

**TENDER SPECIFICATION FOR CONSTRUCTION OF 02 X LARGE PATROL
CRAFT (LPC) IN LOCAL SHIPYARD FOR BN**

References:

- A. AFD Letter No 06.00.0000.021.44.000.19.104 dated 21 October 2019(Not to all).
- B. NHQ Letter No 23.02.2626.123.06.004.19.2221 dated 14 November 2019 (Not to all).

Approved Tender Specification for construction of 02 x Large Patrol Craft (LPC-ASuW) for Bangladesh Navy in local shipyard is enclosed as Annex A and Annex B to this document.

Annexes:

- A. Terms & conditions of Tender specification for construction of Two Large Patrol Craft (LPC) for Bangladesh Navy (BN) - Total 13 (Thirteen) pages.
- B. Detailed tender specification for construction of Two Large Patrol Craft (LPC) for Bangladesh Navy (BN) - Total 115 (One Hundred and Fifteen) pages.

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ANNEX A

**TERMS & CONDITIONS OF
TENDER SPECIFICATION FOR CONSTRUCTION OF
TWO LARGE PATROL CRAFT (LPC)
FOR
BANGLADESH NAVY (BN)**

**TENDER SPECIFICATION FOR CONSTRUCTION OF 02 X LARGE PATROL CRAFT (LPC)
FOR BANGLADESH NAVY**

TERMS AND CONDITIONS

101. **Preamble.** Two Large Patrol Crafts (LPC) (ASuW) will be constructed for Bangladesh Navy (BN) in a local shipyard of Bangladesh in collaboration with foreign shipbuilder or their authorized principal/agent. The offered LPCs will be designed and made proven by Computational Fluid Dynamics (CFD) analysis followed by model tank test. The primary role of these LPCs will be to detect, identify and destroy surface targets with limited capability of self-air defence. The secondary role of the LPCs will be to perform coastal patrol and constabulary duties within Exclusive Economic Zone (EEZ). The project will involve three parties, namely BN, the SHIPYARD and a foreign ship builder or their authorized principal/agent. These LPCs will be constructed and certified by an internationally recognized Classification Society {Member of International Association of Classification Societies (IACS), DNV-GL/BV/Lloyds} regarding their design, material and construction.

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

a. The Bidder will purchase from any reputed foreign shipbuilder or their authorized Principal/Agent all required items like design, drawing, constructional materials, propulsion and auxiliary machinery, sensors, weapons, SSM's, navigational aids, communication equipment, power generation and distribution plants, deck machinery, air conditioning and ventilation system, electrical and electronic equipment, galley equipment, stores, tools etc. except those which will be supplied by BN.

b. The Bidder will also purchase other items where necessary, as per the contract. In general, BN supply will include Small arms (with ammunitions) and pyrotechnics.

c. The Bidder will construct, equip and complete the LPCs in all respect under the supervision of the classification society surveyor and BN project implementation team.

103. **Responsibilities of the Parties Involved.**

a. **BN.** The responsibilities of BN will be as follows:

(1) To approve technically suitable offer from the shipbuilders/bidders.

(2) To employ a 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 etc. drawings as regards to production.

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- (4) To provide Small arms (with ammunitions) and pyrotechnics from BN stock.
- (5) To overview test & trial of the LPCs conducted by the Bidder and experts of OEM or their authorized Principal.
- (6) To assist the Bidder in exemption of customs duties, taxes etc. for all equipment, machinery and materials imported for the LPC.
- (7) To accept the LPCs 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 offer to BN for approval.
- (2) To construct hull and structure of the LPC under supervision of classification society survey or and PIT.
- (3) To install all machinery, equipment, sensors (including all communication & navigation equipment such as Radar, Gyro compass, Eco sounder etc.) and fittings under the assistance/supervision of the OEM engineer/concerned suppliers of the machinery as necessary.
- (4) Quote separately western origin and manufactured Surface to Surface missile system including its interfacing with ships combat system.
- (5) To install Guns and Fire Control system under the assistance/supervision of the OEM/concerned suppliers. Necessary drawings, instructions, special tools/instruments and guidelines will be provided by the OEM/concerned suppliers.
- (6) Installation and Test/Trial of ASuW weapons etc. will be done under the assistance/ supervision of the OEM/concerned suppliers. Necessary drawings, instructions, special tools/instruments and guidelines will be provided by the Principal/concerned suppliers.
- (7) To assist in/perform conducting test, trial and commissioning of all machinery, equipment, fittings, sensors, weapons and systems as necessary.
- (8) To arrange insurance of all equipment, machinery and materials imported for the LPCs.

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(9) To provide the followings from equipment manufacturer (Origin: UK/GERMANY/ FRANCE/EU/USA/JAPAN/TURKEY/ROK) (to be specified in the offer and subject to BN approval):

- (a) RAS gear, Towing gear, DCFF equipment.
- (b) Security equipment (lock and key arrangements).
- (c) Lavatory fittings.
- (d) Entertainment equipment (like TV, DVD, Sound system etc.).
- (e) Mess traps, mess utensils and galley implement.
- (f) POL items(along with specification) including cooling water inhibitor, grease, refrigerant, and chemicals required for first time filling and or test & trials and or till handing over to BN along with specification.
- (g) 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.).
- (h) Minor items required for normal operation of a war ship.

(10) To deliver the LPCs to BN as per contract.

(11) "Test and trial completion certificate" is to be jointly signed by shipbuilder/their authorized principal/Agent, the Classification society surveyor and BN.

c. **Shipbuilder/ Authorized Principal/Agent of the Bidder.** The shipbuilder/ authorized principal/Agent is to be responsible for followings:

(1) To provide design and drawing package of the offered LPC after being designed and made proven by Computational Fluid Dynamics (CFD) analysis followed by model tank test.

(2) To provide full set of constructional drawing of the LPC within 30 days after conducting Computational Fluid Dynamics (CFD) test analysis. It is to contain full details of hull form, scantlings, frames, bulkheads, superstructure, tank arrangement, engine and machinery/equipment seating, shafting arrangement etc.

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

RESTRICTED

- (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 brackets, Plummer blocks etc.(refers to Section - V of Annex B).
- (c) Electrical power generator sets including switchboards, power distribution boards/panels, lighting system, emergency power supply system, conversion machinery, batteries, cables etc. (Refers to Section - VI of Annex B).
- (d) Supply all required equipment/items for external and internal communication including HF, VHF, Walkie-talkie sets etc.
- (e) Supply of all weaponry & sensors such as SSM, 30 mm gun, 12.7 mm Guns and FCS, ASuW Combat suit and associated Gyro compass, RADAR, Echo sounders etc (refers to Section - VII,VIII, IX and X of Annex B)
- (f) Supply all necessary ammunition, target, test equipment and expert personnel services required for successful test/trial of weaponry/sensors.
- (g) Anchors, cables, capstan, bollards, fair leads, mast, lifesaving equipment, ship's boat including outboard engine, boat hoisting crane and other deck fittings(refers to Section - IV of Annex B).
- (h) Auxiliary machinery including all types of pumps, air compressors, seawater and fresh water hydrophore systems, fittings etc. (refers to Section -V of Annex B).
- (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.

RESTRICTED

- (q) Fin Stabilizer.
 - (r) IMO approved means for disposal of oily water and sewage i.e. Oily water separator, sewage treatment plant etc.
 - (s) Lifesaving equipment such as life raft, life buoy with marker, General Service Life Jacket, Hazardous Duty Life Jacket, EPIRB, SART, two-way VHF telephone etc.
- (4) To propose other requirement/specifications of items as considered essential for the offered LPCs.
- (5) To carryout speed/performance test of the LPCs, as well as, test / trial and commissioning of all machinery, equipment, weapons, sensors and system.
- (6) To arrange operation and maintenance training for the ship's crew. The training should cover all aspects of operation and 2nd level maintenance of all machinery, equipment, weapons, sensors and system on board.
- (7) To supply all required books, manuals, drawings, catalogues, circuit diagrams and other documents of all machinery/equipment and item in English as per article 105(f) and articles 209, 549, 603, 721, 1205, 1206 of Annex B.
- (8) 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.
- (9) To supply all tools, test equipment and recommended spare parts for 05 (five) years. (Article 1201, 1202 and 1203 of Annex B also refers).
- (10) 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 foreign shipbuilder or their authorized Principal/Agent.
- (11) "Test and trial completion certificate" is to be jointly signed by foreign shipbuilder/their authorized principal/Agent, Classification society surveyor, the Bidder and BN.
- (12) To provide one-year warranty for all equipment of the ship after handing over to BN.
- (13) To provide any item/interface/arrangement required for the standard operation of equipment/system/weapon whether it is mentioned or not.

104. **Qualification/Eligibility of the BIDDER.**

- a. Well established local shipbuilder permanently owning internationally recognized and reputed shipyard with experience of building similar type of at least 04 (Four) LPC/PC (Not less than 250 tonne in displacement)for Bangladesh Navy/Coast Guard in the recent past.
- b. Foreign shipbuilders or their authorized Principal/Agent can submit quotation on behalf of them through the shipbuilder(s) stated in article above. In that case the foreign shipbuilder will provide, with the offer, authorization certificate, in regard to their Principal/Agent, Local Shipyard where the LPCs will be constructed and also certificates of providing after sales warranty, supply of spares and other services for complete package of supply.
- c. 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.
- d. Financial solvency is to be proven by submitting relevant documents.
- e. Staffing and logistics of the firm should support technical specialty in the ship building and submit relevant document in support of the claim.
- f. Must submit certified copies of the following documents:
 - (1) Income Tax certificate - for last three financial years.
 - (2) VAT registration certificate; and
 - (3) e-TIN certificate.

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

- a. Complete technical specification of the LPCs as per annex B of this tender specification.
- b. Preliminary General Arrangement (GA) drawing of the offered LPC.
- c. List of LPCs/PCs built so far by the shipbuilder with the names of owners and their present contact address.
- d. Delivery schedule (with reference to the date of contract effecting) of the drawings, material and machinery, equipment, weapons, sensor and other items for construction of 02 in number LPCs.
- e. Production schedule for construction (especially major events related to the payment terms mentioned in this tender specification).

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f. A set of design calculations and drawings of the LPC need to be submitted within 30 days after conducting CFD test, which may include the following drawings:

- (1) Tanks (POL, Fresh water, ballast etc.) layout Plan with capacity.
- (2) Trim and Stability Booklet.
- (3) Damaged Stability Calculations.
- (4) Endurance and Sustainability Calculations.
- (5) Layout of armaments (with firing arc) and Magazines.
- (6) Arrangement of accommodations.
- (7) Arrangement of Machinery-plan View.
- (8) Arrangement of Main Shafting.
- (9) Ventilation and Air Conditioning Diagram.
- (10) Arrangement of Electrical/Electronic Equipment.
- (11) Electrical Load Analysis.

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

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

j. Before submission of quotation, a pre-bid meeting may be held in NHQ.

107. **BN Project Implementation Team and Crew at Construction Site.** A project implementation team consisting of at least 03 BN officers {1 X Captain (X), 2 X Cdr/Lt Cdr (E/L), 4 JCOs (1 each from Seaman, Engineering, Electrical and Radio Electrical branch) and 4 Ldg & below (1 each from Seaman, Technical, Writer and Store branch)} will remain at the construction site throughout the period of ship construction. BIDDER/Shipbuilder 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. Internal transportation for the project purpose and accommodation facility for the PIT at Shipyard.
- c. Food and Accommodation facilities (non-family, including cooking facilities) for the total ship's crew during training till handing over the LPCs to BN.

108. **Factory Acceptance Test (FAT)**

- a. Suitable BN representative will carry out FAT of machinery/equipment /items to be supplied by foreign shipbuilder's/Bidder's arrangement at OEM's

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premises. Terms and conditions are to be settled down between BN and the Bidder. Copies of FAT certificates (original) duly signed by the parties present are to be submitted to BN. FAT team may also carry out PSI in the factory premises during FAT.

b. BN will bear all expenses regarding international travel, accommodation and meals for the FAT of BN team. All expenses related to internal travel within the manufacturer's country, reception and arrangement for entry into the country/concerned area for FAT will be borne by the supplier/bidder.

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

a. **Bid Price.** The quoted price (in Bangladeshi Taka) is to be broken down into the following components as per Annex B, Appendix 1 to 3 from where BN will have the option to choose the whole or part of any component.

- (1) Price of design package of construction drawings plans etc. and all other documents as per the specifications.
- (2) Price of the construction material package.
- (3) Price of propulsion machinery, its control systems, gearboxes, shafting and propellers.
- (4) Price of electrical power generation and distribution system.
- (5) Price of all auxiliary machinery and equipment.
- (6) Price of all deck machinery and fittings.
- (7) Price of electrical and electronic equipment and sensors (Electrical and electronic equipment, navigational equipment, communication equipment, sensors etc.).
- (8) Price of Combat Management System (CMS) and sub systems.
- (9) Price of all weapon systems and sensors separately for 30 mm Gun and 12.7 mm Gun (excluding SSM).
- (10) Price of SSM system with launcher and associated system (Country of Origin and manufactured: Italy/Turkey/South Korea).
- (11) Price of different types of Chaff and launching system.
- (12) Price and list of spare parts for 5 years (Excluding SSM) in accordance with article 1201.
- (13) Price of spare parts for 5 years for SSM (Country of Origin and manufactured: Italy/Turkey/South Korea).
- (14) Price and list of general tools, special tools and test equipment.
- (15) Cost of Orientation Training on operation and maintenance of machinery, equipment and systems in accordance with Article 1208 of Annex B.
- (16) Cost of services related to construction, supervision etc.

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(17) Price for 10 years maintenance contract {e.g. Integrated logistic support (ILS)- Optional.

(18) Price for SSM (Country of Origin and manufactured: Italy/Turkey/South Korea) base support facilities - Optional.

(19) Price for supply of 30 mm Gun ammunition (Required for conducting proof firing acceptance and 2500 rounds separately) as compatible to the mentioned guns- Optional.

(20) Price for 16 X SSM (Country of Origin and manufactured: Italy/Turkey/South Korea) including 2 x test SSM- Optional.

(21) 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 LPCs 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 Commerce, the Government of Peoples Republic of Bangladesh (NBR Memo No 9 (41) NBR/Cus-IV/72/246 dated 10 Apr 1981).

d. **Payment Schedule.** Mode of payment shall be through bills/documents submitted by the SHIPBUILDER/BIDDER to the PURCHASERs per the following terms of payment:

(1) 1st Installment of 10% of the Total Contract Price (TCP) will be paid on signing of the Contract and upon submission of a Bank Guarantee (BG) in a scheduled Bank of Bangladesh equivalent to 10% of the TCP.

(2) 2nd Installment of 10% (5% for each LPC) of TCP will be paid after keel laying and on submission of basic drawing approved by Classification society (Lloyds/DNV-GL/BV) of LPCs. The copy of the certificate (keel laying) issued by shipbuilder in this effect and endorsed by BN representatives and clearance from DGDP.

(3) 3rd installment of 10% (5% for each LPC) of TCP will be paid on receiving shipping documents of Hull material package shipment for 02 LPCs at Shipyard and endorsed by the BN representatives and clearance from DGDP.

(4) 4th Installment of 10% (5% for each PC) of TCP will be paid on submission of purchase order copies for procurement of Machinery/items (Main Engines, Gear Box, Generators, shafting and steering equipment, Combat System, all Guns/Weapons, all Missile System and all Radars) for 02 LPCs issued by the BN representatives and clearance from DGDP.

RESTRICTED

(5) 5th Installment of 10% (5% for each LPC) of TCP will be paid on submission of copies of shipping document of Major Machinery/items (Main Engines, Gear Box, Generators, shafting and steering equipment, Combat System, all Guns/Weapons, all Missile System and all Radars) for 02 LPCs issued by the BN representatives and clearance from DGDP.

(6) 6th Installment of 10% (5% for each LPC) of TCP will be paid on arrival of Major Machinery/items (Main Engines, Gear Box, Generators, shafting and steering equipment, Combat System, all Guns/Weapons, all Missile System and all Radars) of 02 LPCs endorsed by the BN representatives and clearance from DGDP.

(7) 7th Installment of 10% (5% for each LPC) of TCP will be paid on completion of construction up to deck level of 02 LPCs and endorsed by BN representative and clearance from DGDP.

(8) 8th Installment of 10% (5% for each LPC) of TCP will be paid upon confirming the launching, satisfactory HAT & SAT of 02 LPCs and Certificates in this effect issued by the supplier and endorsed by the Representative of BN and clearance from DGDP.

(9) 9th Installment of 20% (10% for each LPC) of TCP will be paid upon Satisfactory Test, Trial and Final Acceptance of 02 LPCs by BN Acceptance Team.

e. **Price Escalation.** BN will not consider escalation of price due to fluctuation of exchange rate over the period of construction of the aforementioned LPCs.

f. **Currency.** All payments from PURCHASER to SUPPLIER shall be in local currency (Bangladeshi Taka, BDT).

110. **Validity of Offer:** Up to 30 June 2020.

111. **Delivery Schedule.** Two LPCs are to be constructed, test and trial to be completed and delivered within 36 months after contract effecting date. Contract effective date (herein after referred as CED) for this tender specification means the date on which BG equivalent to 10% of TCP is submitted by the SUPPLIER/BIDDER or the date 15 (fifteen) days after signing of the contract, whichever is earlier.

112. **Guarantees.**

a. **Bank Guarantee (BG)/Bond.** The Bidder shall submit a BG for an amount equivalent to 10% (Ten Percent) of the Total Contract Price (TCP). The BG has to be in a scheduled bank in Bangladesh in favour of Senior Finance Controller (Navy), Lalasarai, Sailors Colony, Mirpur-14, Dhaka-1206, Bangladesh. This BG shall remain valid on arrival of the machinery, equipment, armament and items for two LPCs into the shipyard premises. The BG has to be submitted within 15 (Fifteen) days of Contract signing. This BG shall be released after payment of sixth instalment as per payment schedule (article 108.d).

b. **Performance Guarantee (PG)**. The Bidder shall submit a PG/bond prior signing of Contract for an amount equivalent to 10% of the TCP (Total 02 PG i.e. 01 PG for each LPC amounting 5% of TCP) in any scheduled bank in Bangladesh in favour of Senior Finance Controller (Navy), Lalasarai, Sailors Colony, Mirpur-14, Dhaka-1206, Bangladesh. This PG shall remain valid till satisfactory test, trial and Final acceptance of each LPC to BN. The PG shall be released upon receipt of Final Acceptance Certificate issued by BN and Routine Order -12 (i.e 50 % of total PG shall be released after successful final acceptance of each LPC and receipt of Routine Order -12 from DGDP).

c. **Guarantee for Warranty**. The bidder shall furnish to DGDP a bank guarantee for warranty in any scheduled bank in Bangladesh after satisfactory handing over of LPC(s) an amount equivalent to 5% (five percent) of the TCP for 02 (two) LPCs (i.e. 2.5% of TCP for each LPC) which shall remain valid until expiry of the warranty period for the concerned LPC. The Guaranty of warranty shall be in in favour of Senior Finance Controller (Navy), Lalasarai, Sailors Colony, Mirpur-14, Dhaka-1206, Bangladesh.

113. **Warranty Repair/Replacement**.

a. The bidder shall undertake the full responsibility to rectify, any defect in any of the LPC(s) which is due to defective material, construction, miscalculation and/or improper workmanship on part of Shipbuilder/bidder and/or its subcontractors, or to replace any such defective item, equipment and machinery, provided that the defects are revealed/discovered during the period of 12 (twelve) months after Acceptance of each LPC at Supplier's/bidder's expense. Warranty repair/replacement shall be accomplished within 03 months of notification of the relevant defect. Otherwise warranty will be extended by non-operational period of the equipment.

b. In the event of any item of 2 X LPCs supplied against the contract found to be contrary and not in accordance with the contract during the inspection at the consignee's premises/by BN Project Implementation Team, the Supplier/bidder will make repair/replacement free of cost within 03 months from the date of receipt of reports from the consignee/ BN Project Implementation Team, without involving any extra cost to the Purchaser. But the Purchaser will have to forward such report to the Supplier/Bidder. Even after the repair, if the items are not found satisfactory, such item(s) will be replaced by the supplier/bidder at Supplier's/bidder's cost (i.e. freight, insurance and charges if any). The supplier/bidder is to arrange dispatch of the unsatisfactory item(s) after necessary co-ordination with the purchaser.

114. **Legal and Financial Issues**. All legal and financial issues mentioned in the specification are to be fully complied/ agreed by the bidder or by bidder's authorized competent authority on behalf of the bidder. Besides, all legal issues will be governed by Bangladesh Defence Purchase Regulations, DP-35, AFD Policy for Procurement - 2010 (2nd edition) other procurement related rules and regulations in practice for Bangladesh Defence Forces. The Purchaser will have option to cancel the bid in case such compliance is not agreed upon by the bidder during in process of evaluation and negotiation of finalize the contract specification.

115. **Special Terms.** Special terms/conditions to be incorporated in the Contract and to be adhered to by the Bidder at the time of signing of the Contract are given at Appendix 4 of Annex B. The Bidder or their authorized Principal/Agent is to clearly state their agreement to these terms/conditions while submitting the offer.

116. **Condition for Acceptance of Quotation.** Quotation has to have supported documents (all required certificates as mentioned before, booklets, leaflet, catalogue, brochure etc) having detailed particulars of the intended ship, it's machinery, equipment's, fittings, fixtures, accessories, spare parts etc. If detailed information regarding intended ship and it's machinery, equipment's, fittings, fixtures, accessories, spare parts etc. are not provided; the quotation will not be accepted.

117. **Compliance Statement.** A compliance statement fulfilling all the requirement of the tender is to be submitted for evaluation of the quotations. Stating mere 'Yes' or 'No' will not suffice. The Shipbuilder/bidder should clearly mention whether the offer of that article comply with the requirement of the Purchaser or not. Therefore, detailed compliance statement supported by appropriate documents are to be submitted in a tabular format attached as Appendix 6 of Annex B. An incomplete compliance statement may attribute to cancellation of the offer.

118. **Article wise Compliance Sheet.** Article wise compliance on the purchaser's Technical Specification of LPCs is to be provided. The Bidders should clearly mention whether they comply with the requirements/offers of the purchaser mentioned in the various articles of the tender specification or not. Any deviation is to be clearly mentioned in the offer. A blank format is given as Appendix 6 of Annex B.

ANNEX B

DETAILED TENDER SPECIFICATION FOR CONSTRUCTION OF TWO LARGE PATROL CRAFT (LPC) FOR BANGLADESH NAVY (BN)

CONTENTS

SECTION	DESCRIPTION	PAGE NO
Section-I	Introduction & General Provisions	B-1
Section-II	Design and Drawing	B-10
Section-III	Hull and Structure	B-14
Section-IV	Deck Auxiliary and accommodation outfit	B-19
Section-V	Engineering Machinery, Equipment and Systems	B-26
Section-VI	Electrical Equipment, Machinery and Systems	B-42
Section-VII	Navigational Equipment/aids	B-65
Section-VIII	Sensors and Combat System	B-69
Section-IX	Communication and EW Equipment	B-71
Section-X	Weapons and Armaments	B-74
Section-XI	Accommodation Stores and Amenities	B-81
Section-XII	Miscellaneous	B-90
Appendix 1	Summary of Tender Prices for 02 in Number LPC with Accessories, Spare Parts, Tools and Services	B1-1
Appendix 2	Price Schedule for Service Related to construction and Training	B2-1
Appendix 3	Price Schedule for Material Package including Construction Material and All Types of Machinery, Equipment and Items	B3-1
Appendix 4	Special Terms / Conditions for the Contract	B4-1
Appendix 5	Comparison of Design Particulars between Previously Constructed LPC and Offered LPC	B5-1
Appendix 6	Article wise Compliance Sheet on the Purchaser's Tender	B6-1

RESTRICTED

SECTION - I

INTRODUCTION AND GENERAL PROVISIONS

101. Functions.

- a. Primary. To be able to detect, identify and destroy surface targets with limited capability of self Air Defence.
- b. Secondary. Perform coastal patrol and constabulary duties within EEZ.

102. General Descriptions.

- a. Should be capable of operating in tropical conditions.
- b. Should have an expected life of minimum 25 years.
- c. Annual usage of approximately 3000 hours.
- d. Normal refit interval 03(three) years.

103. Displacement at Full Load.

- a. Full Load : Not less than 700 tons. (To be mentioned).
- b. Normal Load : To be mentioned.

104. Dimensions.

- a. Length (overall). Not less than 60 m (To be mentioned).
- b. Breadth (max). Not less than 9 m (To be mentioned).
- c. Maximum (full load) Draught. Not more than 04 meters (including all underwater projections like Propeller Projection, Skeg etc.). Draught is to be mentioned as follows:

- (1) Draught Fwd - Not more than 04 m (To be mentioned).
- (2) Draught Aft - Not more than 04 m (To be mentioned).
- (3) Draught Midship - Not more than 04 m (To be mentioned).

105. Speed.

- a. Maximum speed. Not less than 27 Knots (At full load).
- b. Maximum continuous speed. To be mentioned.
- c. Economic speed. To be mentioned.

106. Endurance. Not less than 2500 NM at economic speed.

107. Propulsion and maneuvering. The propulsion system should consist of the following:

- a. Diesel Engines. Preferably two in number four stroke western origin and manufactured (UK/Germany/France/USA) marine diesel engines (driving two propellers) capable of developing sufficient power required to attain the maximum ship's speed mentioned in this specification.

RESTRICTED

b. **Reduction Gearbox.** Two in number of western origin and manufactured (Germany/France) gearboxes compatible with Diesel Engines (Two propeller shafts connected with One/Two engines through two independent reduction gearboxes). The gear box needs to be compatible with Diesel Engine (Details to be mentioned).

c. **Number of Shafts.** Two shafts (USA or EU Origin and manufactured) according to the number of main engines propulsion system should be CPP with reduction gear box (To be mentioned).

d. **Steering System.** Steering system including emergency provision (western origin and manufactured) are to be supplied.

e. Associated auxiliary machinery (western origin and manufactured) are to be supplied.

f. **Maneuverability.** The hull, propulsion and steering system of the LPC will be such that it can have very good maneuverability:

- (1) Stopping length from full ahead to stop : To be mentioned.
- (2) Turning Circle : To be mentioned.
- (3) Tactical diameter : To be mentioned.
- (4) LPC's vital machinery and equipment are to be capable of operating satisfactorily under the following conditions:

- (a) Permanent trim : Up to 5⁰.
- (b) Permanent list : Up to 15⁰.
- (c) Pitching : Up to 10⁰.
- (d) Rolling : Up to 45⁰.

108. **Power.**

a. 03 x Main Diesel Generator (DG).

b. DC power backup (For emergency power supply for navigational equipment/lights etc. for her safety at sea).

c. Facility for shore supply connection.

d. Solid state conversion equipment.

e. Generators should be of western origin and manufactured (UK/GERMANY/France/USA). Name of the origin & manufacturer's country is to be mentioned.

109. **Seaworthiness.**

a. **Damaged Stability.**

(1) The LPC should be able to remain stable, even if any 2 adjacent main transverse watertight subdivisions are flooded.

(2) The ship's buoyancy and stability are ensured even if 3 adjacent aft and fore extreme compartments are flooded.

RESTRICTED

b. **Sea Keeping.** The stability of the LPC shall comply with the requirement of International Stability Criterion of IMO/SOLAS regulation. Preliminary capacity plan and stability curves under different loading conditions are to be submitted with the quotation. The LPCs should be able to operate at sea state 4 and capable to withstand and sustain up to sea state 6. The stability of the LPCs shall comply with the requirement of internationally accepted stability regulation.

110. **Complement.** The total complement of the ship should be 50. The ship should accommodate not less than 60 personnel (including 07 officers). Details of complement to be ascertained from Classification society and OEM. (To be mentioned)

111. **Construction.**

a. Welded steel Ship building Grade AH-36 Mild Steel Plates for hull.

b. Superstructure may be of shipbuilding quality class approved Aluminum plate.

c. A classification society from Lloyds/DNV-GL/BV shall be appointed for Approval of relevant drawings, construction supervision/inspection and certification.

112. **Design.** The offered LPC need not be based on prototype of the previously built LPC but will be designed and made proven by CFD analysis followed by model tank test. Besides, previously built LPC by the shipbuilder should be either in use or in service in any country.

113. **Place of Construction.** Local Shipyard in Bangladesh.

114. **Project Duration.** 2 x LPCs will be constructed within 36 months after the contract effecting date (CED).

115. **Special Features.** The ship should be capable of towing another vessel of similar size and shape. Necessary arrangement for stern towing must be there.

116. **Wartime Mission Length.** 10 days.

117. **Ops Room/ Combat Information Centre (CIC).** A compatible Ops Room/ Combat Information Center (CIC) must be made above water line with internal and external communication system to control/operate all the sensors/armaments.

118. **Signature.** All signatures should be minimum. Sharp bended (right angled) superstructure/high temperature object on upper deck should be avoided. The shafting and propellers are to be designed for low noise. All heavy vibrating machinery should be mounted on special noise absorbing mounts.

119. **Armament.**

- a. A complete SSM system with 02 x **04 launcher** (Country of Origin and manufactured: Italy/Turkey/South Korea) to be quoted separately with price.
- b. 1 x 30 mm (NATO compliant, Single barreled) gun with associated FCS having local and remote firing facilities (Western origin and manufactured).
- c. 2 x 12.7 mm heavy machine gun (NATO compliant) - Price to be quoted separately.

120. **Navigation, Direction and RADAR.**

a. **Navigational Equipment including RADAR.**

- (1) 02 x Navigational Radar (western origin and manufactured).
- (2) 02 x Gyro Compass. (Western origin and manufactured).
- (3) 01 x Magnetic Compass.
- (4) 01 x GPS (western origin and manufactured).
- (5) 01 x Echo Sounder (western origin and manufactured).
- (6) 01 x AIS (western origin and manufactured).
- (7) 01 x Speed Log (western origin and manufactured).
- (8) 01 x Anemometer (western origin and manufactured).
- (9) 01 x ECDIS.
- (10) 01 x Siren.
- (11) 06 x Binoculars and 01 x Night Vision Binocular.
- (12) Required number of barometers, barograph, thermometers, Stuarts distances meter, star pamphlets, sextants and equipment for chart work, as accepted by PIT.
- (13) One ship's horn with automatic fog signal capability (Western origin and manufactured).

b. **Surface and Air Search RADAR.** 01 x Surface & Air Search radar and Electro-optics sensors associated with standard accessories including FCS to be integrated with armaments through Combat Management System mentioned in Art 119(a,b).

c. **FC RADAR.** FC radar with Electro-Optics system capable to provide fire control data to 30 mm gun.

d. **Meteorological Arrangements.** Standard meteorological equipment and warning system.

121. **Communication and EW.**

a. **Radio Communication.** As per BN standardized communication equipment for LPC (ASuW) which should include:

- (1) 2 x Tx/Rx HF - 100-150W
- (2) 1 x Tx/Rx HF - 400-500W
- (3) 2 X Tx/Rx VHF/ UHF - (Narrow Band)

RESTRICTED

- (4) 1 x Tx/Rx VHF/ UHF - (Wide Band)
- (5) 1 X Tx/Rx VHF - Air Band
- (6) 2 X Tx/Rx Marine VHF
- (7) 2 X Data Message Terminal (DMT)
- (8) 1 X HF RX
- (9) 7 X Tx/Rx VHF Walkie Talkie
- (10) 1 X INMARSAT Satellite Telephone
- (11) 1 X EPIRB
- (12) 1 X SART
- (13) 2 X SARBE MK 3 (Emergency Survival Radio)
- (14) 1 X Weather Fax Receiver

Note : All Communication set should be compatible with existing BN communication set in terms of voice data, CW & message. **(Details to be mentioned).**

b. **Visual Signaling.** As per BN standardized communication equipment for LPC (ASuW). These are following but not to be limited to :

- (1) Visual Signaling Stowage Arrangements (02 X Flag Locker & 01 X VS Store).
- (2) 04 X Semaphore Pair.
- (3) 06 X Black Ball.
- (4) 04 X Black Diamond.
- (5) 02 X Complete Sets of Dressing Line.
- (6) 02 X Complete Set of Flags, Pennants, Ensigns, National and Distinguishing Flags.
- (7) 03 X Signal Projector (20 Inch X 01 & 10 Inch X 02).
- (8) 02 X Flashing light on mast.

c. **EW Equipment.** Arrangement for standard ESM and Chaff equipment **(Details of make and model to be mentioned).**

d. **Internal Communication System.**

- (1) Internal telephone system.
- (2) Internal broadcast system.
- (3) Internet/LAN facilities.
- (4) Central TV receiving system etc.

e. **IFF and Data Link.** Provision to install BN Compatible IFF and Data Link.

122. **Accommodation.**

a. **Accommodation System.**

- (1) Standard air-conditioned accommodation to be catered for not less than 60 personnel (including 07 officers) (Article 110).
- (2) Required toilet, shower and washing facilities for the ship's complement as per Section-XI.

b. **Ventilation and Air Conditioning.**

- (1) Central air conditioning system for operational and living spaces with alternative arrangements (all equipment's should be western origin and manufactured) (Condenser shall be Shell and Tube type & Compressor shall be Semi-hermetic/ Open type where motor will be fitted separately).
- (2) Forced and natural ventilation for other spaces.
- (3) Standard ablution facilities for total complement of the ship.

123. **Logistic Arrangement.**

a. **POL.** Fuel, oil and lubricants stowage facility for stated endurance.

b. **Storage and Refrigeration Facilities.** Storage facilities for the following are to be provided:

- (1) Dry provisions for 15 days.
- (2) Fresh provisions for 15 days.
- (3) Standard on board spares for all machinery and equipment, and consumable Naval Stores for 15 days.
- (4) Tin provisions for 7 days.
- (5) Naval, Engineering, Electrical and Bos'n stores facilities.

c. **Ammunition.**

- (1) Appropriate stowage facilities (One Magazine) for the ammunition of the armament specified.
- (2) Armoury, Pyrotechnic Locker and Web equipment store facilities.

d. **Water.**

- (1) The fresh water capacity should be not less than 40 tons.
- (2) Provision for generating fresh water (all equipment should be western origin and manufactured).

e. **Cooking Facilities.**

- (1) Standard cooking facility for authorized ship's complement.
- (2) Separate pantry for Officers, Senior and Junior sailors.
- (3) Standard dining facility for Officers, Senior and Junior sailors.
- (4) Standard mess traps and mess utensils for total ship's complement.

124. **Miscellaneous.**

a. **Shock, Vibration and Noise.**

(1) Shock standard should fulfill the cumulative thrust of weapons and weather. The LPCs are to be designed and constructed to limit the vibration to such a level which will neither result in discomfort /annoyance to the crew nor cause damage to/malfunctioning of/reduction of performance the machinery, equipment and the structure. Shock and vibration mountings according to Classification society warship building standard to withstand shock are to be provided.

(2) Necessary sound insulation and isolation are to be provided so as to keep the sound levels within the limits, which will not result in discomfort to the crew, speech interference or deafness problem. Noise levels to the following spaces will have to be provided during maximum continuous speed:

- | | | | |
|-----|---------------------|---|------------------|
| (a) | Engine control room | : | To be mentioned. |
| (b) | All living spaces | : | To be mentioned. |
| (c) | Wheelhouse | : | To be mentioned |

(3) To reduce radiated noise to underwater, elastically mounted appliances for propulsion engines, diesel generators and other auxiliary machinery will be incorporated to the design.

(4) Torsional vibration calculation for the shafting system will have to be made in the design stage to demonstrate the acceptability of vibration levels.

b. **Protection Against Marine Pollution.** LPC will have necessary IMO approved means for disposal of garbage, oily water, sewage and other wastes.

c. **DCFF/Emergency requirement.**

- (1) Standard Fire Fighting and Damage Control equipment as needed.
- (2) Fixed fire fighting arrangement for machinery space.
- (3) Standard first aid and limited medical support including medicine storage facilities.
- (4) DCFF gear store facilities.

d. **Life Saving Equipment.**

- (1) Standard Life Saving Equipment/items as per GMDSS standard.
- (2) 1 x Rigid Hull Inflatable Boat (RHIB) including outboard engine as per following BN standard:
 - (a) Length - 6.5 mtr.
 - (b) Breadth - 2.5 -2.8 mtr.
 - (c) Quantity of Engine - 02
 - (d) Engine Power(per engine HP) - 80-90
 - (e) Engine brand - Yamaha or Evinrude.
- (3) Standard GMDSS equipment including EPIRB, SART etc (equipment should be western origin and manufactured).

e. **Diving Equipment.** Standard Diving Equipment for a complete diving team including charging and stowage facilities compatible with BN Standard (To be mentioned).

f. **Deck Crane.** 1X Electro-hydraulic telescopic knuckle boom type cranes shall be provided (should be western origin and manufactured). The crane shall be suitable for the hoisting and lowering of RHIB. In addition, this crane shall be used to handle cargo provisions as necessary. Capacity: SWL 2.5 tons at 9.0 m distance.

g. **Other Equipment /facilities.**

- (3) Fin Stabilizer (should be western origin and manufactured).
- (4) Degaussing System (should be western origin and manufactured).
- (5) Standard office equipment (Computer, UPS, Printer, Laptop etc).
- (6) Recreation facilities (Television, DVD Player, Music system for ward room, Senior and Junior rating recreation room).

h. **General Fitting.** Standard fittings/equipment for general operations necessary for similar kind of war ships.

j. **Documents.** Appropriate drawings, designs, documents, manuals, certificates etc. are to be provided. The list of certificates will include but not limited to the followings:

- (1) Certificate issued by the internationally recognized classification society for the main and auxiliary machinery and equipment.
- (2) International Tonnage Certificate.
- (3) Builders Certificate.
- (4) Certificates for fixed fire-fighting system.
- (5) Inspection/Test Certificate for anchor and chain cables.
- (6) Magazine safety certificate.
- (7) Any other certificates required for classification of the LPC.

RESTRICTED

125. **Classification.** The LPC must be built according to an internationally recognized classification society's warship building standard (Lloyds/DNV-GL/BV). The classification society referred here must possess the following criteria:

- a. Classification society for the construction of LPC must be a permanent member of IACS.
- b. Classification society will be from Lloyds/ DNV-GL/ BV.

126. **Standard.** In addition to the class requirement for hull, machinery and equipment, internationally recognized classification society's standard shall be followed in respect of the following:

- a. Subdivision and stability.
- b. Tonnage calculations.
- c. Life saving appliances.
- d. Crew accommodation.
- e. Fire fighting appliances.
- f. Doors, windows, hatches and openings.
- g. Safety of navigation (lights and sound signals).
- h. Noise and vibration.
- i. Safety of firing arcs in accordance with the gun manufacturer by Shipbuilder.

SECTION - II

DESIGN AND DRAWING

201. **Introduction.** The offered LPC may be designed and made proven by Computational Fluid Dynamics (CFD) analysis followed by model tank test. Besides, previously built LPC/Similar Ship(s) by the shipbuilder should be either in use or in service in any country.

202. **Design Philosophy.** The vessel should have the following main features:

- a. Enhanced survivability.
- b. Good sea-worthiness.
- c. Easy maintenance.
- d. Increased availability of operation.
- e. Lower life-cycle cost.

203. **Design Criteria and Standards.**

- a. The LPC is to be designed and constructed to the latest naval ship design criteria and standards with respect to subdivision, stability, structures, shock, vibration, noise, EMI, NBC protections, fire-fighting and vital systems.
- b. Vital systems such as propulsion, electric plants and navigation and communication system are to be according to naval design criteria and standards.
- c. Commercial equipment and standards based on the requirement of Lloyds register may be utilized where practicable for non-vital system, subject to acceptance of such standards by the buyer.
- d. **Damaged Stability.**
 - (1) The LPC should be able to remain stable, even if any 2 adjacent main transverse watertight subdivisions are flooded.
 - (2) The ship's buoyancy and stability are to be ensured even if 3 adjacent aft and fore extreme compartments are flooded.
- e. **Sea Keeping.** The stability of the LPC shall comply with the requirement of International Stability Criterion of IMO/SOLAS regulation. Preliminary capacity plan and stability curves under different loading conditions are to be submitted with the quotation. The LPC should be able to operate at sea state 4 and capable to withstand and sustain up to sea state 6. The stability of the LPC shall comply with the requirement of internationally accepted stability regulation.

204. **Design.** The design of the offered LPC may be made proven, which shall mean the following:

- a. The offered design must be made proven by CFD analysis followed by model tank test.

RESTRICTED

b. The stability criteria and sea keeping capability of the offered LPC must comply with that of the same specified in the warship building of the IACS (DNV-GL/BV/Lloyds) and Naval Standard of the country of the designer.

c. The design of the offered LPC needs to be finalized after General Arrangement, full load displacement and type/model of the machinery/equipment/armament/system are acceptable to the buyer.

205. **Classification.** All drawings supplied by the bidder should be approved by the designated internationally recognized classification society (DNV-GL/ Lloyds/ BV).

206. **Certification.** Relevant certificates issued by classification society are to be provided with the drawing.

207. **List of Drawings.** A complete list of drawings that will be supplied is to be submitted prior delivery of these LPCs to BN.

208. **Fees for Certification.** All fees regarding certification of the drawings are to be borne by the bidder.

209. **Drawing Package.** Five copies (one for each LPC, one each for NHQ, BN Dockyard Chittagong and Base Workshop Khulna) of each drawing are to be supplied as well as electronic copy. During hand over the drawings which are to be supplied will include but not limited to are given below:

- a. General Arrangement.
- b. Lines Plan.
- c. Offset Table.
- d. Detail specification.
- e. Hydrostatic data and Curves.
- f. Preliminary trim and Stability Calculation booklet.
- g. Capacity Plan.
- h. Sounding Table.
- i. Tank Calibrations.
- j. Assessment of Inclining experiment at lightship condition.
- k. Final Trim and Stability booklet.
- l. Principal structural sections.
- m. Aft profile and decks.
- n. Fwd profiles and decks.
- o. Aft sections and bulkheads.
- p. Fwd sections and bulkheads.
- q. Shell expansion.
- r. Engine girders / foundations.
- s. Bulwark construction.
- t. Bilge keel.
- u. Welding plan / Scheme.
- v. Deckhouse and Superstructure construction.
- w. Bridge deck and Wheel house construction.
- x. Hatch covers and hatch coaming.
- y. Details of rudder construction.
- z. Steering gear arrangement.

RESTRICTED

- aa. Details of propellers and shafting.
- ab. Plummer block.
- ac. Stern tube details.
- ad. Shaft bracket/bearing.
- ae. Anchoring and Mooring arrangements.
- af. Towing arrangement.
- ag. Mast details.
- ah. RIB seating arrangement.
- ai. RIB lowering and hoisting arrangement.
- aj. Bollard and fairlead details.
- ak. Ladders, guardrails and stanchion.
- al. Manholes.
- am. Watertight hatches.
- an. Ventilation arrangement.
- ao. Position of sea chest.
- ap. Bilge piping diagram.
- aq. Firefighting system diagram.
- ar. Scuppers and drain arrangement.
- as. Fresh water and sea water system diagram.
- at. Fuel oil filling system diagram.
- au. Engine cooling sea water and fresh water diagram.
- av. Fuel oil pipe line diagram.
- aw. Lub oil pipe line diagram.
- ax. Main Engine and Generator exhaust piping diagram.
- ay. Lub oil filling pipe diagram.
- az. Air vent pipe diagram.
- ba. Sounding pipe diagram.
- bb. Sewage system diagram.
- bc. Engine room layout.
- bd. Accommodation arrangement.
- be. Docking plan.
- bf. Draught mark.
- bg. Electric lighting circuit diagram.
- bh. Electric feeder circuit diagram.
- bi. Radio equipment diagram.
- bj. Nav aid diagram.
- bk. Nav aid lighting system diagram.
- bl. Main switch board drawing.
- bm. Arrangement of electric power equipment.
- bn. Ops room arrangement.
- bo. Radio room arrangement.
- bp. Midship section drawing.
- bq. Drawing of frames.
- br. Watertight door arrangement.
- bs. Chain locker and hawse pipe details.
- bt. Capstan seating arrangement.
- bu. Fender construction details.
- bv. Engine room hatch.
- bw. Wheel house arrangement drawing.
- bx. Curve of forms.
- by. Damaged stability calculation.

RESTRICTED

- bz. Electrical load calculation.
- ca. Deck longitudinal girder drawing.
- cb. Bottom longitudinal girder drawing.
- cc. Bulkhead construction.

210. **Special Condition**. The list of drawings given above will act as a guideline only. All other drawings, circuit diagrams, fault finding diagrams and manuals of all relevant to the LPC and equipment including Generators, Weapon system, FCS, Combat Suits, Guns, Radar, Gyro, Log, Radio sets, and other electrical and electronic equipment are to be supplied complete in all respect by the bidder.

SECTION - III

HULL AND STRUCTURE

301. **General.** The following paragraphs describe some of the requirement of the hull and structures. The fact is that anything which is not mentioned herein shall not relieve the bidders from their obligation to supply the LPCs complete in all respect.

302. **Construction.** The hull is to be of internationally recognized shipbuilding quality (Lloyds grade AH-36) steel and of all welded construction. The superstructure may be constructed of internationally recognized shipbuilding quality marine grade aluminum (with adequate fire-retardant coating). The aluminum is to be prevented from electrolytic corrosion and bi-metallic joints are to be used to connect superstructure with the hull. The structural design and details of construction are to be made so as to avoid unacceptable noise and vibration.

303. **General Arrangement.** Each LPC is to be arranged to have the following accommodation, living and working spaces, tanks and stores in accordance with Sec-XI.

304. **Hull and Structure.** Combined transverse and longitudinal framing systems are to be adopted to enable the LPC to withstand heavy impact forces. The longitudinal structural elements will consist of the plating 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. Steel works are not to be boxed in pockets collecting water. Maximum frame spacing is to be mentioned.

305. **Hull Materials.** The hull will be made of internationally recognized shipbuilding quality (Shipbuilding quality grade AH-36) steel. Appropriate welding material and techniques approved by the Classification Society shall be used.

306. **Scantlings.**

a. The scantlings of the structural members are to be as per the requirement of the internationally recognized classification society standard.

b. The minimum scantlings/thickness/spacing of the following places are to be mentioned in the quotation:

- (1) Side and bottom plating.
- (2) Deck plating.
- (3) Sheer strake.
- (4) Bulkheads plating.
- (5) Shell plating.
- (6) Transom plating.
- (7) Tank.
- (8) Side longitudinal.
- (9) Deck longitudinal.
- (10) Web frames.

RESTRICTED

- (11) Deck girders.
- (12) Keel bar.
- (13) Superstructure plating.

307. **Frames.** The frames are to be of one piece from keel to gunwale except in the way of tanks. All beams, girders, stringers, etc are to be as per the internationally recognized classification society's requirements.

308. **Side Longitudinal.** The side longitudinal is to be of one piece as far as possible. All beams, girders, stringers, etc are to be as per the internationally recognized classifications society's requirements.

309. **Deck Longitudinal.** The deck longitudinal is to be of one piece as far as possible. All beams, girders, stringers, etc are to be as per the internationally recognized Classifications Society's requirements.

310. **Bulkheads.** The bulkheads are to be watertight and all welded to the requirement of internationally recognized classification society.

311. **Bulkhead Stiffeners.** These are to be as per Class requirement of internationally recognized classification society.

312. **Main and Auxiliary Machinery Mounting.** These are to be as per the requirement of the international Classification Society/maker of the concerned machine and equipment.

313. **Engine Room Hatches.** The Engine Room hatches are to be of watertight.

314. **Anchor Chain/Cable Locker.** Self-stowing chain locker of sufficient capacity will be arranged to stow the cables well clear of the deck. The locker will be of watertight construction.

315. **Sea Chests/Sea Inlets.** Required numbers of sea chests (in main and auxiliary machinery spaces) are to be integrated in the hull bottom construction. Separate sea chests/ sea inlets shall be provided for Main Engines, DGs and other systems (one for Main Engines, one for DGs and one or more for other systems). Each chest is to be provided with a dismountable 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 the bottom side.

316. **Hawse Pipe.**

- a. The anchor is to be stowed in recessed pockets in the shell.
- b. The hawse pipe of adequate diameter and length are to be fitted 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.
- c. Washing outfitting is to be provided in the hawse pipe.

317. **Construction of Tanks.** The fuel oil, lub oil, fresh water, dirty lub oil, sewage 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 internationally recognized classification society.

318. **Superstructure.**

a. The superstructure including its closed bridge is to be constructed by marine grade aluminium. The superstructure will be of welded construction with bimetallic joints welded to the deck.

b. Superstructure is to be transversely stiffened and inside division bulkheads will be of vertically stiffened flat type or wedged type where suitable.

c. Arrangement of internal webs, pillars and steel bulkheads will be specially considered to minimize vibration.

319. **Foundation for Missile Launchers and Guns.**

a. All gun and Missile launcher's foundations will be made to withstand the thrust on the deck for avoiding distortion of the structure and the armament/equipment.

b. Gun and Missile launcher's foundations and supporting structures are to be stiffened to prevent misalignment which would interfere with operation of the weapon/equipment and is to preclude excessive vibration on the foundation.

c. Machining and alignment of Missile Launchers and guns foundations are to be carried out in accordance with the requirement of manufacturers.

320. **Magazine.** Magazine room for stowage of ammunitions for guns is to be made. In the design of ammunition storage system, full consideration will 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 inclined to 30⁰ either side while rolling. 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 fire proof shielded cables and explosion proof lights and fittings are to be fitted inside the magazine. It is to have flooding and sprinkler system for fire fighting. In the magazine, recommended fire-retardant paint scheme is to be applied. Details of the magazine are given in Section X Article 1013.

321. **Small Arms Stowage.** Small arms locker equipped with suitable stowing facility with accessories and ammunitions are to be made as convenient.

322. **Primary Surface Preparation and Shop Priming.** Steel/Aluminum plates and sections are to be cleaned and cleared of mill scale by blast cleaning and coated with a primer prior to fabrication. The shop primer shall not be harmful to the welding work and will be compatible to the subsequent coatings.

323. **Painting.**

- a. Epoxy coating of International Paint/SIGMA/JOTUN should be applied in the underwater area. Suitable Epoxy/Conventional paint is to be used in other areas as acceptable to BN.
- b. The paint scheme and dry film thickness should be as per the recommendation of the paint manufacturer for new building ship.
- c. Detail paint schedule for different areas of the LPC is to be submitted with the tender quotation.
- d. Fuel oil and fresh water tanks are to be painted with appropriate epoxy paint scheme.
- e. Bilges areas are to be painted with approved paint skim of BN.
- f. Non-skid paint is to be applied at weather decks (walkway).
- g. Magazine may be painted internally with non-inflammable paint approved by the internationally recognized classification society.
- h. Colour of external and internal painting of the ship's hull and structure will be decided by BN.

324. **Cathodic Protection.** Appropriate Cathodic protection (ICCP) to protect the underwater hull and fittings is to be provided (Both western and manufactured).

325. **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.** Details of the insulation for deck/wall, beam/girder/stiffener, external deck's bulkheads, galley, ceiling and bulkheads (in bridge, Ops room, wardroom, accommodations, messes, bathrooms and magazine) are to be mentioned. Machinery spaces are to be insulated above the water line portion only.
- c. **Face Plate / Lining.** The bulkheads and ceilings of bridge, ops room, living spaces, messes, offices and lavatories are to be laid with plastic coated marine quality wood/panel boards or appropriate honey comb or other standard material with light decorative colour approved by BN.
- d. **Deck Coverings.**
 - (1) Within galley, wash places, toilets and other wet accommodation spaces, deck coverings are to be of non-slip ceramic tiles laid on cement base.

RESTRICTED

(2) In other accommodation spaces, offices, lobby, etc. deck coverings are to consist of suitable underlay covered with Polyurathene/linoleum.

326. **Signature.** All signatures should be minimum. Sharp bended (right angled) superstructure/high temperature object on upper deck should be avoided. The shafting and propellers are to be designed for low noise. All heavy vibrating machinery should be mounted on special noise absorbing mounts.

327. **Hull Designation and Markings.**

a. **Location and Access Closure Marking.** All compartment, doors, hatches, manholes and scuttles are to be marked/numbered and colour coded in accordance with 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, both sides of the quarter deck and at the stern.

c. **Ship's Number and Distinguishing Marks.** The ship's number and distinguishing marks are to be provided. Name box in Bangla and English are also to be provided.

d. **Builder's Data Plaque.** Two in number bronze/copper plaque in English and Bangla cast or engraved are to be supplied.

e. **Bench Marks.** 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 markings (both water tight and gas tight risks) or compartments, doors, hatches etc. are to be as per British Navy's BR 2170 (RN) system as practiced in BN.

g. **Warning, Operating and Instruction Plates.** In addition to plate required for particular applicable specifications, warning (such as various safety warnings), operating and instruction plates etc. are to be installed as required. Self illuminating "Exit" markings are to be provided inside all compartments/machinery spaces. Various display and information boards are to be provided in lobby and different working areas as required.

h. **Frame Marking.** Frame marking are to be carried out on upper deck (Port & Stbd) engraved and welded with brass plate.

SECTION - IV

DECK AUXILIARY AND ACCOMMODATION OUTFIT

401. **General.** This section describes the general specification and requirement for deck fittings, deck auxiliary, deck machinery, safety appliances, firefighting and damage control, NBC protection, accommodation outfit etc.

402. **Watertight Doors.**

a. Watertight steel doors secured with wedge clips and handle for working them on both sides of the bulkhead are to be fitted to all external accesses.

b. The doors are to be provided with seals, gaskets and clamping devices of type approved by the classification society, permanently attached to the bulkhead or to the doors and the doors are to be so arranged that those can be operated from both the sides of the bulkheads.

c. Hooks clips or catchers are to be fitted for fixing the door when open. The steel hinges are to have naval brass pins and are to be equipped with a grease nipple for lubrication.

d. Doors of store rooms and similar compartments are to have their hinges with hinge pins clenched.

e. Padlocks are to be provided where necessary.

f. Clear height of doors from deck covering, numbers of clips, depth of seals in different doors etc. are to be in accordance with class requirement.

403. **Miscellaneous Non-Watertight Doors.**

a. Access to all offices and accommodations etc. are to be hinged by non-structural doors.

b. The doors are generally arranged to open into the spaces they serve. Ventilation louvers are to be fitted in doors of all toilets.

c. Ventilator openings on the lower half of the doors as per standard practice are to be provided.

d. Joiner doors are to be without coaming except where the doors are located in structural bulkheads or in bulkheads bounding wet spaces.

e. Door closure and other fittings are to be fitted only on joiner doors to all air conditioned spaces only.

404. **Hatches.**

a. All hatches are to be watertight with coamings and covers where necessary. They are to be stiffened to withstand the test pressure of the compartment to which they are fitted.

RESTRICTED

- b. Hatches are to be fitted complete with clips, wedges, hinges, guards, chains and all other fittings as required.
- c. Hatches to store rooms and other spaces which are not normally occupied are to be fitted with butterfly nuts and hinged clips.
- d. Hatches required for escape purposes are to be fitted with wedges and clips worked by handles both above and below the hatch.

405. **Manholes and Covers.**

- a. Manholes and covers of steel are to be fitted to give access tanks, watertight compartments and similar inaccessible spaces. They are to have water tight or oil-tight covers as necessary with test plugs.
- b. The manhole covers are to be secured with gaskets and stainless steel bolts and nuts as necessary.
- c. Label plates are to be fixed to covers giving the name of the compartments to which they give access.

406. **Windows.**

- a. All windows are to be made of aluminum alloy anodized frame with heat treated safety glass. These may be of fixed type or opening hinged type.
- b. Three sets of clear view screen are to be fitted with the front window of bridge.
- c. Wiper and fresh water spray (pipe connected to domestic fresh water line) is to be provided over bridge front window for washing the window.

407. **Side Scuttles and Portholes.**

- a. All side scuttles are to have brass frame and steel hinged dead light cover.
- b. All operable type portholes are to be made of hard glass in brass frames.
- c. Water collector is to be fitted with each porthole.

408. **Plan for Doors, Windows and Openings.** A plan for doors, windows, port-lights, deck openings, etc in details is to be submitted with the quotation.

409. **Ladders.**

- a. Suitable inclined ladders and vertical ladders are to be installed as required.
- b. All footsteps of inclined ladders should be of rectangular flat shape with non-skid rubber for slip resistance.

RESTRICTED

c. Accommodation and deck houses are to be provided with climbing steps and hand grip.

d. Two sets of portable pilot rope ladders are to be provided and arranged adjacent to lifeboat and RIB with fittings and securing arrangement of the deck.

410. **Bulwark, Rails and Stanchions.** Bulwark shall be installed around the main deck. The material of Bulwark shall be steel at the forward portion of the ship and aluminium at the other portions. Steel or aluminum hand rails, storm rails and stanchions will be provided around the open decks and the superstructure where necessary. Details of height, width and thickness of the bulwark to be mentioned with the quotation.

411. **Floor Plates and Gratings.** In machinery spaces and stores, non-skid aluminum floor plates are to be provided. Gratings are to be installed for easy maintenance.

412. **Mast.** A fabricated steel/aluminium mast strong enough to carry fire control, search and navigational radar 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.

413. **Jack Staff and Ensign Staff.** Collapsible jack staff and ensign staff of steel pipe 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.

414. **Navigation Light Boxes.** Two steel/aluminium sidelights' boxes welded on the bridge wing are to be provided for housing port and stbd navigation lights.

415. **Air Inlet Gratings.** The engine room, ventilation air inlet gratings (mist-eliminator type) and outlet gratings are to be installed on the aft bulkhead of engine room.

416. **Air Dust Covers.** Arrangement for closing the inlet and outlet gratings for ventilation of engine room is to be made with watertight steel covers.

417. **Bollards.**

a. Adequate number of double head type bollards are to be fitted on the fore and aft deck on either side. It is to be of welded construction with steel pipe or plate. Number and position of bollards and fairleads are to be made iaw the requirements of BN (considering the tidal range and berthing arrangement of naval berths).

b. All bollards are to be provided with suitably placed fairleads of good quality steel casting.

418. **Fairlead.** Adequate number suitable fairleads are to be provided. The fore and aft fairleads will be suitable for receiving the mooring lines and the towing ropes.

RESTRICTED

419. **Cleats and Eyebolts.** Sufficient number of cleats, eyebolts, ring bolts and other fittings of required capacity necessary for attachment, working, belaying and securing of all parts and appliances are to be fitted in appropriate location.

420. **Towing Bitt.** Suitable towing bitt and bollards are to be fitted on the fore peak and aft deck.

421. **Towing Rope.** Two 'braided' polyamide towing hawser, size 204 mm in dia and 110m in length, is to be provided on a horizontal reel and kept on deck with necessary fittings for towing and being towed facility.

422. **Mooring / Berthing Hawsers.**

- a. 8 x berthing hawser (size 127mm x 80m)
- b. 2 x spring hawser (size 50 mm x 110m)
- c. 8 x heaving lines are to be provided.

423. **Reels.** Appropriate numbers of reels for securing berthing hawsers, towing rope, spring hawser, shore supply electric cables etc. are to be provided.

424. **Riggings.** Sufficient halyards in the main mast have to be catered for hoisting various flags and ensigns (such as naval ensign, signal flags, commissioning pendent, battle ensign, board pendent etc.).

425. **Canvas.**

- a. 2 sets of portable awnings (one for regular use and the other one for ceremony) are to be provided as required for spaces at forward and aft main deck. The same is to be provided on upper deck if design permits.
- b. Equipment, armaments and sensors requiring protection on the weather decks are to be provided with water proof canvas covers.

426. **Shore Gangway/Brow.** One aluminium made shore gangway/brow of suitable size fitted with handrail, stanchions, wheels, lighting arrangements etc. is to be provided. The ladder is to have a shore roller with neoprene tire at the shore and hook at the other end. Gangway position in Forecastle, Mid-ship and Quarterdeck (on both sides) to be considered accordingly while designing bulwark.

427. **Locks, Keys and Tags.** Grandmaster and Master Key section wise for all doors, hatches, stores, lockers, keyboards etc. are to be provided with locking arrangement (padlocks or rim-locks) along with key rings and identification tags etc. Mortise type cylinder locks are to be fitted to joiner doors.

428. **Key Boards.** One in number 'Armament Keyboard' and one in number 'Important Keyboard' are to be fitted in Captain's cabin and Ward room respectively. A 'General Keyboard' will be fitted in the lobby near the wardroom. All key boards will have glass fronts with wire mesh, key hooks and identification tags. Similar smaller key board will be provided in various work spaces as required.

429. **Safety Appliances.** The LPCs are to be provided with standard life saving appliances. Following must be supplied.

a. **Rigid Hull Inflatable Boat(RHIB)/Rigid Inflatable Boat(RIB).** 1 x Rigid Inflatable Boat (RIB)/Rigid Hull Inflatable Boat (RHIB) as ship's boat for 6 persons with outboard patrol engine to attain speed about 25 knots is to be provided on the main deck. The boat together with appropriate deck crane for hoisting/lowering arrangement is to be supplied. Details about the boat is to be mentioned. BN Standardization for ships boat need to be followed as per following criteria:

(1)	Length	: 6.5 meter
(2)	Breadth	: 2.5 - 2. 8 meter
(3)	Quantity of Engine	: 02
(4)	Engine Power (Per Engine) (HP)	: 80-90
(5)	Engine Brand	: YAMAHA/ EVINRUDE

b. **Life Rafts.** 4 x 25 men capacity inflatable life rafts with cradle and accessories are to be provided.

c. **Life Saving Equipment.** Sufficient numbers of life buoys, life jackets, survival-suits, signal and first aid kit etc. are to be provided as per GMDSS standard.

430. **Fire Fighting.**

a. **Fixed Fire Fighting System for Engine rooms.** The engine rooms will be provided with a fixed firefighting system which can be operated from the engine room entrances. Number of bottles and their capacity are to be specified.

b. **Fire Main System.** A pressurized sea water fire main system with sufficient number of fire hydrants is to be laid in the LPC with two dedicated robust fire pumps (to use alternately) attached with hydrants throughout the ship. The fire main pressure, actual number and location of fire hydrants are to be specified.

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.

e. **Breathing Apparatus.** 10 x breathing apparatus (BA) with spare bottle and extension harness are to be supplied.

f. **Fearnought Suit.** 5 x Fearnought suits for firefighters are to be supplied.

RESTRICTED

- g. **Portable Firefighting Pump.** Two portable diesel fire fighting pump of 30-40 tons/hour capacity with accessories is to be supplied (Brand and type to be mentioned).
- h. **Foam Making Branch Pipe and Foam Gun.** Four in number portable foam guns, foam making apparatus and foam tanks with accessories are to be supplied.
- i. **Flooding and Sprinkler System.** Flooding and sprinkler system is to be provided for each magazine/ammunition store.
431. **Fire & Smoke Detector.** One suitable fire and smoke detection system will be fitted. All working, accommodation and machinery compartments should have sensors. The monitor of the system will be located at bridge/any suitable place.
432. **Damage Control Equipment.** Following damage control equipment are to be supplied:
- a. 2 x electrically driven (as per generator's output voltage and frequency) submersible pumps of 25-30 tons capacity with accessories.
 - b. 2 sets of damage control equipment, tools and materials.
 - c. 6 x portable emergency lamps(Re-chargeable).
433. **Diving Equipment Room.** The air conditioned diving equipment room will be located in the main hull of the LPC. Eight in number diving sets with necessary gears and a portable electric air compressor (Western Origin and Manufactured) suitable to supply diving air will be arranged in the room. The diving equipment room will have provision for charging the diving sets with safe compressed air supplied from the compressor.
434. **Flag and Navigation Shape Locker.** Two in number flag lockers with 70 pigeon holes and one in number Navigation Shape locker of suitable size are to be fabricated and fitted on the upper deck near to the mast.
435. **Miscellaneous.** Following items are to be supplied:
- a. Two in number aluminum three tier steps is to be provided for using at the end of gangway ladder during high/low water when the ship is alongside jetty.
 - b. At least 2 wooden plungers and one Boson's chair for painting the shipside and the mast.
 - c. Ropes for halyard, heaving line, boat fall etc. of various sizes and length.
 - d. Two in number boat hooks (with securing arrangement at main deck).
 - e. Watch and station bill board in the lobby.

RESTRICTED

- f. Deck tackles (with arrangements) for hoisting anchors manually.
- g. One in number bottom chain.
- h. Emergency cutting gears (such as axe in forecastle and after deck).
- i. One digital camera with optical zooming facility.
- j. One in number gunmetal ship's bell.
- k. One break water arrangement at Fox'l of the ship.

436. **Deck Machinery.** Deck machinery is to be classed by the internationally recognized classification society with certificates issued.

437. **Steering Gears.**

a. One electro-hydraulic steering gear system of appropriate capacity and design according to internationally recognized classification society's requirement for double plated twin rudders is to be installed in the steering gear room. Primary steering is to be from bridge with secondary steering position located in the steering gear room. The steering system is to be operated with ship's main power supply. The specification of the steering system is to be stated in details.

b. Appropriate steering wheel, a joystick for electrical operation and an auto pilot should be situated on (preferably at the ship's center line) in the bridge.

c. Rudder angle indicators are to be installed in the Bridge, MCR and Steering Gear room.

d. **Emergency Steering Gear.** Necessary arrangements with hand pump are to be fitted for emergency steering in case of system failure.

438. **Anchor and Chain Cable.** Two in number stockless anchors of adequate size with necessary chain cables and other accessories including chain compressor and strong back are to be provided. The anchors and cables installation must meet the class requirement. Details about the anchors and chain cables (including length) are to be provided.

439. **Capstan.** Two in number electrical and manual operated duplex vertical capstan of adequate capacity are to be installed on the forecastle deck for handling chain cables/mooring ropes. The capstans are to be operated with ship's main power supply. Detail of capstans (including power output) are to be provided.

440. **RAS Gears.** The LPCs should have facility and posts for underway RAS. Standard RAS gears (with accessories) are to be provided. Details to be mentioned with the quotation.

SECTION - VENGINEERING MACHINERY, EQUIPMENT AND SYSTEMS

501. **General.** Propulsion and auxiliary machinery will be supplied by the bidder as part of package material for the LPC. However, the machinery should meet certain requirements as described below.

502. **Propulsion System.** The propulsion system should consist of the following:

a. Preferably Two in number marine diesel engines (driving two propellers) capable of developing sufficient total power required to attain the maximum continuous ship's speed of at least 27 knots (Number of engines with propellers to be mentioned with the quotation).

b. Each engine will be connected with Controllable Pitch Propeller (CPP) to one reduction gear box. Gearbox should preferably have trailing capability for unlimited period. If required extra trailing pump/cooling arrangement is to be provided.

c. The propulsion control system should be able to provide centralized monitoring and control from Bridge and MCR. Local Control and Monitoring Panel is to be available in engine room. Provision should be kept to operate and engage engines with gearbox locally in the engine room.

d. 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.

503. **Technical Specification of Engine.** The engine should meet following technical specification:

a.	Model / Type	:	To be mentioned.
b.	Make	:	MTU/PIELSTICK/CATERPILLAR/MAN
c.	Country of Origin	:	UK/Germany/France/USA
d.	Country of Manufacture	:	UK/Germany/France/USA
e.	Year of Manufacture	:	2019 or later.
f.	Cycle	:	4 Stroke.
g.	Aspiration	:	Turbo charged and after cooled.
h.	Fuel Injection	:	Direct fuel injection.
i.	Cooling	:	Freshwater cooling. Freshwater being cooled by seawater through tubular type heat exchanger
j.	Numbers of Cylinder and Arrangement	:	To be specified.
k.	Bore and Stroke	:	To be specified.
l.	rpm	:	To be specified.
m.	Maximum Continuous Power	:	To be specified for each engine, at 45°C air and 32°C seawater temperature.

RESTRICTED

n.	Maximum power output	:	To be specified.
p.	Brake Mean Effective Pressure (BMEP)	:	To be specified.
q.	Idling rpm	:	To be specified.
r.	Time between Top Overhaul	:	10,000 hours.
s.	Time between Major Overhaul	:	20,000 hours.
t.	Fuel oil to be used	:	HSD or NATO F-76/Dieso F-76 fuel (To be mentioned).
u.	Lub oil to be used	:	Grade SAE 40 or equivalent to be used, which must be available in Bangladesh local market (To be mentioned).
v.	Dry and Wet weight in kg	:	To be mentioned.
w.	Dimension	:	To be mentioned.

504. **Ambient Condition.**

- a. Air intake temperature : + 45⁰ C (Max).
- b. Sea water temperature : + 32⁰ C (Max).
- c. Humidity : Up to 98%.
- d. Highly mud (suspended) content in sea water in coastal area.

505. **Design and Record of Sales.**

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

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

- a. All engines/accessories should be facilitated for easy removal and re-installation.
- b. The layout of all machinery and system should 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.

507. **Automatic Protection Devices.** The machinery should have following protection devices:

- a. All main engines, prime movers and other machinery 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 slow down to safe limit or shutdown is to be arranged for low lub oil pressure and high fresh water temperature.
- 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.

508. **Machinery Control, Monitoring and Alarm System.** Details of machinery control, monitoring and alarm system are given below:

a. **Machinery 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 by means of a single lever. 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 control of engines is to be provided in the MCR, Bridge and on the engines (Locally).
- (5) Control of the generators is to be provided from the switchboard located in MCR.
- (6) Starting and stopping of each generator is to be provided from a panel mounted adjacent to each set. An emergency stop control for each generator set is to be provided in MCR.
- (7) The mechanical local control system is to be independent of remote control system.

RESTRICTED

(8) A machinery control console is to be provided in the MCR from which each set of propulsion machinery and selected auxiliary machinery can be controlled and monitored.

b. **Monitoring and Alarm System.** The monitoring and alarm system should 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 should be presented by audible and visual signal with a test and acceptance push-button. Following safety devices are to be provided:

- (1) Low lub oil pressure alarm (audio and visual) and auto shut down.
- (2) High cooling water temperature alarm (audio and visual).
- (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) Manual emergency shut off device.

509. **Classification.** Type approval certificate of internationally recognized classification society (Lloyds/DNV-GL/BV) for the engines, gearboxes and auxiliaries are to be provided.

510. **Engine Load Test.**

a. Engine load tests up to maximum permissible limit and time are to be carried out in the factory premises as per requirement of the classification society.

b. All documents related to engine load test are to be provided.

511. **Specific Fuel Consumption (sfc).** Specific fuel consumption curve of engines are to be provided. Specific fuel consumption at following ratings are to be specified:

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

512. **Fuel System.** HSD or NATO F-76/Dieso F-76 fuel is to be used (To be mentioned). The proposed fuel system should include the following:

- a. Engine driven fuel delivery pump with motor driven fuel priming pump.
- b. Fuel pre-filter and fuel duplex filter with changeover valve.
- c. Individual cylinder fuel injection pumps/Unit injector with emergency shutdown device with the engine and at the remote control panel.
- d. Engine governor (Electronic).
- e. Fuel flow meter.
- f. Fuel oil pressure and temperature gauge.
- g. Fuel drain tank.

513. **Lubricating Oil System.** Proposed propulsion engines and gearboxes are to use same type of lubricating oil (SAE 40/equivalent). The lub oil system for diesel engines and reduction gears are to be arranged in accordance with the requirement of manufacturer. Lubrication system should be of dry sump type specified by the bidder. However, the lubricating oil system should include the following:

- a. Engine driven lubricating oil circulation pump with safety device to shut off the engine automatically in case of lubricating oil pump failure of main engine
- b. Lubricating oil cooler, with lubricating oil and coolant inlet and outlet temperature gauges. Type of cooler is to be specified. Tubular type cooler will be preferred.
- c. Motor driven lubricating oil priming pump and emergency hand priming pump.
- d. Lub oil scavenging pump.
- e. Lubricating oil duplex filter with changeover valves.
- f. One in number lub oil transfer pump of adequate capacity is to be incorporated in the system (**Capacity to be mentioned**).
- g. Crankcase vent (breather).

514. **Cooling Water System.** Engine internal cooling is to be done by fresh water with coolant additives (anti corrosive chemicals). Cooling of this fresh water is to be done by sea water through heat exchangers. Sea water temperature is from 5°C to 32°C. Sea water is muddy in the harbour where the ship is usually berthed and also in the area where the ship usually operates. The cooling water system should include the following:

- a. Self-priming engine driven seawater and fresh water circulation pumps with discharge pressure gauges.

RESTRICTED

b. Fresh water cooler with seawater and fresh water inlet and outlet temperature gauges and coolant thermostat. Type of cooler is to be specified. Tubular type cooler will be preferable.

c. Fresh water expansion tank with vent pipe.

515. **Starting System.** Main engines should be started by battery/Compressed Air. Required number of starting air compressor with appropriate capacity is to be provided or else compressed air for starting engines may be taken from ships compressed air system (In case of compressed air starting system). Otherwise latest starting motor and maintenance free battery may be used in the Engine Starting System (In case of starting system by battery). **(Details to be mentioned).**

516. **Shutdown System.** Engine shutdown system may include the following:

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.

517. **Combustion Air System.** Following may be included with the combustion air system:

a. Turbocharger.

b. Air after cooler.

c. Set of air intake adapters and filters.

518. **Exhaust System.** Among other, the system should have the following:

a. Provisions for monitoring exhaust temperature of combined cylinders/individual cylinder and supply of temperature gauge for turbo-charger.

b. Expansion bellows between turbo-charger and main exhaust pipe.

c. Exhaust silencers.

d. Exhaust flaps.

519. **Mountings.** Following should be supplied with each main engine:

a. Required number of shock mountings (Naval standard)

b. Vibration mountings as required (Naval standard).

c. Combined bed plate to match with engine seating.

d. Lifting eyes.

520. **Torsional Vibration Damper.** The engines are to be fitted with torsional vibration damper.

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

- a. Heat resistant torsionally resilient coupling approved by the Classification Society (Lloyds/DNV-GL/BV).
- b. Coupling is to be integrated and aligned with engine and gearbox with necessary connecting hardware.

522. **Gear Box.** Details of gearbox are as follows:

- a. One/two main engines (preferably one) is to drive one propeller shaft via a reduction gearbox of western origin and manufactured. Gearbox and propeller shafts are to be mounted 'in-line'. The gearbox will be flanged to the engine and will take the axial thrust.
- b. The details of gearbox with reduction ratio are to be specified.
- c. The gearboxes are to have a provision for unlimited trailing operation. If required separate trailing pumps are to be added.
- d. **Clutch Control.** Each clutch is to be operated remotely and emergency clutch control mechanism should also be provided on the gear box.
- e. **Mounting of Gearbox.** Mounting for the gearbox housing is to be of rigid mounting type.
- f. **Oil Filter.** Duplex type oil filters are to be mounted on the gearbox.
- g. **Oil Pressure Gauges.** The gear box is to be fitted with oil pressure gauges as required for local and monitoring of the clutch oil and lubricating oil system.
- h. **Lub Oil Cooler.** Tubular type lub oil cooler is to be mounted on or near a gearbox. Sea water to gearbox is to be supplied from separate sea water pump with emergency cooling from fire-main.
- i. **Temperature Gauges.** Temperature gauges are to be provided for oil temperatures and sea water inlet outlet temperatures of the cooler.
- j. **Monitoring.** Following monitoring systems are to be provided:
 - (1) Lub oil pressure -local and remote.
 - (2) Lub oil temperature-local and remote.
 - (3) Clutch engage/disengage status - local and remote.
 - (4) Bearing temperature -local (preferred).

523. **Propeller.**

- a. CPP made of Nickel-Aluminium-Bronze alloy or any other suitable material is to be fitted for the nominal marine diesel engine torque. The propellers are to be class approved by the internationally recognized classification society.
- b. The detailed technical information including weight, diameter, pitch, BAR, Numbers of blades, material etc are to be included in the offer.

524. **Technical Particulars of Shafting.** Technical particulars of shafting are to be as follows:

- a. **Propeller Shaft.** Propeller shafts are to be made as per latest technology and should be made of high quality stainless steel in accordance with the requirements of the internationally recognized classification society. The propeller will have sufficient strength to transmit power of the engines during ship's entire life.
- b. **Stern Tube and Brackets.** Each stern tube is to be made of a thick walled steel pipe which should be welded to the hull and would be supported aft by V- configuration brackets. The stern tube is to be sea water cooled and provided with rubber sealing glands fore and aft.
- c. **Propeller Shaft Sealing.** The stern tube is to be sealed fore and aft by grease lubricated radial seal rings as necessary by class rules. Type/model of packing is to be mentioned.
- d. **Stern Tube Lubrication.** The stern tube is to be lubricated by seawater.
- e. **Shaft Brake and Locking Gear.** Each propeller shaft is to be provided with necessary brake and locking gears. These should be sufficient to stop the shaft when the other shaft is running at normal speed.
- f. **Turning Device.** Appropriate motor driven turning device with built in reduction gear is to be installed to turn propeller shaft.
- g. **Plummer Block and Watertight Bulkhead Gland.** Plummer block and water tight bulkhead gland is to be installed as per the relevant rules of classification.

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

526. **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.

RESTRICTED

527. **Instruments to be Mounted on Main Engines.** Sensors and displays with alarm system for sea water, fresh water, lub oil systems to be incorporated (Details to be mentioned).

528. **Remote Control from MCR.** Each local control desk is to be equipped at least with the following:

- a. Telegraph transmitters for both main engines.
- b. Engine speed control throttles/levers or switches.
- c. Engine rpm indicators (independent and direct reading).
- d. Engine stop switches.
- e. Engine fresh water temperature gauge (independent and direct reading).
- f. Engine lub oil pressure gauge (independent and direct reading).
- g. Engine lub oil temperature gauge (independent and direct reading)
- h. Gearbox lub oil pressure gauge.
- i. Engine exhaust temperature (combined) gauge.
- j. Control levers/ switches for ahead/astern/neutral position of both gearboxes.
- k. Changeover switches to shift throttle control from engine local control to MCR vice versa and from MCR to wheel house 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.

529. **Remote Control from Bridge.** Control desk for both engines and gearboxes is to be positioned in the wheel house of the ship. The control desk is to be equipped with the following instruments:

- a. Engine speed control throttles/levers.
- b. Main engine rpm indicators.
- c. Shaft rpm indicators.

RESTRICTED

- d. Gear box control levers for ahead, astern and neutral position for both gearboxes.
- e. Engine telegraphs' transmitters.
- f. Engine stop switches.
- g. Alarm (visual and audio) and emergency shut down in case of:
 - (1) Engine over speed.
 - (2) Low engine lubricating oil pressure.
 - (3) Low gearbox lubricating oil pressure.
 - (4) High engine coolant temperature (only alarm).

530. **Ship's Compressed Air System.** A suitable compressed air system (from air compressor used for starting engines) is to be provided to supply compressed air for ship's services. Necessary reducing valves are to be arranged as necessary.

531. **Generating Plant, Diesel Engines for Generators.** 3 x Diesel Generator with 2 DG should be capable to take the full load (operational and combat) with 25% surplus power are to be fitted onboard each LPC. Each marine diesel generator should be capable of meeting the electrical load requirement at normal operating condition. The prime mover engines are to be as per the specification given at later part.

532. **Fresh 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. Fresh water supply is to be given to galley, sanitary spaces, dining space and engine room.

b. **Fresh Water Generating System.** A freshwater generating system (Reverse Osmosis) is to be provided onboard for generating fresh water from the sea water. The capacity should commensurate with the ship's complement and space available onboard. The system should be independent of the propulsion system of the ship.

533. **Firemain System (Ship's Main Sea Water System).**

a. The fire main system will be of 'dry type'. Fire main system is to be fitted with a single main line served by 2 x 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.

RESTRICTED

b. The fire main system should always maintain at least 7 bar pressure to provide seawater for the following systems/points:

- (1) Fire hydrants.
- (2) Sprinkler system for ammunition store/magazine.
- (3) Emergency cooling system of required machinery.

534. **Domestic Sea water Hydrophore System.** Sea water is to be supplied to the lavatories, bath room, galley and engine room through a sea water hydrophore consisting of pressure tank of required capacity and 2 X electrical centrifugal pumps. The specification of the seawater pumps and hydrophore tank are to be same as fresh water pump and hydrophore tank except that the hydrophore tank is to be off corrosion resistant material. The origin and manufacturer should be western. Details capacity, type to be mentioned.

535. **Sewage System.** Sewage Treatment Plant is to be provided. Details of the system are to be mentioned.

536. **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 should 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'l deck for fire fighting/ deck wash purpose. The bilge suction should be fitted with galvanized suction strainer. Same pumps will be used to maintain pressure in the fire main line.

537. **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 Main Engines, one for 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.

538. **Fuel Oil Tank and System.** The fuel tank capacity should be such that the desired endurance of at least 2500 nautical miles at economical speed can be achieved at the consumption of total fuel oil capacity. 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 pump to transfer fuel oil between the tanks with alternative manual transfer facility. (Details to be mentioned during submission of quotation).
- b. Required number of strainer 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 mentioned.
 - (2) Type : Gear.
 - (3) Capacity : 20 m³/h.
 - (4) Pressure head : 3 bar or more.
 - (5) Drive : Electric motor
- f. Separate storage facility for gasoline (petrol) for ship's boat (approximately 120 liters).

539. **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. One in number lub oil transfer pump of adequate capacity is to be incorporated in the system.

540. **Air Conditioning and Ventilation.** The Air Conditioning system should be of "All air system". i.e cooled air will be circulated through AHU by ducting and louver. Arrangement of ventilation and air conditioning system will be as follows:

a. **Air Conditioning Plant.** 02 x western origin and manufactured marine type central air conditioning plant with 02 x compressor in each plant are to be installed onboard the LPC with air handling unit and ducting to provide conditioned air for operational and living spaces including accommodation spaces, closed bridge, machinery control room, office spaces, magazine and diving store etc. The compressors should be reciprocating or screw type 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:

- (1) **Environmental Conditions.**
 - (a) Dry bulb temperature : 35-42⁰ C.
 - (b) Relative Humidity : Up to 98%.

(2) **Desired Conditions.**

- (a) Dry bulb temperature : 18⁰ C to 23⁰ C.
- (b) Relative Humidity : 50%.

(3) **Details.** 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.

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 bidder 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.

541. **Refrigerating Plant.**

a. The refrigerating plant should have sufficient capacity to refrigerate fresh provision of at least 15 days. 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.

b. Detailed specification of the refrigerating plant is to be submitted within the quotation.

542. **Piping.** Piping of various systems should 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.

RESTRICTED

- e. Gauges and thermometers are to be installed in such a manner that their removal should 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 should be provided from leaks or dripping through the piping for any damage.
- g. Unless absolutely necessary, flanges or screwed joints are not be located over electrical equipment.
- h. Where piping are 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.
- i. Where piping or its components penetrate watertight or oil-tight structure, suitable bulkhead pieces are to be arranged.
- j. All gaskets are to be of such material that resists attack by the fluid carried in the pipe line, they are to be strong enough to hold the pressure and perform purpose intended.
- k. Pipes are to be marked with colour bands for identification.
- l. Insulation on piping is to be provided where necessary.
- m. 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.
- n. Temporary strainers are to be installed in the lub oil piping for cleaning and flushing the system.
- p. Sharp/right angled bending of pipes are to be avoided.
- q. Materials of different piping system are to be as follows:
 - (1) Fresh water system : Galvanized steel
 - (2) Scupper and drains : Galvanized steel
 - (3) Fire main system : Cu-Ni-Fe pipes
 - (4) Bilge system : Cu-Ni-Fe pipes
 - (5) Domestic sea water system : Cu-Ni-Fe pipes
 - (6) Sprinkler system : Cu-Ni-Fe pipes
 - (7) Fuel oil system : Seamless steel pipe

(8) Lub oil system : Seamless steel pipe

(9) Hydraulic system : Seamless steel pipe

543. **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.

544. **Air and Exhaust Arrangement.**

a. The turbo- chargers 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 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.

545. **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.

546. **Fin Stabilizer.** A fin stabilizing system to reduce the ship's roll sufficiently for the efficient operation of ship's weapon and machinery and crew comfort is to be installed (Detail of the fin stabilizer including manufacturer are to be mentioned).

547. **Protection against Marine Pollution.** The LPCs will have IMO approved means for disposal of garbage, oily water, sewage and other wastes.

RESTRICTED

548. **POL and Chemicals.** Sufficient quantity of the following items is to be provided to run the machinery for test and trial and till handing over to BN:

- 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. Lub oil test kit and chemicals.

549. **Manuals and Drawings.** The following manuals and drawings (3 copies of each in English) may be provided:

- a. Operation and maintenance manuals of main engine, auxiliary machinery and gearbox.
- b. Parts catalogue (with identification diagram) of main engine, auxiliary machinery and gearbox.
- c. Installation drawings and diagrams for main engines and their local and remote controls.
- d. Workshop level repair manual.
- e. Installation drawings and diagrams for gearbox and its controls.
- f. Main engines and gearbox maintenance schedules.

SECTION - VI

ELECTRICAL MACHINERY, EQUIPMENT AND SYSTEMS

601. General.

- a. All electrical systems, equipment, machinery, fittings, fixtures, items, cables, wiring etc shall comply with recognized marine standard.
- b. Electrical equipment shall be tropicalized and shall have Class F insulation unless otherwise stated. The maximum allowable temperature rise on all electrical equipment and wiring are to be based on an ambient temperature of 45°C and humidity of about 95% RH.
- c. Machinery temporarily or permanently exposed to the outside atmosphere or water shall have Ingress Protection Rating IP56.
- d. Electrical equipment shall be designed and located for easy access for repairs and removals. Equipment shall be located so as to minimize damage.
- e. The casings of all electrical machine/equipment are to be properly earthed (grounded) and earthing points are also to be provided for portable electrical equipment as per requirement. All electrical equipment's are to be interference free as per manufacturer's requirement.
- f. All wiring, cables, breakers, distribution panels, machines etc are to be clearly labelled and systematically coded for ease of identification. Recognized warship standard of "Procedure of Identification of Electrical Circuit in Warship" is to be followed.
- g. Necessary documents, drawing, circuit diagram of electrical and Electronic Items including the detailed description of the items are to be provided. Articles 601.f., 603, 604, 721, 1205 and 1206 also refers.
- h. Red, Yellow and Blue colours are to be used to identify 3 phases of cables, busbars, terminals etc of AC circuit.
- j. Red and Black colours are to be used to identify positive and negative polarity of cables, busbars, terminals etc of DC circuit.
- k. All electrical motors of load capacity more than 3kW should be provided with Star-Delta starter.

602. Ship's Main Power System. The main power supply system will be designed and developed as a complete solution for the ship to run at full efficiency both at sea on own power (without conversion) and at harbour on national power supply system 400V, 50Hz, 3 Phase. Accordingly, all electrical machinery necessary to use at harbour should be so designed. In case of precision equipment's sensitive to voltage and frequency change required for harbour use, two sets of converters, one for running at required harbour load (as per load calculation to be submitted by the bidder) and another standby of same capacity, along with other necessary gears will be installed on board. Necessary load calculation and load management information for sea and harbour are to be submitted with the quotation.

603. **Schematic Diagram.** Schematic diagram of electrical distribution system of the ship are desirable with the offer. Detail diagram of the electrical distribution system is to be provided during delivery of ship.

604. **Electrical Load Analysis.** Electrical load analysis is desirable with the quotation showing following:

- a. Maximum operational load (when all system and armament are operating).
- b. Cruising Load.
- c. Load at anchor.
- d. Shore Load

605. **Provision of Power for Future Equipment.** At least 10% of full load capacity of reserve power is to be kept for future machinery/ equipment.

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

- a. Three (03) in number Main Diesel Generators (DG) with Automatic Transfer Switch (ATS) in each DG.
- b. One in number Main Switchboard.
- c. Distribution Panel/Switches with required safety features as required.
- d. Required number of motors, pumps and auxiliary machineries as required following international standard for a warship.
- e. **Conversion Machinery.**
 - (1) Numbers of Transformers (for generating voltage 220 V and 115 V) as required of appropriate capacity (are to be mentioned with capacity during the offer).
 - (2) Rectifiers 110V DC and 24V DC as required for FCS, Guns, Navigational lights, Sensors etc of appropriate capacity.
 - (3) Static frequency converter for control system, fire control system is to be provided. Alternate arrangement is to be there in case of failure of frequency converter. Required number of frequency converter along with paralleling of those is to be mentioned.
- f. **Shore Supply Arrangement.**
 - (1) One in number suitable Shore Supply Connection Box.
 - (2) One in number shore supply cable of 200m, 600/1000V, 3 core, flexible, appropriate ampere ratings and properly insulated.
- g. Ship along sides supply arrangement with breaker (See Article 613).

h. **DC Power Backup.**

(1) One in number Battery Switch board.

(2) **Batteries.**

(a) General Use batteries as required are to be provided (number is to be mentioned).

(b) Battery required for Communication System including emergency as required (number is to be mentioned).

(c) Emergency battery supply for engine control and monitoring, navigational equipment/lights etc. for safety at sea.

(3) Battery capacity is to be calculated so that general use battery need to operate for the services of at least 2 hours continuously. Communication system battery also needs to be designed for 2 hours operation.

(4) Automatic Battery Chargers including portable battery chargers are to be provided (number is to be mentioned).

j. Wall mounted/ceiling mounted fans as required.

k. **General Alarm.** Action (combat), emergency, NBC, general etc.

l. **Internal Communication.**

(1) Internal telephone system covering all machinery control, all cabins, ward room, mess, offices and other places are to be provided.

(2) Internal broadcast system covering all part of the ships.

(3) Internet/LAN facilities covering office spaces, mess deck, ward room, accommodations space etc.

(4) Central TV receiving system covering office spaces, mess deck, ward room, accommodations space etc.

(5) Separate conning system and gun intercom system to be provided.

m. **Alarm System.** Heat, flood, fire, smoke etc detection system with alarm.

n. **Man Overboard Alarm.** At Forecastle and After deck area.

607. **Main Generator Sets.** An electrical power generation system consisting of three identical marine type 400V, 3 Phase, 50Hz, 3 wire generators is to be installed. Two DG should be capable to take the full load (combat) with 10% surplus power. Each generator should be capable of taking maximum cruising load of the vessel. Generators should be suitable to run continuously in parallel condition with auto load sharing

RESTRICTED

arrangement in case of increase/decrease load to a specified maximum/minimum level. The generators should have all standard safety devices including emergency shut down devices. The requirement of the main generators is outlined below:

a. **Specifications of Main Generating Set.** Each generator set shall be of following specification:

- (1) Make : To be mentioned.
- (2) Type : Marine
- (3) Year of Manufacture : 2019 or later.
- (4) Maximum Continuous Rating : Maximum cruising load by one DG (To be mentioned). Combat load plus 10% reserve by 2 DG.
- (5) Type of Operations Required : Continuous duty (could be for days at a stretch).
- (6) Overload rating : To be specified.
- (7) Minimum allowable continuous load (low load running) : To be specified (25% of Maximum Continuous Rating or less preferable).
- (8) RPM : To be mentioned (preferably not more than 1500 rpm).
- (9) Overall weight and dimension : To be mentioned

(10) **Loading Condition.** The generators will be subjected to sudden high inductive load, like 3 phase induction motors, where starting transient current will be very high (about 05 times of rated current). Under such circumstances, the output voltage should remain sufficiently stable so that the precision electronic equipment of the ship can be operated without any problem. The governor and AVR system must be highly responsive and should meet the following condition.

(a) **Transient Voltage Variation.** The transient voltage variation of the generating sets will be as follows:

RESTRICTED

Ser	Description	Variation/Recovery Time
1	Transient voltage variation, when at any load up to 50% of the rated load at 0.8 lagging power factor, a load equal to 50% rated load at any power factor between zero and 0.4 lagging is suddenly applied/removed.	To be mentioned.
2	Transient voltage variation, when at any load between 25% and 75% of rated load at 0.8 lagging power factor, a load equal to 25% rated load at 0.8 lagging power factor is suddenly applied/removed.	Should be within $\pm 4.5\%$.
3	Transient voltage variation, when 100% of the rated load is suddenly applied/removed.	To be mentioned.
4	<u>Voltage Recovery Time</u> In all the cases mentioned above, the voltage is to be restored to 99% of the rated voltage within 2 seconds of the instant of load change.	

(b) **Transient Frequency Variation.** The transient frequency variation of the generating sets will be as follows:

Ser	Description	Variation/Recovery Time
1	Transient frequency variation for 25% load changes from 0% to 100% (in steps) and also in reverse load changes	$\pm 1.5\%$ Recovery time to be mentioned.
2	Steady state frequency variation from no load to full load (governor droop)	Up to 1% Recovery time to be mentioned.
3	Time of recovery to reach within 0.2% i.e. 99.8% of the rated frequency.	Not more than 2 Sec. Recovery time to be mentioned.

Note: Graphs showing various characteristics and response of transient voltage and frequency variation are to be submitted with the FAT (Article No 1207.b. (1) refers) report.

(11) **Coupling.** The double bearing alternators are to be flanged to the prime mover (engine) via flexible coupling.

(12) **Combined Base Frame.** The diesel engine and the alternator of each generator sets are to be mounted on a combined base frame and rigidly fixed to the generator mounting. Lifting eyes are to be provided for lifting the complete generating set as a whole and also the engine and the alternator separately.

RESTRICTED

(13) **Mounting.** The generators are to be installed with standard shock and anti-vibration mountings along with holding-down bolts.

b. The detailed specifications of the main generators are to be submitted with the offer.

c. **Specification of Prime Mover (Diesel Engine) for Generators.** Marine type with alternate cooling system arrangement.

- (1) Make : MTU/BAUDOUIN/CATERPILLER/
MAN.
- (2) Country of Origin : UK/ Germany/France/USA
- (3) Country of Manufacturer : UK/Germany/France/USA
- (4) Model : To be specified
- (5) Number of stroke : 4
- (6) Number of cylinders and : To be mentioned.
arrangement
- (7) Bore and Stroke : To be mentioned
- (8) Compression ratio : To be mentioned.
- (9) Aspiration : Turbocharged and after cooled.
- (10) Combustion : Direct fuel injection.
- (11) rpm : To be mentioned (Preferably not
more than 1500 rpm).
- (12) Brake Mean Effective : To be specified.
Pressure (BMEP)
- (13) Power : To be mentioned. It should match
the requirement of alternator as
per marine standard to provide
required power at continuous
rating and also at overload rating
at 45⁰C air and 32⁰C sea water
temperature.
- (14) Specific fuel consumption : To be mentioned.
at rated Maximum
Continuous Rating
- (15) Specific lub oil : To be mentioned.
consumption at rated
power
- (16) Combustion air requirement. : To be mentioned.

(17) **Governor.** Load sharing and speed control precision electronic governor of approved type is to be provided. The governor should maintain the rpm in steady state and should response instantaneously to any amount of inductive/resistive load change (from 0 to 100% of rated load).

(18) **Turbocharger.** Make, model may be specified.

(19) **Fuel Oil to be used.** HSD or NATO F-76/Dieso F-76 fuel (To be mentioned).

RESTRICTED

(20) **Lub Oil to be used.** Grade SAE 40 or equivalent to be used, which must be available in Bangladesh local market (To be mentioned).

(21) **Starting System.** Generator is to be started by batteries. Necessary arrangement is to be made in this regard.

(22) **Time Between Overhauls.**

(a) **Major Overhaul.** To be mentioned.

(b) **Top Overhaul.** To be mentioned.

(23) **Accessories.** Standard accessories as required by are to be fitted.

(24) **Engine Control and Monitoring Panel.** The following meters and gauges are desirable in the engine mounted engine control and monitoring panel:

(a) **Meters.**

(i) RPM tachometer.

(ii) Hour counter.

(b) **Gauges.**

(i) Lub oil pressure gauge.

(i) Sea water pressure gauge.

(iii) Fresh water pressure gauge.

(iv) Fuel oil pressure gauge.

(v) Lub oil temperature gauge.

(vi) Fresh water temperature gauge.

(vii) Exhaust temperature gauge (combined).

(viii) Lub oil filter differential pressure gauge.

(ix) Fuel filter differential pressure gauge.

(25) **Safety Devices.** Following safety devices are to be provided in each generator set:

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

(b) High cooling water temperature alarm (audio and visual).

RESTRICTED

- (c) High lub oil temp alarm.
- (d) Low cooling water pressure alarm (audio and visual).
- (e) Engine over speed alarm and auto shut down device/over speed trip gear.
- (f) Manual emergency shut off device.

(26) **Dimension and Weight.** The dimension and weight of the prime mover are to be mentioned.

d. **Specification of Marine Alternators.** Each of the alternators is to be of following specification:

(1) **Type.** Self exciting, self-regulating, revolving field brushless alternator with permanent magnet exciter/auxiliary regulation excitation system (ARE).

(2) **Standard and Classification.** The marine alternators will conform to IEC recommendations and other international standards such as NFC 51-111, UTE 5100, VDE0530, BS 5000, IEC 2.3, NMEA, IEEE, CSA etc as applicable. The radio suppression is to be in accordance with BS 800 or equivalent and surge protection as per IEC standard applicable for sea going ship having high noise and voltage spike source. The marine alternators are to be supplied with certificates issued by internationally recognized classification society standard.

- (3) Name of manufacturer : STAMFORD/LEROY SOMER.
- (4) Country of origin and manufacture : UK/ France.
- (5) Model/type : To be mentioned.
- (6) Number of poles : Four or more.
- (7) Maximum continuous rating : Sufficient to cater for action load plus 10% reserve. When two DG will be running in parallel.
- (8) Power factor : 0.8 lagging.
- (9) Rated Terminal Voltage : Refer to Article 07.02. To be mentioned.
- (10) Frequency : Refer to Article 07.02. To be mentioned.
- (11) No of phases : 3 (three).
- (12) Speed : To be mentioned (Preferably not more than 1500 rpm).
- (13) Rotor : Dynamically balanced after winding as per BS 49999/50 and with surge voltage suppression device wound on field poles.

RESTRICTED

- (14) Stator : Durable winding in star configuration with high grade electrical steel or equivalent.
- (15) Connection : 3 wire, star connection, neutral ungrounded.
- (16) Excitation : Shunt with Permanent Magnet Generator (PMG) excitation system/Auxiliary Regulation Excitation system (ARE).
- (17) Ventilation : Self-ventilated, air cooled, air temperature up to 45°C.
- (18) Insulation : F/H
- (19) Temperature rise : To be mentioned.
- (20) Enclosure : IP 23 or better.
- (21) Number of Bearings : 2 x bearings, re-greaseable type.
- (22) Space heater : To be provided. It is to be interlocked with the generator breakers. The space heater lamps are to be fitted on the switchboard for indication.
- (23) Stator temperature detectors : Shall have embedded temperature sensors in each phase for protection. Temperature readings to be shown on main switchboard.
- (24) Parallel operation : Both auto and manual parallel operation system are to be incorporated. Droop kit (as applicable) for continuous parallel running with all 03 generators is to be provided.

(25) **Auto Voltage Regulator (AVR).** The AVR is to be of electronic type with three phase sensing devices. At least following should be included in the AVR:

- (a) Maker : To be mentioned.
- (b) Model/Type of AVR : To be mentioned.
- (c) Voltage adjustment range : Should be ± 10 % of rated value.
- (d) Sensing input voltage : 3 Phase sensing.
- (e) Steady-state stability : Should be within 0.5% of rms rated value.
- (f) Remote hand voltage trimmer : Voltage trimmer at switchboard to adjust voltage by hand trimmer.

RESTRICTED

- (g) Over excitation protection : To be incorporated. and indication
- (h) Thermal trip protection : To be incorporated. and indication
- (j) Short circuit : As per naval vessel characteristics requirement.
- (k) Over and under voltage : To be incorporated. protection
- (l) Over and under frequency : To be incorporated. protection

- (m) Detail description of the AVR is desirable with the quotation.

(26) **Alternator Warning and Shutdown Indications.** To ensure safety following warning and shutdown devices are desirable in each of the alternator panel of Main Switchboard:

- (a) Overload Indication.
- (b) Short circuit condition.
- (c) Synchronization failure.
- (d) Over / under voltage indication.
- (e) Reverse power indication.
- (f) Under frequency indication.
- (g) Excitation loss.

(27) **Control Panel.** The following components are to be included with the generator mounted control panel:

- (a) Panel lights with ON / OFF switch.
- (b) Over speed protection device.
- (c) Visual / audible alarm device.

e. **Generator Control Panel.** All necessary gauges / meters including kilowatt meters are to be fitted in the control panel.

608. **Main Switchboard.**

a. **Type.** One in number Main Switchboard is to be supplied and installed. The switchboard is to be of marine type, floor mounted. Switchboard and internal components shall be capable of withstanding shipboard vibration without damage or faulty operation. The switchboard is to be built as per internationally recognized classification society marine standard for seagoing ships and a certificate in this regard is to be provided by the manufacturer.

b. **Make.** To be mentioned.

RESTRICTED

- c. **Location.** The main switchboard is preferable in the MCR.
- d. **Dimension.** The dimension of the switchboard is to be such that enough space is made available on all sides of the switchboard for easy maintenance.
- e. **Construction.**
- (1) The switchboard is to be of drip-proof design, closed from back and other sides and should have watertight protection on the top. It shall be of box frame construction and shall have hinged front instrument panels that can be opened without disturbing the meters, pilot lamps etc mounted on them. The dead front type switch board is to be insulated with all necessary devices mounted on it i.e. breakers, switches, instruments, synchronizing devices for paralleling, fuses, bus-bars, terminals, cable glands etc. All devices are to be accessible from the front. Breakers shall be arranged so that they can be easily operated and removed for maintenance. Handrails covered with insulating material are to be provided. All monitors and controls are to be marked with name plates (in English). Switchboard configuration is to be drawn on the front panel of the switchboard for easy understanding by the operators. Rubber mat is to be fitted at the front of the main switchboard.
 - (2) Copper bus bars are to have sufficient current carrying capacity for continuous operation. Provision should be made for withstanding mechanical stress caused by short circuit current. Bus bars shall be made of high quality copper and identified with color (Red, Yellow and Blue). Bus bar supports shall be moisture resistance.
 - (3) The switch board is to be fitted with earthing test facilities.
- f. **Panel Arrangement.**
- (1) The main switchboard will mainly have two sections. The switchboard is to consist of following panels:
 - (a) Two Alternator Panels (port and starboard).
 - (b) One Synchronizing Panel.
 - (c) Generator's Power Feeder Panels (refer to Article 07.02, 07.07 and 07.08).
 - (d) 220 V single phase Feeder Panel.
 - (e) 115 V single phase Feeder Panel.
 - (f) 24V DC Feeder Panel.
 - (g) Missile System Power Supply Feeder Panel.
 - (h) Armament Power Supply Feeder Panel.

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(2) **Alternator Panel.** These panels are to be fitted with the control and monitoring system of the alternators. Each Alternator Panel is to be equipped with the following:

- (a) Main supply breaker (air circuit breaker) of appropriate capacity.
- (b) Ammeter with change over switch (for monitoring all 3 phases).
- (c) Voltmeter with a change over switch (for monitoring all 3 phases and shore voltage).
- (d) Frequency meter.
- (e) rpm meter.
- (f) kW meter.
- (g) Green lamp for main supply breaker 'ON'.
- (h) Space heater Auto ON/OFF switch.
- (i) Orange lamp for space heater 'ON'.
- (j) Hand voltage regulator.
- (k) Hand frequency control.
- (l) Reverse power and over current relay.
- (m) Green lamp for generator running.
- (n) Pilot lamp for each generator.
- (o) Earth/ground detection means
- (p) Power Factor Meter.
- (q) Winding Temperature Indicator.

(3) **Synchronizing Panel.** The synchronizing panel is to be divided into control section and indication section for parallel running. Generator synchronizing control section and indication section are to be equipped with required number of meters, regulators, switch, breakers, indication light, synchronizing devices etc.

(4) **Generator's Power Feeder Panel (refer to Article 07.02).** Each of the alternator control and monitoring sections will have a feeder panel. Each generator's power feeder panel (refer to Article 07.02) is to be equipped at least with the following devices:

- (a) One Insulation resistance meter for each panel with audible alarm.
- (b) Required number of MCCBs.

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(5) **220V Single Phase Feeder Panel.** One in number feeder panel is to be supplied for distribution of 220V single phase AC. 220V feeder panel is to be fed from Generator voltage (refer to Article 07.02)/220V transformer for subsequent distribution to 220V services of the LPC. The 220V feeder panel is to be fitted with the following:

- (a) Ammeter and Voltmeter.
- (b) Transformer 'ON' indication system.
- (c) Insulation resistance meter
- (d) Earth test indication system with audible alarm.
- (e) MCCB for power transformer.
- (f) Required number of feeder breakers of appropriate ratings.

(6) **115 V Single Phase Feeder Panel.** One in number Feeder Panel is to be supplied for distribution of 115V single phase AC supply. The 115V feeder panel is to be fed from Generator voltage (refer to Article 07.02)/115V transformer of appropriate capacity. The feeder panel is to be fitted with the following:

- (a) Ammeter and Voltmeter.
- (b) Transformer 'ON' indication system.
- (c) Insulation resistance meter
- (d) Earth test indication system with audible alarm.
- (e) MCCB for power transformer.
- (f) Required number of feeder breakers of appropriate ratings.

(7) **24V DC Feeder Panel.** One in number Feeder Panel is to be supplied for distribution of 24 V DC. Adequate number of rectifiers Generator voltage (refer to Article 07.02)/24 V DC of appropriate capacity are to be provided. Rectifiers will be fed from the Generator voltage (refer to Article 07.02) power distribution panels. The 24V DC Feeder Panel will be primarily used for supply and distribution of DC power to various services. In absence of primary supply, secondary supply will be provided to important services by automatic changeover switches. These automatic changeover switches are to be installed either on the switchboard or in another suitable location near the switchboard. However, this 24 DC Feeder panel is to have at least the following facilities:

- (a) **Monitors.**
 - (i) Voltmeter and Ammeter.
 - (ii) Rectifier 'ON' indication system.
 - (iii) Battery supply 'ON' indication system.

(b) **Control.**

- (i) Rectifier ON/OFF.
- (ii) Battery supply ON/OFF.
- (iii) Rectifier/Battery power selection control.

(c) **Distribution.**

- (i) MCCB for rectifier.
- (ii) Required number of feeder breakers/fuses for consumer services.

(8) **Feeder Panel for Missile and Armaments Power Supply.** Sufficient numbers of Feeder Panel of required voltage and capacity are to be fitted for distribution for missile and armaments power supply. This Feeder Panel will be fed from generator's feeder panel. Necessary arrangement is to be made as appropriate. This Feeder Panel is to have the following facilities:

(a) **Monitoring.**

- (i) Voltmeter.
- (ii) Ammeter.
- (iii) Rectifier "ON" indication light.

(b) **Control.**

- (i) Rectifier ON / OFF.
- (ii) Rectifier selection control.

(c) **Distribution.** Circuit breaker / switch of required capacity for armament.

g. **Alternator Circuit Breaker.** Alternator shall be protected by circuit breaker of appropriate capacity.

h. **Bus-bar Linking Switch.** A bus-bar linking switch/breaker of appropriate capacity is to be provided for easily connecting or disconnecting the two 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.** Safety devices are to be arranged as under:

(1) **For Alternator Supply Breakers.** Following safety devices may be incorporated with each of the supply breaker:

RESTRICTED

- (a) Trip release with short and long delay, suitably chosen and set.
- (b) Reverse power release.
- (c) Under voltage release.
- (d) Over current release.
- (e) Interrupting capacity against short circuit release.

(2) **Safety Devices in Other Breakers.** Following safety devices are to be provided for all the other breakers:

- (a) Instantaneous trip release on each pole for short circuit protection.
- (b) Delay trip release on each pole for overload protection.

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

m. **Meters.** All meters mounted on the front panel of the main switch board are to be of flush-mounted square marine type with the exception of synchronizing frequency meters, which are of the reed type. The accuracy of the meters is to be within 1.5 percent of full-scale deflection. The indicating ranges of the voltmeter and ammeter are to be of at least 20% and 30% higher than the rated voltage and the rated current respectively. Indicating range of the watt-meter is to have range from 15% reverse power to about 130% of rated wattage. Frequency meter is to have range from 45 to 65 Hz. Rated value is to have red mark on the scale. All meters are to be calibrated before final delivery to BN.

n. **Labeling.** Circuit breakers, control switches, instruments, indicating lights and terminal blocks etc are to be clearly labeled to identify their purpose and function. Labels for fuses should in addition indicate the rating of the fuses. Feeder nameplate shall indicate the feeder designation, application and rating current. Each circuit on the switchboard shall be distinctly marked with labels.

609. **Power Distribution System.**

a. **Configuration.** The power distribution system is to be of radial configuration with floated neutral, three wire, three phase supply on board the LPC. In general voltage, frequency and phase are to be as follows:

Generator	Refer to Article 602, 607
Main Power System	Refer to Article 602
Lighting system, domestic control system, etc	220 V AC, 1 Ph
Emergency lighting	24 V DC

RESTRICTED

Pumps, Capstan, Steering system and other Motors	Generator Voltage/Refer to Article 06.02, 06.07
Navigation and Communication equipment	115 V AC/220 V AC/24 V DC
Interior communication and instrumentation	115 V AC, 1 Ph/220 V AC, 1 Ph/24 V DC
Missile System and Armament	Refer to Article 602, section IX and section XI

b. **Wiring.** The wiring is to be of three wire insulated system for AC three phase circuit and of 2 wire insulated system for AC single phase circuit and DC circuit.

610. **Distribution Panel / Switch Box.** Required numbers of distribution panels are to be fitted. The following factors are to be considered:

a. Non water tight (IP 23) and wall mounting type for accommodation space.

b. Totally enclosed (IP 44) and wall mounting type for engine room and IP 56 for weather deck spaces.

c. Distribution Panels shall be provided at suitable position to supply power to the various consumers for power, lighting, communication, missile and armament system etc.

d. Distribution Panels should have nameplate at the inner side of the front door representing the name of each circuit.

e. Each distribution panel shall have nameplate on the outer side of the door showing name and identifying number of distribution panels and source of power. Inside the distribution panels, each circuit breaker shall have nameplates showing circuit number, services, circuit breaker frame size and rating.

f. Each distribution panel is to have voltage measuring outlets without opening the cover of the circuit breakers / busbars.

g. In distribution panel, there shall be at least 20% spare MCCB / Fuse for future expansion. However, any distribution panel having MCCBs / Fuses less than 05 shall have at least one spare MCCB / fuse.

611. **Conversion Machinery.**

a. **Transformers.** Required numbers of 400V/115V and 400V/220V transformers, air cooled dry type, class F, of appropriate capacity are to be provided. Maximum ship's load should not exceed 70% of the capacity of the transformer and capacity of transformers is to consider at least 30% growth potential for future expansion.

b. **Rectifiers (24 V DC).** Required numbers of 24 V DC rectifiers of appropriate capacity are to be provided. Maximum ship's load should not exceed 70% of the capacity of the rectifier and capacity of rectifier is to consider at least 30% growth potential for future expansion.

612. **Shore Supply Arrangement.**

a. **Shore Supply Connection Box.** One shore power connection box of 400V, 50 Hz, 3 phase of appropriate capacity is to be fitted at a suitable place to take power from the shore. However, exact capacity to be decided by bidder on calculation of Shore Load for ship. It should be fitted with phase sequence indicator, panel alive indicator lamps, and one circuit breaker with overload and short circuit protection.

b. **Shore Supply Cable.** One flexible shore supply rubber insulated connection cable of 200m length of appropriate capacity wound on aluminium roller is to be provided. The outer end of the cable is to be fitted with lugs to facilitate easy connection of the same with the shore supply feeder point.

613. **Ship's Along Side Feeder Breaker.** A feeder breaker of capacity 150 amps, 400V, 50Hz, 3-phase is to be provided in the shore connection box to supply power to other ship alongside.

614. **Battery Switchboard.** One battery switchboard is to be provided for charging and discharging of battery and for distributing DC sources to navigation lights, general alarm system, fire monitoring system, propulsion control circuits, gyro compass, internal communication, radio equipment etc as emergency supply. In absence of main power supply, emergency supply is to be fed to important services by automatic changeover switches of appropriate capacity. Required number of changeover switches is to be located either in battery switchboard or in suitable location near the battery switchboard. The switchboard is to be of dead front and self-supporting type. The board is to be fitted with the following instrument and devices:

- a. DC voltmeter with a selector switch.
- b. DC ammeter for discharging current.
- c. DC ammeter for charging current.
- d. Source pilot lamp.
- e. Insulation resistance meter with earth indicating lamp.
- f. Change over switch (quick charging or trickle charging).
- g. Necessary number of miniature circuit breakers of fuses.

615. **Cables.**

a. Cables installed throughout the LPC are to be of approved by classification society. It is to be of appropriate grade insulation to meet the voltage to which they are subjected.

RESTRICTED

- b. Cables supplying one or more loads shall have a continuous current capacity as per the standard of Classification Society.
- c. The voltage drop on all power and lighting circuits from main busbars to final point shall be as per the standard of Classification Society.
- d. Cables shall be of fire-retardant type approved by internationally recognized Classification Society.
- e. Shock, vibration, temperature, relative humidity and other conditions of the cables are to be approved by internationally recognized Classification Society.
- f. All cables including power cables shall have outer shielding.
- g. Except power cables up to three cores, all cables shall have 20% spare core. However, for signal cables up to five cores there shall be at least one spare core.
- h. Insulation of cables throughout the vessel shall be as per the standard of internationally recognized classification society.
- j. **Cable Installation.** Cables are to be laid / installed as per internationally recognized classification society requirement.

616. **Motors and Starters.**

- a. **Motors.** Motors are to be of squirrel cage induction type of International Electro-technical Commission (IEC) standard frame designed for as explained in Articles 601 and 602. Motors should be rated for continuous full load duty except motors for steering gear, deck machinery, etc. However following factors are to be considered:
 - (1) **Enclosure.** In general, motors are to be of totally enclosed type. However, motors exposed to the weather are to be of totally enclosed water proof type (IP 55).
 - (2) **Space Heater.** Large motors exposed to the weather deck, steering gear motors and essential motors may have space heaters.
 - (3) **Duty / Name Plates.** Motors are to be fitted with duty nameplates engraved in English with manufacturer's name, serial number, rated kW / kVA, rpm and full load and starting current.
 - (4) **Insulation.** In general, motors shall be treated with insulating varnish to resist oil and water. Generally, motors shall be designed and constructed into insulation class 'H'.
 - (5) The detailed specifications of all motors used for different purposes of the LPC are to be supplied in the offer.

b. **Starters.** Starter for respective equipment/machinery is to be separate and no group starter is acceptable. Starters for non-essential motors of 1 HP and less may be manually operated with MCCBs. In general, starters should be of direct-on-line starting type for small motors (below 3 kW rated). All motors above 3 kW are to be provided with star-delta starting type starter. Circuit diagram of starter is to be engraved inside starter box. Following protections are to be provided in motor starters:

(1) **Under Voltage Feature.** Starters except for non-essential motors of 0.5 kW and less are to be provided with under voltage protection or release feature.

(2) **Over Current Protection.** Over current protection relay of the thermal type is to be provided in each starter. The relay should be of manual reset type with a reset switch operated inside the starter cabinet.

(3) **Indicator.** Power and Running indication light are to be provided on the starter panel.

617 **Lighting.**

a. **General Lighting.**

(1) The lighting is to be divided into the normal 220 V lighting and the 24 V DC emergency lighting.

(2) The LPC is to be illuminated with fluorescent lamps as much as possible. LED lights with guard are to be fitted in machinery spaces as necessary.

(3) Weather deck and area around the bridge are to be illuminated with LED light and floodlights according to the warship standard.

(4) 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, wheel house, engine control room, equipment spaces etc
Explosion-proof type	Magazine room, paint room, battery room, ammunition handling / ready use space etc

(5) Lighting fixtures exposed to mechanical damage are to be protected with guards for incandescent lamp and polycarbonate globe for fluorescent lamp.

(6) Domestic power supply arrangements are to be made available at various places on the exposed decks for using portable lights and electrical equipments.

RESTRICTED

- (7) All lighting fixture are to be of Warship Standard.
- (8) Illumination lights (with circuit) are to be provided for rigging from ship's mast to forepeak and to ensign staff at after deck.
- (9) Decorative lighting circuit (with lights) are to be provided for the gangway brow, bridge and other areas as necessary.

b. **Interior Lights.**

- (1) The interior lighting is to be designed for operation on 220 V. The interior of the vessel is to be adequately lighted with marine type florescent lights.
- (2) Details of the interior lighting, socket outlets etc in the engine room, MCR, steering gear room, cabins, corridors, stores, toilet / shower, mess / galley, bridge, ops room etc are to be specified.
- (3) All chart table lights are to be provided with chart light with long folding arm, red lens and dimmer.
- (4) Ops room and communication room lighting is to have dimmer facility.

c. **Magazine Lighting.** All electrical fittings in the magazine is to be of intrinsically safe type and to be of watertight to protect it from water spray. Special fire proof shielded cables and explosion proof lights and fittings are to be fitted inside the magazine. All cables in magazine must be encased in metal conduit. Switches are to be mounted outside the access to the magazine. Magazine lighting switches are to be painted red.

d. **Exterior Lighting.** Details of all the exterior lights, socket outlets etc in the aft and fore deck and on top of bridge are to be specified.

e. **Emergency Lighting - Automatic Emergency Lanterns.** Sufficient number of automatic emergency lanterns is to be provided in every compartment, passage and internal areas to meet lighting requirement in case of power failure to show passage out to the weather deck. They shall be wired in conjunction with normal lighting supply system for automatic charging with the normal ship's supply and they will automatically switch on when normal supply fails.

f. **Navigation Lights.**

- (1) Electric navigation lights are to be provided as per the international maritime regulation and warship standard. The source for navigation lighting is 24V preferable with battery backup source.
- (2) Other source for navigation lighting is to be mentioned.

RESTRICTED

(3) A control panel for navigation lighting fitted with navigation light 'ON' indications, visual and audible alarms are to be installed in the bridge.

(4) The navigation lights are to be as IMO/warship standard as applicable.

g. **Signal Lights.** Electric signal lights are to be as per international maritime regulation and warship standard and are to be located in the appropriate location in the LPC as per warship standard. All signal lights are to be connected to the signal light control panel installed in the bridge. Required number of signal lights / search light / Morse signal light are to be provided as per IMO / warship standard.

h. **Flood Lights.** The following watertight floodlights are to be provided:

(1) Four portable LED floodlight (each 300W) are to be provided.

(2) Two fixed flood light of appropriate capacity watt for boat area and two appropriate capacity sealed beam type (24 V DC) boat lowering light.

(3) Two in number of appropriate capacity floodlights are to be installed in front of Bridge to illuminate fox'l area and two at the aft side of the ship to illuminate aft area of the ship.

j. **Search Lights.** Two in number 500W LED signal search lights swivel mounting type are to be provided at a suitable location. These should be remotely controlled from bridge.

k. **Portable Lights.** Following lights of 220V AC are to be provided:

(1) 04 x 100W watertight type with 15 m cord and plug.

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

(3) 10 x 60W working light with one side cover, 15m cord and plug.

l. **Spot Lights.** Appropriate number of spotlights with red lens and dimmer are to be provided for spot illumination of ops room equipment, displays, repeaters, Captain's chair at bridge and ops room etc.

m. **Red Lighting.** Red lighting (220V, AC, 20W fluorescent) is to be fitted in the spaces when there is exposure of light to the outside due to movement of personnel onboard LPC. Intensity of the light is to be such that minimum of illumination is to be maintained for the movement of the personnel.

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

to be incorporated in the ship's installation. This facility shall be controlled by a number of darken switch boxes and door limit switches in the suitable positions. A single switch to interrupt supply of all non-essential external lighting in darken ship's state shall be conveniently located on the bridge.

p. **Dressing Light / Illumination Circuit.** Watertight ceremonial dressing lighting circuits of required length are to be provided to illuminate ship's side, super structure and fore to aft over the mast. Required number of watertight power receptacle with switch is to be provided on the main deck and superstructure to provide electric power to the dressing light.

618. **Navigation Auxiliary Equipment.**

a. **Window Wipers.** Required numbers of electrically operated parallel window wipers are to be fitted on the front windows in the Bridge. Arrangement for fresh water supply is to be provided for this purpose.

b. **Clear View Screen.** Two in numbers clear view screen are to be fitted at both sides of front window.

619. **Fans.**

a. Sufficient numbers of swivel type oscillating fans are to be fitted in the bridge, accommodation spaces and other spaces as required.

b. The number and specifications of fans are to be mentioned.

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

Compartments	Power
All equipment compartment, bridge, Ops room, machinery space etc.	115V, 220V AC and 24V DC
All accommodation and recreation space, wardroom, equipment compartment, bridge, galley etc.	Generator Voltage and 220V
At least 03 locations on the main deck for submersible pump.	Generator Voltage/Refer to Article 702
All equipment compartment, bridge, Ops room, machinery space etc.	24 V DC
All equipment related to ASuW weaponry System and Armament supply.	Refer to Article 07.02, section IX and section XI

621. **Ship's Alarm System.**

a. **General Alarm.** General alarm is to be audible in all spaces except tanks. Alarm is to be operated on 24V DC. Following are to be provided:

(1) Three master switch (one in bridge, one in ops room and the one in a suitable position where the gangway will be placed).

RESTRICTED

- (2) Bells and red rotating lamps in engine room / machinery spaces.
- (3) Bells with and without red lamps as required at different places on board LPC.

b. **Action Alarm.** In the broadcast system, provision of an action alarm to be incorporated and its tone is to be sharp to meet the naval requirement.

622 **Fire Detection System.** An effective fire detection system is to be provided in the Magazine, Engine room and other important places of the LPC. Details of the fire detection system are to be given in the offer.

623. **Bonding Strip.** All ladders, stanchion 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.

624. **Miscellaneous Electrical Equipment.** Following equipment's are to be provided:

- a. Two portable transistorized megaphones.
- b. One portable switchboard with fuses and terminals.
- c. Two in number portable blowers.
- d. One DC emergency switchboard.
- e. Ten in number electric irons.
- f. Ten in number iron board / stand.
- g. Four in number Aldis lamp or Portable Signal Lamp.
- h. Smart TV (minimum 40 inch) and Blue-Ray disk player each for CO's and EXO's cabin.
- i. Smart TV (minimum 48 inch), a music system (with speaker and karaoke facilities) and Blue-Ray disk player for Wardroom.
- j. LED TV (minimum 40 inch) and disk player for senior ratings dining space.
- k. LED TV (minimum 48 inch) and disk player for junior ratings dining space.
- l. Any other electrical items considered essential in LPC.

SECTION VII

NAVIGATIONAL EQUIPMENT/AIDS

701. **General.** The Navigation equipment/aids will be required for ship's movement, position and navigational plot. Each LPC is to be provided with the following navigation equipment / aids:

- a. Two Navigation Radar (Western Origin and manufactured).
- b. Two Gyro Compass with Ring laser Gyro (RLG) (Western origin and manufactured).
- c. One Magnetic Compass.
- d. One Echo Sounder (Western origin and manufactured).
- e. One Speed Log (Western origin and manufactured).
- f. Two Navigational Radars (Western origin and manufactured).
- g. One ECDIS along with integrated electronic chart covering Bay of Bengal and adjacent area.
- h. One GPS (Western origin and manufactured).
- j. One AIS (Western origin and manufactured. To be interfaced with navigational radar and GPS).
- k. One Anemometer(Western origin and manufactured).
- l. One Siren.
- m. Six Binoculars and one Night Vision Binocular.
- n. Required number of barometers, barograph, thermometers, Batten burg, Stuart's distance meter, star pamphlets, sextants and equipment for chart work.
- p. One ship's horn with automatic fog signal capability (Western origin and manufactured).

702. **Gyro Compass.** Two in number modern Gyro Compass are to be supplied from an internationally reputed company of (Sperry Marine/SAGEM/GEM Electronica/Arma Brown/ANSYS)(Country of origin and Manufactured :UK/USA/France/Italy/Germany). The proposed gyro (INS/Fiber Optic technology) should provide extremely precise rotational rate information and quick settle time. The gyro platform is to be mechanically aligned accurately to meet manufacturer's installation specification. It is to be interfaced through a Data Distribution Unit (DDU) with navigation RADAR, GPS and other aids as required. The compass is to be supplied with at least following units:

- a. Two Gyro master unit.
- b. 05 x Ship's digital heading marker indicator (CIC, bridge, Steering Gear Room, MCR, Captain Cabin).
- c. 03 x bearing repeaters (with Azimuth Circle) in bridge wings and centre.

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- d. One DDU with two inputs (one input from each gyro). The DDU should have automatic and manual selection facility for selecting inputs. The output of the DDU will go to various units as required.
- e. The gyro shall have the facility to interface with the installed other sensors and weapons on board ship.
- f. There should be adequate number of spare ports in DDU for supply to ship's Weapons/Systems and future development.

703. **Magnetic Compass.** Each LPC is to be fitted with 01 magnetic compass and located on the bridge/bridge top. There should be at least two repeaters at suitable location. A telescope mirror is also to be fitted in the bridge position.

704. **Echo Sounder.** The ship is to be fitted with one proven type Echo sounder consisting of a digital indicator and echo-graphic display. The maximum measuring depth of the echo sounder should be between 05 to 1000 meters. The transducer is to be of hull flush mounting type and is to be installed at an appropriate place at the bottom of the hull. The transmission cable between transmitter/recorder unit and transducer unit is to be installed separately from main cable route to avoid interference caused by pulse energy generated by other systems. Two depth digital repeaters are to be installed in the bridge and ops room/CIC. It should have the facility to interface required.

705. **Speed Log.** Each LPC is to be fitted with one electromagnetic log. The master speed unit is to be installed in the bridge. The log is to be fitted with at least 03 repeaters. It should have the facility to interface with the Radars, Gyro, FCS, ASuW System and as required. Dual axis Doppler Speed log may be installed.

706. **Horns / Sirens.** Each LPC is to be provided with air whistles for navigational purpose to produce a clear, sharp tone of unvarying intensity under all weather conditions regardless of time between blasts as per COLREGs 1972 and appropriate control device for producing desired sound signals to be incorporated.

707. **Navigational Radar.** Two I-band navigational radars are to be installed in Bridge and interfaced with gyrocompass, AIS, GPS, speed log etc. One radar will have two colour tactical displays (one at bridge and the other in CIC/Ops Room) and the other will have single tactical display in the bridge but to be interfaced with the tactical display of other radar at CIC/Ops Room. Navigational Radar should be fully integrated with CMS as secondary fire Control Radar. It should be of IMO or mil std. These Radars should be from an internationally reputed company and latest version of both originated and manufactured from UK/Netherlands/Italy/Japan (Model: Kelvin Hughes/Thales/Leonardo/Furuno).

708. **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 indicator each is to be installed in CIC/Ops room and in the Captain's Cabin. The equipment must be interfaced with the required weapons and sensors on board ship. Country of origin and manufactured from Western country (To be mentioned).

RESTRICTED

709. **Chart Table.** A chart table with dimmable lamp and curtain for chart work is to be fitted in suitable place in the bridge. The chart table should be fitted with drawers to keep the ready use charts.

710. **W-AIS.** One in no W-AIS has to be installed (NEMA standard) in each LPC which need to be interfaced with Ship's Radar.

711. **Helmsman Rest.** One helmsman rest is to be provided for the Steering Console.

712. **Barometer.** Two Aneroid Barometers are to be provided and mounted in the bridge and ops room/CIC.

714. **Barograph.** One barograph is to be provided and fitted in the Captain's Cabin.

715. **Binoculars.** Six in number Prismatic Binoculars with covers and one in number Night Vision Binocular are to be provided.

716. **Chronometer and Watches.** Chronometers and Watches are to be provided in the Bridge.

717. **Anemometer.** Each LPC is to be fitted with an Anemometer, which will indicate the relative wind speed and direction. The wind transmitter will be located on the mast and the remote indicators in the ops room and bridge. It will be interfaced with the FCS

718. **Navigation Lights.** All lights are to be fitted onboard as per relevant International Rules for Preventing Collision at Sea. The lights will include (but not limited to) one must head light, two side lights, one stern light, one towing light, one wake light, two anchor lights, 'Not Under Command' light (fixed or portable), towing light, 'Restricted in Her Ability to Maneuver' light, RAS light etc.

719. **Additional Navigational Equipment/Item.** Following additional navigational equipment/items are to be provided:

- a. 3 x steering repeaters, 2 for bridge (out of which one will desk mount type on bridge console for helmsman) and 1 for steering compartment.
- b. Fog Horn (automatic) - one set.
- c. Ship's Bell - one set.
- d. Deck Watch - one set.
- e. Clinometer - 03 (Bridge, CIC/Ops Room and MCR).
- f. Marine Ship's Clock - 10 in No (position to be mentioned later).
- g. Azimuth Circle - 03 in No (Bridge and both Wings).

RESTRICTED

- h. Dry and Wet Thermometer- Two set.
- i. Max-Min Thermometer - 04 in No.
- j. One rear view camera with monitor at bridge.
- k. One maneuvering board with 1 set miniature ships model.
- l. One Officer of the Watch (OOW) state board.

720. **Standard Meteorological Arrangements.** Standard meteorological equipment (other than already mentioned) and warning system is to be provided.

721. **ECDIS.** One latest version of Electronic Chart Display and Information System (ECDIS) of EU/USA/Canada/Japan origin has to be provided for the LPC.

722. **Electronic Navigational Chart (ENC).** For above mentioned (Art 721) ECDIS one set of ENC of Bay of Bengal (with one year license) is to be provided for each LPC.

723. **Necessary Drawings.** Necessary drawing, Circuit diagram, Fault finding diagram etc. of all Electrical and Electronic equipment are to be provided with the items.

724. **Dimming of Lights.** Various switches, control panels and displays at bridge will have dimming facility for night navigation.

SECTION - VIII

SENSORS AND COMBAT SYSTEM

801. **General.** The all sensors of the LPC should be the latest version of an internationally reputed company from Japan/EU/UK/Canada. Necessary drawing, Circuit diagram, Fault finding diagram etc of all the sensors are to be provided with the items. It should also be interfaced as required. Each LPC will be equipped with following sensors:

- a. Two Navigational Radars as mentioned in Article 707.
- b. Each LPC will be equipped with one radar optronic tracker for the purpose of fire control for 30 mm naval gun. Its maximum anti-surface tracking range will be horizon range and air tracking range will be at least 25 km. It will track sea-skimming anti-surface missile, aircraft in low/ultra-low altitude and surface ship in its effective operation range. The radar features passive tracking capability and high anti-jamming capability, can track target stably and accurately in complicated electronic environment and cooperate with FCU to effectively guide the naval gun to fire.
- c. Each LPC will be equipped with one general-purpose air and surface search radar. Its maximum search range against surface target will be horizon range, its search range against air target tracking will be minimum 100 Km. The radar features high anti-jamming capability and can search medium and low altitude aircraft and surface target. It will be able to perform automatic omni direction extraction of target while transmitting radar video signal and target course to the integrated command and control system of the ship in real time.

802. **Surface and Air Surveillance Radar.** One suitable medium range Surface and Air Surveillance (western origin and manufactured) Radar with ECCM capable and Target Indication Capability. The Radar should have the capability for detection & determination of accurate ranges, bearings and other necessary data of surface targets including low-flying aircrafts; feed data to the FC system for accurate firing solutions. It will also have the capability to maintain 360⁰ search for all targets within line-of-sight distance from the radar antenna. Radar Optronic Surveillance and tracking system to be included and integrated with CMS. Model (Thales/Leonardo/Terna AS/Aselsan AS/ Bofors). Country of origin and Manufactured from France/Netherlands/Italy/Denmark/ Turkey/ Sweden). **Details to be mentioned.**

803. **Combat System.** The Combat System will be composed of required number of multi-operation console for surface and Air surveillance system, integrated command and control system, SSM fire control system, 30 mm naval gun weapon system, communication system, Navigation system, IFF, Data Link and auxiliary equipment of combat system. The combat system will be capable to search, detection, intelligence processing, target designation, target tracking, data calculation and weapon control. The system will be organized with 8 x SSM to attack surface target, control 30 mm naval gun to defense against air/surface target including sea skimming missile. Model: Thales/General Dynamics/Leonardo/Havelsan AS / Aselsan AS), Country of Origin and Manufactured : France/Netherlands/Canada/Italy/Turkey). **Details to be mentioned.**

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804. **Ship's Data System.** Ship's data system will have to be comprised of the following and are to be interfaced with all sensors, weapons and gadgets as required.

- (1) Ring Laser/ Fiber Optic Gyro Compass.
- (2) Speed Log.
- (3) GPS Receiver.
- (4) Metrological Instruments.
- (5) Echo Sounder.
- (6) Anemometer.

805. **FC System and FC Radar.** One suitable Fire Control (FC) system and FC RADAR capable to calculate a complete FC solution and provide necessary FC data to gun for accurate firing. It has to be co-located with Optronic director. The control console (Multi-operational console) will be installed in the Ops Room and will be interfaced with associated sensors/equipment/weapons. The RADAR shall provide information (mainly target azimuth, elevation, range and velocity) to FC system for firing solution. The RADAR should be capable to emit narrow, intense beam of radio waves to ensure accurate tracking information and to minimize the chance of losing track of the target. It should have track-while-scan capability for enabling it to function simultaneously as fire-control radar. Model: Thales/Leonardo/Raytheon/Havelsan/ Aselsan AS/Bofors), Country of Origin and manufactured : France/ Netherlands/ Italy/ USA/ Canada/Turkey). Details to be mentioned.

806. **Meteorological Arrangement.** Standard Meteorological Arrangement-of Western Origin & Manufactured to be installed.

807. **State Boards.** Various state boards, totes, information boards and plot tables are to be arranged in the ops room/CIC to meet BN requirements.

SECTION - IX

COMMUNICATION AND EW EQUIPMENT

901. **External Communication Equipment.** External communication system (Voice, Morse and Radio Teletype) for ship-ship, ship shore and aircraft communication will be enabled by following:

- a. 2 x Tx/Rx HF - 100-150W
- b. 1 x Tx/Rx HF - 400-500W
- c. 2 X Tx/Rx VHF/ UHF - (Narrow Band)
- d. 1 x Tx/Rx VHF/ UHF - (Wide Band)
- e. 1 X Tx/Rx VHF - Air Band
- f. 2 X Tx/Rx Marine VHF
- g. 2 X Data Message Terminal (DMT)
- h. 1 X HF RX
- j. 7 X Tx/Rx VHF Walkie Talkie
- k. 1 X INMARSAT Satellite Telephone
- l. 2 X Modem and PC message terminal to use in MF/HF sets. The PC message terminal shall be matched with BN communication system.

The communication Sets are to be latest version from Japan/EU/UK/USA/Canada/ROK.

902. **Distress and Safety Communication Equipment.** Distress and safety communication system will include following:

- a. 1 X EPIRB
- b. 1 X SART
- c. 2 X SARBE Emergency survival radio (**Latest version**).
- d. 1 X Weather Fax receiver
- e. Any other equipment necessary in accordance with IMO requirements for sea going vessels.

903. **Antenna.** All radio equipment are to be installed with the associated antenna. Appropriate radiation signs and warnings are to be placed or marked near antenna for hazard warning purpose. Antenna location should ensure minimum mutual interference and Electromagnetic compatibility.

904. **Internal Communication System.** Following types of internal communication means are to be provided:

- a. **Auto Telephone System.** One automatic exchange telephone system of 4+24 lines is to be installed which will be operated at ship's 115 V / 220 V and single phase or 24 V DC supply in emergency. Required number of wall or desk mounted type telephones are to be fitted in cabins, important office/maintenance spaces, gangway etc places. A telephone cable of at least 10 pair cores of 100 metres length is to be provided. Provision is to be kept for connecting it to the shore telephone connections.

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b. **Internal Telephone System.** In addition to the auto telephone system, warship standard following intercoms are to be installed. All intercom amplifiers are to be identical so that they are interchangeable. In addition, one spare amplifier is to be provided in the intercom rack.

(1) **Engine Room Intercom.** It will be used to maintain voice communication in noisy places between MCR, Engine Room, Machinery Spaces, Bridge and Emergency Conning Position.

(2) **Combat Intercom.** It will be used to control; gun, weapon, sensor and associated control system from bridge, ops room, gun mountings, etc as required.

(3) **Conning Intercom.** It will be used to maintain communication between bridge, CO's Cabin, MCR and Propulsion machinery compartment.

c. **Voice Pipes.** Internal voice pipes are to be fitted as required.

d. **Internet Connection.** Suitable facilities are to be provided for creating Local Area Network (LAN) inside the ship.

905. **General Broadcast and Entertainment System.** The General Broadcast and Entertainment System of appropriate output power is to be provided for reliable broadcasts of alarms, announcements and entertainment program. The main unit is to consist of number of identical amplifiers as required with one spare amplifier, radio tuner, DVD/VCD/CD/MP3 player including alarm and announcement initiation abilities as well as speakers spread over the LPC. IP based broadcast system with networked components may be installed. The broadcast system is to be divided into several announcement groups. The priority of the broadcast signals will be as follows:

a. Alarm signals shall have the highest priority and are to be broadcasted from all speaker groups.

b. General announcement shall have the next higher priority.

c. Entertainment program shall have the lowest priority.

d. The control panel is to be fitted with microphone and monitor speaker and able to control in following spaces:

(1) Bridge top (watertight horn speaker).

(2) Weather deck (watertight horn speaker).

(3) Cabins and passages (Box speaker).

(4) Engine room and machinery room (horn speaker).

(5) All other compartments/spaces as necessary.

e. All cabins, mess, living spaces, wardroom are to be provided with receptacle for connecting TV and radio with national TV, shore cable TV and Radio signal (FM,MW and SW).

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906. **Central TV Receiving System.** Central TV receiving system is to be provided for various TVs of the ship. LPC is to be fitted with omni directional TV antenna connected to ship's recreation system to transmit TV signal to all TV in the ship. A shore connection point is to be provided for connecting shore Cable TV to the ship's recreation system.

907. **Signaling Projectors.** Two in number signaling projectors (500W, size not less than 10 inches) are to be provided and installed at a suitable location.

908. **Signaling Flag.** Two sets of dressing lines (complete with dressing flags) and two sets of signal flags (Naval Standard) are to be supplied.

909. **EW Equipment.** Arrangement for standard ESM and Chaff system. The ESM should have standard EW library facility. Model: Thales/Raytheon/Aselsan AS/Leonardo), Country of Origin and manufactured : France/ Netherlands/ Italy/ USA/UK/Canada/Turkey). Details to be mentioned. Chaff of different types to be supplied along with suitable launchers. Cost of Chaff (various kinds) are to be quoted separately.

910. **IFF & Tactical Data Link.**

a. Necessary arrangement including integration with CMS and Surveillance Radar to be kept to install BN Compatible IFF and Data Link in future.

b. BN IFF ST36A and BN TDL BANGLA-22 should be considered and they should be integrated with both CMS and Surveillance Radar.

c. VHF and HF radios should be compatible (Rockwell, Collins) with BANGLA-22 TDL system.

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SECTION - X

WEAPONS AND ARMAMENTS

1001. **Weapon/Armaments.** The LPC is to be capable of being used as a platform for carrying armament which includes ASuW weapons, close range weapons, Surface to Surface Missiles, small caliber guns and facility for laying mines. The deck structure in those positions is to be strengthened accordingly. All the weapons and sensors (of internationally reputed company from western origin and manufactured) will be provided during construction of the ship by the bidder. All ammunition, target, test equipment and expert personnel services required for test and trial i.r.o weapons/armaments will be provided by the bidder. Following weapons/armaments are planned to be fitted:

- a. Two set quadruple SSM launchers with complete launching system for each ship will be provided by Bidder. The Bidder will quote price for Missile with Fire control System (western origin and manufactured). The provided SSM system to be interfaced with combat system, radars and other sensors on board. Model: MBDA/Aselsan AS/ Roketsan AS/LIGNex-1), Country of Origin and manufactured: Italy/Turkey/South Korea).
- b. 1 x 30 mm gun (**NATO compliant, Single Barrel**) with associated FCS having local firing system and remote firing facilities for each ship (Western Origin & Manufactured).
- c. 2 x 12.7 mm Heavy Machine Gun for each ship (**NATO compliant**).
- d. **Facility for laying Mines.** Mine rails including mine securing arrangement will be fitted on either side of the weather deck at after part of ship. The ends of the rails on transom plate will be made curve for smooth delivery of the mines.

1002. **Surface to Surface Missile (SSM) System.** Two sets quadruple SSM launcher with complete launching system for each ship to be provided and installed by Bidder. The control console (Multi-operational Console) will be installed in the CIC/Ops Room and will be interfaced with combat system, associated sensors/equipment for accurate firing. The onboard installation and integration with on board other sensors will be the responsibility of ship builder/supplier.

1003. **Interface.** The SSM system is to be interfaced with the following for target designation, acquisition, firing etc:

- a. Air and Surface surveillance Radar.
- b. Integrated CMS.
- c. Navigation radar.
- d. Ships Gyro Compass.
- e. GPS.
- f. Other as necessary.

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1004. **Main Naval Gun System.** The main gun of the ship will be 30 mm new generation light weight rapid fire gun integrated with fire control system and the combat system. It is to be fitted in the forward part of the ship. The gun is to be provided with necessary power supply. Gun will be controlled by FCS with following provision:

- a. Full Automatic Firing.
- b. Single shot firing.
- c. Manual/Local firing (if any).
- d. Maintenance test.

1005. **Performance And Technical Data Of Main Gun.** The performance and technical data of main gun are to be as follows:

- a. Model/ Type : (Any one)
 - (1) DS 30
 - (2) 30 mm x 173 MK-30/2 ABM
 - (3) 30 mm SMASH
 - (4) 30 mm KCB
 - (5) Mauser MK 30-2, ATK-MK44
- b. Year of manufacture : 2019 or later.
- c. System composition : Firing system, feeding system, gun mounting, Laying drive system, electrical system, hydraulic system, ventilation system, protection mechanism.
- d. Gun barrel.
 - (1) Caliber : 30 mm.
 - (2) Overall length : To be mentioned.
 - (3) Pressure : Actual service pressure and muzzle pressure to be mentioned.
 - (4) Projectile velocity : To be mentioned.
 - (5) Stabilization : Details to be mentioned.
 - (6) Servo system accuracy : To be mentioned.
 - (7) Firing failure rate : $\leq 0.3\%$

RESTRICTED

- e. Cooling : To be mentioned.
- f. Firing mechanism : Percussion type or latest. Details to be mentioned.
- g. Recoil mechanism : To be mentioned.
- h. Balancing mechanism : To be provided.
- j. **Mounting Feature.**
 - (1) Carriage : To be mentioned.
 - (2) Gun mounting should have low RCS (against centimeter band radar).
 - (3) Screw feeder Hoist : To be mentioned.
 - (4) Revolving Feed Magazine or any other type: To be mentioned.
 - (5) Empty catching arrangement : To be mentioned.
 - (6) Loading Mechanism : Loader drum, loading tray etc. to be mentioned.
- k. Training/ Elevation : To be mentioned.
- l. Speed, deg/sec : To be mentioned.
- m. Rate of Fire : To be mentioned.
- n. Range : To be mentioned.
- p. Ammunition : 30 mm NATO standard compatible ammunition.

1006. **Firing Mode.** The gun system will be intergrated with the combat system and will receive all the required parameter and target information. The gun can be fired from bridge as well as from CIC. The firing can be done in the following modes:

- a. Automatic through combat system.
- b. Local / Manual from gun (if any).

1007. **Integration.** The gun is to be integrated with the following:

- a. Integrated Combat Management System (CMS).
- b. Fire Control system for anti air and surface firing.

1008. **Hoist for 30 mm Gun.** The Magazines are to be designed below/ nearer to the gun bay and ammunition hoisting arrangements are to be made. The hoisting system should be of both electrically and manually driven.

RESTRICTED

1009. **Installation.** The firing thrust and vibration must not affect the performance of precision equipment.

1010. **Secondary Gun.** 2 x 12.7 mm gun (**NATO Compliant**) for each ship. Necessary installation facilities (pintle) to be made for the gun.

1011. **Performance And Technical Data of 12.7 mm Gun.** The performance and technical data of main gun are to be as follows:

- a. Model/ Type : (Any one)
 - (1) M2HB 12.7 mm SEAHAWK MWS
 - (2) Hitrole G/N
 - (3) CIS 0.50 MG
 - (4) M2 Browning
 - (5) Gatling Gun GAU -17A MK-16
 - (6) STAMP 2
 - (7) K6 M2 HMG
- b. Year of manufacture : 2019 or later.
- c. System composition : Firing system, feeding system, gun mounting, Laying drive system, protection mechanism etc. (Details to be mentioned)
- d. Gun barrel.
 - (1) Caliber : 12.7 mm.
 - (2) Overall length : To be mentioned.
 - (3) Pressure : Actual service pressure and muzzle pressure to be mentioned.
 - (4) Projectile velocity : To be mentioned.
 - (5) Stabilization : Details to be mentioned.
 - (6) Servo system accuracy : To be mentioned.
 - (7) Firing failure rate : $\leq 0.3\%$
- e. Cooling : To be mentioned.
- f. Firing mechanism : Percussion type or latest. Details to be mentioned.

RESTRICTED

- g. Recoil mechanism : To be mentioned.
- h. Balancing mechanism : To be provided.
- j. **Mounting Feature.**
 - (1) Carriage : To be mentioned.
 - (2) Gun mounting should have low RCS (against centimeter band radar).
 - (3) Screw feeder Hoist : To be mentioned.
 - (4) Revolving Feed Magazine or any other type: To be mentioned.
 - (5) Empty catching arrangement : To be mentioned.
 - (6) Loading Mechanism : Loader drum, loading tray etc. to be mentioned.
- k. Training/ Elevation : To be mentioned.
- l. Speed, deg/sec : To be mentioned.
- m. Rate of Fire : To be mentioned.
- n. Range : To be mentioned.
- p. Ammunition : 12.7 mm NATO standard compatible ammunition.

1012. **Illuminating Flare and Pyrotechnics.** A suitable locker for storing flare and pyrotechnics is to be provided.

1013. **Small Arms (BN Supply).** Storing facility for the under mentioned small arms with their ammunition and accessories including web equipment are to be made:

- a. 4 x LMGs.
- b. 12 x CSMGs.
- c. 6 x Pistols.
- d. 20 x Rifles.
- e. 2 x SignalPistols.

1014. **Magazine.** Suitable magazine/(s) for stowage of ammunitions for small arms and guns. Magazine should have stowage capacity of approximately 2500 rounds of ammunitions for 30 mm gun, 2500 rounds of ammunitions for 12.7mm guns. Magazine is to be constructed as watertight compartments with air conditions facilities. Magazine is to fulfill following safety criteria for prevention of fire:

- a. Magazine is to be fitted with flooding system. Flooding of the magazine may be considered freely through a sea valve or through fire main. Valves of this system are to be provided with deck operated rod gearing. Pumping out system is also to be fitted.

RESTRICTED

- b. Magazine is also to be fitted with sprinkling system.
- c. Fire retarding paint is to be used in magazine. These may be painted internally with non-inflammable paint as approved by internationally recognized classification society.
- d. Approved type smoke/fire detectors are to be installed in the magazine. Smoke/fire detectors are also to be installed in all adjacent compartments except low risk value compartments, bathroom, WCs, tanks, lobbies, to operate alarms in bridge and at position adjacent to the gangway staff in harbour.
- e. All furniture in magazine are to be manufactured of metal including the magazine contents and/or state boards and key boxes.
- f. Magazine is to be protected by a flash-tight barrier at the exit to the ammunition supply routes or as near to them as are practicable.
- g. All electrical fittings in the magazine are to be of intrinsically safe type and to be of watertight to 0.1 bar to protect it from water spray. Special fire proof shielded cables and explosion proof lights and fittings are to be fitted inside the magazine. All cabling in magazine must be encased in metal conduit.
- h. The details about the magazine are to be provided.
- j. **Anti-Sabotage Arrangements.**
 - (1) All ventilation trunks are to be arranged to prevent the passage of articles or liquids into the compartment.
 - (2) Natural exhaust outlets are to be of anti-sabotage construction.
 - (3) All suction, sounding, filling tubes/pipes that terminate in or adjacent to or pass through a magazine are to be of all welded construction and fitted a lockable cap.

1015. **RU Locker for 30 mm Gun.**

- a. RU locker will be in the close vicinity of the gun.
- b. RU locker will have capacity to store sufficient amount of rounds of ammunition for 30 mm guns (To be mentioned).
- c. RU lockers will be protected from fire.
- d. Dual locking arrangements will be provided on door.
- e. Fire retarding paint will be used in RU lockers.
- f. RU locker will be able to against over heating in direct sun light.

1016. **RU Lockers for 12.7 mm Guns.**

- a. RU lockers should be in the close vicinity of the guns.
- b. RU lockers should have capacity to store 400 rounds of ammunition for 12.7 mm guns.
- c. RU lockers should be protected from fire.
- d. Dual locking arrangements are to be provided on doors and hatches.
- e. Fire retarding paint is to be used in RU lockers.
- f. Sprinkling system is to be provided in each RU locker.
- g. RU lockers are to be placed in such way so that they do not receive direct sun light as preventive measure against overheating.

1017. **Ammunition Handling.** Necessary means are to be provided so that the ammunitions can be loaded aboard, struck down and removed in the most efficient manner considering the safety and speed of handling.

1018. **Helmets and Anti Flash Hoods** Helmets and anti-flash hoods are to be provided for all required gun crews and 20% extra.

1019. **Supply of Ammunition and Documents for Gun.** Bidder is to supply required amount of ammunitions for conducting Proof firing of Guns in Bangladesh. Besides following documents need to be supplied. Price to be quoted separately for supply of ammunition and maintenance training of guns(Details to be mentioned). Details as follows:

- a. Required ammunition for Proof firing and in addition 2,500 rounds of standard ammunition of 30 mm Gun.
- b. Operation and 2nd level maintenance training for 30 mm Gun.
- c. Supply of 05 years recommended spare parts from OEM.
- d. Manual of supplied guns.
- e. Parts catalogue and Coloured PIL.

SECTION - XI

ACCOMODATION, STORES AND AMENITIES

1101. **General Arrangement.** The LPC is to be arranged with the following accommodation, living and working spaces, tanks and stores:

a. **Accommodation.**

- (1) 01 x single berth cabin each for CO's and EXO's with attached lavatory.
- (2) 03 x double berth cabins for officers with common lavatory.
- (3) 01 x cabin for JCOs (for total 12 JCOs). The Cabin will have 06 double berths and accommodation facilities.
- (4) 01 x cabin for POs (for total 08 POs). The cabin will have 04 double berths and accommodation facilities.
- (5) 02 x mess rooms for 34 junior ratings (for 17 junior ratings each). Each mess will have 09 double berths.

b. **Utility Compartments.**

- (1) Wardroom for officers.
- (2) Senior Rates' mess (For JCO's and PO's separately).
- (3) Junior Rates' mess.
- (4) Galley.
- (5) Officers' Sanitary Space.
- (6) Senior Rates' Sanitary Space.
- (7) Junior Rates' Sanitary Space.

c. **Working Compartments and Rooms.**

- (1) Closed bridge with chart table, navigation and communication equipment etc with bridge wings on port and starboard side.
- (2) MRO/Signal office (includes a locker with combination safe for stowage of classified communication documents).

RESTRICTED

- (3) Combat Information Centre (CIC)/Ops Room.
- (4) Gunnery and Regulating Office.
- (5) Ships and Store Office.
- (6) Ventilation and air conditioning room/space.
- (7) Steering gear compartment.
- (8) Main and auxiliary machinery compartments.
- (9) Machinery Control Room.
- (10) Cold and cool rooms.
- (11) Diving equipment compartment.
- (12) Magazine room/rooms.
- (13) Ship's Canteen.
- (14) Technical Office.
- (15) Sick Bay with Medical stores.
- (16) Boson's Store.
- (17) Spare room for ships library, BR etc.
- (18) Repair station and HQ1.

d. **Stores and Lockers.** Following are to be provided if not otherwise mentioned in different parts of this document:

- (1) Pyrotechnic locker.
- (2) Dry provisions and condiments rooms.
- (3) Vegetable lockers.
- (4) Rope and rigging locker.
- (5) Paint store.
- (6) Anchor chain/cable locker.
- (7) Marine engineering store.
- (8) Gunnery store.
- (9) Electrical store.

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- (10) Fore peak tank/store.
- (11) Ready use ammunition lockers.
- (12) Small arms locker.
- (13) Mess gear locker.
- (14) Cleaning gear locker.
- (15) 10 x Breathing Apparatus lockers.
- (16) Communication store and 2 x Flag Lockers.
- (17) Spare parts locker (Engineering, Electrical and Electronics).
- (18) Crockery lockers (Galley, Ward Room, Senior Rates' pantry, Junior Rates' dining).
- (19) Navigation Equipment locker (preferably at bridge).
- (20) Minimum 12 x Lockers for storing official documents at all working spaces.
- (21) Web equipment locker.
- (22) Lockers for storing all supplied life jackets.

e. **Tanks.** Tanks for fuel oil, lub oil, fresh water, dirty lub oil, etc. are to be provided as necessary. Most of the tanks are to be constructed as integral part of the hull. The tanks are to be fitted with filling and discharge lines and valves, gauges, vents, etc.

f. **Capacity of Stores and Tanks.** Store and tanks' capacity is to commensurate with the requirements of complement and endurance. Water tank capacity should not be less than 40,000 liters. The stores are to be fitted with shelves, racks, bins and other facilities as required.

1102. **Storage Capacity.** The fuel oil capacity should be such that LPC can run at least an endurance of 2500 nm at cruising speed. The dry provisions, fresh provisions and tin provisions capacity should be for 15 days, 15 days and 7 days respectively. The fresh water tank capacity is to be not less than 40 tons. Adequate on board fast moving & ready use spares' storing capacity is to be available.

1103. **Key Boards.** One in number armament key board with key hooks and identification tags will be fitted in Captain's cabin. A general key board will be fitted in the wardroom. One in number radiation hazard key board is to be fitted in suitable place.

1104. **Diving Store.** Air-conditioned stowage and charging facilities is to be provided for 8 in number diving sets with necessary gears and a portable diesel air compressor suitable to supply diving air is to be placed in a suitable location. The diving store should have provision for charging the diving sets with safe compressed air supplied from compressor. Diving sets are to be supplied by ship builder. One Breathing Air Compressor (preferably BAUER Brand) is to be provided with each LPC.

RESTRICTED

1105. **Flag Lockers.** Two in number flag lockers of suitable size with 70 pigeon holes to be fabricated and fitted on the upper deck near to the mast.

1106. **Miscellaneous.** Following items are to be supplied:

- a. Two in number aluminum two tier steps is to 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 is to be provided as per BN standard.
- c. At least 2 wooden plungers and one Boson'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 bill in the lobby.
- j. One in number bronze ship's bell.
- k. Two deck washing machine (Water Jet).

1107. **Furniture.** Furniture and facilities of accommodation, living spaces and working places are to be adequate for number of personnel and of good marine quality. Materials of furniture are to be good quality teak. Metallic furniture may also be used as required.

1108. **Furniture Application for Living Spaces and Bridge.**

Name of Place	Allocated Person	Description	Remarks
CO's cabin	1	This cabin should possess 1 x Single tier bed with drawer and bedding items, 1 x combination safe, desk, revolving chair, easy chair, table, wardrobe, book rack, mirror, filing cabinet, sofa with arm rest, 1 x armament key board, hat and coat hook, clock, ash tray, waste basket, shoe rack etc. Arrangement for items mentioned in article 624(h).	1 X Lavatory (Includes Toilet, Wash Basin And Shower) With Standard Fittings. 1 X GPS Monitor (Slave of master GPS in the Bridge), 1 X Eco sounder display, 1 x Barometer & Course/Hdg indicator
EXO's cabin	1	This cabin should possess 1 x Single tier bed with drawer and bedding items, desk, revolving chair, table, wardrobe, book rack, mirror, filing cabinet, sofa with arm rest, hat and coat hook, clock, ash tray, waste basket, shoe rack etc. Arrangement for items mentioned in article 624(h).	1 X Lavatory (Includes Toilet, Wash Basin And Shower) With Standard Fittings.

RESTRICTED

Name of Place	Allocated Person	Description	Remarks
Officers' cabin	6	Three double cabins. Each cabin with 2 x Single tier bed with drawer and bedding items, desk, arm chair, wardrobe, book rack, mirror, filing cabinet, hat and coat hook, clock, ash tray, waste basket, shoe rack, etc. 1 cabin (SO's cabin) is to have one combination safe of suitable size.	1 x common lavatory (includes 2x toilet cubicles, 1 x urinals, 2 x shower cabinets, 2 x wash basins and 1x washing machine) with standard fittings.
Ward Room	7	One wardroom with dining table, 1 x 3 seater sofa, 7 dining chairs, hat hook board, serving window, magazine rack, clock, waste basket, first aid box, important keyboard, pistol cupboard, crockery locker, information board etc. Arrangement for items mentioned in article 624(i).	1 x small pantry
Senior Ratings' room (JCO)	12	In one cabin consisting (6 x two tire) with drawers and bedding items, table, armless chairs, wardrobe, book rack, mirror, hat and coat hook, shoe rack, clock, waste basket etc.	1 x common lavatory (includes 2 toilet cubicles, 2 urinals, 2 wash basins, 2 shower cabinets, 1 washing machine) with standard fittings.
POs' Mess	08	In one cabin consisting (4 x two tire) with drawers and bedding items, table, armless chairs, wardrobe, book rack, mirror, hat and coat hook, shoe rack, clock, waste basket etc.	1 x common lavatory (includes 2 toilet cubicles, 2 urinals, 2 wash basins, 2 shower cabinets, 1 washing machine) with standard fittings.
Junior Ratings' room	34	In two messes. Each mess with maximum 09 x two tier beds with drawer and bedding items, tables, benches, kit locker, book racks, mirrors, ash tray hat and coat hooks, shoe racks, waste basket etc.	2 x common lavatory (includes 3 toilet cubicles, 2 urinals, 2 wash basins, 2 shower cabinets, 1 washing machine) with standard fittings.
Senior Rates' Dining (JCO's)	12	Standard dining facility for 12 person with chairs, tables, wash basins and suitable crockery locker. Arrangement for items mentioned in article 624 (j).	With separate pantry.
PO's Dining	08	In one cabin consisting (5 x two tire) with drawers and bedding items, table, armless chairs, wardrobe, book rack, mirror, hat and coat hook, shoe rack, clock, waste basket etc.	With suitable serving facility from galley.
Junior Rates' Dining	34	Standard dining facility with benches, tables, wash basins, suitable crockery lockers and drinking water supply facility from water purifier mentioned in article 0546. Arrangement for items mentioned in article 624 (k).	With suitable serving facility from the ship's galley

RESTRICTED

Name of Place	Allocated Person	Description	Remarks
Bridge	-	1 x chart table with dimmer light (red) and curtain, 2 x radio table (with a chair and red dimmer light on both sides), 1 x captain's chairs with arms, 1 x helmsman seat, 1x Engine operator's seat, 1 x clock, 1 x nav equipment locker, file/book cabinet (2-drawer), inclinometer, book rack, first aid box etc.	
Gangway	-	1 x gangway table, 1 x officer's state board, 1 x lifebuoy with stand, 1 x hygrometer in a box, 1 x barometer and a wall clock.	Includes one post each for shore telephone and general broadcast.
Lobby	-	1 x Notice board, 1 x General key board, 2 x watch and station bill board, 2 x display board and a first aid box.	

1109. **Furniture for Exposed Deck and Other Spaces.** Following furnitures are to be provided on exposed deck:

- a. 3 x Aluminium life jacket boxes.
- b. 2 x Wooden thermometer box.
- c. 4 x First aid boxes.
- d. 2 x Stretchers with securing arrangement
- e. 8 x revolving chairs.
- f. Shelves, cupboards etc for galley.
- g. Shelves, cupboards etc for ward room pantry.

1110. **Fittings of Sanitary Space.** All exposed metal fixtures, taps, valves, accessories etc. are to be of chromium coated brass. Rubber washers are to be fitted between all china plumbing fixtures and metal supports.

- a. **Wash Basin.** Stainless steel wash basins with spring loaded tap, S-trap and rubber ring are to be provided.
- b. **Water Closet.** The water closets are to be of pedestal type for all officers and crews. Sea water flush and one fresh water tap are to be provided.
- c. **Shower.** The showers are to be of swivel shoe head type.
- d. **Toilet Cabinet.** The material of the toilet cabinet is to be of moulded plastic with shelf inside and mirror on the hinged door. Mirror lamp is to be fitted over toilet cabinet.
- e. **Others.** Wall mounted lavatory rack and mirror with the wash basins, soap holder, towel rack, hooks, toilet paper holder, sea water tape, etc. are to be provided as necessary.

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1111. **Galley.** The galley should have facility to cook food for minimum 80 persons. Adequate supply and exhaust blowers are to be fitted to have good ventilation. Following equipment and furniture is to be provided:

- a. 2 x Electric cooking ranges each with 2 hot plates and electric chimneys over the cooking ranges. Both the equipment should be able to run by ship's generator supply and shore electric supply.
- b. 1 x Steam rice cooker (should be able to run by ship's generator supply and shore electric supply).
- c. 1 x Stainless steel sink (2 x bowls).
- d. 1 x Stainless steel working table.
- e. 1 x chopping table.
- f. 2 X Exhaust fan with separate control switch.
- g. 2 x Supply fan with separate control switch.
- h. Fresh and sea water tapes as required.
- i. 1 x Water purifier (UV filter with RO, capacity minimum 20 ltr/hour) fitted with fresh water line with minimum 40 ltrs storage facility.
- j. 1 x Deep fridge (Freezer) (minimum 380 ltrs).
- k. 1 x Egg bitter (electric).

1112. **Ward Room Pantry.** The followings are to be provided in the Ward Room pantry:

- a. 1 x Refrigerator (minimum 280 ltrs).
- b. 1 x Micro wave oven (about 12 litres).
- c. 1 X Blender.
- d. 1 X Bread toaster.
- e. 1 X Stainless steel sink (1 bowl).
- f. 1 x Water purifier (UV filter with RO, capacity minimum 10 ltr/hour) fitted with fresh water line with minimum 20 ltrs storage facility.
- g. 1 x Sandwich maker.
- h. 1 x Coffee maker.

RESTRICTED

1113. **Senior Rates' Pantry.** The followings are to be provided in the Senior Rates' pantry:

- a. 1 x Refrigerator (minimum 280 ltrs).
- b. 1 x Micro wave oven (about 12 litres).
- c. 1 X Bread toaster.
- d. 1 X Stainless steel sink (1 bowl).

1114. **Mess Traps, Mess Utensils and Galley Implements.** Mess Traps, mess utensils and galley implements will be supplied for Wardroom, Senior Rates' mess, Junior Rates' mess and ship's galley as per existing authorization for the ship's complements at the time of first outfit (BN standard for this is to be followed).

1115. **Office Equipment.** To meet the ship's administrative functions, ships office is to be equipped with the followings:

- a. Cabinets and shelves for correspondence files and publications stowage.
- b. One in number combination safe of suitable size.
- c. 3 x computers (with monitor, key board, mouse), 1 x Laptop, 3 x printers, 1 x scanner. A Local Area Network (LAN) facility for these equipment is to be provided.
- d. One desk with desk light, one file cabinet, two chairs with arm, two chairs without arms, etc.

1116. **Damage Control Stations.**

- a. DCHQ (Incorporated in combined Central control Station).
- b. Damage control headquarters shall be located in MCR/Junior rating dining room and fitted with good communication facilities. Communication facilities provided for shall include:
 - (1) General Broadcast System.
 - (2) Auto Telephone.
 - (3) Intercom.
 - (4) SPT.
- c. Thermal Imaging Camera (TIC) (complete with battery, carrying case and 02 x spare battery for each LPC).
- d. **Incident Board.** The damage control headquarters shall be provided with sufficiently large erasable Perspex board for the following:
 - (1) Incident board
 - (2) Counter flooding board
 - (3) Main services board
 - (4) Electrical state board

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1117. 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.

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SECTION - XII

MISCELLANEOUS

Spare parts, Tools, Test Equipment and Accessories

1201. Spare Parts. A proposal containing list of fast-moving spares along with item wise price for 05 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 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, armaments, missiles and combat system.
- 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.

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

j. **Main Engine.**

Ser	Description	Total Quantity
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 valve complete with seat, spring and fittings for all cylinders	6 in no per ship

RESTRICTED

Ser	Description	Total Quantity
13.	Exhaust valve 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

k. **Generator Set.**

Ser	Description	Total Quantity
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 valve 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

RESTRICTED

Ser	Description	Total Quantity
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

l. Alternator and Control / Monitoring Panel.

Ser	Description	Total Quantity
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, frequencymeter etc.	1 set per ship
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

m. Gearbox.

Ser	Description	Quantity for each gearbox
1.	Filter elements (all types of filter)	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
8.	Clutch plate assembly	1 Set
9.	Pressure plate assembly	1 Set

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1202. **Special Tools.** The following special tools are to be supplied with each LPC:
- a. 1 x Propeller nut spanner.
 - b. 1 Set of Propeller pulling device.
 - c. 3 x Grease guns with nipple.
 - d. 3 x Tool boxes 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).
 - i. 3 sets of Files (Range to be mentioned).
 - j. 2 x Vernier callipers (Range to be mentioned).
 - k. 2 x Micrometers (Range to be mentioned).
 - l. 3 sets of Adjustable spanners (Range to be mentioned).
 - m. 2 x Carpentry tool boxes with standard tools (Details of tools are to be mentioned).
 - n. 2 x Bearing extractors (Standard size).
 - o. 2 x Chain block (2 tons capacity).
 - p. 2 x Chain block (3 tons capacity).
 - q. 1 x Torque spanner (Range to be mentioned).
 - r. 2 x Punch set (Range to be mentioned).
 - s. 2 x Tool Kit Set (Brief Case of all necessary tools for electrical system).
 - t. 2X Safety Harness for working in radio-electrical system fitted in the mast.
 - u. 1X Portable Hot Blower.
 - v. 1X Portable Hand Blower.
 - w. A set of supplementary tools such as workbench, hoisting gear and deck tools.
 - x. List of items in the set of supplementary tools is to be mentioned.
 - y. 1X Lub oil and cooling water test kit.
 - z. 1 X Crimping tool set.
1203. **Test Equipment.** The following test equipment are to be supplied with each LPC:
- a. 2 X Digital Multimeter.
 - b. 2 X Weber Tester.
 - c. 1 X Clamp Tester.
 - d. 1 X Megger.
 - e. 1 X Digital Tachometer.

RESTRICTED

1204. **Accessories.** Standard accessories for all machinery and equipment in addition to those mentioned herein are to be supplied.

1205. **Drawings.** All the drawings required should be provided with the ship at the time of delivery. Moreover, following drawings should be included:

- a. As fitted General arrangement drawing.
- b. As fitted Machinery and Equipment plan.
- c. As fitted Armament and Magazine drawing.
- d. As fitted Ventilation and Air Conditioning diagram.
- e. As fitted Electrical wiring diagram.
- f. Arrangement of tanks.
- g. Arrangement of main shafting.
- h. Docking plan and alternate docking plan.

1206. **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 be written in English. Following manuals/parts catalogues/ documents (3 copies for each ship) of every machinery, equipment, sensors, weapons, SSM system, combat system, control system etc (in English language) are to be supplied with the ship at the time of delivery:

- a. Operation, maintenance and technical 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 faultfinding flow charts.
- f. Installation drawing.
- g. Ship's data book.

Inclining Experiment, Factory Acceptance Test (FAT), Harbour Acceptance Trial (HAT), Sea Acceptance Trial (SAT) and Training.

1207. **General.** Prior to keel laying, basic design and production drawing of hull and super structure is to be finalized by the approval of the Classification Society and BN's representative (Project Implementation Team). During construction, all production drawing and installation diagrams are to be approved by the BN's representative (Project Implementation Team) and on completion of each work, inspection is to be done jointly by BN's representative, bidder / builder and class (as applicable). Test and trials of individual equipment and machinery at various level i.e. FAT, STW (Setting to Work/Installation), HAT, SAT etc. as applicable are to be done

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jointly by the BN's representative and the bidder. Test/trial procedure of each stage are to be submitted to the BN's representative well in advance duly concurred by the class (as applicable) for necessary approval. A list of the tests and trials to be conducted during HAT and SAT is to be submitted and approved by the BN. However, the test and trial are to include the following:

a. **Inclining Experiment.** The inclining experiment is to be carried out upon the substantial completion of LPC but before the sea trial and results are to be recorded for the calculation of the vessel's trim, stability, light weight and dead weight.

b. **Test and Trial.**

(1) **Factory Acceptance Test (FAT).** All machinery, equipment and items are to be factory tested. To this effect, copies of FAT certificates are to be provided. Provisions are to be kept so that BN representatives can attend FAT for major equipment and systems (like main engines, generators, combat system, FC system, SSM, Guns and major sensors etc.) at the manufacturers' premises. FAT team may also carry out PSI in the factory premises during FAT. BN will bear all expenses regarding international travel, accommodation and meals for the FAT of BN team. All expenses related to internal travel within the manufacturer's country, reception and arrangement for entry into the country/concerned area for FAT will be borne by the supplier/bidder.

(2) **Harbour Acceptance Trial (HAT).** Performance test of all machinery and equipment are to be carried out with BN personnel on board. During on board test, all machinery, equipment and all piping and wiring systems supplied and / or installed on board will be tested as far as practicable and should meet the international classification society's requirement (as applicable). The harbour trial of the following machinery is to be carried out prior to sea trial and the test should meet the international classification society's requirement (as applicable).

(a) Main engines are to be tested according to standard practice.

(b) Auxiliary machineries are to be tested according to standard practice.

(c) All pumps and other engine room equipment are to be tested.

(d) Steering system is to be checked for leakage.

(e) All armaments including missile system are to be tested as per standard practice.

(f) All major sensors, FCS, Combat system, ICS, machinery control and monitoring system are to be tested as per standard practice.

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(g) The following equipment / machinery will be checked for good operating condition:

- (i) Control of the propulsion system.
- (ii) Navigational aids.
- (iii) Internal communication system.
- (iv) Fixed fire fighting system.
- (v) Fuel transfer system.
- (vi) General Service and bilge system.
- (vii) Fresh water system.
- (viii) Electrical power generation and distribution system.
- (ix) Ventilation and air conditioning system.
- (x) Watertight integrity of the compartments.
- (xi) Pressure test for tanks.
- (xii) Lowering / hoisting test for RIB.
- (xiii) Anchor, capstan and self-stowage of cable.
- (xiv) Galley equipment.
- (xv) Refrigeration system.
- (xvi) Steering system.
- (xvii) Piping pressure test.

(3) **Sea Acceptance Trial (SAT).**

(a) Standard Sea Acceptance Trial of the ship will be conducted by the bidder in presence of BN personnel and manufacturers of concerned major equipment on board. Sea trial will be carried out to verify the correct operation of the systems and machinery during underway and to check that the test performance is in compliance with the LPC specification. The trial will include:

- (i) Maximum speed trial.
- (ii) Crash stop manoeuvre trial.
- (iii) Economic speed trial.
- (iv) Turning circle test at full power.
- (v) Endurance.
- (vi) Testing of all sensors for determining their sensitivity and maximum range and coverage
- (vii) Testing of combat system and SSM system/equipment.
- (viii) Proof firing of all guns.

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(b) Ship's gun firing trial will have to be arranged by the bidder during SAT. Necessary ammunition and target is to be arranged by the bidder.

1208. **Personnel Training.** Orientation training for a period of 10 weeks on operation and maintenance of machinery, equipment and systems is to be arranged and conducted by the bidder in the shipyard after launching of the ship.

APPENDICES:

1. Summary of Tender Prices for 02 in Number LPC with Accessories, Spare Parts, Tools and Services - 01(One) page.
2. Price Schedule for Service Related to construction and Training - 01(One) page.
3. Price Schedule for Material Package including Construction Material and All Types of Machinery, Equipment and Items - 03 (Three) page.
4. Special Terms / Conditions for the Contract - 03 (Three) pages.
5. Comparison of Design Particulars between Proven and Offered LPC - 01 (One) pages.
6. Article wise Compliance Sheet on the Purchaser's Tender - 09(Nine) pages.

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APPENDIX 1 TO ANNEX B TO
TENDER SPECIFICATION FOR
CONSTRUCTION OF LPC FOR BN

SUMMARY OF TENDER PRICES FOR TWO LPC WITH ACCESSORIES, SPARE PARTS, TOOLS AND SERVICES

S No	Description	Price (in BD Taka)		Any other Charges	Total price of Two LPC
		For one LPC	For two LPC		
1.	Price of design package including all design, drawings, etc.				
2.	Price of total material package including all sorts of construction material, propulsion and all other machinery / equipment & items (Annex C)				
3.	Price of mandatory spare parts in accordance with article 1201				
4.	Price of general and special tools and test equipment in accordance with 1202 and 1203				
5.	Cost of services related to construction and training (Appendix 2 to Annex B)				

SIGNATURE

DATE

NAME.....

SEAL.....

PRICE SCHEDULE FOR SERVICES RELATED TO CONSTRUCTION AND TRAINING

SNo	Description	Price (in BD Taka)		Total Price
		For One LPC	For Two LPC	
1.	Orientation Training on operation and maintenance of machinery, equipment's and systems in accordance with and Article 1208 of Annex B.			
2.	Services of shipbuilding experts, machinery installation experts, etc. related to construction in accordance with Article 103.c. of Annex A			
3.	Services related to construction in accordance with Article 103.b. of Annex A			

SIGNATURE -----

NAME-----

DATE -----

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APPENDIX 3 TO ANNEX B TO
TENDER SPECIFICATION FOR
CONSTRUCTION OF LPC FOR BN

**PRICE SCHEDULE FOR MATERIAL PACKAGE INCLUDING CONSTRUCTION MATERIAL
AND ALL TYPES OF MACHINERY AND EQUIPMENT**

Ser	Description	CFR upto BD port (in FC)		CFR upto BD port (in equivalent BD Taka)		C&F Charges (in BD Taka)		Total Price of Material Package
		One LPC	Two LPC	One LPC	Two LPC	One LPC	Two LPC	
1.	Price of construction material package provided by foreign shipbuilder.							
2.	Price of propulsion machinery, its control system, gearboxes, shafting & propellers provided by foreign shipbuilder.							
3.	Price of electrical power generation and distribution system							
4.	Price of all auxiliary machinery and equipment provided by foreign shipbuilder.							
5.	Price of all deck machinery provided by foreign shipbuilder.							
6.	Price of electrical and electronic equipment (including navigational, communication equipment, Sensors, etc) provided by foreign shipbuilder.							
7.	Price of Weaponry System, FC system and Armaments provided by foreign shipbuilder.							
8.	Price of all material package provided by the Bidder in accordance with Article 109 of Annex A.							

SIGNATURE -----

NAME-----

DATE -----

SEAL-----

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2 X LPC (ASuW) AT LOCAL SHIPYARD

Ser	Description	Price (BDT)	
		For one LPC	For two LPC
1.	Price of design package of construction drawings, plans and all other documents as per the specification		
2.	Price of construction material package		
3.	Price of propulsion system, control system, gear boxes, shafting and propellers		
4.	Price of electrical power generation and distribution system		
5.	Price of all auxiliary system and equipment		
6.	Price of all deck machinery and fittings		
7.	Price of electrical and electronic equipment and sensors (Electrical and electronic equipment, Navigational Equipment, Communication Equipment)		
8.	Price of Combat Management System (CMS) and sub systems		
9.	Price of all weapon systems and sensors separately for 30 mm Gun and 12.7 mm Gun (excluding SSM).		
10.	Price SSM system with launcher and associated system		
11.	Price of different Chaff and launching system		
12.	Price of spare parts for 5 years (Excluding SSM)		
13.	Price of spare parts for 5 years for SSM		
14.	Price of general tools and special tools & Test equipments		
15.	Charges for operations and maintenance training		
16.	Cost of shipbuilding related services (Hull construction supervision, piping supervision, machinery installation and supervision, electrical, communication equipment installation and supervision, supervision cost of classification society and paint supervision)		
17.	Freight		
18.	Other Charges of Local Shipbuilder (Construction cost including overhead, LC opening charge, marine insurance, C&F agent commission, port expenses, material transportation cost etc)		
19.	VAT and IT		
20.	Total Cost for 2 X LPC (in BDT)		

Optional Price:

1.	Price for 10 years maintenance contract {e.g. Integrated logistic support (ILS)}	
2.	Price for SSM (Western origin and manufactured) base support facilities	
3.	Price for 16 X SSM (including 2 x test SSM)	
4.	Price for supply of 30 mm Gun ammunition (Required for conducting proof firing acceptance and 2500 rounds separately) as compatible to the mentioned guns	

SIGNATURE -----

NAME-----

DATE -----

SEAL-----

APPENDIX 4 TO ANNEX B TO
TENDER SPECIFICATION FOR
CONSTRUCTION OF LPC FOR BN

SPECIAL TERMS / CONDITIONS FOR THE CONTRACT

Insufficient Speed

1. 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 2500 (Annex B, Article-106) nautical miles at an economic speed in full load condition.
2. In case the LPC 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 two LPC for Speed Deficiency in case of one LPC	Penalty counted in % of total contract value of two LPC for Speed Deficiency in case of two LPC
1.	0.10 to 0.49 knot	1%	2%
2.	0.50 to 0.99 knot	2%	4%
3.	1.00 to 1.49 knots	3%	6%
4.	1.50 to 1.99 knots	4%	8%
5.	2.00 to 2.49 knots	5%	10%
6.	2.50 to 2.99 knots	6%	12%

3. If the deficiency in actual speed of the LPC is more than three (3.0) 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 or cancel the Contract.

Delayed Delivery

4. Delay in delivery of any one of the LPC shall mean partial delay in delivery and will be dealt individually. If BN is satisfied that the failure to deliver LPC within the scheduled delivery period has been for reasons within the control of the bidder, and/or if the Government has suffered loss for reasons of belated delivery, liquidated damages(LD), will be recovered at the rate of 2% but not less than 1% of the value of each LPC per month or fraction there of the period exceeding the original delivery period, subject to the provision that the total liquidated damages thus leviable will not exceed 10% of the contract value of each LPC.
5. Delay in the delivery of each LPC 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 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 21 days formal amendment to delivery period will be calculated from the original delivery date given in the contract.

RESTRICTED

6. 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.

7. But if the delay in delivery of each LPC continues for a period of more than two hundred and ten (210) days beyond the date upon which the delivery is due from the bidder under the terms of this CONTRACT, then, in such event, and after such period has expired, BN may, at its opinion, cancel this contract by serving upon the bidder a notice of cancellation directed to the bidder's address given in this contract.

8. For the purpose of this Article, the delivery of LPC shall be deemed to be delayed when and if LPC, 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.

9. During delivery if number of item/items remains short supplied which shall not affect/hamper operational capability of LPC, delivery of LPC may be accepted by BN, under mutual agreement between BN and bidder.

Force Majeure

10. Notwithstanding the provision of the previous clauses, the bidder shall not be liable for forfeiture of its performance security, liquidated damages or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the contract is the result of an event of force majeure.

11. For purposes of this clause, force majeure means any event, act or other circumstances, beyond control of the bidder and not involving the bidders fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of the purchaser either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight and freight embargoes.

12. If a force majeure situation arises, bidder shall promptly notify the purchaser in writing of such condition and the cause thereof. Unless otherwise directed by BN in writing the supplier shall continue to perform its obligations under the contract as far as is reasonably practical, shall seek all reasonable alternative means for performance not prevented by the force majeure event.

Omission

13. In case the bidder fails to supply/provide any of the items (i.e. machinery, equipment, sensors, missile system and armaments etc) within the scope of supply of the contract for construction of LPC, 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

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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.

Arbitration

14. All legal dispute of whatever kind arising out of the contract concluded between the parties including disputes regarding validity of contract shall be settled wherever possible amicably with the exclusion of ordinary Court of Law. Should this not be possible the dispute can/shall be settled with the strict application of the law of the land under the rules of arbitration of the Bangladesh Chamber of Commerce/International Chamber of Commerce by arbitration appointed in accordance with the rules. The said Court of Arbitration having jurisdiction is explicitly competent to decide overall legal dispute arising from or concerning the Contract. The Court of Arbitration shall have the right to determine its own rules of the procedure in its absolute discretion. It shall, however, grant both the parties opportunity to present their case and their proofs in writing and by words of mouth in the course of the proceedings

COMPARISON OF DESIGN PARTICULARS BETWEEN PREVIOUSLY CONSTRUCTED LPC AND OFFERED LPC

Reference LPC	Offered LPC
1. Principal Dimensions: a. Length : b. Breadth : c. Draught :	1. Principal Dimensions: a. Length : b. Breadth : c. Draught
2. Displacement : a. Full load b. Light load	2. Displacement : a. Full load b. Light load
3. Hull form	3. Hull form
4. Maximum speed achieved at full load condition	4. Maximum speed achieved at full load condition
5. Endurance at cruising speed	5. Endurance at cruising speed
6. Cruising Speed	6. Cruising Speed
7. Stability Characteristics	7. Stability Characteristics
8. Speed power calculation / curves	8. Speed power calculation / curves

SIGNATURE

NAME.....

DATE

SEAL.....

APPENDIX 6 TO ANNEX B TO
TENDER SPECIFICATION FOR
CONSTRUCTION OF LPC FOR BN

**ARTICLE-WISE COMPLIANCE SHEET ON THE PURCHASER'S
TENDER SPECIFICATION OF LPC
(TO BE FILLED BY THE TENDERER)**

<u>SECTION I</u>			
<u>INTRODUCTION AND GENERAL PROVISIONS</u>			
Art. No	Description	Shall comply or not	Deviation (if any)
101	Functions.		
102	General Description		
103	Displacement at full load		
104	Dimensions		
105	Speed		
106	Endurance		
107	Propulsion and maneuvering		
108	Power		
109	Seaworthiness		
110	Complement		
111	Construction		
112	Design		
113	Place of construction		
114	Project duration		
115	Special features		
116	Wartime mission length		
117	Ops room/ Combat information center (CIC)		
118	Signature		
119	Armament		
120	Navigation, Direction and RADAR		
121	Communication and EW		
122	Accommodation		
123	Logistics Arrangement		
124	Miscellaneous		
125	Classification		
126	Standard		

<u>SECTION II</u>			
<u>DESIGN AND DRAWING</u>			
Art. No	Description	Shall comply or not	Deviation (if any)
201	Introduction		
202	Design Philosophy		
203	Design Criteria and Standards		
204	Design		
205	Classification		

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206	Certification		
207	List of Drawings		
208	Fees for Certification		
209	Drawing Package		
210	Special Condition		

SECTION III			
HULL AND STRUCTURE			
Art. No	Description	Shall comply or not	Deviation (if any)
301	General		
302	Construction		
303	General Arrangement		
304	Hull Structure		
305	Hull Materials		
306	Scantlings		
307	Frames		
308	Side Longitudinal		
309	Deck Longitudinal		
310	Bulkheads		
311	Bulkhead Stiffeners		
312	Main and Auxiliary Machinery Mounting		
313	Engine Room Hatches		
314	Anchor Chain /Cable Locker		
315	Sea chests / Sea Inlets		
316	Hawse pipe		
317	Construction of Tanks		
318	Superstructure		
319	Foundation for Missile launchers and Guns		
320	Magazine		
321	Small Arms stowage		
322	Primary Surface Preparation and Shop Priming		
323	Painting		
324	Cathodic Protection		
325	Insulation and Deck Coverings		
326	Signature		
327	Hull Designation and Markings		

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SECTION IV			
<u>DECK AUXILIARY AND ACCOMMODATION OUTFIT</u>			
Art. No	Description	Shall comply or not	Deviation (if any)
401	General		
402	Watertight Doors		
403	Miscellaneous Non-Watertight Doors		
404	Hatches		
405	Manholes and Covers		
406	Windows		
407	Side Scuttles and Portholes		
408	Plan for Doors, Windows and Openings		
409	Ladders		
410	Bulwark, Rails and Stanchions		
411	Floor Plates and Gratings		
412	Mast		
413	Jack Staff and Ensign Staff		
414	Navigation Light Boxes		
415	Air Inlet Gratings		
416	Air Dust Covers		
417	Bollards		
418	Fairlead		
419	Cleats and Eyebolts		
420	Towing Bitt		
421	Towing Rope		
422	Mooring/Berthing Hawsers		
423	Reels		
424	Riggings		
425	Canvas		
426	Shore Gangway / Brow		
427	Locks, Keys and Tags		
428	Keyboards		
429	Safety Appliances		
430	Fire-fighting		
431	Fire and Smoke Detector		
432	Damage Control Equipment		
433	Diving Equipment Room		
434	Flag and Navigation Shape Locker		
435	Miscellaneous		
436	Deck Machinery		
437	Steering Gears		
438	Anchor and Chain Cable		
439	Capstan		
440	RAS Gears		

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SECTION - V			
ENGINEERING MACHINERY, EQUIPMENT AND SYSTEMS			
Art. No	Description	Shall comply or not	Deviation (if any)
501	General		
502	Propulsion System		
503	Technical Specification of Engine		
504	Ambient Condition		
505	Design and Record of Sales		
506	Maintenance Facility		
507	Automatic Protection Devices		
508	Machinery Control, Monitoring and Alarm System		
509	Classification		
510	Engine Load Test		
511	Specific Fuel Consumption (sfc)		
512	Fuel System		
513	Lubricating Oil System.		
514	Cooling Water System		
515	Starting System		
516	Shutdown System		
517	Combustion Air System		
518	Exhaust System		
519	Mountings		
520	Torsional Vibration Damper		
521	Power Transmission		
522	Gear Box		
523	Propeller		
524	Technical Particulars of Shafting		
525	Thrust block		
526	Sensors, Indicators and Gauges		
527	Instruments to be Mounted on Main Engines		
528	Remote Control from MCR		
529	Remote Control from Bridge		
530	Ship's Compressed Air System		
531	Generating Plant, Diesel Engines for Generators		
532	Fresh Water System		
533	Firemain System (Ship's Main Sea Water System)		
534	Domestic Sea water Hydrophore System		
535	Sewage System		
536	Bilge and Deck wash System		
537	Sea Chests / Sea Inlets		
538	Fuel Oil Tank and System		

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539	Lubricating Oil Tank and System		
540	Air Conditioning and Ventilation		
541	Refrigerating Plant		
542	Piping		
543	Heat Exchangers		
544	Air and Exhaust Arrangement		
545	Filling, Sounding and De-aeration System		
546	Fin Stabilizer		
547	Protection Against Marine Pollution		
548	POL and Chemicals		
549	Manuals and Drawings		

SECTION - VI			
<u>ELECTRICAL EQUIPMENT, MACHINERY AND SYSTEMS</u>			
Art. No	Description	Shall comply or not	Deviation (if any)
601	General		
602	Ship's Main Power System		
603	Schematic Diagram		
604	Electrical Load Analysis		
605	Provision of Power for Future Equipment		
606	Equipment and Items of Electrical System		
607	Main Generators Sets		
608	Main Switchboard		
609	Power Distribution System		
610	Distribution Panel / Switch Box		
611	Conversion Machinery		
612	Shore Supply Arrangement.		
613	Ship's Alongside Feeder Breaker		
614	Battery Switchboard		
615	Cables		
616	Motors and Starters		
617	Lighting		
618	Navigation Auxiliary Equipment		
619	Fans		
620	Power Receptacles		
621	Ship's Alarm System		
622	Fire Detection System		
623	Bonding Strip		
624	Miscellaneous Electrical Equipment		

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SECTION VII			
<u>NAVIGATIONAL EQUIPMENT / AIDS</u>			
Art. No	Description	Shall comply or not	Deviation (if any)
701	General		
702	Gyro Compass		
703	Magnetic Compass		
704	Echo Sounder		
705	Speed Log		
706	Horns / Sirens		
707	Navigational Radar		
708	GPS		
709	Chart Table		
710	W-AIS		
711	Helmsman Rest		
712	Barometer		
713	Barograph		
714	Binoculars		
715	Chronometer and Watches		
716	Anemometer		
717	Navigation Lights		
718	Additional Navigation Equipment/item		
719	Standard Meteorological Arrangement		
720	ECDIS		
721	Electronic Navigational Chart (ENC)		
722	Necessary Drawings		
723	Dimming of lights.		

SECTION VIII			
<u>SENSORS AND COMBAT SYSTEM</u>			
Art. No	Description	Shall comply or not	Deviation (if any)
801	General		
802	Surface and Air Surveillance RADAR		
803	Combat System		
804	Ship's Data System		
805	FC System and FC RADAR		
806	Meteorological Arrangement		
807	State Boards		

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SECTION IX			
COMMUNICATION AND EW EQUIPMENT			
Art. No	Description	Shall comply or not	Deviation (if any)
901	External Communication Equipment		
902	Distress and Safety Communication Equipments		
903	Antenna		
904	Internal Communication System		
905	General Broadcast and Entertainment System		
906	Central TV Receiving System		
907	Signaling Projectors		
908	Signaling Flag		
909	EW Equipment		
910	IFF and Tactical Data Link		

SECTION X			
WEAPONS AND ARMAMENTS			
Art. No	Description	Shall comply or not	Deviation (if any)
1001	Weapon / Armaments		
1002	Surface to Surface Missile(SSM) System		
1003	Interface		
1004	Main Naval Gun system		
1005	Performance and Technical Data of main Gun		
1006	Firing mode		
1007	Integration		
1008	Hoist for 30mm Guns		
1009	Installation		
1010	Secondary Gun		
1011	Performance And Technical Data of 12.7 mm Gun		
1012	Illuminating Flare and Pyrotechnics		
1013	Small Arms (BN Supply)		
1014	Magazine		
1015	RU Lockers for 30mm gun		
1016	RU Lockers for 12.7mm gun		
1017	Ammunition Handling		
1018	Helmets and Anti Flash Hoods		
1019	Supply of Ammunition and Documents		

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SECTION XI			
ACCOMODATION, STORES AND AMENITIES			
Art. No	Description	Shall comply or not	Deviation (if any)
1101	General Arrangement		
1102	Storage Capacity		
1103	Key Boards		
1104	Diving Store		
1105	Flag Lockers		
1106	Miscellaneous		
1107	Furniture		
1108	Furniture Application for Living Spaces and Bridge		
1109	Furniture for Exposed Deck and Other Spaces		
1110	Fittings of Sanitary Space		
1111	Galley		
1112	Ward Room Pantry		
1113	Senior Rates' Pantry		
1114	Mess Traps, Mess Utensils and Galley Implements		
1115	Office Equipment		
1116	Damage Control Stations		

SECTION-XII			
MISCELLANEOUS			
Art. No	Description	Shall comply or not	Deviation (if any)
Spare parts, Tools, Test Equipment and Accessories			
1201	Spare Parts		
1202	Special Tools		
1203	Test Equipment		
1204	Accessories		
1205	Drawings		
1206	Manuals and Documents		
Inclining Experiment, Factory Acceptance Test (FAT), Harbour Acceptance Trial (HAT), Sea Acceptance Trial (SAT) and Training			
1207	General		
	a. Inclining Experiment		
	b. Test and Trial		
	(1) Factory Acceptance Test		
	(2) Harbour Acceptance Trial		
	(3) Sea Acceptance Trial		
1208	Personnel Training		
1209	Validity of offer		

APPENDIX 4 ANNEX B			
SPECIAL TERMS AND CONDITIONS FOR THE CONTRACT			
Art. No	Description	Shall comply or not	Deviation (if any)
1-3	Insufficient Speed		
4-9	Delayed Delivery		
10 -12	Force Majeure		
13.	Omission		
14.	Arbitration		