Part VII - Technical Specifications

Annexes

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Chapter 1 General Provisions

1.1 Introduction

1.1.1 This document (or "Technical Specifications" or "TS" or "Part VII") sets out the requirements of the Government in relation to **Five (5) Aluminium Alloy Harbour Patrol Vessels** for use by the **Marine Department of Hong Kong** as the "**user department**" or "**MD**". References to "Vessel" shall mean each of the five (5) vessels.

1.1.2 Unless otherwise specified in the Technical Specifications, all the specifications stated in this Part VII of the Tender Documents are classified and labelled as follows:

(a) Essential Requirements [E];

(b) Desirable Specifications [D], and

(c) Those specifications that are not labelled with [E] or [D] shall equally form part of the Contract like the specifications labelled as [E] ("Specifications without Label").

1.1.3 All Essential Requirements and Specifications without Label shall form part of the Contract. For Desirable Specifications, to the extent the Contractor has committed to comply with them in its tender, they shall also form part of the Contract. As part of the tender evaluation during the tendering stage (viz. Stage 1 of the evaluation – completeness check), the Tenderer shall submit all the information sufficiently detailed to substantiate that the product and the services offered meet the Essential Requirements as stipulated in this TS (viz., specifications with [E] label) and repeated in Annex C to Part II - Conditions of Tender, failing which its tender will not be considered further. For those Specifications without Label, where there is any proposal or evidence to show that the tender does not comply with these specifications, the Tenderer's tender will not be considered further. Commitment to comply with the Desirable Specifications will equally form part of the Contract.

1.1.4 Neither the Essential Requirements nor the Specifications without Label may be counter-proposed by the Tenderer. Any contravening counter-proposal shall be dealt with in accordance with Clause 17 of Part II - Conditions of Tender.

1.1.5 All specifications forming part of the Contract in the aforesaid manner shall be of equal materiality and importance upon the award of the Contract. The non-compliance with any specifications set out in these Technical Specifications shall have the same consequences as specified in the Contract. Save during the tendering stage in the manner as mentioned above, no differentiation shall be made based on the classification unless otherwise expressly specified.

1.1.6 The Vessel shall be Ready for Use before the Delivery Date and delivered by the Delivery Date as per the schedule stipulated under Schedule 2 - Delivery Schedule of Part V.

1.1.7 Unless otherwise expressly defined in the Contract, all technical terms and expressions used in the TS shall be interpreted in accordance with the professional or common usage in naval architecture, marine engineering, nautical navigation and the shipbuilding industry.

1.1.8 Where design specifications of the Vessel or any Equipment are required to be approved by the specified RO, they must be approved by the RO as well as by GNC prior to the construction of the Vessel or installation of that Equipment on the Vessel. Where design specifications of the Vessel or Equipment are not required to be approved by the RO, they must be approved by GNC prior to the construction of the Vessel and installation of the Equipment on the Vessel. This applies regardless of whether this is stated to be the case in the relevant individual provisions.

1.1.9 For the avoidance of doubt, references to "tests" throughout the Tender Documents and the Contract shall include all inspections, surveys, assessments, trials and experiments.

1.1.10 Without prejudice and in addition to the interpretation principles set out in Clause 1.2 of the Part IV - Conditions of Contract, the following interpretation principles shall apply when interpreting the Tender Documents and the Contract including this Part VII - Technical Specifications:

(a) references to "Chapter" or "Paragraph" or "Annex" refer to the chapter of or the paragraph of or the Annex to this Part;

(b) quotation marks may or may not be added for each defined term whether with or without brackets; a defined term may be identified with quotation marks and brackets, or just quotation marks, or just brackets;

(c) the use of article "the" may or may not appear before a defined term or an abbreviated term; there shall be no difference whether the term is preceded with or without the article;

(d) a defined term may have two or more versions (typically a longer version and an abbreviated version) (e.g. "Factory Acceptance Tests" or "FAT"); or may still be referred to by the original description of the subject matter based on which the term is defined; the original description, or the longer version of the defined term, or the shorter version of the defined term may be used interchangeably. For clarity sake, the original description, or the longer version may be used for more self-explanatory purpose; however, there shall be no difference;

(e) where a subject matter has been defined with two or more alternative terms of reference, any one of these terms of reference may be used interchangeably;

(f) a defined term may appear earlier than the provision in which it is defined; a term defined will have the same meaning throughout the document;

(g) there shall be no difference between a term with a hyphen and the same term without a hyphen (e.g., "sub-system" or "subsystem");

(h) titles and headings may appear in lower case or upper case throughout or only in upper case with the first word at the beginning; there shall be no difference in meaning;

(i) headings and titles do not affect the construction of the Tender Documents and the Contract;

(j) a sub-Section of this Part (at whichever sub-level and regardless of the numbering system adopted) may begin in upper or lower case and may be ended with semi-colon or full stop; these differences do not have any interpretation significance on their own;

(k) figures may be expressed in Arabic numerals or in words; or both; there shall be no difference; three zeros in a figure may or may not be separated by any space or comma; there shall be no difference;

(l) where more than one unit of a subject matter is to be supplied as part of the Work, all requirements stated to be applicable to that subject matter shall apply to each such unit of that subject matter. This is regardless of whether the term "each of" or other cognate expression is used preceding that subject matter. This principle shall apply including without limitation where the subject matter is the Vessel and the Equipment on each Vessel.

1.2 Statement of Purposes of the Vessel

1.2.1 The Vessel is to be used by MD for patrolling, assisting and investigating marine emergency cases, conducting law enforcement within Hong Kong Waters and pushing other vessels or towing small craft (length below 15 m) when necessary.

1.2.2 The Vessel shall be designed and constructed for a service life of at least **15** years.

1.3 Authorities

1.3.1 The Government New Construction Section ("GNC") of the Marine Department ("MD") is the section responsible for the procurement of the Vessel for the Government of the Hong Kong Special Administrative Region ("HKSAR") of the People's Republic of China (hereinafter referred to as the Government).

1.3.2 GNC may delegate the site supervision work including plan reviewing work during the construction stage to private consultancy firms to act on behalf of the Government.

1.3.3 The Electrical and Mechanical Services Department ("EMSD") is the Department which will oversee the communication equipment and Electronic Navigational Equipment ("ENE") technical acceptance.

1.4 Shipyard

1.4.1 The Tenderer's shipyard must have the essential shipbuilding and workshop facilities such as lifting gears, aluminium hull construction and calibration equipment, machinery installation and calibration equipment, and the Vessel launching or slipping facilities.

1.4.2 The Contractor shall employ a team of professional staff to carry out the design of the Vessel and also carry out supervision and quality control work in the course of the Vessel construction.

1.5 Design and Construction Responsibility

1.5.1 It is the SOLE responsibility of the Contractor to supply the Vessel which is safe, fit and suitable for the operation of the user department and which meets all the relevant regulations and the specifications in these TS including the desirable specifications (if and to the extent the Contractor has indicated compliance in its tender), which include without limitation requirements for safety, health, environmental protection, hull form design features, structure, method and materials for construction and fitting out, stability, sub-division and operational efficiency.

1.5.2 Unless otherwise expressly specified in this Part VII, references to "RO" in this TS shall mean, in the case of the Vessel, the Recognised Organisation as specified in Schedule 9 of Part V for the Vessel. References to "RO Requirements" (in upper or lower case) shall mean, in the case of the Vessel, the requirements of the rules and regulations of the aforesaid RO as specified in Schedule 9 of Part V. References to "IMO requirements" shall mean the latest and as amended requirements published by the IMO and available on its website and applicable to the relevant subject matter in the relevant paragraph where it is required that IMO requirement shall be complied with provided that where the IMO requirements are of any convention or resolution or other multilateral treaty of the IMO (including any amendment thereto), Hong Kong has joined in as a party to such IMO requirements.

1.5.3 The Vessel is required to be issued with **a certificate of classification** with such class notations by the RO all as specified in Schedule 9 of Part V, as one of the conditions to be fulfilled before the Acceptance Certificate for the Vessel will be issued. All plans, particulars and documentations which are required for the classification of the Vessel by the RO, in addition to those listed in Annex 3 to this Part shall be approved by the RO before submission to MD for endorsement and final approval prior to commencement of vessel construction works. Any subsequent modifications or additions are to be treated in the same manner. Those drawings which are not required under ship classification approval shall be submitted to MD for approval before works is carried out.

1.5.4 Notwithstanding the submission of the preliminary plans and drawings by the Contractor then as part of its tender for the Contract, all plans and drawings of the Vessel except the design stresses and scantling, shall be submitted to GNC for approval before completion of the Vessel design. The design stresses and scantling including internal structural members shall be approved by the RO.

1.5.5 The Contractor shall design, build and supply the Vessel in full compliance with the requirements given in these TS which, to that extent, may be over and above what is normally required by any statutory and RO's rules and regulations. Should there be any contradiction between the rules and regulations of the RO and the TS, the TS shall prevail unless GNC stipulates or agrees otherwise.

1.5.6 Even if the Contractor may appoint a Sub-contractor to design the Vessel with the prior written consent of the Government, the Contractor shall not be relieved of its obligations under the Contract through such appointment, and the Contractor shall be responsible for all acts, defaults and omissions of the sub-contractor as if they were its own.

1.6 Survey and Inspection

1.6.1 Tenderers shall note that the unit price per Vessel quoted in Schedule 1 - Price Schedule in Part V shall be deemed to have included the cost of surveys to be carried out by the RO in respect of the Vessel (if required to be arranged by the Contractor under the Contract).

1.6.2 All electronic items and their installations shall be approved and inspected by EMSD or EMSD representatives as part of the Technical Acceptance.

1.6.3 Subject to Paragraph 1.6.7 of this Chapter, an advance written notice of not less than five (5) working days (if the Vessel is located in Asia), and ten (10) working days (if the Vessel is located other than Asia) must be given to GNC before the representatives of MD/GNC and other Government officers are invited to conduct a survey visit of the Vessel. The Contractor shall be fully responsible for any delay if the Contractor fails to give adequate notice as aforesaid.

1.6.4 The Contactor shall provide

(a) An Implementation Timetable, in the form set out in Annex 2 to the TS, setting out the major milestones and their scheduled completion dates and incorporating the Delivery Dates specified in Schedule 2 of Part V;

(b) The Drawing Submission Timetable in the form set out in Annex 3 to the TS; and

(c) The Main Items Inspection Timetable in the form set out in Annex 4 to the TS.

Each one of the above shall be submitted to GNC for approval by the respective deadlines specified in

Clause 11 of Part IV - the Conditions of Contract.

The Delivery Date for the Vessel as stated in the Implementation Timetable shall be no later than those set out in Schedule 2 of Part V. Notwithstanding anything in the Contract to the contrary, the Government may suspend payment of any of the instalment specified in Schedule 3 of Part V of the Contract if any of the timetables required herein has not been submitted for GNC's approval or GNC does not approve any of them or if the progress of work does not comply with any of them as approved by GNC.

1.6.5 A weekly work progress report with photos evidencing the progress and material/equipment procurement status is required to be submitted to GNC during the construction of the Vessel. The weekly report shall be submitted before noon of every Monday. The Contractor shall provide supporting evidence, including but not limited to photos and videos, to demonstrate that the milestones have been completed according to the completion dates stated in the submitted Implementation Timetable in Annex 2 to Part VII.

1.6.6 GNC may designate consultant(s) from private sector who will be authorised to represent the GNC in all technical matters including site supervision and plan approval related to the construction of the Vessel ("GNC consultant"). The Contractor shall cooperate with the GNC consultant and afford it unhindered access to the Vessel at all times during working hours, and shall furnish it with current copies of all approved drawings, sketches, correspondence, change notices, change orders, test agendas, schedules etc. For the Main Items Inspection Timetable set out in Annex 4 to this Part (even in the version approved by the Government), the GNC consultant will further elaborate such timetable by including and expanding on these items into an on-site supervision programme ("Programme"), and which Programme shall be deemed to form part of the Contract and superseding Annex 4 (even in the aforesaid approved version) in the event of any inconsistency where the Programme is more detailed than Annex 4 to this Part. All these inspections, tests and trials must have been performed to the satisfaction of the Government before the Vessel may be shipped to Hong Kong (unless it is expressly stated in Annex 4 to this Part that certain items shall be performed in Hong Kong as part of the Delivery Acceptance).

1.6.7 After arriving at the site for a survey visit, if MD/GNC officer / consultant considers it is unsafe to carry out the test or inspection, the test/inspection will not be carried out. The Contractor shall arrange another additional survey visit at the Contractor's expenses. The Government shall not be responsible for any delay arising from any postponement in conducting the survey visit due to any safety issue as specified in this Paragraph.

1.6.8 Where any fee charge and associated expense are payable for the services of the RO which are necessary in order to fulfil any obligation of the Contractor under the Contract, the Contractor is responsible for paying the RO all such fees, charges and associated expenses. Such fees shall include charges for drawing approval, surveys (if deemed necessary), issue of certificates, and any other expenses payable to the RO.

1.6.9 The Contractor shall provide offices space for MD/GNC officers and consultants during their survey visits and construction progress visits to the Vessel at the shipyard where the Vessel are constructed. The office space shall include, but not be limited to, two (2) desks, six (6) chairs, one (1) telephone, one (1) conference table for 10 persons, drinking facilities, power supply and one (1) cupboard for storage of documents and working clothes. The space provided by the Contractor shall also be fitted with air conditioning, have Internet access, a copying and a printer machine. Cleaning of the space shall be carried out in each working day.

1.6.10 The hours of work of MD/GNC officer, or consultant will be arranged to coincide with those of the shipyard, in so far as it is practicable to do so. It is intended that all reasonable steps be taken so that the duties of the MD/GNC officer, and consultants can be carried out with a maximum of efficiency and a minimum of interference with the Contractor's work.

1.7 Official Sea Trial, Speed Requirements

1.7.1 The Contractor shall submit for GNC approval, an Official Sea Trial programme 14 working days in advance of the Official Sea Trial, which shall include details of proposed procedures for carrying out the Official Speed Trial, endurance test, manoeuvrability test, crash stop test, astern running test / emergency steering test, anchoring tests, other tests as specified in paragraph 1.7.6 below, bottom survey on the slipway and all other tests as stated in this Part VII, all of which shall be required to be performed as part of the Official Seal Trial and therefore part of the Technical Acceptance (if not earlier). This programme must be submitted to MD in not less than 14 working days before the trials commence. The notification for Official Sea Trial shall include documentary evidence that the Vessel is safe to go to sea for the intended tests and trials specified in the Contract (including the inclining experiment report as mentioned in Paragraph 3.6 of this Part and approved by the RO).

1.7.2 Like all other tests and trials to be conducted as part of the Technical Acceptance, the Contractor is required to carry out the full Official Sea Trial in Hong Kong at its own expense (including the expense of fuel, lubrication oil, crew and other necessary expenses), in the presence of MD/GNC officer(s), user department officers and the consultants. The Contractor shall observe the local requirements on navigation before the sea trial, including the third party insurance in accordance with the laws of Hong Kong.

1.7.3 The Contractor shall provide to MD/ GNC officers, the name, post, duty and experience of each one of the Contractor's staff on board the Vessel during the Official Sea Trial to ensure the safe operation of the trial. The number of persons on board during a particular test or trial has to be agreed by the MD/GNC officers. The location of each person on board (which can affect the centre of gravity of the Vessel under trial) will need to be first agreed by the MD/GNC.

1.7.4 The Contractor shall provide a test report to GNC after completion of the above tests. The report shall contain information regarding the method of test, engine(s) running condition, sea, weather and wind conditions, the Vessel loading condition, the heeling angles (steady or varying as the case may be) during each forward turning manoeuvre, and any other relevant information as required by GNC or GNC appointed consultant during the tests; and such information shall be prepared in a format agreed by GNC.

1.7.5 Official Speed Trial

(a) The Official Speed Trial shall be carried out in the Hong Kong Waters under the conditions as specified in Paragraph 1 of Annex 5 to this Part.

(b) As part of the Technical Acceptance as specified in Paragraph 1.8.2 of this Chapter 1, the Contractor shall carry out the Official Speed Trial in the presence of GNC officers or their appointed agents.

(c) The actual mean speed of the Vessel (i.e. NOT theoretical) shall be measured during the Official Speed Trial runs to determine if the Contract Speed can be achieved. The speed calculations must NOT be corrected by wind, wave, tidal current, shallow water effects and weather condition.

(d) The actual mean speed is to be calculated as the arithmetic mean of not less than FOUR continuous runs, i.e. TWO runs in each direction. The speed for each run shall be taken by measuring the time of the Vessel running for one nautical mile between two poles or other measuring method acceptable to MD.

(e) The Contract Speed is considered not achieved if the Contract Speed cannot be attained once during the Official Speed Trial after a total of two attempts each attempt to be measured in the manner specified in (d) above.

(f) The Contract Speed to be achieved by the Vessel in the Official Speed Trial shall be the minimum highest achievable speed of **20** knots with both marine diesel engines running at **100%** MCR and the Vessel under Official Speed Trial Conditions as stated in Paragraph 1 of Annex 5 to this Part. If the Vessel fails to achieve the minimum highest achievable speed of **20** knots under the aforesaid conditions in the manner specified in sub-paragraphs (d) and (e) above, the Government will deem that the Vessel has failed to pass the Official Speed Trial and therefore Technical Acceptance.

(g) The instrument use in measuring the Contract Speed for the Official Speed Trial shall be provided either by:

1. The Contractor provided that the speed measuring device has been calibrated by a certified body in Hong Kong acceptable to GNC; or
2. Global Positioning System ("GPS") supplied by the Government.

(h) The GPS or Differential Global Positioning System ("DGPS") which is properly calibrated (with supporting calibration documents) and installed on board the Vessel, is acceptable to GNC; or other speed measuring methods that are acceptable to GNC.

(i) The instrument used in measuring the **Propeller Shaft Power** for the Official Speed Trial shall be provided by the Contractor and shall be able to measure both port and starboard Propeller Shaft Power simultaneously. The Propeller Shaft Power measuring device shall have been calibrated by a certified body in Hong Kong acceptable to GNC.

(j) The Vessel must be in the trial conditions (see Paragraph 1 of Annex 5 to this Part for the conditions of the trials) during the Official Speed Trial. All Equipment shall also have passed the Technical Acceptance and which operation shall not be affected during the Official Sea Trial.

(k) The speed, time of the day, engine running conditions, sea condition, etc., shall be properly recorded by the Contractor, and signed as witnessed by GNC surveyor (or GNC representatives) during the Official Sea Trial. A copy of the Official Sea Trial Report as required in Paragraph 1.7.6 below shall be given to GNC before Delivery Acceptance.

(l) Upon successful completion of the Official Speed Trial in Hong Kong, the Contractor shall arrange GNC officers to carry out hull bottom inspection on the Vessel to check for any hull damage before delivery.

1.7.6 The following tests shall be conducted as part of the Technical Acceptance for the Vessel, and the testing results shall be recorded and form part of the Official Sea Trial Report. The applicable conditions under which each of the tests specified below shall be conducted are further set out in the relevant Paragraph of Annex 5 to this Part:

(a) Endurance Test

The Endurance Test shall be carried out for different engine loading and speeds to obtain the speed/fuel consumption curves (or data) for the Vessel, with the engine(s) operating within the manufacturer recommended engine operating conditions. The test results shall be recorded in accordance with the requirements stipulated in Annex 6 to this Part. The report submitted shall include a curve or curves showing ship speed versus propulsion engine(s) rpm and power, with particulars of the Vessel loading and displacement in the test(s).

(b) Manoeuvrability Test

Forward turning circle tests to port and starboard sides shall be carried out with:

1. Both main propulsion engines running; and
2. Single main propulsion engine running.

The minimum time for turning to both sides at 15°, 90°, 180°, 270° and 360°shall be recorded.

The permitted speed and rudder angle shall be measured and recorded when the heeling angle due to high speed turning is less than 12 degrees.

(c) Crash Stop Test

The minimum time and distance achievable by the Vessel when running from full ahead to stop, and then to full astern shall be determined at the Crash Stop Test.

(d) Astern Running Test / Emergency Steering Test

The maximum astern running speed achievable by the Vessel shall be determined by the test. Also an emergency steering test shall be carried out to ascertain satisfactory emergency steering operations.

(e) Starting Tests for Main Engines and Electric Generator Engines.

(f) Anchoring Test according to the RO Requirements.

(g) Noise Level Test according to the requirement stipulated in Paragraph 4.16.1 of this Part.

(h) Megger test as mentioned in Paragraph 8.3.7 of this Part.

(i) the bottom survey on the slipway, i.e. inspection of condition of underwater hull, underwater machineries and equipment.

1.7.7 The Contractor shall submit the special equipment test programme for the Special Equipment (as specified in Paragraph 4.26 of this Part) of the Vessel for GNC approval 14 working days in advance of the tests for these Special Equipment as further mentioned in Paragraphs 1.7.8 and 1.7.9 below. All parts of these tests for these Special Equipment shall be conducted and completed in the presence of the GNC consultant, users of MD and officers of GNC.

1.7.8 The functional test of each piece of the Special Equipment for the Vessel shall be conducted as part of the Technical Acceptance ("Special Equipment Functional Test") at the shipyard to ensure that that each piece of the Special Equipment on the Vessel shall be compliant with all requirements set out in the Overall Specifications including those stated in Paragraph 4.26 of this Part. The result of Special Equipment Functional Test shall be proved to the satisfaction of GNC before delivery of the Vessel to Hong Kong.

1.7.9 Another functional test of these Special Equipment shall be conducted upon delivery the Vessel to Hong Kong ("Functional Test in Hong Kong" (in upper or lower case)). Some parts of the tests shall be repeated when the Vessel is delivered to Hong Kong for a second testing as well as those tests which GNC agrees that they need not to be performed at the place of the vessel construction.

1.8 Acceptance and Delivery

1.8.1 Acceptance of the Vessel (including all Equipment) is to be carried out in two parts:

(a) Part 1: Technical Acceptance; and

(b) Part 2: Delivery Acceptance.

1.8.2 Technical Acceptance comprising all of the following tests and trials specified in three stages as further specified below:

(a) Stage 1: This Stage 1 includes two parts. The first part requires the satisfactory inspection, test and trials by the GNC consultant of all items covering the hull and superstructure of the Vessel including Items H-1 to H-20 as listed in Annex 4 to this Part. In addition to and without prejudice to the foregoing, the second part is as follows: If and after the GNC consultant's confirming acceptance of all of the aforesaid items (or such other timing as considered appropriate by the Government), the officers of GNC and the users of MD will make visit to the shipyard to make inspection of the hull and the superstructures of the Vessel (viz., Item H-21 and H-22 of Annex 4 to this Part). The Contractor may not proceed to the next stage until both parts of this Stage 1 are satisfactorily completed as confirmed by GNC.

(b) Stage 2: This Stage 2 includes two parts. The first part requires the satisfactory inspection, test and trials by or in the presence of the GNC consultant of all items covering the remaining parts of the hull and superstructure of the Vessel including from Item H-23 of Annex 4 to this Part onwards as well as all items set out under the heading of "Machinery and Electrical Installation" in Annex 4 to this Part. They notably include the inclining experiment mentioned in Paragraph 3.6 of this Part and the sea trial to be performed in the nearby waters of the shipyard. The tests to be performed as part of the sea trial of Stage 2 shall include all such tests and trials as specified in Paragraphs 1.7.5 and 1.7.6 of this Part except that they shall be performed in the nearby waters of the shipyard. Separately and in addition to the first part, the second part covers the following: if and after the GNC consultant's confirming acceptance of the items up to such stage of EM-2 (viz the main engines) as well as all Special Equipment of the Vessel to be covered by the Special Equipment Functional Test (or such other timing as considered appropriate by the Government), the officers of GNC and the users of MD will make visit to the shipyard to make inspection of the machinery and electrical installation of the Vessel including participating in the Special Equipment Functional Test as specified in Paragraph 1.7.8 of this Part, the inspection and function test of the main engines, as well as other major equipment on a random basis. The Contractor may not proceed to the next stage until this Stage 2 is satisfactorily completed including the aforesaid visit as confirmed by GNC consultant.

(c) Stage 3: This includes all the tests and trials to be conducted in Hong Kong Waters after shipment of the Vessel to Hong Kong. The Contractor shall be responsible for all costs in keeping the Vessel in Hong Kong whilst this stage of the Technical Acceptance is conducted. These tests and trials shall include without limitation equipment tests, the Official Speed Trial as mentioned in Paragraph 1.7.5 of this Part, all of those tests and trials as specified Paragraph 1.7.6 of this Part, the bench acceptance test and on-site commissioning test for ENE as mentioned in Chapter 9 of this Part, the Functional Test in Hong Kong as mentioned in Paragraph 1.7.9 above, and all other tests whether as specified in this Part or otherwise necessary to determine whether or not the Vessel including the Equipment has been supplied in accordance with all the specifications set out in these Technical Specifications

(d) As mentioned above as part of Stage 2 or Stage 3 (where applicable), all units of all ENE items and their installations shall be approved and inspected by EMSD as part of the Technical Acceptance including the Special Equipment Functional Test, the Functional Test in Hong Kong, the bench acceptance test and on-site commissioning test for all units of all ENE items as mentioned in Chapter 9 of this Part.

(e) The Contractor shall supply all necessary equipment and labour at its own cost for carrying out the tests and trials comprised in the Technical Acceptance.

(f) If the Vessel cannot pass each of the tests, inspections and trials comprised in the Technical Acceptance by the applicable date specified in the Implementation Plan, the options available to the Government are set out in Clause 12 of Part IV - Conditions of Contract and other applicable provisions of the Contract.

1.8.3 Delivery Acceptance

(a) The Vessel, after its successful completion of Technical Acceptance, and the Spare Parts as specified in Schedule 1 of Part V, shall be delivered at the Contractor's expense to the Government Dockyard. In accordance with the applicable Delivery Date as specified in Schedule 2 of Part V. If the delivery of the Vessel in Ready to Use condition is **120** days later than the Delivery Date specified in Schedule 2 of Part V, at the discretion of Government, the Contract may be terminated according to the applicable terms stipulated in the Contract.

(b) Certificate of classification for the Vessel with notations as specified in Schedule 9 of Part V shall have to be issued by the RO as specified in Schedule 9 of Part V before the Acceptance Certificate can be

issued by the Government.

(c) The Delivery Acceptance of the Vessel shall be carried out by GNC in accordance with the terms stipulated in the Contract. The Delivery Acceptance is only completed when the Acceptance Certificate is issued by the Director of Marine.

(d) The Contractor must demonstrate to MD/GNC that all hull construction, outfitting, Vessel stability, machinery, electrical and electronic equipment are in good working order; and must hand over the Vessel, its fixtures and Equipment to GNC in good and complete condition.

(e) Not later than six (6) weeks before the Delivery Acceptance of the Vessel, the Contractor is required to submit to GNC four (4) copies of the Inventory List covering all items of or relating to the Vessel including all engines, on board equipment, manuals, documentation, spares, stores, and equipment for testing in respect of the entire Vessel. The Inventory List shall be approved by GNC seven (7) days before the day of Delivery Acceptance and covers everything which the Contractor is required to deliver under the Contract. At the Delivery Acceptance of the Vessel, the approved Inventory List will be used to check that all the items have been delivered to GNC in a satisfactory state. Details of each inventory item shall include: item name, description, type, quantity, manufacturer's name and contact details, part reference number and/or serial number, and the items' locations in the Vessel.

(f) The items specified in Paragraph 10.2 of this Part, all items listed in Annex 7 to this Part, all items set out in the Inventory List in the form as approved or stipulated by the Government, and all other items which are required to be delivered under this Part as part of the Delivery Acceptance shall be delivered to GNC as part the Delivery Acceptance of the Vessel. The Contractor must provide fourteen (14) days advance notice in writing for Vessel delivery when the Vessel is considered to be completed in accordance with the Contract and Ready for Use and to be delivered for the Delivery Acceptance. The Government will not accept delivery if after undergoing the tests and trials in the Technical Acceptance, the Government does not consider that the Vessel is in Ready to Use condition.

(g) On delivery, the Vessel must be in a clean, tidy and fully fitted and operational condition.

1.9 Warranty Services During the Warranty Period

1.9.1 Notwithstanding and without prejudice to the Contractor's obligation to provide the Warranty Services for the Vessel under the Conditions of Contract, the original copy of the manufacturer's warranty certificates and all related manuals and documents in respect of all the Equipment valid for 12 months from the date of unqualifiedAcceptance Certificate of the Vessel, shall be delivered to MD upon Delivery Acceptance.

1.9.1 The full scope of the Warranty Services is set out in Annex 1 to this Part.

1.9.2 The Contractor is responsible for arranging the Vessel for Guarantee Slipping at the end of the Warranty Period (and if there is any extension of the Warranty Period for the entire Vessel, GNC has to right to decide whether the Guarantee Slipping should be done at the end of the original Warranty Period before any extension, or at the end of the extended Warranty Period.). In addition to any defects which the Contractor may be required to fix as part of the Warranty Services as stated in Annex 1 to this Part VII, the Contractor shall also be responsible for the rectification of any defects found in the course of Guarantee Slipping. The full scope of the Services to be provided as part of the Guarantee Slipping is set out in Annex 1 to this Part.

1.10 Support Services

1.10.1 The Vessel must be designed for through life support and easy maintenance in the HKSAR based on an operation profile and minimum life expectancy as mentioned in the TS.

1.10.2 The above also applies to the main engines as well as all other equipment installed in the Vessel. Support and maintenance services must be available (i.e. serviceable) in Hong Kong in respect of all equipment installed in the Vessel and return of the whole or part of the Equipment to the original place of manufacturer or supplier shall not be necessary in order to carry out any repair work.

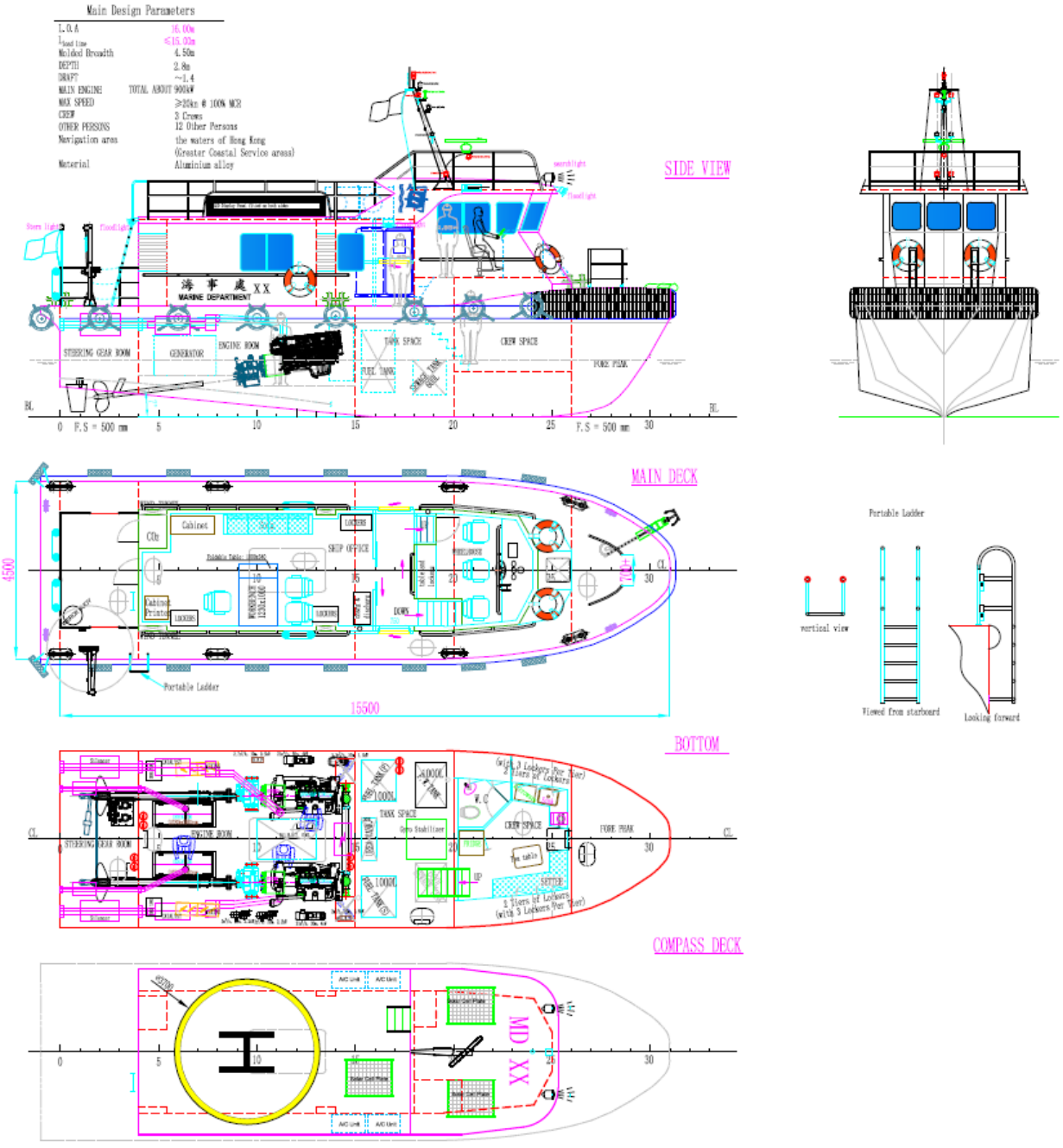
1.11 Asbestos Free

1.11.1 The Vessel must not contain any asbestos or asbestos containing materials. The Contractor must comply with the Hong Kong Air Pollution Control Ordinance (Cap. 311), Part X. The Contractor shall engage a service supplier approved by one of the ROs or other entities acceptable by MD to verify that there is no asbestos on the Vessel. An asbestos free certificate or a statement of compliance issued by the service

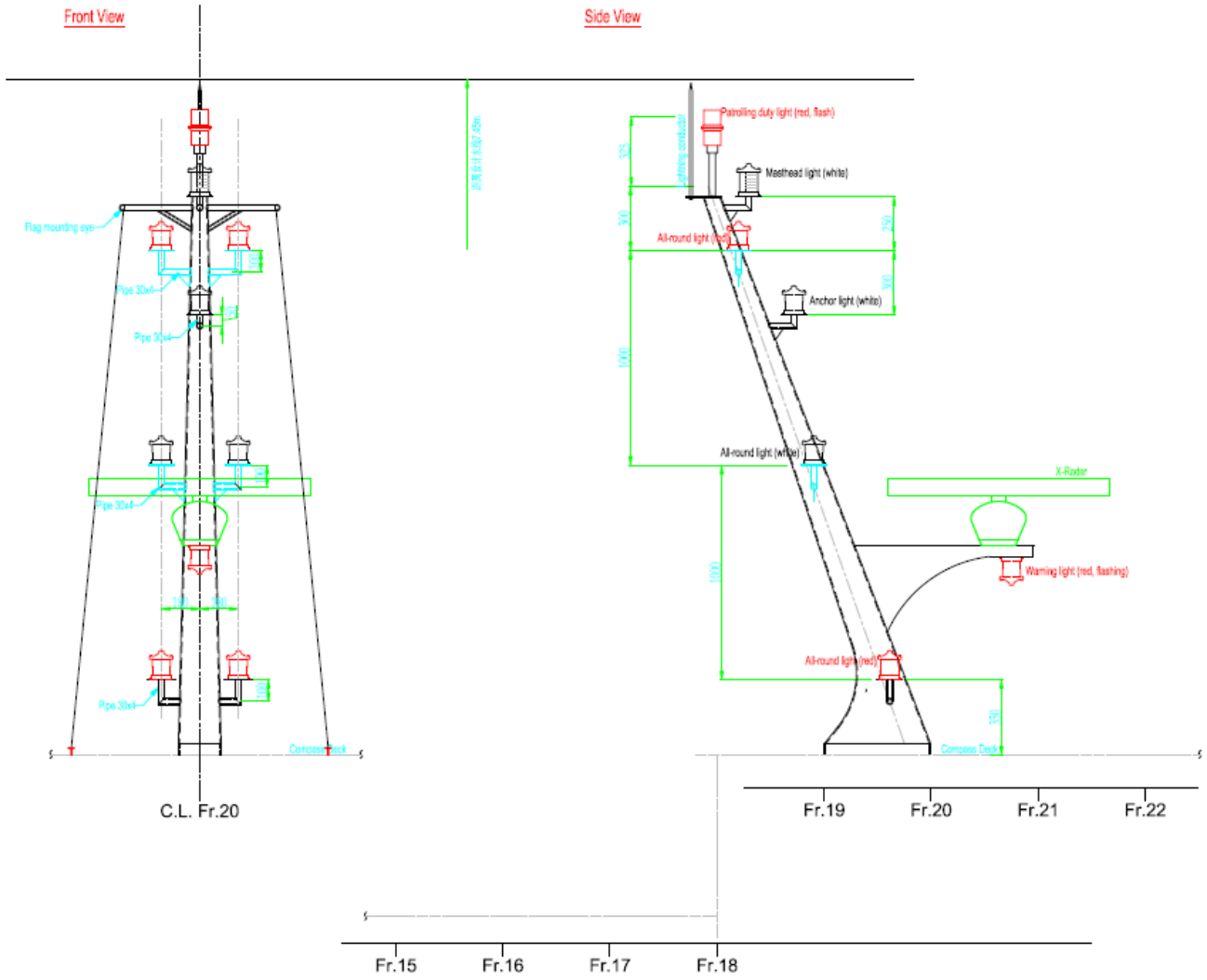
supplier to this effect shall be provided upon delivery of the Vessel.

Chapter 2 General Technical Requirements

2.1 Guidance General Arrangement Plan



Mast Arrangement



2.2 General Provisions

2.2.1 Without prejudice to the generality of Chapter 1, this Chapter contains the more particular technical specification for the Vessel. The significance of Essential Requirements is explained in Paragraph 1.1 of Chapter 1 above.

2.2.2 The work to be done under this Contract consists of the design, construction, outfit, testing and delivery of **Five (5) Aluminium Alloy Harbour Patrol Vessels for the Marine Department**. Workmanship, functions, characteristics and performance are to be in accordance with these TS, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.

2.2.3 The Contractor is required to exercise its professional expertise and knowledge to come up with an appropriate design for the Vessel which can comply with all requirements of the Contract. The Guidance General Arrangement Plan shown above ("Guidance General Arrangement Plan") is a reference drawing to help to explain the tender requirements. The Contractor is required to submit its own design in details for MD's approval.

2.2.4 During the design and construction of the Vessel, the Contractor is required to submit a detailed General Arrangement Plan ("GA Plan") and all relevant construction drawings for GNC's approval and acceptance. As for the preliminary General Arrangement Plan which has to be submitted during the tendering stage in Schedule 7 ("Preliminary General Arrangement Plan"), unless the Government otherwise directs, the GA Plan to be submitted after the Contract award shall incorporate those features set out in the Preliminary General Arrangement Plan. Requirements in these Technical Specifications that the General Arrangement Plan shall follow the "Guidance General Arrangement Plan" in these Technical Specification shall be changed to follow the Preliminary General Arrangement Plan instead if in the opinion of the Government, the relevant aspect of the Preliminary General Arrangement Plan submitted by the Contractor is better than the Guidance General Arrangement Plan, but not otherwise.

2.2.5 ALL the machinery, equipment and facilities, furniture, fixtures and fittings, including outfitting of the Vessel that are described in the TS, together with their requirements for design and installation standards that are stipulated in this Chapter and in any other parts of the TS, are the items that must be included in the complete "As-built" Vessel delivered to the Government.

2.2.6 It is desirable that the Preliminary General Arrangement Plan to be submitted by the Tenderer shows improvements over the Guidance General Arrangement Plan over such functional aspects (Part A(I)) as mentioned in Annex D Marking Scheme in Part II - Conditions of Tender. [D]

2.2.7 It is desirable that the hull shell line to be a "V" type as shown in the Guidance General Arrangement Plan. [D]

2.2.8 It is desirable that the main deck at the front area of the Vessel is gradually raised in a streamline form rather than stepped. [D]

2.3 Rules and Regulations

2.3.1 The Vessel shall be designed and constructed in accordance with the latest edition of the rules and regulations of the Recognised Organisation as specified in Schedule 9 of Part V. By latest edition, it is meant the latest edition as at the keel laying date of the Vessel. The Tenderer shall state in Schedule 9 of Part V which RO (to be selected from the definition of "Recognised Organisation" in Clause 1.1 of Part IV) and its rules and regulations and class notations that shall be used in the design and construction of the Vessel.

2.3.2 The Vessel is required to be issued with certificate of classification (without conditions) with notations as in Schedule 9 of Part V by the RO. All plans, particulars and documentations which are required for the classification of the Vessel, in addition to those listed in Annex 3 to this Part shall be approved by the RO before submission to GNC for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions are to be treated in the same manner.

2.3.3 The Vessel shall be with class notations which is suitable for "Statement of Purposes of the Vessel" as stated in Paragraph 1.2.

2.3.4 Without prejudice to the general requirement that the Contractor shall perform all Work in full compliance with all applicable laws and regulations, and in full compliance with the RO requirements and requirements of the Contract including these TS, the construction of the Vessel must comply with the rules, regulations, standards, and recommendations of the entities as specified below:

(a) International Electrotechnical Commission ("IEC") Regulations for the Electrical and Electronic Equipment.

(b) International Telecommunications Union recommendations in the International Radio Regulations ("ITU-R").

(c) Quality and standards of the welding shall comply with the rules of RO or American Welding Society ("AWS") or other applicable international standards or rules acceptable by MD.

(d) International Regulations for Preventing Collisions at Sea 1972, as amended by International Maritime Organisation ("IMO") from time to time.

(e) Applicable Hong Kong local regulations including Code of Practice ("COP").

(f) All equipment/fittings shall be designed and manufactured to at least the standards as specified in these Technical Specifications. When none of the rules and regulations in Paragraphs 2.3.4 (a) to (e) above are applicable, then the applicable standards specified by the applicable organisations below shall be complied with:

BSI	British Standards Institute
GB	Standardization Administration of the People's Republic of China
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Organization for Standardization
JIS	Japanese Industrial Standards

2.3.5 The Contractor shall design, build and supply the Vessel in full compliance with the requirements given in these TS which, to that extent, may be over and above what is normally required by any statutory and RO's rules and regulations. Should there be any contradiction between the rules and regulations of the RO and the TS, the TS shall prevail unless GNC stipulates or agrees otherwise.

2.4 Contract Speed

2.4.1 The Contract Speed of the Vessel shall not be less than **20** knots at Beaufort wind scale number **0 to 2** when both marine diesel engines running at **100%** MCR under Official Speed Trial Conditions as stated in Paragraph 1 of Annex 5 to this Part and whilst observing the requirements further specified in Paragraph 2.4.2 below. [E]

2.4.2 The guaranteed speed prescribed above shall be achieved without porpoising, or other dynamic instabilities. The propulsion system selected shall match the engine profile and avoid cavitations as far as possible.

2.4.3 The estimated engine propulsive power and characteristic curves of the Proposed Propulsion System for attaining the Contract Speed of the Vessel under the Official Speed Trial conditions as stated in Paragraph 1 of Annex 5 of these TS, together with a descriptive account of the engineering principles and methodology employed for such propulsive power estimate and evaluation, shall be provided to GNC in Schedule 7 of Part V. [E]

2.5 Principal Dimensions

General Requirements:	- Mono-hull	[E]
Length Overall (as defined further below):	- 15.8 metres - 16.4 metres (both figures inclusive and fenders included)	[E]
Length (as defined further below):	- not greater than 15.0 metres	[E]
Breadth:	- 4.2 metres - 4.5 metres (fenders excluded)	
Free board:	- About 1.4 meters	[D]
Depth:	- Design to suit (It is more desirable that the draught is shallower)	
Restricted dimensions:	- Air draft not more than 7.8 m	

The Tenderer shall indicate the length overall and length of the Vessel in dimension scale in Preliminary General Arrangement Plan submitted according to Schedule 7 of Part V.

"Length Overall" means the distance between the foreside of the foremost fixed permanent

structure and the aftside of the aftermost fixed permanent structure of the Vessel (transom) including fenders, but does not include waterjet system and out-fittings.

"Length" means the greater of the following: (a) the distance between the foreside of the stem and the axis of the rudder stock; (b) 96% of the distance between the foreside of the stem and the aftside of the stern, measured on a waterline at 85% of the least moulded depth, except that—(c) if the vessel has a rake of keel, the waterline on which the distance is measured shall be parallel to the designed waterline; and (d) if the vessel is not fitted with a rudder stock, the length shall be determined in accordance with paragraph (b).

2.6 Material of the Structure

Material of Hull Structure:	Marine grade aluminium alloy	[E]
Material of Superstructure:	Marine grade aluminium alloy	[E]

2.7 Propulsion System

2.7.1 The Vessel shall be equipped with the Proposed Propulsion System as further described in paragraph 7.2 of this Part.

2.7.2 Each of the two (2) diesel engines deployed in the Proposed Propulsion System shall meet the IMO Tier III emission requirements with or without after NOx treatment as specified in paragraph 7.2.1 of this TS.

2.7.3 Hybrid system adopting electric motors for low speed operation shall be provided.

2.8 Vessel Operating Profile and Environment

2.8.1 The Vessel shall be designed and built to operate in Hong Kong Waters with the below said operational profile.

2.8.2 Summary of Operational Hours / Range [E]

Number of hours/day:	10 hours/day
Number of days/year:	345 days/year
Endurance for fuel capacity:	10 hours without the need for refueling, includes: 2 hours at 100% MCR 4 hours at 15 knots and 4 hours at 5 knots (plus 10% margin for total fuel calculated in accordance to the number of hours mentioned above.)

2.8.3 Total carrying capacity of the Vessel shall be 15 persons including 3 crew members and 12 officers. [E]

2.8.4 Operational environment:

The Vessel shall be able to operate safely in weather conditions up to and including the conditions equivalent to Beaufort wind scale number ("Beaufort scale") 7 and Sea State 6 set out in Annex 8 of this TS.

2.8.5 Ambient Conditions - All machinery, equipment, systems shall be capable of operating at their full design performance under the following environmental conditions:

External air	0 ~ + 40 ºC	
Internal air	0 ~ + 20 ºC	
Machinery space	≤ 45 ºC	(All equipment at full rated power)
Maximum seawater temperature	+ 32 ºC	

2.9 Markings and Colour Scheme

2.9.1 Markings and colour scheme for the Vessel shall be provided by the Contractor. Colour scheme shall be approved by GNC before application. All painting colour scheme for fittings shall be agreed by GNC.

2.9.2 All labelling shall be both in Chinese and English and as per applicable rules and regulations of the RO. MD shall instruct the Contractor to design and produce any logos or graphics to be displaced on both sides of the superstructure or deckhouse and/or at locations as agreed by MD.

2.9.3 The Vessel's name shall be painted on both sides of the bow, the transom centre and the compass deck to MD and user department's satisfaction. Draught marks shall also be marked at both sides of bow and stern. The full load design draught mark shall be marked at port and starboard amidship. Vessel's identification shall be marked as large as possible at the deckhouse top for helicopter viewing.

2.9.4 All labelling, stencilling and marking (not limited to the hull but including all aspects of the Vessel) shall be made on separate plaques, boards or labels attached to the structure. By default, all displays, control actuators, electric switches, valves, and other equipment shall be labelled to indicate their type and function as appropriate.

2.9.5 Exits shall be identified and labelled. Stowage locations for life jackets and quantities of life jackets contained therein shall be identified.

2.9.6 Safety markings for the prevention of person tripping in the Vessel shall be provided where necessary.

2.9.7 The design of the colour scheme of outlook profile of each vessel to be submitted to GNC for approval prior to painting.

2.10 Tally Plates

2.10.1 The following information shall be displayed on the builder's plate.

(a) Builder's name;

(b) Vessel's name;

(c) Year of build; and

(d) Maximum number of persons including the crew that the Vessel is designed to carry.

2.10.2 Tally plates in both English and Chinese characters shall be fitted for all spaces and all equipment as required by MD including but not limited to:

(a) Equipment in the console;

(b) Electrical and communication equipment;

(c) Air vents and filling pipes for the fuel oil tanks;

(d) All valves and equipment on deck;

(e) Control panels, switchboards, distribution boxes and electrical circuits; and

(f) Any other equipment/fitting as required.

Information engraved on the tally plates shall include: service, function, mode of operation, source of power, fuse rating, voltage and warning and other information as required by MD.

2.10.3 Tally plates exposed to weather shall be made of durable and weatherproof material and be securely fastened.

2.10.4 List of tally plates shall be provided as directed by MD.

2.11 Other Design Features

2.11.1 Berthing requirement of the Vessel shall match with the designated point of berth at Government Dockyard.

2.11.2 Permanent list is not allowed, and where it is not practical to achieve this requirement, the maximum permanent list of the Vessel in its lightship condition must not be greater than **0.5** degree.

2.11.3 Permanent ballasts can only be used as agreed by GNC. The Contractor should note that it shall be under a very exceptional case that GNC would agree for the Vessel to have ballast installed.

2.11.4 The Vessel shall be free of unacceptable structural vibrations and free of excessive porpoising at all speeds

so that there is no loss of directional control.

2.11.5 All lifting appliances shall be properly certified and a Registry of Lifting Appliances and Lifting Gear is to be provided in accordance with the applicable laws and regulations.

Chapter 3 Hull and Deckhouse

3.1 Structures of the Hull and Deckhouse

3.1.1 The Vessel shall be designed and built with a mono-hull form. The strength of the hull structure shall be approved by the RO while fulfilling the Contract Speed specified in Paragraph 2.4.1 of these TS and the hull structure shall be constructed of marine grade aluminium alloy.

3.1.2 The hull structure design loads shall be in accordance with the Vessel operational profile and other applicable requirements. The design stress and load (wave height versus speed), maximum acceleration considered and scantlings calculation including the internal structural members shall be approved by the RO. The maximum vertical acceleration at the longitudinal center of gravity of the Vessel shall not be less than the value determined according to the requirements of RO at a wave height of 4.0 m corresponds to the speed of 8.5 knots.

3.1.3 Strength shall be maintained by ensuring hull structural continuity of main members including bottom and deck girders and transverse web frames. Where the strength of a main structural member is impaired by cuts or interruptions in continuity, efficient means of compensation shall be fitted. Special care shall be given to reinforcing the hull in way of the fenders and areas likely to experience slamming.

3.1.4 The keel structure shall be arranged to accommodate Vessel's dry docking and lifting requirements in the Government Dockyard and relevant dockyard in Hong Kong.

3.1.5 All materials and build processes for aluminium alloy construction shall comply with an approved standard. Their selection shall recognise the vessel through life cycle and service conditions for ease of repair in the event of hull damage.

3.1.6 Hull construction materials shall be new and of a type which has been certified by the RO or other entities acceptable to GNC for shipbuilding purposes. Materials for composite structures construction shall be traceable to ensure quality, and follow good materials handling procedures, for example: workshop conditions, material storage and handling, and requirements for the manufacturing of the craft.

3.1.7 The Contractor shall carry out quality control throughout the construction of the Vessel by their quality control personnel.

3.1.8 Records of the structural materials used for vessel construction and up-to-date copies shall be provided to GNC before and/or during the construction stage of the Vessel.

3.1.9 Major penetrations or access openings through the transverse hull bulkheads below the main weather deck level shall be avoided as far as possible. Cable penetrations shall be located as high and as far inboard as possible. Any and all penetrations through bulkheads below the main deck shall be fitted with RO approved devices and be so arranged to ensure the bulkhead to be entirely watertight and strength maintained.

3.1.10 Weather-tight deckhouse located above the main deck shall, in their outside boundaries, have means of closing the openings, and such means shall be of sufficient strength and be of a design to maintain weather-tight integrity in all operational conditions.

3.1.11 The number of openings in watertight bulkheads is to be reduced to the minimum compatible with the design and proper working of the ship.

3.1.12 Where pipes, scuppers, electric cables, etc., are carried through watertight bulkheads, arrangements are to be made to ensure the watertight integrity of the bulkheads. Valves not forming part of a piping system are not to be permitted in watertight bulkheads. Lead or other heat-sensitive materials are not to be used in systems which penetrate watertight bulkheads.

3.1.13 Where pipes, scuppers, electric cables, etc. are carried through watertight divisions, the arrangements for creating a watertight penetration shall be of a type which has been prototype tested under hydrostatic pressure equal to or greater than that required to be withstood for the actual location in the vessel in which they are to be installed. The test pressure shall be maintained for at least 30 minutes and there must be no leakage through the penetration arrangement during this period. The test pressure head shall be 10% greater than that determined from the minimum permissible height of a downflooding opening.

3.1.14 Where a ventilation trunk forms part of a watertight boundary, the trunk shall be capable of withstanding the water pressure that may be present taking into account the maximum inclination angle allowable during all stages of flooding.

3.1.15 Close attention shall be paid to the fabrication and installation of machinery foundations to insure rigidity of the foundations and their structural continuity with adjacent structure.

3.2 Hull and Deckhouse Structural Requirements

3.2.1 General Requirements for Hull Structure Construction

(a) All materials used in the construction shall be agreed by GNC prior to construction.

(b) The keel structure shall be arranged to enable the Vessel's dry docking and lifting at the Government Dockyard in Hong Kong.

3.2.2 Workmanship

(a) Trunks, coamings and openings where applicable shall have radius corners as large as possible.

(b) Fittings and openings through decks and bulkheads for pipes and cables shall be properly designed using approved fittings to maintain watertight integrity, reduce transmission of heat, and to minimise transfer of machinery vibration and noise to the hull structure.

(c) Limber and vent holes shall be cut as necessary to ensure proper venting and drainage of all tanks, compartments, pockets, and voids. All tanks shall have limber holes and vent holes of adequate size for full capacity flow to suction and vent lines. There shall be no pockets where water or other liquids can be trapped at any normal list or trim to be encountered in service.

(d) Sharp corners shall be avoided.

3.2.3 Tightness

(a) Tanks shall be tested by pressurizing to the equivalent of a head of water from the tank bottom to one metre above the top of the vent loop subject to the RO Requirements. If pressurized by air, all fittings and welding shall be checked by application of a soap solution. No leakage is permitted. During testing, tanks shall hold their pressure without leakage for six (6) hours or fulfilling applicable requirements of the RO.

(b) The weather-tightness of any fittings on the weather deck and deckhouse shall be demonstrated by directing a water stream from a 12 mm diameter nozzle at all parts of the exterior including all windows, doors, and hatches. The nozzle shall be 1.5 metres or less from the fitting being tested, and the water pressure at the nozzle shall be at least 4 bars. Any leakage will be considered to be a failure of the test and corrective measures shall be taken.

(c) Chalk tests shall be carried out if the above two methods are not applicable.

(d) All structures and fittings shall withstand the tests described above and any weakness shall be rectified at the expense of the Contractor.

3.2.4 Fairing

The hull, decks, and deckhouse side wall shall be fair, and shall be free from objectionable buckles or uneven sight edges. Special care shall be used in aligning and fairing of surfaces which are to be joined.

3.2.5 Decks, Platforms, Flats and Stiffness

(a) All decks, platforms and walking flats shall be sufficiently reinforced to prevent deflection that might be caused by service load, an individual walking or standing on the deck and/or by structural flexure of the hull and/or deckhouse. Structures under or behind fittings shall be adequately strengthened to withstand the load exerted by or on the fittings.

(b) The hull shall be designed with stiffening at bow, midship and quarter. That is, it can give a good ability in structural strength which is suitable for berthing alongside of larger ships and pushing other vessels or towing other small crafts (below 15m) when necessary.

(c) The main deck (and where relevant cabin roof) shall be fitted with water-tight hatches for removal of main engines and generators.

(d) The deck area shall have a camber at 1/50~1/80 of the beam of the deck edge and may slope up towards the bow at forward part.

(e) Adequately secured grating shall be provided as required and to GNC's satisfaction. Removable grating shall be provided where required for access to valves, equipment, bilge pickups, and to other systems below.

3.2.6 Through-Hull Fittings

(a) Through-hull fittings shall be located in convenient locations for maintenance purposes, as required for equipment listed in these TS. The number of through-hull fittings shall be kept to a minimum.

(b) If required all through-hull fittings located below the waterline shall be fitted with flanged type screw

down non-return valves fabricated of metal and having suitable corrosion protection, such as cathodic protection.

(c) The hull external shell surface below the waterline where through-hull fittings are located shall be fitted with external fairings/screens to minimise drag.

3.2.7 Hull Structural Closures

(a) Inspection hatch shall be provided on each fuel oil tank. The inspection hatch shall be sized to allow proper inspection of the entire tank interior. The inspection hatch shall have gasket covers secured by stainless steel bolts and self-locking nuts.

(b) Access to hull compartments from the main deck shall be provided by watertight deck hatches.

(c) Emergency escape access shall be provided for hull compartments for RO and GNC approval.

(d) Flush deck hatches fitted with waterproof soft patch or gasket shall be provided for engine and equipment removal or maintenance purposes. Soft patches shall be secured properly and to GNC's satisfaction.

(e) Flush watertight deck hatches shall be installed for the access to fore peak / after peak tank / tank space from main deck.

(f) Hinged hatch covers shall be provided with means to hold them in the fully opened position. A protective device shall be installed to prevent the crew from accidentally dropping into the opening after opening the hatch. For hinged type watertight door, they shall be opened outward except those in high flooding risk spaces where they shall be opened into the space.

(g) All access closings shall be able to be opened and closed at both sides. The warning "Door must be kept closed when underway" shall be marked on both sides of the watertight door and all watertight doors shall fit with visual and audio alarms in the wheelhouse to give alerts when watertight doors are opened.

3.2.8 Deckhouse Closures

(a) The weather-tight doors complied with the requirements of RO shall be provided for access into the deckhouse.

(b) Doors giving access to the deckhouse shall have a coaming as per RO's regulation above the finished main deck surface.

(c) Appropriate locking devices shall be provided for all access doors which can be operable at both sides.

(d) Deckhouse shall be so designed to facilitate the removal of engines from the engine room to shore for maintenance and repair. Opening on deck and closing hatches shall be provided and maintaining the structural strength of the deck structure.

(e) All doors in the deckhouse shall have clear toughened safety glass windows.

3.2.9 Freeboard Area and Hull Preservation

(a) Exterior surfaces of the Vessel above the fully loaded draught, (that is, that part of the hull which is exposed alternately to wind and water) shall painted and prepared to a satin finish / appearance / texture.

(b) Antifouling paint shall be applied by the Contractor to the paint manufacturer and GNC's satisfaction.

(c) Wherever paint is used, the Contractor shall propose a suitable paint specification in conjunction with a preferred paint manufacturer for GNC's approval. Painting report prepared by the paint supplier shall be submitted to GNC for record.

(d) All coatings shall be applied as specified by the manufacturer including temperature and humidity at time of application, coverage/rate, wet and dry film thickness, recoat time and application equipment and rate, etc.

(e) The Vessel shall be painted externally with a paint process which can be guaranteed for a minimum of two (2) years' service life by the paint manufacturer. Paint shall be used on surfaces as directed by GNC.

(f) Painting Schedule shall be proposed by the Contractor in consultation with the paint suppliers/manufacturers and submitted for GNC agreement and approval.

(g) All materials used for painting of the Vessel internally and externally shall be agreed by GNC and shall not have adverse effects to the environment and the health of persons on board.

(h) Painting report for the complete vessel on delivery and after warranty slipping shall be prepared by the paint manufacturer and submitted to GNC.

3.3 Weld Quality

3.3.1 All welding and fabrication work shall be carried out according to the rules of the RO to be deployed for overseeing the welding and fabrication work.

3.3.2 Welding joints shall be carefully designed and constructed to conform to the latest established standards and shipbuilding practice to prevent fatigue failures.

3.3.3 Cutting for edge preparations and welding shall be carried out by the RO recognised qualified workers.

3.3.4 Certification of the qualifications of each individual welder shall be submitted to MD by the Contractor before commencing welding works.

3.3.5 Welds carried out by unqualified procedures or welding performed by non-certified welders shall be subject to removal by the Contractor at his own expense.

3.4 Supervision of Fabrication and Assembly

3.4.1 The items listed below (but not limited to) are required to be recorded by the Contractor and submitted to GNC or the delegated consultant firm in accordance to Paragraph 1.3.2 before fabrication:

(a) Inventory of the incoming materials, consumables components and machinery;

(b) Traceability procedures for the use of the materials, traceable identification codes which shall be serial and indexed to the controlled manufacturing procedures;

(c) Lofting, cutting, fitting, welding, forming and dimensions control of all the major structural components, measures shall be taken to avoid deformation of structure during fabrication and welding;

(d) Welding and inspection procedures for identifying the type and extent of Non-Destructive Test ("NDT") inspections carried out on the Vessel structures. GNC may extend the NDT where deemed to be necessary subject to the quality of the welding. A NDT inspection plan shall be submitted to GNC for approval before inspection;

(e) All NDT reports;

(f) Welding and inspection qualification and certification of each person;

(g) Records of maintenance and calibration of the welding, machining, measuring and inspection equipment;

(h) Records of machining, finish surfaces, and bolting;

(i) Procedures for work quality non-conformance reporting and records of rectification of defects; and

(j) The design and manufacturing drawing control procedures, including any of its revisions and updates, and records for any re-issue of drawings.

3.5 Stability and Subdivision

3.5.1 The stability calculations shall be carried out by using a proven computer system, with evidence (viz. recognised by a government authority or the RO). All calculations and drawings must be in metric units.

3.5.2 The Vessel is required to comply with the intact and damage stability requirements stated in this Part VII.

3.5.3 A final stability assessment of the sea trial loading condition using final lightship data shall be delivered to MD prior to the Official Speed Trial mentioned in Paragraph 1.7 of this Part.

3.6 Inclining Experiment

3.6.1 As part of the Technical Acceptance, an inclining experiment shall be carried out in near the waters of the Contractor's shipyard, with the attendance of MD officer(s) and/or appointed consultant, according to the guidance of Annex I to IMO Resolution MSC.267 (85) in conducting such an inclining experiment, to determine the lightship weight and the position of the centre of gravity of the Vessel.

3.6.2 At least 14 working days in advance of the inclining experiment, a "Scheme of Inclining Experiment" ("the Scheme") shall be approved by the RO and submitted to GNC for acceptance. The inclining experiment can only be conducted after GNC has accepted the Scheme, and in the presence of the RO surveyors and MD officer(s) and/or appointed consultant.

3.6.3 The Scheme shall include:

(a) The intended date and time, and the place conducting the inclining experiment.

(b) The anticipated water depth at the time conducting the inclining experiment.

(c) A recent photograph of the site that will conduct the inclining experiment.

(d) A recent photograph of the Vessel, including its external view and hull superstructures and main deck situation.

(e) The name of the RO representative and the Contractor representative who will attend and be responsible for the inclining experiment.

(f) The Vessel's intended initial loading condition (with a comprehensive list of all the items on board that are not part of the ship structures, machinery, fixture and fittings, liquid including persons and inclining experiment facilities and equipment) during the inclining experiment.

(g) The proposed initial locations and the subsequent movements of the inclining weights.

(h) The calculation of the estimated heel of the Vessel before and during the inclining experiment.

(i) The proposed number, location and lengths of pendulum used; or other methods of measuring heel angles (that must be of a type acceptable to GNC).

(j) hydrostatic table, and tank capacity tables.

(k) The list of data to be measured in accordance with the IMO Resolution MSC.267(85) – International code on intact stability, 2008.

3.6.4 The metacentric height of the Vessel after each and every shift of inclining weight shall be determined.

3.6.5 The lightship weight and centres of gravity shall be calculated and presented in the inclining experiment report. Free surface effects of all liquids on board shall be taken into account in all calculations.

3.6.6 The Inclining Experiment Report shall be approved by the RO before submitting to MD for further comments and acceptance. The report shall include a statement from the Contractor stating that the Vessel is safe to go to sea for all other tests and trials covered in the Technical Acceptance.

3.6.7 The Vessel must not be subject to any operational limitations with respect to its stability capability within the operational requirements stipulated in these TS.

3.7 Stability Information Booklet

3.7.1 The stability due to wind and ship rolling shall be calculated for the operational sea and weather conditions stipulated in the TS. These calculations shall be submitted to GNC for approval.

3.7.2 All the requirements stipulated in the latest and as amended IMO Resolution (i.e. International code on intact stability, 2008 regarding the Stability Information Booklet and the conduct of the inclining experiment and the Inclining Experiment Report) shall be followed.

3.7.3 In this regard the format and presentation of the Stability Information Booklet, Inclining Experiment Report shall follow strictly to the requirements and instructions in the latest and as amended IMO Resolution.

3.7.4 The Stability Information Booklet and the Inclining Experiment Report shall be approved by the RO before they are submitted to GNC for the final acceptance. These documents shall only be considered as acceptable when they are accepted in writing by GNC.

3.7.5 A Preliminary Stability Information Booklet based on the estimated centre of gravity ("CG") positions of the Vessel shall be submitted to GNC during the design stage and within four (4) months after the kick-off meeting, to show that the Vessel can fulfil the TS required Vessel stability as well as any other stability requirements required by GNC for GNC to consider, during the design and construction stage.

3.7.6 The Official Sea Trial shall only be carried out after the results of the inclining experiment show the Vessel's actual centre of gravity position is consistent with the information given in the PRELIMINARY Stability Information Booklet, and that the Vessel is safe to go on with the sea trials.

3.7.7 The FINAL Stability Information Booklet and the Inclining Experiment Report shall be delivered to GNC at least 14 days before the Delivery Acceptance.

3.7.8 **For the avoidance of doubt, in addition to the above requirements**, the Stability Information Booklet

in its final version shall include (but not limited to):

(a) The Vessel's particulars, sketch of general arrangement drawing showing different compartment and tank positions, hydrostatic curves, and cross curves of stability;

(b) Tank calibration/sounding tables include but not limited to fuel oil tank and freshwater tank. These tables shall consist of the locations of tanks (in terms of frame numbers), levels from tank bottom, capacity, VCG/LCG/TCG and free surface moments, and the location of the sounding points. The trim and heel of the Vessel for which these tables are applicable shall be stated clearly;

(c) Stability calculations for each loading condition shall include but not be limited to a profile drawing of the Vessel and items of deadweight, lightship, displacement, drafts, trim, VCG, GM (solid & fluid), LCG, down-flooding angle and maximum static stability - GZ curves;

(d) Any other information as reasonably required by the RO and/or GNC; and

(e) The RO approved inclining experiment report.

3.7.9 The Official Sea Trials shall only be carried out after the results of the inclining experiment show that the Vessel is safe to go on with the sea trials.

3.7.10 The Contractor shall supply four (4) copies of the Stability Information Booklet (for the as-built Vessel) to MD.

3.7.11 Both the preliminary and final Stability Information Booklet shall include the following loading conditions (and any other conditions as may be required by MD during the design and construction of the Vessel) and their stability results shall be presented in a manner and format as indicated in latest and as amended IMO Resolution.

Loading Condition	Fuel	Fresh Water	Black water	Dirty oil and water	Urea	Crew [1]	Other Persons [2]
Lightship	0	0	0	0	0	0	0
Light Load Departure	50%	50%	10%	10%	95%	3	0
Light Load Arrival	10%	10%	50%	50%	10%	3	0
Full Load Departure	95%	95%	10%	10%	95%	3	12
Full Load Arrival	10%	10%	95%	95%	10%	3	12
Sea Trials	95%	95%	10%	50%	95%	3	12

1 Crew:

75 kg body weight and **10** kg effects for each crew.

2 Other Persons:

75 kg body weight and **5** kg effects for each other person.

3.7.12 The calculations shall follow the requirements below:

1. The maximum free surface moments shall be used for calculating the stability of the Vessel in all above conditions.
2. VCG of each crew/person shall be assumed as one (1) metre above deck in their most likely positions. The most likely positions of these persons shall be agreed by GNC and user department.
3. Likewise the LCG of each crew/person shall be in their most likely position on board. The most likely positions of these persons shall also be agreed by GNC and user department.
4. The effect of wind moments in various loading conditions due to Beaufort scale number not less than **7** at beam shall be calculated and duly considered in the stability calculations of all the above stated conditions, to the satisfaction of GNC.

3.8 Intact Stability Criteria

3.8.1 The Vessel shall comply fully with the intact stability criteria stipulated in 2008 IS Code (i.e. the International Code on Intact Stability, 2008, adopted by IMO resolution MSC.267(85), as from time to time revised or amended by any revision or amendment that applies to Hong Kong) ("latest and as amended IMO Resolution").

3.8.2 Stability will also be considered satisfactory if the Contractor choose to apply related rules and regulations in stability requirements of the RO.

3.9 Damage Stability Criteria

3.9.1 For the purpose of making damage stability calculations, the volume and surface permeabilities shall be comply with the requirements of RO.

3.9.2 Suitable watertight transverse bulkheads shall be arranged to maintain the stability of the Vessel when any one watertight compartment under deck damaged and flooded, and when there is asymmetric flooding to any one of the under deck compartments.

3.9.3 The residual stability of the Vessel in the above mentioned damage condition shall be sufficient to maintain adequate stability of the Vessel at sea in any one of operational modes mentioned in the TS.

3.9.4 The residual stability of the Vessel shall be considered satisfactory if the following criteria are complied with, after taking into account of free surface effects and wind moment, for loading conditions as specified above.

(a) The residual transverse metacentric height shall not be less than 0.05 metre.

(b) The inclination angle shall not exceed 7 degrees.

(c) The final water line is located below any inlet opening.

N.B.The inlet opening means an opening through which progressive flooding may take place is immersed. This would not be an opening closed by a watertight manhole cover or a vent fitted with an automatic closure.

3.9.5 The opening(s) to determine the down-flooding angle(s) shall first be agreed by GNC before carrying out the damaged stability calculations. The permeability of each flooded compartment for the stability calculations shall first be agreed by GNC.

3.9.6 The damage stability calculation shall be produced and has obtained the RO's approval before submitting to GNC for further comments.

3.10 Tonnage Measurement

3.10.1 The Vessel shall be measured as per International Convention on Tonnage Measurement of Ships (ITC) 1969. Tonnage measurement shall be endorsed and approved by the RO. The RO shall issue a Certificate of Compliance as part of the certificate of classification with notations. (Tonnage certificate is not required).

3.10.2 The Tonnage calculation shall also comply with relevant requirements as said in the Code of Practice - Safety Standards for Class II Vessels in the version as amended and issued by Local Vessels Safety Section of Hong Kong Marine Department.

3.11 Freeboard Assignment

3.11.1 The freeboard assignment shall be in accordance with Cap. 369AD Merchant Shipping (Safety) (Load Line) Regulations, as amended from time to time, or equivalent requirements of the RO. The Vessel shall be issued with the Certificate of Compliance by the RO.

3.11.2 The freeboard assignment shall also comply with relevant requirements as said in the Code of Practice - Safety Standards for Class II Vessels in the version as amended and issued by Local Vessels Safety Section of Hong Kong Marine Department.

Chapter 4 General Arrangement Plan

4.1 General Provision

4.1.1 The Vessel shall be designed and built as a mono-hull vessel. The hull and the superstructure shall be all welded marine grade aluminium alloy plates and specially designed extrusions.

4.1.2 Without prejudice to the requirements set out in this Part VII (whether it is Essential Requirements or Specifications without Label or other Overall Specifications) ("Proviso"), to the extent that the arrangement as specified in the Guidance General Arrangement Plan do not show indication concerning compliance with the aforesaid requirements, such arrangement shall be understood to serve as a guide and to help to explain the tender requirements. Without prejudice to the generality of the Proviso as aforementioned, all components of the Vessel as specified in the Overall Specifications including in this TS shall be included in the as-built Vessel.

4.1.3

Dimension	**Guidance**
Side deck walkway width	Minimum 0.60 metre Obstructions to this walkway shall be avoided
Clear headroom for accommodation compartments crew space and wheelhouse	Minimum 2.0 metres
Number of crews and other persons	Maximum 15

4.1.4 During the design and construction of the Vessel, the Contractor is required to submit a detailed General Arrangement Plan for GNC's written approval and acceptance.

4.1.5 It is a contractual requirement that all furniture, equipment and facilities, fixture and fittings, including outfitting of the Vessel that are described in the TS, together with their requirements for design and installation standards that are stipulated in this Chapter and in any other parts of the TS are the items that must be included in the complete "As-built" Vessel delivered to the Government.

4.1.6 The Tenderer shall note that the requirements given in the TS are in addition to the RO Requirements and IMO requirements and shall be met by the design and construction of the Vessel.

4.2 General Arrangement

4.2.1 The subdivisions and accommodation compartments are listed below:

(a) Under Deck compartments:

1. Fore peak and chain locker;
2. Crew space;
3. Tank space;
4. Engine room; and
5. Steering gear room.

(b) Compartments above the main deck:

On the main deck there shall be comprised of the following compartments:

1. Wheelhouse;
2. Ship office; and
3. CO_2 room.

4.2.2 Final design for subdivisions and accommodation compartments mentioned above shall be subject to full compliance with the requirements of stability and subdivisions from the RO.

4.2.3 All cabins shall be designed and arranged so as to protect the occupants from weather and sea conditions, and aims to minimise risk of injury.

4.2.4 All controls, electrical equipment, high-temperature parts and pipelines, rotating assemblies or any other items in cabins and compartments shall be properly placed not to cause injury.

4.2.5 Equipment fixtures and fittings on board shall be fitted properly to avoid injury to persons at all times

during bad weather and worst sea conditions.

4.2.6 Store space shall be arranged for storing the anchor chains, mooring ropes, navigational equipment, shapes, spare fire extinguishers and other equipment.

4.2.7 There shall be a public address system covering all open areas and spaces of the Vessel, and where crew shall have access, including the escape routes. The system shall be such that at the initial stage of flooding to occur, or at the start of fire in a compartment, would not cause the system inoperable.

4.2.8 All interior decks shall be covered with fire retarding vinyl composition sheet and colour to be selected by GNC.

4.3 Fore Peak and Chain Locker

4.3.1 The fore peak space shall be watertight and located at the foremost end of the hull, with a watertight collision bulkhead. IMO requirements for collision bulkhead must be complied with.

4.3.2 The fore deck geometry of the Vessel shall be carefully designed to facilitate safe boarding/mooring to MD's satisfaction. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the Vessel.

4.3.3 The fore deck shall exhibit a flush deck free of anchoring/mooring equipment.

4.3.4 A hinged flush type watertight hatch cover shall be provided on the main deck for access to the Fore Peak. Access ladder shall be provided.

4.3.5 A store space with steel walls for storing the anchor chains shall be arranged inside the fore peak compartment. Perforated marine plywood flooring with thickness of not less than 50mm shall be provided. Suitable sparred wooden shelves shall be provided.

4.4 Crew Space

4.4.1 The crew space shall be located under-deck (or partially under-deck) aft the fore peak.

4.4.2 There is a washroom at the back of the crew space.

4.4.3 A galley shall be provided at the front end of the crew space.

4.4.4 Notwithstanding requirements specified in other sections, the crew space shall include the following:

(a) A stairway with handrail shall lead directly from the main deck to the crew space.

(b) One emergency escape hatch to the exterior deck with a fixed escape ladder as a means of escape to the main deck from crew space.

(c) Several storage lockers with lock. Each locker shall be able to fit standard Marine Department bags (approximate 500 mm x 300 mm x 300 mm). It is desired that there are two (2) tiers of locker, each tier has six (6) lockers.

(d) Grab rails shall be provided where necessary.

(e) One (1) electric powered marine wall-mounted clock.

(f) One (1) 240V AC wall mounted 300mm diameter fan.

(g) The crew space shall be ventilated by a split-type air-conditioning.

(h) Appropriate number of electric sockets shall be provided.

(i) One (1) electric exhaust fan shall be provided.

(j) One (1) 240 VAC electric tea kettle securely fixed in location.

4.5 Tank Space

4.5.1 The tank space shall be located between the crew space and the engine room.

4.5.2 The tank space shall be designed to accommodate:

(a) Independent stainless steel fuel oil tanks with manhole cover;

(b) Independent stainless steel fresh water tank with manhole cover;

(c) Independent stainless steel urea tank with manhole cover;

(d) Independent stainless steel sewage tank with manhole cover; and

(e) Independent steel oily bilge water tank with manhole cover.

4.5.3 Adequate ventilation for this space shall meet the requirements of the RO.

4.5.4 The tank space shall be designed with flush watertight cover. Watertight integrity shall be maintained when the top covering is in place.

4.5.5 The flooring of this compartment shall be covered with unpainted aluminium chequer plates.

4.5.6 Aluminium chequer plates adjacent to valves, shafts, etc., shall be easily removable for maintenance. Hinged access plates shall be fitted in way of valves. The arrangement of hinged plates shall avoid/ minimise the rattling noise.

4.6 Engine Room

4.6.1 The layout of the engine room shall be in accordance with IMO Requirements, the RO Requirements and to the satisfaction of GNC.

4.6.2 Special attention shall be paid to the layout of the engine room for the maintenance and repair of main engines, generators and other machinery. The specific requirements given in the TS shall be complied with.

4.6.3 The engine room shall be designed as an unattended engine room. Access to the engine room shall be efficient.

4.6.4 The floor of engine room shall be covered with aluminium chequer plate. Aluminium chequer plates adjacent to bilges, pumps, shafts, pipes and strainers etc, shall be easily removable for maintenance.

4.6.5 Hinged access plates shall be fitted in way of valves. The arrangement of hinged plates shall avoid / minimise the rattling noise.

4.6.6 Splash plates, casings, fenders, screens, etc. shall be provided for the protection of personnel and machinery. Removable guards shall be provided over exposed moving parts of the machinery, hot pipe, etc.

4.6.7 All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports, etc. in the engine room and steering gear compartment shall be of lightweight construction.

4.7 Steering Gear Room

4.7.1 The layout of the steering gear compartment shall be arranged for easy and convenient installing, operating and access for maintenance/repairs to the steering gear system. Flush access manhole with hinged cover shall be provided for access to this compartment.

4.7.2 Readily accessible space shall be provided for the operation of an emergency manual hydraulic pump with independent piping.

4.7.3 The floor of this compartment shall be covered with aluminium chequer plate.

4.7.4 Aluminium chequer plates adjacent to valves, shafts, etc., shall be easily removable for maintenance.

4.7.5 Hinged access plates shall be fitted in way of valves. The arrangement of hinged plates shall avoid/minimise the rattling noise.

4.8 Wheelhouse

4.8.1 The wheelhouse shall be located in front of the deckhouse on the main deck. A door shall be provided on the rear wall of the wheelhouse.

4.8.2 The outside configuration of the deckhouse shall be of a design that deflect rain and seawater during heavy weather; and to provide practically all-round visibility at the steering/helm position of the console area. Pillars are not allowed to be fitted inside the bridge area.

4.8.3 Instruments, instrument panels and controls shall be permanently mounted in the consoles, taking into account operational, maintenance and environmental needs.

4.8.4 The wheelhouse shall be designed with a wheelhouse control station for one-man operation comprising controls and instruments for navigation, manoeuvring, communication and machinery operation.

4.8.5 Three (3) heavy duty pedestal seats with hydraulic damping system, arm-rest and with safety belts for the crew are required. The seats shall have high density foam cushions, adjustable back rest, folding arms, lumbar support and adjustable footrest. The height and direction of these seats shall be adjustable. (details as refer to Paragraph 4.17 of this TS)

4.8.6 Controls for the steering shall be easily reachable by a person of normal Asian stature in the seated position without needing to extend his arms, and without obstructing the coxswain and the navigating crew all-round field of view.

4.8.7 Controls for the coxswain controls shall be easily reachable by a normal Asian size in the sitting position without needing to unduly extending his arms, and that it would not interfere the coxswain's all round field of view.

4.8.8 The wheelhouse shall not be designed for used purposes other than navigation, communications, monitoring the performance of the machinery and other functions essential to the safe operation of the Vessel.

4.8.9 In addition to the RO and IMO requirements, the wheelhouse shall be properly designed for the controls and instruments for navigation, manoeuvring, communication and machinery operation to the satisfaction of GNC.

4.8.10 The steering position, console and its instrument and gauges, and control layout, coxswain seat and the navigator and engineer officer seats, and in fact the complete interior arrangement of the wheelhouse shall first be agreed by GNC before the installation and construction. For this purpose, the Contractor shall construct a mock-up of the internal arrangement in the shipyard for the GNC officers and the user department officers to approve.

4.8.11 The arrangement of equipment and means for navigation, manoeuvre, control, communication and other essential instruments shall be located sufficiently close together to enable the coxswain and the assisting officer to read/receive all the necessary information, and be able to use the equipment and controls while they are seated.

4.8.12 All instruments shall be logically grouped according to their functions. In order to minimise the risk of confusion, instruments shall not be rationalised by sharing functions or by inter-switching.

4.8.13 The instrument panels for the emergency controls and the monitoring of the fire-fighting systems shall be in a separate position, and shall be in clearly defined locations agreed by GNC officers.

4.8.14 Instruments required for use by any member of the operating crew shall be plainly visible and easily read with minimum practicable disposition from his normal seating position and deviation from line of vision; i.e. they will cause minimum risk of confusion under all likely operating conditions.

4.8.15 The instruments and controls shall be provided with screen and dimming facilities to minimise glare and reflections and prevent them from being obscured by strong light.

4.8.16 The surfaces of console tops and instruments shall have dark glare-free colours. Surface finishing and interior linings of the wheelhouse shall be of a matt non-reflecting finish to facilitate night operation.

4.8.17 The controls, displays and equipment are required to incorporate into the bridge control station so that all relevant controls can be reached from a fixed working position (e.g. sitting, standing or both).

4.8.18 The Contractor shall build a preliminary mock-up and a final mock-up of the bridge including all the navigation equipment arrangement, seats and other fittings as required under this Part. The mock up shall be of FULL SIZE dimensions and agreed by GNC. The bridge mock-up inspection shall also include the visibility requirements in Paragraph 4.13.

4.8.19 It is desirable that the preliminary control console plan to be submitted by the Tenderer shows improvements over the Wheelhouse Arrangement Plan over such operational aspects (Part A(II)(a)) as mentioned in the Marking Scheme in Part II - Conditions of Tender. [D]

4.9 Other Wheelhouse Outfitting

4.9.1 The following fittings and equipment are required to be provided in the wheelhouse or the store of wheelhouse:

(a) Two (2) wall mounted fans of diameter 300 mm;

(b) One (1) display board for posting plans, maps, notices, etc.

(c) One (1) set of pigeon holes for stowage of international code flags;

(d) One (1) set of international code flags suitable for the mast;

(e) One (1) set of open shelves for the stowage of log books and files;

(f) One (1) chart table with lamp and dimmer over, a drawer shall be provided under the table top for the stowage of charts;

(g) One (1) dial type inclinometer and one thermometer for marine use;

(h) One (1) metal rubbish bin with cover shall be stored inside a cabinet/locker;

(i) One (1) metal box for keys shall be provided and fitted inside the wheelhouse;

(j) One (1) magnetic compass with independent illuminated dimmer switch;

(k) One (1) wooden box with locks for the storage of binoculars, and it shall be fitted within the vicinity of the coxswain and navigator seats. One (1) waterproof and fog proof 7x50 Marine binoculars for day time use shall be provided;

(l) One (1) electric powered marine wall-mounted master clock;

(m) Four (4) cup holders;

(n) One (1) framed safety plan of appropriate size;

(o) Four (4) coat-hooks;

(p) A number of storage lockers; and

(q) One (1) approved type first aid box.

4.10 Wheelhouse Console Control Equipment

4.10.1 The following controls, displays and equipment are required to be incorporated into the wheelhouse control station so that all relevant controls can be reached from a fixed working position (e.g. sitting, standing or both):

(a) Steering is controlled by steering wheel and quick action lever control (Joystick);

(b) Engine speed and clutch controls;

(c) Rudder or steering angle indicators;

(d) Public address system as mentioned in Paragraph 9.2 of this TS;

(e) Magnetic compass as mentioned in Paragraph 9.3 of this TS;

(f) Fiber-optic Gyrocompass as mentioned in Paragraph 9.4 of this TS;

(g) Satellite Gyrocompass as mentioned in Paragraph 9.5 of this TS;

(h) Differential global positioning system as mentioned in Paragraph 9.6 of this TS;

(i) Marine radar as mentioned in Paragraph 9.7 of this TS;

(j) Electronic Chart Display and Information System ("ECDIS") as mentioned in Paragraph 9.8 of this TS;

(k) International maritime mobile ("IMM") VHF radio with GMDSS as mentioned in Paragraph 9.9 of this TS;

(l) Marine band hand-held water proof radio transceiver as mentioned in Paragraph 9.10 of this TS;

(m) Secure Automatic Identification System ("AIS") transponder as mentioned in Paragraph 9.11 of this TS;

(n) Radar transponder as mentioned in Paragraph 9.12 of this TS;

(o) Satellite EPIRB as mentioned in Paragraph 9.13 of this TS;

(p) Electric horn conforming to IMO requirement as mentioned in Paragraph 9.14 of this TS;

(q) CCTV system as mentioned in Paragraph 9.15 of this TS;

(r) Windshield wiper as mentioned in Paragraph 9.16 of this TS;

(s) Waterproof LED Display System as mentioned in Paragraph 9.17 of this TS;

(t) Voyage Data Recorder ("VDR") as mentioned in Paragraph 9.18 of this TS;

(u) Speed log as mentioned in Paragraph 9.19 of this TS;

(v) Direction Finder System as mentioned in Paragraph 9.20 of this TS;

(w) Wired and Wireless Intercom (Talkback) System as mentioned in Paragraph 9.21 of this TS;

(x) Wind speed and direction system as mentioned in Paragraph 9.22 of this TS;

(y) Echo sounder system as mentioned in Paragraph 9.23 of this TS;

(z) Lighting control panel incorporating controls for navigation lights, and alarms, search lights and flood lights;

(aa) Main and auxiliary engines monitoring indicators and tachometers;

(bb) Instrument & control and alarming system for major machinery containing start/stop switches;

(cc) Exhaust temperature gauges;

(dd) Gear box oil pressure indicators alarms;

(ee) Fire detection system and CO_2 flooding system control panel;

(ff) Emergency stop switch for accommodation ventilation fans;

(gg) Meter/Gauge indicating the quantity of fuel remained in the fuel tank;

(hh) Navigation light and flashing beacon control panel.

(ii) VHF radio receiver stowage position and power sockets;

(jj) Gyro Stabilizer panel; and

(kk) Any other instrumentation recommended by the manufacturer of the proposed propulsion system and GNC.

4.11 Galley and Mess Space

4.11.1 A galley shall be provided at the front end of the crew space. The galley shall be adequate for preparing hot meals and beverage.

4.11.2 The following furniture, fittings and equipment are required to be provided in the galley:

(a) One (1) refrigerator with positive latches of a suitable size and type;

(b) Portable cooking power inverter microwave oven (of a size and type decided by the user Department);

(c) One (1) electric rice bowl (of a size and type to be decided by the user department);

(d) One (1) double-burners induction cooker;

(e) Two (2) stainless steel kitchen sinks with a spring loaded cold freshwater supply tap;

(f) One (1) large rubbish bin of a suitable size with cover;

(g) One (1) electric kitchen range hood;

(h) One (1) stainless steel cooking table;

(i) One (1) drawer for kitchen tools; and

(j) One (1) stainless steel condiment rack.

4.11.3 The mess space shall be located close to the galley, with enough seats and tables suit for 5 persons at one time.

4.11.4 One (1) electric powered marine wall-mounted clock and two (2) 240V AC wall mounted 300 mm diameter fans.

4.11.5 One (1) water dispenser with hot and cold water supply function shall be provided in the mess room.

4.11.6 Appropriate numbers of electric sockets (220V AC and 24V DC) shall be provided. The number and location of sockets shall be proposed by the Contractor and be subject to GNC approval.

4.12 Shower and Toilet

4.12.1 A washroom shall be arranged at the back of the crew space.

4.12.2 Aluminium toilet door shall be fitted with louver with lock.

4.12.3 The washroom shall be equipped with electric hot water unit. The electric water heater shall have a capacity of no less than 50L and hot/cold water shower spray.

4.12.4 Not-withstanding requirements specified in other sections, each wash room shall include the following:

(a) Electric flush toilet (not of a "vacuum" type) shall be provided;

(b) Non-slip flooring and waterproof grating shall be provided;

(c) One (1) stainless steel wash basin with a spring loaded cold/hot freshwater supply tap；

(d) One (1) liquid soap dispenser;

(e) One (1) water delivery point under basin with a plastic hose for toilet cleaning；

(f) One (1) bulkhead mounted fresh water supply valve for washing purpose;

(g) One (1) cabinet with mirror and vanity lights;

(h) Appropriate number of electric sockets shall be provided;

(i) One (1) paper towel waste bin;

(j) One (1) toilet paper holder;

(k) Three (3) coat hooks;

(l) Sufficient lighting;

(m) Stainless steel hand rails as appropriate to allow safe use of the facilities while at sea;

(n) One (1) electric exhaust fan, the exhaust air shall be routed to outside; and

(o) Means to avoid water accumulated on the toilet floor.

4.12.5 Sewage flushed from toilets shall be stored in a sewage tank and have an option to discharge direct overboard when required.

4.13 Windows and Visibility

4.13.1 Throughout the vessel polarized and tinted windows shall not be fitted.

4.13.2 All windows shall be manufactured from clear toughened safety glass, secured to the structure and shall be issued with the type approval certificate by the RO and is suitable and safe for marine use. Details of all windows shall be submitted to GNC for approval and window glass thickness shall be verified in accordance with the submitted information before installation.

4.13.3 Windows shall be strong and suitable for the worst intended operating conditions. Window glass and the frame shall be made of materials which will not break into dangerous fragments when fractured/shattered.

4.13.4 Retractable transparent solar UV roller blinds shall be installed on all side windows throughout the Vessel. The blinds shall be capable of being retained in position either partially lowered or fully lowered, without swinging due to vessel motions at sea.

4.13.5 All windows of the accommodation space shall be fitted with curtain.

4.13.6 A basic layout of the windows is shown in the Guidance General Arrangement Plan. Details of all windows shall be submitted to GNC for approval. Weather-tight test shall be carried out after windows installation.

4.13.7 Where practical, depending on the design of the wheelhouse configuration, more windows are preferred to provide a wider clear view. [D]

4.13.8 Retractable transparent solar blind (American Standard Window Film ASWF, Sunny-Kool or RO approved type or equivalent) shall be installed inside of all wheelhouse front windows. All forward facing windows of wheelhouse shall be inclined forward and provide visibility free of any glare under all operating condition. The wheelhouse front windows shall be inclined from a vertical plane topside out to reduce unwanted reflection, at an angle of not less than 10° and not more than 25°.

4.13.9 The height of the lower edge of the wheelhouse front windows above the main weather-deck shall be,

where practical, kept as low as possible for a better view forward. Care shall be given to ensure the lower edge will not present an obstruction to the forward view.

4.13.10 Large RO approved sliding window shall be fitted at port and starboard side to facilitate direct downward viewing to the side of the Vessel. These windows also provide ventilation while the air-conditioning system is not operating excluding the forward section of the side windows fitted with heavy duty wipers.

4.13.11 Frames at the wheelhouse window separations shall be kept to a minimum, and they shall be of adequate structural strength and stiffness. They shall not be installed immediately in front of any navigation seats. The positions of window frames shall be agreed by GNC before installation.

4.13.12 The following outfitting items shall be provided:

(a) Heavy-duty marine type wide span and large area electric wiper(s) (covering not less than 60% of the window glass plane area) with fresh water window washing systems shall be fitted to all wheelhouse front and side windows.

(b) Wipers shall be fitted with electrical fresh water window/wiper washing systems. The type of wiper must be submitted to GNC for acceptance before they are fitted.

(c) Each wiper shall be operated and adjusted from independent control circuit. Power switch shall be provided in each wiper power circuit for isolating faulty wiper from power trip. All wiper control operation shall not be connected on a common control bus for preventing all wiper shutdown at same time. All the wipers shall be operated independently.

(d) The operating mechanism and control equipment (two-way switch) shall be located inside the wheelhouse and on or near the wiper it controls, within easy reach of the operator.

(e) Each wiper motor can be accessible for maintenance inside wheelhouse as far as practicable.

(f) Two (2) sets of spare wiper blades shall be provided for each window wiper installed for the Vessel. Two (2) spare unit of wiper for the coxswain front window shall also be provided.

(g) An all-round de-misting system shall be provided for all wheelhouse windows at the interior side of the windows. [Remark: The air conditioning system can be used for this purpose].

4.13.13 As a minimum requirement, the visibility to outside from inside the cabins and wheelhouse shall be in compliance with the requirements set out in IMO. As far as this Vessel is concerned, special attention should be paid to the blind sector caused by arrangements on the deck outside of the wheelhouse forward.

4.13.14 Side mirrors / CCTV shall be provided at locations to allow the coxswain to safely manoeuvre the vessel to a berth.

4.13.15 Vision blind spots or sectors shall be as few and small as possible, and in any case they must not adversely affect the keeping of a safe look-out from the helm position in the wheelhouse.

4.13.16 At all times regardless of the weather and sea conditions at least two third of the wheelhouse front width in front of the coxswain shall have a clear view. The visibility check shall also be carried out during the wheelhouse mock-up inspection.

4.14 Hatches, Doors, Ladders and Access

4.14.1 Design of all outfitting including, but not limited to, doors, hatches, ladders, ventilation heads, etc. shall be of a type approved by the RO for this type of vessel, or other entities acceptable to MD.

4.14.2 Detailed specifications of these items shall be provided. They shall include the structural arrangement, scantlings, material and welding procedures. These shall be in accordance with the RO Requirements.

4.14.3 It is desirable that RO approved access hatch with a coaming height of minimum 600 mm shall be used. Where the use of an access hatch is not practical on the weather deck, flushed type watertight hatch/manhole shall be used. [D]

4.14.4 The design and the arrangement of the flushed type watertight manhole shall be submitted to GNC for approval.

4.14.5 Where the hatches are used for escape purpose, it shall be capable of operating from both sides.

4.14.6 Hatches for access to the watertight compartments below the main deck level shall be type approved by the RO. Watertight and weather-tight deck hatches shall be of hinged type as far as practical.

4.14.7 All hatches shall be fitted with a hold back device.

4.14.8 All deck hatches shall be fitted with a high quality commercial-grade marine-type lock. Three (3) sets of

keys shall be provided. All keys shall be tagged for identification.

4.14.9 Hatches and doors shall be fitted with manual means of locking; and shall be able to be quick opened from both inside and outside of compartment.

4.14.10 Aluminium alloy safety grating shall be provided for each hatch. The sample of the grating can be referred to the following two (2) pictures -

4.14.11 Door to aft deck shall be RO approved outwardly opening weather-tight type. Doors opening to the side deck could be of a sliding type with width acceptable to GNC.

4.14.12 All doors shall be fitted with hooks or other means to hold them in the fully open position if required.

4.14.13 All exterior doors shall be fitted with high quality commercial-grade marine lever-type locksets. Three (3) sets of keys shall be provided. All keys shall be tagged for identification and all locks shall all be keyed alike.

4.14.14 Stairway slopes shall be acceptable to MD and shall be fitted with handrails on each side. A minimum width of 600 mm shall be provided between the handrails.

4.14.15 Vertical ladders, if provided, shall be constructed with non-slip purpose with suitable step space intervals including but not limited to adequate footsteps and handholds for safe access to the compartments and locations of equipment.

4.14.16 A stair/ladder fitted with handrails is located at the back of the deckhouse for access to the upper open deck from the weather deck. The inclined angle of the ladder shall be to GNC's satisfaction. A small ladder shall be installed for boarding to the deck above the wheelhouse from the deck above the ship office.

4.14.17 The engine room shall be provided with two (2) widely separated means of access/escape of minimum 400 mm x 600 mm. Access to engine room shall be protected from weather.

4.14.18 All stair/ladder shall be constructed with non-slip steps.

4.14.19 An aluminium portable ladder shall be provided. It shall be fitted on the port or starboard quarter of the Vessel for embarkation and disembarkation to and from small craft. When it is not required to use, the ladder could be attached to the aft handrail for storage. The portable ladder shall fulfil the requirements as said in the Code of Practice on Provision of Safe Means of Access for Works on Local Vessels (issued under Section 45A of the Merchant Shipping (Local Vessels) Ordinance, Cap 548). The requirements shall include but not limited to:

(a) The supports are so constructed and rigid as to take the weight of a man and a ladder with an ample margin of safety.

(b) The top end of ladder shall be provided with stanchions of not less than 1000 mm at the upper landing place unless there are other suitable hand grips.

(c) The top end shall be firmly secured to prevent from twisting, tilting or overturning. Its bottom end shall be ensured free from smashing or crushing on the sea-wall or adjacent vessel due to tidal movement.

(d) It shall be so placed as to afford a clearance of at least 115 mm behind the rungs for footholds.

(e) The steps must be horizontal and equally spaced at interval between 250 mm and 360 mm for users to climb up or down safely. The width of a ladder shall be at least 400 mm.

(f) The length of portable ladders shall be adequate for safe access purpose, but not exceed 3 m unless both top and bottom ends are firmly secured.

4.15 Open Deck Area, Railing and Handrail

4.15.1 Open deck area shall include:

(a) Clean and simple bow deck area for efficient boarding and mooring operation:

1. The bow deck area shall be a fore raised deck high enough.
2. The deck area shall be clean and simple for efficient anchoring, mooring.
3. The deck area geometry of the vessel shall be carefully designed to facilitate safe mooring to MD's satisfaction. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the vessel.
4. As part of the boarding frame, a permanent forward deck railing for safe embarkation and disembarkation shall be provided.
5. There shall be a weather-tight mooring cables store on the deck area (of a size and type to be decided by the user department).

(b) Clean and simple aft deck area for efficient boarding and mooring operation:

1. The aft deck area shall be large enough for mooring. The clearance shall not be less than 0.6 m.
2. Notwithstanding requirements specified in other sections, the aft deck shall have the following fittings: one 24V DC waterproof power socket, one 240V AC waterproof power socket, and one waterproof shore connection.

(c) Side deck area:

1. Walk around deck which provides easy access to fore deck or aft deck.
2. The width of the side deck on both sides of main deck and upper deck shall be at least 0.6 m for providing safe passages for crew / other persons to walk.
3. Components including but not limited to air vents and pipes are preferably recessed into the deckhouse side. [D]
4. Excessive protrusion of components including but not limited to air vents and pipes shall be avoided to prevent obstructions.

(d) Compass deck area:

1. Compass deck area shall be fitted with a mast.
2. The arrangement shall be such that the equipment on the compass deck shall not interfere with each other.
3. Safe access for the maintenance and servicing to equipment and its fittings shall be provided.
4. Vessel identification shall be marked on compass deck as large as possible.

(e) Upper deck area:

1. There shall be sufficient area on the upper deck clear from permanent obstruction, for taking off and landing of the unmanned aircraft vehicle (drone).
2. The mentioned area shall be clearly marked on the upper deck. The position marker shall be painted using non-slip paint and the markings shall meet the needs of operational.
3. Where operations at night are required, the area floodlighting with emergency back-up power shall be provided to illuminate the area for taking off and landing of the unmanned aircraft vehicle. Floodlights shall be arranged and adequately shielded so as to avoid glare to the operator. The floodlighting arrangement shall ensure that shadows are kept to a minimum.
4. Fire-fighting equipment suitable for use shall be provided in close proximity to the area to the satisfaction of GNC.

4.15.2 All exterior deck areas shall be covered by an appropriate anti-slip surface for boarding / landing and deck covering requirements. The anti-slip paint shall not be made of a mix of paint and added grit material ("sand") and shall be to GNC's satisfaction.

4.15.3 Walk around deck facility provides easy access to fore deck or aft deck. The walking area on deck shall be

well illuminated in dark environments. Illumination lights shall not provide obstruct the movement of personnel.

4.15.4 Main deck, upper deck and compass deck external spaces shall be provided with railings along the sides, except where the convenience of crew operation (e.g. at the mooring operation area) requires otherwise.

4.15.5 All guard rails shall comply with the RO Requirements for protection of persons on board.

4.15.6 Hand rails shall be provided where necessary. Grab rails shall be positioned internally and externally throughout the Vessel to MD's satisfaction. There shall be hand rails on ceiling of the ship office and the crew space. Hand rails and grab rails shall be made of high quality marine grade aluminium extrusions or stainless steel.

4.15.7 All hand rails shall be strongly secured to provide support for persons on board, to prevent them from falling or being thrown on deck or overboard in deteriorated weather and sea conditions, the design to consider the circumstances when all persons on board are lined up together on one (1) side of the deck in case of an emergency situation at sea.

4.15.8 Where necessary, the rails of the railings are made of detachable marine stainless steel chain and insulation between stainless steel and aluminium to be fitted to avoid galvanization. A basic layout of the railings is shown in the Guidance General Arrangement Plan. Permanent stanchion with chains for safe embarkation and disembarkation shall be provided.

4.16 Insulation and Lining

4.16.1 Insulation:

(a) Boundaries and ceilings inside the wheelhouse crew space and main deck cabin shall be properly insulated against weather heat and temperature, with not less than 50 mm thick glass-fibre wool; and be lined with protective/decorative panel linings of hard wearing surface and water sealing.

(b) Boundary of machinery space shall be effectively fire and sound insulated with asbestos-free materials of adequate thickness, pinned and wire-mesh secured, and lined with incombustible sheathing in accordance with the RO Requirements.

(c) The noise level in the accommodation space shall not exceed **78** dB when the Vessel is operating at all speeds. The Contractor shall make all reasonable efforts to minimise noise and vibration in the Vessel.

4.16.2 Lining:

(a) Panels of wall, ceiling panels and their joint materials shall be readily removable. The joining method shall provide long-lasting firm and strong attachments between the adjoining members and parts against excessive vibration, and withstand temperature changes and wear and tear within the life expectancy of the Vessel.

(b) The panels shall be fitted to avoid noise generation due to its own vibration or in resonance response to the overall vibratory mode of the Vessel. This requirement applies to all operational speeds of the Vessel.

(c) Colour of the lining material shall also be agreed by MD.

(d) The deck or floor of accommodation space shall be covered with non-skid, wear resistance and fire retardant vinyl PVC sheets that are acceptable to GNC officers. Colour of the floor covering shall be agreed by MD.

4.17 Seating

4.17.1 Three (3) upholstery heavy duty pedestal seats shall be provided in wheelhouse. Requirements of the seats as follows:

(a) The seats shall have high density foam cushions;

(b) Seats shall be of a hydraulically damped, shock reducing type;

(c) Lumbar support;

(d) Adjustable height and direction (Turntable/Mounting pedestal 0°- 180°) with foot rest; and

(e) Safety belt to be provided.

4.17.2 One (1) high-density foam black colour leather sofa for four (4) persons shall be provided in the ship

office.

4.17.3 One (1) upholstery seat shall be provided at aft of the workbench for MD officers. This seat shall be of a hydraulically damped, adjustable seat height with armrests.

4.17.4 One high-density foam black colour leather settee for two (2) persons shall be provided opposite the officers.

4.17.5 The seat and the attachment system shall be designed to withstand vessel collision and shall be acceptable by MD.

4.17.6 Seating and handholds shall provide support for spinal neutral alignment and postural stability for each person up to the crew limit and also to prevent them from falling or being thrown on deck.

4.17.7 All seat materials of upholstery shall be of fire retardant foam material for heavy duty marine use.

4.18 Furniture and Fittings

4.18.1 Built-in furniture shall be adequately secured against ship impacts in case of ship collision or in bad weather and sea conditions.

4.18.2 All seats shall be strongly secured against 45 degrees inclination in all directions when all seats are occupied by sitting persons.

4.18.3 All tables and seats shall be lightweight, tough and robust.

4.18.4 Upholstery such as seat cushions back rests and settees shall be fire self-extinguishing, e.g. urethane foam to BS 3379 or equivalent, and be of thickness not less than 100 mm and be covered with imitation leather.

4.18.5 Lockers if fitted shall be provided with built-in locks and keys. They shall be designed and fitted to the satisfaction of GNC officers.

4.18.6 Drawers shall be provided for storage of charts.

4.18.7 All hardware including screws, hooks, hasps, hinges, handles, sliding bolts, etc. shall be made of brass with chrome plated finish, or in stainless steel.

4.18.8 All fittings and hardware fitted on board the Vessel such as coat hooks, ceiling lights, bulkhead mounted lights, etc. shall be of a high quality chrome finish. They shall be properly fitted in accommodation space and any other spaces directed by GNC officers.

4.18.9 Colour and decoration schemes (or a furnishing sample board showing materials and colour to be used) for furniture and fittings shall be submitted to MD for approval before installation/fitting.

4.18.10 All furniture shall be fitted as to allow easy removal of the under-deck machineries and tanks if required.

4.18.11 Workbench for officers on duty shall be of about 1230 x 1000 mm, with a small foldable table of 1000 x 340 mm that attached to one side of the table (could be extended to lengthen the table when needed).

4.18.12 Cable channel shall be reserved from the ship office of main deck to compass deck for installation works of 4G LTE network antenna and the its network equipment. Contractor has to provide and install two (2) coaxial high frequency cables in the cable channel.

4.19 Mast and Ensign Staff

4.19.1 One (1) mast shall be fitted on the deckhouse top with IMO required navigational lights (including but not limited to: mast head light, anchor light, not under command light, restricted in their ability to manoeuvre light), shapes, sound signals, radar scanner and other electronic and navigational equipment, including the lightning arrestor, ensign hoist, two (2) signal hoists, the antennas, GPS and UHF mobile transceiver (as indicated in the Guidance General Arrangement Plan). There shall be an all-round flashing red light on the mast below the mast head light for emergency when the fire alarm and the bilge alarm system were not acknowledged after a period of time, the audible and visual alarm shall be extended externally to bring the attention of the persons around for safety. There shall be another all-round flashing red light for patrolling duty.

4.19.2 There shall be two (2) separate switches in the bridge for NUC (not under command) and RAM (restricted in their ability to manoeuvre) lights.

4.19.3 The Vessel shall have an air draft of not more than 7.8 m under any possible loading condition to pass bridges.

4.19.4 The masthead light shall be exhibited forward of amidships as far forward as is practicable.

4.19.5 The structure of the mast associated with its mountings and fixtures shall be designed so that all the equipment as stated in this Part can operate in all weather conditions, with general provisions as follows:

(a) The mast shall have streamline shape and permits navigation light bulbs to be changed by an individual and to permit the servicing of any equipment it carries. Facilities for access to high location shall be provided where necessary.

(b) The mast shall be constructed such that no vibration is experienced in any operating condition including at harbour. The mast design shall be of appropriate size/strength to suit its purpose, but it shall not be too thick. The following example picture is for reference only:

(c) The mast is so designed to accommodate all the navigation lights and lights indicating types of operation. Arrangement shall also be provided for hoisting of navigational shapes.

4.19.6 Access for maintenance and servicing of equipment and its fittings shall be provided.

4.19.7 The requirements of staff are as follows:

(a) Three (3) ensign staffs of length and size to be confirmed by GNC, for flags, shall be supplied.

(b) It is desirable that two (2) ensign staffs shall be placed at the mast and the other one to be placed at aft main deck. [D]

(c) Each ensign staff shall be supplied with a hook for binding the rope.

4.19.8 All equipment and their components including but not limited to cables, conduits, connectors, junction boxes, glands and fittings etc. shall be water proof and be able to function in all weather conditions at sea.

4.19.9 All hardware for mast and ensign staff, such as screws, hooks, hasps, hinges, handles, sliding bolts etc., shall be made of stainless steel and be with proper galvanic corrosion preventive measures at their contact points with the hull/superstructures.

4.20 Anchoring and Mooring Equipment

4.20.1 Anchor

(a) At least one (1) on port bow high holding power type anchor approved by the RO for this type of vessel and acceptable to GNC shall be provided with its associated swivel, shackles, stowage cable or cable and warp and means of recovery.

(b) The Vessel shall be provided with adequate and safe means for releasing the anchor and its cable and warp.

(c) The means of release shall be capable of safe operation even when the anchor cable or warp is under load.

(d) Adequate means and arrangements shall be provided to secure the anchor under all operational conditions.

4.20.2 Windlass

(a) An electric windlass with its associated gypsy and warping drum, cable stopper, hawse pipe, bollards and fairleads shall be of a size, type, height and power suitable for an easy run of the anchor chain and cables as well as the mooring lines.

(b) The windlass shall be capable of lifting one (1) anchor with sufficient length of chain, at a speed acceptable to the RO and in accordance with IMO requirements. The unit shall be fitted with an emergency manual operating mechanism.

(c) Control of the windlass shall be located in the vicinity of the windlass through a starter control unit enclosed in the watertight cabinet. There shall be another control unit in the wheelhouse, that it can be controlled in rough weather.

(d) Emergency stop button for windlass shall be provided in the wheelhouse at the coxswain station position and local area.

(e) A canvas/tarpaulin windlass cover shall be provided.

(f) The Vessel shall be protected so as to minimise the possibility of the anchor and cable damaging the hull structure during operation (including in bad weather and sea conditions).

4.20.3 Mooring

(a) Suitable fairleads, bitts and mooring ropes shall be provided and fitted at the appropriate position for the safety mooring operation. Eight (8) Nylon mooring ropes each 40 metres shall be provided.

(b) As a minimum eight (8) bollards on deck shall be provided. All the bollards shall be double bitts and suitable for towing vessels of similar dimensions from side and rear. The structure associated with these bollards shall be strengthened as per the RO Requirements.

(c) Quantity and dimension of mooring ropes shall comply with the RO Requirements.

(d) Enclosed lockers or bins for storing mooring lines shall be provided on deck such that they are readily available and are secured against the high wind and ship motion accelerations.

(e) Two (2) stainless steel boat hooks with 3-metre staves and stowage arrangement shall be provided.

4.20.4 Towing

(a) The stern double bollard with strengthening shall be set for towing craft with similar size (around 15 metres in length) when necessary.

4.21 Fenders

4.21.1 Fender system shall be provided on the gunwale and diagonally on the hull as shown on the Guidance General Arrangement Plan. Internal stiffeners shall be suitably provided to strengthen the hull structures. The fender arrangement shall be suitably designed to ease the operation during alongside the pier at outlying islands and to MD's satisfaction. The base plates of fender installation shall be widened properly.

4.21.2 Side and Stern Fenders

(a) Fixed hollow D shape rubber fenders of suitable size (a size acceptable to MD) shall be fitted continuously along the ship sides at the main deck level.

(b) Thickened fenders of sufficient height shall be installed at the bow, samples of this fender is shown in the Guidance General Arrangement Plan.

4.21.3 The rubber fender shall be of a type with good ability in strength and wear resistant which is suitable for berthing alongside of large ships.

4.21.4 Sufficient numbers of rubber tyre fenders of appropriate size, each with a stainless steel securing ring shall be provided. Two (2) of them shall be fitted at the Intersection of ship's stern plate and side plate while each of them is equipped with two (2) sets of fixed small chains.

4.21.5 At least eight (8) units of portable air filled fenders at diameter not smaller than 300 mm shall be provided.

4.22 Cathodic Protection and Painting

4.22.1 The aluminum-alloy hull, shaft bracket, propellers, stern tubes and the lightning protection system underwater etc., shall be protected by a cathodic protection system for two-year life.

4.22.2 Service life expectancy of anti-fouling systems shall be provided according to the requirements of the RO or other equivalent international standards.

4.22.3 The Contractor after contract award shall propose a list of the paint (including anti-fouling paint) to be used for the hull, deck, superstructures structural materials with detailed specifications. Thickness of each coating shall be specified. Property compatibility of different paint layers must be maintained.

4.22.4 Paints shall be fire-retardant in maritime use and applied in accordance with the manufacturer's specification.

4.22.5 The Contractor shall propose a suitable paint specification in conjunction with a preferred paint manufacturer for GNC's approval.

4.22.6 All surfaces and any parts of the hull, deck or machinery, fittings that may cause glare or reflection must be matte powder-coated.

4.22.7 All fastening preparation and other penetrations shall be completed before painting of any surface.

4.22.8 Surfaces that require painting shall be fully prepared to meet with paint maker's requirement prior to painting.

4.22.9 Volatile Organic Compounds ("VOC") content limits of the paints shall comply with the Controls and Requirements of the VOC Regulation (VOC content limits for regulating paints used on vessels and pleasure craft) of the Regulation of Hong Kong Air Pollution Control Ordinance.

4.22.10 A Tributyltin ("TBT") and Cybutryne free fouling-release/anti-fouling paint complies with actual operating profiles of this working vessel shall be applied on the following areas below the water line to provide at least two-years protection against the marine growth.

(a) Exterior of the hull; and

(b) Sea chest, sea chest grate and sea suction pipe.

4.22.11 A TBT and Cybutryne free certificate issued by the paint manufacturer shall be submitted before the Delivery Acceptance. The fluoropolymer foul release coating / antifouling paint (e.g. Intersleek 1100SR or equivalent) shall comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 as adopted by the IMO.

4.22.12 All deck areas shall be covered with hard wearing and anti-slip epoxy paint.

4.22.13 All paint work shall carry a one-year guarantee provided by the Contractor against defects in material and workmanship.

4.22.14 Painting schedule proposed by the Contractor in consultation with the paint suppliers/manufacturers shall be submitted for GNC approval before painting.

4.22.15 A painting report shall be submitted to MD upon the completion of painting work for the Vessel.

4.22.16 The Contractor shall provide GNC at Delivery Acceptance a letter of certification from the paint manufacturer to certify the application of the paint is under the paint manufacturer's quality control, and that it is in accordance with the manufacturer's requirements for surface preparation, metal surfaces temperature and atmospheric conditions, paint thickness and method of application.

4.22.17 The colour of the paints shall refer to Paragraph 2.9 Markings and Colour Scheme of TS.

4.22.18 In order to prevent the marine growth (such as bio-film, barnacles) leads to block partial and complete blockages in the seawater cooling system (such as sea chests, seawater manifolds) which resulting in dramatic effects on the engine running temperatures and increasing fuel consumption, an Ultrasonic Antifouling System ("UAS") shall be adopted in the vessel. The UAS includes control unit, ultrasonic transducer, cables and connectors. The transducer, cables and connectors to be in IP68 standard and cables are in oil and fire resistant type. The UAS shall be capable of operating in dual voltage system (AC & DC) and supplied with at least a two (2) year warranty by the manufacturer.

4.23 Ventilation

4.23.1 The requirements for ventilators and the ventilation system shall comply with the RO Requirements.

4.23.2 Wheelhouse and accommodation compartments shall be protected from gas or vapour fumes from machinery, engine-exhaust gas and smells from the fuel system.

4.23.3 The wash room and the galley shall be fitted with an exhaust fan of not less than 36 air changes per hour; and a louver at the lower portion of the toiler door shall be provided. There shall be covers for the exhaust fans capable of being closed to prevent rain water and seawater spray.

4.23.4 Air pipes shall be fitted to all tanks, void spaces, and all spaces and compartments which are not fitted with other types of ventilation arrangement.

4.23.5 The lower edge of openings in all exterior air pipes and trunks shall be at least 300 mm above the main deck.

4.23.6 All ventilators shall be provided with weather-tight covers.

4.23.7 Natural ventilation for all the compartments in the Vessel shall be provided as practical as possible.

4.24 Lighting

4.24.1 Natural light shall be allowed as far as possible in the deck cabin and wheelhouse.

4.24.2 Adequate lighting intensity and lighting arrangement, as well as any necessary lighting segregation, by means of blinds or other means, shall be provided inside the wheelhouse to enable the operating personnel to perform their navigation task if there is a need.

4.24.3 The walking area on deck shall be well illuminated in dark environments.

4.24.4 Care shall be taken to avoid large shadows as well as glare and stray image reflections in the operating area environment. High contrast in brightness between work area and surroundings shall be avoided. Non-reflective or matt surfaces shall be used to reduce indirect glare to a minimum.

4.24.5 Emergency lighting shall be provided throughout the Vessel for its operational needs.

4.24.6 Only in fault situation, limited (and suitably reduced) illumination of the essential gauges, instruments and controls for monitoring likely system is allowed.

4.24.7 Lights shall not obstruct the movement of persons.

4.25 Lightning Protection

4.25.1 The Vessel shall be fitted with a proven lightning protection system as per RO and IMO requirements to protect the Vessel, persons on board and the electronic equipment installed.

4.25.2 Method and working principle of protection shall be submitted to GNC for approval before the installation.

4.26 Special Equipment

4.26.1 After NOx treatment equipment ("treatment equipment")

(a) The Vessel shall be equipped with two (2) marine diesel engines (alternatively referred to as "main propulsion engines" or "main engines") of adequate power for attaining the Contract Speed. Each of the two (2) diesel engines deployed in the Proposed Propulsion System shall meet IMO Tier III emission requirements with or without NOx after-treatment. Type-approved certificates issued by the RO or another classification society listed in the definition of "Recognised Organisations" in Clause 1.1 of Part IV certifying compliance with the emission level as specified above shall be provided.

(b) After NOx treatment may be an equipment which is not part of the marine diesel engines.

(c) It is desirable that emission level of the two marine diesel engines shall meet IMO Tier III emission requirement without NOx after-treatment which can reduce the NOx content. [D]

4.26.2 Winch and Davit for Wreck Buoy

(a) An electrical winch and manually operated rotatable davit shall be installed on aft deck near the ship side for the recovering of wreck buoy (about 15 kg), its cable (match with the anchor and about 30 m), its anchor chain (match with the anchor and about 9 m) and its anchor (about 15 kg) for the wreck buoy.

(b) It shall be certified and a Registry of Lifting Appliances and Lifting Gear is to be provided in accordance with the applicable laws and regulations.

(c) The lifting capacity shall not less than 200 kg x 1 m outside of the Vessel side. The height from the hanging point to the main deck shall not be less than 2 m, convenient for personnel standing on the deck to carry out the operation of recovery and release a wreck buoy.

(d) The davit shall be able to rotate 360°. It is acceptable to use rope(s) to turn the davit or any other method even better. In the scheme of adopting rope(s), the hook(s) for securing the rope(s) shall be set. The davit shall be equipped with a limit device to fix it in an expected direction. The number and position of limit points shall be up to GNC's satisfaction.

(e) It is desirable that the cable, anchor chains and anchor which mentioned above can be recovered to the Vessel at one time by using appropriate equipment. Special attention shall be paid to the applicability of the pulley and the rope capacity of the winch.

(f) The motor of the winch shall be capable of both forward and reverse rotation. It is necessary that the motor will automatically shut off when the cable and anchor chain are fully retracted.

(g) The size of the winch and davit foundations, the materials used and the location of relevant accessory fittings shall be comprehensively considered by the Contractor based on the layout of relevant structures and equipment on the deck.

(h) The strength of the deck support structure under the winch and davit foundations shall meet applicable RO requirements.

4.26.3 Gyro stabilizer

(a) A gyro stabilizer is required on board to reduce transverse rolling of the Vessel in particular during idling speed and patrol operation. The product shall be able to handle the operating profile of the Vessel.

(b) The expected percentage of significant amplitude of roll reduction contributed by the gyro stabilizer shall be not less than 70% when the Vessel in a static zero forward speed and the waves approaching in a direction perpendicular to the heading, under the maximum wave height not less than 1.0 m in Hong Kong Waters (typically near the coast).

(c) The noise steady state output measured in the factory at 1 metre distance shall be not higher than 75 dB. Noise insulation shall be installed if the stabilizer is installed nearby the deck office or sonar equipment.

(d) The gyro stabilizer must be compact and self-contained. It is to be positioned such that it can be overhauled without removing other major equipment such as main propulsion engine or generator set.

4.26.4 Hybrid system

(a) Adopting hybrid system, the propulsion system shall be able to work in different states including the traditional Diesel Mode and Electric Mode.

(b) It is required that when in the Electric Mode, the Vessel can at a loitering speed not higher than 5 knots to fulfill the port management requirements.

4.27 Miscellaneous

4.27.1 Navigational shapes shall be provided and properly stowed in the Vessel.

4.27.2 A full set of maritime signal flags shall be provided and properly stowed in the wheelhouse of the Vessel.

Chapter 5 Fire Safety Equipment

5.1 General Provisions

5.1.1 The Vessel shall be enclosed by fire-resisting divisions complying with the requirements of the International Code for Application of Fire Test Procedures (FTP Code), as defined in Chapter II-2 of SOLAS.

5.1.2 Fire-resisting bulkheads and decks shall be constructed to resist exposure to the fire as per RO Requirements for that specific location. The main load-carrying structures shall be arranged to distribute load such that there will be no collapse of the construction of the hull and deckhouse when it is exposed to fire.

5.1.3 The hull, structural stiffeners, bulkheads, decks, deck houses and pillars shall be constructed of approved non-combustible materials as required in the FTP Code and having adequate structural properties.

5.1.4 The arrangement of pipes, ducts, electrical cables etc., penetrating into fire-resisting divisions shall be made to ensure that the fire-resisting integrity of the division is not impaired, and necessary testing shall be carried out in accordance with the FTP Code.

5.1.5 All furniture shall be constructed entirely of approved non-combustible or fire-restricting materials, except that a combustible veneer with a calorific value not exceeding 45 MJ/m^2 may be used on the exposed surface of such articles.

5.1.6 All upholstered furniture, draperies, curtains, suspended textile materials shall have the qualities of resistance to the propagation of flame in accordance with the FTP Code.

5.1.7 All deck finish materials shall comply with the FTP Code.

5.1.8 All the exposed surfaces and surfaces in concealed or inaccessible spaces in corridors and stairway enclosures, and of bulkheads (including windows), wall and ceiling linings in all compartments shall be constructed of materials having low flame-spread characteristics as required in FTP Code.

5.1.9 Any thermal and acoustic insulation shall be of non-combustible or of fire-restricting material. Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings for cold service systems need not be non-combustible or fire restricting, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame spread characteristics.

5.1.10 Exposed surfaces in corridors and stairway enclosures, and of bulkheads (including windows), wall and ceiling linings, in all compartments shall be constructed of materials which, when exposed to fire, are not capable of producing excessive quantities of smoke or toxic products, this being determined in accordance with the FTP Code.

5.1.11 Hose reel with attached fire hose shall be installed in engine room(s) for ready-to-use purpose, each with a length to cover the whole engine room length.

5.2 Fire Detection System

5.2.1 An approved automatic fire detection system shall be provided in the Vessel at appropriate locations in accordance with RO Requirements. The fire detection system shall comply with the rules of the RO or International Standard acceptable to GNC.

5.2.2 The fire detection panel shall be installed in the wheelhouse.

5.2.3 The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the wheelhouse control station.

5.2.4 Fire detectors shall be installed in the steering gear room, engine room, crew space, ship office, wheelhouse, etc. in addition to meeting the RO Requirements. Detection system using only thermal detectors shall not be permitted unless in spaces of restricted height and where their use is especially appropriate.

5.3 Fixed Fire-Extinguishing System for Unattended Engine Room

5.3.1 Engine room fire extinguishing systems shall be a fixed CO_2 flooding system complying with the RO regulations for engine room protection.

5.3.2 The CO_2 fire extinguishing system shall be of a total flooding high pressure system.

5.3.3 CO_2 piping shall be of galvanized steel pipes.

5.3.4 Mechanical measuring device shall be provided for checking the content of CO_2 bottles.

5.3.5 Activation of the CO_2 system shall cause an audio and visual warning alarm in the wheelhouse and the engine room.

5.3.6 The CO_2 bottles for the system shall be stowed preferable at the aft as indicate on the Guidance General Arrangement Plan and shall be properly protected from weather.

5.3.7 Engine room ventilation systems shall automatically shut down upon activation of the CO_2 flooding systems or manually from controls at the control station.

5.4 Portable Fire Extinguishers

5.4.1 Adequate number of portable fire extinguishers shall be provided to serve all compartments in the Vessel and so positioned, as to be readily available for immediate use. The quantity and position of portable fire extinguishers shall also comply with relevant requirements as said in the Code of Practice - Safety Standards for Class II Vessels as amended version issued by Local Vessels Safety Section of Hong Kong Marine Department.

5.4.2 Fire extinguishers shall be type-approved by the RO or other international standards acceptable to GNC. Certificates shall be submitted to GNC before Delivery Acceptance.

5.4.3 Fire extinguishers shall be ready for use and located in easily visible places such that they can be reached quickly and easily at any time in the event of a fire. Portable fire extinguishers shall be properly secured in place.

5.5 Fire Pumps

5.5.1 One (1) electric fire pump located outside of the machinery space shall be provided to have sufficient capacity to pump water from the sea-chest to deck hydrant with a jet throw of at least 12 metres. The fire pump shall be controlled from the wheelhouse. The fire main and fire pump design shall meet RO and relevant requirements as said in the Code of Practice - Safety Standards for Class II Vessels as amended version issued by Local Vessels Safety Section of Hong Kong Marine Department.

5.5.2 If other driven means is not fitted, a semi-rotary hand pump of brass casing and bronze internal components shall be provided on deck for fire-fighting purpose. The pump shall be able to produce a flow jet of at least 6 metres distance. The suction sea-chest of the hand pump shall be fitted outside the engine room and the suction valve shall be operated by an extended spindle on main deck. Installation shall comply with relevant requirements as said in the Code of Practice - Safety Standards for Class II Vessels as amended version issued by Local Vessels Safety Section of Hong Kong Marine Department.

5.5.3 Isolating valves shall be fitted at appropriate locations and at hydrant outlets. The hydrant shall be supplied with a complete set of fire-fighting accessories including appropriate length of fire hose made of suitable material and spray/nozzle. The hose and nozzle shall be stowed inside a fire box located in the vicinity of the hydrant.

5.5.4 A deck washing pipe line shall be branched off from a fire main line. Fire water to be provided for anchor chain flushing.

5.6 Safety Plan

5.6.1 The fire control plan shall be permanently exhibited at main deck and bridge deck for the guidance of the ship's crew, using graphical symbols in accordance with IMO Resolution A.952 (23) as amended.

5.6.2 The contents of the safety plan shall meet the relevant regulations of MD.

5.6.3 The fire control plan must be approved by GNC before Vessel acceptance.

5.6.4 The text of such plan shall be in the languages of English and traditional Chinese.

5.7 Additional Protection

5.7.1 When the Vessel is afloat and unmanned, the fire detection system and the bilge alarm system shall continue to function. When the audible and visual alarm is not acknowledged after a time period of five (5) minutes (can be adjusted), the audible and visual alarm shall be extended externally to an audible and

visual alarm fitted on the mast to bring the attention of the persons ashore or the guard of the Government Dockyard.

5.7.2 The additional protection shall be able to be turned on and off when required.

Chapter 6 Lifesaving Appliances ("LSA") and Arrangements

6.1 General Provisions

6.1.1 Lifesaving appliances and arrangements shall be provided as per Merchant Shipping (Local Vessel) Ordinance Cap. 548G and the Code of Practice issued by the Hong Kong Government HKSARG regarding the Vessel of this type.

6.1.2 Lifesaving appliances shall be provided in the Vessel at appropriate locations in accordance with the RO Requirements. All the required Life jackets shall be Inflatable Life jackets.

6.1.3 Lifesaving appliances shall be of approved types conforming to the latest International Life-Saving Appliance Code ("LSA Code") adopted by the Maritime Safety Committee of the Organization and approved by the RO.

6.1.4 Life jackets shall be so placed as to be readily accessible and their positions shall be clearly indicated. Donning instructions shall be posted at suitable positions in the Vessel.

6.1.5 Adequate number of lifebuoys shall be provided, relevant requirements as said in the Code of Practice - Safety Standards for Class II Vessels as amended version issued by Local Vessels Safety Section of Hong Kong Marine Department. Lifebuoys shall be marked with ship names on both sides.

6.1.6 Approved LSA Plan by RO in frame shall be posted on the wall of wheelhouse or the corridor in mess room.

Chapter 7 Machinery

7.1 General Requirements

7.1.1 The Tenderer shall note that Vessel is for use in Hong Kong and it is desirable that the main engines, gearboxes, electric generator sets and any other machinery offered by the Tenderer are those at present commonly used by ship operating in Hong Kong Waters, and that they have good support for spare parts and after sale services locally in Hong Kong.

7.1.2 It is desirable that the support of local agents shall include supplying brand new proposed main engines, gearboxes, electric generator sets and other machinery for five years after vessel delivery. [D]

7.1.3 The vessel shall be equipped and fitted with all machinery described in this Chapter each complying with the specifications set out in this Chapter for such machinery. The Spare Parts to be provided shall be of the same model as supplied for the vessel and shall equally comply with all specifications set out in this Chapter.

7.1.4 The engine room shall be an unmanned machinery space (UMS), designed for unmanned operation. Under normal operation, all controls are directed from wheelhouse where the control console shall be fitted with a full set of monitoring instrumentation and alarm indication. However, essential local manual controls shall also be provided for the main propulsion engines and steering gear for emergency operation.

7.1.5 Two (2) accesses with reasonable separation shall be provided for the engine room. The design of the engine room layout shall be approved by the RO and agreed by GNC. The machinery, associated piping systems and fittings relating to the main engines and electric generator sets shall be of a design and construction adequate for the service for which they are intended and shall be installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design shall have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board. Cushion/protection on the overhead cable trunk for preventing head injury of crew shall be provided.

7.1.6 Easy access and ample headroom around all machinery shall be provided for local operation, routine checking and "in-situ" maintenance. Well-planned removal routes shall be provided for the major items such as the main propulsion engines, gearboxes and the generator sets, etc.

7.1.7 Sufficient space and headroom in the vicinity of the machinery for local operation, inspection and routine maintenance for all the machinery shall be provided. Procedures and sequences for complete removal of the major items such as the main engines, gearboxes, generator sets, fuel oil tank etc. shall be carefully designed to enable their removal from ships for maintenance in a practicable manner to avoid the need for the deck or shell plate to be cut.

7.1.8 All parts of machinery, hydraulic, control and other systems and their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time.

7.1.9 Provision shall be made to facilitate cleaning, inspection and maintenance of main engine, electric generator sets, fire pumps etc. and their associated piping and equipment.

7.1.10 Lifting brackets for moving heavy equipment shall be mounted underneath the deck head of the engine room, the engine room entrance and other appropriate locations. The lifting capacity shall be marked on every of these lifting brackets after a load test to the RO Requirement. All lifting appliances shall be properly certified and a Registry of Lifting Appliances and Lifting Gear is to be provided in accordance with the applicable regulations.

7.1.11 All emergency stops shall be fitted with protective guards to prevent inadvertent use.

7.1.12 The machinery installation shall be suitable for operation as in an unmanned machinery space. The monitoring and control, including automatic fire detection system, bilge alarm system, remote machinery instrumentation and alarm system shall be centralized in the control station of the wheelhouse.

7.2 Main Propulsion Engine

7.2.1 The Vessel shall be equipped with two (2) electrically started, fresh water cooled marine diesel engines (alternatively referred to as "main propulsion engines" or "main engines") of adequate power for attaining the Contract Speed. The rating of the engines, as published by the manufacturer, shall support an annual operation profile of 3,450 hours (10 hours 345 days/year) taking into account of the speed profile as stated in Paragraph 2.4.1 of this Part VII. The emission level of the two (2) marine diesel engine shall meet IMO

Tier III emission requirements with or without NOx after-treatment. [E]

7.2.2 Type-approved certificates issued by the RO or another classification society listed in the definition of "Recognized Organization" in Clause 1.1 of Part IV certifying compliance with the emission level as specified in paragraph 7.2.1 above shall be provided.

7.2.3 EIAPP certificate for each main propulsion engine shall be submitted by the Contractor.

7.2.4 It is required that the Vessel will at a loitering speed of about 5 knots for 4 hours per day. Hybrid system adopting electric motors for low speed operation shall be provided. Each electric motor is arranged between the main diesel engine and the gearbox. In Electric Mode, it is desired that the power is provided from only one available generator set. The electric motors are purposed for serving the vessel in loitering speed (not higher than 5 knots) operation mode to fulfill the port management requirements and also to reduce the main engine emission at sea.

7.2.5 The aggregate propulsive power of the main propulsion engines shall be not greater than 1500 kW

7.2.6 The engines' aft end shall be connected to the fixed-pitched propellers via reduction gearboxes through a flexible coupling.

7.2.7 The main propulsion engines shall be resilient-mounted to the ship's structure.

7.2.8 The main propulsion engines shall be marine diesel engines of proprietary make, electric started by 24 Volt-DC, and to have integral fresh water/sea water heat exchangers, fresh water pump, sea water pump, LO pump, fuel lift pump (if necessary), FO filters, LO filters, engine-mounted instrumentation panel with essential gauges and protective devices, and any other ancillary equipment and fittings as recommended by the engine manufacturer for the efficient operation of the engines.

7.2.9 Flexible mounting shall be used for containing the noise levels in wheelhouse and accommodation compartments not to exceed 80 dB(A).

7.2.10 Engine-mounted charging alternator, capacity of not less than 60 amperes, with built-in voltage regulator shall be provided on each main engine for charging their respective starting batteries.

7.2.11 The proposed propulsion System including its control system shall be approved by the RO.

7.2.12 To facilitate LO renewal, a suitable hand pump connected to the LO sump shall be provided for each diesel engine so that LO can be drained from the lowest point of the engine LO sump.

7.2.13 The main engine's exhausts and silencers shall be protected according to the RO Requirements to avoid the hot surface danger to the personnel and minimum the heat transfer into the machinery space. All components of exhaust system shall be mounted or suspended by the hangers which will not transmit heat, noise or vibration to the vessel's structure.

7.2.14 Engine performance

(a) The Tenderer is required to submit the estimated propulsive power requirements and characteristic curves of the Propulsion System for the vessel to support its claim for the achievable 20 knots Contract Speed with both marine diesel engines running at 100%MCR.

(b) Manufacturers' full power shop trial certificate for a continuous running test at full load for four (4) hours for each main engine must be submitted to MD.

(c) The governor control of the engine must be capable of proper control when the engine is suddenly unloaded.

(d) For double safety, the back-up governor of each main engine shall be able to take over control instantaneously (and immediately) as soon as the main governor fails. When this happens the alarm (which is with individual indication visual and sound signals) shall be sound and signaled in the wheelhouse.

(e) Main engines shall always be in the standby mode and being per-lubricated.

7.3 Main Engine Control

7.3.1 The design and installation shall follow the RO requirement. The control and instrumentation of the main engines shall be designed for one-man operation in the wheelhouse, they shall be ergonomically laid out and grouped around the steering position in the wheelhouse control console

(a) Instrumentation and control systems for the main and auxiliary machinery shall be designed for unmanned machinery space operation.

(b) Engine mounted instrumentation panel with the essential gauges shall be provided locally for each machinery to facilitate easy maintenance.

(c) The monitoring probes and sensors fitted to the main and auxiliary machinery shall be of a type-approved by RO.

(d) Emergency telegraph light signal panels for the communication between the wheelhouse and the engine room shall be arranged.

7.3.2 The following instrumentation and control devices shall be provided for the controls and instrumentation of the marine diesel engines (includes dedicated for driving the electric generating sets where applicable as further described in Paragraph 7.4 below) and shall be designed for one-man operation in the wheelhouse. These instrumentation and controls in the control console shall be comprehensive and include:

(a) Start / stop keys or push buttons to be fitted with guard cover and running / stop indication lamp for each of the two (2) main engines;

(b) RPM control device for each of the two (2) main engines;

(c) Shaft tachometer; and

(d) Wheelhouse/local control change-over switch and indicator.

7.3.3 Instrumentation and controls in the control console shall be comprehensive and shall include:

(a) Starting and stopping of main engines and where applicable E-Motors from the wheelhouse;

(b) Emergency stop button with guard cover;

(c) Wheelhouse/local control change over switch and indicator;

(d) Speed control device;

(e) Rudder angle indicator;

(f) Engine tachometers with running hour meter (The recorded running hour reading shall be retained after main engine is powered off. The running hour reading shall be automatically reset back to zero after the maximum running hour is reached.);

(g) Sea water cooling pressure gauge;

(h) Coolant water temperature and pressure gauges;

(i) Engine lubricating oil temperature and pressure gauges;

(j) High cooling water temperature alarm and de-rate function;

(k) Engine low lubrication oil pressure alarm and trip;

(l) Gearbox lubrication oil low pressure gauge;

(m) Gearbox lubrication oil low pressure alarm and trip;

(n) Ammeter for each engine;

(o) Engine exhaust gas pyrometer;

(p) Fresh water tank content gauge;

(q) Fuel oil tanks content gauge;

(r) Over speed alarm and trip;

(s) Main engine expansion tank low level alarm;

(t) Battery charging control lamps;

(u) D.C. power on light;

(v) Central illumination dimmer for all light in the control console;

(w) Lamp test;

(x) Alarm test and reset;

(y) A standard engine maker’s engine control panel to be provided in the engine room; and

(z) Any other instrumentation recommended by the manufacturer of the Proposed Propulsion System and GNC.

7.4 Electrical Generating Sets

7.4.1 Two (2) electrically started, fresh water cooled diesel engines integral with alternating current alternator, of self-excited, brushless and ventilated type, shall be installed. [E]

7.4.2 The capacity of these generating sets shall be such that either one (1) of the two (2) generating sets shall be able to supply all electricity necessary to ensure that normal operational conditions of propulsion and safety can be achieved. Synchronization of the generators are not required.

7.4.3 Each electric generating set at its continuous service rating, shall have sufficient capacity for:

(a) Supplying all full operational electrical load of the whole Vessel including air conditioning running at full capacity plus not less than a 15% reserve margin; and

(b) Permitting the starting of the largest motor without causing any motor to stall or any other device to fail due to excessive voltage drop of the system when the electric generating set is supplying full operational electrical load including air conditioning running at full capacity of the whole Vessel

7.4.4 Electrical load analysis and calculations shall be approved by the RO before submission to GNC.

7.4.5 The exhaust of the electric generating sets shall be arranged with a water sealing silencer with a view to reducing its noise levels. This shall be configured with the exhaust gas from the gen-set running into the bottom of water sealing silencer and mixing the cooling sea water then drain from the water sealing silencer upper outlet:

(a) The exhaust outlets leading to stern side on the transom shall be positioned above the waterline and be as high as practicable to prevent standing waves sealing the outlet. Exhaust pipe outlets shall be at a minimum of 300 mm vertical distance above loaded waterline and can be arranged via goose-neck type expansion bellow to the exhaust outlet fitted to shell above waterline for discharge.

(b) The exhaust systems shall be designed appropriately to comply with the gen-set and exhaust manufacturer’s requirements. The generator set exhaust system shall be arranged to provide reasonable access to engine room machinery.

(c) RO approved expansion bellows (for example the goose-neck type in both dry and wet side) shall be used.

(d) All exhaust components shall be mounted or suspended using spring-type hangers which will not transmit heat, noise or vibration to the Vessel's structure.

(e) Lagging / Noise control requirements: Flexible sound reduction wrap for exhaust piping works shall be based on manufacturer / appropriate industrial standard.

7.4.6 The design and installation of the generator sets, switchboard and the associated wiring shall follow the RO Requirements. For the avoidance of doubt the following requirements shall also be met:

(a) Each electric generator set shall be provided with a type approval certificate issued by any classification society listed in the definition of “Recognised Organisation” in Clause 1.1 of Part IV but not necessarily the RO for the Vessel specified in Schedule 9 of Part V.

(b) The rating of each diesel engine shall be capable of developing for a short period (15 minutes) a power of not less than 110% of the alternator's continuous service rating.

(c) The resilient-mounted generator set designed for marine application shall be of a proprietary make. The arrangement of the electrical and piping systems shall enable the quick dismantling and easy replacement of the unit.

7.5 Electrical Generator Control

7.5.1 The controls and instrumentation of the electric generator shall be designed for one-man operation in the wheelhouse, the instrumentation and controls in the control console shall be comprehensive and shall include:

(a) Remote start and stop;

(b) Tachometer with running hour meter (The recorded running hour reading shall be retained after generator is powered off. The running hour reading shall be automatically reset back to zero after the maximum running hour reached.);

(c) Cooling water temperature gauge;

(d) Exhaust gas temperature gauge;

(e) Lubricating oil pressure gauge;

(f) Battery charger ammeter;

(g) Fault indicating lights and alarms;

(h) Protective devices such as overspeed, low lubricating oil pressure trip etc. as recommended by the engine builder;

(i) A standard manufacturer's local control panel to be fitted in the engine room;

(j) Instrumentation and alarm panel for generator sets; and

(k) The local control panel in engine room shall contain the following devices:

1. Start / stop push buttons to be fitted with guard cover and running / stop indication lamp for each of the two (2) generator engines; and

2. Volt-metre, Watt-metre for each generator.

7.6 Instrumentation and Control

7.6.1 A control station in the wheelhouse shall be provided with comprehensive instrumentation and controls for remote operation and monitoring of the main engines, electric generator sets and other auxiliaries to facilitate for unattended engine room operation.

7.6.2 One (1) fire detector panel and one (1) engine room carbon dioxide fire-fighting panel shall be installed in the vicinity of the control station.

7.6.3 Additional controls and monitoring devices shall also be provided locally in the vicinity of that machinery or equipment.

7.6.4 All the instruments such as temperature sensors, pressure sensors, level gauges etc. shall have obtained type approval certificates issued by the RO or the manufacturer's certificate complying with the national standards of the place of manufacture of the relevant instrument. The Contractor shall provide copies of the type approval certificates or the manufacturer's certificate to GNC on or before the Delivery Acceptance

7.6.5 All indication lights, illumination of instrumentation gauges fitted on the consoles of the wheelhouse control station shall be fitted with dimmers for day and night operation.

7.6.6 At least two (2) independent means of stopping the main engines from the wheelhouse control station under any operating conditions shall be available.

7.7 Reduction Gearboxes

7.7.1 The reversing reduction gearboxes shall be resilient-mounted to the ship's structure. The gearboxes shall be provided with clutches, alarm sensors, and switches.

(a) Gear oil heat exchangers shall be piped to the engine cooling circuits as specified by the manufacturer. Gearboxes oil coolers shall be sized to accommodate the heat generated by the clutches at less than full engagement.

(b) Reduction gearboxes shall be sized to provide both low and high speed performance.

7.7.2 The gearboxes shall be provided with alarms for low oil level and oil temperature. Alarms shall be repeated both locally and at the wheelhouse.

7.7.3 Sufficient engine side space for maintenance and repair shall be required. Design of installation arrangement shall be confirmed either using vertical offset or horizontal offset gearboxes.

7.8 Propeller Shafts, Stern Tubes, Propellers

7.8.1 All the components of the shafting system design and installation shall follow the RO Requirements such as Torsional Vibration Calculation.

7.8.2 All the components of the shafting system shall be of adequate strength and stiffness to enable it to withstand the most adverse combination of the loads without exceeding acceptable stretch levels for the material concerned.

7.8.3 Shaft torque measuring device shall be fitted at the tail shafts for measuring the output power of main engines. This item is only measured during the sea trial.

7.8.4 Stern tubes

(a) Water lubricated stern tubes with packing type glands shall be of type approved by the RO or other organisations acceptable to GNC. Propeller shaft bearings shall be RO approved water-lubricated cutlass rubber/composite type. Forward and after ends of stern tubes shall be bored for bearings and a dripless shaft seal system shall be fitted to the inboard side of each stern tube.

(b) The material of the stern tube shall be stainless steel 316L (austenitic) stainless steel or equivalent.

7.8.5 The propeller shafts shall be made of corrosion resistant and high yield stress material, such as stainless steel 316L (austenitic) stainless steel or equivalent

7.8.6 The two (2) propellers shall be of a fixed pitch type with the design to minimise the vibration cause to the hull. The propellers shall be turned outboard when the Vessel is in moving forward motion.

7.8.7 Rope cutting device shall be fitted nearby the propellers.

7.8.8 The propeller shaft brackets shall be of stainless steel 316L (austenitic) stainless steel or equivalent construction. The materials for shaft brackets, shafts, keys, locking nuts, etc. shall be compatible for use with the propeller material.

7.8.9 Grease or packing containing graphite shall not be used with these shafts.

7.9 Steering Gear System

7.9.1 The steering gear system will be a twin rudders arrangement and shall comply with the RO Requirements.

7.9.2 Electro-hydraulic steering gear with two (2) independent power units, each running unit is capable of providing the maximum torque operating on twin rudders from 35 degrees on either side to 30 degrees on the other sides within 28 seconds with the vessel running ahead at maximum continuous shaft rpm and at the sea trial condition.

7.9.3 The steering gear system shall include motor driven pumps, reservoir/filter units, emergency manual helm pump, rudder transmitter limit switch, rudder angle indicators, actuating cylinders, master helm control and one non-follow-up controller.

7.9.4 Rudders are controlled by steering wheel and joystick in the control station of the wheelhouse. Coxswain shall be able to use steering helm wheel or joystick at the same time. Steering helm wheel may also function as emergency manual helm pump in case of emergency. The power hydraulic pump could be started and stopped both in wheelhouse and in steering gear room. Hydraulic steering wheel type shall be non-skid type of appropriate size acceptable to GNC.

7.9.5 The control of the rudder shall be switched from elector-hydraulic steering to emergency hydraulic helming via a change-over switch in the wheelhouse.

7.9.6 Separated illuminated rudder angle indicator with dimmer switch, running and overload alarm shall be provided in the wheelhouse.

7.9.7 Emergency steering system shall be provided and the emergency system proposal to be acceptable to GNC.

7.9.8 A change-over electric switch shall be provided in the wheel house for switching the steering control between electric mode and manual mode.

7.10 Rudders and Rudder Stocks

7.10.1 The rudders shall be designed to meet the RO Requirements.

7.10.2 Rudder angle indicators shall be provided in the steering gear room. The port and starboard degree markings in intervals not greater than one degree shall be permanently marked and distinguished by red (port) and green (starboard) in English and traditional Chinese.

7.10.3 Extremes of rudder travel shall be provided by mechanical stoppers.

7.10.4 Lower bearings of rudder stock shall be water-lubricated.

7.10.5 The rudder stock and rudder blade shall be made of 316L stainless steel and shall be designed in accordance with the RO Requirements.

7.11 Engine Room and Other Machinery Space Ventilation

7.11.1 There shall be four (4) sets of marine axial type A.C. ventilating fans with silencers in the engine room. 2 sets of supply fans and 2 sets of exhaust fans. Reversal function shall be provided for all fans. All air inlet and outlet shall be equipped with fire dampers.

7.11.2 Arrangements shall provide sufficient air to the engine and shall give adequate protection against damage, as distinct from deterioration, due to ingress of foreign matter.

7.11.3 The air supply inlet vents shall be connected to louvers of efficient design in preventing ingress of water during extreme weather conditions. All vents shall be provided with weather-tight covers, fire dampers and coaming of adequate height.

7.11.4 The engine room compartment shall be adequately ventilated so as to ensure that when machinery therein is operating at full power in all weather conditions, an adequate air supply is maintained to the compartment for the safety of personnel and the operation of the machinery.

(a) All spaces containing machinery shall be provided with forced ventilation for combustion and ventilation air to meet the requirements of the prime movers and other heat sources with a minimum 50 air changes per hour for the machinery space. The ventilation design shall be such to avoid any hot spot or "dead air" area.

(b) All ventilation ducts, intakes, and outlets shall be sized to minimise pressure drops and flow noise. For design purpose, air flow rates in ducting shall be kept at 10 m/s or less. Airflow rates at vents and louvers shall be as low as required to avoid flow noise (Typically 5 m/s depending on vent or louver design).

7.11.5 Steering gear room and tank space shall be adequately mechanically ventilated for the purpose of those compartments. The ventilation arrangements shall be adequate to ensure that the safe operation of the Vessel is not put at risk.

7.11.6 The steering gear room, tank space and engine room shall be adequately ventilated for ensuring the safe operation of the Vessel.

7.11.7 For guidance, the ventilation air to the compartment as stated shall:

(a) limit the temperature rise in a machinery space to 10°C above ambient temperature;

(b) as the prime movers draw combustion air from within the compartment, the total ventilation air be based on ISO 7547 "Standard for Shipbuilding - Air-conditioning and ventilation of accommodation spaces" as a minimum but shall not be less than that required for combustion plus 50%.

(c) The instrument use in measuring the minimum 50 air changes per hour for the machinery space shall be provided by the Contractor and shall have been calibrated to the satisfaction to GNC.

7.11.8 Automatic shut-off device shall be provided according to RO Requirements when CO_2 system is activated.

7.11.9 Calculation for the capacity of the fans to meet the minimum air changes requirements shall be submitted to the RO for approval.

7.12 Air-Conditioning System

7.12.1 A Proprietary Make split-type air-conditioner system for maritime application including indoor and outdoor units for each of the following compartments shall be provided. The Contractor shall propose specific equipment for approval by GNC prior to purchasing.

(a) Wheelhouse 1 Set (ceiling mounted air unit)
(b) Crew space 1 Set
(c) Ship office 2 Sets (ceiling mounted air unit)

7.12.2 The temperature of the compartments as stated in Paragraph 7.12.1 shall be maintained at 22°C for 60% relative humidity when the external ambient air temperature is 38°C at 90% relative humidity with full crew and full carrying capacity on board. An acceptance test of the complete air-conditioning system of the Vessel shall be carried out by GNC to verify the system is effective and complying to the requirements given here. The Contractor shall provide GNC a copy of this test report upon completion of the test.

7.12.3 The design of the cooling air capacity shall be evenly distributed. Designed air cooling capacity with extra 50% cooling capacity. An individual control shall be provided in each compartment.

7.12.4 The location of air-conditioning indoor and outdoor units shall not create obstructions to the removal of

any hatch covers or direct maintenance of any major machinery and equipment.

7.12.5 The way of refrigerant copper tubes between indoor unit and outdoor unit shall not create obstructions to the removal of any hatch covers or direct maintenance of any major machinery and equipment.

7.12.6 The use of refrigerants under Class 2 and Class 2L (such as R717, R32 and R1234yf) shall be avoided as far as possible. If it is unavoidable to use refrigerants under Class 2 and Class 2L, the refrigerants shall fulfil the relevant restrictions as specified by the manufacturers, agents or suppliers, such as requirements on minimum room area and minimum installation. Reference shall be made to the "Guidance Note on Household Air-Conditioners Using Mildly Flammable Refrigerant" issued by EMSD.)

7.12.7 Stainless steel 316 supporter rack for each outdoor unit shall be provided and earthed. Removable covers shall be provided for protection the external unit of air-conditioner from sunlight / rain.

7.12.8 The refrigerant shall be CFC and HCFC free.

7.12.9 Emergency stop switches of the air conditioning system in addition to the normal power 'on' and 'off' switches shall be installed in the wheelhouse control station.

7.12.10 Sufficient fresh air induced to the air-conditioned area shall be based on ISO 7547 "Standard for Shipbuilding - Air-conditioning and ventilation of accommodation spaces" for all compartments; and there shall be not less than 25 m^3/h per person so as to keep the CO_2 level low enough for health reasons.

7.12.11 Bacteria resistant replaceable filters shall be fitted at air inlets.

7.12.12 The air-conditioning indoor units shall be located in the compartments for its efficient operation within the cabin environment, as recommended by the air-conditioner manufacturer, with due regards to air moisture at sea environment to avoid undue condensation formation. In view of design constraints with respect to the already compact cabin space and its other installed fixtures and fittings, the exact installation position of the indoor units shall be agreed by GNC before installing the indoor units in the cabin(s).

7.12.13 Sufficient ventilation shall be provided in case of air-conditioning breakdown.

7.12.14 The installed location of air-conditioning indoor unit shall be selected to prevent condensation on cabin fire alarm detectors, lighting and electrical panels from indoor unit cool air.

7.12.15 Install slim duct for cover up exposed refrigerate piping and wirings at outdoor space and vessel cabin. Slim Duct shall be U.V. resistant and fireproof to BS 476 Part 7 Class I.

7.13 Piping System

7.13.1 Pipes connection and bending:

(a) Piping connections and joints shall be constructed and designed in accordance with the rules and regulations of the RO.

(b) Pipe bends shall be kept to a minimum and have sufficient radius to facilitate smoothness of flow.

7.13.2 The piping material shall be copper chrome plated or stainless steel 316L. The thickness accords with the RO Requirements.

7.13.3 All pipes for essential services shall be secured in position to prevent chafing or lateral movement. Long or heavy lengths of pipe shall be supported by bearers so that no undue load is carried by pipe connections or pumps and fittings to which they are attached.

7.13.4 Suitable provision for expansion shall be made, where necessary, in each range of pipes.

7.13.5 Where expansion pieces are fitted, arrangements shall be provided to protect against over extension and compression. The adjoining pipes shall be suitably aligned, supported, guided and anchored, where necessary, expansion pieces of the bellows type shall be protected against mechanical damage.

7.13.6 As far as practicable, pipelines, including exhaust pipes from engines, are not to be routed in the vicinity of switchboards or other electrical appliances in positions where the drip or escape of fluids or gas from joints or fittings could cause damage to the electrical installation.

7.13.7 Watertight bulkheads, decks or structural members having pipeline penetration shall be designed and compensated in accordance with RO Requirements.

7.13.8 The material of the gaskets shall be capable of resisting chemical attack of the fluid being conveyed. Galvanic corrosion shall be avoided if different materials used in the system.

7.13.9 Machinery and piping designation and marking.

(a) All piping and equipment shall be labelled and colour-coded. And each pipe running through each

compartment shall be colour coded, labelled, and have the direction of flow marked in at least two places.

(b) Colour coding of machinery and piping shall be in accordance with the following:

Fire main	Red
Sea Water	Dark green
Fuel Oil	Dark brown
Lube Oil	Striped black/yellow
Fresh Water	Blue
Hydraulic Oil	Orange

7.14 Fuel Oil System

7.14.1 As Government vessels are committed to utilise sustainable / renewable fuel blends. The propulsion diesel engines and the electric generating sets of the Vessel shall be able to use ASTM D975-21 B05 blends diesel fuel (5% biodiesel, 95% diesel labelled B5) and approved by the engine makers.

7.14.2 The fuel oil of the propulsion diesel engines and the electric generating sets shall be supplied from one or more fuel oil tanks. Endurance for fuel capacity shall be as stated in paragraph 2.8.2 of this Part.

7.14.3 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets.

7.14.4 Boost pumps shall be arranged to lift fuel to the engines through coalescing filters.

7.14.5 Fuel filters shall be mounted near the fuel tank on the suction side of the fuel pump. The system design and filtration systems shall be approved by the engine and generator system manufacturer.

7.14.6 The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight.

7.14.7 An electric motor-driven pump shall be provided for transferring the fuel.

7.14.8 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.

7.14.9 All materials used in fuel systems shall be resistant to deterioration by its designated fuel and to other liquids or compounds with which it may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.

7.14.10 The filling pipe shall be of metallic construction and a permanent fixture led from the deck and secured to the tank by an approved connection. A screwed cap and name plate inscribed ‘Fuel Oil’ shall be provided at the filling point. Flexible hoses are not permitted as filling pipes. The fuel oil inlet and inlet pipe size shall be properly enlarged to the satisfaction of GNC and the user department.

7.14.11 An easily removable coarse strainer shall be built into the filling line, if required.

7.14.12 Two (2) duplex filters shall be fitted in the oil fuel supply lines to the main and auxiliary engines, and the arrangements shall be such that any filter can be cleaned without interrupting the supply of filtered fuel oil to the engines.

7.14.13 Flexible pipes of approved type shall be used as short joining lengths to the engine where necessary.

7.14.14 Water separators shall be fitted to the fuel supply line, if required.

7.15 Fuel Oil Tanks

7.15.1 The Vessel shall be built with independent stainless steel 316L fuel tanks to service the Vessel’s main propulsion engines and ship service electric generators, actual location to be designed and approved by the RO and accepted by GNC. Individual components of the system, and the system as a whole, shall be designed to withstand the combined conditions of pressure, vibration, shocks, corrosion and movement encountered under normal operating conditions and storage.

7.15.2 The tanks shall be interconnected to permit fuel transfer between the tanks.

7.15.3 All materials used in fuel systems shall be resistant to deterioration by its designated fuel and to other

liquids or compounds with which it may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water. All seals such as gaskets, O-rings and joint-rings shall be of non-wicking, i.e. non-fuel absorbent material.

7.15.4 Earthing device shall be provided for fuel filling system. Grounding wires shall not be clamped between a hose and its pipe or spud.

7.15.5 Fuel filling systems shall be designed to avoid blowback of fuel through the fill fitting when filling at a rate of 30 litres/min at between 1/4 and 3/4 full of the tank capacity.

7.15.6 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets.

7.15.7 Fuel filters shall be mounted near the fuel tank on the suction side of the fuel pump. The system design and filtration systems shall be approved by the engine manufacturer.

7.15.8 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.

7.15.9 Provisions of the fuel oil tank

(a) A tank content gauge and low level alarm shall be fitted in the console. A level gauge in litres shall be provided for each tank;

(b) Rigid fuel suction pipes near the tank bottom shall be provided;

(c) An inspection hole, air vent with flame trap on deck and discharge valve with remote operated quick closing device shall be provided. Fuel tank inspection hatch shall be sized to allow proper inspection of the entire tank interior. The inspection hatch shall have gasket covers secured by stainless steel bolts and self-locking nuts;

(d) Suitable provision such as drip trap shall be made for collecting the oil discharge;

(e) Baffle openings shall be designed so that they do not prevent the fuel flow across the bottom or trap vapour across the top of the tank;

(f) The tanks shall be designed and installed to prevent water from being trapped on the exterior surface;

(g) Sounding pipes with chained cap shall be provided;

(h) Tank drain shall be provided; and

(i) The compartment or space containing the fuel oil tank shall be fitted with two (2) ventilating pipes of arrangement acceptable to GNC.

7.15.10 Structures and Design

(a) The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight. Before testing the internal surfaces of the diesel tank, it shall be left unpainted and shall be cleaned thoroughly to the satisfaction of MD.

(b) Two (2) separate fuel oil tanks built in or integrated to the hull shall be provided. The fuel oil tanks shall be symmetrical (one at portside and the other at starboard) to minimise the tank beam and to reduce free surface effect.

(c) Diesel tanks shall be at the under deck position. The tanks shall be installed so that the loads due to the mass of the full tank are safely induced into the structure, with due consideration given to upward and downward acceleration due to the Vessel's movements at maximum speed in the sea.

(d) Except the electric wires for the fuel oil tank level sensor(s), no other shall pass through any fuel tank. Ventilation for the fuel tank shall comply with national or other acceptable industrial standards.

(e) The total capacity of the diesel oil tank shall be provided. Fuel supplied shall not be less than requirement of the Vessel's operation as Paragraph 2.8.2 of this Part with 10% margin in litres. The unpumpable capacity of each tank shall not be more than 10% of the capacity of that tank.

7.16 Fresh Water System

7.16.1 Fresh water tank arrangement

(a) One (1) independent stainless steel fresh water tank with a total capacity of not less than 1,000 litres shall be arranged in the Vessel to supply fresh water to the main deck, under-deck and crew space.

(b) It shall be installed in the tank space as indicated on the Guidance General Arrangement Plan.

7.16.2 The fresh water shall be supplied by a fresh water pump to achieve a pressure at the tap located at wheelhouse, main deck and under-deck to GNC's satisfaction. This system acts as the potable fresh water

system and a hose which freely reaches all parts of the Vessel shall also be provided.

7.16.3 Marine grade stainless steel 316L shall be used for fresh water tank. The fresh water tank shall be flushed clean before installation and delivery of Vessel.

7.16.4 The fresh water tank shall be designed to easily accessible for maintenance. It shall also be arranged with its own fill and vent pipes with gauze to prevent ingress of material / bugs to the tank. The freshwater tank shall be fitted with the following:

(a) Inspection / cleaning access cover;

(b) Filling / sounding pipe;

(c) Air pipe; and

(d) A tank content level gauge in litres and low level alarm shall be fitted on the wheelhouse control station.

7.16.5 The tank shall not be integral with the hull and shall be installed so that the loads due to the mass of the full tank are safely induced into the structure.

7.16.6 The thickness shall sustain the loads due to the mass of the full tank with due consideration given to upward and downward acceleration due to the Vessel's movements at maximum speed in the sea without damaging the integrity of the tank and ship's structure.

7.16.7 The freshwater tank shall not be directly adjacent to any other tanks carrying liquid of any kind.

7.16.8 The freshwater tank shall be tested without leakage by a head of water equal to the maximum to which the tank may be subject, but not less than 2.5 m above the top of the tank. The static test pressure shall be applied for 5 minutes without pressure drop.

7.16.9 A capacity indicator calibrated in litres shall be provided.

7.16.10 The impressed unit shall be provided with a starter, pressure switch, pressure gauge, relief valve and suction valve. The freshwater pump shall maintain the pressure automatically.

7.16.11 Domestic freshwater piping shall be made of copper or stainless steel 316L. Certificate of piping material shall be submitted before the delivery of the Vessel. The welding joints of the domestic fresh water piping's shall be free from lead. The domestic fresh water from the fresh water tank shall be free from any substance harmful to health and shall comply with the Government requirements for domestic water.

7.16.12 Cold freshwater taps completed with PVC braided / reinforced transparent hoses shall be fitted on the main deck aft, crew space and wheelhouse top to provide a rinse off facility for cleansing purposes.

7.17 Bilge System

7.17.1 The Vessel shall be fitted with a bilge system to the requirements of the RO.

7.17.2 A bilge audible and visual alarm panel shall be fitted in the wheelhouse control station for all subdivision compartment spaces.

7.17.3 When the Vessel is afloat and unmanned, the bilge audible and visual alarm system shall continue to function. When the audible and visual alarm is not acknowledged after a time period such as 5 minutes (can be adjusted), the audible and visual alarm shall be extended externally to an audible and visual alarm fitted on mast to bring the attention of the persons ashore or the guard of the Government Dockyard. The additional protection shall be able to be turned on and off when required.

7.17.4 A bilge water holding tank of capacity according to the requirements of RO shall be provided. A suitable oily water separator shall be provided, the separated oil shall be hold in an independent stainless steel 316L tank which shall meet the requirement of RO and get the satisfaction of GNC.

7.17.5 The bilge of the engine room and steering gear room shall lead to a bilge water holding tank. An electric motor-driven pump fitted in engine room with associated piping shall be provided in pumping out bilge water ashore or to the oily water separator. A suitable electric motor-driven pump shall be provided to pump out the dirty oil ashore. A direct overboard shall be provided in case of emergency affecting the safety of the Vessel.

7.17.6 Bilge piping shall be of stainless steel 316L.

7.17.7 24 V DC bilge pumps shall be installed in all compartments for oily-free water discharge overboard except forepeak, engine room and steering gear room.

7.18 Seawater System

7.18.1 All sea valves shall be compatible with the hull material, valves and flanges connected to the sea chests shall be tested according to RO Requirements.

7.18.2 It is desirable that sea chests provided for the main and auxiliary machineries shall be installed in the vicinity of their respective seawater pump suctions but with adequate distance between each other to avoid water flow disturbance. [D]

7.18.3 Seawater piping shall be constructed of 316L Stainless steel pipe. A suitable strainer with isolation valves and air vent shall be fitted to each seawater system. Due consideration shall also be given for quick and easy access to the seawater strainers.

7.18.4 The sea chest for sea water inlet is to be designed for open up easily to clear debris at sea without moving out the attached ventilation pipe. The thickness of the side plates and top plates are to be in accordance with the RO requirements. The structure of sea chest shall be independent of the engine girders, bottom longitudinals and bottom transverses as far as possible.

7.19 Sanitary, Grey and Black Water System

7.19.1 There is one (1) toilet located in the crew space. The toilet shall use fresh water for flushing.

7.19.2 One (1) black water holding tank with capacity of not less than 600 litres shall be provided.

7.19.3 Fresh water impressed unit tank shall supply fresh water to sanitary services.

7.19.4 A little black water tank (for transit purpose) shall be arranged under the crew space. A transferring macerator electric pump shall be set and used for pumping out the black water to black water holding tank or directly overboard in emergency condition. A high level alarm shall be provided.

7.19.5 The black water holding tank shall be fitted with a level gauge and a “Tank Full” indicator installed in a highly visible location in the wheelhouse.

7.19.6 The design of the toilet shall be agreed and acceptable to GNC before installation. Alternative piping to be provided to discharge the toilet directly overboard in emergency.

7.19.7 A discharge macerator electric pump shall be provided for pumping out the contents of the black holding tank. This shall be primarily lead to the shore connection, but shall also be arranged with a backup direct overboard discharge via non-return valve. The shore connection shall be arranged with an international shore connection.

7.19.8 Sanitary, Grey and Black Water piping shall be made of stainless steel 316L.

7.19.9 It is desirable that the Contractor should provided to supply additional equipment and/or system on top of those already required in Paragraphs 7.17 and 7.19 above to further mitigate the discharge all (but not just one or two) of the following: oily water, black water and grey water from the Vessel in the Hong Kong waters (“Additional Discharge System”). [D]

7.20 Open Deck Drainage System

7.20.1 The Vessel shall be fitted with an Open deck drainage system to the requirements of the RO.

7.20.2 Upper deck lines are constructed by aluminium alloy 6061 tubes and thick wall galvanized seamless steel tube if pass through the steel main deck

7.21 Floor Plates, Handrails and Guards

7.21.1 The floor in compartments under main deck shall be covered with unpainted aluminium chequer plate for safe operational use.

7.21.2 All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports in the compartments shall be of lightweight construction. Aluminium chequer floor plates shall be secured by fixing with sections but shall be readily removable for access to the components including but not limited to bilges, pumps, shaft, pipe work and strainers for ease of maintenance.

7.21.3 Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid rattling noise.

7.21.4 Removable guards for the protection of personnel and machinery shall be provided over exposed moving parts of the components including but not limited to machinery and hot pipe work.

7.21.5 Components including but not limited to splash plates, casings, fenders and screens shall be provided for the protection of personnel and machinery.

7.22 Hydraulic Power Pack Station for Steering Gear System

7.22.1 Hydraulic power pack station consists of:

- Two (2) pumps
- One (1) oil tank
- Two (2) pressure relief valves
- Two (2) oil suction filters
- Two (2) automatic backflush oil filters
- Pressure gauges
- Connection pipe
- One-way valves
- Oil level indication
- Oil temperature indication
- Starter cabinet
- Other items RO required

7.22.2 Hydraulic power pack station shall be remoted controlled from wheelhouse. However, essential local manual controls shall also be provided for emergency operation.

7.22.3 Hydraulic power units, including pumps and other pressurized components, installed within machinery spaces are to be placed or shielded as necessary to prevent any oil or oil mist that may escape under pressure from coming into contact with surfaces with temperatures in excess of 220°C (428°F), electrical equipment, or other sources of ignition. Piping and other components are to have as few joints as practicable.

7.22.4 To obtain a trouble-free hydraulic system, special attention needs to be paid to system flushing and pressure testing. Careful flushing of the system prior to start-up will significantly reduce malfunctions and prolong its service life.

7.22.5 Hydraulic power pack station shall be approved by the RO.

Chapter 8 Electrical System

8.1 General Requirements

8.1.1 All the electrical equipment and installation shall comply with the requirements of the RO.

8.1.2 Two 24 volts electrically started, fresh water cooled diesel engines shall be installed and integrated with two alternating current alternators, which shall be of self-excited, brushless and ventilated type. Synchronising and parallel operation is required.

8.1.3 All electrical equipment, fittings, instruments, switches, cables, insulation, sheathing, circuit breakers, rating standards and their installations shall comply with the latest Regulations of the International Electrotechnical Commission (hereinafter referred to as IEC), Electrical Installations in Ships.

8.1.4 Protective devices such as circuit-breakers or fuses shall be provided at the source of power, e.g. the switchboard, to interrupt any overload current in the circuit conductors before heat can damage the conductor insulation, connections or wiring-system terminals.

8.1.5 Switches and controls shall be marked to indicate their use, unless the purpose of the switch is obvious and its mistaken operation will not cause a hazardous condition. Each cable shall be clearly labelled and carry its own unique identification code.

8.1.6 The Contractor shall submit a layout plan showing the exact locations of the Equipment and the layout plan to be placed in wheelhouse and engine room. All Equipment shall be accessed easily and safely for inspection and maintenance.

8.1.7 All electrical Equipment installed shall be provided with manuals for operation and maintenance.

8.1.8 The standard of installation shall enhance the Equipment's safety features of not presenting any hazards to the operator, e.g. all metal panels exposed to the operator shall be grounded properly. Warnings of any potential hazards shall be displayed in both English and Chinese, or with universally recognised labels.

8.1.9 If electrical fittings, not of aluminium, are connected to aluminium, suitable means is to be taken to prevent electrolytic corrosion.

8.1.10 The Contractor shall submit cable route layout for showing major power and control system cables, main engine and generator electronic system control cable layout and electronic navigation equipment cables layout, etc. for ease of inspection and maintenance. Location of cable transit system (Paragraph 8.11.17) where cables pass through at watertight bulkhead or deck penetration shall be shown in the layout plan.

8.1.11 All the electric appliances for crews daily use such as Electromagnetic furnace, TV set, Refrigerator, Washing machine etc. must meet Hong Kong Mandatory Engine Efficiency Labelling Scheme (MEELS) through Cap. 598 Energy Efficiency (Labelling of Products) Ordinance.

8.1.12 All metallic outdoor control panel enclosure shall be made of stainless steel 316, waterproof and with ingress protection rating of at least IP65.

8.2 Electricity Distribution Network

8.2.1 The main electrical AC power supply shall be provided by two (2) electric generators. Synchronising operation is not required.

8.2.2 The generators shall be sized based on a 15% growth margin above the predicted maximum load condition. The Vessel’s electrical load calculation shall include summer and winter, static and transient, loads on AC, DC, shore power, and ship service systems. The Vessel’s electrical load calculation shall be approved by the RO and accepted by GNC.

8.2.3 The generator set will maintain an output voltage within ±5% over the entire load range and frequency within ±1.5 Hz.

8.2.4 The generators starting circuit shall be 24V DC. Starting and normal shutdown controls shall be mounted on the generator along with generator oil pressure and water temperature gauges; AC voltmeter and ammeter shall be directly connected to existing wiring systems with the use of a double-pole, double-throw (DPDT) transfer switch / centre-off switch for an ammeter to read both legs (AC Volts readings).

8.2.5 The generators shall be protected against short-circuits and overloads by multipole circuit-breakers (overload protector).

8.2.6 The distribution of the electricity to the equipment is through circuit breakers fitted on an electrical distribution board.

8.2.7 Circuit breakers shall be provided for each circuit. Circuit breakers shall be of the proper voltage rating, manual reset type, designed for inverse time delay, instantaneous short circuit protection, and capable of repeatedly opening the circuit in which it shall be used without damage to the circuit breaker. Circuit breakers shall indicate whether they are in the open or closed position. All circuit breakers shall be labelled to identify the circuit being protected.

8.2.8 Twenty (20) percent of spare circuit breakers or three (3) spare circuit breakers, whichever is the greater, shall be provided in each distribution panel, both AC and DC. The Vessel's ENE shall be supplied from an independent distribution panel, which shall in turn be supplied from a single breaker in the main DC panel.

8.2.9 All three/single-phase loads shall be balanced on each feeder. Loads of one type such as heaters or receptacles shall not be concentrated on a single branch or leg.

8.2.10 All supply panels shall be fitted with a miniature circuit breaker of double-pole type with over-current and short circuit trips. All junction boxes shall be readily accessible. A special arrangement is required for the navigation lights supplied from this prime panel.

8.3 Main Switchboard

8.3.1 Provide one main switchboard installed in engine room. Bottom incoming line, front plate maintenance.

8.3.2 Switchboards for main power supplies shall be installed such that the control elements, indicating instruments, circuit-breakers and fuses are readily accessible. The terminal side shall be accessible.

8.3.3 Under all normal conditions of operation, power is distributed from the main switchboard and the distribution system shall be designed to keep cable costs to a minimum by distributing to power panels located close to the user services and in general located in the engine room. Connections and components on panel-boards shall be in locations protected from the expected conditions in conformity with IEC 60529:

(a) IP 67 as a minimum, if exposed to short-term immersion;

(b) IP 55 as a minimum, if exposed to splashing water;

(c) IP 22 as a minimum, if located in protected locations inside the Vessel.

8.3.4 Switchboards shall be permanently marked with the nominal system voltage.

8.3.5 A self-standing dead front marine type main switchboard of aluminium construction with adequate ventilation louvres shall be fitted in an accessible and well ventilated position and shall contain the following:

(a) Sector for single phase supply 220-240V AC (designed by Contractor)

(b) Sector for 24V DC supply

(c) Sector for shore power supply

8.3.6 Due consideration shall be given in respect of the switchboard location to avoid any risk of damage resulting from oil and water spray or other mechanical hazards. Adequate guardrail(s) and insulated mat(s) shall also be provided.

8.3.7 Megger test and other relevant tests shall be carried out and witnessed by GNC. The results for these tests shall form part of Sea Trial Report that shall be submitted to GNC before Delivery Acceptance.

8.3.8 An appropriate laminated electrical diagram shall be attached on each switchboard.

8.3.9 All switchboard instruments, controls, and all circuit breakers, both on external panels and inside the switchboard, shall be provided with labels of durable flame-retardant material bearing clear and indelible indications. The appropriate ratings of fuses, the setting of adjustable protective devices and the full load current of electric generator shall be indicated.

8.3.10 Apart from the spare feeder breakers, the switchboard shall contain but not limited to the following:

(a) Electric Generator Set Sector with the following:

1. Circuit breaker of adequate capacity with over-current trip and short circuit trip;
2. Interlock device to ensure only one electric generator is connected to the bus bar;
3. Voltmeter, ammeter, wattmeter and frequency meter;
4. Indication lights for "Power Available", "Breaker Opened" & "Breaker Closed"; and

5. All necessary fittings and any other protective devices.

(b) 220V AC Single Phase Sector with the following:

1. Meters or earth lamps to indicate the state of insulation;
2. Moulded case circuit breakers with over-current and short circuit trips for the distribution of 220V AC power supply to their components including but not limited to lighting services, fans and motors; and
3. Any other necessary fittings and protective devices.

(c) 24V and 12V DC Feeders Sector:

1. Transformer / rectifier of adequate capacity for converting AC power to DC power. The rectifier shall be of 1-phase full wave regulated type with voltage regulation ±5% and ripple factor 4% at 100 Hz;
2. Magnetic automatic relay switch for activating emergency 24V DC supply in event of AC power failure;
3. Supply source indicator lamp for transformer / rectifier;
4. Ammeter for charging unit;
5. Voltmeter with selector switch (charging voltage and battery voltage);
6. Meters or earth lamps to indicate the state of insulation;
7. Moulded case circuit breakers with over-current and short circuit trips for 24V DC bus and feeder circuits; and
8. Any other necessary fittings and protective devices.

(d) Sector for shore power supply

8.4 DC Power Source

8.4.1 Batteries for Main Engines and Electric Generator Set Starting:

(a) Independent bank of 24V batteries shall be provided for starting of each of the two (2) main engines and each of the two (2) electric generator sets.

(b) The capacity of the batteries shall be sufficient to provide at least six (6) consecutive starts of each of the main engines, and at least three (3) consecutive starts of each of the electric generator set from cold, without recharging.

(c) Electrical connections shall be arranged so that the batteries can be used to start either main engine or generator engine by operating a manual change-over switch in the engine room.

(d) The batteries shall be charged by engine driven alternators with backup service provided by an automatic battery charger. Interlock or protective devices shall be provided to prevent simultaneous charging from the charger and the alternator. The battery charger shall also be prevented from charging the batteries during main engine starting.

(e) Batteries to be of maintenance-free type

1. There will be four (4) sets of 24V batteries charged directly from engine driven alternators, generator set. There shall be one (1) battery set allocated to each engine.
2. Power supply batteries shall be portable, maintenance free, heavy duty, deep cycle and produced from environmentally friendly materials. They shall have a minimum life expectancy of five (5) years, or 200 full discharge cycles at full load, rated in accordance with cognizant regulatory body requirements.
3. The supplied 12V / 24V batteries for configuration of any battery bank should be either of 75AH, 100AH, 150AH or 200AH to match for the replacement of existing Government Dockyard batteries during maintenance and repair work. [D]

(f) Each engine driven alternator shall have its own built-in voltage regulators, automatic cut-off, and any other required protective devices.

(g) The batteries shall be located as close as practicable to the engines in order to minimise the voltage drop. The battery bank shall be housed in a separate GRP or GRP lined storage box. Each box shall be provided with a removable cover with locking clips for ease of maintenance.

8.4.2 Batteries for Routine and Emergency Supply

(a) 24V battery shall be provided for routine and emergency supply, all emergency equipment shall operate from a dedicated 24V DC power supply.

(b) In event of main electrical AC power failure, 24V DC batteries shall act as an emergency supply for all communication equipment, navigation and emergency lighting, fire monitoring and control system, and other vital instrumentation and control systems for the Vessel to return to base.

(c) This emergency supply shall come into operation automatically in the event of main electrical power supply failure. The capacities of these sets of batteries shall be sufficient to maintain the emergency supply for a period according to the RO Requirements.

(d) The batteries shall be installed in a separate compartment located outside of the engine room above deck. The compartment shall be well ventilated and prevent ingress of water.

(e) The Contractor shall provide two (2) independent chargers, one (1) for daily battery group and another one (1) for emergency battery group.

8.4.3 Independent batteries for electronic equipment:

(a) Battery shall be provided solely for the VHF.

(b) The battery bank shall be housed in a separate GRP or GRP lined storage box, that the box shall be located outside of the engine room above deck. The box shall be well ventilated and prevent stagnant of water.

(c) The Contractor shall provide an independent batteries charger for it in the wheelhouse.

8.4.4 12/24V DC services shall be supplied from the switchboard in the steering console through a 2-wire insulated system to the following items:

(a) Navigation light control panel and navigation lights;

(b) Horn;

(c) Emergency lighting;

(d) Fire detecting system;

(e) Compass light;

(f) Instrument panel in control console;

(g) CCTV;

(h) Public address;

(i) One hand-held searchlight and one fixed searchlight (for aft);

(j) Unmanned duty alarm system; and

(k) Any other navigational and electronic equipment (if applicable).

8.4.5 The batteries as required in Paragraphs 8.4.1 and 8.4.2 shall be subjected to continuous trickle charge under normal operation of the Vessel by an automatic battery charger. Under the battery fully discharged condition, the charger shall be able to perform a quick charge function.

8.4.6 Apart from the charger, a provision shall also be made to allow the batteries to be charged by an engine driven alternator. The battery chargers shall provide automatic control between float and boost charges. Each charger shall also be provided with a voltmeter, voltage regulator, selector switch, blocking rectifier, and the required devices for protecting the chargers against short circuit, reverse connection, excessive temperature and overloading. The capacity of each battery charger shall be sufficient for charging one (1) set of completely discharged starting batteries to fully charged condition within 10 hours.

8.4.7 Battery charger installations shall meet all cognizant regulatory body requirements including:

(a) One (1) set of charging and discharging board with two (2) chargers for Routine and Emergency battery shall be provided. Charging method shall be float-charging type and boosting charge type with manual voltage adjuster.

(b) The charger is equipped with rectifying device. When the main power supply is normal, the rectifying device provides DC 24V power. When the main power failure, it automatically switches to battery for power supply. The character of battery charger shall be: Input (AC) 220V, 2Ph, 50Hz. Output (DC) Max. Voltage: about 28V.

(c) The chargers shall be sized such that a completely discharged battery bank can be recharged to 80%

capacity within 8 hours (100% at 10 hours). At the end of the charge, the charge shall be tapered to a trickle value.

(d) The chargers shall be fitted with a pilot lamp, a charging adjustment, a voltmeter and an ammeter indicating charging current.

(e) Discharge protection shall be provided to prevent a failed charger component from discharging the battery bank.

(f) Battery charging facilities will be available via the main propulsion engines and the 220V AC generator. Battery chargers shall not be mounted directly over batteries.

(g) Battery selector/isolator switches shall be provided between battery chargers and the battery banks they serve.

(h) Provisions shall be made to allow either main engine to be started by the other engine's starting batteries.

(i) The charger has protection against overcharge.

8.4.8 An instruction plate with a schematic wiring diagram illustrating the operating procedures and precautions for the selection of battery banks and charging of batteries shall be provided in the vicinity of the charger, battery selection switchboard and charging distribution board. All charging control shall be conducted in the wheelhouse.

8.4.9 Batteries shall be permanently installed in a dry, ventilated location above the anticipated bilge-water level.

(a) Battery rooms, boxes and lockers are to be ventilated to prevent the accumulation of flammable gases. Natural ventilation may be employed if the required number of air changes is small and the duct can be run directly from the top of the battery room, box or locker to the open air above, with no part of the duct more than 45° from the vertical.

For natural ventilation of the battery room, the cross-sectional area A of the inlet is to be equal to that of the outlet, not less than:

1. for vented type batteries

$$A = \frac{50 \times U_n \times Q \times n}{1000} \text{ cm}^2$$

2. for valve-regulated sealed batteries

$$A = \frac{20 \times U_n \times Q \times n}{1000} \text{ cm}^2$$

where: Un — nominal voltage of the battery, in V;

Q — battery capacity, in Ah;

n — number of cells in series.

The quantity Q of air expelled from the rooms, boxes or lockers containing vented type batteries is not to be less than:

$Q=0.11In$ m³/h

where: I — the maximum charging current during the development of gas, but not less than 25% of the maximum charging current output by the charging device, in A;

n — number of battery cells.

The quantity of air expelled from the rooms, boxes or lockers containing valve-regulated sealed batteries may be reduced to 25% of that required in $Q=0.11In$ m³/h

(b) Batteries shall be located in areas so as to avoid heat soak. Emergency batteries shall be located in the area outside the engine room such as wheelhouse.

(c) All battery storage boxes shall be provided with removable covers and locking clips for ease of maintenance.

(d) Drainage shall also be provided to avoid accumulation of moisture.

8.4.10 Batteries shall not be installed directly above or below a fuel tank or fuel filter.

8.4.11 Any metallic component of the fuel system within 300 mm above the battery top, as installed, shall be electrically insulated.

8.4.12 Battery cable terminals shall not depend on spring tension for mechanical connection to them.

8.4.13 A battery-disconnect switch shall be installed in the positive conductor from the battery, or group of batteries, connected to the supply system voltage in a readily accessible location, as close as practical to the battery or group of batteries except the circuits for engine starting and navigation lighting and electronic devices with protected memory and protective devices such as bilge-pumps and alarms, if individually protected by a circuit breaker or fuse as close as practical to the battery terminal.

8.4.14 Local information plates showing the voltage, ampere-hour rating, group number and application shall be provided for each battery set.

8.5 Shore Power Supply and Connection

8.5.1 The electrical system shall include the provision for shore power supply (220V AC, 1PH, 50Hz, 32A) designed to an approved standard. And with phase sequence automatic adjustment device.

8.5.2 The shore power system shall be interlocked to prevent the Vessel's generator from providing power to the shore. Indicating lights for "shore power available", "shore power breaker on" and "shore power breaker closed" to be fitted.

8.5.3 The Contractor shall provide a 1:1 isolation transformer for the shore power supply. The earth wire of the shore power cable shall be connected to the shielded core of the isolation transformer. The core of the isolation transformer shall be completely insulated from the case. It shall be convection cooled and shall have no moving parts. The transformer enclosure shall be drip-proof and the isolation transformer shall be rated for continuous operation at full capacity of the shore power connection.

8.5.4 The watertight connection box shall be designed with a quick release receptacle.

8.5.5 Not less than 30 metres long shore connection power cable of adequate rating with quick release watertight plug shall be provided.

8.5.6 The 30-metre shore connection power cable terminating at compatible connections to mate with existing facilities on Government Dockyard, to be identified by GNC. Suitable stowage on board shall be provided for the cable.

8.5.7 The shore power connection enclosure box shall be made of stainless steel 316, waterproof and with ingress protection rating of at least IP65.

8.6 AC Distribution Boards and Circuit Breaker

8.6.1 Electrical distribution shall be installed throughout the Vessel for AC electrical distribution. Distribution panels shall be of a drip-proof steel construction with hinged doors.

8.6.2 Moulded case circuit breakers shall be fitted as far as possible on all sub-circuits. Where this is not possible, fuses may be used and subjected to GNC acceptance. Where the sub-circuit is three phase or where the current is above 60 Amps, the moulded case circuit breakers shall be fitted with thermal and magnetic tripping devices

8.6.3 All circuit breakers shall have time delay thermal overload tripping devices and instantaneous short circuit current tripping devices. The overload tripping devices shall be set at 110% of the maximum circuit load current. The cable rating shall be in excess of the circuit breaker overload tripping current.

8.6.4 Circuit breakers shall act as protective devices only and shall not be used for switching purposes. An individual on/off switch shall be installed for each electrical fitting.

8.6.5 All distribution boards and circuit breakers shall be clearly labelled with the name of each circuit. Labels shall be in both English and traditional Chinese.

8.7 Motor and Starters

8.7.1 Where a starter is situated remotely from the motor, stop and start buttons shall be provided near the motor for local operation. All electric motors of essential services shall have separate start and stop push buttons plus running indication lights (with dimmer control) inside the wheelhouse console.

8.7.2 Motors installed in the engine room and other enclosed spaces shall be of semi-enclosed drip-proof type. Motors installed in locations exposed to weather or moisture shall be of waterproof construction.

Insulation of motors shall not be less than Class B standard under IEC Regulations for the Electrical and Electronic Equipment.

8.7.3 A circuit diagram shall be placed in the local control box of each electrical installation.

8.7.4 In general, starters to be of magnetic control type except that small motors (0.5 kW or less) may be manually operated by line switch with protective fuse on each pole.

8.7.5 Individual Starter

(a) Starters which are not contained in the group starter panels to be mounted in the drip-proof metal cabinet.

(b) The cabinet shall be arranged for bulkhead mounting type near the respective motor.

8.8 Unmanned duty alarm system

8.8.1 When the Vessel is afloat and unmanned, if the bilge-alarm or fire detecting system trigger, nobody acknowledged after 5 minutes (can be adjusted), the audible and visual alarm shall be extended to an audible and visual alarm. This alarm shall be fitted on mast to bring the attention of the persons ashore or the guard of the Government Dockyard. The additional protection shall be able to be turned on and off when required.

8.8.2 DC 24V power supply shall be supplied from DC Power Source.

8.9 Level Alarm and Indicator Panel

8.9.1 The Contractor shall provide a level alarm and indicator panel in wheelhouse. DC 24V power supply from general batteries. The liquid level alarm and indicator panel include the following functions:

(a) High level alarm: The minimum technical requirements are as follows:

1. Steering gear room bilge water;
2. Engine room bilge water;
3. Tank space bilge water;
4. Fuel oil tank (P);
5. Fuel oil tank (S);
6. Fresh water tank;
7. Crew space bilge water;
8. Black water tank; and
9. Fore peak bilge water.

(b) Low level alarm: The minimum technical requirements are as follows:

1. Fuel Oil Tank (P);
2. Fuel Oil Tank (S); and
3. Fresh Water Tank.

(c) Level indicator (Percentage) panel in wheel house:

1. Fuel Oil Tank (P);
2. Fuel Oil Tank (S);
3. Fresh Water Tank; and
4. Black Water Tank.

8.9.2 All bilge water high level alarm signal shall be connected to unmanned duty alarm system.

8.9.3 All other level alarm for other equipment/instrument refer in the Chapter 7 shall be required in the wheelhouse.

8.10 Transformer

8.10.1 Two (2) sets transformers of suitable capacity shall be installed in the engine room for general lighting system, domestic service, interior communication, nautical instruments and radio device etc.

Principal particulars shall be as follows:

Type:	Drip-proof, dry type
Number:	2 (one as spare)
Voltage:	380/230 V
Phase:	3 PH
Frequency:	50 Hz
Insulation:	Class F
Rating:	Continuous
Cooling:	Natural-cooling

8.11 Cable, Wiring and Fuse

8.11.1 Cables which may be exposed to physical damage shall be protected by sheaths, conduits or other equivalent means. Cables passing through bulkheads or structural members shall be protected against damage to insulation by chafing. When cables pass through bulkheads and decks with certain fire protection requirements, integrity shall not be weakened.

8.11.2 Where cables are protected by pipe conduits, the space factors of the pipe conduit shall conform to IEC regulations in order to prevent bunching of wires and to minimise earth faults.

8.11.3 Cables shall have minimum dimensions in accordance with IEC regulations or other equivalent international standard acceptable to GNC, or the conductor manufacturer's rated current carrying capacity, based on the load to be supplied and allowable voltage drop for the load to be carried.

8.11.4 Cables shall be flame-retardant, marine type, low smoke, zero halogen according to IEC 60332-3. Their selection and method of application shall comply with IEC 60092-352 and the RO requirements.

8.11.5 Cabling for emergency systems shall also comply with the higher fire survival rate stipulated in IEC 60331 and the RO requirements

8.11.6 Cables in voltage-critical circuits, such as starter motor circuits and navigation light circuits, whose output may vary with system voltage, shall be sized in compliance with the component manufacturer's requirements.

8.11.7 The metallic sheathing, armour or braid of cable shall be properly earthed at both ends. All bare terminals shall be properly insulated using approved cable insulators.

8.11.8 Cables that are not sheathed shall be supported throughout their length in conduits, cable trunking or trays, or by individual supports at maximum intervals of 300 mm. Cushioning/protection on the overhead cable trunk for preventing crew head injuries shall be provided in the engine room.

8.11.9 Sheathed cables and battery cables to the battery disconnect switch shall be supported at maximum intervals of 300 mm, with the first support not more than 1m from the terminal. Other sheathed conductors shall be supported at maximum intervals of 450 mm. Sheathed engine starter conductors constitute an exception to this requirement.

8.11.10 Wiring shall be run along perforated metal trays and shall be secured in such positions as to allow easy maintenance.

8.11.11 In principle wiring shall not be installed below the engine room floor plates. If it is unavoidable, it must be laid through galvanized pipes.

8.11.12 Cabling inside accommodation areas shall be run behind linings, but shall not be embedded inside the insulation, which shall have removable panels for inspection and maintenance.

8.11.13 Separation shall be provided on cable runs for power cables, instrument cables, control cables and computer network cables in accordance with manufacturer's recommendations and in line with the requirements of IEC 60533 Annex 'C'.

8.11.14 Each electrical cable that is part of the electrical system shall have a means to identify its function in the system, except for conductor integral with engines as supplied by their manufacturers.

8.11.15 Cables and the wiring terminals of different AC and DC power supply voltages in the junction box, fuse box as well as the equipment terminal box shall be laid separately and shall have a distinctive code and labelling system for easy identification to facilitate tracing.

8.11.16 Tally plates showing the cable size and the number of cores shall be provided for each of the main power cables.

8.11.17 Where electric cables have to be fitted on the decorative surface of bulkheads, they shall be enclosed in conduits.

(a) RO approved watertight, fire resistant and gastight cable transit system shall be provided in way of watertight bulkhead or deck penetrations (Hilti, RISE or equivalent).

(b) The penetration shall be located as high as practicable and well clear from the ship side.

8.11.18 All fuses are preferably of cartridge type and rated adequately for the protected circuits.

8.11.19 Electric wiring (whether single core or multi-core type) shall use approved (by an authority acceptable to GNC) type of bulkhead/deck penetration gland/fitting when they pass through watertight bulkheads or the weather deck.

8.12 Lighting Fixtures

8.12.1 General lighting shall be provided for all compartments and shall be arranged to give sufficient illumination to all working areas for normal operation. All lighting shall be equipped with LED bulbs including the navigation lights.

8.12.2 Lighting shall be in accordance with the recommended practices for marine lighting and to GNC's satisfaction, particular attention will be paid to the level of brightness provided in all areas.

8.12.3 The general lighting system described herein shall be composed of fixtures permanently installed as necessary to provide the levels of illumination required to an approved standard. The system shall include fixtures, switches, panels, boxes, and cabling for the distribution system supplying the lighting fixtures. Fixtures shall be accessible for re-lamping and cleaning.

8.12.4 General lighting shall have individual or group switches to conserve power, unless agreed with GNC, all light sources, including signalling, shall be of LED type. The LED colour temperature shall be to GNC's satisfaction.

8.12.5 Accommodation space and wheelhouse shall be equipped with lights / lamps for night time working. The installed lightings at accommodation space shall be able to provide lux level of 300-500 lux for normal desk office work. Dimmers and switches shall be provided for night time working operation. Lighting from the engine room shall not be seen through the ventilation louvres during operation at night. Emergency lighting of 24V DC supply shall be provided for all compartments, emergency embarkation stations, open decks as per the RO Requirements.

8.12.6 Emergency exit routes shall be identified and illuminated as required by RO Requirements.

8.12.7 For the accommodation space and wheelhouse, red and daylight lighting shall be provided above all desks and working areas including the chart table. Red and daylight can be changed by switch.

8.12.8 Controls shall be provided within each compartment for the illumination therein. Each light shall have a manually controlled switch located at the primary entrance to that compartment and switches for this purpose shall be installed near the access and located so as not to be obscured when the door is open. A separate switch shall be provided in each compartment to control each group of lights. Switches shall break both sides of the circuit. Fixtures shall be installed so that illumination therefrom will not be obstructed by the components including but not limited to fixed pipes, ducts, bins and berths.

8.12.9 Fixtures shall be mounted so as not to vibrate in any operating condition and so that the vessel vibration will not harm the fixture. Fixtures shall be selected and mounted to maintain the maximum possible headroom.

8.12.10 All sockets, terminal blocks, and switch and receptacle interiors shall be made of non-flammable phenolic

material.

8.13 Navigational Light

8.13.1 All navigational and signal lights to be provided shall be in compliance with the International Regulations for Preventing Collisions at Sea 1972, as amended by IMO from time to time. Type approved certificate in respect of each model of the navigational and signal lights issued by RO shall be provided on or before the Delivery Acceptance at the latest.

8.13.2 The lighting shall be controlled from a control and alarm signal panel in the wheelhouse. Each navigation light circuit shall be provided with a switch, protection fuse, indicating lamp and alarm. A dimmer for the panel indication lights, buzzer stop and lamp test buttons shall be fitted. The navigation light control panel alarm and its communication interface must be suitable to VDR.

8.13.3 Navigation light circuits shall be independent of any other circuit. There shall be two (2) essentially separate power supply systems to the distribution board: one (1) from the main AC power source and one (1) from the emergency DC power source.

8.13.4 The following navigational and signal lights (with double-pole circuit breakers) and shapes shall be provided:

(a) Port-side light;

(b) Starboard-side light;

(c) Stern light;

(d) Masthead light;

(e) Anchor light;

(f) Combined NUC and diving lights as follows: three (3) all-round lights in a vertical line where they can best be seen. The highest and lowest of these lights shall be red and the middle light shall be white, all respective lights shall be grouped together and operated together for different use;

(g) One (1) all-round flashing red light installed on compass deck appropriate location to bring the attention of the persons ashore or the guard of the Government Dockyard (see details in Paragraphs 4.19.1, 5.7.1, 7.17.3 & 8.8.1 of Part VII);

(h) Black ball (three numbers);

(i) Black diamond;

(j) Whistle;

(k) Bell;

(l) One (1) set of immigration examination signal lights and red rotating beacon light; and

(m) Any other navigation lights as required.

8.13.5 Three (3) sets of spare bulbs (one (1) per light) shall be provided for the navigational and signal lights. The red rotating beacon light to be provided with separate on/off switch.

8.14 Searchlight

8.14.1 Three (3) proprietary make 220V AC, 1500W adjustable remote control searchlights are required for operation, two (2) toward the bow and the other one (1) toward the stern. Three (3) switches for the searchlight shall be mounted adjacent to the searchlight control joystick.

8.14.2 The searchlights shall be installed on the top of the wheelhouse. The searchlight shall be remotely controlled by electric joystick located in the wheelhouse control station for turning and tilting.

8.14.3 Tarpaulin covers shall be provided for the searchlights.

8.14.4 One (1) 24V DC LED portable search lights (with luminosity equivalent to not less than 150 W conventional type) with 30 metres water proof cable reels and plugs shall be provided in the wheelhouse.

8.14.5 Each searchlight shall be operated from independent power and control circuit. Power switch shall be provided in each searchlight power circuit to isolate faulty searchlight from power trip. All vessel searchlight control operation shall not be connected on a common control bus for prevention of all searchlights shutdown at same time.

8.14.6 Opening access for maintenance shall be provided at wheelhouse ceiling for replacement/repairing of searchlight lamp fitting in case room for replacement/repairing at the wheelhouse top is not available.

8.15 Floodlight

8.15.1 A floodlight control panel installing on wheelhouse console. It can control all the floodlights. All floodlights must be LED lamp, AC 220V, 50Hz.

8.15.2 The floodlights shall be for marine use and capable of withstanding a corrosive environment.

The minimum requirements of floodlights arrangement shall be:

Lighting fixture	Qty	Location	Illuminated area
80W LED lamp	2	Compass deck front	Wheelhouse front area
80W LED lamp	1	Main deck aft	Main deck aft area
80W LED lamp	2	Main deck port side	Main deck port side
80W LED lamp	2	Main deck starboard side	Main deck starboard side

8.15.3 Sufficient amounts of floodlights to GNC's satisfaction shall be arranged on the main deck and compass deck to ensure sufficient lightings at night.

8.16 Power Receptacles / Sockets

8.16.1 Receptacles/sockets installed in locations subject to rain, spray or splashing shall have a minimum protection of IP55, in accordance with IEC60529 when not in use, e.g. protected by a cover with an effective weatherproof seal.

8.16.2 A system of 220V AC, 13A and 24V DC 5A socket outlets shall be provided in the engine room, fore and aft ends of the Vessel on the main deck and in the fore peak of the Vessel.

8.16.3 Socket outlets for 220V AC (with USB charging socket 5V 4A max), 24V DC or 12V D.C shall be provided in the wheelhouse. 13A AC power socket integrated with USB charger socket 5V 4A max shall comply with BS1362.2, BS5733, IEC 61558-2-16, IEC61000-6-1 & IEC 61000-6-3 standard.

8.16.4 Sockets shall be provided in ship office for hardware including but not limited to printer, personal computers, charger for portable VHF, charger for digital camera, charger for mobile phone, desk lamp and spare.

8.16.5 The crew space requires 220V AC power sockets (with USB charging socket 5V 4A) for the equipment including but not limited to portable apparatus and the domestic equipment.

8.16.6 The wheelhouse and accommodation space require 220V AC power sockets for fans which adequate natural ventilation is ensured in case air-conditioning break down.

8.16.7 Each socket outlet shall be integrated with an 'On/Off' switch to facilitate local switching of the electrical equipment. The 220V AC socket outlets shall be supplied with 13A 3-square-pin fused plugs. The 24V DC socket outlets shall be supplied with fused plugs.

8.16.8 Sockets for different voltage systems shall be clearly labelled and with different pin sizes so that one system cannot plug into the other.

8.16.9 Power sockets on the weather deck, in the engine room and other damp locations shall be watertight and be provided with watertight covers and switches. All power plugs provided for the portable equipment intended to be used in these areas shall also be of weatherproof marine type.

8.17 The Solar Panel Systems

8.17.1 It is desirable that the Contractor should provide a solar panel system complying with all of the specifications set out in below: [D]

(a) The solar panel system shall be fitted on the top of the deckhouse as indicated on the Guidance General Arrangement Plan. For a maximum solar collection, it shall maximize efficient use of the deck space in a manner as practical as possible. The solar battery systems must have the ability to be charged from the solar panels.

(b) The solar panel system converts solar energy sufficiently to power shipboard AC 220V lighting and others, such as cabin lighting, fans, the portable apparatus and the domestic equipment.

(c) A multipole switch located in wheelhouse which can send the solar power to charge all the 24V DC batteries, this multipole switch must interlock with other battery charger.

(d) A rigid service walkway and platforms shall be provided for maintenance.

8.18 Lightning Protection

8.18.1 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.

Chapter 9 Electronic Navigation Equipment

9.1 General Requirement

9.1.1 The Contractor shall supply and be responsible for the supply, delivery, testing, installation, commissioning and warranty (12 months from the date of the unqualified Acceptance Certificate) and provision of operational and maintenance service manual and training of the following equipment / systems to be fitted onboard the Vessel for GNC:

(a) Loudhailer/Siren and public address system with USB player (paragraph 9.2 of TS);

(b) Magnetic compass (paragraph 9.3 of TS);

(c) Fiber-optic gyrocompass (paragraph 9.4 of TS);

(d) Satellite compass (paragraph 9.5 of TS);

(e) Differential Global Positioning System ("DGPS") (paragraph 9.6 of TS);

(f) Marine Radar (x-band) (paragraph 9.7 of TS);

(g) Electronic Chart Display and Information System ("ECDIS") (paragraph 9.8 of TS);

(h) International Maritime Mobile (IMM) VHF radio with Global Maritime Distress Safety System (GMDSS) (paragraph 9.9 of TS);

(i) Marine Band Hand-held Waterproof Radio Transceiver (paragraph 9.10 of TS);

(j) Secure Automatic Identification System ("S-AIS") transponder (Include the receiver and transmitter modules) (paragraph 9.11 of TS);

(k) Radar Transponder (paragraph 9.12 of TS);

(l) Satellite EPIRB (paragraph 9.13 of TS);

(m) Electric horn conforming to IMO requirement (paragraph 9.14 of TS);

(n) CCTV System (paragraph 9.15 of TS);

(o) Windshield wiper (paragraph 9.16 of TS);

(p) Waterproof LED Display System (paragraph 9.17 of TS);

(q) Voyage Data Recorder ("VDR") (paragraph 9.18 of TS);

(r) Speed Log (paragraph 9.19 of TS);

(s) Direction finder system (paragraph 9.20 of TS);

(t) Wired and Wireless Intercom (Talkback) System (paragraph 9.21 of TS);

(u) Wind Speed and Direction Indicating System (paragraph 9.22 of TS);

(v) Echo Sounder System (paragraph 9.23 of TS); and

(w) Desktop Computer (paragraph 9.24 of TS).

9.1.2 The Contractor shall provide all labour, material, transportation, installation calibration, testing and commissioning, Warranty Services in Warranty Period, test equipment and all other tools and equipment which are necessary to complete the work required in this Chapter. References to "Equipment" in this Chapter 9 shall mean the above-mentioned Equipment in (a) to (w). References to "Electronic Navigation Equipment" or "ENE" or "Electronic Navigational Equipment" throughout the Tender Documents or Contract shall mean each set of the above-mentioned Equipment in (a) to (w).

9.1.3 An integrated system covering all ENE is preferred, so that information and also the display monitors of different systems, such as colour plotter system, radar system, can be shared in order to utilise the limited space available in coxswain operation area and to provide users a better displaying interface. ("Integrated Navigation System" or "INS")

9.1.4 All ENE offered shall be designed for marine applications and shall allow effective operation under most arduous condition such as poor weather, strong winds and heavy rains and severe vibration. Exposed components shall be weather-proof and adequate protection against splash and water shall be provided for all electronic equipment fitted on board.

9.1.5 All components of the equipment exposed to the weather shall be sea water corrosion resistance. Internal components shall be fully enclosed with heavy duty seals and sufficient heat dissipation mechanism such as ventilation and conduction to protect the Equipment.

9.1.6 The Contractor shall pay attention to the compass safe distance of the equipment and the radiation hazard zone of the radar scanner in the Vessel design.

9.1.7 All radar and radio equipment shall meet both the applicable requirements of the International Maritime Organization and the licensing requirements of the Office of the Communications Authority of Hong Kong.

9.1.8 All siting, installation and cabling in respect of components including but not limited to compass, VHF and radar shall comply with the relevant rules and regulations of Hong Kong.

9.1.9 When the generation / use of calendars are employed for logging of reports, activation off equipment, or as any essential part of logic for the proper functioning of the system, then the calendar generation shall function without any error or manual intervention for all leap years.

9.1.10 The circuit breaker for the ENE shall equip with lockout device so that the breaker can be locked during the equipment maintenance.

9.1.11 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.

9.1.12 Equipment supplied shall complete with all standard and/or maker recommended accessories as required for normal operation.

9.1.13 All the ENE control system on wheelhouse console shall not use touch screen (Except for ECDIS and Radar).

9.1.14 All the ENE shall have warranty support services in Hong Kong and on-site maintenance shall be available in Hong Kong.

9.2 Loudhailer / Siren System and Public Address System with USB player

9.2.1 The system shall function as a loudhailer / siren system for external broadcast specially designed for maritime purposes. The system shall also consist of a public address system for internal broadcast in the crew area. The whole system must be marine type.

9.2.2 Loudhailer / Siren

(a) The system shall comprise three (3) master control units (included two (2) fixed forward and aft loudhailers control units on the console installed on the port and starboard of the bridge while the remaining control unit for the Directional Loudhailer shall be fitted with joystick in the wheelhouse.) There shall be three (3) weather proof horn type loudspeakers, in conformance to IPX5 or better, located at forward, mid and aft of the Vessel respectively. One (1) controllable loudhailer located at middle top of wheelhouse with an electrical remote control platform which can be 360 degree rotated, and it was controlled by a joystick on the wheelhouse console with angle indicator. The direction of the loudhailer shall be displayed in the wheelhouse in real time. The remote control platform and its joystick must be provided by the loudhailer system.

(b) The system shall have the capacity to generate a “Yelp” siren and a horn signal sound in manual mode. It shall also have a selection of at least six (6) warning signal sounds in automatic mode for general marine navigational uses, namely Underway, Stopped, Sail, Tow, Anchored, and Aground.

(c) There shall be a volume control on external broadcasting speaker so it shall be adjustable to full power for messages to be heard 0.5 km away from the Vessel and down to minimum for night operations.

(d) Two (2) master control units, which shall be completed with fist microphone and microphone hanger, shall be recessed mounted in the wheelhouse with the following facilities provided at the front panel:

1. Power ON / OFF
2. Hail volume control
3. Function control
4. One joystick with 360 degree rotation angle indicator.

(e) Speech shall be delivered through a fist microphone hanging on the console. The fist microphone shall be splash-proof, and preferably water-proof.

(f) The amplifier shall be with a rated power output of not less than 30 watts per speaker and shall have the following characteristics:

1. Mic in (hail) sensitivity: Not greater than 30 mV for 30 watts output at 1 kHz

2. Hail distortion: Not greater than 10% at 30 watts output at 1 kHz

(g) The horn type loudspeaker shall be weatherproof reflex type, and with an impedance compatible with the amplifier and with power rating not less than 30 watts.

(h) A USB player shall be provided with the system in such a configuration that the audio signal from the USB player can be broadcasted through the loudhailer system.

9.2.3 Public Address System

(a) There shall be at least one (1) speaker installed at accommodation compartments for a one-way internal broadcast to the crew and officer from the microphone at either of two (2) control panel units. There shall be volume control for these internal broadcast speakers for adjusting acoustic levels to comfortable levels for the crew and at the same time avoid excessive acoustic feedback to the microphone. These internal broadcast speakers shall be waterproof to IPX5 or better and suitable for the location of installation.

(b) The positions of two (2) master control units of loudhailer / siren system, control panel and both the position and quantity of speakers of public address system shall be finalised in the detailed design stage.

9.3 Magnetic Compass

9.3.1 The Contractor shall provide one magnetic compass, built-in.

9.3.2 The power of the equipment shall be supplied from the 24V DC system of the vessel by switch on wheelhouse console.

9.3.3 The Contractor shall provide a magnetic compass deviations table by professional magnetic compass adjuster.

9.3.4 The magnetic compass shall have a direct-read dial with dial size of at least 2 inches.

9.3.5 The magnetic compass shall have a green night lighting function.

9.3.6 The magnetic compass shall have a built-in compensator to adjust for deviation.

9.3.7 The compass dome shall be constructed of heavy duty, optically clear polymer, and shall provide clear and accurate magnification of the dial.

9.3.8 Performance Requirements of fluxgate compass:

(a)	Resolution:	2º or better
(b)	Mounting option	Binnacle or flush or bulkhead mount
(c)	Waterproofing	IPX5 or better

9.4 Fiber-Optic Gyrocompass

9.4.1 The technical specifications meet the follow:

Heading accuracy :	<0.5° secant latitude RMS
Roll & pitch accuracy:	0.05° RMS
Heave accuracy :	5cm or 5% (delayed heave)
Alignment time:	<10 minutes
Angular rate:	>500°/s
Operating latitude:	± 80°
Power supply:	18 - 36Vdc
Interface:	4 x configurable bi-directional RS-232 / RS-422
	4 x configurable transmit only RS-232 / RS-422
	1 x Ethernet
	Status / Alarm relay contacts
	Signal Outputs VDR 1 x IEC 61162-1(include the roll, pitch signal)
Data formats:	NMEA 0183 / IEC61162, TSS proprietary and industry standard
Rating:	IP31

Operating temperature:	-20°C to +55°C
Storage temperature:	-30°C to +70°C
Environmental:	Meets or exceeds IEC 60945
EMC:	Meets or exceeds IEC 60945
MTBF:	30,000 hours
Standards:	IMO A424(XI), IMO A821(19), IMO A694(17), MSC 191(79), ISO 8728, ISO 16328, IEC 60945,IEC 62288, IEC 61162, US Coast Guard MRA
Control & Display Unit Capabilities:	Heading, roll, pitch, latitude, longitude, speed, status and alarms

9.5 Satellite Gyrocompass

9.5.1 The Contractor shall supply and install one (1) complete satellite compass set. The satellite compass shall consist of at least a sensor unit and an electronic digital display unit. The unit shall be compact and recessed in the console.

9.5.2 The satellite compass sensor unit shall be connected to the radar, ECDIS, and other equipment as necessary via a NMEA 0183 or NMEA 2000 standard interface.

9.5.3 The sensor unit shall incorporate two (2) or more satellite receivers from at least two (2) types of satellite positioning systems.

9.5.4 The satellite compass shall incorporate integrated 3-axis rate gyro and acceleration sensors to deliver fast start-up times and shall be capable of providing heading updates during temporary loss of satellite signals (i.e. during navigation under bridges).

9.5.5 Performance:

(a)	Reference:	Either Magnetic North or True North
(b)	Warm-up Time:	Less than one second
(c)	Accuracy:	Marine Horizontal Accuracy: < 2.5m
		Heading Accuracy: < 0.25° rms
		Pitch/Roll Accuracy: <1° rms
(d)	Resolution:	0.1°
(e)	Deviation Compensation:	Automatic
(f)	Operating Temperatures:	Sensor unit: 0 °C to 50°C
(g)	Waterproofing:	Sensor unit: IPX5, Display unit: IPX6.

9.6 Differential Global Positioning System

9.6.1 The Contractor shall supply and install one set of DGPS which fulfils the following general requirements.

9.6.2 The DGPS shall integrate with radars, ECDIS, for providing real time Vessel position and clock signal in the NMEA 0183 and NMEA 2000 format. The antennas for the DGPS shall be installed on the compass deck.

9.6.3 The DGPS shall consist of the following:

(a) 7” (or larger size as agreed by GNC and user Department) ultra-bright high contrast colour LCD display;

(b) Touch screen and keyboard;

(c) DGPS to be compatible with GPS and GLONASS networks;

(d) DGPS to have receiver autonomous integrity monitoring (RAIM) functionality to alert when position accuracy is below user set limit.

(e) DGPS to be displayed at Wheelhouse Control Station and at Navigation/Communications Console and

anywhere else required by GNC;

(f) Capable or integrating with secure AIS, radar, ECDIS.

(g) The DGPS antenna/receiver shall be connected to the radar for the provision of GPS-related data, such as position fix, time, speed over ground and course over ground;

(h) The GPS system shall be fully compatible with the radar;

(i) The GPS system shall support Serial NMEA 0183, Serial 26-pin D-sub, Serial 9-wire RS232, Serial 3-wire RS232 and Ethernet (NMEA 2000); and

(j) The GPS system shall support at least the following data displayed at the GPS display unit and through outputs to the radar display:

1. Position (latitude/longitude): to at least four (4) decimal points,
2. Horizontal Position accuracy (at speed of 15kt): less than or equal to 10m,
3. Course: 1^{o} resolution,
4. Speed: 0.1 knot or 0.1 km/hour resolutions with at least three (3) digits,
5. Date and time: selectable as GMT or local mode, and
6. Satellite status information.

9.6.4 The GPS system's antenna/receiver shall fulfil the following technical requirements:

(a) Receiver Type: 8 or more channel parallel receiver

(b) Receiving Frequenc and Code: 1,575.42 MHz (C/A code)

(c) Position Accuracy: Within + or - 3 metres horizontal rms or better 95% of the time

(d) Warm Start Time: Less than 30 seconds

(e) Ambient temperature: 0 ℃ to 55 ℃ or better

(f) Waterproofing: IPX7 or better

9.7 Marine Radar (x-band)

9.7.1 General Requirements

(a) The equipment shall be a relative motion high performance radar suitable for small vessels and comprise a transceiver, an antenna and a colour display unit, suitable for bright daylight and night viewing.

(b) The radar shall be able to track high speed small crafts easily.

(c) The radar shall be equipped with a collision avoidance system that is an Automatic Radar Plotting Aid – ARPA or other equivalent function capable of tracking at least 10 targets.

(d) The transceiver shall be housed in the scanner unit and shall be designed for aloft mounted construction and capable of satisfactory operation at high wind speeds. The scanner assembly shall be housed in a weatherproof housing.

(e) The radar scanner unit shall be installed well clear of obstructions to minimise undue interference and Non-Ionizing Radiation ("NIR hazards"). Care shall also be taken to ensure the scanner mounting does not give excessive shadow sectors for navigation lights.

(f) Complete interface kit shall be provided to interface the radar for the fluxgate compass, GPS/DGPS, colour plotter and AIS. The Marine Radar have the interface kit to output the radar signal to ECDIS. The radar shall have interface to accept and display navigation data such as latitude and longitude positions of the Vessel given by the GPS/DGPS receiver.

(g) There shall be interface provided to the radar for AIS. The radar shall have interface to accept and display AIS information such as Vessel names, call signs, heading, destination, maritime mobile service identity ("MMSI"), latitude, and longitude and other navigation data given by the AIS.

(h) The Contractor shall pay special attention to any possible radar blind zone, and shall address this during the design stage and verify it after installation, and rectify it if required. The Contactor shall pay special attention to the Equipment installed before the radar scanner like flood lights and/or horn speakers. Care shall also be taken to ensure the mounting does not obstruct the navigation lights.

(i) The radar shall have standard NMEA 0183 OR NMEA 2000 interface ports, i.e. National Marine Electronics Association ("NMEA") Standard, capable of accepting navigational data from a wide selection of GPS/DGPS Receivers and Electronic Compasses, AIS and to output comprehensive data on all tracked targets in the form of a track table to a wide selection of electronic chart plotters. However, connection of the radar system to the other systems supplied under this Contract via other standard or proprietary interface types equivalent to NMEA 0183 OR NMEA 2000 is acceptable.

(j) The power for the equipment shall be supplied from the D.C. 24V system of the Vessel.

(k) The radar transceiver shall be housed in a radome antenna/scanner unit of maritime type. It shall be designed for aloft mounted construction and capable of satisfactory operation at high relative wind speeds of not less than 70 knots.

(l) Guard zones and alarm functions shall be provided in the radar. The zone shall be set and shown on the display screen. Audible alarm shall be activated if other vessels enter the zones set.

(m) The display unit shall be of table top mounting type providing clear and clutter free picture in all weather conditions and suitable for bright daylight and night viewing. It shall indicate clearly the important parameters such as radar targets, range marker, bearing line, heading marker, range rings, guard zone and background.

(n) On the viewing side of the display unit, the following controls shall be provided:

1. Power ON/OFF
2. Standby/Transmit
3. Automatic adjustment of gain, sea clutter and tune keeps targets clearly in view
4. True motion display the Vessel's movements relative to fixed targets
5. Bearing cursor rotation
6. Electronic bearing line ("EBL")
7. Variable range marker ("VRM")
8. Range scale selection
9. Display brilliance & illumination
10. Selection of background colour and target colour
11. Tuning
12. Heading marker ON/OFF
13. Change over switch to use the radar which is for the High Command Office, in case the bridge radar was out of order in restricted visibility at sea.

9.7.2 Performance Requirements

(a) The marine radar shall perform at least or better than the following requirements in this Paragraph.

(b) Display Unit

1.	Display:	Flat panel colour LCD	
2.	Screen size:	15 inches (381 mm) or larger	
3.	Resolution:	1280 x 1024 pixels or better	
4.	Display mode:	Head up, course up, north up and true bearing modes (with inputs of compass and speed data)	
5.	Range scale:	0.125 nm to 24 nm	
6.	Range units:	Selectable from nautical miles, kilometres, and kilo yards	
7.	Minimum range:	30 m or less	
8.	Range ring accuracy:	1.5% or less of the maximum range of the scale in use; or 30 m, whichever is the greater	
9.	Radar bearing accuracy:	1.5 degree or less	
10.	Display language:	English Bilingual (English and Chinese) is preferred	[D]
11.	Others:	With adjustable electronic bearing lines and variable range	

markers features

12. Operating temperature: -15℃ to +55℃ or better
13. Relative humidity: 90% or better

(c) Transceiver

1. Operating frequency : 9410±30 MHz (X–band)
2. Peak power output: At least 6 Kw(Magnetron Radar) or
   At least 100w(Solid state Radar)
3. Pulse length: Equipped with long, medium and short pulse modes for close, medium and long range operation
4. Overall noise figure: 6 dB or better

(d) Antenna

1. Operating frequency : 9410±30 MHz (X–band)
2. Aerial type: Open array radar antenna
3. Horizontal beam width: 2.0 degrees or less
4. Vertical beam width: 26.0 degrees or less
5. Polarization: Horizontal
6. Rotation speed: Not less than 24 rpm within satisfactory operation at relative wind speed up to 70 knots. Manual and automatic selection of antenna rotation speed such as 24 rpm, 36 rpm and 48 rpm shall be available according to detection range.
7. Operating temperature: -15℃ to +55℃ or better
8. Relative humidity: 90% or better

(e) Heading Marker, Bearing Measurement and Display

1. The thickness of heading marker shall not be greater than 0.5 degree with an accuracy of not greater than 1 degree.
2. Arrangements shall be provided for bearing measurement with an accuracy of better than 1.5 degree. Bearing discrimination shall be better than 2.0 degrees.

(f) ARPA (Automatic Radar Plotting Aid) Requirement

1. Target acquisition: 10 targets (manual)
2. Tracking: Automatic
3. ARPA range scales: From 0.75 to 12 nautical miles or better
4. Readout of selected target: Range, bearing, course, speed, CPA (Closest Point of Approach), TCPA (Time to Closest Point of Approach)
5. Target vector: Relative, true
6. Intercept mode: Automatically calculate intercept course and Time to Go (“TTG”) to tracked target
7. Adjustable warning limit: warming for CPA to a desired adjustable limit

(g) The crew operator shall be able to select the following modes of presentation at the radar display:

1. radar image only,
2. plotter image only, or
3. plotter image overlaid with radar image.

9.8 Electronic Chart Display and Information System (“ECDIS”)

9.8.1 The ECDIS shall show the radar, AIS, depth of water by echo sounder and ENC information in one picture.

(a) General Requirements

1. One (1) set of Electronic Chart Display and Information System ("ECDIS") with DGPS receiver, AIS and echo sounder installed on the bridge, must provide the following functions:
   (i) Navigational calculation
   (ii) Chart updating
   (iii) Piloting
   (iv) Voyage monitoring.
   (v) Create User Charts and Route Plan.
2. It shall consist of DGPS, display control units, a remote GPS antenna and differential beacon receiver, colour chart plotter with electronic chart cartridges for Hong Kong Waters, and echo sounder.
3. The information received by the DGPS receiver shall be input to the marine radar and display on the marine radar and the screen of colour plotter. The output of the receiver shall give the Vessel position in a format compatible to marine radar in the "American Standard for Interfacing Marine Electronic Navigational Devices" NMEA 0183 or NMEA 2000 format. However, connection of the radar system to the other systems supplied under this Contract via other standard or proprietary interface types equivalent to NMEA 0183 OR NMEA 2000 is acceptable.
4. The GPSD/GPS/plotter system shall be provided with "speed logs and electronic compass interface" or "gyro and its interface" to support the "dead reckoning" mode operation, if GPS satellite signal is absent for a period greater than 10 minutes
5. The system shall be equipped with navigational sea charts in details covering the entire Hong Kong Waters. The system must read, show and update the Electronic Chart in the IHO/S-57 format from Hydrographic Office of Hong Kong Marine Department.
6. For ENC charts update purpose, the ECDIS have at least one external USB port which is installed at Bridge.
7. The ECDIS' control unit shall have keyboard, trackball, scrollwheel and left/right click button. The control unit is installed at Bridge.
8. The information received by the AIS and Marine Radar shall be able to display on the screen monitors of ECDIS.
9. Complete interface kit shall be provided to interface with the colour chart plotter for the radar, AIS, echo sounder and GPS/DGPS. The colour chart plotter shall accept and display information given by the radar, echo sounder and GPS/DGPS receiver.

9.8.2 Performance requirements

(a) Display Unit

Size	: At least 23 inches
Touch screen	: Yes
Panel	: TFT LCDs with a special anti-reflective glass filter
Resolution	: UXGA and at least 1600 x 1200
Viewing Area	: left/right and up/down: 80 degree or more
Interface	: At least 1 Analog RGB port, At least 2 DVI ports
Waterproof	: At least IP22

(b) Navigational Features

1.	Total waypoints:	2000 or more
2.	Routes:	50 route plans or more
3.	Alarms:	Including but not limited to, proximity alert, cross-track error, and arrival /anchor watch

(c) Electrical and Physical

1.	Power source:	12 - 24V D.C. (external)
2.	Display (screen type):	At least 23 inches or greater diagonal high resolution colour display, resolution 1280 x 1024 pixels or better for 4:3 aspect ratio

(d) Environment

1. Operating temperature : -10 oC to +50 oC
2. Storage temperature : -20 oC to +60 oC

(e) GPS Receiver

1. GPS receiver type: Equipped with 8 channel parallel receiver or better
2. Frequency range (GPS): 1575.42±1MHz (C/A code), L1
3. Sensitivity (GPS) : -130 dBm or better
4. Dynamic range (GPS): 25 dB or better
5. Warm start fix time: Less than 30 seconds
6. Cold start fix time: Less than 3 minutes
7. Position accuracy: no greater than 15 m
8. Tracking velocity: 999 knots

(f) Differential Beacon Receiver

1. Frequency range: 283.5-325 kHz
2. Frequency step: 500 Hz
3. Position accuracy: No greater than 5 m

(g) Data Display

1. Lat/Lon: N or S plus 7 digits E or W plus 8 digits
2. Speed and course: 0.1 Kt/h or 0.1 Km/h resolution digit 1-degree resolution
3. Cross track error: Graphic or direction indication
4. Bearing: 3 digits, 1-degree resolution
5. Range: 4 digits, 0.01-nm resolution
6. CDI: Active perspective view, selectable scale (0.1, 0.3 or 0.5 nm)
7. Time: Selectable as GMT or local mode
8. Mapping : Resident world map in memory (reversible video)
9. Language for system : English operation and display
10. Bilingual (English and Chinese) is preferred [D]

(h) Echo Sounder & Depth Indicator

1. The equipment shall consist of a transducer and a digital depth indictor which is recessed mounted at the steering console and capable of providing readout of sea depth in feet, fathoms and meters.
2. The measuring depth shall be from 3 feet to 999 feet or equivalent fathom or metre with at least three selectable ranges to indicate shallow, mid and deep ranges. The unit of measurement shall be selected at the front panel of the equipment.
3. Shallow water audible alarms shall be provided. Setting of the alarm depth shall be at the front panel of the equipment.
4. The electronic accuracy of depth reading shall be better than + 5% of full scale range.
5. The peak to peak transmitting pulse power of the transducer shall not be less than 200 watts and the nominal operating frequency shall be 200 kHz.

9.9 International Maritime Mobile ("IMM") VHF Radio with GMDSS

9.9.1 General Requirements

(a) Two (2) sets of the IMM VHF radio shall be a type approved make by the Office of the Communications Authority of Hong Kong.

(b) One (1) set on the wheelhouse console for navigation. One (1) set shall be installed in the Ship Office.

(c) The radio shall be fully compatible with Global Maritime Distress Safety System ("GMDSS") and equipped with a lithium battery with a lifetime of at least five years.

(d) The radio shall be fully compatible with GMDSS, which is a class A Digital Selective Calling ("DSC") transceiver fully compatible with the International Maritime Organization ("IMO") GMDSS carriage requirements.

(e) The radio shall be equipped with all the international maritime VHF channels complete with fist microphone with press-to-talk switch or telephone handset, mic/handset hanger, mounting bracket and loud speaker.

(f) The radio shall have an independent dual watch mode selection switch that incorporate with Channel 16 and shall be able to dual watch on any other selective channel.

(g) The radio shall be completed with electrical components including but not limited to antenna and integrated microphone, loudspeaker, control knobs/keys, display screen and re-chargeable battery, necessary for a stand-alone portable radio. The radio shall be equipped with a 220 VAC battery charger (for battery charging on shore) and one extra set of spare re-chargeable battery. The Contractor shall provide proper stowing space and facilities for keeping of the portable radio and the spare battery such that the crew can take the portable radio out for use when necessary.

(h) The operating temperature shall be -5℃ to +55℃ or better. The water ingress protection shall be IPX7 or better.

(i) The radio shall be supplied with a belt clip and a shoulder carrying case.

(j) The Contractor shall also supply a D.C. battery charger (one for each Vessel extra to the 220 VAC battery charger) which can be readily and directly connected to a D.C. power outlet at each Vessel such that the portable radio can be charged on the Vessel if necessary. Normally the D.C. battery charger shall be not in use and shall be stowed on the Vessel with stowing space and facilities provided by the Contractor.

(k) The following facilities shall be provided at the front panel of the radio:

1. Power ON/OFF
2. Transmit indicator, volume and squelch controls
3. Socket for plug for microphone and external speaker
4. Quick selection of Channel 16
5. Channel selection and indicator
6. Independent dual watch mode selection switch
7. Transmission power selector for HIGH and LOW Power (25 W/ 1 W)

9.9.2 Performance Requirements

(a) Transmitter Characteristics

1. Spurious and harmonics: -70 dB or better emissions
2. RF output power: 25 W / 1 W (High / Low)

(b) Receiver Characteristics

1. Sensitivity: Less than 1 uV for 20 dB SINAD or equivalent
2. Adjacent channel selectivity: 60 dB or better
3. Spurious image rejection: 65 dB or better
4. Intermodulation: 65 dB or better
5. Audio output: Not less than 1 Watt at rated audio power output with less than 10% distortion

(c) Aerial and Feeder

1. The aerial provided shall be a marine type aerial with at least 3 dBi gain, vertically polarised, omni-directional and suitable for mounting on the launch.
2. The V.S.W.R. of the aerial installed shall be less than 1.5 : 1.
3. The aerial feeder shall be RG58U type or equivalent.

4. Coaxial cable lightning suppresser with appropriate earthing connection shall be provided for protecting the radio equipment. All outdoor connector joints shall be properly covered by waterproof tape or material.

9.10 Marine Band Hand-held Waterproof Radio Transceiver

9.10.1 General Requirements

(a) The Contractor shall provide four (4) GMDSS IMM VHF waterproof handheld transceivers.

(b) Each portable IMM VHF transceiver shall be of proprietary make and completed with two sets of rechargeable batteries, batteries charger, helical antenna with V.S.W.R. not exceeding 1.5:1 and carrying case (with shoulder strap or belt clip).

(c) The operation period of each fully charged battery shall not be less than eight hours per charge (10% transmit, 10% receive, 80% stand-by). The charger shall be designed for 220V AC input power supply and equipped with a BS 1363 type 13A power plug.

(d) The portable transceiver shall, as a minimum, be capable of transmitting and receiving on all 55 International Maritime VHF channels, together with the private maritime VHF single frequency channels 96 (157.925MHz) and/or 99 (157.975MHz).

(e) The transceiver shall be of robust, waterproof, light weight design and made with shock proof material suitable for hand held radio communications both on the Vessel and ashore.

(f) The transceiver shall be fully solid state and of software programmable carrier frequency type. Add-on crystal for carrier frequency will not be acceptable.

(g) The unit shall be a type approved model accepted by OFCA for maritime frequency band application.

9.10.2 Performance Requirements

(a) The transceiver shall, as a minimum, incorporate the following controls/switches/functions:

1. Power on/off button;
2. Volume control;
3. High/low transmitting power switch;
4. Press to talk switch;
5. Built-in microphone and loudspeaker;
6. Channel selector operating channel display; and
7. Sockets for external microphone, press to talk and loudspeaker

(b) The transceiver shall comply with the following:

1. Operating frequency range: International Maritime VHF Band
2. No. of Operating Channels: 99 (programmable)
3. Channel spacing: 25kHz
4. Frequency stability: ± 8ppm between 0 and 50 ℃
5. Housing IP Category: IP 57

9.11 Secure Automatic Identification System (“S-AIS”) Transponder

9.11.1 General Requirements:

A Secured Automatic Identification System compatible with the VTS system of Marine Department of Hong Kong SAR;

Since the S-AIS onboard shall be cooperated with the system (“SAAB”) already installed in VTC, therefore, the SAIS shall be SAAB R 5 or latest type by SAAB.

(a) The equipment shall receive information from AIS-equipped vessels.

(b) The equipment shall be a Class A universal AIS complying with IMO MSC. 74(69) Annex 3, IEC 61993-2, ITU-R M.1371-3, ITU-R M.493-13, ITU-R M.825(DSC), IEC60945, IEC61162-1/2.

(c) The AIS transponder (receiver module) shall be capable of receiving AIS information from AIS

equipped vessels that includes: dynamic data (vessel position, coordinated universal time (UTC), course over ground (COG), speed over ground (SOG), rate of turn (ROT), heading), static data (maritime mobile service identity (MMSI), vessel name, type of ship, call sign, length and beam, heading, destination, latitude and longitude, location of position-fixing antenna on the ship), short safety-related messages and other navigational data.

(d) The AIS supplied shall be compatible with all systems using NMEA 2000 standard and be capable of interfacing with the navigation radar, surveillance radar, multi-function displays, ECDIS, compass, and DGPS and the INS.

(e) The AIS shall be capable of operating in at least four (4) modes, including but not limited to:

1. Normal mode – function as a normal SOLAS Class A AIS broadcasting and receiving without encryption;
2. Secure mode – only encrypted AIS data will be broadcasted, both encrypted and non-encrypted AIS messages will be received;
3. Passive mode - no AIS will be broadcasted, both encrypted and nonencrypted AIS messages will be received; and

(f) It shall be possible to edit AIS message information relating to navigation and ship information.

(g) The AIS shall be easy to identify other ship's status by providing electronic chart data.

(h) The AIS shall have a self-restoring function to enhance stability.

(i) The AIS shall have a user-friendly one touch keypad (or equivalent).

(j) Each set of AIS shall include:

1. A display with minimum dimensions of 250mm x 130mm;
2. An AIS transponder unit;
3. A VHF antenna;
4. A GPS antenna; and
5. Installation/operation handbook.

9.11.2 The AIS shall be capable of the following performance requirements:

(a) General Requirements

1. Power Supply: 24V DC
2. Default Frequencies

   AIS1 (CH 87B) : 161.975MHz

   AIS2 (CH 88B): 162.025MHz

   DSC (CH70) : 156.525MHz
3. Frequency Range: 155-163MHz
4. Transponder Size/Weight (+2%): 237mm W x 79mm H x 170mm D, 1.7kg
5. The initial setting of the S-AIS, shall be protected with password that it will not be easily deleted by the normal operator.

(b) AIS Transmitter

1. Power Output: 12.5W or 1.0W (δ1.5dB)

9.11.3 The antennas for the S-AIS shall be installed on the compass deck.

9.12 Radar Transponder

9.12.1 The Contractor shall provide 2 sets SART Radar transponder. A radar transponder gives the location for any nearby vessel and aircraft with X-band radar. Easy mounting in bulkhead bracket onboard the vessel, easy to release and activate in an emergency situation.

(a) General

1. Frequency range : 9,200 MHz to 9,500 MHz

2. Polarization : Horizontal
3. Form of sweep : Saw tooth
4. Fast return : 0.4μS ± 0.1 μs
5. Sweep rate : 7.5μS ± 1μs
6. Pulse emission / number of sweep : 100 μs nominal / 12 sweeps
7. Antenna beam width : Vertical beam At least ±12.5° Azimuthal beam Omni directional within 2dB
8. Effective isotropic radiated power (EIRP) : More than 400 mW
9. Effective receiver sensitivity : Better than -50 dBm
10. Recovery time following excitation : Within 10μs
11. Delay time (radar signal / SART transmission) : 0.5 μs or less

(b) Environmental Condition

1.	Battery:	Lithium battery (primary) Nominal voltage 7.2 V, Capacity 3.6 AH Operation life time 96 hours in stand-by mode, and then at least 8 hours in response mode Useful life time 5 years after plant delivery
2.	Temperature range:	-30 ºC to +65 ºC storage -20 ºC to +55 ºC operation

9.13 Satellite EPIRB

9.13.1 The Contractor shall provide one (1) set of maritime type Satellite EPIRB (406 MHz) stowed on upper deck.

9.13.2 The equipment shall be comply with IMO A.810(19), IMO A.763(18) and IMO A.662(16).

9.14 Electric Horn Conforming to IMO Requirement

9.14.1 One (1) set of maritime type electric horn shall be fitted on the radar mast.

9.14.2 One (1) set of horn controller shall be fitted on navigation watching console capable of operating horns.

9.14.3 One (1) set of horn push button shall be fitted on appropriate location.

9.14.4 The electric horn shall be marine grade and weatherproofed to IP56.

9.14.5 The equipment shall be fed from the AC 220V and DC 24V emergency supply system and sound pressure level at least 100 dB at 10 m.

9.15 CCTV System

9.15.1 The Contractor shall supply and install a CCTV System to provide a 360 degrees view of the exterior of the vessel to assist with navigation and in particular berthing of the vessel as well as the rear and front deck for view of operations being carried out at those locations. Interior views include the Unmanned Machine Spaces.

9.15.2 The CCTV system shall be provided with the following major equipment

(a) IP based, high definition cameras;

(b) Recording / processing devices including network video recorder (“NVR”), workstation computer; and

(c) Uninterruptible Power Supply (“UPS”).

9.15.3 The locations of the CCTV cameras shall be determined with the GNC either in the kick-off meeting after the Contract is awarded or during the design phase of the Vessel.

9.15.4 Unless otherwise specified, all CCTV cameras shall comply with the following technical requirements:

(a) All cameras shall be IP based, high definition camera (1920 x 1080p), water-proof, vandal-resistant type, Infrared Cut Filter ("ICR") day and night dome pan-tilt-zoom cameras. They shall be marine type and shall be suitable for operation in a rough sea environment. Ingress protection: Outside door must IP56 or better, inside of up-deck may be IP20 or higher IP value, and under-deck may be IP44 or better.

(b) All cameras shall have an image stabilization function to accommodate the rough sea conditions.

(c) All cameras shall be capable of covering diagonal view by wide angle lens or standard lens according to the actual condition.

(d) CCTV images shall show relevant multi-function display on the Wheelhouse Control Station. Exterior CCTV views of the port / starboard / aft shall be permanently displayed on the overhead monitors. Interior CCTV images of the UMS shall be displayed at the Engineering Officer's Console.

(e) UPS shall be designed, supplied and installed to sustain the operation of the CCTV system for a minimum of thirty (30) minutes.

(f) The CCTV system shall be equipped with a control panel or virtual control panel, installed in the Wheelhouse to allow the operator to control pan-tilt-zoom of the selected camera. These requirements will be discussed further during the design phase.

(g) All cameras shall be powered by Power over Ethernet ("PoE") as part of the CCTV system.

9.15.5 CCTV for view of the exterior and internal of the vessel:

(a) The CCTV system shall consist of sixteen (16) channels covering including but not limited to the following areas:

1. one (1) camera on the port side, view the boarding ladder location;
2. one (1) camera on the starboard side, view the boarding ladder location;
3. one (1) camera facing aft for navigation purposes;
4. one (1) camera looking at the helicopter winching area;
5. one (1) camera facing forward to view operations on the bow;
6. one (1) camera facing forward for navigation purposes, just for record not need on monitor;
7. At least two (2) cameras in the engine room;
8. At least one (1) camera in the steering gear room; and
9. At least one (1) camera in the wheelhouse.

9.15.6 Camera shall be a fixed camera with a wide field of view of at least 100°and with Infra-Red (IR) Light Emitted Diodes (LEDs) enabling operation in poorly illuminated areas or conditions. The camera shall be installed in the location that that covers the area in front of the Vessel.

9.15.7 The control and monitoring of the CCTV system shall be from the Wheelhouse.

9.16 Windshield wiper

9.16.1 Contractor shall provide windshield wiper with spare wipers sufficient for the wheelhouse front windows.

9.16.2 Marine type wide span and large area wipers shall be provided.

9.16.3 It shall be heavy-duty wipers (preferable of straight-line type).

9.16.4 They shall have an interval operating function with electrical fresh water window / wiper washing systems.

9.16.5 These wipers shall be capable of operating independently of each other and not controlled by touch screen.

9.16.6 All the sprinkler pipe in the wiper system shall be made of copper pipe.

9.16.7 Power unit shall be input AC220V 50Hz from main switchboard and DC 24V from battery

9.17 Waterproof LED Display System

9.17.1 Two (2) waterproof externally mounted LED panels (minimum size 3000 mm by 450 mm, IP56) shall be provided and situated both port and starboard on the passenger cabin roof. The LED panel shall be provided with a control on the bridge deck allowing for predefined or custom message to be displayed.

9.17.2 Two LED Panels, Display control (optional) and the desktop computer (mentioned in the Paragraph 9.20 below) are interconnected to form IP network (Local Area Network) by network hub and network cable.

9.17.3 Performance Requirements:

(a) The minimum technical requirements are as follows:

1. LED modules with display three colors White, Red and Green
2. Pitch: 10 mm or better
3. Panel size at least 3000 mm x 450 mm (WxH)
4. Resolution: 300 dots x 45 dots (horizontal x vertical) or better
5. Brightness: 5000 cd/m2 or better
6. Viewing angle: 110° horizontial, 45° vertical or better
7. 220V AC single phase, 50 Hz+- 1 Hz with timer ON/OFF control
8. Enclosure: IP51 standard, made of aluminium
9. Operating temperature: from 10° C to 50° C or better
10. Environmental humidity: 10% - 90% RH (non-condensing)

(b) The Display Content Software must support two operation modes:

1. Synchronous mode: Two LED modules show the same content.
2. Asynchronous mode: Two LED modules show the different contents.

(c) Key locks shall be provided with the enclosure.

(d) The window of the enclosure shall be made of anti-vandal shatter proof.

(e) The enclosure shall be so designed to prevent overheating.

(f) Display Content Software Requirement

1. The Display Content Software shall be installed and configured in the Desktop Computer at the ship office (mentioned in Paragraph 9.20 below).
2. The System shall allow the operator to assemble several image files into a sequence and play the recorded sequence on the display as configured.
3. The System shall run on the latest version of Traditional Chinese Windows, with well-designed user-friendly software interfaces as per the comments from the Engineer and other relevant parties, such as the users.
4. Installation disc and licenses for the Display Content Software shall be provided.
5. Allow the user to input/edit any free- form text message in Chinese and English and draw graphics picture. All master software and all licenses shall be included in the supply.
6. After initiation of the send command in the display controller/LED panel, the display information shall be loaded into the signage unit and to the display within three (3) seconds.
7. The software shall have the following facilities: Character font/size selection, pause, right shift, left shift, scroll up, scroll down, flash, jump, wipe, inverse color, rolling messages and graphic display.
8. Simplified and Traditional Chinese (hereafter Chinese), English or Alphanumeric messages shall be input through the Desktop Computer in the ship officer desk and then be displayed in the display. A mix of Chinese, English and Alphanumeric could also be input and displayed in the same picture.
9. The operator shall be able to set via the display controller the period and duration for displaying graphic, Chinese message, English message or alphanumeric message.
10. The system shall support, but not be limited to, the following message display features.
11. Message Scheduling–release message at predefined time

12. Message Chaining – to link message together
13. There shall be a time schedule display function so that the operator shall be able to pre-set files of graphics, messages and sources for display at the specified time.
14. The system shall have facilities to create, edit, save, rename, copy, delete, preview,import, open and close files of graphics, messages, animation and video.
15. The duration of display time of each file shall be adjustable (for animation display, the input duration shall be integral multiples of the time length of the animation so that the animation shall be able to be displayed several times consecutively. The software shall automatically check the input duration. If the input duration is wrong or in conflict, warning signal in audible and visual format shall be generated). The display style described above shall also be selectable.
16. There shall be a preview function so that the display information can be previewed before actually sent out for display. The display content software shall have an integral text and graphics editor.

9.18 Voyage Data Recorder ("VDR")

9.18.1 A VDR meeting the specifications listed in IMO IEC 61996-1 and MSC. 333 (90) shall be fitted to the Vessel for the purposes of post incident review.

9.18.2 The Contractor shall install the play back software for playing back the recorded files in the desktop computer in the ship office (mention in the clause 9.18). The software program that can download the saved data and playback information. The software shall be compatible with the commercial off the shelf notebook computer provided by the operating system. When using non-standard or proprietary format to save data in VDR, the software shall convert the saved data into open industry standard format.

9.18.3 The VDR shall satisfy the following performance requirements:

(a) Data collection unit ("DCU")

1.	Recording period:	720 hours or better
2.	Recorded media:	Removable CF Solid State Drive
3.	Built in UPS:	Two (2) hours or above
4.	Number of audio interface input :	Ten (10) or above
5.	Number of serial data input:	Twelve (12) or above
6.	Number of Ethernet data input:	Seven (7) or above
7.	Interface:	Support NMEA 0183 or NMEA 2000 (Ethernet base)
8.	Remote Alarm Display Panel:	4.3 inches colour LCD or better

9.18.4 Following are the minimum items that the VDR shall need to record:

(a) Bridge microphones;
(b) VHF;
(c) ECDIS for navigation;
(d) Radar for navigation;
(e) DGPS including information of position, speed over ground;
(f) Satellite compass;
(g) Fiber-Optic Gyrocompass;
(h) Echo sounder;
(i) Secure AIS;
(j) Wind Speed and Direction System;
(k) Speed and Distance Through Water from the speed log installed;
(l) Main engine and generator detection and alarm;
(m) Bilge alarm system;
(n) Fire detecting and alarm system;

(o) Navigational light control panel alarm;

(p) Steering gear system;

(q) Watertight door status indication (if any); and

(r) CO2 pre-release alarm system.

9.18.5 Extraction of data from the VDR shall be download to the USB Flash Drive.

9.19 Speed log

9.19.1 A device shall be fitted to measure speed and distance through the water and be integrated with the INS for display at the Wheelhouse Control Station.

9.19.2 The speed and distance measuring device shall be type approved by the RO.

9.19.3 A transducer is to be fitted to the hull, such that the system will operate without disturbance when the Vessel is operating at full speed in all sea conditions.

9.19.4 The transducer is to be located away from any sea water inlets or hull appendages so as not to disturb the flow of water across the transducer.

9.20 Direction Finder System

9.20.1 The Contractor shall supply a Direction Finder System for VHF that can be co-operation with VTC, DC24V power from general batteries.

Technical data

Method of bearing:	Doppler principle (3 kHz rotational frequency, right/left rotation)
Bearing indication:	Relative bearing and true bearing(if external heading data available)
Bearing accuracy[1]:	±5°
Internal resolution:	1 °
Sensitivity:	RF voltage at receiver input (50 Ω): VHF, UHF: < 100 nV, Cospas-Sarsat: < 150 nV
Frequency stability:	±2.0 ppm (Δf/f = ±2 x 1 0 -6) (in temperature range -30 °C to +80 °C)
Reception bands:	4 (VHF air band, VHF marine band, UHF air band, Cospas-Sarsat)
Reception frequency:	VHF air band: 1 1 8.000 to 1 21 .500 to 1 22.975 MHz
Frequency ranges:	VHF marine band: 1 56.000 to 1 56.800 to 1 62.025 MHz
	(channels 0 to 28 / 60 to 88 / sea + coast)
	UHF air band: 240.000 to 243.000 to 245.975 MHz
	Cospas-Sarsat: 406.022 to 406.076 MHz (channels A to S)
Channel pattern:	25 kHz (depends on frequency band)
Scanning /Monitoring mode:	Monitoring: Four additional frequencies (emergency frequencies 1 21 .500 MHz, 243.000
	MHz and two free selectable frequencies) are monitored during normal operation.
	Standby: The Cospas/Sarsat and one free selectable frequency is monitored at all times
	in standby mode.
Signal filtering:	Optional, all emergency frequencies can be filtered for ELT modulation (false alarms disabled).
Cospas-Sarsat analysis:	Reception and analysis of Cospas-Sarsat data signal (112 or 144 bit, 400 baud, biphase
	L-phase modulated, with Bose-Chaudhuri-Hocquenghem error test, specified according

	Cospas-Sarsat C/S T.001 October 1 999)
	Indication of data content (mode, country, GPS coordinates)
Bearable modulation:	A3E, F3E, A3X (PLB modulation), bearing largely independent of modulation.
Polarization:	Vertical
Polarization error:	< 5° at 60° field vector rotation
Garbling cone:	approx. 30° to the vertical
Response time [2] :	< 50 ms (with sufficient reception field strength)
Keyboard:	Foil on the front with integrated keyboard matrix and EL background illumination
TFT display:	320 x 240 pixels with max. brightness of approx. 450 cd/m^2 , continuously variable
	brightness
Operating voltage:	12 V to 30 V DC
Current consumption:	Max. 2.5 A
Audio out:	External speaker 4 W (4 Ω, 8 Ω)
	Line out (adjustable from 1 00 mV pp to 2000 mV pp)
Interfaces:	NMEA I/O (RS-422 and RS-232)
	Ethernet LAN
	Test port (RS-232) optional customer-specific
	Alarm relay output (1.0 A, 30 V DC / 0.3 A, 125 VAC)
	PTT input for self-bearing suppression
	Squelch output for external audio control

9.20.2 With undisturbed wave field and sufficient field strength. Measured by changing the angle of incidence with the antenna rotating on a revolving table in order to eliminate environmental influences on the results.

9.20.3 Very weak signals will increase response time considerably.

9.20.4 The antennas for the direction finder shall be installed on the compass deck.

9.21 Wired and Wireless Intercom (Talkback) System

9.21.1 The Talkback System shall be robust, ergonomic and suitable for using in sea environment.

9.21.2 The Talkback System shall comprise of the following components:

(a) The Talkback System shall be operating on 24V DC power or nominal AC Power, 220V±10%, 50Hz. The supplier shall be responsible for connecting the Talkback System to the 24V DC and 220V AC supply on the Vessel.

(b) The operator panel in the Wheelhouse shall be capable of initiating an intercommunication call to any talkback station. Each of the talkback stations shall be capable of initiating an intercommunication call to the operator panel in the Wheelhouse.

(c) One (1) gooseneck microphone shall be installed at the operator panel.

9.21.3 The Talkback System shall be capable of making a single call, group call and all call to twenty (20) or more talkback stations. The locations of operator panel and talkback stations shall be determined in the kick-off meeting or during the design phase after Contract is awarded.

9.21.4 The operator panel of Talkback System shall comprise of the following functions:

(a) Dimmable panel backlight;

(b) Buzzer indicator of incoming calls;

(c) Step volume control;

(d) Push-to-talk button; and

(e) Call signal button.

9.21.5 The talkback stations to be installed on the exterior or covered exterior of the vessel shall be of at least IP 66 rated and include a speaker of at least 10W or more.

9.21.6 The talkback stations to be installed internally shall include an indoor speaker that is suitable for using in a marine environment.

9.21.7 Talkback stations to be installed in the following locations shall be at least IP 66 standard waterproof talkback stations including speakers of 10W or more, which associated with Combined Audible devices (Call Alert with Flashing Light & Ringer) and Portable Headsets for the use in noise areas (with 10 metres long cable, plug and headset holder).

(a) Steering gear room x1

(b) Engine room x1

(c) Tank space x1

9.22 Wind Speed and Direction Indicating System

9.22.1 The Contractor shall provide a Wind Speed and Direction Indicating System.

System Parameters

The sensor converts wind speed and direction into serial digital data. Data is displayed by the P1249 Indicator in digital format and also in analogue for wind direction. The instrument interfaces in NMEA 0183/RS422 to other ship systems. Sentence – MWV

Input voltage: 24v DC 40mA

Wind Speed Measurement:

Range: 0–120 knots

Accuracy: +/- 2% (@ 24kts)

Resolution: 0.01 knots

Wind Direction measurement:

Range: 0°–359°

Accuracy: +/- 3° (@ 40 kts)

Resolution: 0.1°

Environmental

Operating Temperature:

Sensor: -35 °C to +70 °C

Indicator: 0 °C to +55 °C

Storage Temperature:

Sensor: -40 °C to +90 °C

Humidity: <5% to 100%

9.22.2 The wind speed and direction apparatus shall be installed on the compass deck.

9.23 Echo Sounder System

9.23.1 The Contractor shall supply and install an Echo Sounder System with the sonar unit securely installed on the body of the vessel. The Echo Sounder shall be as follows:

(a) The equipment shall consist of a transducer and a digital depth indictor front panel which is flushed mounted at the steering console and capable of displaying depth information in feet, fathoms and meters.

(b) The measured depth shall be between 0m and 5000m with at least three selectable ranges to indicate shallow, mid and deep ranges. The unit of measurement shall be selected at the front panel of the equipment.

(c) Shallow water audible and visual alarms shall be provided when entering an area with a depth shallower than the pre-set depth. Setting of the alarm depth shall be capable on the front panel of the equipment.

(d) The measuring accuracy of depth reading shall be better than + 5% of full scale range.

(e) The peak to peak transmitting pulse power of the transducer shall not be less than 200 Watts and the nominal operating frequency shall be 200kHz.

(f) There shall be an isolating switch to switch off the recorder in case of shortage of recording paper but the equipment for sensing and indicating the depth shall still be operating and functioning as in normal working condition.

(g) The transducer shall not interfere or be interfered with by other equipment on the vessel.

(h) The echo sounder supplied shall be completely compatible with all systems using the NMEA 0183 or 2000 standard and be capable of interfacing through the INS with the navigational radar, surveillance radar, multi-function displays, ECDIS, compass, DGPS and other equipment as necessary. The echo sounder supplied shall be connected to the navigation radar display.

9.23.2 Echo sounder display shall be:

(a) 10.4" (or larger size as agreed by GNC and user Department) colour LCD with adjustable backlight and full dimming capability with day/night pre-sets;

(b) Either 24 V DC or 220-240V AC Power Supply;

(c) Provide data Output in NMEA 0183 and / or NMEA 2000 format;

(d) Provide output for external VGA;

(e) Provide output for printer; and

(f) Type approved in accordance with IMO Requirements.

9.24 Desktop Computer (2 sets)

9.24.1 A Windows-Intel-based desktop computer (in which the Electron Chart Software is installed) shall be installed on the starboard side table inside the Ship Office. Two sets of the desktop computers are required. One is installed in the table of the Ship Office and the other one is used for spare purpose.

9.24.2 It shall provide the interface kit to connect for the radar, echo sounder, GPS/DGPS, Secure AIS and Fiber-Optic Gyrocompass.

9.24.3 The DVR software of the CCTV system (mention in the Paragraph 9.15) and the Display Content software of the Waterproof LED Display System (mention in the Paragraph 9.17) shall be installed and configured at the desktop computer. Also all the software (in the software item of the Paragraph 9.24.6) shall be installed and configured.

9.24.4 This Electronic Chart Software which must read, show and update the IHO/S-57 format electronic chart from Marine Department Hydrographic Office of the ECDIS.

9.24.5 This desktop computer shall meet the following requirement:

Operating system	Window 11 Professional/Enterprise (Traditional Chinese) 64bits version
CPU	At least Intel Core i7 Processor 3.1 GHz or higher
RAM	At least 16 GB
Display	Up to 1920 x 1080 HDMI, DVI interface, VGA in which the dual displays function which provide display signal to the 23 inches multi-touch monitor of ECDIS (mention in the clause 9.6) at the Bridge Deck
HDD	At least SSD 480GB or above

Interface	At least three serial ports, (receive NMEA Data from the navigational equipment e.g AIS, DGPS, echo sounder and gyrocompass At least six USB ports, At least two gigabyte network interfaces cards
Accessories	DVD-RW/CD-RW Dual Recorder Multi-card reader (SD/MMC+/mini SD, Micro SD)
Printer	At least 35 pages per minutes and support auto double-sides printing, copying and scanning. The dimension (width,,depth and height) of the printer is equal or less than 494 mm x 430 mm x 448mm Interface: LAN port (RJ45) and USB Port
Software	Orca Master (ECS Software) with the most up-to-dated Electronic chart of Hong KONG Waters from Marine Department, Microsoft Office Standard 2019 Adobe Reader Java Runtime Environment,Adobe Flash Player for Internet explorer, Chrome and Firefox, Internet Browser (Chrome, Firefox) DVR of the CCTV System Display Content Software of the LED Display System

9.24.6 The Contractor shall provide the display unit which is a 32 inches multi vision display with mounting bracket. It is installed in ship office table.

9.24.7 Key features of this display unit:

(a) 4K UHD - DisplayPort (DP), HDMI inputs

(b) LED Backlight Technology

(c) Full Dimming 100%

(d) Glass Display Control

(e) Multi-Touch Option

(f) Superior Optical Bonding Option

(g) Resolution at 3840 x 2160 (4K)

(h) ECDIS & Radar Compliant (the Radar & ECDIS mentioned in Paragraphs 9.5 & 9.6)

(i) Integrated with desktop computer (mention in Paragraph 9.18.5)

(j) EN60945 Tested and Type Approved

9.25 IP Network

9.25.1 The desktop computer, the printer (mention in the Paragraph 9.24.5), the CCTV System (mention in the Paragraph 9.15), the voyage data recorder (mention in the Paragraph 9.18) and Waterproof LED Display System (mention in the Paragraph 9.17) are interconnected to form IP network (Local Area Network - LAN) by network hub and network cable.

9.25.2 The Contractor shall install the trunk and the socket with RJ45 port.

9.26 Installation/Space/Cabling/antenna

9.26.1 Contractor reserve cable channel from the ship office of main deck to compass deck for installation works of 4G LTE network antenna and the its network equipment.

9.26.2 Contractor shall provide and install two coaxial high frequency cables in the cable channel. Also the Contractor shall provide two coaxial jumper cables and one 12 voltage DC power cable for connecting the 4G LTE network. The following specification of coaxial high frequency cables and the coaxial jumper cable:

Coaxial High-freq. Cable	Quantity: 2

Cable type:	3/8" High flexible corrugated coaxial cable
Nominal impedance:	50-Ohm
Cable diameter:	Around 11 mm
Connector :	N-type (Male) at both ends

Coaxial Jumper Cable	Quantity: 2
Cable type	SMA to N-type jumper cable
Length	At least 1 meter
Length	End A: SMA(Male) End B: N-type (Female)

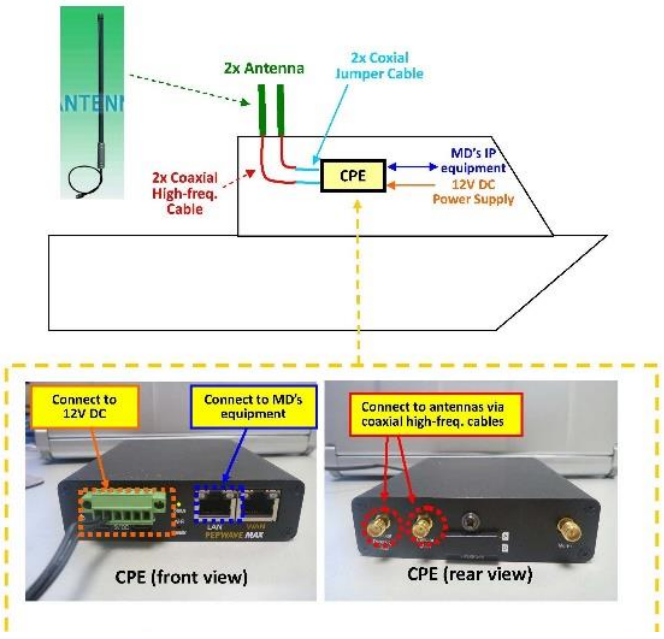
12V DC Power cable	Quantity: 1
Cable type:	2.5mm 2-core DC power cable

9.26.3 Contractor shall install two antennae at the compass deck and connect it to the coaxial high frequency cables in the Paragraph 9.26.2. The horizontal separation between antennae is at least 1 meter. Two antennae and the 4G LTE network equipment are provided by HKSAR Marine Department.

9.26.4 4G LTE network antenna equipment according to the requirements of design drawings shall be equipped. Technical specifications of 4G LTE network antenna:

Antenna	Quantity: 2
Brand/Model:	JSCC Antenna J1718O06
Antenna length:	800mm
Performance:	1710-1880MHz 6dBi Vertical Polarization Omni
Connector:	N-type (Female)
Horizontal separation between antennas:	Min. 1m

9.26.5 The following is the overview of the 4G LTE Network system



9.27 Acceptance Test

9.27.1 The acceptance tests shall comprise the following:

(a) A bench acceptance test which includes functional tests and detailed measurements of the performance of the Equipment to verify that each item of Equipment complies with all the Offered specifications.

(b) On-site commissioning test shall be carried out by the Contractor in the presence of the EMSD representatives after completion of the installation of each set of Equipment. The overall installation standard and operational features of each set of Equipment shall be evaluated. The test shall be carried out during the Official Sea Trial.

9.27.2 The Contractor shall deliver each set of Equipment to the EMSD representatives for bench acceptance test prior to the installation on the Vessel. Where the test is failed (i.e. the Equipment does not comply with any requirements as set out in this Chapter or in other applicable part of the Contract), the Contractor shall provide a brand new replacement to the EMSD for reconduct of the bench acceptance tests.

9.27.3 The Contractor shall submit a schedule of commissioning tests of the ENE installed on board of the Vessel at least one month prior to the on-site commissioning test date.

9.27.4 The Contractor shall provide all the necessary test equipment and tools for carrying out all tests as mentioned in this Chapter 9 at no extra cost to Government.

9.27.5 At least one month before the end of the Warranty Period, the Contractor shall arrange and perform confirmation test in the presence of the representatives from EMSD. Should any defects be found during the confirmation test, the Contractor shall fix the defects as soon as possible and in any event no later than the time prescribed by the EMSD representatives. The Warranty Period shall be extended correspondingly for so long as the defects are not fixed by the Contractor.

9.27.6 For defects found during the confirmation test, the Equipment or its parts shall be repaired or replaced, and the Warranty Period of the Equipment shall be extended for one more year.

9.28 Documentation for the Proposed Equipment

9.28.1 The Contractor shall supply the following documentation:

(a) Technical and proposed equipment information including integrated system equipment schematic diagram of all this general electronic equipment and sufficiently detailed to enable a technical appraisal of the Equipment in this Chapter to be made.

(b) Lists of Equipment as required in this Chapter.

9.28.2 The Contractor shall upon delivery of the Vessel, supply three (3) sets of Operation Manuals, Service Manuals and integrated system/equipment schematic diagram in English or Chinese (at least two (2) sets of which shall be original), giving full details on:

(a) Operations and working principals;

(b) Equipment functional description;

(c) Equipment specifications;

(d) Schematic block diagrams and circuit diagrams with sufficient information and details for Equipment maintenance and repairing;

(e) Calibration procedures;

(f) Equipment (adjustment/mounting procedure) and parameter settings;

(g) Part list with part numbers and locations (the adjustment/calibration tools/kit/program shall also be included);

(h) Maintenance and troubleshooting instructions;

(i) Equipment interfacing with wiring diagram with clear signal labelling;

(j) Software operation manual for Equipment driven by application software;

(k) As fitted conduit/trunking route diagrams for the electronic equipment installed on board for the purpose of future maintenance; and

(l) The design conduit/trunking route diagrams submitted to MD and EMSD for approval during construction stage.

9.28.3 Contractor shall supply three (3) sets of Equipment handbooks in English (at least two (2) sets of which shall be original) giving the above required information within one (1) month after the delivery of the Vessel.

9.28.4 In addition, the Contractor shall submit a list to show the unit price and the installation cost for each proposed Equipment and the accessories and recommended maintenance spares for the first year as stated in this Chapter. The name of the manufacturer and model / type shall also be included in the above list for MD and EMSD's consideration / evaluation.

9.29 Installation Requirements

9.29.1 General

(a) The control panel of all Equipment shall be installed and flush-mounted in the coxswain operation area unless otherwise specified. The mounting screw shall be detachable from the front of the Equipment and the Equipment shall be taken out at the front for further checking or replacement. The Contractor shall submit a layout plan showing the exact locations of the Equipment before installation.

(b) Equipment supplied shall be completed with all standard and/or maker recommended accessories as required for normal operation.

(c) The Equipment supplied shall be completed with all the auxiliary items required for normal operation including connectors, circuit breakers, power sockets, interface device, plugs and cables with conduits. Additional power conditioners, filtering devices, power stabiliser or regulator shall be provided and installed at no extra cost if required.

(d) RF connectors of suitable impedance shall be provided and used for connections of the RF cables, antennae and radio equipment. Connectors between the feeder cables and antennae shall be protected by weatherproof material to avoid water seepage.

(e) All wiring shall be finished in a neat and appropriate manner approved by the Government.

(f) Adequate measures to prevent interference amongst the Equipment shall be taken, which include but not limited to the following:

1. Separate screened conduits or trunkings shall be provided.
2. Rules, regulations and recommended practices regarding screening of electric wiring must be observed.
3. Receiving apparatus and other electronic equipment which may be affected by radio frequency induced voltages must be effectively earthed, screened and protected against such voltages.
4. Lightning protection devices shall be fitted.

(g) All sitting, installation and cabling work shall be undertaken to the highest standard to ensure:

1. satisfactory performance of the Equipment,
2. protection from mechanical and water damages,
3. ease of accessibility for maintenance and repair, and
4. manufacturers' recommendations shall be strictly observed.

(h) Cables connecting to flush-mounted equipment

1. The power, signal and control cables connecting to the flush-mounted equipment shall be long enough to let the equipment wholly rest on a secure surface with valid cable connections for fault finding and equipment testing. These extended cables shall be properly managed and resided inside the console.
2. Induced mutual interference shall be within an appropriate level which would not affect normal operation.

(i) Installation location

1. Installation location of the Equipment shall be easily accessible for inspection and maintenance. Exact location shall be subject to the approval of the Government.
2. Installation location of the Equipment shall not cause interference with other Equipment including any emitted interference.

(j) Material and Workmanship

1. Material and Equipment shall be of high quality, and shall comply with, where applicable, the appropriate British Standards and Code of Practice, together with any amendments made thereto, suitable for installation in the Vessel.
2. All the designs shall be subject to the approval of the Government and the respective works shall be carried out in a first class workman-like manner.
3. The Government reserves the right to reject any part of the installation not compliant with these Specifications. The Contractor shall carry out the necessary remedial work or replacement at its own cost and expense and without delay.
4. The Contractor shall provide all installation materials including but not limited to cables, casing and mounting accessories which are durable and fire retarding. Where it is impracticable for signal cables for data to be run inside conduits, PVC insulated and sheathed with armoured cable shall be used.

(k) Equipment Fixing and Interconnection

1. All switches, connectors, jacks and receptacles shall be clearly, logically and permanently marked during installation. All wires and cables shall be identified at every termination and connection point with permanent type markers suitable for installation in the Vessel.
2. Interconnection of various items of Equipment shall be mechanically and electrically connected by multi-pin connectors or terminals.
3. All cables shall be joined by properly designed connectors or inside joint boxes. Where terminal blocks are used for connection cables, the tip of each conductor shall be crimped with a suitable terminal pin before it is inserted into the terminal block.
4. The Contractor shall be responsible for providing and installing properly rated power cables from the power points to its own equipment.

(l) Electricity

1. The power supply shall be compatible with Vessel's D.C. electrical system.
2. The Equipment shall be protected by appropriately rated fuses. The fuses shall be contained in independent fuse holders which are easily accessible.

(m) Cable

1. All exposed cables and wiring shall be sheathed or protected by metal conduits.
2. Watertight cable glands shall be provided by way of watertight bulkhead or deck penetration.
3. Signal wiring shall be separated from power supply cables and housed in separate screened conduits or cable trunks.
4. Cables and wirings shall run behind the compartment lining. Where electric cables are necessary to be fitted on the decorative surface of bulkheads, they shall be enclosed in proper metal conduits.

(n) Labelling and Marking

1. Each cable shall be clearly labelled and carry its own unique identification code.
2. Polarity of power cables shall be labelled.

Chapter 10 Hybrid System

10.1 Hybrid System Functional Modes

10.1.1 The objective of the hybrid system is to provide a secondary smaller electric propulsion system as an alternative to the main diesel engine when the Vessel operates at slow speeds and is the application of an electric generator-motor (E-motor) system in combination with the main diesel engines ("hybrid system" or "hybrid propulsion system", in upper or lower case). The Vessel shall be propelled by either diesels or electric power. When propelled by electric power with no main diesel engine power input, there shall also be a reduction in noise and vibration, as well as an increase in crew comfort.

10.1.2 The hybrid system shall provide the following functions:

(a) Diesel Mode

1. Operate conventionally using main diesel engines only to propel the Vessel, with no additional power being supplied from the E-motors;
2. E-motors are disengaged from the propeller shaft; and
3. All required house loads are to be supplied by the diesel generator(s).

(b) Electric Mode

1. Propel the Vessel via E-motors alone, taking power from the diesel generator(s);
2. Main diesel engines are to be cut-off completely from the power train; and
3. Automatic coordination of electric power supply by power management system ("PMS").

10.1.3 The E-Motor shall be of a permanent magnet type.

10.1.4 The E-Motor is only used as the propulsion motor.

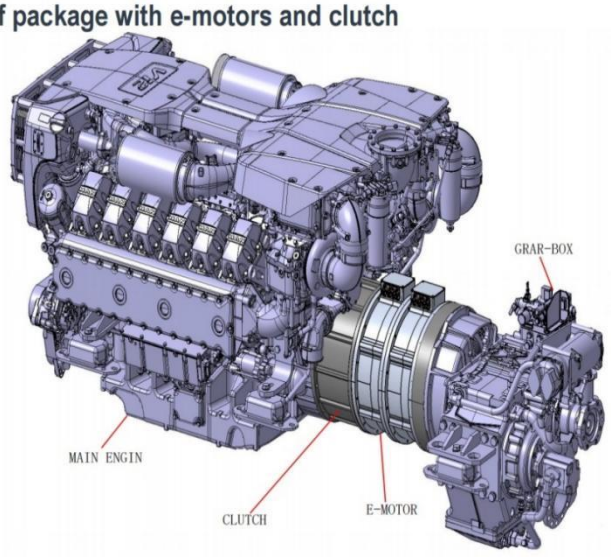
10.1.5 E-Motor high winding temperature alarm shall be provided.

10.1.6 E-Motor single-phase protection is to be provided.

10.2 General Provisions

10.2.1 During the design of the Vessel, two (2) motors will be installed between the main diesel engine and the gearbox. The E-motor of the hybrid system shall have the power to propel the Vessel at a speed about 5 knots while running in electric mode only.

View of package with e-motors and clutch



10.2.2 The reliability of the hybrid system shall be the paramount consideration. Design and arrangement shall ensure that a single failure of any key component, including but not limited to main diesel engines, E-motor, diesel generators, Power Management System ("PMS"), frequency drive ("VFD"), etc. shall not cause the total black out to the Vessel or fail to operate.

10.2.3 The hybrid system shall meet the RO requirements with appropriate notation wherever applicable. All components shall be RO type-approved. The hybrid system shall be submitted to the RO for approval and to GNC's satisfaction. The operating voltage shall be below 1000V.

10.2.4 The Contractor shall note that the Vessel is for use in Hong Kong and it is essential that the hybrid system offered by the Contractor is supported and shall have good availability of spare parts. Good technical support and maintenance services shall be available locally in Hong Kong.

10.2.5 The provided Spare Parts shall be of the same model as supplied for the Vessel and shall equally comply with all specifications set out in this Chapter of Part VII.

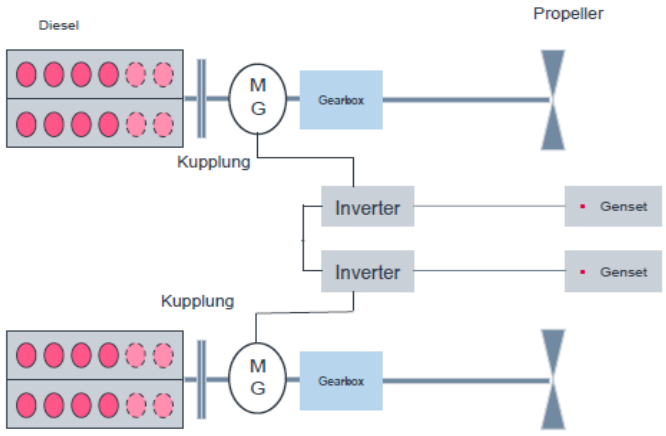
10.2.6 Sufficient space and headroom in the vicinity of the hybrid equipment for local operation, inspection and routine maintenance shall be provided.

10.2.7 The hybrid propulsion system installation in the Vessel shall be suitable for operation as an unmanned machinery space. The control and monitoring shall be centralized in the Wheelhouse Engine Remote Control Console.

10.3 General Requirement

10.3.1 The modular hybrid system shall work in Diesel Mode and Electric Mode as per Paragraph 10.1.2. [E]

10.3.2 The hybrid system shall include the following equipment, e.g. inverter, coupling, clutch (clutch gearbox), motor, gearbox, control system with interface, cable, pump, display, throttle valve and software. With this system, the propulsion system can work in different Mode.



Basic scheme of the hybrid system

10.3.3 A Power Management System (PMS) shall be implemented to automatically determine the most efficient power source subject to the power demands on board.

10.3.4 The hybrid system shall include but not be limited to:

(a) The main diesel engines;

(b) Diesel generator(s);

(c) E-motor;

(d) AC switchboards (“switchboard”);

(e) Power management system (PMS); and

(f) Frequency drive (VFD) and/or other equivalent means wherever applicable.

10.3.5 The hybrid system shall be designed to avoid excessively high temperatures being generated in the components (i.e. motor, clutch, frequency drive, etc.). Impact loading to E-Motor and associated shafting, improper load sharing and interruption of power transmission, shall not occur during change over between different modes. An alarm shall be provided to indicate lengthy switching over time.

10.3.6 The switch board shall be so arranged that short circuit or faults on the AC shall not induce excessive current or voltage on the main AC system, or shall be protected from the induced excessive current or voltage on the AC side, and vice versa. The switchboard shall have, but not be limited to, the following protections:

(a) Over current and short-circuit protection;

(b) Under voltage & overvoltage protection; and

(c) Ground fault insulation alarm and monitor.

10.3.7 The protection arrangement shall be arranged to trip the defective circuit only without undue interruption of other services.

10.3.8 The hybrid system shall be so designed to avoid voltage spike, over-voltage and over-current of its component, i. e. electronic components, and also the system.

10.4 Power Management System

10.4.1 The Power Management System ("PMS") of the hybrid system shall communicate, control and monitor all components within the hybrid system including the main diesel engines. The PMS shall enable control of the hybrid system to operate in the operational mode as selected by the user. This is also to achieve the user's objective together with optimum energy allocation.

10.4.2 During the operation, the following vessel operational modes (selected through a two-way switch) shall be provided to the Coxswain:

(a) Diesel Mode

(b) Electric Mode

10.4.3 Under the Diesel Mode, the PMS shall isolate the E-motors from the power train and the propulsion thrust shall be solely provided by the main diesel engines. The PMS shall optimize the efficiency of the electric power supply between the diesel generators according to the on-board instantaneous power demand condition.

10.4.4 Under the Electric Mode, the PMS shall isolate the Diesel Engines from the power train and the propulsion thrust shall be solely provided by the E-motors. The PMS shall optimise the efficiency of the electric power supply between the diesel generators according to the on-board instantaneous power demand condition.

10.4.5 The PMS system shall provide a self-diagnostic function with a manual activation capability.

10.4.6 The power management system shall control and manage the available power and convert power as required according to the applied load profile, including the house load.

10.4.7 One hundred percent (100%) redundancy shall be provided for both the software and hardware of the PMS in order to avoid any sudden disruption to the system.

10.5 Variable Frequency Drive ("VFD")

10.5.1 The VFD has the maximum and minimum frequency limiting function, which makes output-frequency operated within the specified range. The protection to the VFD and E-Motors shall provide the following:

(a) Stall prevention;

(b) Over current and Short-circuit protection;

(c) Under voltage & over voltage protection;

(d) Ground fault protection;

(e) Power supply phase failure protection; and

(f) Motor thermal protection through sensing of the motor winding temperature.

10.5.2 Seawater cooling pump is adopted for the frequency converter seawater cooling to ensure a long stable operation.

Chapter 11 Services Support

11.1 General Requirement

11.1.1 In determining the appropriate design for the Vessel, all of the following factors shall equally be taken into account without one outweighing another.

1. Vessel performance (e.g. engine rating, size, etc.);
2. Initial cost;
3. On-going cost (e.g. maintenance cost, petrol consumption, spare parts, etc.);
4. Reliability (frequency and time to repair breakdown);
5. Time between maintenance periods;
6. Time to undertake scheduled maintenance (downtime); and
7. All machineries and equipment installed in the Vessel shall be serviceable in the HKSAR.

11.1.2 Allowable Vessel downtime (including scheduled preventive maintenance and unscheduled repair and maintenance) shall not exceed 10% of the total hours of operation per month based on the operation profile as specified in Paragraph 2.8.2 of this Part.

11.1.3 Maintainability - the Vessel shall be easy to maintain by ensuring that there shall be:

(a) Good access to all installed items for monitoring, service and overhaul.

(b) Ease access to in-situ service and maintenance in the HKSAR.

11.2 Information to be Provided Prior to and at Delivery Acceptance

11.2.1 Information provided prior to Delivery Acceptance:

(a) Detailed inventory list for the whole Vessel to be submitted to the Government for approval.

(b) The Inventory List shall cover all discrete items down to major component/unit level.

(c) Full details of each item includes:

1. Item number;
2. Description;
3. Type/model;
4. Quantity;
5. Manufacturer;
6. Manufacturer’s reference number;
7. Location in Vessel;
8. Local agent/supplier address, telephone and fax numbers;
9. Order time;
10. Self-life; and
11. Unit cost.

(d) FOUR (4) paper copies and ONE (1) soft copy of the Inventory List shall be provided to GNC.

11.2.2 “As Fitted” Plans and Drawings including those as listed in (but not limited to) Annex 7 of the TS, and any other relevant information as required by GNC and including those specified below shall be supplied either before or upon Delivery Acceptance of the Vessel.

(a) Not less than four (4) weeks before the Delivery Acceptance of the Vessel, the Contractor shall provide a list of all “As Fitted” Plans and Drawings to GNC for acceptance. FOUR (4) hard copies of final version of the “As Fitted” Plans and Drawings and ONE (1) soft copy in Compact Disk (CD-ROM) shall be provided by the Contractor to GNC upon delivery of the Vessel to the Government Dockyard.

(b) At Delivery Acceptance, the Contractor shall provide to GNC all the necessary service and repair manuals, operational guides, spare parts information of all engines, machinery equipment, electrical

equipment, steering, windlass, electronics and navigational lights and lightings and the outfitting items of the Vessel。

11.2.3 In addition to the above mentioned items, upon Delivery Acceptance, the Contractor shall also supply the following:

(a) FOUR (4) copies of ship equipment list for all bought-in machineries and electrical equipment. The list shall include:

1. Description;
2. Type/model;
3. Makers part number or equivalent;
4. Location;
5. Quantity;
6. Supplier or agent's name and contact address;
7. Order time;
8. Shelf life; and
9. Unit cost.

(b) FOUR (4) copies (at least one original) of maker operation, maintenance and workshop manuals for all machineries / equipment in English.

(c) FOUR (4) paper copies and ONE (1) soft copy in CD-ROM as per the Vessel delivered of "Docking Plan" which shall include the profile, plan and sections shall be prepared by the Contractor.

(d) FOUR (4) copies of On Board Operator's Manual (English and Chinese) covering:

1. Daily user check and operation procedure;
2. Operating detail of each system; and
3. Emergency operation procedure.

(The precise format and detail required will have to be subject to the GNC's approval when the configuration of the Vessel and outfitting is decided.)

(e) The first draft of the On Board Operator's Manual (in both English and Chinese) shall be submitted to GNC for approval one (1) month before documentation acceptance.

(f) The documentation for all Equipment, spare parts and stores, special tools and test equipment shall be provided at the Delivery Acceptance of the Vessel.

11.2.4 Spare Parts and Consumable Parts for the Main Engines:

(a) All items of Spare Parts and Consumable Parts for the main engines shall be delivered to the Government Dockyard as per the requirements stipulated in Schedule 2, Delivery Schedule of Part V.

(b) All items supplied shall be identical in make, quantity and size to the parts currently in use. All items shall be properly documented, preserved and packed.

11.2.5 Tools & Test Equipment for Electronics

(a) All test and tool equipment for the electronics equipment of the Vessel shall be directly to EMSD.

(b) All items shall be properly documented, preserved and packed.

11.2.6 Photographs

The Contractor shall provide the following upon Delivery Acceptance:

(a) As-Fitted Photographs

1. Two (2) sets of colour prints (130 mm x 90 mm) from different aspects to give an overall picture of the various parts/areas of the Vessel shall be provided upon Delivery Acceptance.
2. Each print shall be enclosed in a suitable album and labelled showing the position of the content.

(b) Official Photographs

1. Four (4) framed colour photographs of picture size not less than 350 mm x 270 mm and frame size not less than 510 mm x 400 mm showing the profile of the Vessel in Hong Kong Waters

shall be provided upon Delivery Acceptance.

2. Four (4) 200 mm x 150 mm colour photographs with specifications of vessel particulars showing the profile of the Vessel in HKSAR Waters shall be provided upon Delivery Acceptance.

3. Four (4) 150 mm x 100 mm colour photographs showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.

(c) Soft-copy of Photographs

All photographs as required in the Paragraphs (a) and (b) above shall be taken by way of digital camera in JPEG format at a resolution of not less than 5.0 Mega pixel. The photographs shall be stored in Compact Disk (CD-ROM) and forwarded to GNC at the time of Delivery Acceptance.

11.2.7 Certificates and Reports

Copies of the following documents (one (1) original with two (2) copies and one (1) soft-copy stored in CD-ROM), filed in clear folders, shall be forwarded to GNC at the time of Delivery Acceptance:

(a) Associated test certificates;

(b) Test performance certificates of equipment (e.g. electronics, switchboards, etc.);

(c) Main engines performance test certificates issued by the engine manufacturer;

(d) Complete record of the trial commissioning tests of the Technical Acceptance;

(e) Original copy of the warranty certificates of all machineries, equipment and apparatus of the Vessel (valid for twelve (12) months from the date of unqualified Acceptance Certificate of the Vessel);

(f) Certificates of light and sound signalling equipment;

(g) Builder certificates;

(h) Certificates of building material;

(i) Deviation card for compass (after adjustment in the HKSAR);

(j) Undertaking duly signed and sealed by the Contractor's (or its sub-contractor's) shipyard for providing Warranty Services in relation to all aspects of the Vessel during the Warranty Period in the HKSAR as stipulated in Annex 1 of this Part;

(k) Certificate of Class with such class notations as specified in Schedule 9 of Part V to be issued by the RO; and

(l) Any other certificates as appropriate.

11.2.8 Ship Model

(a) The Contractor shall provide three (3) ship models (scale 1:40) for display and training purpose.

(b) The purpose of the ship model is to provide a reasonable realistic appreciation to the viewer (who cannot see the actual vessel) about the shape, scale, construction of the Vessel and the machinery installations and fittings therein. Hence the model shall include the position and look of the major external fittings including but not limited to the skeg, appendages, water-jet, shafts, propeller (propulsion units), rudders, mast, mast fittings and navigation lights and any other external above and under water items; and the Vessel shall be made to an overall exact scale standard relevant to model making. The price for such model shall be INCLUDED in the Total Purchase Price of the Vessel in the Tender Documents.

Chapter 12 Training

12.1 Training on Electronics Navigational Equipment (ENE)

12.1.1 General Requirements

(a) The Contractor shall provide classroom-based and vessel-based training as specified in Paragraphs 12.1.2, 12.1.3 and 12.2 of this Part VII as appropriate before Delivery Acceptance of the Vessel to the MD in Hong Kong, to the operational and technical staff to familiarise officers with the operation and maintenance of the Equipment being supplied and installed. The trainer shall be able to communicate with the local trainees effectively.

(b) Coronavirus Disease-2019 ("COVID-19") was declared as a pandemic by World Health Organisation on 11 March 2020. COVID-19 pandemic shall be regarded as a pre-existing condition, and shall not be considered as a reason for not to provide the mentioned training in person by the trainers in HKSAR.

(c) All training courses shall be held in the venue to be provided by GNC in HKSAR and delivered by qualified instructors. The training shall be conducted in Cantonese and/or English with relevant training manual in both Traditional Chinese and English supplied by the Contractor to each trainee in both paper and CD-ROM format before the start of each course.

(d) Any engineering/operational systems upgrade that have been implemented during the construction of the preceding Vessel shall be supplemented to and reflected in the training notes/ operator's manual.

(e) The Contractor shall submit a detailed course syllabus and a schedule for conducting the training course for acceptance one (1) month prior to Delivery Acceptance of the Vessel to the MD and EMSD as appropriate.

(f) Training manual in both Traditional Chinese and English shall be provided and submitted to MD and EMSD as appropriate for approval at least one (1) month prior to commencement of the Training on Electronic Navigational Equipment that include Operator Training and Equipment Maintenance Training, and the Training on Operation and Maintenance of the Vessel respectively.

(g) It is anticipated that two (2) distinct types of training shall be required, namely:

1. Operator Training
2. Equipment Maintenance Training

12.1.2 Operator Training Course

(a) This course shall provide training for trainers.

(b) The course shall provide a full knowledge and appreciation of the day-to-day operation of all ENE. This shall include hands-on demonstrations and operation of all ENE including the necessary routine cleansing requirement.

(c) The course shall be held immediately before the commissioning of the ENE on the Vessel.

(d) A total of up to **22** trainees will attend the course. The training course shall accommodate the specified number of trainees.

12.1.3 Equipment Maintenance Training Course

(a) The equipment maintenance training course shall enable the maintenance staff to:

1. acquire full knowledge and appreciation of all aspects of the design considerations, day-to-day operation, inter-connected system operation, fault breakdown, routine maintenance and fault finding/ repairing procedures of the ENE being offered; and
2. effectively maintain the ENE. This shall include practical demonstrations and tests.

(b) The maintenance training shall include, but not limited to the following items:

1. Introduction of the ENE locations;
2. ENE operational, working principle and functional descriptions;
3. ENE block and schematic functional descriptions;
4. ENE adjustment/calibration procedure and parameter settings;
5. ENE construction and mounting;
6. ENE interfacing and signal interfacing; and

7. Preventive maintenance and trouble-shooting.

(c) The course shall enable technical staff to effectively maintain the ENE.

(d) The course shall be held immediately after the commissioning of the ENE on the Vessel.

(e) A total of up to **15** trainees will attend the course. The training course shall accommodate the specified number of trainees.

12.2 Training on Operation and Maintenance of the Vessel

12.2.1 In addition to the training to be provided for the ENE, the Contractor shall provide training in relation to the operation of the Vessel for the operational staff of the user department, training in relation to maintenance of engine and equipment on board for the technical staff of the user department and for the Maintenance and Support Section of Government Dockyard.

12.2.2 In order to ensure the navigational work-up team of the MD acquires full knowledge and appreciation of all aspects of the manoeuvrability, vessel handling, turning characteristics, engines, etc., the Contractor shall provide an appropriate training course for **25** officers of the MD in the HKSAR upon the Delivery Acceptance of the Vessel. An operation training programme shall be proposed for consideration by GNC which shall include details of depth and duration of the training course. The training instructors must possess suitable qualifications acceptable to MD. A certificate shall also be issued to the trainees by the training instructor or his organisation upon completion of the training course for proof of competence and satisfactory completion of the course.

12.2.3 In order to ensure the engineering work-up team and the front-line maintenance teams of the MD and the maintenance personnel of the Government Dockyard acquire full knowledge and appreciation of all aspects of the designs, day to day operation, breakdown, routine maintenance and fault diagnosis of the engine/electrical distribution system, hull structural repair, etc., the Contractor shall therefore provide appropriate train-the-trainer courses for a total of **25** engine operators and **10** maintenance personnel from the Government Dockyard in the HKSAR or overseas at the delivery of the Vessel. A certificate shall also be issued to the trainees by the training instructor or his organisation upon completion of the training course for proof of competence and satisfactory completion of the course.

12.2.4 All facilities, venue, and materials necessary for the above-mentioned training courses shall be provided by the Contractor unless otherwise specified. The training shall also be conducted in Chinese and/or English with relevant training materials to be supplied by the Contractor. The training materials shall be provided before the training, in both paper and CD-ROM format. The training video and manuals for major operations shall be provided onboard.

Chapter 13 Abbreviations

ABS	American Bureau of Shipping
AC	Alternating Current
AFFF	Aqueous Film-Forming Foam
AIS	Automatic Identification System
AML	Additional Military Layers
ARCS	Admiralty Raster Chart Service
ARPA	Automatic Radar Plotting Aid
ASCII	American Standard Code for Information Interchange
ASTM	American Society for Testing and Materials
ASWF	American Standard Window Film
AUX	Auxiliary
AV	Audio Video
AVLS	Automated Vehicle Location System
AWS	American Welding Society
BER	Bit Error Rate
BNC	Bayonet Neill-Concelman
BS	British Standards
BSB	data encoded in the BSB format
BWA	Biological Warfare Agent
CBRN	Chemical, biological, radiological and nuclear
CCD	Charge-coupled device
CCTV	Close Circuit Television
CD	Compact Disc
CDI	Course Deviation Indicator
cd/ m^2	candela per square metre
CD-ROM	Compact Disc Read-Only Memory
CFC	Chlorofluorocarbon
CH	Channel
cm	centimetre
CMR	Compact Measurement Record
CO_2	Carbon Dioxide
COG	Course Over Ground
COP	Code of Practice
CPA	Closest Point of Approach
CPU	Central Processing Unit
CRT	Cathode ray tube
c/w	come with

CWA	Chemical Warfare Agent
dB	Decibel
dBi	decibel isotropic
dBm	Decibel-milliwatts
DC	Direct Current
DDR	Double Data Rate
deg	Degree
DGNSS	Differential Global Navigation Satellite System
DGPS	Differential Global Positioning System
dia.	diameter
DNC	Digital Nautical Chart
DPDT	Double-pole, double-throw
DSC	Digital Selective Calling
DTM	Digital Terrain Model
DTRS	Digital Trunk Radio System
DVD	Digital Versatile Disc
DVI	Digital Video Interface
DVR	digital video recorder
E.C.C.	Engine Control Console
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
EFFS	External Fire-Fighting System
EFCP	External Fire-Fighting Control Panel
EGNOS	European Geostationary Navigation Overlay Service
ENC	Electronic Navigational Charts
ENE	Electronic Navigational Equipment
EPIRB	Emergency Position-indicating Radio Beacon
E/R C.C.	Engine Room Control Console
FM200	heptafluoropropane
FSK	Frequency-shift keying
FTP	Fire Test Procedures
FO	Fuel oil
FOV	Field of View
g	Gravity
GB	Gigabyte
GeoTIFF	Format File
GHz	Gigahertz
GLONASS	Global Navigation Satellite System
GM	Metacentric Height
GMDSS	Global Maritime Distress Safety System

GMSK	Gaussian Minimum Shift Keying
GMT	Greenwich Mean Time
GPS	Global Positioning System
GRP	Glass-reinforced plastic
GSOF	General Serial Output Format
GZ	Righting Lever
HazMat	Hazardous Material
HEPA	High-efficiency particulate arrestance
HCFC	Chlorodifluoromethane
HD	Hard Disk
HDCP	High -bandwidth Digital Content Protection
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
HPS	Harbour Patrol Section
HSC	High-speed Craft
HVAC	Heating, ventilation and air conditioning
Hz	Hertz
IBSS	International Bibliography of the Social Sciences
ICLL	International Convention on Load Lines
IEC	International Electrotechnical Commission
IEEE	Institution of Electrical and Electronic Incorporated Engineers
ICR	Information Collection Request
IHO	International Hydrographic Organization
IMD	Intermodulation Distortion
IMM	International Maritime Mobile
IMO	International Maritime Organisation
INS	Inertial Navigation System
IP	Ingress Protection
IPX	Internetwork Packet Exchange
IR	Infrared
IS	Intact Stability
IS CODE	International Code on Intact Stability
ISO	International Organization for Standardization
ITU-R	International Telecommunication Union – Radiocommunication Sector
ITC	International Tonnage Certificate
K	Kilo
kΩ	Kilo Ohm
kg	Kilogram
kHz	Kilohertz
km	Kilometre

km/h	Kilometre per hour
kn	Knots
kW	Kilowatt
L/min	litre per minute
LAN	Local Area Network
LO	Lube oil
LCD	Liquid Crystal Display
LCG	Longitudinal Centre of Gravity
LED	Light-emitting Diode
L/s	Litre per second
LSA	Lifesaving Appliances
m	Metre
m/s	Metre per Second
m^3	Cubic Metre
M/E	Main engines
MARPA	Mini-automatic Radar Plotting Aid
MCR	Maximum Continuous Rating
MEI	MEI Corporation
MFD	Multi-function Display
MHz	Megahertz
min	minium
Max	maximum
m/min	Metre per minute
MJ/ m2	Megajoule per Square Metre
MKD	Minimum Keyboard Display
mm	Millimetre
MMC	Multi Media Card
MMSI	maritime mobile service identity
mph	Mile per hour
MS PRO	Memory Stick PRO
MS PRO Duo	Memory Stick PRO Duo
MSC	Maritime Safety Committee
MSK	Minimum Shift Keying
mV	Milli Voltage
NAVSEA	Naval Sea Systems Command
NDT	Non-Destructive Test
NIR	Non-Ionizing Radiation
NFPA	National Fire Protection Association
NMEA	National Marine Electronics Association
NOx	Nitrogen Oxides

ns	Nanosecond
NTRIP	Networked Transport of RTCM via Internet Protocol
NUC	Not Under Command
OBE	On-board electronics
OSHA	Occupational Safety and Health Administration
OSDS	Oil Spill Detection System
P&S	Port and Starboard
Pa	Pascal
PAL	Phase Alternating Line
ppm	Part per Million
p.s.i.	Pounds per square inch
PTO	Power take off
PVC	Polyvinyl Chloride
QZSS	Quasi-Zenith Satellite System
RAM	Random Access Memory
RCA	Radio Corporation of America
RGB	Red Green Blue
RF	Radio Frequency
RG58U	RG58U Type Coaxial Cable
RH	Relative Humidity
RMS	Root Mean Square
RO	Recognised Organisation
ROT	rate of turn
rpm	revolutions per minute
RT	Radioactive Test
RTCM	Radio Technical Commission for Maritime Services
SART	Search and Rescue Transponder
SATA	Serial Advanced Technology Attachment
SBAS	Satellite-based augmentation systems
SD	Secure Digital
sec	send
SENC	System Electronic Navigation Chart
SINAD	Signal-to-noise and Distortion Ratio
SOG	speed over ground
SOLAS	Safety of Life at Sea
SPL	Sound Pressure Level
SSD	Solid-state Drive
STANAG	NATO Standardization Agreement
SVP	Sound Velocity Profiler
TCG	Transverse Centre of Gravity

TCPA	Time of Closest Point of Approach
TFT	Thin-Film Transistor
TIFF	Tagged Image File Format
TMR	TOPEX/Poseidon Microwave Radiometer
TNC	Threaded Neill-Concelman connector
TS	Technical Specifications
UHF	Ultra High Frequency
UPS	Uninterruptible Power System
USB	Universal Serial Bus
UTC	coordinated universal time
uV	nano voltage
UV	Ultraviolet
VAC	Voltage of Alternating Current
VCG	Vertical Centre of Gravity
VDC	Voltage of Direct Current
VDR	Voyage Data Recorder
VGA	Video Graphics Array
VHF	Very High Frequency
VMAP	Vector Map
VRS	Virtual Reference Station
V.S.W.R.	Voltage Standing Wave Ratio
VTC	Vessel Traffic Centre
VTS	Vessel Traffic Services
W	Watt
WMS	Web Map Service
W/H E.C.C.	Wheelhouse Engine Control Console
XGA	Extended Graphics Array

Part VII - Annex 1 - Warranty Services and Guarantee Slipping

1. Warranty Services

1.1. The Contractor shall provide Warranty Services in relation to all aspects of the Vessel during the Warranty Period, including Guarantee Slipping as stipulated in this Annex. Both the Warranty Services and Guarantee Slipping shall be carried out locally in Hong Kong. If the Contractor appoints a local sub-contractor to perform the Warranty Services (hereinafter "local agent"), the Contractor shall ensure that the local agent appointed will perform the Warranty Services and Guarantee Slipping in full compliance with the requirements of the Contract including those as set out in this Annex 1. It must be emphasized that it is the Contractor's responsibility to ensure the Warranty Services and Guarantee Slipping are performed in full compliance with the terms of the Contract. The Contractor shall arrange their own technical staff with all the necessary skills, qualifications and experiences to conduct the services. Unless the technical staff from the local agent meet all these requirements, the technical staff from the local agent shall not provide the required Warranty Services but those technical staff from the Contractor to travel to Hong Kong for providing the Warranty Services. The Contractor shall provide the curriculum vitae of the local agent's engineers involved in providing the Warranty Services as part of the Deliverables to be provided as part of the Delivery Acceptance. The Government reserve the rights to reject any engineer whose qualification and experience are not acceptable to GNC and the Government reserves the right not to accept the Vessel.

1.2. The Government reserves all rights and claims against the Contractor in the event that any warranty claim has not been handled in accordance with the terms of the Contract including this Annex and the Detailed Procedures as mentioned in Paragraph 1.6 below. Furthermore, even it is agreed between the Government and the Contract after the necessary joint inspection and investigation that certain damage to the Vessel or any part thereof falls outside the scope of the Warranty Services, if so requested by the Government, the Contractor and its local agent shall still be responsible for the repair of such damage on the same terms as set out in this Annex 1 except that it shall be at the cost of the Government. Should the Contractor and its local agent refuse to do so or provide an unreasonable quotation of the repair cost, without prejudice to the rights and claims against them, the Government shall have the full right to appoint another contractor for the repair, and the Contractor agrees that the Warranty Period and the Warranty Services for the relevant Warranty Item(s) shall not be violated or affected notwithstanding such appointment.

1.3. For the Equipment in respect of which the manufacturer/supplier does not offer a one-year free warranty on such equipment, the Contractor shall provide the Warranty Services throughout the Warranty Period at the Contractor's own cost. For other loose equipment and installations, such as life-saving and firefighting equipment, etc., which are required to be serviced, inspected or renewed annually, the Contractor shall provide the servicing, inspection and renewal as per the manufacturer's requirements of that equipment or installation throughout the Warranty Period applicable to such items.

1.4. During the Warranty Period, when the Vessel or any part thereof is handed over for the Warranty Services and/or Guarantee Slipping, the Contractor shall be responsible for the collection and due return of the Vessel in good order (including all freight from and to the Government Dockyard and insurance (as further mentioned below)). Should there be any loss or damage of the Vessel or any Warranty Item (as defined in Paragraph 1.5 below) caused by any reason whatsoever while the Vessel is in the possession or control of the Contractor (including even when the Vessel is at the Government Dockyard or a maintenance base of the user department) or at the shipyard of the Contractor or an authorised agent appointed by it, the Contractor shall pay for the cost for the loss or damage plus 20% as and for liquidated damages but not as a penalty. Throughout the Warranty Period, notwithstanding anything to the contrary in the Contract, the Vessel and all Warranty Items are deemed to be at the Contractor's risks, and the Contractor shall insure and keep insured, at his own expense, a property insurance with the Government to be named as the sole payee, for an indemnity amount of not less than the purchase price of the Vessel plus 20% to protect the Government property against all risks. The Certificate of Insurance and evidence showing that the premium has been paid shall be available for inspection in advance. The Contractor shall provide this insurance policy before the commencement of the Warranty Services and/or Guarantee Slipping. Any excess payable under the insurance policy shall be borne by the Contractor.

1.5. Total Vessel Warranty

It is required that the Vessel is covered by the free of charge Warranty Services for one year after the date of the issue of the unqualified Acceptance Certificate in respect of the Vessel. If there is more than one (1) Vessel, each such Vessel shall be covered in the aforesaid manner. The Warranty Services shall cover the entire Vessel and all its Equipment (including without limitation all Equipment specified in Schedules 6 and 7 in Part V and all Electronic Navigational Equipment as defined in Chapter 9 of Part VII), fittings and outfit and all Spare Parts (collectively, "Warranty Items") against defects in design, construction, workmanship or materials and against any non-compliance with any of the Product Warranties. The Warranty Services may be backed up by the Contractor using individual equipment suppliers/manufacturers' warranties but the Contractor shall remain solely liable to MD as a primary obligor to provide the Warranty Services regardless of the terms of the warranty including duration provided by such suppliers or manufacturers. Notwithstanding and without prejudice to the Contract on warranty obligations for the total Vessel, any individual equipment supplier/manufacturer's warranty extending beyond the one-year total Vessel warranty must be assigned to the Government as appropriate. In order not to violate the warranty of the engine(s) and gearbox(es), the Contractor shall also provide the corresponding periodic maintenance services based on the manufacturer(s)' manuals and recommendations within the Warranty Period at no extra cost to the Government.

1.6. Procedures for Warranty Claim

Without prejudice to the provisions of the Contract, detailed procedures for dealing with warranty claims must be proposed by the Contractor and agreed by MD before the issuance of the unqualified Acceptance Certificate of the Vessel ("Detailed Procedures"). These Detailed Procedures shall be agreed based on the following principles:

1.6.1. Any notification of claimed defect shall be sent from MD to the Contractor through a defined route.

1.6.2. There shall be a joint inspection and investigation to examine the defect and the Contractor shall propose the appropriate and necessary remedial action to the satisfaction of the Director.

1.6.3. The Contractor shall undertake on-site Warranty Services (including provision of all replacement Warranty Items, spare parts, labour, materials, test equipment, lifting, docking, and transportation) whether, at the option of the Government, the Vessel is berthed at the local agent's shipyard or in the Government Dockyard or maintenance bases of the user department. Taking the Vessel back to the shipyard of the Contractor (place of construction) should be avoided unless absolutely necessary.

1.6.4. Rectification of defects must have a minimum effect on the operation of the Vessel by the provision of on loan equipment if the anticipated repair time exceeds the time frame as specified in Paragraph 1.7.1 below. The proposed manner of the rectification must first be approved by the Government.

1.7. Throughout the Warranty Period, the Contractor shall be responsible for the provision of free of charge corrective maintenance and rectification of all defects in all and any of the Warranty Items including repair and replacement as necessary. This shall, at no cost to the Government, include Warranty Services to be performed by the Contractor described in the following sub-paragraphs:

1.7.1. To attend to the Vessel for inspection and repair within 24 hours (excluding Hong Kong public holidays) of receiving the report of a fault ("fault report") and to take immediate action to rectify the defect after inspection. Unless otherwise agreed by the Government, all corrective maintenance and rectification must be effected within 48 hours after the fault report is first issued. The MD must be informed of what corrective maintenance and rectification actions have been taken within 72 hours of receiving the relevant fault report.

1.7.2. To provide all necessary transport, replacement Equipment, spare parts, labour and materials, tools and testing instruments required for the corrective maintenance and rectification.

1.7.3. Any replacement item or part to be used shall originate from the manufacturer of the original Warranty Item to be repaired and must be listed on the latest spare parts list issued by such manufacturer. Alternative components shall not be used without the prior approval in writing of the MD.

1.7.4. If the Contractor fails to respond to any reported warranty claims within 48 hours, the MD may arrange corrective maintenance and rectification of the defect either on its own or by deploying a third-party contractor as deemed appropriate with a view to minimising any downtime incurred. In such case, the Contractor shall compensate the Government for the full cost of such repairs plus 10% as and for liquidated damages but not as a penalty no later than 10 working days after a written demand has been served on the Contractor by MD. **Any such corrective maintenance and rectification of the defect completed by MD on its own or by another third-party contractor shall not relieve the Contractor from its obligations under the Contract including those in respect of the remainder part of the Warranty Period (including all extensions). The Warranty Period shall not be affected or broken due to such course of action.**

1.8. Extension of Warranty

1.8.1. The Warranty Period for any Warranty Item shall be extended for such duration whilst the Contractor has failed to repair and correct satisfactorily the defects in such Warranty Item exceeding seven working days counting from the date when the relevant fault report was first issued (or otherwise exceeding such longer permissible repair duration of more than 7 working days as the Government considers appropriate depending on the warranty claim) (and depending whichever is applicable, this is the "permissible repair time").

1.8.2. Warranty Items which are replaced during the Warranty Period shall have a new warranty period of one year commencing from the date of replacement including the replacement as mentioned in Paragraph 1.9 below.

1.8.3. Equipment which is found to be defective during the trials at the Guarantee Slipping as mentioned in Paragraph 2.2.5 below shall have an extension of warranty of one year.

1.8.4. The Warranty Period of the Vessel shall be extended if the entire Vessel is out of service for more than 24 hours in excess of the permissible repair time as mentioned in paragraph 1.8.1 above due to any failure in any Warranty Item and this extension will count from the date when the relevant fault report was first issued until the rectification of such fault. For the avoidance of doubt, this paragraph 1.8.4 shall apply if due to any failure the Vessel has to be put out of service. It is only if the Vessel would not be put out of service notwithstanding any failure that there shall only be extension of the relevant Warranty Item but not the entire Vessel under paragraph 1.8.1.

1.8.5. In relation to a Warranty Item with extended Warranty Period as mentioned in Paragraph 1.8.1 and/or 1.8.2 and/or 1.8.3 and/or 1.8.4 above, depending on whichever is applicable, all references to Warranty Period in the Contract shall be construed to include such extended Warranty Period. For the avoidance of doubt in the case of paragraph 1.8.4, the entire Vessel and all Warranty Items installed therein shall be given an extended Warranty Period in accordance with that paragraph.

1.9. Recurrent Defects

During the Warranty Period, should a second and similar defect arise in relation to a Warranty Item, this shall be construed as conclusive evidence of the Warranty Item's unsuitability for the purpose intended, and the Contractor shall take immediate steps to conduct a thorough investigation jointly with MD at the Contractor's expense, to ascertain the reasons for any such defect and shall forthwith at the MD's option and the Contractor's expense, procure and deliver another replacement Warranty Item with a new design suitable for the purpose intended to replace the original defective Warranty Item.

1.10. In the event that the Contractor proposes to modify any Warranty Item or any part of the Vessel in order to repair or replace the same or another Warranty Item, the Contractor shall obtain the Government's advance written consent to the proposed modification.

1.11. Throughout the Warranty Period, the Contractor shall maintain an inventory of spare parts of those items listed in Schedules 6 and 7 of Part V, which shall be brand new, and originate from the manufacturer of such items and must be listed on the latest spare parts list issued by such manufacturer.. The Government will not provide its own inventory of the Spare Parts to the Contractor for the provision of the Warranty Services.

1.12. Updated/Upgraded Information

It is expected that during the Warranty Period certain Warranty Items may be modified or changed. All documentation affected by this change must be updated to reflect the new situation. All the support documentation such as the Vessel inventory list, job information and maintenance scheduling in relation to these modifications and changes shall be provided at the expiry of the Warranty Period.

1.13. Warranty of Electronic Navigational Equipment

On top of the Warranty Services described in this Annex 1, there are also service specifications of the Warranty Services set out in Chapter 9 of this Part VII for the Electronic Navigational Equipment. In the event of any inconsistency, the better service specifications shall prevail. Please refer to the Chapter 9 of this Part VII.

2. Guarantee Slipping

2.1. As stated in the section "Warranty" above, Guarantee Slipping shall be carried out at the end of the original Warranty Period (but if there is any extension of the Warranty Period for the entire Vessel, GNC has to right to decide if the time of Guarantee Slipping should be upon the expiry of the original Warranty Period before any extension or upon the expiry of the extended Warranty Period).

2.2. At the Guarantee Slipping, the Contractor shall carry out the following work and provide all necessary materials, spare parts, labour and equipment in order to carry out such work:

2.2.1. Pre-guarantee slipping inspection and trial

(a) Joint inspection with trial to confirm the list of guarantee slipping items; and
(b) Collect vessel performance information beforehand for comparing when guarantee slipping completion.

2.2.2. Engines and Gearboxes

(a) Renew the lubricating oil and replace the filters for the engines and gearboxes and top up the engine coolant (if applicable) as per the manufacturer's recommendations;
(b) Clean all the engine air filters and change the filter elements;
(c) Change all fuel/water separators elements and fuel filters for all engines;
(d) Flush through the cooling system of the engines and gearboxes and renew all zinc anodes if provided;
(e) Check all the engines' belts and adjust or renew if necessary;
(f) Check tappet clearances for the inlet and exhaust valves, ignition timing and idle speed and adjust if necessary;
(g) Conduct function tests for the engines' protection system and their associated sensors, gauges and other measuring devices;
(h) Disconnect and remove all engines and gearboxes sea water pipes (suction & discharge) for inspection, and clear off marine growth and obstructive materials in all pipes and fittings;
(i) Repair all damages and leakages in the pipelines; and
(j) Any other work required or recommended by the engine manufacturer.

All of the work listed at Paragraphs 2.2.2(a) to (i) shall be carried out by the manufacturer's authorised agent/dealer. All the work procedures and the spare parts used shall comply with the manufacturer's specifications and requirements.

2.2.3. Hull and Deck Items (where applicable):

(a) Paint Under the Water Line

(i) Paint under the water line shall be checked by the paint manufacturer's representative for the effectiveness of one year's protection against marine growth;
(ii) The hull shall be cleaned and ready for inspection of paint damage;
(iii) Damaged paint shall be repaired according to the paint/gelcoat manufacturer's procedures;
(iv) After the repair of the damaged paint as specified at Paragraph 2.2.3(a)(iii), two coats of touch up primer and one coat of touch up shall be applied; and
(v) One touch up anti-fouling paint of finishing coat shall be applied to the damaged paint as specified at Paragraph 2.2.3(a)(iii).

(b) Paint Above the Water Line

(i) Damaged paint on the hull above the water line and deckhouse shall be repaired properly. After repair, two coats of touch up primer and one coat of touch up (finishing) shall be applied;
(ii) Two coats of paint shall be applied on the Vessel's name, draft marks and insignia; and
(iii) One full coat of anti-slip paint shall be applied to the open and side deck.

(c) Inspect, clean and polish propellers
(d) Inspect, clean and remove obstructed object on the propeller shaft
(e) Free, clean, grease and recondition all moving parts of the deck fittings, i.e. WT (water tight) hatches, vent covers, rollers and fairleads and anchor chain stoppers, etc
(f) Renew all zinc anodes on hull, rudder(s) and tail shaft(s)
(g) Life-saving appliances ("LSA") and Fire-fighting appliances ("FFA") must be serviced and re-certified as required. (Free, clean, grease and recondition all fire control valves, hydrants and bilge suction and control valves)
(h) Free, clean and repaint the anchor chain and swivel set
(i) Remove the fuel tank(s) from the fuel tank compartment(s). all fuel tanks shall be pressure-tested free of leakage, while the hull structures in the fuel tank compartment should inspected correct
(j) In order to facilitate GNC/user Department officers carrying out any inspections (if any found necessary) inside the under-deck compartments (including but not limited to visual inspections, non-destructive tests to the welding beams, etc), open up all the compartment hatches & inspection doors and remove the fuel oil tank(s) from vessel. Prepare and obtain a gas free certificate issued by approved person according to local regulation. Restore the fuel system afterward

2.2.4. Mechanical, Electrical & Air-conditioning

(a) Dismantle all overboard valves for inspection and renew the defective parts;
(b) Check and clean the sea water system (including the grating, sea chest internal, sea suction and strainers) complete with renew their zinc anodes;
(c) Each of the compartment bilge suction to be checked and free of rubbish;
(d) Generator megger test and electrical circuit earth leak test;
(e) Electric cables and pipes penetration inspection; and
(f) Batteries condition check and switch over test.

2.2.5. The following shall be tested at the dock trial / sea trials as part of the Guarantee Slipping:

(a) Engine control and steering system including emergency/alternative method;
(b) Engine alarm and shut down function (including emergency stopping of engines at wheelhouse);
(c) Hybrid system;
(d) Functional test of fuel supply emergency shutdown devices;
(e) Navigational equipment, lights and sound signals;
(f) Ahead and astern running and crash stop test;
(g) Steering trial;
(h) Speed measurement;
(i) Bilge system function (including high level bilge alarm system);
(j) Fire pump(s) function (including fire detection system, alarms, ventilation fans /fuel pump remote shutdown);
(k) Other trials or testing of equipment as required by the Government Representative;
(l) Any item or component found defective shall be repaired or replaced;
(m) The Dock Trial and Sea Trial Safety Checklist items, as listed below:

Dock Trial Check List

General items will be checked during dock trial	
1.	Engines start and stop testing
2.	Engines emergency stop check

3.	Engines speed and clutch unit testing
4.	Engines speed high and low idle speed testing
5.	Engines gauges and alarm check
6.	Propulsion system testing
7.	Anchor testing
8.	Navigation lights testing
9.	Vessel horn testing
10.	Fire protection system check
11.	Portable fire extinguishers inspection
12.	Life-saving equipment inspection
13.	Signal and light testing
14.	Bilge system in each compartment testing.
15.	Floor plate inspection
16.	Fuel tanks quick closing valves testing
17.	Bilge pumps testing
18.	Fuel oil pumps testing
19.	Waste water pumps testing
20.	Steering system power assisted and manual operation testing
21.	Emergency steering operation check

Sea Trial Safety Check List

General items will be checked during sea trial	
1.	Engines start and stop testing
2.	Engines emergency stop check
3.	Engines speed and clutch unit testing
4.	Vessel horn testing
5.	Portable fire extinguishers are in place
6.	Life jackets and life buoys are in place
7.	Sea trial navigation flag hoisted
8.	Telecommunication system function check
9.	Approved coxswains are in control
10.	Sufficient fuel oil to perform the full course of sea trial

(n) Other trials or testing of equipment as required by the Government Representative; and

(o) Any item or component found defective shall be repaired or replaced.

2.3. After Guarantee Slipping, the Contractor shall submit the above works completion report (including engines trial/testing report completed with engines parameters) to the Government Representative.

Part VII - Annex 2 - Implementation Timetable

Item No.	Milestone	Completion Date
1	Issuance of "Notification of Conditional Acceptance"	To be advised after Tender Evaluation
2	Contract Date (the date of the last party signing the Articles of Agreement)	The date when the last party signs the Articles of Agreement. The Government will not sign the Articles of Agreement until and unless the Contractor fulfils all of the conditions precedent as specified in Clause 25.2 of Part II - Conditions of Tender (save to the extent waived by the Government, if any).
3.	The Contractor shall submit the following in accordance with Clauses 11.1 and 11.2 of Part IV (a) An Implementation Timetable, in the form set out in Annex 2 to the TS, setting out the major milestones and their scheduled completion dates and incorporating the Delivery Dates specified in Schedule 2 of Part V; (b) The Drawing Submission Timetable in the form set out in Annex 3 to the TS; and (c) The Main Items Inspection Timetable in the form set out in Annex 4 to the TS.	Within 14 days after the Contract Date
4	Kick-Off Meeting	To be held within two (2) months after the Contract Date at the Government Dockyard or the Contractor's Shipyard
5	Submission of all drawings as listed in Annex 3 to Part VII	Two (2) months from the Contract Date
6	Completion of design with GNC approval	

7	Completion of hull and superstructure of the Vessel	The Contractor shall propose the completion dates of Milestones 6-16 for GNC's approval within two (2) months after the Contract Date.
8	Stage 1 of the technical acceptance as described in paragraph 1.8.2(a) of Part VII	
9	Completion of installation of engine propulsion system, propellers and steering system	
10	Completion of installation of ENE	
11	Launching of the Vessel	
12	Stage 2 of the technical acceptance as described in paragraph 1.8.2(b) of Part VII	
13	Shipment to Hong Kong	
14	Conduct of all tests, inspections and trials as part of Stage 3 of the Technical Acceptance to be performed in Hong Kong Waters	
15	Delivery Acceptance as mentioned in paragraph 1.8.3 of Part VII	
16	The date when the Vessel shall be Ready for Use	This date must be on or before the Delivery Date for the Vessel as set out in Schedule 2 (Delivery Schedule) of Part V

Part VII - Annex 3 - Drawing Submission Timetable

Item No.	Drawings Approval	Completion Date
1	General Arrangement Plan	*All the drawings shall be submitted in two months after Signing of Articles of Agreement for GNC's approval / reference.*
2	Lines Plan	
3	Stability Information	
4	Inclining Experiment Report	
5	Midship Section	
6	Stern Construction	
7	Frames and Bulkhead Sections	
8	Construction Profile and Deck Plan	
9	Shell Expansion Plan	
10	Bow Construction & Bow ramp Details	
11	Deckhouse Construction Plan	
12	Fuel Oil tank Construction	
13	Paint Schedule	
14	Tank Capacity Plan	
15	Main Engine & Gearbox Mounting Arrangement	
16	Power / Speed Estimation and Curve	
17	Deck Cabin Arrangement & Details	
18	Crew Cabin Arrangement & Details	
19	Engine Room Arrangement	
20	Shafting Arrangement	
21	Propeller Drawing	
22	Steering Arrangement & Rudders & Rudder Stock	
23	Mast Structure	
24	Details of Diesel Generator Arrangement	
25	Details of ENE Equipment System	
26	Control Console Arrangement and Schematic Diagram	
27	Instrumentation and Control System	
28	Calculation of Fuel Oil Capacity	
29	Details of Main Engines /Generators Alarms & Sensors	
30	Engine Room Piping Diagrams including sea water system, bilge system, fresh water system, black water system, HVAC	
31	Engine Room Ventilation and Exhaust & Calculation	
32	Details of the Air-Conditioning System & Calculation	
33	Ship's Ventilation Arrangement & Details	
34	Fire Detection System	

Item No.	Drawings Approval	Completion Date
35	Details of Electrical Equipment	
36	Electrical Load Calculations	
37	Schematic Layout of Electrical Circuits	
38	Lighting Arrangement	
39	Battery Arrangement & Details	
40	Navigation Light Arrangement	
41	Search Lights & Flood Lights Arrangement	
42	Lightning Protection Arrangement	
43	Solar Panel Arrangement	
44	Details of Galvanic Corrosion Prevention	
45	Torsional Vibration Calculation	
46	Fire Fighting Arrangement	
47	Lifesaving Arrangement	
48	Tonnage Measurement Calculation	
49	Freeboard Calculation	
50	Anchoring & Mooring Arrangement	
51	Hatches & Manholes Arrangement & Details	
52	Ship's Railing Arrangement & Details	
53	Wheelhouse Windows & Visibility Diagram	
54	Windows Arrangement & Details	
55	Insulation & Lining Arrangement & Details	
56	Fender Arrangement & Details	
57	Cathodic Protection Arrangement & Details	
58	Ship's Name & other Tally Plates Details	
59	Safety Plan	
60	Others as required	

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "MD 73", "MD 74", "MD 75", "MD 76" and "MD 77"			Inspection date	Outstanding / Reinspection / Remarks
Item	Items to be inspected			
	Hull Structure, Layout and Outfitting Inspection			
H-1	Hull Lofting			
H-2	Construction materials - Steel plate mark checking for hull			
	a) Steel plate mark checking for hull			
	b) Material certification verification			
H-3	Construction materials - aluminium plate mark checking for deckhouse			
	a) Aluminium plate mark checking for deckhouse			
	b) Material certification verification			
H-4	Welding consumables and welders' certificates verification			
H-5	Keel lay inspection			
H-6	Fabrication of hull up to main deck in stages of work including			
	a) Alignment			
	b) Edge preparation			
	c) Welding			
	d) Workmanship			
	e) Compliance with approved plans			
	f) Non-destructive tests NDT (X rays) of welds			
	g) Hull internal work inspection			
	h) Plating thickness gauging			
H-7	Engine girder fabrication and welding			
H-8	Deckhouse scantling and welding check			
H-9	Inspection and weld check of connection between deckhouse and main deck			
H-10	Welding construction and pressure test of tanks			
	Fuel oil tank(s)			
	a) Tank construction (internal/external/fitting)			
	b) Tank pressure test			
	Fresh water tank(s)			
	a) Tank construction (internal/external/fitting)			
	b) Tank pressure test			
H-11	Hose test for hull and deckhouse			
H-12	Mock-up inspection for the wheelhouse			
H-13	Deckhouse console mock up			
H-14	Installation of the various outfitting items			
	a) Anchor and chain			
	b) Windlass			
	c) Hand pump			
	d) Hatches			
	e) Doors			

	f) Windows			
	g) Ventilators			
	h) Seating of heavy equipment and mast			
H-15	Function test of various outfitting items			
H-16	Water-tightness or weathertightness of openings			
	a) Manholes			
	b) Hatches			
	c) Doors			
	d) Windows			
	e) Ventilators and Air pipes			
	f) Cable glands			
H-17	Painting inspection of different layers			
H-18	Zinc anodes and lightning protection			
	a) Installation of zinc anodes			
H-19	Vessel dimension verification			
H-20	Draught marks verification			
H-21	Hull completion survey in the presence of GNC officers and users of MD			
H-22	Arrangement of deckhouse, wheelhouse and accommodation to be inspected by GNC officers and users of MD			
H-23	Inspection of fire, heat and sound insulation			
	a) Fire Insulation			
	b) Heat Insulation			
	c) Sound Insulation			
H-24	Internal furnishing			
H-25	Lifesaving appliances and firefighting appliances			
	a) Lifesaving appliances			
	b) Firefighting appliances			
H-26	Inspection of sea chest and grating			
	a) Sea chest			
	b) Grating			
H-27	Inclining experiment			
H-28	Sea trials including operation of outfitting to be performed in Stage 2 – Technical Acceptance (“Stage 2 sea trial”)			
H-29	Trial of anchor & mooring arrangement in the Stage 2 sea trial			
H-30	Cleanliness inspection before acceptance			
H-31	Inventory check in HKSAR (this is the item to be performed during Delivery Acceptance)			
H-32	Acceptance of all inspection items listed in this Annex 4 as well as in the Programme (as defined in paragraph 1.6.6 of Part VII) as part of Stage 3 of Technical Acceptance (this item will not be performed until Stage 3 of the Technical Acceptance)			
H-33	Inspection of As-Fitted drawings and Engine/Equipment manuals and Documentation as part of the Delivery Acceptance (this is the item to be performed during Delivery Acceptance)			

VESSEL NAME : "MD 73", "MD 74", "MD 75", "MD 76" and "MD 77"			Inspection date	Outstanding / Reinspection / Remarks
Item	Items to be inspected			
	Machinery and Electrical Installation			
EM-1	General inspection and function tests on installation of machinery:			
	a) General inspection of the main propulsion engine			
	b) General inspection of the generator set			
	c) General inspection of the shafting			
	i. Propeller taper bedding test			
	ii. Coupling taper bedding test			
	iii. Coupling and rudder bolts fitting			
	d) General inspection of propeller			
EM-2	Main Engine:			
	a) Test of engine safety devices and alarms			
	b) Test of emergency stop			
	c) Inspection of exhaust pipe before lagging			
EM-3	Hydraulic test of sea valve			
EM-4	Inspection of the sea water suction strainers			
EM-5	Fresh water system:			
	a) General inspection and dimension checking of the fresh water system			
	b) Fresh water tank low level alarm test			
	c) Fresh water tank final cleaning/internal inspection before filling			
	d) Fresh water tank high level alarm test			
	e) Fresh water tank content gauge calibration and test			
	f) Inspection of piping penetration of bulkhead and deck			
	g) Hydraulic test of fresh water system piping			
	h) Functional test of fresh water system			
EM-6	Fuel oil system:			
	a) General inspection and dimension checking of the fuel oil system			
	b) Fuel oil tank(s) low level alarm test			
	c) Fuel oil tank(s) final cleaning/internal inspection before filling			
	d) Fuel oil tank(s) high level alarm test			
	e) Fuel oil tank(s) content gauge calibration and test			
	f) Inspection of piping penetration of bulkhead and deck			
	g) Hydraulic test of oil fuel system piping			
	h) Functional test of oil fuel system			
EM-7	Bilge system:			
	a) General inspection and dimension checking of the bilge system			
	b) Bilge tank low level alarm test			
	c) Bilge tank high level alarm test			

	d) Bilge tank content gauge calibration and test			
	e) Inspection of piping penetration of bulkhead and deck			
	f) Hydraulic test of bilge system piping			
	g) Functional test of bilge system			
EM-8	a) Inspection of piping penetration of bulkhead and deck b) Hydraulic test of black water/sanitary system piping c) Functional test of black water/sanitary system			
EM-9	Firefighting system:			
	a) General inspection and dimension checking of the firefighting system			
	b) Inspection of piping penetration of bulkhead and deck			
	c) Hydraulic test of firefighting system piping			
	d) Functional test of firefighting system			
EM-10	Fire extinguishing systems:			
	a) General inspection and dimension checking of the fire extinguishing system			
	b) Inspection of piping penetration of bulkhead and deck			
	c) Hydraulic test of fire extinguishing system piping			
	d) Functional test of fire extinguishing system			
	e) Test of fixed fire extinguishing alarm system			
	f) Test of fire detection (smoke and heat detection) alarm system			
EM-11	Function test of drainage system			
EM-12	Hydraulic system:			
	a) General inspection and dimension checking of the hydraulic system			
	b) Inspection of piping penetration of bulkhead and deck			
	c) Hydraulic test of hydraulic system piping			
	d) Functional test of hydraulic system			
EM-13	Engine room ventilation:			
	a) Inspection of E/R ventilation fan installation			
	b) Function test of start/stop at remote and local control for E/R ventilation fans			
EM-14	Air conditioning system:			
	a) General inspection and dimension checking of the air conditioning system			
	b) Inspection and hydraulic test of cooling water system(if applicable)			
	c) Functional test of air conditioning system			
	d) Full test of air conditioning during the Stage 2 sea trial			
EM-15	Batteries:			
	a) Inspection and dimension checking of the batteries spaces including ventilation.			
	b) Inspection of battery connectors and battery boxes			
	c) Inspection of battery charger			
	d) Operational test of battery charger			
	e) Test of main engines and generators consecutive starting by each group of battery (start/stop at remote and local control)			

EM-16	Electrical installation:			
	a) Inspection of lightening conductor			
	b) General inspection of cable layout and checking of cable sizes			
	c) Inspection of cable penetration of bulkhead and deck			
	d) Inspection of transformers			
	e) Inspection of tally plates			
EM-17	Main and emergency switchboard and panels:			
	a) Main switchboard and panels – high voltage primary injection test			
	b) Cable size checking of electrical switchboard installations			
	c) Inspection of AC distribution panel			
	d) Inspection of DC distribution panel			
	e) Megger test of the electrical system			
	f) Earth test of the electrical system			
EM-18	Control console(s):			
	a) Inspection of control console			
	b) Functional test of console controls			
	c) Inspection of navigation equipment control panel			
EM-19	Lighting:			
	a) Inspection and functional test of general lighting			
	b) Inspection and functional test of emergency lighting			
	c) Inspection and functional test of floodlight installation			
	d) Inspection and functional test of searchlight installation			
EM-20	Navigation Lights and Signals:			
	a) Inspection and functional test of navigation lights			
	b) Test of horn /whistle			
EM-21	Shafting (tailshaft and coupling) system:			
	a) Marking/Stamping and material check			
	b) Dimension check and taper bedding test			
	c) Shaft line checking of stern tube/shaft bracket and alignment of main engines and tail shaft			
EM-22	Steering system installation and testing:			
	a) Inspection and dimensional check of rudders			
	b) Inspection and dimensional check of steering gear system			
	c) Steering system functional test			
EM-23	Electronic Navigational Equipment installation and testing by EMSD			
EM-24	Test of window wipers			
EM-25	Test of noise levels throughout the vessel during the Stage 2 sea trial			

VESSEL NAME : "MD 73", "MD 74", "MD 75", "MD 76" and "MD 77"			Inspection date	Outstanding / Reinspection / Remarks
Item	Items to be inspected			
	Operational System			
OS-1	Installation inspection and functional test for ENE Systems			
OS-2	Inspection of tally plate and cable label			
OS-3	Inspection of main engine/genset safety alarms on W/H console table			
OS-4	Function and performance test during the Stage 2 sea trial			

Note:

The inspection items are preliminary and not exhaustive, any items found necessary to be included at a later stage will be added to this list through the Programme as defined in paragraph 1.6.6 of Part VII.

Part VII - Annex 5 - Vessel Condition During Respective Sea Trial

1) Official Speed Trial

Conditions at Speed-Trial		
1	Person on board	15 Persons (at 75 kg per person)
2	Fuel oil tanks	not less than 95% fuel tank capacity
3	Fresh water tank	not less than 95% tank capacity
4	Black water tank	not less than 50% tank capacity
5	Dirty oil and water tank	not less than 50% tank capacity
6	Urea	not less than 95% of the designed load
7	Store/Utilities	nil
8	Sea Conditions	Sea state 0 - 2 : wave height 0.1 - 0.5 metres

2) Endurance and Performance Test

Conditions at Endurance and Performance Test		
1	Person on board	15 Persons (at 75 kg per person)
2	Fuel oil tanks	not less than 85% fuel tank capacity
3	Fresh water tank	not less than 85% tank capacity
4	Black water tank	not less than 10% tank capacity
5	Dirty oil and water tank	not less than 10% tank capacity
6	Urea	not less than 95% of the designed load
7	Store/Utilities	Nil
8	Sea Conditions	Sea state 0 - 2 : wave height 0.1 - 0.5 metres

3) Manoeuvrability Test

Conditions at Forward Turning Circle Test		
1	Person on board	15 Persons (at 75 kg per person)
2	Fuel oil tanks	not less than 80% fuel tank capacity
3	Fresh water tank	not less than 85% tank capacity
4	Black water tank	not less than 50% tank capacity
5	Dirty oil and water tank	not less than 50% tank capacity
6	Urea	not less than 95% of the designed load
7	Store/Utilities	Nil
8	Sea Conditions	Sea state 0 - 2 : wave height 0.1 - 0.5 metres

4) Crash Stop Test / Astern Running Test / Emergency Steering Test

Conditions at Crash Stop Test / Astern Running Test / Emergency Steering Test		
1	Person on board	15 Persons (at 75 kg per person)
2	Fuel oil tanks	not less than 80% fuel tank capacity
3	Fresh water tank	not less than 85% tank capacity
4	Black water tank	not less than 50% tank capacity
5	Dirty oil and water tank	not less than 50% tank capacity
6	Urea	not less than 95% of the designed load
7	Store/Utilities	Nil
8	Sea Conditions	Sea state 0 -2 : wave height 0.1 - 0.5 metres

Note 1: All the tests should be conducted under Beaufort wind scale number 0 to 2.

Part VII - Annex 6 - Endurance Performance - Diesel Propulsion

Date of Test:		Place of Test:	
Vessel's Identification:		Vessel's Name:	

Conditions at Endurance and Performance Test			
Person On board	**3 crews +12 other persons**	Dummy Weight	**75 kg per person**
Fuel (diesel oil)	**Refer to Annex 5**	Other Equipment	
Sea Conditions	**WMO Sea State 2** wave height ≤ 0.5 metres and water depth ≥5 metres		

Engines:	**Port Side**	**Starboard Side**	**Propellers:**	**Port Side**	**Starboard Side**
Maker			Maker		
Type			Type		
Serial Number			Diameter		
Rated Power			Pitch		
Rated Speed			Direction of Rotation		

Engine Load	**Engine Speed (rpm)**	**Vessel Speed (Knots)**	**Time (Start)**	**Time (Finish)**	Fuel Consumption (litres/minutes)	Engine Oil Pressure (Bar)	Engine (in) CW Temp. (ºC)	Others	Others
__% of rated Power	At Minimum Crushing Speed		>15 min						
50% of Rated Power/rpm			>15 min						
60% of Rated Power/rpm			>15 min						
70% of Rated Power/rpm			>15 min						
80% of Rated Power/rpm			>30 min						
90% of Rated Power/rpm			>30 min						
100% of Rated Power (Endurance Test)			>90 min						
Remarks:									

Witness by:	MD Representative	Shipyard Representative

Course	0	45	90	135	180	225	270	315	360
Time Taken Ahead turning to starboard									
Course	0	45	90	135	180	225	270	315	360
Time Taken Ahead turning to port									

Turning diameter: Ahead turning to starboard	Ship length
Engine R.P.M.	rpm
Max heeling angle	degree

Turning diameter: Ahead turning to port	Ship length
Engine R.P.M.	rpm
Max heeling angle	degree

Witness by:	MD Representative	Shipyard Representative

Note 1: All the tests should be conducted under Beaufort wind scale number 0 to 2.

Part VII - Annex 7 - As Fitted Drawings and Documents

As-fitted Drawings and Machinery/Equipment documents and information literature to be delivered to the Government upon Delivery Acceptance

1. As-Fitted Drawings

1.1 Upon delivery of the Vessel, the Contractor shall deliver to the Government four (4) hard copies and two (2) soft-copies in .pdf and .dwg (where applicable) files of the following plans and drawings that contain the technical information of the Vessel and its machinery and equipment as they are when the Vessel is on the day accepted by GNC/MD. These are termed the final version of the "As-Fitted" Plans and Drawings, and they must consist of the following ones as well as any other additional ones that may be required by GNC/MD during the design and construction of the Vessel and before the Vessel is accepted by the Government.

1.2 The As-Fitted Plans and Drawings shall be prepared by professional ship draughtsmen and they shall be prepared in a professional manner, scale, size and style normally required of in the ship design and construction business sector. All plans and drawings shall show and be clearly marked for the profile, plan, and section views of the layout, arrangement details, and construction details in a manner required by GNC officer.

1.2.1 General Arrangement Plan.

1.2.2 Lines plan and offsets data and table.

1.2.3 Final stability information booklet and the final inclining experiment report.

1.2.4 Hydrostatics, cross curves and intact and damage stability calculations for all ship loading conditions specified in the Technical Specifications.

1.2.5 Vessel subdivision drawings and stability calculations.

1.2.6 Painting scheme of the whole Vessel.

1.2.7 Vessel draught marking diagram.

1.2.8 Detailed arrangement and layout plan of the deckhouse, accommodation, decks showing the disposition of all main equipment, fittings and fixtures, furniture, doors, windows, hatches, manholes and access openings. The down-flooding openings (points) shall be clearing indicated on the drawings.

1.2.9 Equipment layout diagram.

1.2.10 Hull structural construction and hull scantlings drawings.

1.2.11 Hull shell and frames and the framings arrangement and construction plan.

1.2.12 Hull shell expansion plan.

1.2.13 Bow construction plan.

1.2.14 Steering gear system and steering arrangement diagrams.

1.2.15 Deckhouse and deck structural and construction plan.

1.2.16 Hull watertight bulkheads construction plan.

1.2.17 Deckhouse to deck connection detailed construction plan.

1.2.18 Deck edge details and construction plan, including detailed structural arrangement drawings of hull to deck connection.

1.2.19 Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.

1.2.20 Mast structural and construction plan and mast equipment arrangement plan.

1.2.21 Anchoring & mooring arrangement plan.

1.2.22 Piping diagrams for fuel oil, freshwater, lubrication oil, bilge, firefighting, scuppers and drains, sewage system.

1.2.23 Fire firefighting system drawings.

1.2.24 Drawings of the main switchboard and all other switchboards and the electrical system.

1.2.25 Electrical Load Calculation

1.2.26 Electrical installation drawings

1.2.27 Details of the Operational Systems

1.2.28 Operational Systems equipment installation and location drawings, including ENE, communications, radio terminal, and CCTV system.

1.2.29 Operational Systems connection drawings.

1.2.30 Engine Room arrangement

1.2.31 Shaft line arrangement.

1.2.32 Propeller details and drawings

1.2.33 Main fuel oil tank drawing and its associated piping and manifold(s), and filling, overflow and ventilation system.

1.2.34 Freshwater tank construction plan and its associated piping arrangement.

1.2.35 Fuel oil tank(s) construction plan and its associated piping system

1.2.36 Black water tank construction plan and its associated piping system

1.2.37 Grey water tank construction plan and its associated piping system

1.2.38 Drawings for anchor, windlass and the anchoring system.

1.2.39 Lifesaving appliance arrangement plan and fire safety plan.

1.2.40 Navigation lights, sound and signal diagrams.

1.2.41 Vessel overall lighting arrangement and light control plan.

1.2.42 Vessel alarm and signals, internal communication systems and public address systems plan.

1.2.43 General layout and arrangement drawing of the air-conditioning system.

1.2.44 Piping layout drawing of the air-conditioning system (if any).

1.2.45 Air-conditioning load calculation.

1.2.46 CCTV system arrangement.

1.2.47 Solar panel system

The lists are not exhaustive, additional as fitted drawings may be added if required.

1.3 Documents shall be provided by the Contractor:

1.3.1 In not less than one month before the Delivery Acceptance of the Vessel, the Contractor shall provide for GNC acceptance a list of all documents to be provided.

1.3.2 When the Vessel is delivered to the Government Dockyard the Contractor shall deliver to the Government all of the documents as listed above, those specified in Chapter 10 which required to be delivered upon delivery acceptance and all other technical information, leaflets, literature, manuals and booklets etc. and whatsoever items that are necessary for the operation, handling, services, maintenance, spare parts, repairs and the technical understanding of any one of all the engines, machinery, motors, pumps, equipment, fittings and outfitting items of the Vessel.

Part VII - Annex 8 - Definition of Waves and Sea

Beaufort Wind scale number	Description	Wind speed	Wave height	Sea conditions	Land conditions
0	Calm	< 1 km/h (< 0.3 m/s) < 1 mph < 1 knot < 0.3 m/s	0 m 0 ft	Flat.	Calm. Smoke rises vertically.
1	Light air	1.1–5.5 km/h (0.3–2 m/s) 1–3 mph 1–3 knot 0.3–1.5 m/s	0–0.2 m 0–1 ft	Ripples without crests.	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
2	Light breeze	5.6–11 km/h (2–3 m/s) 4–7 mph 4–6 knot 1.6–3.4 m/s	0.2–0.5 m 1–2 ft	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
3	Gentle breeze	12–19 km/h (3–5 m/s) 8–12 mph 7–10 knot 3.5–5.4 m/s	0.5–1 m 2–3.5 ft	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended.
4	Moderate breeze	20–28 km/h (6–8 m/s) 13–17 mph 11–16 knot 5.5–7.9 m/s	1–2 m 3.5–6 ft	Small waves with breaking crests. Fairly frequent whitecaps.	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	29–38 km/h (8.1-10.6 m/s) 18–24 mph 17–21 knot 8.0–10.7 m/s	2–3 m 6–9 ft	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway.
6	Strong breeze	39–49 km/h (10.8-13.6 m/s) 25–30 mph 22–27 knot 10.8–13.8 m/s	3–4 m 9–13 ft	Long waves begin to form. White foam crests are very frequent. Some airborne spray is present.	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.
7	High wind, moderate gale, near gale	50–61 km/h (13.9-16.9 m/s) 31–38 mph 28–33 knot 13.9–17.1 m/s	4–5.5 m 13–19 ft	Sea heaps up. Some foam from breaking waves is blown into streaks along wind direction. Moderate amounts of airborne spray.	Whole trees in motion. Effort needed to walk against the wind.
8	Gale, fresh gale	62–74 km/h (17.2-20.6 m/s) 39–46 mph 34–40 knot 17.2–20.7 m/s	5.5–7.5 m 18–25 ft	Moderately high waves with breaking crests forming spindrift. Well-marked streaks of foam are blown along wind direction. Considerable airborne spray.	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	75–88 km/h (20.8-24.4 m/s) 47–54 mph 41–47 knot 20.8–24.4 m/s	7–10 m 23–32 ft	High waves whose crests sometimes roll over. Dense foam is blown along wind direction. Large amounts of airborne spray may begin to reduce visibility.	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over.

10	Storm, whole gale	89–102 km/h (24.7-28.3 m/s) 55–63 mph 48–55 knot 24.5–28.4 m/s	9–12.5 m 29–41 ft	Very high waves with overhanging crests. Large patches of foam from wave crests give the sea a white appearance. Considerable tumbling of waves with heavy impact. Large amounts of airborne spray reduce visibility.	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	103–117 km/h (28.6-32.5 m/s) 64–73 mph 56–63 knot 28.5–32.6 m/s	11.5–16 m 37–52 ft	Exceptionally high waves. Very large patches of foam, driven before the wind, cover much of the sea surface. Very large amounts of airborne spray severely reduce visibility.	Widespread damage to vegetation. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 118 km/h (≥ 32.8 m/s) ≥ 74 mph ≥ 64 knot ≥ 32.7 m/s	≥ 14 m ≥ 46 ft	Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility.	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris and unsecured objects are hurled about.

World Meteorological Organization (WMO) Sea State Code		
Sea State Code	Wave Height (meters)	Characteristics
0	0	Calm (glassy)
1	0 to 0.1	Calm (rippled)
2	0.1 to 0.5	Smooth (wavelets)
3	0.5 to 1.25	Slight
4	1.25 to 2.5	Moderate
5	2.5 to 4	Rough
6	4 to 6	Very rough
7	6 to 9	High
8	9 to 14	Very high
9	Over 14	Phenomenal
Character of the Sea Swell		
	0. None	
Low	1. Short or average 2. Long	
Moderate	3. Short 4. Average 5. Long	
Heavy	6. Short 7. Average 8. Long	
	9. Confused	

Part VII - Annex 9 - Tenderer's Presentation

1. General

1.1 Those Tenderers, who passed the Stage 1 and 2 of the Tender Evaluation Procedures, are required, at the discretion of the Government and at their own costs and expenses, to make a verbal presentation of their proposals to the Government Representatives within twenty-one (21) calendar days upon notice. The presentation shall be conducted by a team of qualified persons who are authorized by the Tenderer. Face-to-face presentation in person is preferred, where should be held at Government premises as designated by the Government Representatives as far as practicable. Presentation by way of video conference may also be considered at the Government's discretion.

1.2 The Tenderer shall introduce, explain and clarify their tender proposals during the presentation. In no circumstances should additional information or new/amended proposal not set out in their tender submissions be accepted. Tender assessment will be made solely based on the Technical Proposal submitted before the Tender Closing Date. The presentation will **not** be taken into account in marking under the Marking Scheme in Annex D to Part II - Conditions of Tender.

1.3 The Tenderer shall focus in presenting the Technical Proposal submitted in respect of its proposed design, philosophy and solutions to be adopted as well as the Excess Proposals therein involving higher standard of specifications and proposed innovative suggestions, if applicable. The scope of presentation shall be strictly based on and within the contents of the Tenderer's Technical Proposal submitted, without any disclosure, clarification or deliberation of the Price Proposal submitted. Organisation introduction and brief of the company profile should be kept to the minimum, which should not be more than five (5) minutes. The length of presentation shall not exceed three (3) hours.

1.4 The presentation shall be followed by a Question and Answer Section for the Government Representatives to make further enquiry about the Tenderer's Technical Proposal and presentation. Such Question and Answer Section should not be construed as any commitment by the Government. Any requests from the Tenderer for the Government to provide additional information about the tender requirements laid down in the Tender Documents or other vessel project plans of the Government will **not** be accepted.

2. Scope of Presentation

2.1 According to the requirements set out in Paragraphs 1.1 to 1.3 above, the presentation shall cover the following topics and follow the numbering sequence below.

(1) Organisation Introduction (not more than five minutes)

(2) Hull

(3) General Arrangement

(4) Fire Safety Equipment

(5) Lifesaving Appliances and Arrangements

(6) Machinery

(7) Electrical System

(8) Operational Systems

(9) Innovation Suggestions