 50% to 100%.
- (c) Load Changes from 100 to 0%.

**(Note:** Graphs showing various characteristics and response of transient voltage and frequency variation are to be submitted with the FAT report.)

e. **Safety Features.** Following safety features and management shall be incorporated in each generator set:

- (1) Low lub oil pressure alarm (audio and visual) and auto shut down.
- (2) High cooling water temperature alarm (audio and visual) and shut down.
- (3) High lub oil temp (audio and visual).
- (4) Low cooling water pressure alarm.
- (5) Engine over speed alarm and auto shut down device/ over speed trip gear.
- (6) Manual emergency shut off device.
- (7) Overload protection & indication.
- (8) Short circuit protection & indication.
- (9) Synchronization failure indication.
- (10) Over / under voltage protection & indication.
- (11) Reverse power protection & indication.
- (12) Over/Under frequency protection & indication.
- (13) Excitation loss protection & indication.

f. **Factory Acceptance Test (FAT)/ Pre Shipment Inspection (PSI).** Provisions to be kept for FAT/ PSI for the Main Generator sets before shipment from manufacturer country as per conditions mentioned in Section-X, Art-1008 of this specification.

0408. **Switchboards.**

a. **Main Switchboard.** One main switchboard of western origin (USA, Canada, UK, EU Countries) is to be supplied and installed. The switchboard is to be of appropriate category of naval ship standard; floor mounted and shall be capable of withstanding shipboard vibration and shock without damage or faulty operation. The switchboard shall have required number of panels including synchronizing panel for the gensets for paralleling.

b. **Band, Model & Maker.** To be mentioned.

c. **Dimension.** The dimension of the switchboard is to be such that enough space is made available on the front and back side of the switchboard for easy maintenance.

d. **Construction.** Details of construction philosophy and material are to be mentioned.

e. **Panel Arrangement.** The main switchboard is to consist of the following panels with appropriate meters/ gauges:

- (1) Two sections (port and starboard).
- (2) One synchronizing panel.

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- (3) 415V Feeder panels.
- (4) 220V Feeder Panel.
- (5) 115V Feeder Panel (if needed).
- (6) 24V DC Feeder Panel.
- (7) Other feeder panel as required.

f. **Synchronizing Panel.** One in number synchronizing panel is to be provided with the switchboard. The synchronizing panel should have auto synchronization synchroscope with load sharing and any other appropriate arrangement for paralleling the generating sets. The panel shall consist of the following:

- (1) Synchroscope.
- (2) Dual Frequency Meter.
- (3) Dual Voltage Meter.
- (4) Frequency Regulator.
- (5) Voltage Regulator.
- (6) Generator Circuit Breaker On/ Off Push Button.
- (7) Insulation meter.

g. **Alternator Circuit Breaker.** Each Alternator is to be controlled and protected by circuit breaker of appropriate capacity.

h. **Bus-bar Linking Switch.** Bus-bar linking switches/ breakers of appropriate capacity is to be provided for easily connecting or disconnecting the sections of the switchboard.

j. **Circuit Breakers for Shore Connection.** An air circuit breaker of appropriate capacity with interlock to prevent running of alternators with shore supply is to be provided in the switchboard.

k. **Safety Devices.** Appropriate safety devices are to be provided. Details to be mentioned.

l. **Interlocking Arrangement.** Interlocking arrangements with the generators are to be provided so that shore power cannot be fed to bus bars when any of the alternators is in operation.

m. **Meters.** All meters (Digital/ Analogue readout display) mounted on the front panel of the main switchboard are to be of flush-mounted. All meters are to be calibrated before final delivery to BN and certificates are to be issued accordingly.

n. **Labelling and Colour Coding.** Circuit breakers, control switches, instruments, indicating lights and terminal blocks etc are to be clearly labelled to identify their purpose and function. Labels for fuses, in addition, are to indicate the rating of the fuses. Feeder nameplates are to indicate the feeder designation, application and rating current. Each feeder breaker on the switchboard is to be distinctly marked with colour (Blue, Red, Green, White and Yellow).

p. **Electrical Power Monitoring System.** The power management system (PMS) is to be used for smooth operation/ control, monitoring and automatic load management of total electrical power distribution system. The real-time data including graphical representation of the total power distribution system is to be displayed both in Main Switchboard using appropriate Human Machine Interfaces (HMI).

0409. **Ship's Main Battery and Charging System.** Required number of maintenance free batteries of appropriate capacity including rack along with battery charging and discharging system are to be provided. It shall be used for charging and distributing DC power sources to navigation lights, general alarm system, fire monitoring system, propulsion control circuits, gyro compass, internal communication, radio equipment, engine and generator control system etc as emergency supply and control supply.

0410. **Conversion Machinery.** Conversion machinery for the Vessel will be as under:

a. **Transformers.** Required number of transformers of appropriate capacity are to be provided and installed. (Details to be mentioned)

b. **Rectifiers.** Required number of rectifiers of appropriate capacity are to be provided and installed. (Details to be mentioned)

c. **Converters.** Required numbers of static converter of appropriate capacity are to be provided for some certain Equipment, Armaments and Sensors etc. (Details to be mentioned)

0411. **Shore Supply Arrangement.**

a. **Shore Supply Cable.** One set of rubber insulated flexible shore supply cable (3 core, each core for each phase) of min 200m length of appropriate capacity wound on a roller is to be provided. (Details to be mentioned)

b. **Shore Supply Connection Box.** One shore supply connection box of appropriate capacity to take shore power supply of Bangladesh (national grid supply 400V±5%, 50Hz, 3 phase) is to be provided with an appropriate breaker, phase sequence indicator and other necessary safety devices.

c. **Ship's Along Side Feeder Breaker.** A feeder breaker of appropriate capacity of 415 V, 50 Hz, 3 Phase is to be provided in the shore connection box to supply power to other ship alongside.

0412. **Cables and Plugs.**

- a. Cables installed throughout the Vessel are to be of marine type approved by classification society. It is to be of appropriate grade insulation to meet the voltage to which they are subjected.
- b. Cabling is to cater for required level of redundancy in every case or as appropriate.
- c. All cables are to be shielded armoured cable duly type approved for marine use.
- d. All plugs and wall receptacles/sockets used in the Vessel must be of appropriate International Electrotechnical Commission (IEC) standard and marine type.
- e. Necessary receptacles are to be provided for dish/ cable TV, telephone and internet connections.

0413. **Power Receptacles.** Following compartments are to be provided with power receptacles:

Compartments	Power
All machinery spaces, galley, deck machineries, equipment and suitable locations at upper deck	415V, 50Hz, 3Ph
Bridge, ops room, communication room, all equipment compartment, all accommodation, recreation space, wardroom, galley, all machinery spaces and suitable locations at upper deck etc.	220V, 50Hz, Single Ph
Bridge, ops room, communication room, emergency lighting etc	24V DC

0414. **Motors, Starters and Lightings.**

- a. **Motors.** Motors are to be of squirrel cage induction type of IEC standard. Motors should be of western origin (USA, Canada, UK, EU Countries) rated for continuous full load duty except motors for steering gear, deck machinery, etc. Motors are to be fitted with duty nameplates engraved in English with manufacturer's name, serial number, rated kW/ kVA, RPM, full load and starting current etc.(Details to be mentioned).
- b. **Starters.** Starter of appropriate rating for respective equipment/machinery are to be separated and no group starter shall be acceptable. In general, starters may be of direct-on-line for small motors (below 3 kW rated). All motors above 3 kW should be provided with star-delta starting type starter/ soft starter. (Details to be mentioned)
- c. **General Lightings and Emergency Lightings.** The vessel is to be illuminated with LED lamps. Lamps with guard are to be fitted in machinery spaces as necessary. The lighting is to be divided into the 220V AC general lightings and 24V DC emergency lighting. Appropriate number of emergency lighting in the living space, engine room, other stores, engine rooms, MCR etc are to be provided. The

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illumination level (lux, lumen/m<sup>2</sup>) of various lights should be as per international standard for indoor use/ confined places/ machinery spaces etc. Details are to be mentioned. The bridge, Ops room and communication room lighting is to have dimmer facility. In general, the type of lighting fixture and fittings are to be as follows depending upon their locations:

Watertight type	Spaces exposed to the weather, machinery spaces, refrigerating plant room, steering gear room, galley, pantry, deck, stores, etc.
Non-watertight type	Living quarters, wheelhouse, engine control room, equipment spaces etc.
Explosion-proof type	Magazine room, paint room, battery room, ammunition handling / ready use space etc.

d. **Navigation Lights.**

(1) Electric navigation light arrangement is to be provided as per the international maritime regulation and appropriate category of naval ship standard. The navigation lighting is to be of 24V DC with battery backup source. There are to be also alternate light for each of the navigational lights.

(2) A control panel for navigation lighting fitted with navigation light 'ON' indications, visual and audible alarms, etc is to be installed in the Bridge.

e. **Signal Lights.** Electric signal lights and morse lights arrangement is to be as per international maritime regulation and appropriate category of naval ship standard. All said lights are to be connected to the signal light control panel installed in the Bridge.

f. **Flood Lights.** Sufficient number of flood lights with IP rating 66 are to be provided. Details to be mentioned.

g **Search Lights.** Two in number LED/Hybrid military grade signal search lights (equivalent of 1000W) of swivel mounting type (IP66) are to be fitted at a suitable location. These are to be remotely controlled from the Bridge.

h. **Portable Lights.** Following lights of 220V 50 Hz single phase are to be provided:

(1) 04 × 100W or equivalent LED watertight type with 15 m cord and plug.

(2) 06 × 100W or equivalent LED non-watertight type with protection guard, 15 m cord and plug.

(3) 10 × 60W or equivalent LED working lights with one side cover, 15m cord and plug.

j. **Spotlights.** Appropriate number of spotlights with red lens and dimmer are to be provided for spot illumination of ops room equipment, displays, repeaters, etc.

k. **Darken Ship Illumination.** Darken ship facilities, whereby no internal lighting is visible externally even when doors and hatches are opened, are to be

incorporated. This facility is to be controlled by a number of darken switchboxes and door limit switches fitted at suitable positions. A single switch to interrupt supply of all non-essential external lighting in darken ship's state is to be conveniently located in the Bridge.

0415. **Domestic Fans.**

- a. Sufficient numbers of swivel type oscillating metallic fans are to be fitted in the Bridge, accommodation spaces and other spaces as required. Number and specifications of the fans are to be mentioned.
- b. 10 (ten) in number 16 inch robust metallic pedestal fans with very low noise are to be supplied with each LCT.

0416. **Ship's Alarm System and Internal Communication.**

- a. **General Alarm.** General alarm of western origin (USA, Canada, UK, EU Countries) is to be provided and it is to be audible in all spaces except tanks. Alarm is also to be operated on 24V DC supply. (Details to be mentioned)
- b. **Fire and Flood Detection and Monitoring System.** An effective suitable fire and flood detection and monitoring system of western origin (USA, Canada, UK, EU Countries) shall be provided. All working spaces, accommodation, Magazine and machinery compartments will have appropriate sensors. Brand, Model and details are to be mentioned. (Brand, Model and details are to be mentioned).
- c. **Man Overboard Alarm.** Man overboard alarm is to be provided at Forecastle and After deck area. (Details to be mentioned)
- d. **Internal Communication.**
  - (1) Internet/ LAN facilities covering office spaces, mess deck, accommodations space etc.
  - (2) Central TV receiving system covering office spaces, mess deck, accommodations space etc.

0417. **Communication & Control (C&C) Office.** A communication & control (C&C) office is to be designed for installing/ monitoring of internal communication system, conversion machineries, broadcast system and machinery monitoring including gyro feeds.

0418. **Bonding Strip.** All ladders, stanchions and structure on the upper deck not permanently connected to the ship's hull are to be provided with appropriate flexible bonding strip to reduce EMI as per Mil-Standard 1310.

0419. **Test Facilities in Electrical Maintenance Room.** The electrical maintenance rooms shall have all common test facilities of appropriate category of naval ship standard. Necessary power supply and suitable test benches are to be fitted as necessary.

0420. **Auxiliary Machinery.** Other standard auxiliary machinery as per class requirements and type of ship's hull are to be provided. The details are to be mentioned.

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0421. **CCTV System.** One complete set of CCTV Camera system with appropriate number of Camera, Network Video Recorder (NVR), Display system are to be provided to cover fore, aft-deck and machinery area for monitoring standard safety for both day and night. System must consist of recording and replay facility for about at least 30 days. The brand, model and details of the system are to be of western origin (USA/ UK/ EU/ Japan).

0422. **Miscellaneous Electrical Equipment.** Following equipment is to be provided:

- a. Two portable megaphones.
- b. Two portable blowers.
- c. Two Portable signal lamp.
- d. One portable public address system.
- e. One portable battery charger.
- f. Ten (10) standard working helmet with head light for maintenance works.
- g. Standard test equipment like digital meggar, digital multimeter, pressure tester, clamp meter, hand drill, Insulating gloves, crimping tools, cable tester, tong tester etc. and two set of standard toolboxes.
- h. Two portable submergible pumps.

0423. **Alternate Power Supply.** An additional power supply arrangement is to be provided when both main Diesel Generators are unable to take load especially when the ship is in beaching condition. Ship's steering, propulsion control system, navigation, ramp lowering/ hoisting, communication galley facilities and habitability are to be considered for this power supply arrangement. It is to be installed in a suitable compartment/ place on the upper deck and shall be able to take the load to meet the power supply requirement mentioned.

**SECTION – V****SEAMANSHIP GEAR**

0501. **General.** This part describes the general specification and requirement for anchoring, ship's boat, berthing hawser, fender, awning, brow, davit, etc.

0502. **Anchors.** Each LCT is to be provided with 3 (three) in number stockless anchors of adequate size with necessary chain cables and other accessories including chain compressor and strong back. The anchors and cable installation must meet the CS requirement. Two anchors are to be installed on the forecastle deck (port and starboard) and one at the stern. Details including length about the anchors and chain cables are to be provided.

0503. **Windlass/ Capstan.** Three in number electrical and manual operated capstan/windlass of adequate capacity is to be installed. Two on the forecastle deck (port and starboard) and one on the stern for handling the chain cable/ mooring ropes. The windlass/capstans are to be operated with ship's main power supply. Details of capstan including power output are to be provided.

0504. **Towing Gears.** Suitable towing bitt including gears is to be fitted on the aft deck. Each LCT is to be provided with one braided polyamide towing hawser of appropriate size and length (to be mentioned), on a horizontal reel and kept on deck with necessary fittings for towing and being towed facility.

0505. **Ship's Boat.** 1 x Rubber Inflatable Boat (IB) as ship's boat with outboard patrol engine to attain speed about 20 knots is to be provided on the main deck. The boat together with appropriate deck crane for hoisting/lowering arrangement is to be supplied. Specification of boat as follows:

- |    |                                |                    |
|----|--------------------------------|--------------------|
| a. | Min Person                     | : 6.               |
| b. | Length                         | : 4-5 meter        |
| c. | Breadth                        | : 2.0 - 2.5 meter  |
| d. | Quantity of Engine             | : 01               |
| e. | Engine Power (Per Engine) (HP) | : 40-50            |
| f. | Engine Brand                   | : YAMAHA/ EVINRUDE |

0506. **Berthing Hawsers.** Standard set of berthing hawsers, spring hawsers and heaving lines to be provided.

0507. **Fender.** Required no of rubber fenders of appropriate size are to be provided.

0508. **Awnings.**

- a. Portable waterproof awnings and rigging arrangements (including ceremonial) are to be provided for spaces at Cargo deck and Flag deck.
- b. Equipment requiring protection on the weather decks are to be provided with waterproof canvas covers.

0509. **Shore Gangway/ Brow.** One aluminium alloy made shore gangway/ brow of suitable size fitted with handrail, stanchions, wheels, lighting arrangements etc is to be

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provided. The ladder is to have a shore roller with neoprene tire at the shore and hook at the other end. In addition, one wooden brow for regular use is to be provided too. Two sets of aluminium footstep with appropriate size are to be provided (user defined).

0510. **Davit**. Each LCT should have suitable davit at a suitable place to lower and hoist the ship's boat and general cargo. Specification of davit as follows:

- a. Type : Knuckle telescopic.
- b. Max lifting capacity : Not less than 2.5 tonne.
- c. Slewing arc : Not less than 360°.
- d. Weight : Not more than 1 tonne.
- e. Country of Origin and Manufacture : Western Origin.

0511. **Miscellaneous**. Following items shall be supplied:

- a. One in number aluminium two tier steps will be provided for using at the end of gangway ladder during high/ low water when the ship is alongside jetty.
- b. Gangway table with suitable wooden/ Perspex state board shall be provided as per BN standard.
- c. 2 in no wooden plungers and one Bos'n's chair for painting the shipside and the mast.
- d. Ropes for halyard, heaving line, boat fall etc. of various sizes and length.
- e. Two in number boat hooks.
- f. One in number gangway buoy stand.
- g. One in number officer's state board.
- h. Watch and station billboard in the lobby.
- j. One in number bronze ship's bell.
- k. Two in no deck Washing Machines (Water Jet).

**SECTION-VI****NAVIGATION, DIRECTION AND RADAR**

0601. The Navigation equipment/ aids will be required for ship's movement, position and Navigational plot. Country of origin of the navigational equipment is to be Canada/ USA/ UK/ Japan/ ROK or EU countries except otherwise mentioned. Manufacturing date of the equipment/ systems/ items is not to be more than two years preceding the delivery date of the LCT. The equipment/ systems are to operate at ambient temperature -0°C to 55°C. Necessary drawings, circuit diagrams, fault finding diagrams, etc of all electrical, electronic and navigational equipment are to be provided with the respective items. Each LCT is to be provided with the following Navigational equipment/ aids:

- a. 2 × Navigation Radar.
- b. 1 × Gyro Compass.
- c. 1 × Magnetic Compass.
- d. 1 × Echo Sounder.
- e. 1 × AIS will be provided by BN.
- f. 1 × Speed log.
- g. 2 × HD Binocular (For guiding of facilitating landing on day/ night).
- h. 1 × GPS.
- j. 1 × Anemometer.
- k. 1 × Foghorn.
- l. Standard navigation lighting including all special arrangements.
- m. 1 × Electro optical surveillance/ observation.

0602. **Navigational RADAR**. Each vessel shall be equipped with integrated navigation radar suit comprising of one X-band navigation radar and one X/S band navigation radar with associated accessories. The Navigation radar suit is to be of western origin (Kelvin Hughes, UK/ Furuno, Japan/ Thales, France/ Thales, Netherland/ Leonardo, Italy). The offered brand, model and technical details are to be mentioned.

0603. **Gyro Compass**.

- a. The digital Gyro Compass is to be of western origin (Sperry Marine, USA/ Arma Brown, UK/ Sagem, France/ Anschutz, Germany/ GEM Electronic, Italy) with appropriate number of repeaters and other accessories.
- b. Brand, model and details are to be mentioned.

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0604. **Magnetic Compass.** Magnetic Compass is to be of western origin (USA, UK, Canada, EU countries, Japan). Brand, model and details are to be mentioned.

0605. **Echo Sounder.** Echo Sounder is to be of western origin (USA, UK, Canada, EU countries, Japan). Brand, model and details are to be mentioned.

0606. **AIS.** Suitable arrangement to be made to install one AIS (Navy provided) in the Bridge at suitable place.

0607. **Speed Log.** Electromagnetic speed log is to be of western origin (USA, UK, Canada, EU countries, Japan). Brand, model and details are to be mentioned.

0608. **HD Binoculars.** Two HD Day/ Night Binoculars from an internationally reputed company are to be provided for guiding or facilitating of landing on day/ night.

0609. **GPS.** One GPS of internationally reputed company are to be installed for continuous position and time reference data. The antenna is to be installed in a suitable location and the main unit is to be installed in the bridge. One remote display is to be installed at the Captain's cabin. The GPS is to be interfaced with all required systems/ sensors onboard.

0610. **Digital Anemometer.** Digital Anemometer is to be of western origin (USA, UK, Canada, EU countries, Japan). Brand, model and details are to be mentioned.

0611. **Foghorn.** Each LCT is to be provided with one automatic foghorn from an internationally reputed company for navigational purpose to produce a clear, sharp tone of unvarying intensity under all weather conditions regardless of time between blasts as per Convention on the International Regulations for Preventing Collisions at Sea (COLREGs), 1972 and appropriate control device for producing desired sound signals to be incorporated.

0612. **Navigation Lighting Including All Special Arrangement.** All lights are to be fitted onboard as per COLREGs, 1972. Switches and miniature indication lamps for different lights are to be arranged in bridge to display which lights are burning. Two steel/aluminium sidelights boxes welded on the bridge deck are to be provided for housing port and starboard navigation lights.

0613. **Electro Optical Surveillance/ Observation System (Optional).** One complete set of Electro-Optic (day and night) passive surveillance system (Detection Range 16 km or more, Spectral Band: 3.5 to 4.8  $\mu\text{m}$  or more) with operator console, necessary software and associated accessories are to be provided. The system is to be of western origin (USA, UK, Canada, EU countries). Brand, model and technical details are to be mentioned. The system is to be considered as an optional item for installation. BN will have the option to accept/ reject the offer for installation. The item wise price of the system is to be mentioned separately in the bid price.

0614. **Additional Navigation Equipment/ Item.** Following additional navigation Equipment/ items to be provided:

- a. Aneroid Barometer - 1 (Mounted in Bridge).
- b. Chronometer - 1 (Installed in Bridge).

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- c. Items for chart work (Parallel ruler, divider, etc.)- 2 sets.
- d. Ship's Bell - 1 set.
- e. Deck Watch - 1 set.
- f. Clinometers - 2 (Bridge and MCR).
- g. Dry and Wet Thermometer - 2 sets.
- h. Max-Min Thermometer - 2 in no.
- j. Digital Hygrometer - 1 set.
- k. Hand anemometer for boat patrol - 1 in number.
- l. Portable Boat Compass - 1 set.
- m. OOW State Board -2(1 each for regular & ceremonial use).
- n. Chart Table with dimming lamp, curtain and drawers - 1 set.
- p. Helmsman Rest - 1 (for steering console).
- q. Dimming lights - Required no for having dimming facility  
for night navigation.
- r. Any other standard navigational equipment/ item as used by BN.

**SECTION - VII****COMMUNICATION****External Communication System**

0701. **General.** All communication sets are to be as per BN standard to maintain compatibility. Their manufacturers and brands are to be same as BN used sets. The communication sets are to be of latest version (manufactured less than 2 years from the date of delivery of the LCT) and from an internationally reputed company (country of origin should be Canada, USA, UK, Japan, ROK or EU countries - to be mentioned). The equipment/ systems are to operate at ambient temperature -0°C to 55°C. The ship's various radio communication equipment has been grouped under various outfits based on their installation criteria, functionality, etc. These are discussed in detail under separate paragraphs below.

0702. **External Communication.** Following Radio transceivers are to be fitted onboard:

a. **2 × HF Tx/Rx 100-150 Watt (1.6-30 MHz).** This transceiver will be used for long-range (worldwide) HF communication. It shall incorporate standard Voice, Morse and Data (with high Speed Data modem and Laptop PC) communication facilities in USB and LSB modes. It will be also fitted with Voice Encryption option. Frequency range is to be 1.6 to 30 MHz. The standard accessories will include rack/cabinet mount, automatic antenna tuner, 9 m flexible marine whip antenna, remote-control unit, etc. (Preferable Brand/Model: HF TX/RX CODAN NGT SR 100 - 150 W or upgraded version) and 1 × Data Message Terminal PC for data communication by HF set. The control unit is to be installed in Main Communication Office (MCO).

b. **1 × VHF/UHF Tx/Rx (AM 50W, FM 100W) (Wide Band).** These will be used for line-of-sight tactical Voice (AM/FM) and data communication as per BN standard. The standard accessories will include rack/cabinet mount, super wideband discone antenna, remote control unit, etc. The control unit is to be installed at MCO and one remote unit in Bridge.

c. **1 × VHF/UHF 50 Watt (Narrow Band) Transceiver (VHF 118-174 MHz and UHF 400-470 MHz).** These will be used for line-of-sight tactical Voice (AM/FM) and data communication. The standard accessories will include rack/cabinet mount, super wideband discone antenna, remote control unit, etc. The control unit is to be installed at MCO and one remote unit in Bridge.

d. **02 × Marine VHF Transceiver (25 – 50 Watt).** These will be used for line-of-sight Voice (FM) and digital (DSC-ITU class D) communication with merchant vessels and port authorities that need to be installed at Bridge. All standard accessories to be provided including desktop/bulkhead mount, antenna, power supply, etc.

e. **Visual Communication Items.** Following items/ arrangements are to be supplied/ provided as per BN standard:

- (1) 02 × Sets of signal flags and pennants.

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- (2) 03 × Commissioning pendant.
- (3) 02 × Semaphore pair.
- (4) 06 × Black ball.
- (5) 03 × Black diamond.
- (6) 03 × Cone.
- (7) 02 × Flag locker & 01 × VS store.
- (8) 02 × Flashing light signalling arrangements (omni directional) to be installed at main mast port and starboard side.
- (9) 03 × Signal projector/ Search light (Marine Military version, 500W, 12 inches).

f. **National flag, Ensign, Jack and Distinguishing Flags.** Following flags are to be supplied/ provided as per BN standard:

- (1) 06 × National flag (2 × 8 breadth, 4 × 6 breadth).
- (2) 08 × BN Ensign (2 × 8 breadth, 6 × 6 breadth).
- (3) 08 × BN Jack (2 × 8 breadth, 6 × 6 breadth).
- (4) 02 × 4 breadth distinguishing flags and pennants set.

g. **Flag Lockers.** Two in number flag lockers of suitable size with 30 pigeonholes to be fabricated and fitted on the upper deck near to the mast.

h. **Other Communication Items/ Arrangement.** Following items are to be supplied/ provided as per BN standard:

- (1) 6 × VHF Walkie Talkie Sets with one extra battery and antenna for each set (Marine type 5 watt with 1 complete set of programming kit).
- (2) 2 sets of dressing line as per BN standard.
- (3) 1 × EPIRB.
- (4) 1 × SART.

0703. **Internal Communication System.** Appropriate category of naval ship standard Internal Communication System of western origin (USA, UK, Canada, EU countries) is to be installed. The brand, model and technical details of the overall system are to be mentioned. The basic descriptions are as follows:

a. **Intercom.** Appropriate category of naval ship standard intercoms are to be installed. All intercom amplifiers are to be identical so that they are

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interchangeable. In addition, one spare amplifier is to be provided in the intercom rack. The variation in intercom is as follows:

- (1) **Engine Room Intercom**. It is to be provided to maintain voice communication in noisy places between Machinery Control Room (MCR), Engine Room, Machinery Spaces, Bridge and Emergency Conning Position.
- (2) **Conning Intercom**. It is to be provided to maintain communication between Bridge, CO's cabin, MCR and engine room.
- (3) **Voice Pipe**. Internal voice pipes are to be fitted as required.

b. **Sound Power Telephone (SPT)**. A SPT system with two way communication is to be installed. The SPT matrix is to be provided by the builder and confirmed by the purchaser.

- (1) The total number of SPT station is to be mentioned.
- (2) In places of high noise level such as Engine Room, Plug-in headsets with microphone are to be provided. In addition, rotating light is also to be provided.
- (3) The following circuits are to be installed:
  - (a) Bridge/ MCR/ Engine Room/ Steering Compartment Circuits.
  - (b) Loading/ docking circuit.
  - (c) Damage and stability control.

0704. **General Broadcast and Entertainment System**. One complete set of General Broadcast and Entertainment System of western origin (USA, UK, Canada, EU countries) with appropriate number of stations, controller, alarm unit and speaker units shall be provided for reliable broadcast, alarms, announcement and entertainment program. The brand, model and technical details of the system are to be mentioned.

**SECTION - VIII****SPARES, TOOLS, DRAWINGS AND OTHER ACCESSORIES**

0801. **Spare Parts.** A proposal containing list of fast-moving spares along with item wise price for 05 (five) years should be submitted with the quotation. These spares are to be provided. "Terms and conditions" of the guarantee for unrestricted supply of the said spares for a period of 15 (fifteen) years after signing the contract are to be mentioned. Following equipment are to be considered:

- a. All main engines, generator sets, gearboxes, auxiliary machinery, air conditioning and refrigerating plants.
- b. All electrical and electronic equipment.
- c. All Sensors.
- d. Spare parts for propulsion and power generation control and monitoring system.
- e. All Deck machinery.
- f. General systems and shafting.
- g. All galley equipment, water generating system and water purifiers.
- h. Any other equipment deemed necessary by the bidder.

0802. In this connection, supply of spare parts for all main engines, generator sets and gearboxes in accordance with the following criteria is mandatory:

a. **Main Engine.**

<b>Ser</b>	<b>Description</b>	<b>Total Quantity</b>
1.	Main bearings complete with shims, bolts and nuts, complete for one engine	3 in no per engine
2.	Large end bearing complete with shims, bolts and nuts for one cylinder	1 set per ship
3.	Small end bearing complete with shims, bolts and nuts for one cylinder	1 set per ship
4.	Gudgeon pins with bush for one cylinder (if applicable)	1 set per ship
5.	Piston	2 in no per engine
6.	Cylinder head assembly Complete	1 in no per ship
7.	Liner Complete	2 in no per engine
8.	Complete set of piston rings	1 set per engine
9.	Cylinder head gaskets for all cylinders	1 set per engine
10.	Fuel injector complete	6 in no per ship
11.	Electronic governor	1 in no per ship
12.	Air inlet valves complete with seat, spring and fittings for all cylinders	6 in no per ship

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<b>Ser</b>	<b>Description</b>	<b>Total Quantity</b>
13.	Exhaust valves complete with seat, spring and fittings for all cylinders	6 in no per ship
14.	Push rod	2 in no per ship
15.	Fuel injection pumps complete with plungers, sleeve valves, springs etc.	1 set
16.	Pressure gauges, different types	1 set per ship
17.	Temperature gauges, different types	1 set per ship
18.	Crank case door joint	1 set per engine
19.	Filter elements, all types fitted	4 sets per engine
20.	'O' rings, all types fitted	3 sets per engine
21.	Gaskets, all types fitted	3 sets per engine
22.	Seals, all types fitted	3 sets per engine
23.	Joints, all types fitted	3 sets per engine
24.	Split pins, all types fitted	1 set per ship
25.	Sensors (all kinds)	1 set per ship

b. **Generator Set.**

<b>Ser</b>	<b>Description</b>	<b>Total Quantity</b>
1.	Main bearings complete with shims, bolts and nuts, complete for one engine	3 in no per engine
2.	Large end bearing complete with shims, bolts and nuts for one cylinder	1 set per ship
3.	Small end bearing complete with shims, bolts and nuts for one cylinder	1 set per ship
4.	Gudgeon pins with bush for one cylinder (if applicable)	1 set per ship
5.	Piston	2 in no per engine
6.	Cylinder head assembly complete	1 in no per ship
7.	Liner complete	2 in no per engine
8.	Complete set of piston rings	1 set per engine
9.	Cylinder head gaskets for all cylinders	1 set per engine
10.	Fuel injector complete	8 in no per ship
11.	Electronic governor	1 in no per ship
12.	Air inlet valve complete with seat, spring and fittings for all cylinders	6 in no per ship
13.	Exhaust valves complete with seat, spring and fittings for all cylinders	6 in no per ship
14.	Push rod	2 in no per ship
15.	Fuel injection pumps complete with plungers, sleeve valves, springs etc.	1 set
16.	Pressure gauges, different types	1 set per ship
17.	Temperature gauges, different types	1 set per ship
18.	Crank case door joint	1 set per engine
19.	Filter elements, all types fitted	4 sets per engine
20.	'O' rings, all types fitted	3 sets per engine
21.	Gaskets, all types fitted	3 sets per engine
22.	Seals, all types fitted	3 sets per engine
23.	Joints, all types fitted	3 sets per engine

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<b>Ser</b>	<b>Description</b>	<b>Total Quantity</b>
24.	Split pins, all types fitted	1 set per ship
25.	Sensors (All kinds)	1 set per ship

c. **Gearbox.**

<b>Ser</b>	<b>Description</b>	<b>Quantity</b>
1.	Filter elements (all types of filters)	4 of each
2.	Temperature gauge	2
3.	Pressure gauge	2
4.	Cooler seal	4
5.	Anode for cooler	2
6.	Control valve seal	2
7.	Control valve seal	2

d. **Propeller and Shafting.**

<b>Ser</b>	<b>Description</b>	<b>Quantity</b>
1.	Shaft gland seal	2 set per ship
2.	Shaft bearing	4 set per ship
3.	Shaft	2
4.	Starboard propeller with boss nut	2
5.	Port propeller with boss nut	2
6.	Shaft liner	2 set per ship

e. **Rudder.**

<b>Ser</b>	<b>Description</b>	<b>Quantity</b>
1.	Rudder gland seal	2 set per ship
2.	Thrust bearing	2 set per ship

f. **Alternator and Control/ Monitoring Panel.**

<b>Ser</b>	<b>Description</b>	<b>Total Quantity</b>
1.	AVR (complete)	1 in no per ship
2.	Governor control PCB	1 set per ship
3.	Magnetic pick ups	1 set per ship
4.	Rotating diodes	1 set per ship
5.	Potentiometers (all types)	1 set per ship
6.	Control knobs (all types)	1 set per ship
7.	Valves / Solenoids	1 set per ship
8.	Other PCBs (all types)	1 set per ship
9.	Indication lights (all types)	1 set per ship
10.	Relays/ contracts	1 set per ship
11.	Thermostats	1 set per ship
12.	Meters i.e., voltmeter, wattmeter, ammeter, frequency meter etc.	1 set per ship

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Ser	Description	Total Quantity
13.	3 Pole air circuit breaker, 200 Amps	1 set per ship
14.	3 Pole air circuit breaker, 100 Amps	1 set per ship
15.	3 Pole air circuit breaker, 50 Amps	1 set per ship
16.	3 Pole air circuit breaker, 30 Amps	1 set per ship
17.	3 Pole air circuit breaker, 20 Amps	1 set per ship
18.	Bearing for Alternator	1 set per ship
19.	Self-Starter	1 set per ship
20.	Dynamo / Charger	1 set per ship
21.	Sensors (All kinds)	1 set per ship

0803. **Test Equipment.** The following test equipment (origin USA/ UK/ France/ Germany/ EU/ Japan) are to be supplied with each LCT:

- a. 2 × Digital Multimeter.
- b. 2 × Weber Tester.
- c. 1 × Clamp Tester.
- d. 1 × Megger.
- e. 1 × Digital Tachometer.
- f. 2 × Digital Thermometer (-)25°C to 1000°C.

0804. **Special Tools.** The following special tools (origin USA/ UK/ France/ Germany/ EU/ Japan) are to be supplied with each LCT:

- a. 1 × Propeller nut spanner.
- b. 1 Set of Propeller pulling device.
- c. 3 × Grease guns with nipple.
- d. 3 × Toolboxes with standard tools.
- e. 2 sets of Socket spanners (Range to be mentioned).
- f. 2 sets of Ring spanners (Range to be mentioned).
- g. 2 sets of Open end spanners (Range to be mentioned).
- h. 2 sets of L-end key (Range to be mentioned).
- j. 3 sets of Files (Range to be mentioned).
- k. 2 × Verniercallipers (Range to be mentioned).
- l. 2 × Micrometres (Range to be mentioned).
- m. 3 sets of Adjustable spanners (Range to be mentioned).

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- n. 2 × Carpentry toolboxes with standard tools (Details of tools are to be mentioned).
- p. 2 × Bearing extractors (Standard size).
- q. 2 × Chain block (2 tons capacity).
- r. 2 × Chain block (3 tons capacity).
- s. 1 × Torque spanner (Range to be mentioned).
- t. 2 × Punch set (Range to be mentioned).
- u. 2 × Tool Kit Set (Brief Case of all necessary tools for electrical system).
- v. 2 × Safety Harness for working in radio-electrical system fitted in the mast.
- w. 1 × Portable Hot Blower.
- x. 1 × Portable Hand Blower.
- y. A set of supplementary tools such as workbench, hoisting gear and deck tools.
- z. List of items in the set of supplementary tools is to be mentioned.
- aa. 1 × Digital cooling water test kit.
- bb. 1 × Crimping tool set.
- cc. 1 × Digital Lub oil test kit.
- dd. 1 × Digital Fuel test kit (Water in the oil).

0805. **Accessories.** Standard accessories for all machinery and equipment in addition to those mentioned herein are to be supplied as necessary.

0806. **Drawings and Related Documents.** All drawings and other documentations are to be in English Language. Classification Society (ABS, BV, DNV-GL or LR) will need to approve all designs and drawings as per their rules, regulations and practices (also to ensure the class notations mentioned in the previous chapter). Important technical and production drawings are to be supplied well before installation to BN representatives for approval. **Three copies of each drawings and related documents as listed below are to be supplied in paper and in electronic format (in CAD form) during the handover of the LCTs for each LCT separately.** However, some drawings are to be submitted before part payment (as mentioned in the payment terms and conditions). The drawings and related documents are as follows:

- a. **Basic Drawings and Booklets.**
  - (1) General Arrangement.

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- (2) Lines Plan.
- (3) Shell Expansion Drawing in Details Showing All Underwater Valves, Openings, Zinc Anode/ ICCP Positions etc.
- (4) Docking Plan and Alternate Docking Plan in Details.
- (5) Piping Arrangement Drawing (Fuel, Lub Oil, Fresh Water, Sea Water, Fire Main Line, Chilled Water of AC, Sewage Etc.).
- (6) Draft Mark, Hull No and Ship's Name Arrangement.
- (7) Tank Capacity Plan.
- (8) Sounding Table.
- (9) Trim and Stability Booklet.
- (10) Damaged Stability Booklet.
- (11) Hydrostatic Data/Curves.
- (12) Procedure of Inclining Experiment and Inclining Experiment Report (Upon Completion) For Each Ship Separately.
- (13) Procedure of Sea Trial.
- (14) Bonjean Curve.
- (15) Detailed Specification.
- (16) Carrier Deck All Possible Vehicle Arrangement Plan.

b. **Production Drawing.**

- (1) Sheer Draught and Table of Offsets.
- (2) Profile.
- (3) Upper and Forecastle Deck.
- (4) Lower Deck and Hold.
- (5) Structural Sections.
- (6) Carrier Deck.
- (7) Superstructure.

c. **Hull Part.**

- (1) Midship Section.

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- (2) Construction Profiles.
- (3) Shell Expansion.
- (4) Engine Room Construction.
- (5) Midship Construction.
- (6) Bow Construction.
- (7) Stern Construction.
- (8) Deck House Construction.
- (9) Carrier Deck Construction.
- (10) Rudder Construction.
- (11) Shaft Gland and Brackets Construction.
- (12) Paint Scheme.
- (13) Docking Plan and Alternate Docking Plan.
- (14) Tank Testing Plan (Hull Tightness Test Plan).
- (15) Tank Arrangement Plan.
- (16) Arrangement of Bottom Plug & Bulkhead Mark.
- (17) Welding Procedure & Details.
- (18) Arrangement of Bilge Keel.
- (19) Watertight Bulkhead Drawing.
- (20) Zinc Anode and ICCP Arrangement.

d. **Outfitting Part.**

- (1) Access and Closing Arrangement.
- (2) List of Key and Cabin Name Plate.
- (3) Mast Construction Plan.
- (4) Arrangement of Natural Ventilation.
- (5) Air-Con Room Arrangement.
- (6) Heating, Ventilation, Air-Conditioning.

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- (7) Bridge (Pilot House) Window Washing Arrangement with Wiper.
- (8) Arrangement of Duct Plan.
- (9) Chilled Water Diagram for Air-Condition.
- (10) Fire Fighting Plan (Fixed, Portable System Including All Alarms).
- (11) Arrangement of Steering Gear Room Including Piping Arrangement.
- (12) Arrangement of Boat Crane Handling.
- (13) Anchor Gear and Hawse Pipe Arrangement.
- (14) Mooring and Towing Arrangement.
- (15) Details of Mooring Fittings.
- (16) Ship's Bow Name.
- (17) Jack Staff and Ensign Staff Arrangement.
- (18) Fire Hose Rack Arrangement.
- (19) Arrangement of Handrail and Lifeline.
- (20) Arrangement of Inclined and Vertical Ladder.
- (21) Jacob's Ladder Arrangement.
- (22) Pilot Ladder Arrangement.
- (23) Arrangement of Refrigerating Machine and Plant Including Piping Arrangement.
- (24) Bos'n Store Arrangement.
- (25) Paint Store Arrangement.
- (26) Ready Service Room Arrangement.
- (27) Ammo Magazine Arrangement.
- (28) Grating for Ammunition Store.
- (29) Armament Mountings, Angles of Bearing and Depression.
- (30) Magazine Spraying Arrangement.
- (31) Pumping Arrangement.

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- (32) Voice Pipe Arrangement.
- (33) Rigging Arrangement.
- (34) Identification Markings of Compartment, Hatches, Doors, Valves, Etc.
- (35) Small Arms Store Arrangement.
- (36) Drainage Plan.
- (37) Sanitary Piping Plan.
- (38) Exposed Deck Planning Arrangement.
- (39) Fire Line Remote Control Arrangement.
- (40) Out Fitting Practice.
- (41) Hold/ Tank/ Void Space.
- (42) Plan of Piping General Arrangement.
- (43) Ventilation and Air Conditioning Diagram.
- (44) Emergency Escape Route.
- (45) Bilge Piping System.

e. **Accommodation.**

- (1) Window and Scuttle Plan.
- (2) Deck Covering Plan.
- (3) Insulation Plan.
- (4) Cold and Cool Room Arrangement.
- (5) Accommodation Arrangement (1: 25 Scale).
- (6) Furniture List.
- (7) Sanitary and Laundry Arrangement.
- (8) Galley Arrangement.
- (9) Pantry Space Arrangement.
- (10) Dry Provision Store Arrangement.
- (11) Cabin Door Arrangement.

- (12) Colour Scheme Book and List.
- (13) Flag Locker Arrangement.
- (14) Fire Fighting/Apparatus Arrangement.

f. **Machinery Equipment.**

- (1) Engine Installation with Foundation Drawing.
- (2) Reduction Gear Installation with Foundation Drawing.
- (3) Arrangement of Machinery Space (Plan).
- (4) Arrangement of Machinery Space (Section).
- (5) Machinery Removal Route Layout.
- (6) Shafting Detail and Arrangement.
- (7) Control Air System Diagram.
- (8) Exhaust Gas Pipe Diagram (In Engine Room).
- (9) Sea Chest Valve Arrangement (Engine Room).
- (10) Shiplside Valve Arrangement (Engine Room).
- (11) F.O Service System Diagram.
- (12) F.O. Fill and Transfer System Diagram.
- (13) L.O. Service and Filling System Diagram.
- (14) Aux. S. W. Cooling System Diagram.
- (15) M/E And A/E S. W. Cooling System Diagram.
- (16) M/E And A/E F. W. Cooling System Diagram.
- (17) Compressed Air System Diagram.
- (18) F/W And S/W Service System Diagram.
- (19) Air Escape, Sounding and Overflow Diagram.
- (20) Valve List.
- (21) Arrangement and Detail for Quick Closing Valve.
- (22) Instrument List.

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- (23) Hydraulic Oil System Diagram.
- (24) Sanitary System Diagram.
- (25) On-Board Test Procedure.
- (26) Propeller Details Drawing.

g. **Electrical Equipment.**

- (1) Ship's Main Electrical Schematic/System Drawings.
- (2) Arrangement of Electrical/Electronic Equipment.
- (3) Benchmark (Standard Platform and Foundation).
- (4) Arrangement of Antenna Extension.
- (5) Fire and Bilge Alarm System.
- (6) Short Circuit Calculation.
- (7) Electrical Load Analysis.
- (8) Illumination Calculation.
- (9) Voltage Drop Calculation.
- (10) Wiring Diagram of Power System.
- (11) Wiring Diagram of Lighting System.
- (12) Wiring Diagram for Control & Instrumentation.
- (13) Wiring Diagram for Communication & Navigation System.
- (14) Wiring Diagram & Arrangement of Fire & General Alarm System.
- (15) Arrangement of Navigation Lights.
- (16) Wiring Diagram of Internal Communication Equipment.
- (17) Arrangement of Main Switchboard Including Functional Diagram.
- (18) Arrangement for Emergency Power Supply System.
- (19) Cable Installation Diagram (Inboard Main Cable Route Schematic).

0807. **Manuals and Documents.** Plans and drawings of construction, hull, outfitting, accommodation, general arrangement, machinery, electrical, weapons, operation and maintenance manuals (workshop levels) including parts catalogue etc. will be provided by the bidder. All the plans and documentation, name plates, caution/identification plates will

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be written in English. All manuals/ catalogues/ publications are to be provided free of cost. Following manuals/parts catalogues/ documents **(3 copies for each ship)** of every machinery, equipment, sensors, weapons, control system etc. (in English language) are to be supplied with the ship at the time of delivery

- a. Operation and maintenance manual.
- b. Maintenance management system documents.
- c. Workshop level repair manual.
- d. Parts catalogue and Coloured PIL.
- e. Electric, electronic and system circuit diagrams including fault finding flow charts.
- f. Installation drawing.
- g. Ship's data book.

**SECTION - IX****MISCELLANEOUS**

0901. **Furniture**. Furniture and facilities of accommodation, living spaces and working places are to be provided for number of personnel and of good marine quality metal.

0902. **Furniture/ Appliances/ Items for Living Spaces and Bridge**.

<b>Name of Place/ location</b>	<b>Allocated Person</b>	<b>Particulars</b>	<b>Lavatory</b>
Captain's Cabin	1	The cabin shall possess 1 × single tier bed (settee berth) with drawer, 1 × combination safe, desk, revolving chair with arm rests, easy chair, folding table, wardrobe/ locker, book rack, mirror, filing cabinet, sofa set with arm rest, 1 × important keyboard, hat and coat hook, clock, LED TV, DVD player, laptop computer, small fridge, wall mounted fan, shoe rack, and any other items essential for the cabin in general.	1 × lavatory with standard fittings.
Officer's Cabin	2	The cabin is to be fitted with two beds (settee berth) with drawer, desk, armchair, wardrobe/locker, book rack, filing cabinet, wall mounted TV, fan, hat and coat hook, clock, shoe rack, and any other items essential for the cabin in general sense. Anyone of the cabins shall have one combination safe of suitable size.	One common lavatory for Officer's with two bathroom and two toilets. The lavatory is to be fitted with adequate wash basins, cabinet and with standard fittings.
Officer's Cabin	8	Two in no cabins are to be fitted with two double tier beds each with drawer, desk, armchair, two wardrobe/Lockers, book rack, mirror, filing cabinet, hat and coat hook, clock, wash basin with cabinet and mirror, shoe rack and any other items essential for the cabin in general sense.	
Wardroom	10	Adequate number of sofas with tea tables, armchairs with dining table, tea table, 40" wall mounted LED TV, DVD player, music player, wall mounted fans, hat hook board, serving hatch, magazine rack, clock, first aid box, important keyboard, pistol cupboard, and any other items essential for the wardroom in general sense.	

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Name of Place/ location	Allocated Person	Particulars	Lavatory
Senior Ratings' room	16	Accommodation facilities with double tire bed with drawers, table, armless chairs, wardrobe, book rack, mirror, hat and coat hook, shoe rack, clock, wall mounted fans, wash basin and any other items essential for the room in general sense.	Common washroom and lavatory with adequate bathroom, toilet and shaving facilities with standard fittings.
Dinning and recreation room with temporary separation	10	Dining chairs/ sofa with dining tables, LED TV, DVD player, fridge, hat hook board, serving hatch, magazine rack, clock, wall mounted fans, wash basin, first aid box and any other items essential for the room in general sense.	
Junior Ratings room	2 × 20	Accommodation facilities with three tier bed, kit locker, racks, LED TV DVD player, mirrors, hat and coat hooks, shoe racks, wall mounted fans, wash basin and any other items essential for the room in general sense.	Common washroom and lavatory with adequate bathroom, toilet and shaving facilities with standard fittings.
Bridge		1 × chart table with chart drawers and dimmer light, curtain with curtain rail, 2 × radio tables with a chair, 1 × captain's chairs with arms, 1 × helmsman rest, 1 × clock, 1 × book rack, wooden filing cabinet (2-drawer), rack, first aid box, small arms rack, inclinometer, barometer etc.	
Gangway		1 × gangway table, 1 × officer's state board, 1 × lifebuoy with stand, 1 × hygrometer in a box, 1 × barometer and a wall clock.	
Lobby		2 × Notice board, 1 × General keyboard, 2 × watch and station billboard and a first aid box.	

0903. **Exposed Deck and Other Spaces Items.** Following items of western origin (US/ UK/ Germany/ France/ EU/ Japan) is to be provided on exposed deck and quantity of each is to be mentioned:

- a. Aluminium life jacket boxes.
- b. Wooden thermometer box.

- c. First aid boxes.
- d. Neil Robertson Stretchers.
- e. Metallic folding chairs.
- f. Helicopter rescue strap and stretcher.

**Cooking Range, Crockery, Cutlery and Galley Utensil and Implements**

0904. Following equipment of Western origin (US/ UK/ Germany/ France/ EU/ Japan) shall be provided:

- a. 2 × Electric cooking range with 6 hot plates (size 24" × 12") as per generator's output voltage and frequency.
- b. 2 × Rice cooker as per generator's output voltage and frequency.
- c. 1 × Heavy Functions electric oven.
- d. 1 × Stainless steel sinks (2 × bowls).
- e. 1 × Stainless steel working table.
- f. 1 × Hot water boiler.
- g. 1 × chopping table.
- h. 2 × heavy duty Bread Toaster.
- j. 2 × exhaust fans.
- k. 2 × supply fans.
- l. Fresh and sea water taps as required.
- m. 1 × Freezer and 1 x Refrigerator.
- n. 1 × Portable oven (gas/oil).
- p. 1 × Heavy duty kneading machine.
- q. 1 × Heavy duty potato peeler.
- r. 1 × Heavy duty vegetable cutter.
- s. 1 × Heavy duty meat cutting machine.
- t. 1 × heavy duty condiments grinder.

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0905. **Wardroom Pantry.** Following equipment of Western origin (US/ UK/ Germany/ France/ EU/ Japan) is to be provided in the Wardroom pantry:

- a. 1 × Refrigerator.
- b. 2 × Microwave oven.
- c. 2 × Blender.
- d. 1 × Hot Water Boiler.
- e. 1 × Bread toaster.
- f. 1 × Coffee maker.
- g. 1 × Stainless steel basin (1 bowl).
- h. 2 × Vacuum cleaner.
- j. 2 × Hot pot.
- k. 1 × Electric Kettle.

0906. **Mess Traps, Mess Utensils and Galley Implements.** Mess traps, mess utensils and galley implement will be supplied for wardroom and ship's galley as per the ship's complements at the time of first outfit.

0907. **Curtain.** Two sets of curtains and cover to be provided for each door, hatch, window, chair, sofa and table located in the wardroom, accommodation and mess area.

0908. **Community Cable TV and Internet Port.** Community Cable TV and internet ports are to be provided in the wardroom, mess area, officer's cabin and office spaces.

0909. **Office Equipment.** To meet the ship's administrative functions, offices are to be equipped with the followings items of reputed brands:

- a. Cabinets and shelves for correspondence files and publications stowage.
- b. One digital combination safe of suitable size.
- c. Six complete set of computers with monitor, keyboard, mouse, printer, scanner and 5 (five) laptops. A Local Area Network (LAN) facility for above mentioned computers shall be provided with sufficient number of routers, switch and other accessories. Networking port to be made available in the offices, wardroom and officer accommodation. Facilities will be provided for connection with internal LAN.
- d. Three desk with desk light, three file cabinet, two chairs with arm, four chairs without arms, etc.
- e. Two in no Photocopy Machine for offices.

0910. Stores, fittings, facilities, etc. and their safety arrangements, control and monitoring gadgets etc. as stated above are inclusive, but not limited to with respect to a naval ship's requirement of construction and operation.

**SECTION – X**

**TERMS AND CONDITIONS**

1001. **Scope of Construction.** The whole project of LCT construction will be executed in the following manner:

- a. The Bidder will arrange supply of all equipment and associated accessories as required and will construct the LCTs in local Shipbuilding Yard as per the contract. In general, BN supply will include AIS and small arms.
- b. The LCTs are to be constructed under the supervision of the classification society surveyor and BN project implementation team.

1002. **Responsibilities of the Parties Involved.**

- a. **BN.** The responsibilities of BN will be as follows:
  - (1) To approve appropriate offer proposed by the Bidder.
  - (2) To employ project implementation team at the Builder's premises.
  - (3) To approve General Arrangement (GA) drawing, Compartment Arrangements(layouts), tank arrangements, firing arcs of weapons, hydrostatic curves, shell expansion drawing, docking and alternate docking plan etc. drawings as regards to production within 30(Thirty) working days of submission.
  - (4) To provide following items from BN stock:
    - (a) 2 × 12.7 mm HMG.
    - (b) Small arms (with ammunitions) and pyrotechnics.
  - (5) To overview test & trial of the LCTs conducted by the Bidder and experts of OEM or their authorized Principal.
  - (6) To assist the Bidder to coordinate customs duties, taxes, etc. as per existing rules and regulation of Bangladesh Govt, for the items, equipment, machinery and materials imported for the LCT.
  - (7) To accept the LCTs as per contract.
  - (8) "Test and trial completion certificate" is to be jointly signed by shipbuilder/ their authorized principal/ Agent, the Classification Society surveyor and BN.
- b. **The BIDDER.** The Bidder will be responsible for the following:
  - (1) To propose appropriate offers to BN for approval.

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- (2) To construct hull and structure of the LCT under supervision of Classification Society surveyor and Project Implementation Team (PIT).
- (3) To install all machinery, equipment, sensors (including all communication & navigation equipment such as RADAR, Gyrocompass, Eco sounder etc.) and fitting under the assistance/ supervision of the OEM engineer/ concerned Bidders of the machinery as necessary.
- (4) To install Gun under the assistance/ supervision of the OEM/ BN. Necessary drawings, instructions, special tools/ instruments and guide lines will be provided by the OEM/ BN.
- (5) To assist in/ perform conducting test, trial and commissioning of all machinery, equipment, fittings, sensors, weapons and systems as necessary.
- (6) To arrange insurance of all equipment, machinery and materials imported for the LCTs.
- (7) To provide the followings (to be specified in the offer and subject to BN approval):
  - (a) POL items including cooling water inhibitor, grease, refrigerant, and chemicals required for first filling and or test & trials and or till handing over to BN along with specification.
  - (b) Any other items small in nature and manufactured in Bangladesh (like flags /buntings, ship's bell, data plaque, safety chains, curtains, sofa covers, bedding items ship's husbandry items, etc.).
  - (c) Minor items required for normal operation of a appropriate category of naval ship.
  - (d) Two sets of Warrant of System/ Equipment/ Fittings (WOSEF) {F (NS) 2} and two sets of Spares Allowance List (SAL) {F (NS) 3}.
- (8) To deliver the LCTs to BN within specified time as per contract.
- (9) "Test and trial completion certificate" is to be jointly signed by shipbuilder/ their authorized principal/ Agent, the Classification society surveyor and BN.
- (10) To provide sign and drawing package of the offered LCT after being designed and made proven by CFD analysis followed by model tank test.
- (11) To provide full set of constructional drawing of the LCT. It is to contain full details of hull form, scantlings, frames, bulkheads, superstructure, tank arrangement, engine and machinery/equipment's seating, shafting arrangement etc.

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(12) To supply all materials, equipment, machinery and fittings (except those specified as BN and the Bidder's supply) as stated throughout this tender specification that are required for construction of the LCT including but not limited to the following:

- (a) Material for construction of hull and structure, like steel and non-ferrous plates, frames and pipes, paints, electric cables, guard rails, panelling, sound and heat insulation material, scuttles, windows, doors, etc.
- (b) Propulsion plants including propulsion engines, gearboxes, engine control system, propellers, propeller shafts, shaft bearings, shaft seals, stern tubes, A/P brackets, Plummer block etc.
- (c) Electrical power generator sets including emergency generator, switchboards, power distribution boards/panels, lighting system, emergency power supply system, conversion machinery, batteries, cables etc.
- (d) Supply all required equipment/items for external and internal communication including HF, VHF, Walkie-talkie sets etc.
- (e) Supply of all sensors such as Electro Optical Surveillance system etc.
- (f) Supply all necessary test equipment required for successful test/trial of sensors.
- (g) Anchors, cables, capstan, bollards, fairleads, mast, lifesaving equipment, ship's boat including outboard engine, boat hoisting crane and other deck fittings.
- (h) Auxiliary machinery including all types of pumps, air compressors, seawater and freshwater hydrophores systems, fittings etc.
- (j) Steering system.
- (k) Refrigerating plant.
- (l) Fixed fire-fighting systems and portable fire-fighting equipment.
- (m) Supply exhaust blowers for machinery spaces, galley, living and sanitary spaces. Ventilation and air conditioning system including air conditioning plant trunking/ducting, fans, blowers, etc.
- (n) Hot plates, rice cookers, ovens, electric meat grinder, electric blender machine and other galley fittings must be marine type.
- (p) Navigation equipment.
- (q) IMO approved means for disposal of oily water and sewage treatment plant etc.

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(r) Life saving equipment such as life raft, life buoy with marker, general service life jacket, EPIRB, SART, two-way VHF telephone etc.

(13) To propose other requirement/ specifications of items as considered essential for the offered LCT.

(14) To carry out speed/ performance test of the LCT, as well as test/ trial and commissioning of all machinery, equipment, sensors and system.

(15) To arrange operation and maintenance training for the ship's crew. The training should cover all aspects of operation and maintenance of all machinery, equipment, sensors and system on board.

(16) To supply all required books, manuals, drawings, catalogues, circuit diagrams and other documents of all machinery/ equipment and item in English.

(17) To supply all necessary certificates along with class notation required by the classification society for the purpose of classification of the vessels and their machinery/ equipment.

(18) To supply all tools, test equipment and recommended spare parts for 05(five) years.

(19) To arrange shipment/ transportation of all equipment/ items/ spares. All costs related to shipment/ transportation, packaging, and all handling charges outside Bangladesh are to be borne by the shipbuilder.

(20) To provide any item/ interface/ arrangement required for the standard operation of equipment/ system/ weapon whether it is mentioned or not.

(21) To appoint Classification Society as per the contract. All cost related to Classification Society will be borne by bidder/ supplier.

(22) To provide required warranty for all equipment of the ship.

1003. **Qualification/ Eligibility of the Bidder.**

a. The bidder must be a well reputed and established local shipbuilder having own shipyard/ dockyard.

b. The bidder must have experience of building at least 5 warships for Bangladesh Navy/ BCG during the last 15 years.

c. The bidder must have experience of refit/ repair of warships of Bangladesh Navy for at least last 10 years.

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d. Experience of installing marine propulsion systems, electric power generation systems, communication systems along with guns and armaments onboard naval warships of compatible size and complexity.

e. Financial soundness of the company to be provided with appropriate bank statements.

f. Relevant documents to be submitted from appropriate authority that the shipbuilder/ bidder is not currently defaulted in payment of bank loan(s); and shipbuilder/ bidder is not bankrupt or known to be on the verge of being insolvent and/ or bankrupt.

g. The local shipyard having the above qualification may submit offer in collaboration with a reputed foreign shipyard/ firm (w.r.t design, material package, technical assistance etc).

h. If the offer is submitted in collaboration with a foreign shipyard/ firm then detail of the foreign shipbuilders/firm is to be provided.

1004. **Submission of Quotation.** The quotation must include the following:

a. Complete technical specification of the LCT as per this tender specification.

b. General Arrangement (GA) Drawing of the Proposed LCT.

c. List of LCTs/ Warship built of ar by the ship builder with the names of owners and their present contact address.

d. Delivery schedule (with reference to the date of signing the contract)of the drawings, material and machinery, equipment, sensors and other items for construction of three in number LCT.

e. Production schedule for construction (especially major events related to the payment terms mentioned in this tender specification).

f. In case of offer from authorized foreign Principal /Agent, the Bidder will provide the offer authorization certificate (original) with regard to their Principal/ Agent.

g. Original certificates of providing after sales warranty, supply of spares and other services for complete package of supply.

1005. **Visit of BN Team.** Soon after the technical evaluation, BN specification/ evaluation committee will visit the ship building yard at buyer's constantan appropriate time. After the visit, the committee will submit here port regarding the capabilities and facilities of the shipbuilding yard of technically suitable Bidder and shipbuilder.

1006. **Approval of Plans and Drawings.**

a. For approval, the Bidder will need to submit to BN 3 (three) copies of following plans and drawings before construction:

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- (1) General Arrangement Drawing.
- (2) Lines Plan.
- (3) Compartment Layout Plan.
- (4) Tank/ Vehicle Arrangement plan.
- (5) Armament Lay Out Plan.
- (6) Firing Arc Drawings.

b. Above mentioned drawings need to be submitted with CAD soft copy for approval. Before submission to BN, the drawings are to be duly checked for conformity with the design standard and endorsed by approved Classification Society when necessary. Once approved by BN, the drawings may however be subjected to only minor modification with approval of BN. All drawings supplied by the Bidder are to be endorsed by the Classification Society (ABS, BV, DNV-GL or LR).

c. After approval of the previous drawings, the Shipyard or Bidder will also need to submit the following technical drawings to the BN Representative for approval:

- (1) Anchoring and Mooring Arrangements.
- (2) Towing Arrangement.
- (3) Firefighting System Diagram.
- (4) Engine Room Layout.
- (5) Accommodation (Including Wardroom, SR and JR Mess) Arrangement.
- (6) Ops Room Equipment Arrangement.
- (7) Bridge Layout with Equipment Arrangement Drawing.
- (8) MCR Arrangement.
- (9) Air Conditioning Piping Diagram.
- (10) Compressed Air System Diagram.
- (11) Shell Expansion Diagram.
- (12) Midship Section Diagram.
- (13) Galley and Wardroom Pantry Equipment Arrangement.
- (14) Mast Arrangement.

(15) Lavatories Arrangement.

1007. **BN Project Implementation Team and Crew at Construction Site.** A project implementation team (consisting of at 03 BN officers, 03 JCOs/ POs and 06 Ldg & Below) will remain at the construction site throughout the period of ship construction. BIDDER will provide following facilities to BN personnel during their stay at shipyard:

- a. Private office room at or in the immediate vicinity of the shipyard with necessary office materials including fax, computer, internet facilities, printer, etc.
- b. Local transportation facility for the team from and to the accommodation area and shipyard.
- c. Food and accommodation facilities (non-family, including cooking facilities) for the total ship' screw during training till handing over the LCTs to BN.

1008. **FAT/ PSI (Factory Acceptance Test/ Pre-Shipment Inspection).**

a. FAT / PSI will be carried out for all major equipment/ machineries. 5 in number BN teams will be present in 5 such FAT programs in the OEM premises. Each team will be comprised of 3 BN personnel and each FAT program will be for at least 4 working days (without journey time). The FAT / PSI programs where BN team will be present will be decided by the NHQ. However BN team will be present in the following FAT programs (included within the mentioned 5 programs):

- i. At least 2 Main Engines (in one program).
- ii. At least 2 Gear Boxes (in one program).
- iii. At least 2 Diesel Generators (in one program).
- iv. Rest 2 FAT programs will be decided later by BN, which may be for any of the above machineries / equipment or any other major machinery / equipment of the LCTs.

b. In this respect, the cost of international air fare, food and accommodation shall be borne by BN. Internal transportation cost within the OEM country shall be quoted and borne within the quoted price by the bidder. But if the FAT is rejected/ repeated due to any reason at the suppliers end, then all costs of the repeated FAT have to be borne by the supplier so that there will not be any cost involvement at BN's end.

1009. **Bid Price and Terms of Payment.**

a. **Bid Price.** The quoted price (in Bangladeshi Taka) is to be broken down in to the following components from where BN will have the option to choose the whole or part to any component.

- (1) Price of design package including all design, drawings, etc.
- (2) Price of the construction material package.
- (3) Price of propulsion machinery, its control systems, gearboxes, shafting and propellers.

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- (4) Price of electrical power generation and distribution system.
- (5) Price of all auxiliary machinery and equipment.
- (6) Price of all deck machinery.
- (7) Price of electrical and electronic equipment (including navigational, communication equipment, sensors, etc.).
- (8) Price of Electro Optical Surveillance/ Observation system.
- (9) Price of mandatory spare parts.
- (10) Price list of spare parts for 05(five) years including list.
- (11) Price of general tools, special tools and test equipment.
- (12) Cost of services related to construction.
- (13) Any other charges.

b. BN reserves the right to accept the whole or part of the offer considering the economic viability.

c. **Special Conditions.** The construction material, machinery and equipment purchased for building LCT will in general be considered as Defence Stores. These Defence Stores shall be used by the Defence Forces only and hence are exempted from payment of custom duties and sales taxes as per Ministry of Finance, the Government of Peoples Republic of Bangladesh (NBR) Memo No 9 (41)NBR/ Cus-IV/72/246 dated 10 Apr 1981.

d. **Payment Terms and Schedule.** Mode of payment shall be through bills/ documents submitted by Supplier to DGDP. All payment shall be made in local currency (Bangladeshi Taka). Payment schedule will be under following terms and conditions:

- (1) **1<sup>st</sup> Instalment.** 19% of the total contract price is to be paid on signing the contract and submission of provisional GA drawing and submission of Bank Guarantees (Bank Guarantee 19% and Performance Guarantee 10%).
- (2) **2<sup>nd</sup> Instalment.** 18% of the total contract price is to be paid on keel laying of 03 LCT and submission of keel laying certificate endorsed by BN (6%for each LCT). Bank Guarantee (BG) will be released after the keel laying of last LCT.
- (3) **3<sup>rd</sup> Instalment.** 15% of the total contract price is to be paid on steel cutting of 03 LCT and submission of steel cutting certificate endorsed by BN (5%for each LCT).
- (4) **4<sup>th</sup> Instalment.** 18% of the total contract price is to be paid after arrival of machinery of 03LCTand submission of arrival certificate endorsed by BN(6%foreachLCT).

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(5) **5<sup>th</sup> Instalment.** 18% of the total contract price is to be paid after launching of 03 LCT and submission of launching certificate endorsed by BN (6%for each LCT)

(6) **6<sup>th</sup> Instalment.** 12% of the total contract price is to be paid after completion of test/trial, final acceptance (by joint committee) and delivery of 03 LCT (4%for each LCT).

(Note: Partial Payment Allowed)

e. **Demand for Payment.**

(1) Date of each event provided in subparagraph 1009 (d) of this Article on which any payment shall fall due hereunder, the SELLER shall not if the BUYER by writing ore- mail or facsimile of the date of such payment shall be come due.

(2) The BUYER shall immediately acknowledge receipt of such notification by letter, e-mail or facsimile to the SELLER and take necessary steps to get the amount paid to the SELLER within 15 (fifteen) days after presentation of documents/bills.

f. **Price Escalation.** BN will not consider escalation of price during the project.

1010. **Delivery Schedule.** Three LCTs are to be constructed, test and trial to be completed and delivered within 24 months after signing the contract. First LCT is to be delivered within 16 months, second LCT within 20 months and final LCT is to be delivered within 24 months of signing the contact.

1011. **Bank Guarantees.**

a. **Performance Guarantee (PG).** The supplier shall furnish a Performance Guarantee (PG), with a validity of 03-12 months (as applicable) from the date of expiry of the delivery schedule (as per DGDP format in local currency) in the shape of Bank Guarantee as security. The PG is of @ 10% on the TCP value amounting to favour of Senior Finance Controller (Navy) as security money through any schedule bank located in Bangladesh (except Standard Chartered Bank Ltd). In all the cases PG should be submitted before signing the contract. The PG will be released by the SFC (Navy) on receipt of a certificate from DGDP to the effect that the supply has been completed satisfactorily and No Objection Certificate (NOC) has been received from the consignee. If the contractual obligation warrants the extension of validity of PG, the Supplier shall remain liable to do so at his own cost. If however, the Supplier, despite being requested by DGDP, decides not to extend PG; DGDP shall deserve the right to encase the PG, which shall later, on completion of contractual obligations be handed over to the Supplier. In case of failure of the Supplier to fulfill the contractual obligation as per terms and conditions of the contract, PG in full or part thereof may be forfeited at the discretion of the purchaser and necessary punitive action will be taken against the supplier as per DGDP rules. If any case either PG validity expires or contractual obligations is not completed, the supplier must ensure the PG issuing bank takes written clearance from DGDP before releasing PG to the Supplier.

b. **Guarantee for Warranty.** The Bidder shall furnish to DGDP a guarantee for warranty after satisfactory handing over of each LCT for an amount equivalent to 6% (Six percent) of the total contract price from any scheduled bank situated in Bangladesh in favour of Senior Finance Controller (Navy), Lalasarai, Sailors Colony Mirpur-14, Dhaka-1206, Bangladesh (i.e., 2% of each LCT). This guarantee for warranty shall remain valid until expiry date of the warranty period.

1012. **Warranty Repair/ Replacement.** The Bidder shall undertake the full responsibility to test, free of charges to BN, any defect in any of the LCT which is due to defective material, construction, miscalculation and/ or improper workmanship on part of the Bidder and/or its sub-contractors, or to replace any such defective item, provided that the defects are appeared/ discovered during the period of 12 (twelve) months after delivery of each LCT. Warranty repair/ replacement shall be accomplished within 3 months of notification of the relevant defect. Otherwise, warranty will be extended by non-operational period of the equipment.

1013. **Legal and Financial Issues.** All legal and financial issues mentioned in this specification are to be fully complied/ agreed by the Bidder. BN will have option to cancel the bid in case such compliance is not agreed upon by the BIDDER during the process of evaluation and negotiation to finalize the contract specification. Besides, all legal issues will be governed by DP-35.

1014. **Validity of Offer.** Offer must be valid until **30 June 2022** as per tender terms and conditions from the date of opening the tender. Within the validity of the offer, withdrawal of offer or unwillingness to sign the contract by the bidder will not be accepted as per Directorate General Defence Purchase (DGDP) rules. DGDP/BN also reserve the right to get the offer validity extended with the consent of the bidder.

1015. **After Sale Service.** The technical advisory service through electronic or conventional mail or online servicing (if available) from the factory is to be provided by the manufacturer as and when required for a period of 02 years on expiry warranty period.

1016. **Special Terms.** Special terms/ conditions to be incorporated in the Contract and to be hard to by the Bidder at the time of signing of the Contract. The Bidder is to clearly state their agreement to these terms/ conditions while submitting the offer.

1017. **Article Wise Compliance Sheet.** Article wise compliance the purchaser's Technical Specification of LCT is to be provided. The Bidders should clearly mention whether they comply with the requirements of the purchaser mentioned in the various articles of the tenders specification or not. For any deviation from that, it is to be clearly mentioned in the offer.

1018. **Force Majeure and War Risk.** This clause will be included in the contract as under:

a. **Force Majeure.** Should circumstances arise which prevent the parties from completion of partial fulfillment of their obligation of any nature of blockages or other fulfillment of their obligation shall be postponed for the time during which such circumstances prevail. The party which has been deprived of the possibilities of fulfillment of their obligations of the contract should notify the other party of the beginning and cessation of the circumstances, which prevent the fulfillment of their agreement. The Certificate issued respectively by the Chamber of Commerce in the

country of the Supplier or the Purchaser shall be accepted as proper evidence of the existence of the above-mentioned circumstances and time of their duration. Non-availability of raw materials for the manufacturing of stores, or an export permit for the export of the contracted stores from the country of this origin/country of supplier, shall not constitute force majeure.

b. **War Risks.** In this clause "War Risks" means any blockage or any other actions which are announced as a blockage by any Government or any belligerent or by any organization, sabotage, piracy or any actual or threatened war, hostilities, war like operations, civil war, civil commotion or revelation. If at any time before the vessel commences loading or during the voyage or during unloading it appears that performance of the contract will subject the vessel or her master and crew or her cargo to war risk at any stage of the voyage, the Supplier has the right to stop the voyage. In all the rest not stipulated in this clause is related to "War Risks", the parties shall be guided by the clause "War Risks" of "Uniform General "(as revised 1922 and 1976). Code name "GENCON" recommended by "The Baltic and International Maritime Conference".

**Note: Decisions under this clause shall not be subject to arbitration.**

1019. **Delayed Delivery.**

a. **Liquidated Damage (LD).** In case the Supplier fails to complete shipment delivery within dates stipulated in the contract, the Purchaser shall have the right to impose and recover Liquidated Damage (unless waived off) at the rate of 2% but not less than 1% of the value of unsupplied quantity of the item(s) per month for the period exceeding the original delivery period, subject to the provision that the total liquidated damages thus livable will not exceed 10% of the total contract value.

Note: Decisions under this clause shall not be subject to arbitration.

b. Delay in the delivery of each LCT up to 21 days will be regarded as "Grace Period" available to the bidder and the delivery date (ending as of 12 o'clock midnight Bangladesh Time on delivery date as mentioned in the contract will be considered to have been automatically extended up to that limit without issuance of any formal amendment and payment of any liquidated damages. For delays beyond 3months, formal amendment to delivery period will be calculated from the original delivery date given in the contract.

c. As soon as it is apparent that, the dates of delivery cannot be adhered to, the bidder shall send an application for extension of delivery period to BN. If failure to deliver within scheduled time as aforesaid shall have arisen from any cause which BN may admit as a reasonable ground for the extension of delivery period, BN may allow such additional time as he considers to be justified without imposing liquidated damages. If the delay is considered by BN due to reasons within the bidder's control, the extension may be granted with liquidated damages. The decision of BN on the issue shall be considered as final.

d. For the purpose of this Article, the delivery of LCT shall be deemed to be delayed when and if LCT, after taking into account extension of the Delivery Date or permissible delays as provided in the contract, is delivered beyond the date upon which delivery would then be due under the terms of the contract.

1020. **Omission.** In case the bidder fails to supply/ provide any of the items (i.e., machinery, equipment, sensors and weapon etc.) within the scope of supply of the contract for construction of LCT, the contract price shall be adjusted by deducting the quoted price of the item along with 25% penalty based on the quoted price of the item. If the price of the item is not quoted in the original offer, BN shall have the right to determine the price of the item based on procurement price of similar item by the BN through DGDP/ NSSD, Dhaka or any other means. However, if the omission / correction is made under mutual agreement between the buyer and bidder no penalty will be made.

1021. **Arbitration.** All legal disputes of whatever kind arising out of the contract except (Delay in Despatch of Documents, Insurance, Grace Period and PG) of the contract between the parties including disputes regarding validity of Contract shall be settled wherever possible amicably. Should these disputes fail to be settled on a friendly basis, they shall become subject to ultimate settlement in accordance with Rules of Bangladesh Arbitration Act 2001 (1 of 2001). The Court of Arbitration having jurisdiction and being exclusively competent to decide overall legal disputes arising from or concerning this Contract. The court of Arbitration shall conduct Arbitration in accordance with the Rules of Bangladesh Arbitration Act 2001. However, it shall grant both the parties full opportunity to present their cases and their proofs in writing and by words of mouth in the course of the proceedings. The conducting Language of Arbitration should be in English and the place will be the city of Dhaka, Bangladesh.

1022. **Insufficient Speed.**

a. The bidder will have to give guarantee that the supplied propulsion machinery will enable the ship to achieve the desired maximum speed (as mentioned in the contract) and an endurance of not less than 1200 nautical miles at an economic speed in full load condition.

b. In case the LCT fails to achieve the maximum speed as stated in the contract specification, then penalties will be imposed on the bidder for non-compliance of the contract as per the following:

S No	Speed Deficiency from that of mentioned in the contract specification	Penalty counted in % of total contract value of three LCT for Speed Deficiency in case of each LCT
1.	0.10 to 0.49 knot	1%
2.	0.50 to 0.99 knot	2%
3.	1.00 to 1.49 knot	3%
4.	1.50 to 1.99 knot	4%
5.	2.00 to 2.49 knot	5%
6.	2.50 to 2.99 knot	6%

c. If the deficiency in actual speed of the LCT is more than two and a half (2.5) full knots below the speed guaranteed in the offer, then BN, at its option, may, subject to the bidder's right to effect alternations or corrections, cancel the Contract.