



Mazagon Dock Shipbuilders Ltd
Corrigendum No. 07 dated 03.05.2024 to Tender No. 1600001907

Corrigendum No. 07 to Tender No. 1600001907 (E-Tender ID: 2024_MDL_94259_1)
Item: Design, Manufacture, Supply, Installation, Training of Propulsion Package for Yard 16101
of CGP Ships.

Please refer to above mentioned tender hosted on MDL e-portal.

1. Tender due date and Opening date:

	Existing Date	Amended Date
Tender Closing Date	03.05.2024	14.05.2024
Tender Opening Date	07.05.2024	15.05.2024

2. The Enclosure-1 of tender (SOTR ref: 3045 ver 0) is replaced with SOTR ref: 3045 ver 01 dated 03.05.2024. The major change in SOTR clauses & revised SOTR are Enclosed along with this corrigendum.
3. All other tender terms & conditions would remain unchanged.

For MAZAGON DOCK SHIPBUILDERS LIMITED

Rupesh Mane
DM (C-P15B & C.G.P.)

Enclosure

Sl. No.	Clause / Reference	Existing Clause	Amended Clause
Propulsion Package supplier			
1	Para 3, (s), (t), (u), (v), (w), (x) Page No 33 – 34.	Newly added	<p>(aa) The dry and wet weight of all items supplied shall be furnished along with the offer.</p> <p>(ab) The OEM of Propulsion Package Supplier (PPS) should have proven experience of PSI executing similar scopes of work in similar platform.</p> <p>(ac) The OEMs of the main engines, gearbox, and shafting are also required to provide a back-to-back guarantee to the respective equipment to the shipyard. Additionally, they must furnish a product support certificate of the equipment for 25- year service life of the ship.</p> <p>(ad) "Total number of starts" in single charging of air bottle and requirement of air bottle capacity also to be confirmed form ME OEM.</p> <p>(ae) The shipyard/class will validate the Model test data, including the wake in the path of the propeller, prior to the installation of the entire propulsion package. If any deviation observed, the same to be addressed for optimal performance of prolusion package system.</p> <p>(af) The OBS of all main propulsion package equipment to cover for exploitation and on-board maintenance for 3 years, with propulsion package annual exploitation of 3500 hours. Further, these spares also include spares conforming to dual classification requirement.</p>
Main engine			
2	Para 7, 7.12 to 7.17 Page No 42 – 43.	Newly added	<p>(aa) The propulsion system annual exploitation shall be catered for minimum 3500 hrs. The MTBO for top overhaul and major overhaul to be specified by OEM.</p> <p>(ab) Provision for mounting accelerometers/ sensors/ torsional- based sensors for measuring vibration or for AI-based predictive maintenance is to be provided.</p> <p>(ac) Firm to indicate the load increasing time from 0 to 100% MCR when the engine is correctly warmed up and pre-lubricated, fresh water and lube oil temperatures higher than 45 deg C in usual conditions and in emergency conditions.</p> <p>(ad) The unloading times are to be general, half the loading time. However, in case of emergency, engine should be stopped without delay.</p> <p>(ae) The firm needs to provide minimum continuous output without time limitation. Graphs showing engine power output, torque versus RPM, and an engine operation regime graph with zones must be included.</p>

			(af) Low load restrictions should be highlighted for operational clarity and efficiency.
3	Para 8, (o), Page No 46	Newly added	Lube oil pump- electric driven, for pre-lubrication to be provided , if required
4	Para 9, (n) & (o) Page No 47	Newly added	(aa) Ingress Protection for engine-mounted panels/controls should be designed in order to withstand fixed local water based fire-fighting system. P rating for these to be indicated by the OEM. (ab) All the alarms , indications , monitoring and control system should as per +ACC notation of equivalent of ABS or IRS
5	Para 7.19 , Page No 43	Newly added	Material for pipe/end connections should be compatible with the following materials for respective system interfaces : Seawater: Pipe Material : 90/ 10 Cu Ni to BS2871 or S1545 Flange/End connection: Composite flange (GM/MS)/ 90/10 CuNi to as 2871 or S1545 Valve construction: GM to Bs1400LG4C. Lub Oil/Fuel Oil: Pipe Material: Seamless steel pipe to ASTM A 106 Gr.B Flange/ End connection: Steel to S 2062 Slip on flange Valve construction: GM to Bs1400LG 4C Compressed air system: Pipe Material: Seamless steel pipe to ASTM A 106 Gr.B or equivalent Flange/ End connection: Steel to S 2062 Slip on flange or equivalent Valve construction: GM to BS 1400LG 4C. Exhaust System: Pipe Material: SS to AISI 304 Flange/ End connection: steel to S2062 Slip on flange Valve construction: GM to BS1400LG4C
6	Para 7.20 , Page No 44	Newly added	(ab) A foul margin of 10% to be considered while designing the lub oil cooler. (ac) Provision for emergency sea water connection from fire main system to be provided. (ac) Fuel flow measuring provision shall be made in inlet and return line of Diesel engines for facilitating recording actual fuel consumption. (ad) The shop test should adhere to the Class acceptance test, lasting approximately four hours. During this test, the engine must be connected to a hydraulic dynamometer and run using Diesel oil and onboard lubricating oil. Class surveyors will individually inspect critical sensors during the Factory Acceptance Test.
Gear box			
7	Para 3, (g), Page No 52	Newly added	Transmission loss range to be indicated for clarity of compliance by the firms
8	Para 3, (o), Page No 52	Newly added	May be included "Gear box must be designed to cater for over torque capabilities up to 120% of maximum torque"
9			

10	Para 3, (x) to (bb), Page No 52-53	Newly added	<p>(aa) One gearbox LO cooler, seawater cooled for each gearbox. The cooler to be mounted on the top of the gear case. The seawater for the lube oil cooler will be provided from built in gearbox driven seawater pump. All fasteners for the L.O. cooler to be of stainless steel/ HT brass bolts Sea water resistant lubricating oil cooler to be provided.</p> <p>(ab) One GB driven SW pump and one Motor Driven SW pump (Standby) of adequate capacity to be provided on each Gearbox for providing SW cooling water to the Gearbox.</p> <p>(ac) SW pump capacity should sufficiently cover both GB oil cooler and CPP oil cooler requirements.</p> <p>(ad) This Lub oil stand-by electrical pump is to start automatically when the system pressure drops below minimum and to stop when adequate pressure is built-up. The starter should have auto/manual as well as remote operation.</p> <p>(ae) Lub oil pressure of the gearbox system should be always higher than the SW pressure in all operating regime of gearbox.</p>
11	Para 3, (h), Page No 52	Newly added	<p>(aa) Pneumatic shaft brake for Fi-Fi PTO to be included in firm's scope of supply along with necessary interlocks and indications compatible to IMCS. Air filter cum moisture separator to be supplied by firm in the compressed air supply line for shaft brake. Pneumatic shaft brake compressed air requirement to be indicated in the offer.</p> <p>(ab) Gearbox to auto declutch External Fi-Fi PTO, if the PTO speed exceeds specified Rpm. The exact rpm for External Fi-Fi PTO to declutch will be indicated during first interface meeting.</p>
12	Para 3, (m), Page No 52	Newly added	The locking device of the propeller shaft shall be rated for maximum 50% of the nominal torque
13	Para 3, (f), Page No 52	Newly added	Each gearbox should be capable for unlimited trailing operation of other shaft. Lubrication of gearbox while trailing of the shaft shall be catered by means of Gear box driven lube oil pump which acts as trailing pump supported by electric driven lube oil standby pump of gearbox during shaft trailing at low rpm.
14	Para 7, (k), Page No 55	Newly added	One changeover type duplex oil filter with magnetic insert in the lubricating oil system to keep the oil free from foreign matters. Duplex filter element shall be reusable type.
15	Para 7, (l), Page No 55.	Newly added	A foul margin of 10% to be consider while designing the lub oil cooler.
16	Para 3, (cc) to (ff), Page No 53	Newly added	<p>(ab) Allowable loads on Gear box bearings to be designed after due consideration to wear down of shaft line bearings to its maximum allowable limits.</p> <p>(aaa) If indigenous firms intend to manufacture the Gear boxes with the proven design From the foreign Collaborator then firm needs to forward the MoU between the two parties clearly stating the roles and responsibilities of each party. Detail work share agreement with timelines to meet the agreed delivery schedule to be indicated in offer.</p>

			<p>(aab) Following additional tests as per class rules to be conducted at Factory, certified by ABS & IRS and certificates to be provided for</p> <p>(aaaa) Static & Dynamic balancing of gear pinion & wheels.</p> <p>(aaab) Measuring accuracy and determination of tooth contact pattern.</p> <p>(aaac) flush test to verify the presence of metallic particle.</p> <p>(aaad) Testing of the alarms, interlocks and trips.</p> <p>(aaae) Spin test in direction of rotation of the gearbox with min 10% Load.</p> <p>(ac) Gear-box should have a high MTBO and preferably match the MTBO of the main engine for optimal propulsion system reliability and performance.</p>
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Shafting system & CPP

17	Para 2, (n), Page No 58.	Newly added	"All material used for shafting and CPP shall be as per IRS and ABS class requirement"
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18	Para 7, (f), Page No 60.	Newly added	All the alarms , indications , monitoring and control system should as per +ACC notation of equivalent of ABS or IRS
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19	Para 2, (o) to (w), Page No 58-59.	Newly added	<p>(aa) CPP stern gear system should meet the +ACC class notation of ABS or equivalent of other ACS members.</p> <p>(ab) Provision for emergency seawater cooling from fire main system to be provided for CPP coolers and stern tube.</p> <p>(ac) Design considerations must be made for power absorption and the operation of a single shaft (with the other shaft trailing or locked) as well as twin shaft operation at the ship's cruising/patrolling speed of 12-15 knots.</p> <p>(ad) The propeller-induced vibrations should be within the limits of Class requirements Propeller should be free of harmful cavitation, vibration and noise.</p> <p>(ae) The CPP should have pitch locking mechanism enabling the propeller blades to be locked hydraulically in case of emergency.</p> <p>(af) The provision will be made in the shaft for fitting of an ICCP ring.</p> <p>(ag) OEM should provide the Shaft Earthing device (suitable spring loaded arrangement), All necessary alarms/indications for shaft grounding shall be provided as per Class rules.</p> <p>(ah) Provision and monitoring of inboard shaft bearing temperature and fitment of digital flow meter for monitoring cooling water rate for shaft seal at local and in MCR and shall be integrated with IPMS</p> <p>(aj) All instruments should be accessible for reading, maintenance and replacement instruments used for operation and monitoring should be mounted on station convenient to the operator</p>
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SHIPBUILDING DESIGN ENGINEERING
DOCKYARD ROAD, MUMBAI - 400 010

STATEMENT OF TECHNICAL REQUIREMENTS
FOR
PROPULSION PACKAGE

PROJECT	:	01 TS
YARD NOS MDL	:	16101
CLIENT	:	INDIAN COAST GUARD
DOCUMENT NO	:	3045
ICG HQ REFERENCE / APPROVAL	:	SA/0157/01TS/Engg Eqpt dated 01 MAY 24
CLASSIFICATION NOTATION	:	+ A1 (E) (Government Service) + AMS NIBS +ACC,FFV1-NS CS-Ready, HELIDK (SRF) by ABS or equivalent of LRS/DNV/GL/BV/IRS/NK

01	SOTR Approval against Letter Ref.No. SA/0157/01TS/Engg Eqpt dated 01 MAY 24 (CGHQ Email dated 02.05.2024)	03.05.24	
00	First Issue	12.12.23	-
REV.	DESCRIPTION	DATE	AUTHORISED BY
ATUL AGAWANE M (D-E)	RAVINDRA MANWATKAR CM (D-E)	S G SONAWANE CM (D-L&Wn)	SANTOSH S DGM/ HOS (D-E)
Prepared By	Checked By		Approved By



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ACRONYMS

CPP	-	Controllable Pitch Propellers
DE	-	Diesel Engine
DER	-	Diesel Engine Room
FATs	-	Factory Acceptance Trials
HATs	-	Harbour Acceptance Trials
HPU	-	Hydraulic Power Unit
IPMS	-	Integrated Platform Management System
MDL	-	M/s Mazagon Dock Shipbuilders Limited, Mumbai
OEM	-	Original Equipment Manufacturer
SATs	-	Sea Acceptance Trials
MCR	-	Machinery Control Center
STW	-	Setting to Work
CGRPT		Coast Guard Refit and Production Team
ICG		Indian Coast Guard



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SECTION I

INTRODUCTION

1. This General Specifications relate to Design, approval of the equipment by the classification society, Manufacture and Supply of one ship set of Equipment for Project 01 Training Ship (TS) of Indian Coast Guard.
2. Project 01 TS consist of Diesel Engine propulsion system comprises of two propulsion plants, each plant consisting of one Diesel Engine driving a Controllable Pitch Propeller and External Fi-Fi pump through single input and twin output Reduction Gearbox and respective shaft line. Each propulsion plant broadly comprises of:
 - (a) One Diesel Engine of minimum 5000 KW power output.
 - (b) One single input, twin-output Reduction Gearbox with built in thrust block.
 - (c) One set of shafting along with associated components
 - (d) One Controllable Pitch Propeller
 - (e) Propulsion plant support systems (for Diesel engines, Gearboxes, Shafting & CPP)
 - (f) Associated Controls & Monitoring System.
3. Class notation for Training Ship is:
+ A1 (E) (Government Service) + AMS NIBS +ACC,FFV1-NS CS-Ready,
HELIDK(SRF) by ABS or equivalent LRS/DNV/GL/BV/IRS/NK
4. The Supplier should submit the quotation based on the General Conditions & Requirements (GCR) and the Technical Requirement for Procurement of each equipment. Should there be any discrepancies between the GCR and the Technical requirement of each equipment, the technical requirement/ specification shall prevail.
5. The reference list of the equipment fitted in Indian or International Navy / Coast Guard or similar platform such as ocean going vessel, Offshore Platforms and Oil-Rigs to be submitted along with the offer.
6. The Year of production of equipment and system to be of latest manufacture (during or after Year 2023). This is to confirm to the current production standards and should have 100% of the defined life at the time of delivery.
(other than permitted running hours during assembly / acceptance trials)
7. The list of indigenous lub oil / hydraulic oil to be furnished.



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GENERAL CONDITIONS & REQUIREMENTS

1. **Subject:** The general conditions and requirements specified in this chapter are intended to meet the functional requirements of a Training platform with integral helicopter capable for operation in oceans environment and performance of all the ICG charter of duties.

2. **Ship's Basic Particulars:** Project 01 - TS class of ships would be Training ships for cadets. Ship's basic particulars, are indicated below: -

Table 1

PARTICULARS		REFERENCE DATA
Ship's dimensions	Length overall (LOA)	107 m
	Beam (water line)	15.2 m
	Draft (deep displacement)	4.02 m
Ship's displacement	Deep displacement	Around 3300Tonnes
Endurance	At cruising speed of 12 to 15 knots	7500 NM
Expected ship's life		25 Years
Operating profile	Continuous slow speeds	Below 8 knots
	Cruising	12 - 15 knots
	Maximum	20 knots
Unrestricted continuous rating of Diesel engine, at 45 degree centigrade ambient temperature		Min 5000 KW

3. Reference Environmental Conditions:

3.1 The equipment shall be suitable for marine applications and achieve specified performance smoothly under tropical marine conditions.

3.2 The equipment is to be designed for continuous operation & survival under the environmental conditions specified for ambient conditions as specified table below:-



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Table 2

Sr. No.	Design Parameter	Value
(a)	Air Temperature	Minimum of 5 deg C and Maximum of 45 deg C
(b)	Sea water temperature	32 deg C
(c)	Relative humidity	90% at 35 deg C
(d)	Atmospheric pressure	750 of Hg column (1000mbar)

3.3 Seaway Conditions: Seaway conditions are defined at a sea water temperature of 1 to + 32 Deg. C, Ambient air temperature of 5 to 45 Deg. C and humidity up to 90% at 35 Deg. C. Salinity of water up to 35000 ppm. The equipment shall be capable of efficient and unrestricted operation without any deviation from its normal operating parameters under the seaway conditions, as below:-

Table 3

Operational (up to sea state 7)	
Roll	Maximum \pm 22.5 degree
Pitch	Maximum \pm 7.5 degree
Survival (up to sea state 7)	
List	Maximum \pm 15 degree from vertical (permanent)
Trim	Maximum \pm 05 degree

3.4 Complement :

(a)	Officers	12
(b)	Subordinate Officers(SOs)/ Enrolled P ersonnel(EPs)	95
(c)	Training Staff	
	(i) Officers.	08
	(ii) SOs/EPs	38
(d)	Under Trainee officers	70
	Total	223

3.5 Propulsion Plant Operating Profile / Modes: The ship is to be available for exploitation for minimum of 190 days in a year. Each shaft is expected to clock a minimum of 3500 running hours per year. Operational cycle of the ship will be around 36 months.

3.6 Service life of ship: The expected service life of ship is 25 years @ 4500 hrs. annual exploitation



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3.7 **Operating Profile:** - The operating profile of the propulsion plants is indicated below.

Table 4

Sr. No.	Speed Range (Knots)	% Time
1	Below 8 knots	20
2	Above 12 to 15	70
3	Above 15	10

3.8 **Operating Modes:** - The propulsion plants are to provide propulsive power in the following modes:-

- Diesel engine in twin shaft drive; for attaining applicable speeds Within permissible power range for Ahead and Astern mode of operation.
- Diesel engine in single shaft drive; while the other shaft being either trailed or locked; for attaining applicable speeds within permissible power range and torque limitations, for Astern mode of operation.

4 **Ship's Support Systems Supplies:** Following ship's support supplies shall be available for the propulsion system. For electrical supplies, in case of different requirements (voltage/frequency, etc.), the equipment supplier shall provide suitable provision (transformer/converter/UPS, etc.).

Table 5

Sr. No	SYSTEM	SUPPLIES	REMARKS
(a)	Fuel system	Low sulphur high flash high speed diesel (LSHFHSD)	Indian equivalent
(b)	Lube oil system	Indian equivalent to be indicated by OEM	Indian Oil Ltd HPCL, BPCL equivalent
(c)	Compressed air system	High pressure air at working pressure of 30 bar & 30 cu m/hr. Suitable reduction available for working pressure at 30 bar & 7 bar.	Any other pressure requirement shall be met by the equipment supplier.
(e)	Fresh water system	Fresh water at 3 bar (approx.) shall be provided by ship's fresh water system.	Specific requirements to be indicated by equipment supplier.
(f)	Electrical	415 V AC @ 50 Hz, 3 phase 230AC @ 50 Hz, 1 phase	Any other power requirement shall be met by the equipment supplier.



5. Noise & Vibration:

5.1 Design of the equipment along with its associated auxiliaries/accessories/controls and mounting system, should ensure minimal vibration and noise.

5.2 All components of the equipment and accessories are to be designed for ensuring resistance to misalignment due to forces of vibration.

5.3 Suitable flexible hoses, bellows and noise reduction clamps are to be used for associated piping connections with the main equipment/auxiliaries.

5.5 Specific requirements on Noise & Vibration are to be as per respective equipment Technical Specification for Procurement.

5.6 Noise and Vibration levels of the equipment shall meet the classification rules and guidelines.

6. **Noise Levels in Machinery Spaces:** Permissible noise levels in machinery spaces are to be in accordance ISO-6954:2000.

The noise criteria for the compartments are as follows:

Sr. No.	Compartments	DB(A)
1.	Machinery spaces	110
2.	MCR	75
3.	Work places	85
4.	Non Specific workshops	90
5.	Bridge and Chartroom	65
6.	Radio Rooms	65
7.	Cabins	60
8.	Dining Hall/Offices	65
9.	Service spaces (galley, pantry)	75
10.	Normally unoccupied spaces	90

7. Vibration Isolators (Anti Vibration Mounts):

7.1 For resiliently mounted equipment, the mounting system shall be capable of attenuating the vibrations of the offered equipment within the limit specified in Technical requirement.

7.2 The installation and connections of the equipment shall account for the extreme displacements that may occur under loading conditions. Wherever necessary, suitable stops/snubbers shall be provided to prevent excessive motion.

7.3 Vibration measurements are to be carried out as per ISO 4868(XII)/latest amendment.

7.4 Following data/details with respect to vibration isolators are to be submitted by the equipment supplier, along with the technical offer:

- (a) Type and quantity
- (b) Characteristics (including dimensions)
- (c) Footprint indicating position of mounts
- (d) Rated load, deflection in three axis and natural frequency
- (e) Resilient Mounting Calculations.



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- (f) Shelf life for each type of Anti Vibration Mounts & Vibration Isolator grouping procedure are to be indicated in the offer.
- (g) Procedure to preserve the Anti Vibration Mounts & Vibration Isolator and their installation on Board the ship shall be given in the Installation document of the equipment.

8. **Manning Policy:**

- 8.1 The machinery spaces are envisaged for unmanned continuous operation. The spaces will be attended for starting/shutdown procedures and for routine checks. The control and monitoring requirements are therefore to be designed keeping the manning policy in mind. However, in degraded condition, the equipment will be operated & controlled from the local control position.
- 8.2 All propulsion machinery shall be capable of control at the equipment level and from each specified remote control station.

9. **Control & Monitoring:**

- 9.1 Propulsion system and auxiliary equipment shall be operated, controlled and monitored for unmanned continuous operation. Propulsion plants and its associated equipment and support systems are located in various compartments/spaces, on-board the ship. These compartments/spaces would be attended for starting/shut down operations and for routine checks as applicable.
- 9.2 Suitable control and monitoring system shall be provided by equipment supplier, with provision of operating equipment from local position (Local Control Panel) as well as from remote position (through ship's IPMS). All sensors, instrumentation and interfaces required for local and remote control shall be provided by equipment supplier, including associated actuators, interlocks, safety cut-outs, alarms, etc.
- 9.3 Pressure gauges and electrical indicators are to be selected as per marine grade standard (electrical indication instruments) guide to selection of sensors for measurement of parameters; pressure, flow, liquid level, temperature) or equivalent standard. Other instrumentation & sensors are to be selected, keeping into account high quality and reliability for marine applications and should be commercially available worldwide. Equipment supplier shall provide all data/details, specifications, test certificates, calibration procedure and source of procurement, for the instrumentation & sensors as part of scope of supply.

10. **Electrical Equipment Requirements:** General requirements for electrical equipment (including Motors & Starters) shall conform as per attached Annexure – 1.

10.1 **IP Rating for Electrical Equipment:** IP rating for associated electrical equipment enclosure is IP 44. Specific IP rating to be as per Technical specification requirement in Section II.

11. **Availability/ Reliability/ Redundancy/ Self Sufficiency:** Maximum time required for bringing the equipment to full operational condition while undertaking daily, weekly and monthly maintenance routines, are to be indicated by the equipment supplier.



11.1 Equipment should be robust in design for ensuring high reliability, ease of operation and minimum maintenance.

12. **Documentation:** Various documentation will be submitted by the equipment supplier as per the scope of supply and responsibility. Quality documentation is to be submitted in comprehensive and time bound manner for meeting ship's detailed design and production targets as well as equipment production and delivery schedule. Documentation to be submitted by the equipment supplier are broadly indicated below:

Table 6

Sr. No.	Documentation	Remarks
(a)	Binding design documentation	For progressing with detailed design, integration & installation.
(b)	(i) Quality Assurance Plan (QAP) (ii) Equipment manufacturing/production documentation (iii) Test & Trial procedure/documents and Reports	For approval by ABS and IRS equipment quality assurance during production and FATs accordingly.
(c)	Equipment STW/HATs/SATs documentation	For preparing installation inspection/trials documentation
(d)	Technical Manuals for equipment operation, maintenance, logistics, etc.	For ship's crew, training and repair organizations.

12.1 All documentation (including documents, drawings, data, reports, manuals, etc.) should be in English language. Dimensional details in the drawings should be as per scale. Technical data and parameters should be in metric units (SI Units).

12.2 Following file/formats would be acceptable:

- Documents, data & reports in MS-WORD/EXCEL, as applicable
- Data base files in ACCESS
- Orthographic drawings (2D) in DXF/DWG format
- 3D model of external topography of the equipment only in AVEVA MARINE/.STP format of max size of 5 MB.

Above drawings/data are to be submitted in soft copies in latest software version.

12.3 Hard documents to be provided suitably grouped (section wise H, E, L, Navigation & Communication etc.) indexed and in moisture proof bound folders.

12.4 **Binding Design Documentation:** Comprehensive list of binding design documentation is to be submitted by equipment supplier, in a structured manner under various levels (I, II & III), along with time schedule. Indicative list (but not limited to) is mentioned below:



Table 7

Sr. No.	DRAWINGS / DOCUMENTATION
Level I : Submission within 04 weeks of placement of order by Shipyard	
(a)	Technical description on main equipment along-with associated auxiliaries/components with operating principle
(b)	General arrangement drawing of equipment and major sub-assemblies along with footprint in 1:25 or appropriate scale
(c)	Assembly drawings of main & associated auxiliaries/components including:- <ul style="list-style-type: none"> • Main dimensions • Vibration Mounting arrangement • Bolting plan • Position & dimension of all Interface details • Operational and maintenance envelopes • Weights • Materials with their specifications • Centre of gravity & lifting points • Flow rate & direction • Etc.
(d)	Equipment performance data
(e)	Characteristics data, curves, efficiency, etc., related to equipment performance
(f)	Heat emission data
(g)	Equipment support systems functional specifications, as applicable along with schematic drawings (such as starting, fuel, lub oil, compressed air, intake, uptake, cooling, hydraulic, vents/drains, controls/monitoring, etc.) including interfaces with shipboard systems
(h)	Data/details for equipment foundation design and interfaces with ship structure
(j)	Any other design data/details, calculations, analysis, specifications, drawings, etc., as applicable
Level II : Submission within 06 weeks of placement of order by Shipyard	
(a)	Equipment control & monitoring data/details along-with structured list of sensors, signals & instrumentation (including in-built sensors for online health condition monitoring)
(b)	Control & monitoring interface data/details for interface with other propulsion equipment and ship's IPMS
(c)	Electrical specifications & wiring diagrams for associated electrical components, local control panels, etc.
(d)	Detailed definition of all terminal points and interfaces, major terminal box diagram, winding & performance data sheet.
(e)	Noise and vibration data/details
(f)	Any other design data/details, calculations, analysis, specifications, drawings, etc., as applicable
Level III : Submission 08 weeks of placement of order by Shipyard	



(a)	Installation drawings, with interfaces and tolerances; main equipment along-with associated auxiliaries/components along with seat machining requirement & torque value of bolts which are tightened in situ.
(b)	Equipment alignment calculations and its procedure
(c)	Shipping/Unshipping requirements
(d)	List of special tools, instrument, Handling & lifting gear (including jigs & fixtures), as applicable forming part of deliverables and associated procedure
(e)	Flushing requirements and procedure for equipment and its support systems
(f)	Preservation, re-preservation and upkeep procedure; including requirement of preservatives (oils, greases, etc.) with international or NATO equivalents along with chemical composition and physical properties.
(g)	Vibration Analysis; Torsional, Lateral & Longitudinal, as applicable
(h)	Reliability, Maintainability and Availability analysis
(i)	Failure Mode and Effect Analysis (FMEA) (if applicable)
(j)	Training plan
(k)	Any other documentation, as applicable

12.5 **Documentation Associated with Quality Assurance Plan, Equipment**

Manufacturing & FATs: Documentation associated with quality assurance plan (QAP), equipment manufacturing and FATs(Factory Acceptance Tests), will be submitted by the equipment supplier in time bound manner, well in advance for approval by the designated classification society.

12.5.1 While preliminary quality assurance & test plan shall be submitted by the equipment supplier along with the technical offer, detailed QAP is to be submitted within 15 days after placement of equipment order, for approval of ABS and IRS class.

12.5.2 Prior to commencement of equipment production activities, equipment supplier shall consult designated Classes and Shipyard/ICG.

12.5.3 Documentation associated with equipment manufacturing would be submitted by equipment supplier progressively in time bound manner, for approval by designated classes.

12.5.4 Documentation associated with equipment FATs procedure shall also be submitted by equipment supplier well in advance in time bound manner, for approval by the designated inspection classification society.

12.6 **Documentation Associated with STW/HATs/SATs:** Documentation associated with equipment setting To Work (STW)/Harbour Acceptance Trials (HATs)/Sea Acceptance Trials (SATs), shall be submitted by the equipment supplier within the agreed time schedule, with Shipyard/Indian coastguard.

12.6.1 HATS/SATS documents shall include HATs/SATs schedule, procedure, pre-requisites, data to be recorded, time interval for data recording, formats for data recording, safety and precautions to be observed during trials, estimated time of the trials and all other relevant data/information required for the successful completion of the trials.

12.7 **Technical Manuals for Equipment (Operation, Maintenance & Logistics) :** The technical manuals/documentation pertaining to equipment & its associated



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auxiliaries/support systems, shall include technical description/information, specifications, drawings, performance data, installation, operational & maintenance requirements, spares & logistics, etc., in systematic, structured & comprehensive manner.

12.7.1 Under operating instructions, pre-starting inspection/checks, starting & shutdown procedures, functional parameters, trouble shooting, fault analysis, precautions, etc. to be suitably covered.

12.7.2 Procedures for undertaking all maintenance routines till the end of service life (for the entire life cycle) (including major overhaul), are to be clearly specified along with preservation/ de-preservation & upkeep requirements (when equipment is not in use, during long refit of ship).

12.7.3 Procedures for setting to work, test & trials of equipment are also to be well documented.

12.7.4 Following technical manuals/documentation (in hard and soft form) shall be provided by the equipment supplier along with equipment supply.

Table 8

Description	Content	Number of copies
Technical Manuals	Technical Description and Operating Instructions Manual	7
	On board Maintenance Manual	7
	Field and Depot Maintenance Manual	7
	Installation and Testing Manual	7
	Parts and Tools Catalogue including CPL & PIL in ILMS/SLMS Format	7
Technical Documentation	Installation Drawings	7
	As fitted Drawings	7
	Applicable Standards Utilised	7
	Test Procedure and Documentation	7
	Certified Test Reports (FATs, Material Test Certificates, Calibration Certificates, Weight Certificate etc.) & Records (including Type Test Certificate).	7

NOTE: 1) Draft copy of the above listed Manuals & Documentations (in hard and soft form) shall be prepared by the supplier and shall be submitted to shipyards for comments & to classification society under copy to MDL/ICG for approval, well ahead of the

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delivery date of the equipment. Approval on the same shall be given within two weeks of receipt of the Manuals & Documentations complete in all respects & required format.

2) Delivery of main equipment shall be considered completed only on receipt of all approved Manuals & Documentations as detailed in Table -8 above.

3) All Manuals & Documentations should be categorised as per the above subject/content description only.

13 **Quality Assurance And Testing:** Quality assurance and testing requirements, pertaining to this equipment should confirm to standard conditions of quality assurance of ABS and IRS.

13.1 **Design Standards:** Following rules and regulations as applicable shall be met:

- (a) Nominated Classification Society Class Rules.
- (b) International load line reg. 1966 as amended by Protocol of 1988 and any other subsequent amendments.
- (c) IMO/MARPOL-73/78 reg and any further / latest amendments including MS Act 58 and their rules.
- (d) COLREG 72 and any further/ latest amendments.
- (e) IMO /Anti Fouling System.
- (f) International tonnage 1969 and any further/ latest amendments.
- (g) SOLAS 1992 as amended in 2002 and any further / latest amendments.
- (h) Stability standard as per NES 109.
- (i) Naval Magazine Explosive Regulations (NMER).
- (j) Helo deck Regulation as per IRS Rules and Regulations for construction of Coast Guard Vessels (Ch-5, Section -8) or equivalent ABS/LRS/BV/DNV/GL/NK rules.
- (k) Superior/higher specifications of standard are acceptable subject to proving and satisfactory trial by Yard.

13.2 During execution of the project, following organizations would be associated for ship design, construction, quality control and Ship trials/acceptance:-

- (a) Design : Shipyard / Nominated Classification society
- (b) Construction : MDL and CGRPT Mumbai, at Shipyard.



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- (c) Quality Control : Nominated Classification society
- (d) Ship Trials : Indian Coast Guard/Shipyard.

13.3 **Quality Standard:** Design and production of equipment should conform to the best worldwide engineering practices, for ensuring high quality, reliability, durability, ease of operation and maintenance for meeting the ship's requirements.

13.3.1 During equipment production the equipment shall be subjected to various stage inspections. Equipment supplier shall ensure high quality of production as per approved quality assurance plan. Quality assurance should meet the specified standards and intent of ISO 9001: 2015 (quality management systems) or its latest version.

13.3.2 During equipment production, any deviation to the QAP/finalized specifications/standards shall be brought to the notice of designated inspection organization and Shipyard/ICG, along with valid reasons and recommended solution, without any compromise on quality, reliability and performance of the equipment.

13.4 **FATs-(Factory Acceptance Trials)(Acceptance Test Procedure)ATP(QAP document)**

13.4.1 In order to verify its correct assembly and operation, each equipment, which is not subjected to the type-test, shall be subjected to Factory Acceptance Trials as per established proven engineering practice. A detailed FATs program and post-test inspections to demonstrate performance characteristics and guaranteed parameters of the equipment shall be prepared and submitted by the supplier for approval.

13.4.2 All the parameters/performance required to be checked during HATs/SATs must be included in the FATs & duly noted.

13.4.3 During Factory Acceptance Trials, the supplied equipment is to be installed on the test bed and operated in the same way as it will be on board the vessel. Any correction applied for different environmental and installation conditions shall be duly notified to Coastguard/shipyard seeking their approval.

13.4.4 The testing installation shall provide for a mounting arrangement of equal stiffness as expected one for the ship structure where the unit will be seating.

13.4.5 The schedule for inspection, test & trials should be drawn up in such a way that all inspections including component level inspection, trials of subassemblies, etc., should be, as far as practicable performed at the corresponding stage of manufacture. Detailed measurements should be carried out at the appropriate stage of manufacture.

13.4.6 Factory Acceptance Trials shall be offered to, witnessed & accepted by ICG reps / Classification Society as indicated in the Purchase order. The FATs shall also be witnessed by shipyard representative.

13.4.7 The supplier shall provide a detailed program of workshop and shipboard tests and post test inspection to demonstrate the performance characteristics and the guaranteed parameters of the equipment for approval by the shipyard/ Indian

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Coastguard, in the technical offer.

13.4.8 All defects observed or developed during the inspection/ testing are to be rectified free of cost before dispatch to shipyard.

13.4.9 Documentation on equipment FATs procedure is to be submitted by equipment supplier in time bound manner, well in advance for approval by the designated inspection organization. For conducting equipment official FATs, around 12 weeks advance notice shall be given by equipment supplier to designated inspection organization/Shipyard/ICG, for participation in FATs. On successful completion of factory acceptances tests, complete FATs report duly certified by the designated inspection organization, shall be submitted to designated inspection organization/Shipyard/Indian Coast Guard within 02 weeks' time.

13.5 Harbour Acceptance Trials/Sea Acceptance Trials: On board trials shall be conducted by Shipyard based upon HATs/SATs documentation and ship's trials schedule, which would be planned by shipyard in consultation of equipment suppliers/Trial organizations/Indian Coast Guard. Draft HATs/SATs schedule in accordance to DME 303 D or equivalent International Standards is to be submitted by the firm for concurrence of ICG.

13.5.1 During equipment setting to work and HATs/SATs, equipment suppliers shall assist and offer the respective equipment trials for their successful completion. Equipment testing, tuning and any defect rectification during on board trials shall be undertaken by the equipment supplier in efficient and effective manner.

13.5.2 HATS/SATS documents shall include HATs/SATs schedule, procedure, pre-requisites, data to be recorded, time interval for data recording, formats for data recording, safety and precautions to be observed during trials, estimated time of the trials and all other relevant data/information required for the successful completion of the trials.

13.5.3 Shipyard will prepare GRAQs (General Requirement of Acceptance of Quality), trial document, based on the HATs/SATs document submitted by the supplier. The same shall be forwarded to the supplier for their vetting.

13.5.4 HATs/SATs shall be carried out to the satisfaction of ICG as per approved Test and Trial document.

13.5.5 Noise and Vibration trials shall be conducted as desired by ICG team / CGRPT. Points for measurement of vibration limits shall be indicated by OEM.

13.5.6 Supplier shall offer / assist HATs and SATs of respective equipment and attest the test and trail document forms on their successful completion.

13.5.7 The major/critical parts of the equipment shall be subject to inspections during the post-CST (SATs) dry docking of the ship.

14 Maintenance & Logistics:

14.1 Equipment supplier shall ensure high reliability and low maintenance of equipment.



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14.2 While equipment maintenance and repair between major overhauls would be carried out in-situ on-board the ship, major maintenance/overhaul would be undertaken ashore by repair organization.

14.3 Equipment design should therefore ensure ease of maintenance and accessibility to important sub-assemblies/components/accessories.

14.4 Suitable provisions (such as inspection windows, etc.) as feasible, are to be made for ease of in-situ visual inspection of important sub-assemblies/components/accessories for routine inspection, checks and maintenance, without dismantling the equipment assembly/components.

14.5 Equipment supplier shall provide maintenance schedules, planned maintenance intervals and procedure for undertaking maintenance of equipment on-board and ashore.

15 **Spares:** - Installation & Commissioning Consumable, On-Board Spares, Base & Depot Spares, special tools, test equipment, etc., are to be recommended by equipment supplier, taking into account operational and maintenance requirements of the equipment. Equipment supplier shall submit comprehensive list of all types of spares & tools under appropriate category along with the technical offer. Different categories of spares & tools shall be supplied, in consultation with Shipyard/ICG, based upon ranging and scaling by ICG.

15.1 Documentation for equipment spares shall include Comprehensive Part List (CPL) & Part Identification List (PIL), for meeting ICG's Logistics Management System (LMS)/Ship's Logistics Management System (SLMS) requirements. All details on spares are to be submitted by equipment supplier in compatible format in electronic media.

15.2 **Installation Tools and Commissioning Consumables:**

15.2.1 Installation Tools: Special tools, jigs and fixtures & test equipment required for flushing, setting to work, testing & tuning, on-board trials (HATs/SATs) and post CST inspection of critical internal parts and reassembly of the equipment and its auxiliary systems shall be supplied. Tools shall be ordered along with the main equipment & delivered along with the main equipment.

15.2.2 **Commissioning Consumables:** The Commissioning consumables (first charge like coolants, greases, special oil, filters, gaskets, refrigerant etc.) shall be included in the scope of supply. Commissioning consumables shall be delivered before STW of the main equipment, tentative schedule of which shall be indicated in the Tender Enquiry.

15.2.3 An itemised list with cost for the same is also to be indicated in the offer to facilitate their procurement in future, if required.

15.2.4 One set of standard tools adequate for undertaking the maintenance on-board should be supplied along with the offer.

15.3 **On Board Spares (OBS):**

- (i) The manufacturer's recommended list of On-Board Spares (MRL-OBS) required for servicing and maintenance, including breakdown maintenance for two years of operation after completion of the warranty period, should be included in the scope



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of supply. A list of On-Board Spares along with the maintenance schedule is to be submitted. The On-Board Spares and special tools shall cater to all on-board maintenance routines and possible repair requirements. Preservation requirements of On-Board Spares, if any, shall be indicated in the offer. The list of On-Board Spares required for auxiliary equipment/system shall also be indicated in the offer.

- (ii) An item-wise list with cost (in LMS format to be submitted in soft copy in Excel) of On-Board Spares, special tools, and test equipment should be as per **Annexure 7**.
- (iii) In case of any defect or deficiency observed in OBS while handing over to ship crew, the same may be made good by the vendor without any cost implication.
- (iv) All the above OBS spares are to be duly packed in SPTA (Spare parts Tools & Accessories) boxes. For Preferred sizes and material, Refer Annexure 8.
- (v) The Manufacturer's Recommended List of On-Board Spares has to be recommended based on the likely consumption rate of the spares and on the exploitation pattern of the equipment.
- (vi) The Manufacturer's Recommended List of On-Board Spares has to be recommended based on the likely consumption rate of the spares and on the exploitation pattern of the equipment.
- (vii) Firms quoting lesser Manufacturer's Recommended List of On-Board Spares in terms of range and depth will have to make good deficiencies at their cost without any financial responsibility or liability to ICG/MDL within 30 days of intimation to render equipment operational.
- (viii) A certificate of sufficiency of Manufacturer's Recommended List of On-Board Spares is to be submitted by the firm for 03 years of operation of the ship.
- (ix) The Manufacturer's Recommended List of On-Board Spares should also include the spare conforming to Classification Society rule requirements for the vessel.
- (x) The MDL/ICG would have the option to amend the list of OBS proposed by the firm during the TNC of the equipment within the quoted price to ensure its sufficiency, based on its past experience of the exploitation of the same or similar equipment.

15.4 Five-year Base & Depot Spares/Comprehensive Part Lists: Base & depot spares are to cover spares requirements for major maintenance/overhaul requirements for 5 years including two refits.

15.4.1 Recommendation for insurance, on long term storage may be indicated. The firm is to submit Comprehensive Part Identification List (CPIL) and Manufacturer Recommended List of Spares (MRLS) for five years exploitation and maintenance.

15.4.2 Itemized list with cost in editable format along with a copy of the maintenance schedule for the equipment is to be provided in the offer. Itemized list (in LMS format to be submitted in soft copy in excel) of Base & Depot spares should be as per Annexure "7"

15.4.3 The B & D Spares shall be procured by MDL on behalf of Indian Coastguard. The B & D Spares shall be ordered at a later date, after ranging and scaling of the Spares done by Indian Coast Guard.

15.4.4 The delivery of B&D Spares shall be prior to the Commissioning of the First of Class Ship. Delivery date for the supply of B & D Spares shall be indicated in the Tender Enquiry



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15.4.5 Quotation for MRL-B&D along with part no for five years exploitation with price to be supplied along with the offer with item wise cost.

16 **INDIGINISATION / LOCAL SUPPORT** : (Applicable to equipment with import content)

16.1 The supplier is to indicate if the equipment is original OEM supply or manufactured in INDIA under license (specifying the import content). The manufacturer is to engage into a co-operation with a reputed manufacturer of similar equipment's in India and accordingly plan for progressive indigenization.

16.2 In this respect, the equipment manufacturer shall confirm that he will be able to authorize priority works at his works and provide the necessary local support as required to meet the ship construction and trial programme and provide the necessary after sale support to the ICG. Future plans for indigenous production of the equipment associated control/monitoring devices and transfers of technology are to be indicated in the proposal for consideration of Indian Coast Guard Headquarters.

17 **Product Support:** Equipment supplier is to provide product support for ship's life of 25 years. In case the equipment is likely to be obsolescent, the supplier shall notify the Coast Guard with at least two years prior notice, along with valid reasons and recommended solution.

(a) The firm/OEM to submit undertaking to provide product support for minimum period of 25 years from date of delivery of the vessel.

(b) Undertaking for upgrade/currency of software for all equipment min 05 years from date of delivery of vessel. In case of obsolescence within 05 years from date of delivery of the Training ship, the same to be upgraded without any additional cost.

(c) Firm to indicate after sales and product support facilities in India with response time for attending defect and providing spares.

(d) All upgradation and modification carried out on equipment during its life cycle must to be intimated to ICG. Further, any upgradation/modification during guarantee period of the equipment same to be included free of cost.

(e) Firm should agree to enter into the rate contract / All-inclusive Annual maintenance contract (AIAMC) with ICG for maintenance and supply of spares.

17.1 **Operational Cycle: The operating refit cycle of ship is as follows:**

(a) 1st and 2nd Ops refit cycle – Operation cycle of 24 months followed by a refit.

(b) 3rd and 4th Ops refit cycle – Operation cycle of 18 month followed by a refit.

(c) Balance Ops and refit cycle – Operation cycle of 15 month followed by a refit.

(d) First three refits are short refit (SR) followed by a normal refit (NR). Second NR will be medium repair (MR).

(e) Short refit is for duration of 04 months. Normal refit is for duration of 05 months and medium refit for duration of 12 months.

18 **Materials:** A component wise material list (with specifications) is to be provided by the equipment supplier. Standard materials for use on board ocean going ships are only to be used. Various materials used shall be in accordance with the stipulated requirements as per international Standard, as stated in the equipment technical specifications. Any deviation from specified materials is to be informed to Shipyard/Indian coast Guard in the Deviation



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List placed at **Annexure- '2'** with suitable reasons and justifications, subject to the condition that the material meets the requirements for envisaged marine application.

18.1 **A separate declaration stating that no asbestos materials are used in the product is to be submitted along with offer and also post manufacturing during equipment delivery.**

19 **Interchangeability:** - Equipment design is to ensure that components and parts having same dimensions and characteristics should be inter-changeable between different units of similar kind, without affecting the specified equipment performance.

20 **Tally and Diagram Plates:** All major components, including fittings such as valves, cocks, levers, gauges, switches, etc., should be provided with suitable identification tallies for appropriate identification. Tally plates shall be in English language and in SI units. All tallies and diagrammatic plates shall be of SS / Chrome plated. Tallies for safety, caution & warning considerations should be in bold black letters on a fluorescent orange background. Diagrammatic plates indicating details of connections are to be provided / affixed near the terminal box of the motor. Size of tally plates, diagrammatic plates, etc. shall conform to International Standards.

20.1 Arrow marking for direction of rotation of motor shall be provided by supplier. This tally shall be made of SS/Chrome plated and properly secured on the motor.

20.2 Motor details such as HP (kW), Starting Current, Full Load Current, rpm, Insulation, Weight, Maker's Name, Sr. No. of Machine, Year of Manufacturing etc. shall be given in the motor tally plate.

20.3 Danger labels in Red colour with white lettering are to be provided on all electrical equipment operating on 150Volts or higher

20.4 Motor winding terminals ending at Connection Box shall have engraved tally number as per the anodised aluminium tally affixed at the rear side of motor connection box.

20.5 The diagram plate, which is fixed on the rear side of the front door, shall have complete wiring diagram of the starter with sub-component identification number. The same identification number shall be engraved on the components fitted on the starter.

20.6 Internal Cable-Cores terminating at the connection terminal strip shall have the same corresponding terminal ferrule no. Fixed / fitted on it.

20.7 Tally of JB/Panel and other equipments internal diagram plate to be prepared by OEM.

20.8 Cable Tallies as per approved system drawing to be prepared by OEM.

20.9 Cable tallies should be supply for both the ends.

21 **Instruction Plates:** Instruction plates listing the starting/shut-down procedure and precautions in brief are to be prominently displayed on the equipment. The Instruction plates are to be SS / Chrome plated is to be supplied with a set of instruction plates duly mounted



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on equipment or supplied loose.

22 **Painting Specification:** Standard painting procedure shall be applicable for suitability for marine environment. Equipment shall be cleaned, degreased and painted with two coats of anticorrosive marine paint & two finish coats. All equipment painting shall conform to CGBR 382 or equivalent International Standards.

23 **Lifting Arrangement:** Equipment components weighing more than 40 kilograms are to be provided with eyebolts/lifting arrangement, for ease of handling/lifting on board the ship or ashore. During transportation/transit of equipment, adequate provisions (such as supports, locking arrangement, jacking, etc.) are to be made for preventing any damage to the equipment & its associated components. Any component requiring special handling shall be clearly marked and appropriate handling instructions shall be provided by equipment supplier. One set of special lifting gear (if any) shall be supplied to shipyard.

24 **Preservation / Conditioning:**

24.1 Equipment supplier is to provide high quality packing for the complete scope of supply along with handling arrangements. The package/container should display clear instructions for stowage, handling, care and accessibility for inspection of equipment preservation condition.

24.2 Equipment shall be supplied with Initial preservation for a period of 12 months for tropical conditions and protected against high humidity. The equipment are to be preserved on delivery as per the standard marine engineering practice. Closing plates/plugs/caps (duly filled with nitrogen gas) are to be provided on all openings.

24.3 For re-preservation requirements, at shipyard or on board ship beyond initial preservation period, suitable provision is to be catered for by equipment supplier. Equipment supplier shall provide re-preservation & upkeep procedure, preservatives/consumables and technical assistance/supervision to the shipyard, as per requirements (if special equipment/Pumps, hoses, fittings, etc. required shall be brought by the supplier along with them for caring out the preservation on board the ship.

24.4 In the event of storage getting extended beyond a period of 12 months, re-preservation shall be carried out on 6 month extensions basis. The conditions and cost shall be stated in the offer for further two re-preservation of 6 months. Details of the preservative used (oils & greases etc.) and the procedure for de-preservation and re-preservation, in shop or on board the ship, shall be indicated in the offer.

24.5 Preservation requirement, procedures and schedule for main equipment, OBS and B & D Spares are to be indicated in the offer.

25 **Packing & Shipping:**

25.1 All equipment shall be adequately packed and protected with supports to ensure adequate protection during all methods of transportation. Each unit within a package/container shall be clearly marked in English for identification. The container shall clearly indicate the commodity description with caution marks, weight, size, etc.



25.2 A separate document giving complete details & instruction for storage, preservation, handling & transportation after delivery shall be supplied & a copy must be included with the shipping document. The supplier should indicate the delivery schedule port of embarkation, transport, packing, preservation, insurance etc.

25.3 The instrumentation, sensors and meters etc. which are fitted on the equipment are to be removed from the equipment and shall be staggered delivered according to shipyard schedule in a separate suitable box/packing during STW.

25.4 Following items shall be packed in separate containers/boxes with proper colour coding (with description) & list of their contents in English for their easy identification and traceability:

25.4.1 Deliverables related to Main Equipment (to be marked in green colour).

25.4.2 Deliverables related to Auxiliary Equipment (to be marked in green colour).

25.4.3 Deliverables related to Installation material and Tools related to Main & Auxiliary Equipment (to be marked in green colour).

25.4.4 Commissioning consumables and Tools (to be marked in green colour).

25.4.5 On Board spares and Tools (to be marked in red colour) in SPTA boxes.

25.4.6 Base & Depot Spares (to be marked in red colour).

25.4.7 Documentation (to be marked in blue colour).

25.4.8 The list of actual deliverables against each of the above serials shall be forwarded to shipyards in soft copy (MS Excel format) with required part nos. within one week of finalization of PNC in order to detail them in the purchase order.

25.4.9 Packing list should give further breakup of items, wherever particular item is quantified by set.

26 **Training :**

26.1 The equipment supplier is to impart training, to ship's crew, training & shore maintenance organization; on aspects related to operation, installation, maintenance and repair of the equipment.

26.2 For imparting training, complete training package in hard & soft form (including suitable training material, docket, computer based aids, etc.), is to be provided by the supplier to the participants.

26.3 Training would be conducted by the equipment supplier at Shipyard/ On-board Ship. Training plan will be submitted by the equipment supplier, along with the technical offer. Training is required to cover the following aspects (but not limited to):

- (a) Design and installation
- (b) Operation and trouble shooting
- (c) Control & monitoring
- (d) Upkeep and routine maintenance
- (e) On board maintenance including major repairs and overhaul.



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26.4 **Familiarization Training:**

26.4.1 Familiarizations on design, installation and operation to be carried out in equipment's manufacturer's workshop / Training School during production of the ship set.

26.4.2 Four executives from MDL & four officers from Indian Coast Guard shall attend training on Familiarization on design, installation and operation, at Equipment manufacturer's workshop / Training School during production of the ship set. For conducting training, around 12 weeks advance notice shall be given by equipment supplier to Shipyard and ICG for participation.

26.4.3 The participants shall make their own arrangement for traveling and boarding for such training.

27 **Security of Information:** The information contained in this document is not to be divulged to any other firm/third party without the prior permission of the Indian Coast Guard and MDL. Adequate measures are to be taken to ensure safe custody of this document.

28 **Warranty:**

28.1 The equipment along with associated auxiliaries/components shall be warranted by the equipment supplier for the stipulated performance for a period of twenty (20) months from the date of delivery of equipment to MDL or twelve (12) months (**36 months for gear box**) after planned delivery date (D) (mentioned in subsequent para) of the ship by shipyard MDL to the Indian Coast Guard, whichever is later. This is to be referred as 'Standard Warranty'.

28.2 During the said period, the equipment supplied shall be warranted against any malfunction, defects, material failure, non-compliance to ordered specifications, sub-optimal performance, design deficiency, poor workmanship and quality. Any expenditure on account of equipment malfunction, repair or supply of spares against warranty defects shall be borne by the equipment supplier. If any defective part is required to be taken back to OEM's factory/works (i.e. importing and re-exporting from Country of origin) for the purpose of service, the entire liability including expenditure towards the same shall be borne by the supplier. The spare parts required / consumed for scheduled servicing & maintenance activities in the period of 'Standard Warranty' shall also be provided by the OEM without any commercial implication.

28.3 The Supplier shall be standard warrants from date of acceptance of the Training ship by the Shipyard at the designated Indian port or as applicable, that the vessel and the associated equipment and service supplied under this contract and each component used in the manufacture there of shall be free from all types of defects/failures.

28.4 In case of systems/equipment, which have not completed trials prior delivery, the warranty of that particular system/equipment and service would commence from the day of successful completion of trials. Gear Box will have a warranty of 03 years from the date of acceptance of Training ship. The Supplier will undertake update (if any) of software's for all equipment up to 5 years from the date of acceptance of the vessel.

28.5 If within the period of warranty, the Training ship and (or) stores and (or) spares are reported by the Shipyard to have failed to perform as per the specifications, the Supplier



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shall either replace or rectify the same free of charge, maximum within 15 days of notification of such defect by the Shipyard provided that the goods are used and maintained by the Shipyard as per instructions contained in the operating Manual.

28.6 Warranty of the equipment would be extended by user in log book, Spares and all consumables required for warranty repairs shall be provided free of cost by Supplier. All activities including diagnosis, rectification, calibration, transportation etc, required for making equipment serviceable and available would be Supplier's responsibility.

28.7 The Supplier also undertakes to diagnose, test, adjust, calibrate and repair/replace the goods/equipment arising due to accidents by neglect or misuse by the operator or damage due to transportation of the goods during the warranty period, at the cost mutually agreed to between the Shipyard and the Supplier subject to acceptability by the Shipyard. The Supplier shall intimate the assignable cause of the failures.

28.8 Supplier hereby warrants that necessary service and repair backup during the warranty period, shall be provided by the Supplier and he will ensure that cumulative downtime period for the Training Ship and or the fitted equipment /system equipment does not exceed 45 days of the warranty period. Thereafter, the Shipyard reserves the right to make good the defects at Suppliers risk and cost.

28.9 If the associated equipment and service, spares of Training Ship fails frequently and/or, the cumulative down time exceeds 45 days of the warranty period or a common defect is noticed repeatedly with respect to a particular item/component/sub-component, that complete item/ equipment shall be replaced free of cost by the Supplier within 45 days of receipt of the notification from the Shipyard duly modified/upgraded through design improvement in all equipment supplied/yet to be supplied and Engineering Support Package (ESP) supplied/yet to be supplied. Thereafter, the Shipyard reserves the right to make the defects at Supplier risk and cost.

28.10 In case the complete delivery of the ESP is delayed beyond the period stipulated in this contract, then the Supplier undertakes that the warranty period for the goods/stores shall be extended to that extent.

28.11 The Supplier warrants that the Training ship, the associated equipment and service supplied will conform to the Temperature and Humidity conditions as mentioned in this document.

28.12 The Supplier agrees to provide back to back warranty of equipment /system or any other item whose specified warranty by the OEM is more than 12 months and shall extend the same warranty to the Shipyard at no. additional terms and conditions.

28.13 **Extension of Warranty:** Supplier shall mandatorily indicate, in the offer, the annual rate for extended warranty period, in the event of expiry of warranty period as detailed above along with the attendant commercial terms and conditions if any.

29 **Planned Ship Delivery date(D):** The planned date for delivery of the Ships to the Indian Coastguard by MDL are tabulated below:



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Ship no.	Yard No.	Planned Delivery date
1	16101	October 2026

30 **Weight Recording / Weight Certificate:** - Weights of all components are to be recorded and a suitable certificate shall be submitted, by the equipment supplier. The designated inspection authorities shall countersign such certificates. Format for weight control data sheet, is placed at **Annexure '3'** of this document.

30.1 Net weight of each component is to be recorded in presence of designated inspection authority and the weight certificate is to be submitted by the equipment supplier, along with equipment supply. Format for weight certificate, is placed at **Annexure '4'** of this document.

30.2 The supplier shall have to submit, reasons for variation between allocated weight and actual/certified weight for each and every item, wherever applicable, to Coast Guard and MDL for their consideration and further necessary action.

31 **Maintenance Management Software:** A Maintenance Management software package for Ship Maintenance, Planned Preventive Maintenance (PPM), Defect Record & Tracking and Maintenance Forecast & Planning as per CG requirements shall be installed and commissioned.

31.1 The software package shall be capable of indicating Maintenance Routines falling due on various equipment fitted on-board and spares requirement, as per OEM promulgated schedule.

31.2 The software will be capable of interlinking on-board spares with actual spares requirement and indicate future requirement to meet Minimum stock level.

31.3 OEM is required to submit the inputs such as routine schedule, spare requirement etc. in the format enclosed at Annexure-9

32 **Technical Assistance:**

32.1 The Supplier shall provide the necessary representative(s) **as and when required**, in carrying out inspection and supervise the work that is done on the equipment, during the following phases:

- (a) Preparation for installation of equipment by shipyard.
- (b) Monitoring of proper equipment preservation during storage.
- (c) On-board erection and alignment.
- (d) Setting to Work (including fitment of latest calibrated instrumentation).
- (e) Harbour Trials.
- (f) Assistance in trouble shooting.
- (g) Customer Sea Trials.
- (h) Post CST equipment Inspections.
- (i) Final Machinery Trials.
- (j) Assistance in operation during equipment guarantee period.

32.2 The supplier shall indicate total cost for executing all technical assistance activities



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mentioned above, in the price bid. Activity-wise cost break up shall also be given in the price bid, to facilitate the payment on satisfactory completion of the activity.

32.3 Shipyard has to progress on ship construction activities, simultaneously on ships of the coastguard project or on ships of different projects. View this, there shall be every likelihood of clash of requirement of technical assistance. In such eventuality, in order to avoid delays on one ship due to similar work requirement on other ship, supplier shall depute their dedicated separate/independent team of supervisors/specialists for required technical assistance, on the required ships. Rotation of supervisors/specialist amongst the various ships/projects shall be avoided.

32.4 The supplier shall provide checklist for installation, setting to work, HATs & SATs to the shipyards to ensure the completeness of the activities by shipyards in order to avoid waiting period of the supplier specialists.

33 **Receipt Inspection:** Receipt inspection for the major equipment shall be carried out in the presence of OEM rep to verify completeness of the scope of supply and intactness of the supplied equipment. Defective / damaged parts and deficiency, if any, in supply shall be made good by OEM free of cost. OEM shall be intimated the date of receipt inspection.

34 **Price:** Price bid shall include cost of all deliverables and services as mentioned in tender. Break-up in percentage of total quoted cost of main equipment for its various components shall be indicated by the supplier. Non-indigenous equipment Suppliers are to indicate the import content in USD/EURO.

35 **Compliance Matrix:** Para-wise compliance matrix, including paras which are not applicable, as per the technical specifications (contained in this document) shall be submitted by the equipment supplier along with the technical offer, in the format as per Annexure-5 (preferably in excel sheet). The technical offer received without Compliance Matrix shall be liable for rejection.

36 **Technical Offer as Per Shipyard Tender:** - Technical part of the offer with respect to the equipment and its associated auxiliaries/components/controls, to be submitted by the equipment supplier in comprehensive, systematic and structured manner, as per the requirements mentioned in this document, including the following (but not limited to)
Vendor to submit the check list as per Annexure-6 :

36.1 Equipment specifications.

36.2 Equipment performance data

36.3 Characteristics data, curves, efficiency, etc., related to equipment performance

36.4 Outline general arrangement drawings of equipment with footprint, main dimensions, weights and mounting arrangement, with recommended maintenance space.

36.5 Requirement of Ship services (Power rating, Sea/Fresh water, Compressed Air etc.)

36.6 Associated support systems specifications and drawings.

36.7 Interface requirements.

36.8 Relevant drawings with all views and maintenance envelopes.

36.9 Control and monitoring system along with complete list of sensors and instrumentation



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(in structured manner).

- 36.10 Mounting data/details and characteristics
- 36.11 Structure borne and airborne noise performance levels (in graphical & digital format).
- 36.12 Comprehensive list of binding design documentation in structured manner along with time schedule for submission.
- 36.13 Associated electrical equipment specifications and drawings.
- 36.14 Recommended list of installation & commissioning Consumables, onboard spares, base & depot spares, special tools, test equipment, etc., in systematic manner.
- 36.15 Indigenization plan, work-share, MOU / Definitive Agreement / License agreement, technology transfer, product support, etc.; as applicable.
- 36.16 Training plan
- 36.17 Preliminary quality assurance and test plan. (QAP)
- 36.18 Compliance matrix (Para-wise compliance to tender specifications).
- 36.19 Complete Weight breakdown for major components (excluding & including oil).
- 36.20 Requirement of Greases, Oils etc., with their Indian equivalents.
- 36.21 Proposed plan for technical assistance for installation, preservation and commissioning, trials, etc.
- 36.22 List of main and auxiliary equipment included in the standard scope of supply with NCN (NATO Code Nos.).
- 36.23 List of items required for auxiliary systems (shipboard systems), which are essentially, be fitted for proper functioning of main equipment with NCN. Also indicate any of them, which are not supplied along with main equipment.
- 36.24 List of Instrumentation & Diagram.
- 36.25 Clear demarcation between the scope of supply of firm and that of the yard.
- 36.26 Trial and commissioning time of complete system on board.
- 36.27 Delivery time from receipt of order.
- 36.28 List of special tools, instruments, jigs & fixtures & facilities required for lifting, transporting, aligning, installing and commissioning of main equipment and their auxiliaries.
- 36.29 Type approval
- 36.30 The specification relates to design, manufacture, supply & commissioning of System / equipment to be used in Indian Coast Guard Ship.
- 36.31 Manufactures may be guided by this document to ensure that their products meet the standards of Installation on Indian coast guard ship.
- 36.32 The drawing & dimensions are for reference purpose only. Vendor to design the equipment based on technical data supplied.
- 36.33 The offer should be strictly conforming to the details indicated in this specification and in the relevant specifications / drawings / documents (All Latest Issues are to be followed).
- 36.34 No omission in the Specifications shall relieve the supplier of his responsibility to ascertain these requirements to perform work & furnish material in accordance with codes specified.
- 36.35 The offer should be complete with all relevant details such as Detailed Technical Specification, Material Specification, Overall Dimensions, Maintenance requirement, Foundation / Installation / Bolting, Storage/ Preservation Details, supported by drawings/documents/data sheets etc.
- 36.36 Any clarification required regarding Technical Specification / Requisition should be sought before submission of the offer.
- 36.37 Four copies of technical offer shall be submitted by equipment supplier; in hard



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and soft form (CD-ROM).

37 INSTRUMENTATION:

- 37.1 Safety, control and monitoring devices are to be fitted on equipment as per requirement. All Miscellaneous items are to be fitted as per functional requirement of the system. All piping material with necessary instrument & accessories & Instruments are to be fitted.
- 37.2 Any other instruments & accessories not listed however are required for satisfactory operation as supplier design shall also be part of scope of supply.
- 37.3 If applicable, 100mm dia. pressure and vacuum gauges (complete with needle valves, nuts and nipples) and thermometers should be supplied for the machinery equipment under supply as per technical, specification and these should be indicated in the installation drawings for the unit. Pressure gauge cocks should be provided with vent holes.
- 37.4 All the thermometers should be brass cases. Suitable pockets/sockets should be arranged on the equipment for fitting the pressure gauges and thermometers.
- 37.5 All the pressure gauges and thermometers should be marked in kg/sq.cm or bar and deg. Celsius respectively. All the pressure gauges and thermometers scale ranges should be selected so that the maximum normal operating pressure and temperature respectively will be approx. 75% of the full-scale range.
- 37.6 Temperature sensing should have the facility to allow for instrument removal without impairing the integrity of the system.
- 37.7 Pressure gauges should be provided with valve arrangements to allow for instrument isolation and removal, without impairing the integrity of the system.



SECTION II: TECHNICAL SPECIFICATION

1. INTRODUCTION

- 1.1 This technical specification will cover Design, Manufacture, Inspection, Testing, trials, Commissioning and Packaging & Forwarding of Propulsion package consisting of Main Diesel engine, Reduction Gear and shafting system including CPP propeller, fitted on suitable resilient mounts along with all the accessories, starter cum control panel with associated fittings & instruments listed in this specification for its Satisfactory Operation on board ship and during ship's sea trials & ship cruising.
- 1.2 The Package Supplier shall provide all information required for integration of the equipment on board the ship for AI and IPMS.
- 1.3 The specification defines coast guard duties and details pertaining to evaluations and testing of the equipment. Manufacturer may be guided by this document to ensure that their product meets the standards of installation on Indian Coast Guard ships.
- 1.4 01 Training Ship for Indian Coast Guard is being constructed by Mazagon Dock Shipbuilders Limited (MDL), Mumbai.
- 1.5 Offered equipment should follow the class notation of: A1 (E) (Government Service) +AMS NIBS +ACC, FFV1-NS CS-Ready, HELIDK (SRF) by ABS or equivalent of LRS/DNV/GL/BV/IRS/NK.
- 1.6 The equipment offered in the package shall confirm the IRS and ABS class rules requirement.
- 1.7 Type approved equipment by IACS authority to be offered by the Vendor along with unit certification from ABS & IRS Class both.
- 1.8 If Type approval is not available with the equipment, class approved equipment to be supplied by the vendor (Class approval by IRS & ABS both).
- 1.9 The Package Supplier will be responsible for the selection of Reduction gear and shafting system along with CPP from the list provided in section: II.

2. Equipment's to be supplied:

- 1.1 02 Nos Marine Diesel Engines (along with all the auxiliaries) of not less than 5000 KW each complying to IMO Tier II – Technical details at **Annexure A**
- 1.2 02 No's Reduction gear (along with all the auxiliaries) – The Technical details at **Annexure B**
- 1.3 02 No's shafting along with stern gear and CPP propulsion system, annual exploitation shall be catered for minimum 3500 hrs. each meeting the requirements specified in classification notification - The Technical details at **Annexure C**



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3. RESPONSIBILITY OF PROPULSION PACKAGE SUPPLIER:

3.1 In this case, Main Engine supplier will be Propulsion package supplier.

3.2 Propulsion package supplier should design, and supply the entire propulsion system which mainly consists of:

- (a) 2 (Two) no's Diesel Engines.
- (b) 2 (Two) no's Reduction Gear
- (c) 2 (Two) no's Shafting system along with CPP which should meet the maximum speed of 20 Knots at full load displacement at 85% MCR (ICFN).

3.3 The Propulsion package supplier shall undertake all necessary calculation / Simulation for the satisfactory operation of the entire propulsion train and should get it vetted by the ABS and IRS.

3.4 Back Pressure calculation of the exhaust piping will be provided by MDL and same to be reviewed by propulsion package supplier.

3.5 Sea water requirement for the system to be provided by the propulsion package supplier.

3.6 Combinatory curve in different mode shall be provided by the propulsion package provider.

- (a) One UPS for each shaft line with 30 minutes backup of sufficient capacity for feeding control system of all propulsion system and their auxiliaries to be included in the scope.
- (b) Propulsion Package-supplier shall source the relevant design data/ details from respective propulsion equipment suppliers. Further relevant design data/ specifications are to be provided by Propulsion package supplier to shipyard for designing sea water cooling system.
- (c) The **Propulsion Package Supplier** shall be responsible to co-ordinate with other OEMs of propulsion train (DE, reduction gear box, shafting with CPP etc.), IPMS vendor to collect / share / exchange the relevant data/ technology / information required.
- (d) The **Propulsion Package Supplier** shall have the responsibility for setting to work and satisfactory completion of HAT/CST/FMT for acceptance of Propulsion package by IRS and ABS Class along with ICG.
- (e) Torsional vibration calculation of the entire propulsion train to be carried out and same to be vetted by ABS and IRS.
- (f) Propulsion package supplier shall take care all the obligations and necessary action to overcome while interfacing with the other vendors of the propulsion train.
- (g) Design of holding down arrangement will be shared with OEM for review / comments.



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- (h) Propulsion Package Supplier shall finalize and supply Flexible coupling to connect engine shaft to Gear box input shaft. (Propulsion package supplier) to liaison with Gear box OEM for getting gear box data/ input flange data for finalization of flexible coupling.
- (i) Power take off (PTO) details like power, torque, RPM etc. of External fire-fighting system will be provided during detail engineering.
- (j) Propulsion Package Supplier Respective equipment OEM to be present during finalization of interface requirement with IPMS.
- (k) All fit bolts between gear box output flange, DE output Flange and shafts are to be supplied by the propulsion package supplier.
- (l) Propulsion package supplier shall be responsible for interfacing the Main engine, Reduction gear and shafting system along with CPP to meet the specified performance requirements of propulsion train.
- (m) Propulsion package supplier assistance includes presence of skilled technicians for supervision during on-board installation (alignment check, bearing load checking, STW of Diesel engine, test & trial etc.) & commissioning of the equipment on-board shall be provided by Package Supplier.
- (n) Entire propulsion plant will be controlled and monitored from remote control stations i.e. through IPMS. All requisite critical / non-critical hardwired signals and Modbus signal list (preliminary) to IPMS from each propulsion equipment to be indicated in the offer which will be finalised after final design review.
- (o) EOT cum Propulsion Control Lever along with remote monitoring and control panel for propulsion package to be supplied by Package Supplier and the same will be mounted on IPMS console at Bridge and MCR.
- (p) All commands from EOT cum Propulsion Control Lever and remote monitoring control panel shall be processed in a separate panel supplied by package supplier and corresponding command shall be given to all propulsion equipment's to achieve the desired ship performance like speed, pitch, power etc. Hard wired for stop signal shall be provided at both EOT stations.
- (q) Propulsion package supplier is responsible for signal interfacing (Hard wired/Serial link) between Main engine, gear box and shafting along with CPP and IPMS for remote control and monitoring. The interface requirement shall comply system design configuration as per class requirement.
- (r) Installation, HAT & SAT protocol to be submitted by the OEM for the approval of class.
- (s) The dry and wet weight of all items supplied shall be furnished along with the offer.



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- (t) The OEM of Propulsion Package Supplier (PPS) should have proven experience of PSI executing similar scopes of work in similar platform.
- (u) The OEMs of the main engines, gearbox, and shafting are also required to provide a back-to-back guarantee to the respective equipment to the shipyard. Additionally, they must furnish a product support certificate of the equipment for 25- year service life of the ship.
- (v) The shipyard to validate the Model test data, including the wake in the path of the propeller, prior to the installation of the entire propulsion package. If any deviation observed, the same to be addressed for optimal performance of propulsion package system.
- (w) The OBS of all main propulsion package equipment to cover for exploitation and on-board maintenance for 3 years, with propulsion package annual exploitation of 3500 hours. Further, these spares also include spares conforming to dual classification requirement.
- (x) Total number of starts" in single charging of air bottle and requirement of air bottle capacity to be confirmed from ME OEM and convey to MDL.

4. DESIGN AND CALCULATION: Following minimum activities shall be undertaken by propulsion package supplier and same to be approved from from class. All these data are to be shared by OEM.

- (a) Shaft diameter and strength calculations
- (b) Calculation of bearing spans
- (c) Whirling, axial, vibration calculations, and noise calculation of propulsion package.
- (d) Propulsion alignment calculations, jack load, Gap & sag values• in four different loading condition with propeller blades.-The loading conditions will be defined during detailed design.
- (e) Shaft stress/deflection analysis
- (f) Bearing load analysis: MCR warm, cold conditions
- (g) Reaction influence numbers
- (h) Shaft transmission losses
- (i) Propeller Pd-n diagram
- (j) Prediction of cavitation inception speed
- (k) Performance prediction.
- (l) Torsional vibration calculations of entire Propulsion package.
- (m) Any other relevant calculation & analysis as required.
- (n) Development of Mechanical and Electrical ICD documents.
- (o) Dynamic simulation for propulsion package (Propulsion package supplier should submit procedural details of dynamic analysis by using mathematical models prepared from propulsion and hull data. Package supplier shall present philosophy for controlling propulsion equipment with combinatory law based on study of dynamic analysis. Package supplier shall also present



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implementation strategy for controlling propulsion equipment in different regimes by using dynamic analysis).

5. TECHNICAL ASSISTANCE: The Propulsion Package Supplier shall provide the necessary representative(s) as and when required, in carrying out inspection and supervise the work that is done on the Propulsion Package equipment, during the following phases:

- (a) Monitoring of proper equipment preservation during storage.
(20 Man Days)
- (b) Preparation for installation, On-board erection and alignment of equipment by shipyard. (100 Man Days)
- (c) Setting to Work (including fitment of latest calibrated instrumentation).
(50 Man Days)
- (d) Harbour Trials. (30 Man days)
- (e) Customer Sea Trials (20 Man Days)
- (f) Post CST equipment Inspections (10 Man days).
- (g) Final Machinery Trials (10 Man days).

5.1 The supplier shall indicate Activity-wise cost break up in the price bid, to facilitate the payment on satisfactory completion of the activity.

5.2 The above activities shall be completed in provided Mandays against activities. Therefore, supplier has to ensure judicious utilisation of Man-days. Any additional Mandays required for above mentioned activities shall be provided free of cost.

6. INTERFACE MEETINGS:

6.1 To ensure effective communication & interaction between MDL/Class & ICG team, during the execution of the contractual commitment, regular design review / interface meetings is required for following activities.

- (a) Review of ship system performance,
- (b) Review of general arrangement drawings,
- (c) During development of ICD document,
- (d) During finalizing of engineering calculations
- (e) During defining of ship's test and trials procedure.

6.2 Minimum 03 meetings shall be required during the project. The package supplier will prepare the meeting agenda, interface specification and provisional memorandum of agreement that shall be approved by shipyard before interface meetings.

7. SCOPE OF SUPPLY:

7.1 Main Diesel Engine Supplier shall be responsible in totality for undertaking detailed design, manufacture, test, supply of main propulsion package equipment with its auxiliaries and ancillaries as per detail technical specification and scope of supply



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brought out in this SOTR and technical details placed as Annexure to this document meeting the propulsion Package system requirement including of associated auxiliary systems as per Class notification.

- (a) Technical Data - "Main Diesel Engine" (Annex A)
- (b) Technical Data - "Reduction Gear Box" (Annex B)
- (c) Technical Data - "Shafting along with stern gear and CPP system" (Annex C)

7.2 The firm shall be responsible for manufacturing and supplying of Main Diesel Engine as per Annexure "A", Reduction Gear Box as per Annexure "B", and Shafting system along with CPP propeller as per Annexure "C" respectively and to be sourced from any one of the ICG nominated vendors mentioned in the table below. The firm shall disclose the selected vendors name for reduction gear box and Shafting system along with CPP propeller in the Technical bid.

SR. NO.	EQUIPMENT / SYSTEM	ICG NOMINATED OEMs	MODEL
1.	Main Diesel Engine	1. M/s CATERPILLAR	C280-16
		2. M/s MAN	12V28/33DSTC
		3. M/s MTU	16V1163M84
		4. M/s WARTSILA	16V26
2.	Reduction Gear Box with multiple output for CPP shaft and External Fire-Fighting Pump	1. M/s Triveni Engineering Industries Ltd with Reintjes	
		2. M/s Elecon	
		3. M/s Renk	
		4. M/s Reintjes	
		5. M/s Flender	
3.	Shafting system along with CPP	1. M/s Wartsila	
		2. M/s MAN	
		3. M/s Kongsberg	
		4. M/s Geeta Engineering with Helseth Kumera/Finnoy	
		5. M/s Nakashima	
		6. M/s Schottel	

7.3 All tools, OBS, components and auxiliaries of particular equipment shall be supplied with original equipment manufacturer part number to facilitate procurement of these items directly from respective equipment manufacturer. All original OEM drawings and document for each propulsion equipment shall be supplied by the firm.



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7.4 The vendors will take back to back guarantee from the respective OEM,s of Gear Box and Shafting. In the SOTR, Engine OEM will be asked to submit the product support certificate from the respective OEM's of Gear Box and Shafting. To avail after sales support, contact details of respective OEM,s (Gear Box & Shafting) will be taken from Main Engine OEM.



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Annexure - A

TECHNICAL DETAILS - MAIN DIESEL ENGINE

1. SCOPE OF SUPPLY:

- (a) Scope of supply will cover Design, Manufacture, Inspection, Testing, trial, Commissioning, Packaging and Forwarding & Satisfactory Operation on board ship for all the equipment's, fittings & instruments listed in this specification during ship trials & ship cruising.
- (b) The manufacturer shall provide all information required for integration of the equipment on board the ship. The equipment shall be designed and constructed so that it can be fully integrated with the subsystem to which it interfaces.
- (c) All components shall be compatible in order that the functional performance of the equipment is not degraded as a result of its integration within the system as a whole.
- (d) All interface Connections should be provided with flexible Hose/Bellows. Flexible/Bellows of all the systems will be in supplier scope.
- (e) The list of equipment's to be supplied along with accessories & instruments are as follow:

Sr. No.	Description	Quantity/Ship sets
1.	Diesel Engine - Min 5000kW complying to IMO Tier II and Annexure VI of MARPOL 73/78 mainly consisting of its associated auxiliary systems and resilient mountings with foundation bolts.	02 Sets
2.	Diesel engine flexible coupling with connecting shaft.	02 Sets
3.	Dry type silencer for each engine set along with supports for Silencer along with drain valve	02 Nos.
4.	Expansion bellows (Stainless Steel) to be provided as per the class requirement.	02 Sets
5.	Diesel engine driven pumps, for fuel, lube oil, freshwater and seawater.	02 Sets
6.	Spark arrestor for the crankcase breather vent (if required).	02 Sets.
7.	Pre-lubricating and pre-heating module mounted on skid .	02 Sets.
8.	Header tank for jacket water with all the fittings and counter flanges/coupling.	02 Nos.
9.	Flexible supporting assembly / Mounting brackets with fixed and Sliding supports for Exhaust line from turbocharger to atmosphere.	12 nos Fixed 12 nos Flexible



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10.	Duplex fuel and lube oil filter.	02 Sets
11.	Pre-Heater with control panel as per class rules (if applicable)	02 Sets
12.	L.O. Priming pump & Starter as per class rules (if applicable)	02 Sets
13.	F.O. Priming Pump & Starter as per class rules (if applicable)	02 Sets
14.	Handling & lifting gear (including jigs & fixtures), as applicable	01 No.
15.	Heat Exchanger	02 Sets
16.	Turning gear motor & starter as per class rules along with pendant control unit with lose cable of requisite length (if applicable).	01 Per Engine
17.	Special Tools (if any) required for the installation and maintenance	01 Set
18.	90 Degree Exhaust hoods.	01 set per Engine
Electrical		
19.	Local Control and monitoring Panel along with cable glands for Diesel Engine as per IR & ABS Class	01 per Engine
20.	Safety alarms/trips as per IRS & ABS.	As required
21.	Battery backup/UPS for 30 min for governor/control panel (if applicable).	02 Sets
22.	Sensors & instrumentation for controls & monitoring	02 Sets
23.	CAT / Communication cable of requisite length (if applicable)	500 m (approx.)
24.	Thermocouple cable of requisite length (if applicable)	500 m (approx.)
25.	CAN cable of requisite length (if applicable)	500 m (approx.)
26.	**All ship system mounted sensors/signal transmitters, RTDs, limit/lever switches, encoders etc which are part of DE System to be supplied by DE supplier (if applicable)	1 Set
27.	Latest version Diagnostic software with permanent validity licence (if applicable)	1 Set

NOTE:

** List of such ship system mounted sensors to be indicated in the offer along with specifications.

(a) Any other instruments and accessories not listed in this document but required for the satisfactory operation of propulsion train shall be supplied by the firm.



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2. SCOPE OF OFFER: The supplier to supply as a minimum the following information along with the technical offer:

- (a) Type Approval certificate
- (b) Technical Specification of the equipment's.
- (c) Details of all connections to equipment, Vibration details with pattern no, seat details, flange details etc.
- (d) GA drawing with technical parameters and maintenance envelope of all equipment's, sub-assemblies & accessories.
- (e) P & ID diagram
- (f) Heat dissipation of the Equipment
- (g) Details of other ship services required.
- (h) Tools required for maintenance.
- (i) Recommended onboard and base spares holding (for 2 year and 5 years operation respectively)
- (j) Manufacturers list of spares for installation & Commissioning.
- (k) Instrumentation List & Diagram.
- (l) Fuel System, Lubrication System, Cooling System, Starting Air System, Exhaust Ducting and Control System Schematics
- (m) Brief on integration of Propulsion Package Control System with ship's Integrated Control System.
- (n) Requirement of Greases, Oils etc. with their equivalents.
- (o) Proposed factory tests and Inspection plan.
- (p) Proposed preservation plan.
- (q) Delivery time from receipt of order.
- (r) Clear demarcation between the scope of supply of firm and that of the yard.
- (s) List of equipment required for installation and operation of the equipment and not supplied by the manufacturer.
- (t) Trial and commissioning time of complete system on board.
- (u) Special tools and test equipment to be supplied for on board maintenance.
- (v) List of accessories inclusive / not inclusive in the standard scope of supply.
- (w) List of tools & accessories required for installation & commissioning
- (x) Proposed Quality Assurance & Quality Inspection Plan.
- (y) Details of standard and optional factory tests.
- (z) Preliminary I/O signal list (hard wired & soft signals through Serial Link)
- (aa) Electrical Power supply requirements of each equipment
- (bb) Block diagram of electrical equipment indicating inter-unit-cabling details and types of cables having bifurcation of yard supplied and OEM supplied cable

3. REQUIREMENTS:

- (a) The supplied item shall be of proven design.
- (b) Shelf-life of all items is to be indicated.



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- (c) The Material, Constructional & Testing requirement of equipment & accessories shall conform to the Codes / Standards specified in this specification
- (d) Each type of equipment & accessories to be supplied shall conform to specifications acceptable to the TYPE APPROVAL AUTHORITY (TAA) – IRS and ABS
- (e) The equipment offered should operate smoothly under tropical marine conditions. It shall withstand air contamination through oil, salt & other contaminants associated with the marine environment. The equipment shall be water drip proof.
- (f) Supplier shall submit Green passport document as per IMO resolution A 962(23).
- (g) All gauges & Instruments shall be calibrated & shall accompany with a calibration certificate.

4. APPLICABLE SPECIFICATIONS: The following documentation or the latest issue in effect is to form a part of this specification to the extent specified herein, except where a specific issue is indicated. In case of a conflict between the contents of this document and the applicable portions of the reference documents, the contents of this document shall take precedence.

a.	Annexure VI of MARPOL 73/78	Regulation for the prevention of Air Pollution from ships and SOx/NOx technical code
b.	Class Notation	The equipment shall comply the class notation as per SOTR
c.	ISO-3046	ICFN Rating for tropical condition
d.	IMO Tier - II	Diesel Engine

5. SPACE CONSTRAINT: Ease of operation and maintenance is to be ensured while designing the layout of the system components housed in compartment, the supplier is to indicate the maintenance envelope required to carry out maintenance on board during normal operation and refit. The equipment dimensions would be finalised by MDL depending upon space availability.

The supplier is to indicate the following limiting dimensions.

≤	Length	Breadth	Height	Mass



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6. MOUNTING:

- (a) For equipment to be mounted on ships structure, supplier to provide foundation details /
mount details for equipment.
- (b) Vendor to provide details of mounting of equipment with control panel on board ship (Mounting Details Drawing).
- (c) Fasteners for mounting equipment on ship structure & mating flanges are to be included in the supplier's scope of Supply.
- (d) All instruments of PROPULSION PACKAGE have to be supplied with necessary mounting arrangement so that the instrument shall be directly mounted on the piping or in ducting.

7. TECHNICAL REQUIREMENTS:

- 7.1 Twin Diesel Engines (Minimum 5000 KW each) to meet power requirement with low fuel consumption, high complying IMO Tier-II.
- 7.2 Engines will have low specific fuel consumption, high MTBO.
- 7.3 Two nos. propulsion lines shall be catered with CPP system.
- 7.4 The Diesel Engines must be air started, turbocharged, intercooled, direct injection type capable of being started, controlled, operated and stopped from remote/local position.
- 7.5 Engines shall be Type approved Marine Diesel Engine, four-stroke, pneumatic started, developing power suitable to meet designed speed under tropical conditions.
- 7.6 Engines shall comply to ISO-3046 rating for tropical condition.
- 7.7 The diesel engines must adhere to controlling limits of NOx and SOx laid out in Annexure VI of MARPOL 73/78 – Regulation for the prevention of Air Pollution from ships and SOx/NOx technical code.
- 7.8 The main engine must be type tested and should have ICFN (100% MCR) rating at tropical conditions as per ISO-3046 for the following applications:

Time	Load
10%	70-100%
20%	10-35%
70%	35-70%

- 7.9 85% MCR (ICFN) rating of engines at tropical condition shall be able to achieve the specified max speed of 20 knots at full load displacement.
- 7.10 Direction of rotation for engines to be decided during details engineering.
- 7.11 Each engine shall be capable of being started and stopped from remote/local position i.e., MCR/Engine room. Necessary standard accessories for proper engine operation shall also be provided as per OEM's recommendation.
- 7.12 The propulsion system annual exploitation shall be catered for minimum 3500 hrs. The MTBO for top overhaul and major overhaul to be specified by OEM.
- 7.13 Provision for mounting accelerometers/ sensors/ torsional- based sensors for measuring vibration or for AI-based predictive maintenance is to be provided.



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- 7.14 Firm to indicate the load increasing time from 0 to 100% MCR when the engine is correctly warmed up and pre-lubricated, fresh water and lube oil temperatures higher than 45 deg C in usual conditions and in emergency conditions.
- 7.15 The unloading times are to be general, half the loading time. However, in case of emergency, engine should be stopped without delay.
- 7.16 The firm needs to provide minimum continuous output without time limitation. Graphs showing engine power output, torque versus RPM, and an engine operation regime graph with zones must be included.
- 7.17 Low load restrictions should be highlighted for operational clarity and efficiency.
- 7.18 The technical specification of main engine shall be as per OEM standard meeting Class requirements and will generally consist of the following system:

- (a) Engine Power as specified
- (b) Engine basic design
- (c) Basic configuration
- (d) Starting system
- (e) Fuel system
- (f) Lube Oil System
- (g) Cooling System
- (h) Exhaust System
- (i) Combustion System
- (j) Control and Monitoring System.

7.19 Material for pipe/end connections should be compatible with the following materials for respective system interfaces:

Seawater:

Pipe Material: 90/ 10 Cu Ni to BS2871 or S1545

Flange/End connection: Composite flange (GM/MS)/ 90/10 CuNi to as 2871 or S1545

Valve construction: GM to BS1400LG4C.

Lub Oil/Fuel Oil:

Pipe Material: Seamless steel pipe to ASTM A 106 Gr.B

Flange/ End connection: Steel to S 2062 Slip on flange Valve construction: GM to Bs1400LG 4C

Compressed air system:

Pipe Material: Seamless steel pipe to ASTM A 106 Gr.B or equivalent

Flange/ End connection: Steel to IS 2062 slip on flange or equivalent

Valve construction: GM to BS 1400LG 4C.

Exhaust System:

Pipe Material: SS to AISI 304

Flange/ End connection: steel to S2062 Slip on flange

Valve construction: GM to BS1400LG4C.



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7.20 Lube Oil System: Each main engine lubrication oil system shall consist of the following:-

- (a) Engine driven lubricating oil pressure pump having suction strainer located in the sump.
- (b) Lubricating oil heat exchanger
- (c) Thermostatic valve
- (d) Duplex lubricating oil filter
- (e) Electrically driven lub oil priming pump
- (f) Self-cleaning lub oil filter.
- (g) Lub oil filter by-pass

7.21 A foul margin of 10% to be considered while designing the lub oil cooler.

7.22 Provision for emergency sea water connection from fire main system to be provided.

7.23 Fuel flow measuring provision shall be made in inlet and return line of Diesel engines for facilitating recording actual fuel consumption.

7.24 The shop test should adhere to the Class acceptance test, lasting approximately four hours. During this test, the engine must be connected to a hydraulic dynamometer and run using Diesel oil and onboard lubricating oil. Class surveyors will individually inspect critical sensors during the Factory Acceptance Test.

8. MACHINERY OPERATION, MONITORING AND CONTROL SYSTEM:

- 8.1 The main engines shall be fully automatic remote controlled from wheelhouse and MCR with provision of local control also. Provision for hard wiring for stopping of Main Engines shall be provided as per Class Rules.
- 8.2 Diesel engine shall aspirate from engine room supply. Air volume at intake to be provided by the OEM.
- 8.3 The engine will have closed circuit system with their own fresh water, fuel oil, lube oil and sea water pumps.
- 8.4 The engines are to be capable of being controlled locally at the engines (from their LCPs – supplied by the Engine OEM) and remotely from machinery control room (MCR) through IPMS.
- 8.5 The guaranteed specific fuel / lube oil consumption (SFC) is to be mentioned in the technical offer (with not more than 5% tolerance at maximum rated power) and demonstrated during factory acceptance trials. Specific fuel/ lube oil consumption data and curves at various engine power and speed are to be submitted as part of technical offer.
- 8.6 The machinery should be able to be started, monitored, controlled & stopped from the Local, Remotely from IPMS.
- 8.7 Torsional vibration calculation: Torsional vibration analysis (TVA) of the Diesel engine shall be undertaken by Diesel engine supplier. Torsional & axial vibration calculation for main diesel engine & high speed coupling is to be approved by Class. TV calculations indicating basic data, duly approved by Class are to be submitted to MDL and ICG. The manufacturer should confirm that the concerned main diesel engine is torsionally safe for specified operation.
- 8.8 Turning gear arrangement shall be provided for alignment, operation & maintenance purposes. The turning gear device shall be engaged only manually when the engine



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is not running. An interlock shall be provided permitting starting of the engine when turning gear is disengaged and same shall be indicated both locally & in MCR through IPMS.

- 8.9 Each engine shall be delivered with torsional flexible coupling suitable for connecting with gear box to prevent excessive torsional vibration in the shafting and shall absorb relative shock displacement between engine and Gear box. The coupling arrangement shall be capable of transmitting the maximum torque from the Diesel engine and absorbing the maximum shock movement between the engine and the reduction gearbox.
- 8.10 Exhaust line back pressure calculation to be provided and air losses at suction.
- 8.11 The propulsion system annual exploitation shall be catered for minimum 3500 hrs.
- 8.12 Each engine set shall consist of Local Control Panel having facility of following:
- (a) PLC based control system with facility of interfacing all input and output signals, engine and alternator mounted sensors, switches, pressure transmitters, RTDs, Thermocouples etc.
 - (b) HMI for Control and monitoring of all engine parameters
 - (c) A duplex filter shall be provided on each fuel line of the diesel engines.
 - (d) The engine to be supplied with inbuilt starting air system which shall be connected to ships compressed air system of 30 kg/cm². Min & Max air consumption per normal start & cold start is required to be furnished by OEM along with technical offer.
 - (e) The engine to be supplied with its own inbuilt, closed lube oil system with engine driven lube oil pump directly coupled to the engine. Engine lube oil system design should take care of priming/pre-lubrication of the engine during starting & stopping. The requirement of pre-heating shall be provided as per class rule.
 - (f) Following information shall be provided along with offer.
 - (i) Wet sump capacity (Max)
 - (ii) Average Lube oil consumption,
 - (iii) Quality of lube oil.
 - (g) The engine to be supplied with its own inbuilt, closed fresh water system with engine driven FW pump directly coupled to the engine.
 - (h) Safety alarm & trip be included for high Fresh water temperatures. The fresh water system must be provided with the expansion tank. Expansion tank with required control and monitoring instruments to be provided by OEM.
 - (i) Seawater cooling system to be supplied with engine driven seawater pump with capacity to cool engine system.
 - (j) Motor driven seawater pump of adequate capacities are to be provided for emergency cooling of entire propulsion train as a backup of Gear driven pump.
 - (k) Each engine to be fitted with its own inbuilt fuel system along with pumps.
 - (l) Engine manufacturer shall supply expansion bellows & silencer as per class requirement (complete with mating flanges & fasteners, as required). Complete information on the exhaust gas flow and temperature shall be indicated by OEM.



- (m) Special hanger supports (Fixed & movable) shall be supplied by engine supplier for exhaust ducting. Total 10 sets of Fixed and 10 sets of movable hanger supports to be supplied.
- (n) Engine in built systems & engine modules shall be provided with bellows & flexible hoses as required to take care of the engine vibrations. OEM is to supply all counter flanges, fasters, gaskets / fittings for all utility systems which are required to be interfaced with ship's system.
- (o) Electronic local control panel including Start / Stop facility and continuous operation, complete functionality for all possible operating conditions (i.e. Alarms, Warnings, Interlocks and Trips etc.) are to be provided by OEM. Additionally, remote control including Start / Stop facility and continuous operation should be provided through serial links signal for IPMS as per the class requirement. Lube oil pump- electric driven, for pre-lubrication to be provided , if required
- (p) Pre heater Start/stop with auto-manual mode and auto temperature based cut-off.
- (q) The main engine must be type tested and should have ICFN (100% MCR) rating at tropical condition as per ISO-3046 for the following applications

Time	Load
10%	70-100%
20%	10-35%
70%	35-70%

- (r) 85% MCR (ICFN) rating of engines at tropical condition shall be able to achieve the specified max speed of 20 knots at full load displacement of 3500MT
- (s) Cruising Speed - 12-15 knots.
- (t) Provision for the fitment of a torsional based vibration sensor if required for the Collection of data to support an AI-based predictive maintenance system.

9. LOCAL CONTROL & MONITORING PANEL (LCP):

- (a) LCP shall be designed, constructed & facilitated as per class rules.
- (b) LCP shall be capable of providing necessary control and monitoring of parameters along with system safety, protection and interlocks.
- (c) LCP shall be comprised of latest technology PLC, HMI and Engine Control System.
- (d) Provision for interfacing all engine mounted RTDs, Pressure Transmitters and other sensors shall be available in LCP.



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- (e) LCP shall provide all necessary hardwired signals in required forms (i.e. DI / DO / AI / AO etc.) to interface with IPMS and AI which will be finalised during detail design.
- (f) Supplier to provide list of hardwired signals and soft signals in Modbus format.
- (g) All necessary indication lamps, push buttons and Emergency Switch along with Audio-Visual alarm facility shall be provided as per class requirement.
- (h) Necessary control and indication of priming pump & Preheater (as applicable) to be provided on LCP.
- (i) Cable entry will be from bottom and removable gland plate shall be provided with suitable cable glands lose.
- (j) Earthing bolts, vibration mounts shall be provided with LCP.
- (k) Necessary cable glands, Lugs are to be provided.
- (l) Paint shade shall be as per class rules.
- (m) Enclosure shall be drip proof IP-44 for machinery spaces.
- (n) Ingress Protection for engine-mounted panels/controls should be designed in order to withstand fixed local water based fire-fighting system. IP rating for these to be indicated by the OEM.
- (o) All the alarms, indications, monitoring and control system should as per +ACC notation of equivalent of ABS or IRS

10. MAIN FUNCTION OF LCP:

- (a) Monitoring of engine and auxiliary system parameters.
- (b) Control of engine and its auxiliary equipment.
- (c) Speed governing of engine including normal and emergency loading.
- (d) Engine safety protections.
- (e) Priming pump Start/ Stop.
- (f) Local/ Remote control selection.
- (g) Monitoring of Fresh water temperature, Lube oil pressure, Fuel oil pressure, Exhaust temperature, Engine speed etc.
- (h) Provision of Audio-Visual alarm as per class requirement.

10.1 Facilities to be provided on LCP front door:

- (a) High resolution HMI display for indicating the engine control parameters and status.
- (b) Hour counter
- (c) LO temperature
- (d) Fresh water temperature
- (e) Local/ Remote selector switch
- (f) Provision for Engine Speed raise/ Lower.
- (g) Emergency stop button.
- (h) Safety reset button
- (i) Start & Stop button.



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- (j) Engine RPM.
- (k) Engine speed indication.
- (l) Priming pump Start & Stop.

11. ENGINE CONTROLS: Following parameters should be displayed at LCP & to be interfaced with IPMS .The list is indicative and subjected to change based on OEM recommendations and class rule.

- (a) Start and stop of ME
- (b) Speed increase/decrease
- (c) Emergency stop
- (d) All functional monitoring parameters of Main Diesel engine
- (e) Common audio visual alarm display
- (f) Safeties override: Only contact is available in LCP for activation from remote station.
- (g) RPM indicator
- (h) Interlock indication
- (i) Common audio/ visual Trip indication
- (j) Ready to start indication
- (k) Safeties reset.
- (l) Safety stops AS PER CLASS RULES FOR DIESEL Engines as well as interfaced equipment's.
- (m) Automatic sequence for priming pump

12. INSTRUMENTATION/ ALARM/ TRIPS/ INTERLOCKS: Instruments/alarms/trips etc. shall be provided for Main Engines, as per OEMs recommendations meeting Class requirements.

13. REMOTE CONTROL SYSTEM FOR MANEUVERING OF PROPULSION PLANT:

- (a) The supplier of the propulsion plant shall include a complete set of Remote Control System (RCS) in their scope of supply for maneuvering Main Engine, GB and CPP system remotely from Bridge, MCR and from Docking Consoles in Bridge Wings.
- (b) Control Panels (dropping plates, flush type) shall be supplied loose for MCR and Bridge with full remote control functionality and control panel for limited control functionality for Docking Consoles (separate sets for port & stbd) to be provided. All control and monitoring facilities shall be as per class requirement and OEM recommendation to meet +AMS NIBS and +ACC notation.
- (c) Remote Control system(RCS) for Bridge and MCR is to include minimum following functions and additional functions as per requirement/manufacturer's recommendation:
 - a. Start/Stop of main engine
 - b. Speed up/down
 - c. Pitch up/down



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- d. Emergency stop
 - e. Clutch-in/Clutch-out of Main Engine
 - f. Clutch-in/Clutch-out of External Fire-Fighting pump
 - g. Other functions as per class requirement/OEM recommendation.
- (d) RCS system shall include monitoring of critical parameters such as engine speed, pitch angle etc. and throttle lever for control of pitch angle and engine speed as per combinatory curve. Developing a combinatory curve (based on dynamic analysis) to suite ship's most efficient working profile shall be responsibility of a propulsion package supplier.
- (e) RCS system shall have Non Follow Up (NFU) mode of control for pitch and engine speed by push buttons & Follow Up (FU) mode of control by Lever as per combinatory curve from the locations at MCR Console, Bridge Console and Docking Consoles in Bridge wings (Separate for port & stbd). The control transfer philosophy between local and remote locations shall be in accordance with class rules and shall be bump less to ensure safety of ship and seamless transfer of control. Local control is through LOPs of the respective propulsion equipment and remote locations being MCR console, Bridge Console and docking consoles (Port & stbd) in bridge wings.
- (f) RCS Control panel dedicated for MCR will be fitted on the MCR console (IPMS scope of supply) and RCS control panels dedicated for bridge and bridge wings will be fitted in the Main bridge console and docking consoles (both IBS scope of supply). Propulsion supplier to provide all technical details, drawings etc to IBS and IPMS suppliers for the integration of RCS panels on their respective consoles.
- (g) Necessary hardware and software for designated functionality shall be included in the scope of supply. RCS system to be fed with redundant power supply and UPS for 30 min. back up.
- (h) Preparation of necessary signal interface (hardwired & soft) between DE, GB, CPP and RCS to achieve satisfactory remote control and monitoring facility will be responsibility of the propulsion package supplier. Preliminary list of signals from each OEM to be indicated in the offer document.
- (i) Generally control in command (master) shall be bridge and other locations will be slave and they should follow the commands given by the bridge after acknowledgment. Needle Pointer indicator/ equivalent mechanism to be provided on the slave levers to indicate the position of the master lever. Transfer mechanism will be decided during TNC meeting/detailed design.



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- (j) Additionally separate EOT transmitter will be provided on Bridge console and Docking consoles whereas EOT receivers will be provided on MCR and Engine room. EOT system will be included in IPMS scope supply.
- (k) Training ship is having trainee bridge console which is replica of main bridge console but will be used in simulation mode without any control. The Propulsion package supplier shall include one set of RCS control panel which should be similar to the one which will be fitted in main bridge console and it should be supplied loose. This RCS control panel will be used in simulation mode (without any control) for training purpose. Integration of RCS control panel in training bridge console will be IMPS scope of supply however propulsion package supplier shall assist IMPS supplier for developing the simulation.
- (l) Supplied Main Diesel Engine shall be mirror image installation on-board with orientation of turbocharger can be changed as per site requirement and will be finalized during TNC/detail engineering without any cost implication.



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Annexure - B

TECHNICAL DETAILS – REDUCTION GEAR BOX

1. SCOPE OF SUPPLY:

- (a) Scope of supply will cover Design, Manufacture, Inspection, Testing, trial, Commissioning, Packaging and Forwarding & Satisfactory Operation on board ship for all the equipment's, fittings & instruments listed in this specification during ship trials & ship cruising.
- (b) The manufacturer shall provide all information required for integration of the equipment on board the ship. The equipment shall be designed and constructed so that it can be fully integrated with the subsystem to which it interfaces.
- (c) All components shall be compatible in order that the functional performance of the equipment is not degraded as a result of its integration within the system as a whole.

2. OVERALL VIEW OF GEAR BOX SYSTEM:

- (a) The main propulsion package system consists of a twin shaft class approved arrangement with one diesel engine per shaft driving a controlled pitch propeller (CPP) through a non-reversible reduction gearbox capable of transmitting full power from a single engine.
- (b) Each gearbox shall be provided with integral thrust bearing and wet multi disc clutch and rigidly mounted.
- (c) The gear boxes shall be connected to the main engines through flexible couplings.
- (d) Each engine shall develop power not less than 5000 KW (to be ratified by class) approx. at 100% MCR. The ship shall be propelled at speed of not less than 20 knot @ 85% MCR at full load displacement and with environmental condition specified in this document.
- (e) The gear boxes should be suitable for marine use & have to meet operating profile of the ship as specified.
- (f) The shaft rake considered is approx. 3 degree with no splay.
- (g) Each class approved gearbox shall be provided with shaft turning arrangement for alignment / maintenance purposes. The turning gear device shall be engaged only manually at a standstill position of the propulsion train and shaft locking device and mounting device for oil distribution box.

3. DESIGN OVERVIEW:

- (a) IRS and ABS class rules will be the guiding standard for Gearbox design, manufacturing, installation, testing and commissioning.
- (b) Gearbox supplier shall ensure high quality product, in terms of performance, reliability, economy of weight/space, resistance to vibration and compliance to stipulated structure and airborne noise criterion.
- (c) Gearboxes are to be made from vibration resistant steel casing and shall have deep wet sump.
- (d) The equipment is to be of modular design to facilitate easy dismantling, shipping, unshipping.



- (e) Each reduction gearbox shall be single input, multiple output (viz. provision for CPP shafting & Fi-Fi pump as per design), non-reversible type capable of transmitting full power (up to 100% full power) from a single engine.
- (f) Each gearbox should be capable for unlimited trailing operation of other shaft. Lubrication of gearbox while trailing of the shaft shall be catered by means of Gear box driven lube oil pump which acts as trailing pump supported by electric driven lube oil standby pump of gearbox during shaft trailing at low rpm.
- (g) Transmission losses should be minimised and kept as low as possible. Transmission loss range to be indicated for clarity of compliance by the firms.
- (h) Each gearbox will drive each propeller with a ratio of reduction to match the propeller requirement. Gearbox should have one input shaft & two output shaft for CPP and Power take off (PTO) for external Fi-Fi pump. Pneumatic shaft brake for Fi-Fi PTO to be included in firm's scope of supply along with necessary interlocks and indications compatible to IPMS. Air filter cum moisture separator to be supplied by firm in the compressed air supply line for shaft brake. Pneumatic shaft brake compressed air requirement to be indicated in the offer. Gearbox to auto declutch External Fi-Fi PTO, if the PTO speed exceeds specified RPM. The exact rpm for External Fi-Fi PTO to declutch will be indicated during first interface meeting.
- (i) Each gearbox is to be provided with integral thrust bearing.
- (j) The gear box should have in-built clutching arrangement
- (k) Gear box should have own gear driven lube oil pump as well as Motor driven standby lube oil Pump as per class requirement.
- (l) The arrangement of Gear driven Lube Oil pump should cater for lubrication of gearbox in case of shaft trailing.
- (m) Each gearbox is to be provided with shaft turning and shaft locking device. The locking device of the propeller shaft shall be rated for maximum 50% of the nominal torque.
- (n) Provision of OD box for shafting to be provided on the gear box.
- (o) Local operating panel to be supplied. "Gear box must be designed to cater for over torque capabilities up to 120% of maximum torque"
- (p) Cabinet for lube oil electric pump (Stand-by pump) and Turning gear arrangement
- (q) Junction boxes for GB sensors/ switches/ actuators.
- (r) Installation materials i.e. glands, lugs, connectors, interconnecting cables, mounts etc to be supplied.
- (s) Special inspection opening covers are to be provided for inspection of the gear teeth and oil sprays.
- (t) Gear boxes are to be rigidly mounted (using MS chock / chock fasted).
- (u) Two gearboxes of a ship set should be mirror image of each other, however desired direction of rotation to be achieved.
- (v) OEM shall be totally responsible for correct performance of the reduction gear box on board the ship. OEM is to undertake performance guarantee of the gear box.
- (w) Provision for the fitment of a torsional based vibration sensor if required for the Collection of data to support an AI-based predictive maintenance system.
- (x) One gearbox LO cooler, seawater cooled for each gearbox. The cooler to be mounted on the top of the gear case. The seawater for the lube oil cooler will be provided from built in gearbox driven seawater pump. All fasteners for the L.O. cooler to be of stainless steel/ HT brass bolts Sea water resistant lubricating oil cooler to be provided.



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- (y) One GB driven SW pump and one Motor Driven SW pump (Standby) of adequate capacity to be provided on each Gearbox for providing SW cooling water to the Gearbox.
- (z) SW pump capacity should sufficiently cover both GB oil cooler and CPP oil cooler requirements.
- (aa) This Lub oil stand-by electrical pump is to start automatically when the system pressure drops below minimum and to stop when adequate pressure is built-up. The starter should have auto/manual as well as remote operation.
- (bb) Lub oil pressure of the gearbox system should be always higher than the SW pressure in all operating regime of gearbox.
- (cc) Allowable loads on Gear box bearings to be designed after due consideration to wear down of shaft line bearings to its maximum allowable limits.
- (dd) If indigenous firms intend to manufacture the Gear boxes with the proven design from the foreign Collaborator then firm needs to forward the MoU between the two parties clearly stating the roles and responsibilities of each party. Detail work share agreement with timelines to meet the agreed delivery schedule to be indicated in offer.
- (ee) Following additional tests as per class rules to be conducted at Factory, certified by ABS & IRS and certificates to be provided for
 - (i) Static & Dynamic balancing of gear pinion & wheels.
 - (ii) Measuring accuracy and determination of tooth contact pattern.
 - (iii) Flush test to verify the presence of metallic particle.
 - (iv) Testing of the alarms, interlocks and trips.
 - (v) Spin test in direction of rotation of the gearbox with min 10% Load.
- (ff) Gear-box should have a high MTBO and preferably match the MTBO of the main engine for optimal propulsion system reliability and performance.

4. **ASSEMBLY:**

- (a) The equipment is to be of modular design to facilitate easy dismantling, shipping, unshipping.
- (b) Basic arrangement of the propulsion train (including locations of propulsion equipment), distance between main shafts and location of ship's watertight bulkheads & decks in way of propulsion train, are considered to be fixed.
- (c) Based upon the respective equipment binding design documentation, mechanical interfaces between main propulsion equipment (Diesel engine, Gearbox and Shafting), operational/maintainability requirements, Shipyard shall refine & finalize the layout of propulsion train, within respective compartments of the ship. The same shall be fully complied by the equipment supplier.
- (d) The OEM is to indicate the dimension & weight of the largest component.
- (e) **Idling Speed/ Clutching RPM:** Reduction gear box supplier has to liaison with Diesel engine OEM to obtain the idling speed of the engine. Clutching rpm-range to be specified by Reduction gear box OEM.
- (f) **Vibration recording & Equipment health monitoring:** Fixed positions for mounting accelerometers/sensors for use when measuring vibration, is to be provided preferably by spot facing on equipment casing/base



5. REDUCTION GEAR BOX FITTINGS AND ACCESSORIES:

- (a) Each Reduction gear box shall be complete with its all necessary accessories & ancillary equipment including Vibration mountings, flexible hose, pipe, fittings, instrumentation, protection devices and control system as recommended by manufacturer as per Classification rules.
- (b) Special tools if required for installation purpose shall be provided by OEM.
- (c) Flexible connections between the gearboxes mounted equipment and any off-gear box items to be provided by OEM.
- (d) All holding down bolts are to be provided by OEM and value of tightening torque for all the fasteners has to be given by OEM.
- (e) Gear boxes are required to be provided with sufficient number of jack bolts at its foot to carry out alignment and installation work.

6. INTERFACING:

- (a) Gear box shall be compatible for interface with other ship systems, electrical systems, structures of the ship.
- (b) The Gear box control system is to be fully integrated to IPMS for start/stop, operation, alarms, interlocks, emergencies, data logging, trending and recording running hours.

7. LUBRICATING OIL SYSTEM:

- (a) Each gear box shall be complete with cooling system, lube oil system etc. with associated piping.
- (b) The gear box is to be lubricated by an integral lube oil system using gear driven lube oil pump.
- (c) **The lube oil is contained in the sump integral with bottom casing.**
- (d) All the lube oil piping and accessories such as coolers, filters, valve control instruments etc. shall be mounted on the gear box casing.
- (e) One electric motor driven lube oil pump, if applicable (with auto cut in and out facility) suitable to supply lube oil at design pressure to be supplied loose complete with starter for each gear box.
It shall also act as standby lube oil pump during starting, for lube oil supply when engine is not in operation.
- (f) While electric motor driven standby lube oil pumps, shall be supplying lube oil during starting-up, idling condition and shutting down of propulsion plants, the Gearbox driven lube oil pumps shall be supplying lube oil operating at output shaft speed corresponding to minimum clutching in RPM and above.
- (g) The lube oil system shall be designed to withstand and maintain the lube oil pressure due to both types of pumps running simultaneously for a short period of time, during changeover.
- (h) Automatic cutting in and cutting off electric motor driven lube oil pumps is to be performed smoothly and effectively at pre-determined shaft speeds and lube oil flow/pressure conditions.
- (i) The standby motor driven lube oil pump shall meet the capacity of gear driven pump at maximum Shaft RPM. The lube oil system should be designed to cater for smooth auto cut in and cut off of the motor driven stand by pump.



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- (j) The OEM Curve should explain the relation between Gear Box speed and Lube Oil pressure requirements for satisfactory operation of propulsion plant.
- (k) One changeover type duplex oil filter with magnetic insert in the lubricating oil system to keep the oil free from foreign matters. Duplex filter element shall be reusable type.
- (l) A foul margin of 10% to be considered while designing the lub oil cooler.

8. CONTROLS AND INSTRUMENTATION:

- (a) Gear box controls, alarms, safeties & interlocks are to be as per OEMs recommendations and in accordance with the IRS and ABS class requirements.
- (b) Electronic local control panel incorporating complete functionality for all possible operating conditions (i.e. alarms, warnings, Interlocks and trips etc.) including clutching/declutching facilities are to be provided by the OEM.
- (c) Additionally, remote control and monitoring including clutching/declutching facility and continuous operation should be provided through serial links with the IPMS.
- (d) Alarms, warnings, interlocks and trips are to be provided for safe operation and indications for these, are to be provided locally and at the IPMS.
- (e) Ingress protection ratings shall be IP 44.

9. GEAR BOX OPERATION:

- (a) The equipment shall be operated in two positions i.e. local & remote.
- (b) Local operation can be activated by selecting local position on equipment LCP. Remote operation can be activated by selecting "Remote" on selector switch available on equipment LCP.
- (c) Local position is default position of operation and has highest priority even if remote mode is active in IPMS, LCP can snatch the control at any given point of time by selecting local position of local/remote switch.
- (d) Gear Box LCP to be provided by OEM. LCP shall have all local instrumentation and alarm including facility for clutch in /clutch out. All instrumentations including clutch in/clutch out and External FI-FI system facility should be interfaced with IPMS.
- (e) All gauges, sensors, electrical meters & overloads fitted are to be supplied duly calibrated and calibration certificates are to be forwarded to MDL. The sensors/gauges are to be re-calibrated post de-preservation and prior starting. Calibration certificate to this effect shall have to be issued to meet trial requirement. All gauges, Indicators, Sensors (both local & remote) are to be approved and shall meet Classification society requirement.
- (f) Each gearbox should be capable for unlimited trailing operation of other shaft. Lubrication of gearbox while trailing of the shaft shall be catered by means of Gear box driven lube oil pump which acts as trailing pump supported by electric driven lube oil standby pump of gearbox during shaft trailing at low rpm.

10. GEAR BOX MONITORING: Following parameters should be displayed at LCP & to be interfaced with IPMS. The list is indicative and subjected to change based on OEM recommendations and class rule.

- (a) Clutch oil pressure



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- (b) Lube oil pressure
- (c) Sea water pressure
- (d) Lube oil temperature
- (e) Sea water temperature
- (f) Bearings temperature
- (g) Thrust bearing temperature
- (h) Gearbox lube oil standby pump stop running
- (i) Turning gear engaged / disengaged
- (j) Shaft lock engaged
- (k) Shaft brake engaged
- (l) Clutch ahead
- (m) Clutch astern
- (n) Shaft RPM
- (o) Safety stop



Annexure - C

TECHNICAL DETAILS – SHAFTING SYSTEM AND CPP

1. SCOPE OF SUPPLY:

- (a) Scope of supply will cover Design, Manufacture, Inspection, Testing, trial, Commissioning, Packaging and Forwarding & Satisfactory Operation on board ship for all the equipment's, fittings & instruments listed in this specification during ship trials & ship cruising.
- (b) The manufacturer shall provide all information required for integration of the equipment on board the ship.
- (c) The equipment shall be designed and constructed so that it can be fully integrated with the subsystem to which it interfaces.
- (d) All components shall be compatible in order that the functional performance of the equipment is not degraded as a result of its integration within the system as a whole.
- (e) Following equipment to be supplied:

SR. NO.	DESCRIPTION	QTY
1.	Shaft (as required)	2 sets
2.	Bearing (as required)	2 sets
3.	Shafting with sleeves	2 sets
4.	Torsion meter with rpm indicator	2 sets
5.	Shaft grounding system as per class requirement	2 sets
6.	CPP propeller with rope cutter	2 sets
7.	Fairing cover for "A" and "P" bracket	2 sets
8.	Hydraulic Sleeve flange coupling	2 sets
9.	All fit bolts for shaft and Gear box	2 sets
10.	Tubes from OD box to propeller	2 sets
11.	CPP power pack	2 sets
12.	OD box	2 sets
13.	Bulkhead Seal	

2. OVERALL VIEW OF SHAFTING & CPP ARRANGEMENT:

- (a) The main propulsion package system consists of a twin stern gear arrangement (as per class approved) complete with CPP along with hydraulic power pack, Shafting & coupling sleeve shall be protected by cold setting epoxy resin & accessories, A, P & stern boss bracket bearing bush & sleeve retainers, coupling bolts, stern tube bush & bearing, cathodic protection, shaft seals, bulk head seal /glands, torsion meter with speed transmitter, Sensors and gauges for stern tube seal, rope cutters, shaft brake, hydraulic sleeve coupling to connect shafts, Water lubricated shaft bearings, Intermediate shaft bearing and all associated accessories. Tentative arrangement is shown at Appendix" 1", however OEM can refine the same as per the design to meet the class requirement.
- (b) Gunmetal sleeves shall be shrunk on tail shaft in way of bearings and adjacent to the coupling so that coupling can be removed and installed without disturbing the entire



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shaft. Fair water plates shall be fitted in way of "A", "P" brackets and outboard sleeve couplings.

- (c) The OEM shall be responsible in totality, on turn-key basis for undertaking detailed design, manufacture, test and supply of stern gear arrangement with class approved arrangement with one diesel engine per shaft driving a controlled pitch propeller (CPP) through a non-reversible reduction gearbox .
- (d) Each engine shall develop power not less than 5000 KW (to be ratified by class) approx. at 100% MCR. The ship shall be propelled at speed of not less than 20 knot @ 85% MCR at full load displacement and with environmental condition specified in GTC (General Terms and Condition).
- (e) The shaft rake considered is approx. 3 degree with no splay. The propulsion system annual exploitation shall be catered for minimum 3500 hrs.
- (f) Shafting shall be designed and manufactured in conformity with Classification Rules. Ship shafting arrangement will consist of 2 Controlled Pitch Propeller (CPP).
- (g) Classification society rules (IRS & ABS), shall be the guiding standard for Shafting & CPP design, manufacturing, installation, testing and commissioning. Shafting & CPP supplier shall ensure high quality product, in terms of performance, reliability, economy of weight/space and resistance to corrosion & vibration.
- (h) OEM should refer to the tentative shafting arrangement drawing (placed at Appx.-1). Model test data will be shared during detail design.
- (i) Following data to be provided by the OEM:
 - (i) Number of blades in CPP propeller
 - (ii) Total shaft length
 - (iii) Max propeller diameter
 - (iv) Thrust
- (j) Provision of Emergency pitch setting shall be provided as per the class requirement.
- (k) Oil distribution (OD) Box:
 - (i) The purpose of the oil distribution box is to distribute oil for the adjustment of the propeller pitch.
 - (ii) OD box is gearbox mounted.
 - (iii) OD box is located in forward end of the reduction gear.
 - (iv) The oil distribution box also contains a pitch feedback mechanism for manual as well as remote indication.
- (l) Shafting supplier shall submit shafting efficiency data and curves for all modes of operation.
- (m) Provision for mounting accelerometers/sensors for measuring vibration, is to be provided.
- (n) All material used for shafting and CPP shall be as per IRS and ABS class requirement.
- (o) CPP stern gear system should meet the +ACC class notation of ABS or equivalent of other IACS members.
- (p) Provision for emergency seawater cooling from fire main system to be provided by MDL for CPP coolers and stern tube. All accessories required for completing the system to be supplied by firm like valve, flow meter etc.
- (q) Design considerations must be made for power absorption and the operation of a single shaft (with the other shaft trailing or locked) as well as twin shaft operation at the ship's cruising/patrolling speed of 12-15 knots.
- (r) The propeller-induced vibrations should be within the limits of Class requirements Propeller should be free of harmful cavitation, vibration and noise.



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- (s) The CPP should have pitch locking mechanism enabling the propeller blades to be locked hydraulically in case of emergency
 - (t) The provision will be made in the shaft for fitting of an ICCP ring.
 - (u) OEM should provide the Shaft Earthling device (suitable spring loaded arrangement), All necessary alarms/indications for shaft grounding shall be provided as per Class rules.
 - (v) Provision and monitoring of inboard shaft bearing temperature and fitment of digital flow meter for monitoring cooling water rate for shaft seal at local and in MCR and shall be integrated with IPMS.
 - (w) All instruments should be accessible for reading, maintenance and replacement instruments used for operation and monitoring should be mounted on station convenient to the operator.

3. HYDRAULIC SYSTEM:

- (a) For each shaft line, the hydraulic system consists of the following min sub-assemblies:
 - (i) One hydraulic power pack skid type consisting of the main tank, electrically driven pump, the hydraulic components and the starter.
 - (ii) One header tank,
 - (iii) One local control panel (LCP).
- (b) Pitch changing time from full ahead to full astern or from full astern to full ahead at maximum shaft speed shall be as per class rules.
- (c) All interfaces with external piping (welding nipples, quick couplings etc.) is OEM scope of supply.
- (d) The starter cabinet and the junction box are mounted on a frame onto the power pack.
- (e) Signals from and to the HPP are sent to the IPMS via serial links
- (f) **Header tank:** In order to prevent seawater entering the system, a certain overpressure needs to be generated in the hub lubrication chamber. This is done via a header tank.
- (g) This header tank is provided with the following min. components:
Connection - BSP threaded, Respiration device, Filling connection, Drain plug, level gauge, Level switch, low oil level alarm etc.

4. LOCAL CONTROL PANEL: The Local Control Panel shall have provision for the following:

- (a) Pitch indicator
- (b) Switch "local/remote"
- (c) Button "pitch ahead"
- (d) Button "pitch astern"
- (e) lamp "power supply on"
- (f) lamp "local selected"
- (g) lamp "remote selected"



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5. MECHANICAL INTERFACES:

- (a) All mechanical interfaces for Shafting; with Gearbox, between shafting components and ship's structure shall be suitably adapted by Shafting supplier as per the design requirements, in consultation with Gearbox supplier and Shipyard.
- (b) Design requirements for Shafting components foundation as applicable, shall be provided by Shafting supplier.
- (c) Flexible hoses at all terminal points of vibrating equipment/items, inter unit pipe and pipe fittings (pipe flanges, couplings, elbows, mating flanges etc.), foundation bolts etc. are to be included in the scope of supply.
- (d) Provision for the fitment of a torsional based vibration sensor if required for the Collection of data to support an AI-based predictive maintenance system.

6. STERN GEAR CONTROLS & MONITORING:

- (a) OEM needs to provide local control panels along with necessary mounts for fitment of control panels.
- (b) Individual local control panels for both the shaft lines is to be provided for indications and alarms.
- (c) The same is required to be interfaced with ship's IPMS.
- (d) Panel colour and IP rating shall be as per IRS and ABS class rules.

7. INSTRUMENTATION/ ALARM/ TRIPS/ INTERLOCK:

- (a) Instrumentation /alarm/trips/interlocks to be provided as per OEMs recommendations.
- (b) All Instrumentation shall be easily accessible for reading, maintenance and replacement.
- (c) Instruments used for operation and monitoring should be mounted near to equipment for the convenience of the operator.
- (d) All gauges, indicators, sensors (both local & remote) are to be class approved and shall meet Classification society requirement.
- (e) All gauges, sensors, electrical meters fitted are to be supplied duly calibrated and said calibration certificates are to be forwarded.
- (f) All the alarms, indications, monitoring and control system should as per +ACC notation of equivalent of ABS or IRS



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Annexure "1"

GENERAL POINT FOR MOTORS AND STARTERS

1. Motors.

- (a) Motors shall be suitable for marine use and conform to latest classification rules of American Bureau of Shipping (ABS) / Indian Register of Shipping classification requirements.
- (b) Motors shall be of standard squirrel cage continuous rated induction type.
- (c) All Motors including Fractional HP motors shall be suitable for 415 Volts, 3 phase, 50 Hz AC supply.
- (d) All Motors shall have class 'F' insulation and totally enclosed with minimum protection of IP-44.
- (e) Motors fitted on the Weather Deck shall be of IP-56 and shall be provided with anti-condensation heaters.
- (f) All motors of 50HP/37.5 KW and above shall be provided with space heaters.
- (g) Interlock is to be provided on starter for switching off the space heater when the motor is switched ON.
- (h) All motors weighing 20 Kgs, and above shall be provided with lifting eyebolts.
- (i) Name plate in English made from engraved brass(black) on weather deck and anodized aluminium (black) in other compartments, indicating motor rated starting current, full load current, rpm, class of insulation, rated voltage, rated running current, number of phases, number of poles and frequency shall be provided.

2. Cable Connections.

- (a) The electric cables shall enter the terminal box on the motor through glands, cable glands to be supplied alongwith the motor.
- (b) Crippage distance of 20mm space for connecting the cables inside the terminal box should be provided.

3. General.



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- (a) All motors of 13.5 HP/10 KW & above shall be provided start-Delta Starters or soft starters.
- (b) Motors below 13.5 HP/10 KW shall be provided with direct on-line starters.
- (c) Fractional HP motors shall be provided with suitable MCCBS/MCBs only.
- (d) Starters to have current protection.
- (e) Starters shall be provided with under voltage protection for motors above/ HP.

4. **Electrical Supply.**

- (a) The starter shall be suitable for 415 Volts, 3 Phase, 50Hz Ac supply.
- (b) The starter shall be provided with Triple Pole Isolator Rotary type incomer.
- (c) MCB/ MCCB.
- (d) ON and OFF Push Buttons.
- (e) Control fuses.
- (f) Motor 'ON' LED indication for Local and remote(As applicable).
- (g) Provision for Auto ON/OFF facility(As applicable).
- (h) Electronic external/separate single phasing preventer to be provided to protect all the three phases of the motors rates 13.5 HP/10KW and above.
- (j) Provision for remote ON-OFF Facility.
- (k) Spare NO/NC contacts for interfacing as required to be provided.
- (l) KED indications with tallies for the following fault condition to be provided.
- (m) Single phasing.
- (n) Overload.
- (p) Thermister Over Heating, if applicable.
- (q) Contactor with two potential free contacts(spare).
- (r) Timer applicable.



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- (s) Over Load Relay (85 to 150%).
- (t) Provision of connecting anti-condensation heater/ space heater.

6. **Thermister and overload Protection.**

- (a) The motor thermal protection system in the starter must detect the abnormal rise in temperature by means of positive temperature co-efficient thermistors (PTCT). Motor should trip due to rise in temperature.
- (b) Timer.
- (c) It should have wide operating range, repeated accuracy and wide time setting.
- (d) Electronic timers should be provided for Star-Delta application.
- (e) Thermal timers to be provided for over lead protection.

7. **Mechanical Construction.**

- (a) The motor starter panel shall be made of 14 SWG Aluminium construction conforming to (A5083 Hill or H 112 or H 116) or (A5086 Hill or H 112 or H 116) or 16 SWG MS Sheet Steel confirming to IS-2026. The panel and assemblies are to be reinforced to withstand the mechanical, electrical (Magnetic) and thermal stresses likely to be encountered in service and are to be protected against corrosion. The panel to be power coated and of dead front type.
- (b) Control Panel fitted on the weather deck shall be made of non-magnetic 16 SWG mat finish stainless steel conforming to IS-316 with IP-56 protection.
- (c) The control panel shall be suitable for bulkheads/in-built eqpt mounting with necessary bolts, nuts, washers, spring – shock mount, screw less terminals etc.
- (d) Suitable locking device will be provided for tixing screws and bolts for preventing them from loosening.
- (e) The panel shall be provided with single hinged door with efficient locking device and door stoppers with Neoprene gasket all around. It shall be suitable for front side maintenance support services.



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(f) The bottom plate shall be of removable type for cable entry through cable glands.

(g) Size of panel to be as small as possible considering space constraints on ship.

8. **Cable Connections.**

(a) The electric cable shall enter the panel from bottom through glands, cable size will be indicated by MDL for supply of cable glands.

(b) The screw less connecting terminals shall be positioned at the bottom of the panel, with all the internal wiring terminated on one side.

(c) Crippage distance of 20mm space for connecting the cables inside the panel should be provided.

(d) 10% spare terminals to be provided.

(e) All electrical supports inside the starter panel shall be of high quality and moisture resistant materials. The contact surfaces and studs of all devices, to which electrical connections are made, shall be tinned.

9. **Internal Wiring.**

(a) The Internal wiring shall be made by using LFH type copper multi-stranded conductor flexible cables of adequate rating with minimum 1.5 sq. mm. size and has to be neatly dressed and bunched.

(b) All control and auxiliary wirings shall be provided with numbered ferrules at both the ends for easy identification.

(c) A laminated circuit diagram plate to be provided inside the panel at appropriate place. Suitable earthing to be provided for earthing the panel with the ship hull.

10. **Name Plate.**

(a) Name plate in English made from anodized aluminium (black) shall be provided for all devices in the panel to identify their function.

(b) Component tallies shall be provided for all the components inside the starter panel.



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(c) Operating voltage tally shall be provided on the front top. Operating voltage tally shall be in red letters.

11. **Painting Scheme.**

(a) Starter Panel to be painted with Polyster power coating of RAL-7032 paint.

12. **Spares.**

(a) Standard spares for unrestricted service meeting the classification should be included in the scope of supply and the list of such spares with Part/Pattern number and quantity in numbers are to be furnished in the offer. These spares are to be supplied as a part of the equipment.

13. **Binding Drawings/Documentation.**

(a) General arrangement Drg. Of Motors and Starters including weight and dimension.

(b) Internal Wiring Diagram.

(c) Calibration Certificate for timers, Thermisters and Overload relays as applicable.

14. **Trials.**

(a) Acceptance of Motors and Starters will be Subject to Satisfactory Results of Performance tests and routine tests. The tests data offered during Performance tests of Motors in Factory Premises to be documented and forwarded to MDL, as part of the Documentation.

(b) Tables of Relay Ranges, Fuses, MCBs, MCCB, Timers & SPP for Motor Protection.



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Annexure "3"

WEIGHT CONTROL DATA SHEET

EQUIPMENT DESCRIPTION		EQUIPMENT NO.	
COMPARTMENT		LOCATION	

SWBD :

TOLERANCE CODE
 PRELIMINARY EST.
 DESIGN EST.
 M.T.O (CALC)
 WEIGHED
 TOLERANCE ± %

1. WEIGHT (Kg.)

(a)	DRY	Kg ±	%
(b)	FLUID	Kg ±	%
(c)	OPERATING	Kg ±	%
(d)	TEST	Kg ±	%
(e)	TOTAL	Kg ±	%

2. EQUIPMENT DIMENSIONAL DATA (mm) & Co-ordinates of CoG

 PLAN	 PLAN	 PLAN
 ELEVATION	 ELEVATION	 ELEVATION

OVERALL SIZE		CENTRE OF GRAVITY	
'A'		'X'	
'B'		'Y'	
'C'		'Z'	

NOTE :

- ALL OFFERS SHALL INCLUDE THIS DATA SHEET DULY FILLED IN BY THE SUPPLIER (SIGNED, DATED & SEAL AFFIXED).
- ALL FINISHED ITEMS SHALL BE WEIGHED & A CERTIFICATE SHALL BE PROVIDED AS PER ATTACHED SHEET.
- SEPARATE SHEETS SHALL BE COMPLETED FOR EACH INSTALLED EQUIPMENT.
- ORIGIN OF 'X', 'Y' AND 'Z' TO BE INDICIATED.

SUPPLIER'S SEAL

SUPPLIER'S SIGNATURE & DATE



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Annexure "4"

WEIGHT CERTIFICATE

EQUIPMENT DESCRIPTION:

EQUIPMENT NO. :

The form shall be completed by Supplier & shall be supplied along with the equipment.

SUPPLIER'S NAME

Ref. Drg. No.

ADDRESS

Part No.

TELEPHONE NO.

ORDER NO.

EQPT. NO.

METHOD OF WEIGHING:

Supplier shall prescribe Method & Equipment Used:

DATE OF LAST CALIBRATION

SPECIFIED ACCURACY REQUIREMENT

NOTE :-

RESULT OF WEIGHING TOTAL EQUIPMENT DRY WEIGHT

(Excluding packing, temporary protection etc.)

ALLOCATED WEIGHT

(Weight estimate agreed by purchaser and supplier based on order specs).

REASONS FOR VARIATION BETWEEN ALLOCATED WEIGHT AND CERTIFIED WEIGHT:

WEIGHING ADDRESS:

WITNESSED BY

FOR SUPPLIER

FOR PURCHASER

Representative

Representative

Date:

Signature / Date & Seal

Signature/Date & Seal



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ANNEXURE "6"

Checklist with offer:

- 1) The supplier to supply as a minimum the following information along with his technical offer:
- 2) Technical Specification of the equipment's.
- 3) Details of all connections to equipment, Vibration details with pattern no, seat details, flange details etc.
- 4) GA drawing of all equipment's, sub-assemblies & accessories.
- 5) Technical parameters of all equipment & accessories.
- 6) Outline drawings of the equipment indicating overall dimensions, C.G. and Maintenance envelope.
- 7) P & ID and E&ID diagram.
- 8) Complete Weight breakdown (excluding & including oil).
- 9) Heat dissipation of the Equipment
- 10) Details of other ship services required.
- 11) Tools required for maintenance.
- 12) Recommended onboard and base spares holding (for 2 year and 5 years operation respectively)
- 13) Manufacturers list of spares for installation & Commissioning.
- 14) Instrumentation List & Diagram.
- 15) Brief on integration of RO Plant Control System with ship's Integrated Control System.
- 16) Inter-unit cabling diagram clearly indicating each unit/sub-unit and types of cables being used for the system.
- 17) Requirement of Greases, Oils etc., with their equivalents.
- 18) Proposed factory tests and Inspection plan.
- 19) Proposed preservation plan.
- 20) Delivery time from receipt of order.
- 21) Clear demarcation between the scope of supply of firm and that of the yard.
- 22) List of equipment required for installation and operation of the equipment and not supplied by the manufacturer.
- 23) Trial and commissioning time of complete system on board.
- 24) Special tools and test equipment to be supplied for on board maintenance.
- 25) List of main equipment included in the standard scope of supply.
- 26) List of accessories inclusive / not inclusive in the standard scope of supply.
- 27) List of tools & accessories required for installation & commissioning
- 28) Reliability parameters.
- 29) User list of similar equipment supplied by the manufacturer.
- 30) Details of standard and optional factory tests.



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MOTOR:

- 1) Service
- 2) Type of motor
- 3) Power supply – Voltage, Frequency & No. of phases
- 4) Output of motor
- 5) RPM (No load and full load)
- 6) No. of poles
- 7) Full load current
- 8) Starting current
- 9) Starting torque when the ambient temp. is 30oC
- 10) Pull out torque
- 11) Run up time
- 12) Motor Enclosure & Protection provided
- 13) Noise & Vibration level
- 14) Class of insulation
- 15) Method of starting – Remote, local facility & indication
- 16) Type of winding
- 17) Weight of the motor
- 18) Over all dimensions of the motor
- 19) Terminal connection detail
- 20) Efficiency at 100%, 75% & 50%
- 21) Power Factor at 100%, 75% load
- 22) Direction of rotation
- 23) Shaft material
- 24) Lifting arrangement of motor
- 25) Whether RIS unit provided
- 26) Whether heaters are fitted and supply voltage to heater is indicated
- 27) Whether heater supply required
- 28) Frame size
- 29) Method of mounting
- 30) Serial no of machine
- 31) Duty cycle (period of output)
- 32) Particulars of shaft end
- 33) Heat dissipation

STARTER:

- 1) Service
- 2) Type of starter
- 3) Voltage, frequency and No. of phases
- 4) Protection provided
- 5) Enclosure
- 6) Vibration level
- 7) Method of mounting and requirement of mounts
- 8) Method of starting, remote and local control



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- 9) Facilities and indication provided.
- 10) Weight and overall dimensions of the equipment
- 11) Rating of the contactors
- 12) Spares provided
- 13) Class of insulation



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Annexure '7'

MANUFACTURER'S RECOMMENDED LIST OF SPARES TOOLS AND SOFTWARE (MRL-OBS)

VESSEL/ EQUIPMENT: 01 TRAINING SHIP

Sr No	Eqpt Part No./ Model no./SI No.	Eqpt Description	OEM Name	Vendor Name	Illustrated Spare Part List (ISPL) Reference/ Part No. of	Desc of Spare	Country of Origin	Unit Price	Seller Order No. & Date	Currency Code	Total Qty	VED* Category	Recommend ed scale for 01 Training Ship	Remarks

MANUFACTURER'S RECOMMENDED LIST OF SPARES (MRL-B&D)

VESSEL/ EQUIPMENT: 01 TRAINING SHIP

Ser No	Eqpt Part No./ Model no./SI No.	Eqpt Description	OEM Name	Vendor Name	Illustrated Spare Part List (ISPL) Reference/ Part No. of Spare	Desc of Spare	Country of Origin	Unit Price	Seller Order No. & Date	Currency Code	Total Qty	VED* Category	Recommended scale for <u>01 Training Ship</u>	Remarks

*VED- VITAL / ESSENTIAL/ DESIRABLE analysis of spares to be carried out by OEM prior to submission to the Buyer.

Original Equipment Manufacturer (OEM): _____ (Complete Address)

1. Data regarding maintenance spares/stores like lubricants, sealing compound, gases should be given separately giving source of supply.
2. Data furnished as OBD and B&D should also include software backups, as applicable



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3. In “Remarks” column following information (if applicable) be given:-
- If an item has a shelf/operational life it be marked as ‘G’ and life be indicated
 - Matching set of components be indicated.
 - Item which can be locally manufactured in India should be marked ‘LM’.
 - Items which cannot be manufactured in India due to sophisticated design/ technology may be marked as ‘SI’ (Special Item).
 - If a component/assembly is common to other similar equipment offered by the OEM earlier, these should be marked ‘CM’ and Name of the equipment be indicated.
4. OBS and B&D spares list should be drawn out of the ‘Part List’ of the equipment, which should be separately given as part of Technical Manuals.
5. If the main equipment consists of other equipment, then OBS and B&D spares list should be prepared for them under proper heads. OBS and B&D spares list is to be prepared as per the maintenance concept of the customer.
6. Items provided along with the equipment as spares should also be included in OBS and B&D list
7. Modules/ Shop Replaceable Unit (SRU) / assemblies should be listed and their components should be included under them so as to relate each item of spare to their module / SRO / assembly.
8. OBS and B&D list for test equipment should also be provided on the similar format.
9. Cost to be indicated in Price bid only.

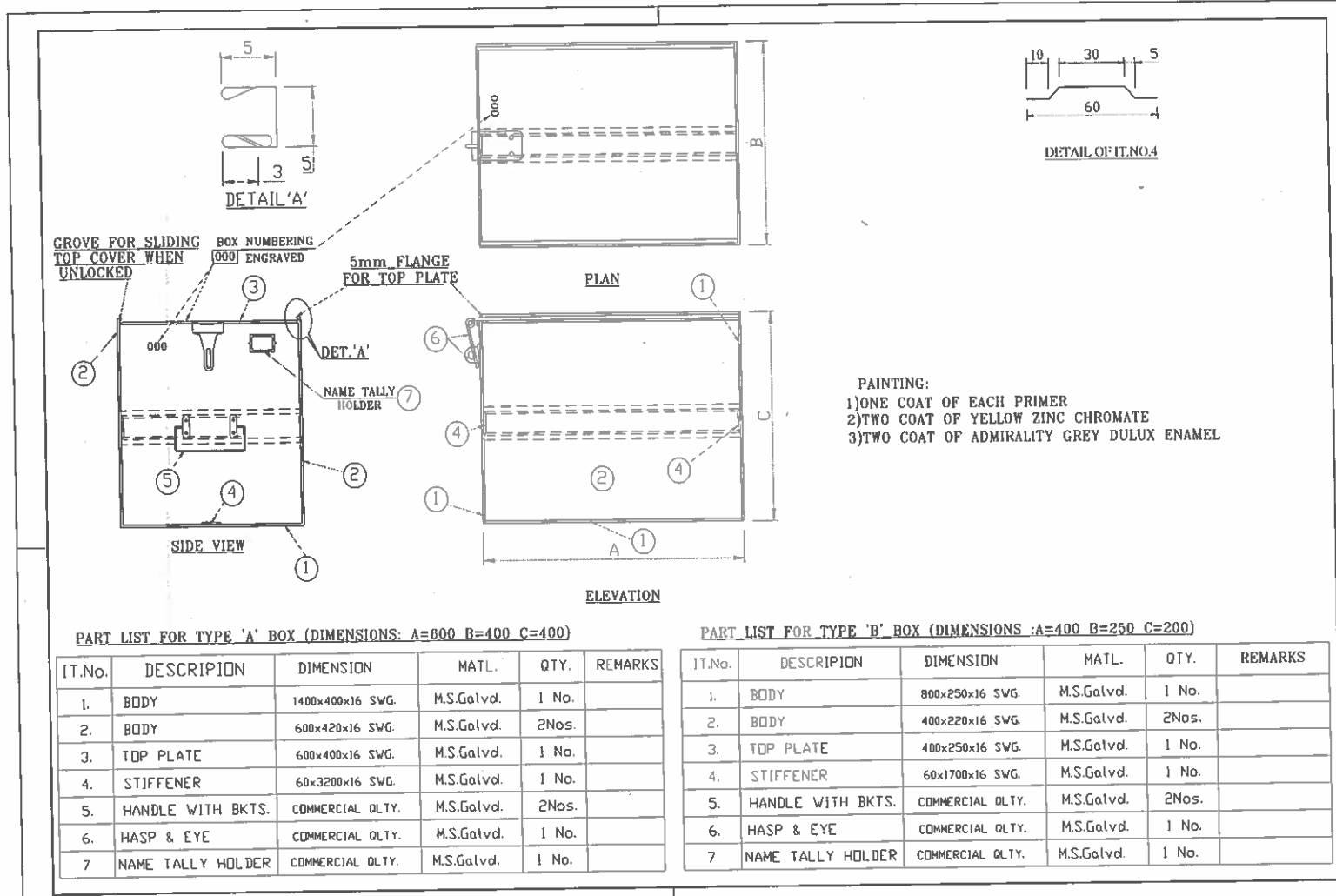


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Annexure "8"
REFERENCE DRAWING FOR SPTA BOX





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Annexure “9”

Maintenance Management Software (MMS) format

Maintenance Interval Schedule	Tasks to be performed	Detailed task description with corresponding equipment image in PDF/ jpeg format	Spares required for performing the tasks			Tools required
			Description	Quantity	Dimension/ weight	
Example:						
Initial 500 Hours	Aux water pump inspect	Check following components for wear and damage 1)Bearings 2)Impeller 3)Seal	Nil	Nil	Nil	1) 1U-7546 chain wrench 2)Engine standard tool kit
	Battery electrolyte level check	1)remove filler caps 2)Add only distilled water if necessary 3)Keep the battery clean 4)clean the terminals with fine grade of sandpaper if required.	Distilled Water	Nil	Nil	
	Engine oil filter change	1)Remove oil filter with 1U-7546 chain wrench 2)Clean sealing surface of filter mounting. 3)Apply clean engine oil to new oil filter gasket 4) intall the new oil filter. Tighten the filter until filter gasket contacts the base. Do no overtight the oil filter.	2) Oil filter gasket	1	Nil	

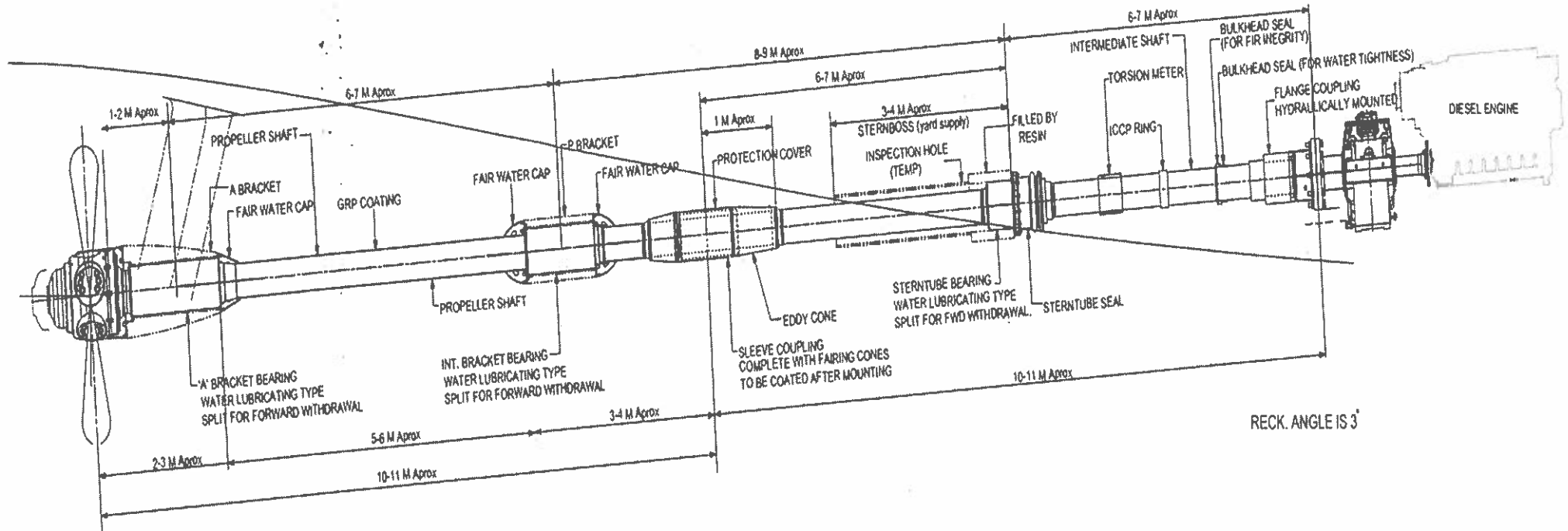


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ANNEXURE "10"

TENTATIVE ARRANGEMENT OF PROPULSION PLANT



Above arrangement for reference only.



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Annexure "11"
TIMELINES FOR TASKS AND DELIVERABLES (DURATIONS) OF PROPULSION PACKAGE

FOR MDL				
Activity	Yard 16101		Duration (Weeks)	
	From	To		
Placement of order	P			
1 Binding Data	P	P+3	03	
2 QAP	P	P+4	04	
3 Manufacturing Drawing	P	P+3	03	
4 FAT & Certification	E-12	E-4	08	
Equipment Supply	E			
6 Documentation	As per SOTR			
7 Preservation	As per SOTR			
(a) In Stores OR				
(b) On- board				
8 Services of Engineers	As per SOTR			
(a) Installation				
(b) STW				
(c) HATs				
(d) SATs				
(e) For Routines				
(f) Training				
9 OBS for two years	As per SOTR			
10 Warranty	As per SOTR			



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FOR MDL			
Activity	Yard 16101		Duration (Weeks)
	From	To	
11 B&D Spares	As per SOTR		

* - These end dates will be indicated as calendar dates in the Purchase Order.
P- Placement of Purchase Order, E- Equipment Delivery, D- Planned Delivery
Above timelines are tentative, subject to change.