

Part VII – Technical Specifications

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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 of the Hong Kong Special Administrative Region ("HKSAR") of the People's Republic of China (hereinafter referred to as the "Government") in relation to **Two (2) unit steel Vessels (viz. "Vessel")** for use by the **Aids to Navigation and Mooring Unit ("ANMU") for Marine Department ("MD")** (the "user department"). References to "Vessel" shall mean each of the two (2) vessels.
- 1.1.2** Unless otherwise specified in the TS, all the specifications stated in this Part VII of the Tender Documents are classified and labelled as follows:
- (a) Essential Requirements [E];
 - (b) Those specifications which are without any label (viz., [E] or [D]) ("Specifications without Label"); and
 - (c) Desirable Specifications [D].
- 1.1.3** As part of the tender evaluation during the tendering stage (viz., 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 Annex C to the Part II – Conditions of Tender, failing which its tender will not be considered further.
- 1.1.4** All Essential Requirements [E], Specifications without Label, (if and to the extent the Contractor has indicated compliance) and the Desirable Specifications labelled with [D] (if and to the extent the Contractor has indicated compliance in its tender), shall also form part of the Contract and be of equal materiality and importance upon the award of the Contract. Where the Tenderer has indicated non-compliance with any Specification without Label, it shall have proposed Counter-Proposals to such Specifications without Label in accordance with Clause 17.3 of Part II – Conditions of Tender for the Government's evaluation.
- 1.1.5** 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.
- 1.1.6** Unless otherwise expressly defined in the Contract, all technical terms and expressions used in this Part VII shall be interpreted in accordance with the professional or common usage in naval architecture, marine engineering, nautical navigation and the shipbuilding industry.
- 1.1.7** Where design specifications of the Vessel or any Equipment are required to be approved by the specified Recognized Organization ("RO"), they must be approved by the specified RO as well as by the Government New Construction Section ("GNC") prior to the manufacture of the Vessel or procurement of such Equipment by the Contractor (as the case may be). Where the design specifications of the Vessel or Equipment (as the case may be) are not required to be approved by the specified RO, they must be approved by GNC prior to the manufacture of the Vessel or procurement of such Equipment by the Contractor.
- 1.1.8** For the avoidance of doubt, references to "tests" throughout the Tender Documents and the Contract shall include all inspections, surveys, assessments, trials and experiments.
- 1.1.9** 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 VII;
- (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 a 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 VII (at whichever sub-level and regardless of the numbering system adopted) may begin in upper or lower case and may be ended with a 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; and
- (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 the Aids to Navigation and Mooring Unit ("ANMU") for MD (the "users of MD") for maintenance to Aids to Navigation ("AtoNs") and Government Mooring Buoys ("GMBs") in Hong Kong waters.

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 Tenderer and Contractor

- 1.4.1** In addition to the drawings and information included in the Technical Proposal for the Vessel offered in its tender submission, the Contractor is obliged to prepare and submit comprehensive and detailed technical specifications of the Vessel, together with all necessary drawings and information, as required in this Part VII within the specified period of time and to the satisfactory acceptance by the RO and GNC. If no period is specified, they shall be submitted and approved by RO, GNC (as the case may be) before the construction of the relevant part of the Vessel. Without prejudice to the Contractor’s obligations for compliance with all contract requirements set out in this Part VII (viz all essential requirements, all requirements not marked as essential, and all desirable specifications committed by the Contractor) and any rights of the Government under the Contract or otherwise, the Contractor shall submit to the GNC supplementary drawings, information and deliverables that may be deemed necessary for the design and construction of the Vessel as required in Items 1 to 16 (Essential Requirements in Part VII) as summarised in Schedule 5 and other relevant parts of the Contract where applicable. Any intended technical solutions to be proposed by the Contractor to ensure the Vessel’s compliance with each individual paragraph of the Technical Specifications shall be at least equivalent to or no less favourable than the respective contract requirements set out in this Part VII or otherwise, and shall be subject to the prior acceptance by the GNC before implementation of such intended technical solutions. In case of any discrepancies on interpretation of the Technical Specifications stipulated in this Part VII between the Contractor and the Government, the final decision on such intended technical solutions in fulfilling the fit-for-purpose standards and requirements shall be vested in the GNC.

1.5 Shipyard

- 1.5.1** The Contractor’s nominated shipyard for building the Vessel must have the essential shipbuilding and workshop facilities such as lifting gear, hull construction equipment, machinery installation equipment, calibration equipment and vessel launching or slipping facilities.
- 1.5.2** 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.

1.6 Design and Construction Responsibility

- 1.6.1** The Vessel shall be designed and constructed for a service life of not less than twenty (20) years under maintenance which is normally expected for the type of vessel which this Vessel may be

classified to belong.

- 1.6.2** It is the SOLE responsibility of the Contractor to supply a Vessel which is safe, fit and suitable for the intended operational purposes as set out in Paragraph 1.2.1 above and which meets all relevant regulations and all specifications in this Part VII, which include without limitation requirements for safety, health, environmental protection, hull form design features, structure, method and materials for construction and fitting out, stability, subdivision and operational efficiency.
- 1.6.3** The Vessel shall be designed and constructed in accordance with the rules and regulations of the RO as specified in Schedule 9 of Part V in the version as at the Contract Date unless the rules and regulations of RO specify that version of such rules and regulations as at the keel laying date of the Vessel shall apply in relation to the relevant requirements specified therein. Unless otherwise expressly stipulated in this Part VII, (a) references to “RO” in this Part VII shall mean the RO as specified in Part V, Schedule 9; and (b) references to “RO Requirements” shall mean the requirement of the rules and regulations of the RO as specified in Part V Schedule 9. Notwithstanding the foregoing, where it is expressly permitted in this Part VII that in relation to any particular requirement (instead of the RO specified in Part V, Schedule 9) another RO which is any one of the RO’s listed in Paragraph 2.2.5 (a) to (i) of this Part VII may be designated for confirmation of compliance with the relevant requirement, references to “RO” shall mean such other RO. References to “IMO requirements” shall mean the latest and as amended requirements published by the International Maritime Organization (“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.
- 1.6.4** The Vessel is required to be issued with a full certificate of class with notations by the RO as specified in Part V, Schedule 9, as one of the conditions, before the Acceptance Certificate for the Vessel may be issued. All plans, particulars and documentation which are required for the classification of the Vessel by the RO, in addition to those listed in Annex 3 to this Part VII shall be approved by the RO before submission to GNC for endorsement and final approval prior to commencement of the manufacturing work of the Vessel. Any subsequent modifications or additions shall be treated in the same manner. Those drawings which are not required for approval by the RO shall still be submitted to GNC for approval before work is carried out.
- 1.6.5** The Contractor shall design, build and supply the Vessel in full compliance with all requirements of the Contract including without limitation the Warranties, this Part VII and the Schedules; which may be over and above what is normally required by any statutory and/or RO’s rules and/or regulations. Should there be any contradiction between the rules and regulations of the RO and this Part VII, this Part VII shall prevail unless GNC stipulates or agrees otherwise.
- 1.6.6** 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
- 1.6.7** 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.

1.7 Survey and Inspection

- 1.7.1** Tenderers shall note that the unit price per Vessel as quoted in Part V, Schedule 1, shall be deemed to have included the cost of surveys to be carried out by the relevant RO in respect of that Vessel (if required to be arranged by the Contractor under the Contract).
- 1.7.2** All ENE items and their installations shall be approved and inspected by EMSD or EMSD representatives as part of the Technical Acceptance.
- 1.7.3** Subject to Paragraph 1.7.9 of this Part VII, an advance written notice of not less than twenty (20) working days where the Contractor's shipyard is located in Asia, and twenty-five (25) working days where the Contractor's shipyard is located outside of Asia, must be given to GNC before the representatives of 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 of the aforesaid. Without prejudice to the generality of the foregoing, if insufficient notice is given, the Government reserves the right only to make such visit after the appointed date and the liability for any delay resulting therefrom shall be borne by the Contractor including any liquidated damages payable under Schedule 4 to Part V
- 1.7.4** The Contractor shall provide:
- (a) An Implementation Timetable, in the form set out in Annex 2 to this Part VII, 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 Submissions Timetable in the form set out in Annex 3 to this Part VII; and
 - (c) The Main Items Inspection Timetable in the form set out in Annex 4 to this Part VII.

Each one of the above shall be submitted to GNC for approval within fourteen (14) days after the commencement of the Contract Period.

The Delivery Date(s) for the Vessel(s) as stated in the Implementation Timetable shall be no later than those set out in Schedule 2 of Part V.

- 1.7.5** Notwithstanding anything in the Contract to the contrary, the Government may suspend payment of any 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.
- 1.7.6** A weekly progress report with photographs evidencing the progress with sufficient details agreed by GNC 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 this Part VII.
- 1.7.7** The Contractor shall submit the inspection and testing plan ("ITP") with RO approval to GNC for discussion. Further details shall be discussed in the kick-off meeting.
- 1.7.8** GNC may designate consultant(s) from the private sector who will be authorized to represent GNC in all technical matters including plan approval and site supervision related to the construction of the Vessel. The Contractor shall cooperate with the consultant(s) and afford them unhindered access to the Vessel at all times during working hours and shall furnish them

with current copies of all drawings, sketches, correspondence, change notices, change orders, test agendas, schedules and other necessary documents where applicable. For the Main Items Inspection Timetable set out in Annex 4 to this Part VII (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 VII. 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 VII that certain items shall be performed in Hong Kong as part of the Technical Acceptance or Delivery Acceptance).

- 1.7.9** After arriving at site for a survey visit, if GNC officers or consultants consider that it is unsafe to carry out the test or inspection, the test or inspection will not be carried out. The Contractor shall arrange for another additional survey visit at the Contractor’s expense. 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.
- 1.7.10** Where any fee charge and associated expenses 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 to pay 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.
- 1.7.11** The Contractor shall provide office space for GNC officers, MD representatives and consultants during their survey visits and construction progress visits to the Vessel at the shipyard where the Vessel is being constructed. The office space shall include, but not be limited to, two (2) desks, six (6) chairs, one (1) telephone, one (1) conference table, 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/heating, have internet access with WiFi connection, and a copying and printer machine. Cleaning of the space shall be carried out on each working day.
- 1.7.12** The hours of work of the GNC officers, MD representatives or consultants will be arranged to coincide with those of the shipyard, insofar as is practicable to do so. It is intended that all reasonable steps are taken so that the duties of the GNC officers and consultants can be carried out with maximum efficiency and minimum interference with the Contractor’s work.

1.8 Official Sea Trial, Speed Requirements

- 1.8.1** 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 1.8.6 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 Sea Trial and therefore part of the Technical Acceptance (if not earlier). This programme must be submitted to GNC 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 3.3.4 of this Part and approved by the RO).

- 1.8.2** 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 GNC officers, MD representatives 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.
- 1.8.3** The Contractor shall provide to 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 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 GNC officers.
- 1.8.4** 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.
- 1.8.5** 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 VII.
 - (b) As part of the Technical Acceptance as specified in Paragraph 1.9.2 of this Part VII, 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 (4) continuous runs, i.e. TWO (2) 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 GNC.
 - (e) The Contract Speed is considered not achieved if based on the actual mean speed as mentioned above, the Contract Speed cannot be attained at least once during the Official Speed Trial after a total of two (2) 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 contract speed with running at 100% maximum power of both propulsion motors and the Vessel under Official Speed Trial Conditions as stated in paragraph 1 of Annex 5 to this Part VII. If the Vessel fails to achieve the minimum highest achievable contract speed under the aforesaid conditions in the manner specified in subparagraphs (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 used in measuring the Contract Speed for the Official Speed Trial shall be provided either by:

- (i)
- (ii) The Contractor shall provide that the speed measuring device has been calibrated by a certified body in Hong Kong acceptable to GNC; or
- (iii) 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 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 1.8.6 below shall be given to GNC before Delivery Acceptance.
- (k) 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.

1.8.6 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 motors loading and speeds to obtain the speed/fuel consumption curves (or data) for the Vessel, with the motors 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 VII. The report submitted shall include a curve or curves showing ship speed versus propulsion motors rpm and power, with particulars of the Vessel loading and displacement in the test(s).

Throughout the test period, the machinery and equipment shall operate without failure, damage, malfunction, or abnormal occurrences, and shall remain in fully functional condition without any damage or defect upon completion of the test.

The test shall be carried out into 2 parts:

- (i) 2 hours in Methanol Mode (i.e. all engine operates primarily on methanol with diesel used only as pilot fuel for ignition. Methanol provides the main energy input, while diesel injection quantity is minimized to maintain stable combustion.); and
- (ii) 2 hours in Diesel Mode (i.e. all engine operates solely on diesel fuel. All combustion is initiated and sustained by direct injection of diesel without methanol supplementation.).

(b) Manoeuvrability Test

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

- (i) Both main propulsion motors running; and
- (ii) Single main propulsion motors 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 not more 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 Electric Generator Engines.

(f) Anchoring Test according to the RO Requirements.

(g) Noise Level Test according to the requirement stipulated in Paragraph 4.1.17(a)(iii) of this Part VII.

(h) Megger test as mentioned in Paragraph 8.3.10 of this Part VII.

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

1.8.7 The Contractor shall submit the equipment test programme for the Methanol System Equipment (“Special Equipment”) (as specified in Paragraph 4.12 and Chapter 12 of this Part) of the Vessel for GNC approval fourteen (14) working days in advance of the tests for these Special Equipment as further mentioned in Paragraphs 1.8.8 and 1.8.9 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.

1.8.8 The functional test of each piece of the Special Equipment for the Vessel shall be conducted as part of the Technical Acceptance (“Functional Test at Shipyard”) 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 4.12 and Chapter 12 of this Part VII. The result of Functional Test at Shipyard shall be proved to the satisfaction of GNC and its consultant before delivery of the Vessel to Hong Kong.

1.8.9 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 shipyard.

1.9 Acceptance and Delivery

1.9.1 Acceptance of the Vessel (including all Equipment) is to be carried out in two (2) parts:

- (a) Part 1: Technical Acceptance; and
- (b) Part 2: Delivery Acceptance.

1.9.2 Technical Acceptance comprising all of the following tests and trials specified in three (3) stages as further specified below as well as the model tests as specified in Paragraph 3.1 below and Annex 11 to this Part VII which shall be commenced before stage 1:

- (a) This Stage 1 includes two (2) 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-21 as listed in Annex 4 to this Part VII (under the heading of “LIGHTHOUSE 1” and “LIGHTHOUSE 2”). 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 where considered appropriate the officers of MD will make visit to the shipyard to make inspection of the hull and the superstructures of the Vessel (viz., Item H-22 and H-23 of Annex 4 to this Part VII). 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 (2) 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-24 to H-30 of Annex 4 to this Part VII onwards as well as all items set out under the heading of “Machinery and Electrical Installation” in Annex 4 to this Part VII. They notably include the inclining experiment mentioned in Paragraph 3.3.4 of this Part VII 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 1.8.5 and 1.8.6 of this Part VII 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 all tests to be performed at the shipyard in the first part of this Stage 2 and the items up to the stage of EM-2 (viz the main engines/generators/motors) as specified in Annex 4 to this Part VII as well as all Special Equipment of the Vessel to be covered by the Functional Test at Shipyard (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 Functional Test at Shipyard as specified in Paragraph 1.8.8 of this Part VII, 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 shipment shall not take place unless and until Stages 1 and 2 above have been completed to the satisfaction of the Government. 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 1.8.5 of this Part VII, all of those tests and trials as specified Paragraph 1.8.6 of this Part VII, the bench acceptance test and on-site commissioning test for ENE as mentioned in Chapter 9 of this Part VII, the Functional Test in Hong Kong as mentioned in Paragraph 1.8.9 above, and all other tests whether as specified in this Part VII 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 Functional Test at Shipyard, 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 VII.
- (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.

1.9.3 Delivery Acceptance

- (a) The Vessel, after its successful completion of Technical Acceptance comprising the three (3) stages as mentioned in paragraph 1.9.2 above, 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 there is any delay in the delivery of the Vessel in Ready to Use condition for more than 120 days after the scheduled Delivery Date specified in Schedule 2 of Part V, at the discretion of the Government, the Contract may be terminated according to the applicable terms stipulated in the Contract.
- (b) A full certificate of classification for the Vessel with notations as specified in Schedule 9 of Part V shall be issued by the RO as specified in Schedule 9 of Part V before the Acceptance Certificate is issued by the Government. A full certificate of classification shall mean a valid "Certificate of Class" issued by the aforesaid RO, confirming that the Vessel has been surveyed and constructed in accordance with the applicable RO Class Rules and Regulations as stated in Schedule 9 of Part V. Furthermore, the Certificate of Class shall include the class notations to be assigned to the Vessel as specified in Schedule 9 (Part I and if applicable also Part II of Schedule 9), and shall confirm the Vessel's entry in the classification society's official records, and shall be subject to the applicable periodic class survey cycle.
- (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 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 and in case of the Warranty Spare Parts, have been

delivered to the Contractor's local agent 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 VII, all items listed in Annex 7 to this Part VII, 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 of 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.

1.10 Warranty Services During the Warranty Period

- 1.10.1** 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 twelve (12) months from the date of unqualified Acceptance Certificate of the Vessel, shall be delivered to MD upon Delivery Acceptance.
- 1.10.2** The full scope of Warranty Services is set out in Annex 1 to this Part VII.
- 1.10.3** The Contractor is responsible for arranging the Vessel for Guarantee Slipping at the end of the 12-month Warranty Period (and if there is any extension of the Warranty Period for the entire Vessel, GNC has the right to decide whether the Guarantee Slipping shall 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 under Clause 18 of Part IV (Conditions of Contract), 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 VII.

1.11 Support Services

- 1.11.1** The Vessel must be designed for through life support and easy maintenance in the HKSAR based on the operational profile and minimum life expectancy as mentioned in this Part VII.
- 1.11.2** 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.
- 1.11.3** The Contractor shall supply with the Vessel a whole life support plan for the timely procurement of spare/replacement parts and the undertaking of preventative maintenance. The whole life supporting plan should include the maintenance schedule and service plan at least 3 months prior to the vessel delivery.

1.12 Asbestos Free

- 1.12.1** The Vessel must not contain any asbestos or asbestos-containing materials. The Contractor must comply with Hong Kong Air Pollution Control Ordinance (Cap. 311), Part X. The Contractor shall engage a service provider approved by one of the RO's or other entities acceptable by GNC to verify that there is no asbestos on the Vessel. An asbestos-free certificate or statement of compliance issued by the service provider to this effect shall be provided upon delivery of the Vessel.

Chapter 2 General Technical Requirements

2.1 Introduction

- 2.1.1** Without prejudice to the generality of Chapter 1 of this Part VII, this Chapter contains the more particular technical specification for the Vessels. The significance of Essential Requirements [E] is explained in Paragraph 1.1 of this Part VII.
- 2.1.2** The work to be done under this Contract consists of the design, construction, outfitting, testing and delivery of two (2) Vessels for the ANMU. Workmanship, functions, characteristics and performance shall be in accordance with this Part VII, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.
- 2.1.3** The Contractor shall exercise its professional expertise and knowledge to come up with an appropriate design for the Vessel, which shall comply with all requirements of the Contract. The Conceptual General Arrangement Plan (“Conceptual GA Plan”) in Annex 10 of this Part VII serves only as a set of reference drawings to assist in illustrate how the tender requirements stated in this Part VII could be complied with, and is by no means a mandatory design layout of the Vessel. The Tenderer’s tender would not be disqualified for not complying with the Conceptual GA Plan provided all essential requirements are complied with.
- 2.1.4** During the design and construction of the Vessel, the Contractor is required to submit a detailed General Arrangement Plan (alternatively known as “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.
- 2.1.5** 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 Rules and Regulations

- 2.2.1** The Vessel shall be designed and constructed in accordance with the rules and regulations of the RO specified in Schedule 9 of Part V in the version as at the Contract Date unless the rules and regulations of the RO specify that version of such rules and regulations as at the keel laying date of the Vessel shall apply in relation to the relevant requirements specified therein. The hull (including equipment) and machinery (including electrical installations and Methanol System Equipment (“Special Equipment”) (as specified in Paragraph 4.12 and Chapter 12 of this Part)) of the Vessel shall be assigned with appropriate class notations in the certificate of classification to be issued by the RO upon completion of the Vessel. In this connection, the Tenderer shall propose the applicable class notation for the Vessel, its hull (including equipment), and the Special Equipment in Schedule 9 of Part V. The Tenderer shall state in Part V, Schedule 9,

which RO and its rules and regulations and what class notations that will be used in the design and construction of the Vessel. The Vessel shall be issued with a full certificate of class (without conditions) with notations by the RO as specified in Schedule 9 of Part V.

- 2.2.3** The Contractor shall design, build and supply the Vessel in full compliance with the requirements given in this Part VII which, to that extent, may be over and above what is normally required by any statutory and RO rules and regulations. Should there be any contradiction between the rules and regulations of the RO and this Part VII, the final decision shall be vested in the Government.
- 2.2.4** 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 VII 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.
- 2.2.5** 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 requirements of the Contract including this Part VII, the construction of the Vessel must comply with the requirements of the RO specified in Schedule 9 of Part V. This is unless where it is expressly stated that any other RO as listed below (which list is repeated in Annex 9 to this Part VII) other than the RO specified in Schedule 9 of this Part VII may apply. There may also be other requirements further specified in sub-paragraphs (j) to (o) below which are also applicable. In each of the aforesaid cases, the version as at the Contract Date shall be applicable unless any of these requirements specifies that version of requirements as at the keel laying date of the Vessel.

(a) American Bureau of Shipping	ABS
(b) Bureau Veritas	BV
(c) China Classification Society	CCS
(d) Lloyd's Register	LR
(e) Registro Italiano Navale Services S.P.A	RINA
(f) Det Norske Veritas	DNV
(g) Korean Register of Shipping	KR
(h) Nippon Kaiji Kyokai	NK
(i) Russian Maritime Register of Shipping	RS

And other entities and regulations as specified below:

- (j) International Electrotechnical Commission ("IEC") Regulations for the Electrical and Electronic Equipment.
- (k) International Telecommunications Union Recommendations in the International Radio Regulations ("ITU-R").
- (l) Quality and standards of the welding shall comply with the rules of the RO or American Welding Society ("AWS") or other applicable international standards or rules acceptable by GNC.
- (m) International Regulations for Preventing Collisions at Sea 1972, and all the effective Resolutions by International Maritime Organization ("IMO").
- (n) Hong Kong local regulations including Code of Practice - Safety Standards for Class II

Vessels (“COP”).

- (o) All other conventions, laws, regulations, guidelines and codes as mentioned in this Part VII;
- (p) 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 2.2.5 (j) to (o) above are applicable, then the applicable standards as specified by the applicable organizations below shall be complied with:

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

In the event of any inconsistency among the above requirements, rules and standards, those mentioned in sub-paragraphs (j) to (o) shall prevail over the requirements of the relevant RO as listed in sub-paragraphs (a) to (i) above.

2.3 Contract Speed

- 2.3.1** The Contract Speed of the Vessel shall not be less than thirteen (13) knots at World Meteorological Organization (“WMO”) Sea State 0 to 2 when the proposed propulsion system as defined in Paragraph 7.2.1 of this Part VII is running at 100% of the maximum power of the propulsion motors of the proposed propulsion system under Official Speed Trial Conditions as stated in Paragraph 1 of Annex 5 to this Part VII and whilst observing the requirements further specified in Paragraph 2.3.3 of this Part VII. **[E]**
- 2.3.2** At the Contract Speed, the Vessel shaft speed and torque is to be determined using a calibrated torque meter fitted at the propeller shaft immediately after the gearbox to validate the actual power delivered at not more than maximum power propulsion motor load measured at propeller shafts. This is to be carried out and witnessed to the satisfaction of the GNC officer(s). Calibration certificates for the torque meter are to be provided to and accepted by the GNC.
- 2.3.3** The Contract Speed prescribed above shall be achieved without porpoising, or other dynamic instabilities. The propulsion system selected shall match the propulsion motor profile and avoid cavitations as far as possible.
- 2.3.4** The estimated propulsion motor propulsive power 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 to this Part VII, together with a descriptive account of the engineering principles and methodology employed for such propulsive power estimate and evaluation shall be provided by the Tenderer. The Tenderer shall also submit the estimated speed-power requirements and characteristic curves of the proposed propulsion system for the Vessel to support its claim for the achievable Contract Speed of not less than thirteen (13) knots at 100% maximum power of the propulsion motors. **[E]**

2.4 Principal Dimensions

- 2.4.1** The Vessel shall comply with the following:

Length Overall (LOA):	24-26 metres (both figures inclusive and Fendering included)	[E]
Length(L):	less than 24 metres	
Breadth (B):	6.5 to 9 metres (Fendering Excluded)	[E]
Depth (D):	Design to suit	
Maximum Draught (T):	not more than 1.80 metres	
Air Draught (T _{AIR}):	not more than 14.0 metres	

"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 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).

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.

2.5 Material of the Structure

2.5.1 The Vessel shall comply with the following:

- (a) **Material of hull structure:** Marine steel [E]
- (b) **Material of superstructure:** Marine steel or marine grade aluminium alloy [E]

2.5.2 The use of marine high tensile steel is not permitted, unless it is agreed by the GNC. In addition, the Contractor shall ensure that the high tensile steel is of a type commonly used in shipbuilding and is freely available in Hong Kong market.

2.6 Propulsion System

2.6.1 The Vessel shall be equipped with the propulsion system as further described in Paragraph 7.2 of this Part VII.

2.6.2 Each of the two or three (2 or 3) units of generators deployed in the proposed propulsion system, including the loitering diesel generator (if fitted), shall meet the IMO Tier II emission requirements with or without NOx after-treatment as specified in Paragraph 7.4.4 of this Part VII.

2.7 Vessel Operating Profile and Environment

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

2.7.2 The Vessel shall comply with the following Operational Hours/Range:

Number of hours per day:	8 hours/day
Number of days per year:	250 days/year
Endurance for fuel capacity:	Each of the methanol–diesel dual-fuel generator sets (i.e. Item 1 in Schedule 6) shall operate for 4 hours in methanol mode and 8 hours in diesel mode within each 12-hour period without refuelling at 100% maximum propulsion motor power. The capacities of each of the methanol storage tank and the diesel fuel tank shall be not less than eight (8) m ³ or the capacity which is necessary to achieve the above operation profile, whichever is the greater. [E]

Total carrying capacity of the Vessel:	Sixteen (16) persons including four (4) crew members and twelve (12) staff.
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2.7.3 The Vessel shall be able to operate safely in weather conditions up to and including the conditions equivalent to WMO Sea State 4 and Beaufort wind scale 5 set out in Annex 8 to this Part VII.**2.7.4** Ambient Conditions - All machinery, equipment and systems shall be capable of operating at their full design performance under the following environmental conditions:

External air	0 to +40°C
Internal air	0 to +20°C
Machinery Space	≤45° C (All equipment at full rated power)
Maximum seawater temperature	+32°C

2.8 Markings and Colour Scheme**2.8.1** The marking and colour scheme for the Vessel shall be in accordance with the requirements given in this Part VII.**2.8.2** The Contractor shall provide the markings and colour scheme for the Vessel, which shall be in accordance with the requirements given in this Part VII. The colour scheme shall be approved by GNC before application. All painting colour scheme for fittings shall be agreed by GNC.**2.8.3** All labelling shall be in both traditional Chinese and English and as per applicable rules and regulations.**2.8.4** The Vessel's name shall be marked permanently and painted on both sides of the deck house and bow and at the transom centre to GNC's satisfaction. Draught marks shall also be marked on both sides of the bow and stern in the same manner as the Vessel name. The full load design draught mark shall be marked port and starboard amidships to the satisfaction of the RO and the GNC.**2.8.5** All labelling, stenciling 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.

- 2.8.6** Exits shall be identified and labelled. Stowage locations for LSA including but not limited to life jackets and quantities of life jackets shall be identified as per the requirements specified under the SOLAS regulations.
- 2.8.7** Fire-fighting equipment to be identified and labelled as per the requirements specified under the SOLAS regulations.
- 2.8.8** Trip hazards aboard the Vessel shall be appropriately marked.

2.9 Tally Plates

2.9.1 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.

2.9.2 Tally plates in both English and traditional Chinese characters shall be fitted for all spaces and equipment as required by the GNC, including but not limited to:

- (a) Equipment contained within consoles;
- (b) Electrical and communication equipment;
- (c) Air vents and filling pipes for fuel 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 warnings and other information as required by the GNC.

- 2.9.3** All cable terminations shall be identified clearly for disconnection and reconnection purposes.
- 2.9.4** Tally plates exposed to the weather shall be made of stainless steel or copper, which is durable and weatherproof and be securely fastened.
- 2.9.5** List of tally plates shall be provided to GNC for approval.

2.10 Other Design Features

- 2.10.1** The berthing requirement of the Vessel shall match with the designated points of berth at the Government Dockyard.
- 2.10.2** A 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.
- 2.10.3** The use of permanent ballasts is not allowed, unless it is agreed by the GNC.

- 2.10.4** 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.
- 2.10.5** The Contractor shall request the RO to carry out the measurement of the Vessel's Gross Tonnage ("GT") and Net Tonnage ("NT"), as defined 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. A statement of compliance for the Vessel stating the measured GT and NT together with the calculation details shall be issued by the RO, and submitted by the Contractor to GNC for records.
- 2.10.6** 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 General Requirements

- 3.1.1** The Vessel shall be designed and built with a mono-hull form and the hull structure shall be constructed of marine steel. The superstructure shall be constructed of either marine steel or marine grade aluminium alloy. All materials shall be new and of a type which has been certified by the RO or other entities acceptable to GNC for shipbuilding purposes. Building processes for construction shall comply with an approved standard. Their selection shall recognize the Vessel through life cycle and service conditions for ease of repair in event of hull damage.
- 3.1.2** The Contractor shall conduct model tests in accordance with the model test plan during the stage as shown in the Implementation Plan in accordance with Annex 11 of this Part VII. The Contractor shall also submit a model test report for the Vessel in compliance with the requirements of Annex 11 and the Procedures and Guidelines of the International Towing Tank Conference ("ITTC") to GNC.
- 3.1.3** Not used
- 3.1.4** The vessel's scantlings calculation shall be approved by the RO.
- 3.1.5** All materials and building 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. All hull construction materials 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 vessel.
- 3.1.7** The Contractor shall carry out quality control throughout the construction of the vessel to the satisfaction of GNC.
- 3.1.8** Strength shall be maintained by ensuring hull structural continuity of main members including bottom girders, 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 the way of fenders and areas likely to experience slamming. (e.g., bow reinforcement near the waterline)
- 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 openings and all penetrations through bulkheads below the main deck shall be recorded, fitted with RO approved devices and be so arranged to ensure the bulkheads are to be entirely watertight and their strength is maintained. All watertight bulkheads shall be permanently marked "WT BHD" in a conspicuous position as agreed by the GNC.
- 3.1.10** The number of openings in watertight bulkheads is to be reduced to the minimum compatible with the design and proper working of the ship. 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. 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. All the typical node drawing and method statement of the watertight bulkhead penetration for piping and cables shall be submitted to RO for approval. Each penetration seal shall pass the inspection conducted by the on-site surveyor of the RO. The Contractor shall list out 100% of the inspection records of each of the penetrations with its inspection date and result to GNC for record purpose. 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.

- 3.1.11** The weathertight deckhouse located above the main deck shall, in their outside boundaries, have means of closing all openings. Such means shall be of sufficient strength and a design to maintain weathertight integrity in all operational conditions and be acceptable to the RO.
- 3.1.12** Any opening in the hull and the deck shall comply with the RO's rules for watertight integrity if not otherwise specified by the GNC at the kick-off meeting.
- 3.1.13** Close attention shall be paid to the fabrication and installation of machinery foundations to ensure rigidity of the foundations and continuity with adjacent structures.
- 3.1.14** The hull structure shall be arranged to accommodate the Vessel's dry docking and lifting requirements in the Government Dockyard in Hong Kong. As specified safety arrangements such as handrail shall be designed and discussed in the kick-off meeting.
- 3.1.15** All welding and fabrication shall be carried out according to the rules of the RO to oversee the construction work, and rules from American Welding Society ("AWS") or other international standards acceptable to the GNC. The welding scheme, including Welding Procedure Specification ("WPS"), shall be approved by the RO and submitted to GNC before work is carried out.
- 3.1.16** Welded joints shall be carefully designed and constructed to conform to the latest established standards as at the Contract Date to prevent fatigue failure. Cutting for edge preparation shall be performed by qualified person(s) to achieve correct angle, shape and smooth finish of the edges. Only qualified welders shall perform the welding work.
- 3.1.17** Certification of the qualifications of each individual welder and inspector shall be submitted to the GNC by the Contractor before the work is carried out. Welds carried out to procedures without approval or by non-certified welders shall be removed and rectified by the Contractor at the Contractor's expense.
- 3.1.18** The structural fabrication information listed below (but not limited to for the purpose) are required to be recorded by the Contractor and submitted to GNC before commencing fabrication:
 - (a) Inventory of incoming materials, consumables, components and machinery;
 - (b) Traceability procedures for materials together with traceability identification codes which shall be in serial and indexed to the controlled manufacturing procedures;
 - (c) Lofting, cutting, fitting, welding, forming and dimensions of structural components. Measures shall be taken to avoid deformation of structure during fabrication and welding;
 - (d) The Contractor shall produce a welding and inspection plan, including Welding Procedure

Specification (“WPS”), clearly identifying the procedures to be used as well as the type and extent of the inspection to be carried out on the Vessels’ structure and this plan shall be approved by the RO. The plan shall include:

- (i) A full length visual inspection of every weld. Additionally, radiographic testing (“RT”) is to be carried out on butt welds with the number of radiographs taken being not less than the length of the vessel’s hull structure in metres (e.g. for a hull length measuring 19.1 metres, 20 radiographs will be taken). The location of these radiographs shall be determined by the RO with the agreement from the Government’s officers or representatives. Alternatively, suitable Ultrasonic Test (“UT”) can be proposed by the Contractor subject to the agreement of RO and the Government’s officers or representatives; and
- (ii) Additionally, personnel conducting the Non-Destructive Test (“NDT”) testing, interpreting and evaluating the results of the tests shall be certified to at least Level II of the American Society for Nondestructive Testing (“ASNT”) or an equivalent recognized by the RO. The NDT reports shall be submitted to GNC for record. The details shall be discussed in the kick-off meeting. Records of maintenance and calibration of the welding, machining, measuring and inspection equipment.
- (e) Welding, machining, measuring and inspection equipment maintenance and calibration;
- (f) Machining, finish surfaces and bolting;
- (g) Procedures for work quality non-conformance reporting and records of rectification of defects; and
- (h) The design and manufacturing drawing control procedures, including any of its revisions and updates and records for any re-issue of drawings.

3.2 Hull and Deckhouse Structure

3.2.1 When the double bottom is relevant, it is to be accessible by a worker and a supervisor. Safe access to the enclosed space shall be ensured. The double bottom is to be painted in accordance with PSPC (Performance Standard for Protective Coatings) requirements.

3.2.2 General Workmanship

- (a) Trunks, coamings and openings where applicable shall have radius corners as large as possible.
- (b) Fittings and openings through decks, tank tops and bulkheads for pipes and cables shall be properly designed to maintain watertight integrity, reduce transmission of heat, and to minimize transfer of machinery vibration and noise to the hull structure.
- (c) Drain holes and air holes shall be provided as necessary to ensure proper venting and drainage of all tanks, compartments, pockets, and voids. All tanks shall have drain holes and air holes of adequate size for full capacity flow to suction and vent lines. There shall be no pockets where water 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 and underdeck compartments shall be tested for watertightness by pressurizing to a

head of water in accordance with the RO requirements. Hydrostatic testing is preferred. If pressurized by air, all fittings and welds shall be checked by application of a soapy 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 weathertightness of any fittings on the weather deck and deckhouse shall be demonstrated by directing a water stream from a 12 mm diameter nozzle at an output pressure of 2 bar, from a distance not exceeding 1.5 m from the fitting perpendicular to the surface, at all parts of the exterior including all windows, doors and hatches. Any leakage detected shall constitute a failure of the test and corrective action(s) followed by re-test(s) shall be performed, or fulfilling applicable requirements of the RO. Vacuum test pressure shall be not more than 0.2 bar.
- (c) Chalk tests shall be carried out if the above two methods are not practicable. Prior agreement shall be obtained from the RO and the GNC.
- (d) All structures and fittings shall withstand the tests described above as applicable.

3.2.4 Fairing

The hull, decks, and deckhouse side wall shall be fair, and shall be free from buckles or uneven edges. Special care shall be taken when aligning and fairing surfaces which are to be joined.

3.2.5 Decks, Platforms, Flats and Stiffness

- (a) All decks, platforms and passages shall be sufficiently reinforced to prevent deflection that might be caused by service load, an individual walking or standing on the deck and/or 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 open deck area except for areas in deckhouse shall have a camber at 1/50~1/80 of the beam of the deck edge and may slope up towards the bow at the forward part.
- (c) Adequately secured gratings shall be provided as required and to the GNC's satisfaction. Removable gratings shall be provided where access to valves, equipment, bilge pickups, and to other systems are required.

3.2.6 Penetration of Hull Fittings

- (a) Penetration of hull fittings, which are required for equipment in this Part VII, shall be located in convenient locations for maintenance purposes. The number of penetration fittings shall be kept to a minimum.
- (b) All penetrations of hull fittings located below the waterline shall be fitted with shut-off valves fabricated of metal and having suitable corrosion protection, such as cathodic protection. All shut-off valves shall be of a type approved by the RO.
- (c) Where penetrations of hull fittings are located below the waterline, the hull external surface shall be fitted with fairings/screens to minimize the drag.

3.2.7 Hull Structural Closures

- (a) Inspection cover(s) shall be provided for each fuel oil tank. The inspection cover(s) shall be sized to allow for proper inspection of the entire tank interior. A suitable non-leaking gasket is to be fitted between the tank and the cover in consideration of the chemical reaction/weakening. The cover is to be bolted to the tank using stainless steel bolts and self-locking nuts. The arrangement is to be installed to the satisfaction of the RO and the GNC.

- (b) The arrangement of the deck hatches shall be submitted to the RO and the GNC, in advance, for acceptance.
- (c) Access to underdeck compartments from the main deck shall be provided by watertight or weathertight deck hatches.
- (d) Flush watertight deck hatches on the open deck shall be installed for the access to fore peak tank / Machinery Space from main deck.
- (e) 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 doors, they shall be opened outward except those in high flooding risk spaces where they shall be opened into the space.
- (f) All access openings shall be able to be opened and closed at both sides. All watertight doors provided shall be RO approved type. The warning “Door must be kept closed when underway” shall be marked on both sides of the watertight door and all watertight doors shall be fitted with visual and audible alarms in the wheelhouse to give alerts when watertight doors are opened.

3.2.8 Deckhouse Closures

- (a) Weathertight doors are to be provided for access into the deckhouse. Entrances shall be made from port, starboard, front and rear sides with a minimum clear opening to the satisfaction of GNC. The weathertight doors are to be RO approved.
- (b) Doors giving access to the deckhouse shall have a coaming above the finished main deck surface as per the RO’s requirement.
- (c) Appropriate locking mechanisms/methods shall be provided for all access doors.
- (d) The deckhouse shall be designed to facilitate the removal of engines from the engine room to the shore for maintenance and repair. Openings in the deck and closing hatches shall not affect the structural strength of the deck structure when opened. Engine access covers shall be installed on the port side and starboard side of the deck respectively, if possible. The Contractor shall submit the instruction of the removal of engines for discussion in kick-off meeting and for GNC approval.
- (e) All doors in the deckhouse shall have clear, toughened and laminated safety glass fitted and RO approved. All windows in the deckhouse shall be toughened and laminated safety glass and RO approved.

3.3 Stability

- 3.3.1** The preliminary lines plan (“Preliminary Lines Plan”) as well as an offset table (“Offset Table”) for the Vessel and the preliminary stability information, including intact and damaged stability calculations as stated in Paragraphs 3.3.10 and 3.3.11 shall be submitted with the tender in Schedule 7 of Part V. The damaged stability calculation shall be based on the single compartment damaged with reference to the damage scenario of each compartment of the Vessel. The calculations shall take into account the applicable wind force as noted in Paragraph 3.3.6 of Part VII. All calculations and drawings must be in metric units.
- 3.3.2** The Vessel shall comply with the intact and damaged stability requirements stated in Paragraphs 3.3.10 and 3.3.11 of this Part VII as well as with applicable RO requirements.
- 3.3.3** A final stability assessment of the sea trial loading condition using final lightship data shall be

approved by the RO before being delivered to GNC prior to the Official Speed Trial mentioned in Paragraph 1.8.5 of this Part VII.

3.3.4 Inclining Experiment

- (a) An inclining experiment shall be carried out to determine the lightship displacement and position of the centre of gravity of the Vessel, in accordance with Part B Chapter 8 and Annex 1 of the International Code on Intact Stability, 2008 (2008 IS Code) 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.
- (b) At least fifteen (15) working days in advance of the inclining experiment, The Contractor shall submit a "Scheme of Inclining Experiment" which includes:
 - (i) The proposed date, time, and place for the inclining experiment;
 - (ii) The anticipated water depth at the time of the inclining experiment;
 - (iii) A recent photograph of the site of the inclining experiment;
 - (iv) A recent photograph of the Vessel to be inclined. That includes its external view and hull superstructures and main deck situation;
 - (v) The name of the RO representative and the name of the Contractor's representative who will attend and be responsible for the inclining experiment;
 - (vi) The Vessel's intended loading condition with a comprehensive list covering all items with the corresponding weight and centre of gravity locations, which may affect the Vessel's recorded lightship including items stipulated in Paragraph 3.3.4 (b) (vii) and (viii) in this Part VII;
 - (vii) Items which are not fitted onboard, on the date of the experiment, but should be included in the Vessel's lightship;
 - (viii) Items which are fitted onboard, on the date of the experiment, but should not be included in the Vessel's lightship;
 - (ix) The proposed initial locations and the subsequent movements of the inclining weights;
 - (x) The calculation of the estimated heel of the Vessel before and during the inclining experiment;
 - (xi) 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);
 - (xii) Hydrostatic table and tank capacity tables. The increment of draft shall be every 100 mm in the hydrostatic table and the increment of sounding shall be every 5 mm in the tank capacity tables;
 - (xiii) The list of data to be measured (i.e. drafts, specific gravity of floating water, etc.) in accordance with IMO requirements;
 - (xiv) The lightship weight, centers of gravity, the draft, trim and the metacentric heights of the Vessel after each and every shift of inclining weight shall be determined in accordance with IMO requirements applicable to the Vessel; and
 - (xv) The Contractor shall demonstrate the condition for the inclining experiment is stable and safe.
- (c) The inclining experiment shall only be conducted:
 - (i) After the "Scheme of Inclining Experiment" has been approved by the RO and GNC; and

- (ii) In the presence of the RO and GNC and/or appointed consultant. A request for attendance shall be made at least five (5) working days in advance. The lightship weight and centre of gravity shall be calculated and presented in the inclining experiment report.
- (iii) All spaces and tanks should be kept dry, or tanks being pressed up with the intended liquid. The free surface of liquids remaining onboard shall be minimised and taken into account.
- (d) For the avoidance of doubt, if there is any liquid on board, the worst possible free surface effects of all liquids on board shall be taken into account in all calculations;
- (e) The PRELIMINARY Inclining Experiment Report shall be submitted to the RO and GNC not later than fourteen (14) working days before the Official Sea Trials. This shall include a statement from the Contractor stating that the Vessel is safe to go to sea for the intended tests and trials specified in the Contract;
- (f) The FINAL Inclining Experiment Report shall be approved by the RO before submitting to GNC for further comments and acceptance.
- (g) In addition to the above the requirements for conducting and reporting the Inclining Experiment, the Stability Information Booklet shall also follow any specific requirements given in this Part VII.

3.3.5 Intact and Damage Stability Information Booklet

The Vessel shall comply with stability criteria mentioned in this Part VII and other applicable IMO regulations. Furthermore, intact stability due to wind and ship rolling for the required service environment of the Vessel shall be calculated.

In addition to the requirements stated above, the booklet in its final version shall include:

- (a) The Vessel's particulars, general arrangement drawing showing all compartments and tank positions, hydrostatic curves (or in table form) and cross curves (or in table form);
- (b) Tank calibration/ sounding tables including but not limited to fuel tank, freshwater tank, black water tank and oily bilge water 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, draughts, trim, VCG, GM (solid and fluid), TCG, LCG, down-flooding angle, maximum static stability - GZ curves and values of the stability criteria; and
- (d) Any other information as reasonably required by the RO and/or GNC, and the Inclining Experiment Report approved by the RO.

3.3.6 In the preliminary and final stability calculations, the estimated and final (obtained after conducting the inclining experiment) lightship data shall be used respectively. Both the preliminary and final stability information booklets shall include the following loading conditions under different scenarios as mentioned in the table below for the intact and damage stability calculations and any other loading conditions as may be required by GNC for the purpose of such operation:

Case	Loading Conditions	Fuel Oil (%)	Fresh Water (%)	Black Water (%)	Oily Water (%)	Dirty Methanol (%)	Crew (No. of)	Staff (No. of)	Stores/ Utilities (Kg)	Beaufort Scale (for intact stability calculation only)
1	Lightship	0	0	0	0	0	0	0	0	5
2	Full Load Departure	95	95	10	10	0	4	12	800	5
3	Full Load Arrival	10	10	100	100	0	4	12	800	5
4	Light Load Departure	50	50	10	10	0	4	0	800	5
5	Light Load Arrival	10	10	100	100	0	4	0	800	5
6	Sea Trials	95	95	10	10	0	4	12	0	3

The following notes from (a) to (g) shall be applied to the appropriate loading conditions in the intact and damage stability calculations:

- (a) The maximum free surface moment shall be used for calculating the stability of the Vessel in all the above conditions.
- (b) Weight of each person is assumed to be 75 kg with each crew carrying personal effects of 20 kg.
- (c) VCG of each person, while standing, shall be assumed to be 1000 mm above the deck where they are likely to be situated. LCG of each person shall be in their most likely position onboard. The likely positions of these persons shall also be agreed by GNC.
- (d) 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
- (e) The effect of wind moments in various loading conditions due to Beaufort Scale number not less than 5 at beam shall be calculated and duly considered in the stability calculations of all the above stated conditions, to the satisfaction of GNC.
- (f) The final stability booklet shall be approved by the RO before submission to GNC for further comments. The Contractor shall supply four (4) copies of the stability information booklet (as built) to the GNC at Delivery Acceptance.
- (g) GNC is the ultimate body to give the final acceptance of the Stability Information Booklet and the Inclining Experiment Report.

3.3.7 The Preliminary Stability Information Booklet based on the estimated position of centre of gravity (“CG”) of the Vessel shall be submitted to GNC during the design stage and within two (2) months after the Contract Date to show that the Vessel can fulfill the TS required stability as well as any other stability requirements considered necessary by GNC, during the design and construction stage.

3.3.8 The Vessel must not carry any operational limitations with respect to its stability capability within the operational requirements stipulated in the TS.

3.3.9 The Official Sea Trial shall only be carried out after the results of the inclining experiment show the Vessel’s actual position of centre of gravity 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.

3.3.10 Intact Stability Criteria

The Vessel shall be considered satisfactory if either the following (a) or (b) shall be complied, [E]

- (a) 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) in the version as at the Contract Date; [E]

OR

- (b) The Vessel shall comply fully with related rules and regulations in stability requirements of the RO based on the version as at the Contract Date. [E]

3.3.11 Damaged Stability Criteria

- (a) The Vessel shall comply fully with the damaged stability criteria stipulated in Chapter 12 of The WorkBoat code from Maritime & Coastguard Agency in UK (including the compliance of Option 1 in 12B.1.2, and taking into account of free surface effects) in the version as at the Contract Date. [E]
- (b) For the purpose of making damage stability calculations, the volume and surface permeability shall comply with the requirements of RO and/or the WorkBoat code.
- (c) 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.
- (d) 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 Part VII.
- (e) The residual stability of the Vessel shall be complied with The WorkBoat code not limited to the following criteria, after taking into account of free surface effects, for loading conditions as specified above.
 - (i) The angle of equilibrium does not exceed 7 degrees from the upright.
 - (ii) The resulting righting lever curve has a range to the downflooding angle of at least 15 degrees beyond the angle of equilibrium.
 - (iii) The maximum righting lever within that range is not less than 100mm.
 - (iv) The area under the curve is not less than 0.015 metre radians.
 - (v) This damage should not cause the vessel to float at a waterline less than 75mm from the weatherdeck at any point.
- (f) 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.
- (g) The damage stability calculation shall be produced and has obtained the approval from RO or individual verified/certified body acceptable to GNC before submitting to GNC for further comments.

3.4 Cathodic Protection and Painting

- 3.4.1** Paint shall be used on surfaces and any parts of the hull, deck, machinery and fittings as directed by the GNC and shall not have adverse effects on the environment and/or health of persons onboard.

- 3.4.2** The volatile organic compound (“VOC”) content limits of the paints shall comply with the Hong Kong Air Pollution Control (Volatile Organic Compounds) Regulations Cap.311W.
- 3.4.3** Paints in fire risk area shall be of a fire-retardant marine quality and be applied in accordance with the manufacturer’s specification.
- 3.4.4** Exterior surfaces of the Vessel above the fully loaded draught mark shall be prepared and painted to a satin finish/appearance/texture.
- 3.4.5** Silicon Based Anti-fouling shall be applied on the exterior of the hull below the waterline to provide at least two (2) years’ protection against marine growth. Tributyltin (TBT) and Cybutryne shall not be contained in this paint. 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 shall comply with the International Convention on the Control of Harmful Anti-Fouling Systems on Ships 2001.
- 3.4.6** The Painting Schedule shall be submitted for the approval of the GNC before commencement of work. The proposal shall contain a list and the detailed specification of the paint intended to be used. The thickness of each coating shall be specified.
- 3.4.7** The Contractor shall guarantee all painting work for two (2) years against defects in materials and workmanship. At Delivery Acceptance the Contractor shall provide GNC with a letter of certification from the paint manufacturer signed by qualified coating inspectors to certify that the paint has been applied under the paint manufacturer’s quality control and in accordance with the manufacturer’s requirements including but not limited to the surface preparation, surface temperature of the metal surfaces above dew point, atmospheric conditions (temperature and relative humidity), dry film thickness and method of application.
- 3.4.8** All steel walls and floor plates shall be degreased, and sand blasted to Sa 2.5 and cleaned before painting. All aluminium alloy walls and floor plates shall be degreased and cleaned before painting. The surface treatment and coating application shall follow the manufacturer’s recommendation. A painting schedule shall be proposed by the Contractor, in consultation with the paint suppliers/ manufacturers, and submitted to the GNC for approval.
- 3.4.9** All deck areas shall be covered with hard wearing and anti-slip epoxy paint. The anti-slip paint shall be to the GNC's satisfaction.
- 3.4.10** Surfaces that require painting shall be fully prepared and pre-drilled prior to painting.
- 3.4.11** All fastening preparation and other penetrations shall be completed before painting of any surface.
- 3.4.12** A painting report shall be submitted to the GNC upon completion of work.
- 3.4.13** The steel hull, shaft brackets, propellers, tail shafts and stern tubes underwater shall be protected by a cathodic protection system for at least one (1) year from the date of Delivery Acceptance.
- 3.4.14** No toxic substances are to be released from sacrificial anodes.
- 3.4.15** An effective shaft earthing system shall be provided to protect the shaft lines, bearings and propellers.

Chapter 4 General Arrangement

4.1 General Provision

4.1.1 Unless otherwise specified in this Part VII, the Conceptual General Arrangement Plan given in Annex 10 of this Part VII only serves as a reference. It is a reference drawing to help to explain the Tender requirements. This Conceptual General Arrangement Plan shows a reference layout of the accommodation and compartment arrangement of the Vessel with the following maximum/minimum dimensional guidance considered:

Main Deck side walkway width	Minimum 600mm
Clear headroom (Throughout Vessel)	Minimum 2000 mm

4.1.2 The Vessel shall be designed and constructed to be capable of carrying all crew and staff of the following:

Number of crew:	4	[E]
Number of staff (other than crew):	12	[E]

4.1.3 The Tenderer shall submit the Preliminary General Arrangement Plan in Schedule 7 of Part V for Government considerations at the tendering stage. During the design and construction of the Vessel, the Contractor shall submit a detailed General Arrangement Plan for GNC's approval and acceptance.

4.1.4 It is a contractual requirement that all furniture, equipment and facilities, fixtures and fittings, including outfitting of the Vessel that are described in this Part VII, together with their requirements for design and installation standards that are stipulated in this Part VII shall be included in the complete "As-built" Vessel delivered to the Government.

4.1.5 The Tenderer should note that the requirements given in this Part VII (the TS) are in addition to the RO requirements and IMO requirements and shall be met by the design and construction of the Vessel.

4.1.6 Subject to full compliance with the requirements of stability and subdivision, the underdeck area shall be divided by transverse watertight bulkheads into different compartments. It can be divided as follows subject to individual design:

- (a) Fore Peak Tank and Chain Locker;
- (b) Nitrogen Generator Room;
- (c) Engine Room;
- (d) Void Room;
- (e) Fuel Preparation Room; and
- (f) Steering Gear Room.

4.1.7 The vessel shall have two deckhouses: a forward deckhouse and an aft deckhouse. The forward deckhouse shall consist of two tiers, while the aft deckhouse shall be a single tier.

4.1.8 The lower tier of forward deckhouse shall comprise of the following:

- (a) Day Room; and
- (b) Main Switchboard Station ("MSBS");

4.1.9 The upper tier of forward deckhouse shall comprise of the following:

- (a) Wheelhouse.

4.1.10 The aft deckhouse shall comprise of the following:

- (a) Airlock Spaces;
- (b) CO₂ Room;
- (c) Foam Proportioner Store Room (“FPSR”); and
- (d) Store Room.

4.1.11 External deck spaces shall include:

- (a) Flat bow and aft main deck areas for efficient mooring operations and for towing twelve (12) tons of light buoy and for towing the Ancillary Boat required under Paragraph 4.17;
- (b) The walking area on deck between the forward and aft deckhouses shall be easily accessible and free from obstructions. The walkways on the deck should be well illuminated for dark environments and night operations. Illumination lights should not obstruct the movement of personnel.
- (c) Life rails shall be installed along all boundaries whenever there is a danger of personnel falling overboard. Railings and handrails shall be provided where necessary. Handrails shall be positioned internally and externally throughout the Vessel to GNC’s satisfaction. Railings and handrails shall be made of aluminium alloy/marine grade stainless steel 316 or other appropriate non-corroding material.
- (d) Openings in railings and easy removable stanchions shall be provided at the embarkation locations and area around the Ancillary Boat. These openings shall have braced stanchions on either side and shall be closed with three tiers of stainless steel 316L chain fastened with quick release closures.
- (e) Railing doors or other methods approved by GNC shall be fitted in the bow area and both of the ship side to facilitate the safe embarkation and disembarkation.
- (f) All railings and handrails shall be secured to provide support for persons on board, to prevent them from falling on to or being thrown on to the deck or overboard in adverse weather and sea conditions. The design shall consider the circumstances when persons on board are lined up together on one side of the deck in case of an emergency at sea.
- (g) Embarkation area around the Ancillary Boat shall be designed to facilitate the operation and access of staff through the ship side ladder.
- (h) Movable guardrails and stanchions shall be installed at the walkways of vessels during docking period to prevent people from falling from heights.

4.1.12 All interior decks shall be covered by non-slip vinyl composition sheet. Colour to be approved by GNC.

4.1.13 All controls, electrical equipment, high-temperature parts and pipelines, rotating assemblies or any other items in cabins and compartments shall be properly placed, protected and/or insulated to maintain comfort and reduce the risk of injury.

4.1.14 Windows and Visibility

- (a) Throughout the Vessel, polarized and tinted windows shall not be fitted.
- (b) 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.

- (c) 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.
- (d) All windows shall be fitted with retractable tinted solar UV roller blinds with RO type-approval to reduce glare. The blinds shall be capable of being retained in position either partially lowered or fully lowered, without swinging due to vessel motions at sea.
- (e) All windows of the day room shall be fitted with curtain.
- (f) 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. Weathertight test shall be carried out after windows installation.
- (g) Wheelhouse window frames/mullions shall be kept to a minimum (including the width of frame pillar), whilst maintaining required structural strength and stiffness in accordance with RO Requirements. They should not be installed directly in front of any navigation seats. The positions of window frames shall be agreed by GNC before installation.
- (h) 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°. All wheelhouse windows shall be equipped with electric heaters to prevent condensation.
- (i) 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.
- (j) Two (2) wheelhouse windows on each side of the vessel shall be able to be opened from inside to a clear opening size which would let an adult swim through. They shall be located within reaching distance of the lookout and launch commander; and.
- (k) Sufficient safety glass breaker hammers shall be provided. They shall be located next to each set of windows in wheelhouse, for use in an emergency.
- (l) The following outfitting items shall be provided:
 - (i) Heavy-duty marine type wide span and large area electric wiper(s) (covering not less than 60% of the window glass plane area) to sweep a minimum of 60% of the clear area of the window to which they are mounted, with fresh water window washing systems shall be fitted to all deckhouse front;
 - (ii) 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;
 - (iii) Each wiper of wheelhouse shall be operated and adjusted from independent control circuit. Power switch shall be provided in each wheelhouse's wiper power circuit for isolating faulty wiper from power trip. All the wipers of wheelhouse shall be operated independently;
 - (iv) 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;
 - (v) The wiper system shall be powered up by 220VAC and 24VDC power supply and be able to maintain wiper system operation in case of blackout. Each wiper motor can be accessible for maintenance inside wheelhouse as far as practicable;
 - (vi) Two (2) sets of spare wiper blades shall be provided for each window wiper installed

on the Vessel;

- (vii) An all-round de-misting system shall be provided for all wheelhouse windows at the interior side of the windows; and
- (viii) A glass electric heater system shall be provided for front side and both sides of the wheelhouse fixed windows. Each windows glass electric heater shall be operated and adjusted from independent control circuit.
- (m) 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 shall be paid to the blind sector caused by arrangements on the deck outside of the wheelhouse forward. 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.
- (n) Side mirrors and CCTV shall be provided at locations to allow the coxswain to monitor and safely manoeuvre the vessel to a berth.
- (o) At all times regardless of the weather and sea conditions at least two-thirds 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.

4.1.15 Lighting

- (a) Natural light shall be allowed as far as possible in the deckhouse and wheelhouse;
- (b) The lighting shall consist of fixtures installed throughout the Vessel for general illumination;
- (c) Lighting distribution in any compartment which has multiple power sources shall be arranged such that the failure of one circuit does not leave any area without light;
- (d) Unless otherwise specified, LED fixtures shall be used for interior lighting. If a compartment has both normal and emergency lighting requirements, every effort shall be made to combine functions and minimise the number of fixtures required;
- (e) Overhead lighting fixtures shall be installed to provide uniform illumination throughout a compartment without contrasting light and dark areas. In arranging fixtures to provide a uniform level of illumination, they shall be spaced to provide maximum illumination on working surfaces. Lighting shall be arranged to avoid shadows cast on working surfaces by stationary obstructions or by personnel as they perform their normal duties in that compartment. Emergency lighting shall consist of lighting fixtures dedicated to provide the vessel with reduced general illumination during loss of ship service power. The primary source of power for emergency lighting shall be from the ship emergency battery system. Details can be referred in Chapter 8 of this Part VII;
- (f) Emergency egress routes shall be lit by emergency lighting and include egress route labelling to ensure that they are visible during low light or smoke conditions;
- (g) A suitable degree of flexibility within the lighting system shall be available to enable the operating personnel to adjust lighting intensity and direction in different areas of the compartment, and such arrangements shall also be available for individual instruments and controls;
- (h) Exterior lighting fixtures shall be installed to illuminate the weather decks, ladders, walkways, obstructions such as windlass, low or narrow passageways, and changes in deck level;
- (i) Where operations at night are required, the area floodlighting with emergency back-up power

shall be provided. The floodlighting arrangement shall ensure that shadows are kept to a minimum; and

- (j) All lighting fixtures installed in hazardous area zones must be explosion-proof and comply with RO requirements, as well as the provisions referred in Chapter 12 of this Part VII.

4.1.16 Furniture and Fittings

- (a) Built-in furniture shall be adequately secured against ship impacts in case of ship collision or bad weather and sea conditions. All seats shall be secured against 45 degrees of inclination in all directions when all seats are occupied by seated persons. All furniture and seats shall be lightweight, tough and robust. Upholstery such as seat cushions, back rests and settees shall be fire-resistant e.g. urethane foam to BS3379 or equivalent, and to be of a thickness of not less than 100 mm and be covered with leather or leather substitute material;
- (b) Lockers shall be provided with built-in locks and three (3) sets of keys with proper labels in cabins and other locations. They shall be designed and fitted to the satisfaction of the GNC.
- (c) Drawers shall be provided for storage of charts.
- (d) All hardware including screws, hooks, hasps, hinges, handles and sliding bolts shall be made of brass with chrome-plated finish or in stainless steel. Hardware used outdoors shall be made of 316L stainless steel.
- (e) All fittings and hardware fitted onboard the Vessel (e.g. coat hooks, ceiling lights, bulkhead mounted lights) shall be of a high-quality 316L stainless steel or other metals with chrome finish provided that galvanic corrosion due to contact of dissimilar metals is not allowed. They shall be properly fitted in all spaces as directed by the GNC.
- (f) Colour and decoration schemes (or a furnishing sample board showing materials and colour to be used) for furniture and fittings shall be submitted to the GNC for approval before installation/ fitting.
- (g) All furniture shall be fitted as to allow for removal of the underdeck machinery and tanks.
- (h) Grab rails are to be positioned internally and externally as deemed necessary for the Vessel to the GNC's satisfaction.

4.1.17 Insulation and Lining

- (a) Insulation:
 - (i) Boundaries and ceilings around the inside of the deckhouse shall be insulated against heat and sound, to be fitted with non-hazardous insulation which is not controlled under Appendixes 1 and 2 of the Hong Kong International Convention of appropriate thickness (minimum 50 mm) or equal and be lined with protective/ decorative panel linings with a hard-wearing surface and sealed against water ingress;
 - (ii) The engine room and machinery space(s) shall be effectively protected from fire and sound insulated with asbestos-free materials of adequate thickness, pinned and wire-mesh secured, and lined with incombustible sheathing in accordance with IMO and RO Requirements and acceptable to the GNC; and
 - (iii) The noise level in the wheelhouse and crew space shall not exceed 85 dB(A) when the Vessel is operating at all speeds. The Contractor shall make all reasonable efforts to minimise noise and vibration in the Vessel.
- (b) Lining:

- (i) Panels for walls, ceilings 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 shall withstand temperature changes and wear and tear within the life expectancy of the Vessel. 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. If the noise level is considered unacceptable to GNC, the Contractor shall improve the design and fitting methods of the panel/ceilings. The colour of the lining material shall also be agreed by GNC.
- (ii) The deck or floor of the wheelhouse and crew space shall be covered with non-skid, wear-resistant and fire-retardant vinyl sheets that are acceptable to GNC. The colour of the floor covering shall be agreed by GNC.

4.1.18 Access, Doors, Ladders and Hatches:

- (a) All outfitting including, but not limited to, doors, hatches, ladders, ventilation heads, shall be type approved by the RO for this type of Vessel. These shall require GNC acceptance and approval before installation;
- (b) Detailed specifications of these items shall be provided by the Contractor to the GNC. These shall include the structural arrangement, scantlings, material and welding procedures. These shall be in accordance with RO Requirements or other international standards acceptable to the GNC.
- (c) Ladder/stair rungs and steps shall be of an anti-slip type and be acceptable to GNC.
- (d) Flush RO type approved watertight manhole covers shall be used where necessary.
- (e) Where the covers and doors are used for the purpose of escape, they shall be fitted with manual means of locking; and shall be able to be quickly opened from both inside and outside of the compartment. All covers and doors shall be fitted with a retaining device. Hatches/ covers for access to the watertight compartments below the main deck level shall be type approved by the RO. Watertight and weathertight hatches shall be of a hinged type as far as practicable.
- (f) All door openings to the main deck shall be RO type approved, outwardly opening weathertight type. All doors shall be fitted with hooks or other means to hold them in the fully open position.
- (g) Exterior side deck doors (if have) shall be hinged on the forward edge. If the door is accidentally left open, it will be naturally closed as the Vessel manoeuvres forward in accordance with RO requirements;
- (h) All exterior doors shall be fitted with high quality 316L stainless steel or bronze 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 be keyed alike.
- (i) All watertight doors, if fitted, shall be equipped with self-closing devices, and doors fitted with such devices shall be RO type approved. Meanwhile, these doors shall be provided with alarm devices that will sound an alarm if left unclosed for an extended period.
- (j) Stairway slopes shall be acceptable to the GNC and shall be fitted with handrails on each side. A minimum width of 600 mm shall be provided between handrails.
- (k) Exterior handrails shall be constructed of aluminium or stainless steel, painted and strongly secured to the perimeter of the upper deck and main deck to provide support for persons

onboard, to prevent them from falling or being thrown on deck or overboard in heavy weather and sea conditions. The design shall consider the circumstances when all persons onboard are lined up together on one (1) side of the deck in case of an emergency situation at sea.

- (l) Vertical ladders, if provided, shall be fixed to the structure. The width of ladders between stringers shall not be less than 400 mm. The treads shall be equally spaced at a distance apart, measured vertically between 250 mm and 300 mm.
- (m) The Engine Room and the crew space, including day room and other underdeck compartments, shall be provided with two (2) separate means of access and escape. If providing two (2) separate means of access and escape is not feasible, such arrangements shall require approval by the RO and acceptance by GNC.

4.1.19 Ventilation:

- (a) The requirements for ventilators and the ventilation system shall comply with RO Requirements;
- (b) The Wheelhouse and crew spaces shall be protected from gas or vapour fumes from machinery, engine exhaust gas and smells from the fuel system (both diesel and methanol);
- (c) The toilets shall be fitted with an exhaust fan with a capacity of not less than 36 air changes per hour; and a louver at the lower portion of the toilet doors shall be provided. There shall be covers for exhaust fans capable of being closed to prevent rainwater and seawater spray ingress;
- (d) Air pipes shall be fitted to all tanks, void spaces, and all spaces and compartments which are not fitted with other types of ventilation arrangements. All air pipes shall be fitted with automatic closure devices to RO's requirement;
- (e) The lower edge of openings in exterior air pipes and trunks shall be set at a minimum clearance above the main deck which shall comply with RO requirements;
- (f) All ventilators shall be provided with weathertight covers;
- (g) Mechanical ventilation for all the compartments in the Vessel shall be provided; and
- (h) All electric equipment installed in hazardous area zones must be explosion-proof and comply with RO requirements, as well as the provisions referred in Chapter 12 of this Part VII.

4.1.20 Equipment fixtures and fittings on board shall be fitted properly to avoid injury to persons at all times either during normal or failure-mode operation, especially when the Vessel moves off quickly or during emergency crash stops, and during ship manoeuvres.

4.1.21 A general emergency visual and audible alarm system shall be provided for the Vessel. The alarms shall be audible throughout the vessel and the sound pressure level shall be at least 15 dB(A) above the ambient noise levels anywhere in the Vessel and its spaces and compartments when the Vessel is in its normal operational conditions. The alarm shall continue to function after it is triggered until it is turned off or is temporarily interrupted by a voice message on the public address system.

4.1.22 A public address system shall be installed covering all areas and spaces of the Vessel, including escape routes where the crew have accessed. The system shall be installed in such a way that it would not be rendered inoperable in the initial stages of flooding or fire in a compartment.

4.2 Wheelhouse

4.2.1 The wheelhouse shall be located on the upper tier of the forward deckhouse and shall have sufficient headroom to the satisfaction of GNC. Access shall be provided via an internal stairway, fitted with

red lights for night-time operation. Additionally, an external stairway shall be installed between the vessel's bow area and the wheelhouse. The Contractor shall supply a 3D computer model of the vessel's interior for review by GNC within two (2) months of the Contract Date. The model shall be provided in a format acceptable to GNC, with no paid license required. Upon review and approval in principle by GNC, the Contractor shall proceed to construct and conduct a mock-up inspection of the wheelhouse, including equipment arrangements, seating, and other fittings as required under this Part VII. The mock-up shall be inspected and approved by GNC prior to finalizing the design. General Arrangement Plan in Annex 10 of this Part VII shall be referred to.

4.2.2 The outside configuration of the wheelhouse shall be of a design that reduces air resistance, to deflect rain and seawater during heavy weather; and to provide practically all-round visibility at the steering/helm position of the console area. Pillars shall not be fitted inside the wheelhouse to avoid obstructing the visibility and CCTV coverage. The wheelhouse layout plan shall be submitted for GNC approval.

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

4.2.4 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.

4.2.5 Wheelhouse Seats:

(a) Three (3) marine-type duty pedestal seats, each equipped with hydraulic or mechanical damping systems, armrests, and safety belts, shall be provided for the three (3) crew members. Additionally, one (1) classic foldable seat with a folding backrest shall be installed in the wheelhouse to accommodate an additional lookout crew member.

(b) The requirements of the marine-type duty pedestal seats are listed as the followings:

- (i) Materials of the structure: stainless steel and/or aluminium alloy;
- (ii) Materials of upholstery: heavy duty vinyl or leather;
- (iii) Height, direction and fore and aft positions of these seats shall be adjustable and suitable for a person of Asian stature;
- (iv) The seats shall have high density foam cushions, adjustable back rest, folding arms, lumbar support and adjustable footrest;
- (v) Suspension seats with multi-level adjustable dampers which provide progressive damping, and allow vertical and longitudinal adjustments; and
- (vi) Shall be a proprietary-made product.

4.2.6 Controls for the steering and coxswain controls 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.

4.2.7 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.

4.2.8 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.

4.2.9 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;
- (b) Propulsion electric motor speed and clutch controls;
- (c) Rudder or steering angle indicators;
- (d) Loudhailer/Siren and public address system with USB player;
- (e) Magnetic compass;
- (f) Fluxgate gyrocompass;
- (g) Differential global positioning system ("DGPS");
- (h) BeiDou Navigation System;
- (i) Real-Time Kinematic ("RTK");
- (j) Automatic Identification System ("AIS") Transponder;
- (k) Marine radar (x-band) for navigation;
- (l) Electronic Chart Display and Information System ("ECDIS");
- (m) International Maritime Mobile ("IMM") Very High Frequency ("VHF") radio with Global Maritime Distress and Safety System ("GMDSS");
- (n) Electric horn conforming to IMO requirement;
- (o) CCTV system;
- (p) Windshield Wipers;
- (q) Talkback System;
- (r) Wind speed and direction system;
- (s) Downward Facing Echo sounder;
- (t) Lighting control panel incorporating controls for search lights and flood lights;
- (u) Diesel generator engines monitoring indicators;
- (v) Instrument & control and alarming system for major machinery containing start/stop switches;
- (w) Exhaust temperature gauges;
- (x) Gear box oil pressure indicators alarms (if any);
- (y) Fire detection system and CO₂ flooding system control panel;
- (z) Emergency stop switch for fuel supply unit, generators, and ventilation fans;
- (aa) Meter/Gauge indicating the quantity remained in the tanks, including diesel tanks, fresh water tank, black water holding tank, etc.;
- (bb) Navigation light and flashing beacon control panel;
- (cc) Control panel of all-round flashing red light on the mast;
- (dd) VHF radio receiver stowage position and power sockets;
- (ee) Instrument & control and alarming system for methanol associated system including methanol supply system, safety system and ventilation system;

- (ff) Meter/gauge indicating the quantity remained in the tanks, including methanol storage tank and methanol drain holding tank;
 - (gg) Emergency stop switch for fuel supply unit and ventilation fans; and
 - (hh) Any other instrumentation recommended by the manufacturer of the proposed propulsion system and GNC.
- 4.2.10** The steering position, console and its instrument and gauges, and control layout, coxswain seat and the 1st Lookout and 2nd Lookout 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 MD officers to approve.
- 4.2.11** 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.
- 4.2.12** All instruments shall be logically grouped according to their functions. In order to reduce the risk of confusion, instruments shall not be rationalized by share functions or by inter-switching. The proposed console arrangement shall be reviewed and approved by the GNC prior to installation.
- 4.2.13** 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.
- 4.2.14** Instruments required for use by any member of the operating crew shall be plainly visible and easily readable with minimum practicable disposition from his/ her normal seating position and deviation from line of vision, i.e. they will cause minimum risk of confusion under all likely operating conditions.
- 4.2.15** 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.
- 4.2.16** The surfaces of console tops and instruments shall be a dark glare-free colour. Surface finishing and interior linings in the wheelhouse shall be of a matt non-reflecting finish to facilitate day and night operation.
- 4.2.17** 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).
- 4.2.18** 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 (1:1) and agreed by GNC. The bridge mock-up inspection shall also include the visibility requirements in Paragraph 4.1.14 in this Part VII. The preliminary mock-up shall be equipped with wheelhouse shock seat model of steering throttle controls, and clearly include the bow of the vessel model.
- 4.2.19** As part of the items listed in Annex 3 to this Part VII, the Contractor shall provide:
- (a) a Control Console Arrangement and Schematic Diagram to GNC to show improvements over the Wheelhouse Arrangement Plan covering all such operational aspects to the satisfaction of GNC,
 - (b) a the detailed General Arrangement Plan as mentioned in Paragraph 2.1.4 above, and
 - (c) a separate Hazardous Areas Plan indicating the hazardous area zones of the Vessel.

4.2.20 The following fittings and equipment shall be provided, at minimum, in the wheelhouse to the satisfaction of GNC:

- (a) One (1) chart table with lamp and dimmer over, a drawer shall be provided under the table top for the stowage of charts;
- (b) One (1) display board for posting plans, charts and notices, etc. ;
- (c) Two (2) wall mounted fans of diameter 300 mm;
- (d) One (1) set of pigeonholes for the stowage of international code flags;
- (e) One (1) set of international code flags suitable for the mast;
- (f) One (1) shelf for the stowage of logbooks and files with retention bar;
- (g) One (1) dial type inclinometer and one barometer with thermometer for marine use;
- (h) One (1) stainless steel rubbish bin with cover shall be stored inside a cabinet/locker;
- (i) One (1) electric powered marine wall-mounted clock;
- (j) One (1) metal box for keys shall be provided and fitted inside the wheelhouse;
- (k) One (1) magnetic compass with independent illuminated dimmer switch;
- (l) One (1) wooden box with locks for the storage of binoculars, and it shall be fitted within the vicinity of the coxswain and 1st Lookout seats. One (1) waterproof and fog proof 7x50 Marine binoculars for day time use shall be provided;
- (m) Four (4) cup holders;
- (n) Four (4) coat hooks;
- (o) A number of storage lockers;
- (p) One (1) framed fire and safety plan of appropriate size;
- (q) One (1) approved type first aid box; and
- (r) At least five (5) wall mounted (220V AC) electrical sockets (Type G for Hong Kong) with dual USB charging ports (or equivalent).

Details to be discussed in the kick-off meeting.

4.3 Day Room

4.3.1 The day room shall be designed and located on the lower tier of the forward deckhouse on the main deck for carrying officers and performing office duty, as a minimum and notwithstanding requirements specified in other sections, shall include the following:

- (a) Twelve (12) fixed cushioned seats and storage compartments for lifejacket under the seats.
- (b) The arrangement of the seats shall be spacious and suitable for a person of Asian stature. The seats shall have high density foam cushions;
- (c) One (1) working table for staff performing office duty;
- (d) One (1) industrial working bench for tools;
- (e) One (1) storage locker for life saving appliances and other equipment with five sets of keys;
- (f) One (1) certain number of coat hooks near the entrance of the deckhouse;

- (g) Sufficient wall-mounted type-G electrical sockets shall be provided for facilities the use of electrical equipment, including but not limited to computer and notebook computer. The number and location of sockets shall be proposed by the Contractor and be subject to the GNC approval; and not less than one socket per five (5) square meters;
- (h) One (1) refrigerator with positive latches of a suitable size and type;
- (i) One (1) cooking power inverter microwave oven (of a size and type decided by the MD);
- (j) One (1) SS316L rubbish bin of a suitable size with cover;
- (k) One (1) distilled water dispenser with water supply function;
- (l) One (1) electric powered marine wall-mounted clock;
- (m) One (1) 240V AC wall mounted 300mm diameter fan;
- (n) The Day room shall be ventilated by split-type air-conditionings; and
- (o) Grab rails shall be provided where necessary.

4.3.2 Details shall be discussed during kick-off meeting.

4.4 Toilet Facility

4.4.1 Two (2) toilet facility with at least one (1) water supply shall be arranged in the day room in the forward deckhouse on the main deck and, as a minimum, shall include the following:

- (a) The door shall be of aluminium and can be opened from the outside. The lower portion of the door shall have a louvre;
- (b) All fixtures, partitions and laminations shall be approved by the GNC;
- (c) All wet spaces shall be provided with a surrounding coaming fully welded to the Vessel's deck. The wet spaces shall be designed to avoid the accumulation of water under all operation trim and draft conditions. It is to be painted in a suitable coating;
- (d) It shall be fitted with non-slip flooring and waterproof grating, and such fittings shall be approved by the GNC;
- (e) Sewage flushed from toilets shall be stored in a black water tank and have alternative piping to discharge direct overboard for maintenance purpose;
- (f) Two (2) electric exhaust fans capable of not less than 36 air changes per hour. The exhaust air shall be routed to outside of the Vessel;
- (g) Two (2) western style seated electric flush toilets (not of a "vacuum" type) with at least one (1) stainless steel wash basin (with fresh water mixer tap) including a grab bar and soap dish, and such fittings shall be approved by GNC;
- (h) One (1) water tap under the wash basin with a plastic hose for cleaning the toilet;
- (i) Two (2) sets of storm handrails, which shall be made of SS316L;
- (j) One (1) mirror;
- (k) Two (2) toilet paper holders, which shall be made of SS316L;
- (l) Two (2) secured SS316L waste bins with lid;
- (m) Twelve (12) clothes hooks which shall be made of SS316L, and

- (n) Drain(s) are fitted with a U-shaped tube or P-trap for gas sealing and to be provided to prevent water accumulation on the toilet floor under all operation trim and draft conditions. The floor covering shall pitch to a floor drain. The grey water shall be discharge direct overboard when required.

4.5 CO₂ Store Room

- 4.5.1** A designated store room shall be designed and located on the aft deckhouse of the main deck for the storage of the CO₂ bottles for the Fixed Fire-Extinguishing System specified in Paragraph 5.3 of this Part VII.
- 4.5.2** The store room shall be directly accessible from the open external deck. The door shall be fitted with a high-quality stainless steel or bronze commercial-grade marine-type locks. Five (5) sets of keys shall be provided. All keys shall be tagged for identification. A key box with break-glass shall be installed outside the CO₂ store room for emergency access.
- 4.5.3** A pre-discharge warning (CO₂ door alarm) shall be installed to provide audible and visual signals when the release cabinet door opens. This alarm shall be extended to the wheelhouse in a separate control panel. The alarm shall incorporate a time delay to allow occupants sufficient time to evacuate after the alarm activates.
- 4.5.4** The layout of the CO₂ Store Room shall conform to IMO and RO requirements.
- 4.5.5** Adequate ventilation for this space shall meet the standards specified by the RO.
- 4.5.6** Clear instructions shall be posted near the entrance and activating station of the CO₂ Store Room in accordance with RO requirements.
- 4.5.7** Electrical equipment in this space shall be explosion-proof specified in Chapter 12 of this Part VII if the CO₂ Store Room is located in hazardous area zones.

4.6 Foam Proportioner Store Room (“FPSR”)

- 4.6.1** The Foam Proportioner Store Room (“FPSR”) shall store all the key components of the foam fire extinguishing system, ensuring rapid and stable delivery of low-expansion foam to the protected area in the event of a fire.
- 4.6.2** Foam liquid and core equipment shall be stored in a manner that prevents exposure to external environmental factors such as seawater and high temperatures. Instruments, instrument panels, and controls shall be permanently installed in the Main Switchboard Station (“MSBS”) and engine room monitoring console, considering operational, maintenance, and environmental requirements.
- 4.6.3** An operation panel or platform shall be provided to enable crew members to start and adjust the foam supply process.
- 4.6.4** The system shall be designed for ease of daily inspection and maintenance to ensure continuous equipment readiness.
- 4.6.5** The layout of the Foam Proportioner Store Room shall conform to IMO and RO requirements.
- 4.6.6** Adequate ventilation for this space shall meet the standards specified by the RO.
- 4.6.7** Clear instructions shall be posted near the entrance and activating station of the FPSR in accordance with RO requirements.

- 4.6.8** For methanol ship, electrical equipment in this space shall be explosion-proof specified in Chapter 12 of this Part VII if the FPSR is located in hazardous area zones.

4.7 Main Switchboard Station (“MSBS”)

- 4.7.1** A designated area of the Main Switchboard Station (“MSBS”) shall be designed and located on the main deck for the installation of the main switchboard (“MSB”) and the engines remote control console, as a minimum and notwithstanding requirements specified in other sections, shall include the following:
- (a) Main switchboard (“MSB”); and
 - (b) Engines remote control console.
- 4.7.2** Instruments, instrument panels and controls shall be permanently mounted in the MSB and the engine room monitoring console, taking into account operational, maintenance and environmental needs.
- 4.7.3** The MSBS shall be provided with split-type air-conditioning as specified in the paragraph 7.14.1 of this Part VII.

4.8 Store Room

- 4.8.1** The Store Room shall not be less than 100 square feet to be provided in the deckhouse for storing spare parts on aluminium shelves.
- 4.8.2** Store Room shall be arranged for storing the anchor chains, mooring ropes, navigational equipment, shapes, spare fire extinguishers and other equipment.
- 4.8.3** Details shall be discussed at the Kick-off meeting.

4.9 Fore Peak Tank and Chain Locker

- 4.9.1** 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.
- 4.9.2** The fore deck geometry of the Vessel shall be carefully designed to facilitate safe boarding/mooring to GNC’s satisfaction. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the Vessel. It shall be fitted with polyurethane or equivalent materials for fenders, which shall be durable enough to meet daily operational and shall be approved by GNC.
- 4.9.3** 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.
- 4.9.4** 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. Bilge pipe and alarms shall be fitted.

4.10 Nitrogen Generator Room

- 4.10.1** The layout of the Nitrogen Generator Room shall be in accordance with IMO Requirements, the RO Requirements and to the satisfaction of GNC.

- 4.10.2** The Nitrogen Generator Room shall meet the applicable IMO requirements and RO requirements and shall be designed to accommodate:
- (a) Fresh water tank with manhole covers (Individual SS316L tank compartment is preferred);
 - (b) Stainless Steel SS316 black water tank;
 - (c) One (1) nitrogen generator and nitrogen cylinder(s), instrumentation; and
 - (d) The tank manholes shall be sized to the satisfaction of RO and GNC.
- 4.10.3** The layout of the nitrogen generator shall be in accordance with IMO requirements and the RO Requirements and to the satisfaction of GNC.
- 4.10.4** At least one (1) oxygen content monitor unit with two (2) oxygen sensors shall be installed within this space, with visual and audible alarms located at each entrance and wheelhouse. The alarms shall trigger if oxygen level falls below 19.5% by volume from the normal atmospheric level of 20.9% by volume.
- 4.10.5** Special attention shall be paid to the layout of the nitrogen generator room for the maintenance and repair of main engines, generators and other machinery. The specific requirements given in the Chapter 12 of this Part VII shall be complied with.

4.11 Engine Room

- 4.11.1** The layout of the Engine Room shall be in accordance with IMO Requirements, the RO Requirements and to the satisfaction of GNC. Special attention shall be paid to the layout of the engine room for the maintenance and repair of generators and other machinery. The specific requirements given in the TS shall be complied with.
- 4.11.2** The engine room shall be designed for unattended operation, with two access points provided. Access to the engine room shall be arranged to ensure efficient and safe entry.
- 4.11.3** The floor of engine room shall be covered with aluminium chequered plates. Aluminium chequered plates adjacent to bilges, pumps, shafts, pipes and strainers etc., shall be easily removable for maintenance. The size of the hinged access plates to be approved by GNC.
- 4.11.4** Hinged access plates shall be fitted in way of valves. The arrangement of hinged plates shall avoid or minimise the rattling noise.
- 4.11.5** 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.
- 4.11.6** 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.
- 4.11.7** Forced ventilation shall be provided for the engine room in accordance with RO requirements. Ventilation calculations shall be submitted to the RO and GNC for approval.
- 4.11.8** The compartment shall be equipped with an independent mechanical extraction ventilation system capable of providing a minimum of fifty (50) air changes per hour.
- 4.11.9** At least one (1) oxygen content monitor unit with two (2) oxygen sensors shall be installed within this space, with visual and audible alarms located at each entrance and wheelhouse. The alarm shall trigger if oxygen level falls below 19.5% by volume from the normal atmospheric level of 20.9% by volume.

4.11.10 The Engine Room shall meet the applicable IMO requirements and RO requirements for tanks and shall be designed to accommodate:

- (a) Steel diesel oil storage tank(s) with manhole cover(s);
- (b) Steel bilge water tank with manhole cover; and
- (c) The tank manholes shall be sized to the satisfaction of RO and GNC.

4.11.11 Individual Transfer Pump shall be provided to transfer diesel fuel between diesel fuel storage tank(s) and diesel fuel daily tank. The Individual Transfer Pump shall be able to transfer and strip the residual diesel from the storage tanks and/or diesel fuel daily tank to the main deck shore connection. The coupling and fitting for the shore diesel transfer connection will be discussed in the Kick-off meeting.

4.11.12 If necessary, transfer pump shall be provided to transfer fuel between diesel storage tank(s) and diesel oil daily tank. The Engine Room shall be designed with flush watertight cover(s) for servicing and maintenance access. The flush watertight cover(s) shall ensuring watertight integrity is maintained when the covers are in place.

4.12 Void Room

4.12.1 The void room shall be equipped with an independent stainless steel methanol storage tank, fitted with a manhole cover, installed within the under-deck compartments as specified in Chapter 12 of this Part VII.

4.12.2 The detailed requirements for the methanol storage system shall be specified in Chapter 12 of this Part VII and shall include, but are not limited to:

- (a) The arrangement of pipelines, valves, and other accessories;
- (b) Forced ventilation systems;
- (c) Fire detection and fire suppression systems;
- (d) Methanol leakage detection systems;
- (e) CCTV monitoring.

4.12.3 The minimum separation between the methanol storage tank to the ship hull and other compartments shall follows the requirement of RO and in addition to MSC.1/Circ. 1621 requirements.

4.13 Steering Gear Room

4.13.1 The layout of the steering gear compartment shall be arranged for easy and convenient installing, operating and access for maintenance or repairs to the steering gear system.

4.13.2 Readily accessible space shall be provided for the operation of an emergency manual hydraulic pump with independent piping. The store or locker or shelf in the steering gear room shall be provided with special protective flooring and drip trays for oil storage area.

4.13.3 The floor of this compartment shall be covered with aluminium chequered plates.

4.13.4 Aluminium chequered plates adjacent to valves, shafts, etc., shall be easily removable for maintenance.

4.13.5 Hinged access plates shall be fitted in way of valves. The arrangement of hinged plates shall avoid

or minimise the rattling noise.

4.13.6 Obstruction adjacent to valves, shafts, etc., shall be easily removable for the ease of maintenance.

4.14 External Deck Area

4.14.1 External deck area shall include:

- (a) Clean and simple bow deck area for efficient boarding and mooring operation:
 - (i) The deck area shall be clean and simple for efficient anchoring, mooring.
 - (ii) The deck area geometry of the vessel shall be carefully designed to facilitate safe mooring to GNC's satisfaction. Adequate geometry can be achieved with the addition of fender mouldings adequately fitted to the vessel.
 - (iii) As part of the boarding frame, a permanent forward deck railing for safe embarkation and disembarkation shall be provided.
 - (iv) There shall be a weather-tight mooring cables store on the deck area of a size and type to be decided by the MD at the Kick-off meeting.
- (b) Clean and simple aft deck area for efficient refuel and mooring operation:
 - (i) The deck area shall be clean and simple for efficient mooring.
- (c) Mid deck area:
 - (i) The main deck port side shall be fitted with a set of ancillary boat and Davit LAR as stated in conceptual general arrangement, as required in 4.17 and 4.18 in this Part VII.
 - (ii) An access cover shall be provided to facilitate the subsequent out-of-cabin maintenance of the engine.
 - (iii) Notwithstanding requirements specified in other sections, the mid deck shall have the following fittings: two (2) 24V DC waterproof power socket, one (1) 240V AC waterproof power socket, and one waterproof shore connection, all of which shall be kept away from hazardous areas.
- (d) Side deck area:
 - (i) Walk around deck which provides easy access to fore deck or aft deck.
 - (ii) The width of the side deck on both sides of main deck and upper deck shall be at least 600 mm for providing safe passages for crew / other persons to walk.
 - (iii) Components including but not limited to air vents and pipes are preferably recessed into the deckhouse side or the bulwark. **[D]**
 - (iv) Air vents and pipes of the Vessel shall be kept at a safe distance from the methanol storage tank vent outlet as specified in Chapter 12 of this Part VII to comply RO requirement and in compliance with the minimum distance as specified in Paragraph 12.4.11 of this Part VII and maximum height as specified in Paragraph 12.4.12 of this Part VII.
 - (v) Excessive protrusion of components including but not limited to air vents and pipes shall be avoided to prevent obstructions.
- (e) Compass deck area:
 - (i) Compass deck area shall be fitted with a conventional fixed mast.

- (ii) The arrangement shall be such that the equipment on the compass deck shall not interfere with each other.
 - (iii) Safe access for the maintenance and servicing to equipment and its fittings shall be provided.
 - (iv) Vessel identification shall be marked on compass deck as large as possible.
 - (v) An explosion proof LED board shall be provided to display dynamic “Warning” signs when fuel is bunkering.
 - (f) Upper deck area:
 - (i) The upper deck area shall be large enough for 3 or 4 the external units of air-conditioner.
- 4.14.2** 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.
- 4.14.3** 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.
- 4.14.4** Main deck and upper 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 and DAVIT LARS Areas) requires otherwise.
- 4.14.5** All guard rails shall comply with the RO Requirements for protection of persons on board.
- 4.14.6** Handrails shall be provided where necessary. Grab rails shall be positioned internally and externally throughout the Vessel to GNC’s satisfaction. There shall be handrails on ceiling of the day room and the crew space. Handrails and grab rails shall be made of high quality marine grade aluminium extrusions or stainless steel.
- 4.14.7** Where necessary, the rails of the railings are made of detachable marine SS316L 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 Conceptual Guidance General Arrangement Plan. Permanent stanchion with chains for safe embarkation and disembarkation shall be provided.

4.15 Mast and Ensign Staff

- 4.15.1** One (1) fixed 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 arrester, ensign hoist, two (2) signal hoists, the antennas and GPS.
- 4.15.2** There shall be two (2) separate switches in the bridge for NUC (not under command) and RAM (restricted in their ability to manoeuvre) lights.
- 4.15.3** The Vessel shall have an air draft of not more than 14 m under any possible loading condition to pass bridges.
- 4.15.4** The masthead light shall be exhibited forward of amidships as far forward as is practicable.
- 4.15.5** 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.
- 4.15.6** Access for maintenance and servicing of equipment and its fittings shall be provided. Securing strong points for crew's safety harnesses and step shall be provided for use of maintenance.
- 4.15.7** The requirements of staff are as follows:
- (a) Two (2) ensign staffs of length and size to be confirmed by GNC, for flags, shall be supplied.
 - (b) It is desirable that one (1) ensign staff should be placed at the mast and the other one to be placed at aft upper deck. **[D]**
 - (c) Each ensign staff shall be supplied with a hook for binding the rope.
- 4.15.8** All equipment and their components including but not limited to cables, conduits, connectors, junction boxes, glands and fittings etc. shall be waterproof and be able to function in all weather conditions at sea.
- 4.15.9** The cable penetrations to the compass deck shall be kept as minimum as possible, centralizing conduits is prefer.
- 4.15.10** All hardware for mast and ensign staff, such as screws, hooks, hasps, hinges, handles, sliding bolts etc., shall be made of 316L stainless steel and be with proper galvanic corrosion preventive measures at their contact points with the hull/superstructures.

4.16 Anchoring and Mooring Equipment

4.16.1 Anchor

- (a) At least one (1) on the 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. The Vessel shall be provided with adequate and safe means for releasing the anchor and its cable and warp.
- (b) The means of release shall be capable of safe operation even when the anchor cable or warp is under load.
- (c) Adequate means and arrangements shall be provided to secure the anchor under all operational conditions.
- (d) One (1) chain stopper shall be provided.

4.16.2 Windlass

- (a) One (1) 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. This equipment shall be approved by RO.
- (b) The windlass shall be capable of lifting 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 near the windlass.
- (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).

4.16.3 Mooring

- (a) Suitable fairleads, bitts and mooring ropes shall be provided and fitted at the appropriate position for the safety mooring operation. At least Six (6) Nylon mooring ropes each with a length of not less than 40 metres shall be provided as per the RO Requirements.
- (b) As a minimum six (6) bollards on deck shall be provided. 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.

4.17 Ancillary Boat

- (a) The Vessel shall be equipped with one (1) ancillary boat. The hull of the ancillary boat shall be a proprietary-made product.

- (b) The ancillary boat shall be made of High-Density Polyethylene (“HDPE”) and designed as in compliance with the requirements of the RO.
- (c) The particulars of the HDPE ancillary boat are listed as follows:
 - (i) Length (overall): 5.0 to 7.0 metres (both figures inclusive, include any fendering, transom overhang, crash bar and engines)
 - (ii) Breadth: 2.0 to 2.8 metres (both figures inclusive);
 - (iii) Design Draft: Design to suit
 - (iv) Crew: one (1) person at 82.5 kg with 10 kg effect;
 - (v) Passenger: three (3) persons at 82.5 kg with 10 kg effect;
 - (vi) Equipment Kit: 100kg;
 - (vii) Diesel outboard engines with power between 50 hp to 60 hp; and
 - (viii) Welded hull constructed from HDPE plates, with documentary evidence proving compliance with the relevant rules of the RO or other equivalent standards and certifying that the weld scantling is adequate based on such rules or standards;
- (d) Portable or built-in fuel tank capable of supporting at least two (2) hours of full-speed operation with four (4) persons and equipment onboard.
- (e) The homologation of HDPE material must be provided by the manufacturer accepted by the GNC. All properties of the material, including the technical data sheets, specifying the mechanical properties shall be provided and approved by RO, or equivalent certification recognized by RO.
- (f) The Contractor shall provide a test report to show the characteristics of HDPE material including its mechanical properties, covering, but not limited to, the following information.
 - (i) Density;
 - (ii) Young modulus at yield (MPa);
 - (iii) Shear modulus at yield (MPa);
 - (iv) Tensile stress at yield (MPa);
 - (v) Stress / elongation curve;
 - (vi) Tensile elongation at yield (%);
 - (vii) Shear stress at yield (MPa); and
 - (viii) Poisson’s coefficient.

The above-mentioned test report shall be submitted by the Contractor together with the tender submission before the Tender Closing Date or upon any subsequent request during the Tender Validity Period if not submitted earlier. It shall demonstrate that the tests have been conducted in accordance with the requirements of any RO, or by an individual verified or certified body, or an equivalent certification recognized by the RO and subject to the acceptance of GNC.

- (g) The test report shall be submitted by the Contractor together with the tender submission before the Tender Closing Date. It shall demonstrate that the tests have been conducted in accordance with the requirements of any RO, or by an individual verified or certified body, or an equivalent certification recognized by the RO and subject to the acceptance of GNC.
- (h) One (1) diesel outboard engine shall be provided with power range between 50 hp to 60 hp.

- (i) The ancillary boat shall be designed and built according to the requirements of the design category C of Directive 2013/53/EU, a declaration of conformity to the requirement of Directive 2013/53/EU or equivalent certification recognized by RO shall be provided.
- (j) The corresponding location of Davit LARS and ancillary boat on the Vessel is shown in the Conceptual General Arrangement Plan (“GA”).
- (k) The ancillary boat shall be compatible with the Davit Launch and Recovery System (“Davit LARS”) Arrangement, specified in Paragraph 4.18 of this Part VII, on the mothership.
- (l) The mechanical properties of HDPE shall not deteriorate when its material is exposed to sunlight for an extended period. HDPE material shall not exhibit issues such as cracking, discoloration, or reduction in strength during its long-term service.
- (m) All shafts, piping, and fittings shall be constructed of stainless steel or equivalent. Where dissimilar metals are bonded, plastic washers must be installed to prevent galvanic corrosion.
- (n) Before procuring the materials, the Contractor shall provide the following documents to GNC to prove the mechanical properties of the proposed materials (and their joints/welds) for marine use in ship hulls together with the Delivery of the vessel for acceptance:
 - (i) HDPE Technical Specification;
 - (ii) Relevant Technical Documents for panel joining and stiffener joining;
 - (iii) Hull strength and scantling calculations;
 - (iv) Welding Specifications and method statements;
 - (v) Repair and maintenance plan;
 - (vi) Relevant Test Reports and statement issued by the manufacturer;
 - (vii) Sea trial report including power – speed curve; and
 - (viii) Any other supporting documents as requested by GNC, to be discussed during the kick-off meeting.

4.18 Davit Launch and Recovery System (“Davit LARS”)

- (a) One (1) Davit Launch and Recovery System (“Davit LARS”) compliant with the requirements of SOLAS (where applicable) for stowing, launching and recovering of one (1) ancillary boat, as further specified in Paragraph 4.17 of this Part VII. The Davit LARS shall be designed so that launch and recovery of the ancillary boat, with a minimum of one (1) crew onboard the ancillary boat, can be performed safely using a dedicated control panel;
- (b) The Davit LARS shall be proprietary-made product;
- (c) The Davit LARS shall be designed and installed as follows to the satisfaction of the RO and GNC:
 - (i) Driven by Hydraulic Power Pack;
 - (ii) Small footprint, easy for installation onboard;
 - (iii) To be bolted/ welded (to be agreed with the RO & GNC) to the main deck supporting foundation;
 - (iv) Self-lubricating bearings;
 - (v) A fixed control stand;

- (vi) Remote-control belly box, with hoisting, lowering and emergency stop controls;
 - (vii) Easy access for periodic maintenance, service and repair;
 - (viii) Davit shall have emergency system according to SOLAS or equivalent, to allow for launching of ancillary boat in the event of total loss of the Vessel power; and
 - (ix) The design shall be able to withstand and operate in sea state 2.
- (d) The corresponding location of Davit LARS and ancillary boat on the Vessel is shown in the Conceptual General Arrangement Plan (“Conceptual GA”) in Annex 10 of this Part VII.
 - (e) The Vessel shall be equipped with a mooring bitt for securing the painter of the ancillary boat to the acceptance of GNC.
 - (f) The allowable Safe Working Load (“SWL”) shall be marked permanently on the davit.
 - (g) The crane shall be bolted or welded to the main deck foundation structure in accordance with RO Requirements, and to the satisfaction of GNC.
 - (h) The crane shall be a marine type of class certified by any one RO listed in Annex 9 of this Part VII and acceptable to GNC. It shall be installed and tested in accordance with the RO Requirements to the satisfaction of GNC.
 - (i) The design and documents of the crane shall be in accordance with CAP 548I, Merchant Shipping (Local Vessels)(Works) regulation, Hong Kong Shipping Ordinance, HKMD, Section 45 "Strength Calculation etc. in Respect of Cranes". All lifting gear and crane shall be tested with a proof load in accordance with the Schedule 1 of CAP 548I together with a valid “certificate of test and examination” provided. Details are to be discussed in the kick-off meeting.

4.19 Fenders

4.19.1 Bow Pushing Head Fenders

- (a) The fender shall be designed and installed to absorb stresses exerted on the Vessel;
- (b) The fender arrangement shall be suitably designed to facilitate operations during alongside the pier at outlying islands and to the satisfaction of GNC; and
- (c) The base plates of the fender installation shall be widened properly.

4.19.2 Side Fenders

- (a) Fixed hollow D shape rubber fenders of a suitable size acceptable to GNC shall be fitted continuously along the ship sides and stern at the main deck level. The arrangement of the fenders shall also provide protection between the waterline and main deck;
- (b) The hull structures shall be suitably strengthened for the proposed fendering arrangement;
- (c) Considerations should be given to protecting the side fenders against shearing forces, particularly in situations where a vessel of similar size is moored alongside, due to vessel rolling and ship-to-ship contact impacts; and
- (d) Adequate provisions should be considered to protect the vessel when the ancillary boats specified in Paragraph 4.17 of Part VII are moored alongside.

4.19.3 The Contractor is to supply portable air-filled fenders of adequate size and strength to support the Vessel during mooring operations alongside. The number required and size shall be agreed with GNC.

4.20 Marine Growth Protection System

- 4.20.1** The Vessel shall be fitted with a Marine Growth Protection System (“MGPS”). The system is to operate at two parts per billion. The system is to produce copper ions in the sea water system to protect the pipeline/machinery systems from marine growth.
- 4.20.2** Within each sea strainer/sea chest, anode(s) shall be fitted. The anodes shall be controlled by a control panel which operated by the crew on board.
- 4.20.3** Each Copper Anode shall be suitably sized to suit the total flow rate of sea water through each strainer. This is to be calculated and to be submitted for approval by GNC prior to installation.
- 4.20.4** Each anode shall be supplied with an integral nylon mounting arrangement and its own integral cathode to ensure that currents are correctly controlled.

4.21 Methanol Fuel bunkering Station

- 4.21.1** The Vessel shall follow the requirements of RO and IMO for the methanol fuel filling station system to ensure the supply of methanol fuel for the vessel.
- 4.21.2** The details of the methanol fuel bunkering station is referred to Chapter 12 of this Part VII.

4.22 Lightning Protection

- 4.22.1** The Vessel shall be fitted with a lightning protection system, acceptable to the RO, to protect the persons onboard and the electronic equipment installed onboard.
- 4.22.2** The methodology and working principles of the lightning protection system shall be submitted to GNC for approval prior to installation. The lightning protection shall prevent lightning from striking vessel by neutralizing and de-ionizing electrical charges in the atmosphere as per IEC 62305 or equivalent.
- 4.22.3** The strength of lightning device and the supporting structures shall be properly designed. The possible dynamic inertia loads due to the motion of the Vessel in design waves as well as the gravity shall be considered in the design.

4.23 The Solar Panels

- 4.23.1** It is desirable that the Tenderer has proposed a solar panel system complying with all of the specifications set out below: **[D]**
- (a) The solar panels should be fitted on the compass deck as indicated in the General Arrangement Plan.
 - (b) The solar panel system should convert solar energy to power normal lighting or cell phone charger.
 - (c) Rigid service walkway and platforms should be provided for maintenance.
 - (d) Details shall be discussed during kick-off meeting.

4.24 Boarding Ladder for Ancillary Boat

- 4.24.1** A boarding ladder shall be installed on the port side of the vessel's hull, near the Davit LARs, to facilitate boarding and disembarking between the ancillary boat and the vessel. The ladder must be robust, securely welded to the ship's side, and designed for safe crew interaction during ancillary boat operations, allowing rapid and secure transfer of crew and personnel.
- 4.24.2** The opening of the boarding ladder to the hull shall be fitted with rounded edges and sufficient padding around the hull extension to prevent injury to personnel deploying into or being recovered from the water.
- 4.24.3** The bottom platform of the boarding ladder shall be self-draining and equipped with secure safety handles, clip-on points for crew safety harnesses, and removable safety chains that can be lowered during operational use.
- 4.24.4** Details shall be discussed during the kick-off meeting.

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. And shall also meet the regulatory requirements specific to methanol-fuelled vessels.
- 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, deckhouses 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/m² 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** Two hose reels with attached fire hose shall be installed on main deck for ready-to-use purpose, each with a length to cover the whole ship length near deckhouse and aft deck.

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, day room, 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.
- 5.2.5** If the alarm is not attended, an external alarm powered by 24V batteries send signals to wheelhouse and whole ship alarm.

5.3 Fixed Fire-Extinguishing System for Unmanned Engine Room

- 5.3.1** Engine room fire extinguishing systems shall be a fixed CO₂ aerosol flooding system complying with the RO regulations for engine room protection.
- 5.3.2** The CO₂ fire extinguishing system shall be of a total flooding high pressure system.
- 5.3.3** CO₂ piping shall be made of stainless steel.
- 5.3.4** Mechanical measuring device shall be provided for checking the content of CO₂ bottles.
- 5.3.5** Activation of the CO₂ system shall cause an audio and visual warning alarm in each protection area and wheelhouse.
- 5.3.6** The CO₂ bottles for the system shall be stowed preferably in a separate CO₂ room at the aft as indicated on the Guidance General Arrangement Plan and shall be properly protected from weather. The CO₂ room and the whole system shall be in accordance with the requirements of RO.
- 5.3.7** When the CO₂ flooding system is activated, the machinery space ventilation system shall shut down automatically; it may also be shut down manually via the control devices located outside the machinery space.

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** A sufficient number of electric fire pumps located in 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 pumps 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** 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.
- 5.5.3** A deck washing pipe line shall be branched off from a fire main line. Fire water to be provided for anchor chain flushing.
- 5.5.4** The electric fire pump shall act as bilge pumps in case of emergency.
- 5.5.5** As required, if an emergency fire pump needs to be configured, the pump shall be arranged outside the machinery space, with a brass casing and bronze internal components. Additionally, it shall be equipped with an independent sea suction, which must remain underwater under any light load condition.
- 5.5.6** An isolation valve shall be set on the main pipe out of the main engine room. Sea suction valve and the emergency fire pump shall be operated in the steering gear room.
- 5.5.7** 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.

5.6 Safety Plan

- 5.6.1** The fire control plan shall be permanently exhibited on the 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 by Alarm System

- 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.

5.8 Miscellaneous

- 5.8.1** Four (4) firemen's outfits shall be provided in the lockers in the crew space.

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 with MED certificate 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 a frame shall be posted on the wall of wheelhouse or the crew spaces.

Chapter 7 Machinery

7.1 General provisions

- 7.1.1** The Vessel is for use in Hong Kong and shall be equipped with methanol-diesel dual electric generator sets and electric propulsion drives system, it is desirable that the main generators, gearboxes with clutches, electric motors and any other machinery offered are those at present commonly used by ships operating in Hong Kong waters.
- 7.1.2** The main machinery stated in Paragraph 7.1.1 above shall be standard products with good support for spare parts and after-sale services locally in Hong Kong.
- 7.1.3** It is desirable that the manufacturers and makes of engines are the ones commonly used in Hong Kong. It is desirable that the support of local agents shall include supplying brand new proposed main engines, electric generators and other machinery for five years after vessel delivery.
- 7.1.4** The dual-fuel (“Methanol-Diesel”) electric system shall comprise with the methanol-diesel dual-fuel generator sets mentioned in Paragraph 7.2.1 in this Part VII. The dual-fuel electric system shall also include the Main Switchboard, Main Propulsion Remote Control System, Power Management System (“PMS”), Monitoring and Alarm System (“MAS”), Variable-Frequency Drive (“VFD”) or Frequency Converter and Propulsion Motor(s) (collectively “electric generator sets” as more particularly specified in Paragraph 7.4 below). All components shall be designed and constructed in accordance with the latest edition of the rules and regulations of the RO and shall be issued with relevant certificate by the RO as specified in Schedule 9.
- 7.1.5** The Vessel shall be equipped and fitted with all machinery described in this Chapter 12 of this Part VII each complying with the specifications set out in this Chapter for such machinery. The Spare Parts to be provided shall be the same model as supplied for the Vessel and shall equally comply with all specifications set out in this Chapter.
- 7.1.6** Two (2) accesses with reasonable separation shall be provided for the engine room, one (1) of which (via watertight hatch with a suitable coaming) shall be from the main deck. The design of the engine room, steering gear and tank space layout shall be approved by an RO and agreed by GNC. The machinery, associated piping systems and fittings relating to the main propulsion motors and electric generator sets shall be of a design and construction adequate for the service for which they are intended and shall be so 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. The engine room access passage shall keep one (1) main passage (not less than 600mm) and try to ensure the maintenance space.
- 7.1.7** Sufficient space and headroom in the vicinity of the machinery shall be provided for the local operation, inspection and routine maintenance of all machinery. Procedures and sequences for the complete removal of major items, such as the main electric generator set, gearboxes, propulsion motors, and methanol storage tanks, shall be carefully designed to ensure that these items/equipment can be removed from the vessel for maintenance in a practical and feasible manner, thereby avoiding the cutting of major structures of the deck or shell plate.
- 7.1.8** All parts of machinery, hydraulic, control and other systems and their associated fittings which are under internal pressure shall be subject 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 electric generator sets, propulsion motors, fire pumps etc. and their associated piping and equipment.

- 7.1.10** Lifting brackets for handling heavy equipment shall be provided above the engines, propulsion motors, gearboxes and other heavy machinery, as well as at the engine room entrance and any other locations deemed necessary. Each lifting bracket shall be marked with its safe working load after a load test to the satisfactory of GNC.
- 7.1.11** The machinery installation shall be suitable for operation, and try to meet the requirements for unmanned operation. The monitoring and control, including automatic fire detection system, bilge alarm system, remote machinery instrumentation and alarm system shall be centralized.

7.2 Main Propulsion System

- 7.2.1** The Vessel shall have a methanol-diesel dual-fuel electric propulsion system, including methanol-diesel dual-fuel generator sets (two units or three units depending on the specification set out in Schedule 6, and if two units, another unit of loitering diesel generator set shall also be supplied), electric propulsion motors, main switchboard and control system (collectively, “propulsion system” or “main propulsion system”) (in upper or lower case)). The single-line diagram of power system is shown in the below figure, which is for reference only, specifying number of generators, voltage levels, number of main switchboards, etc.

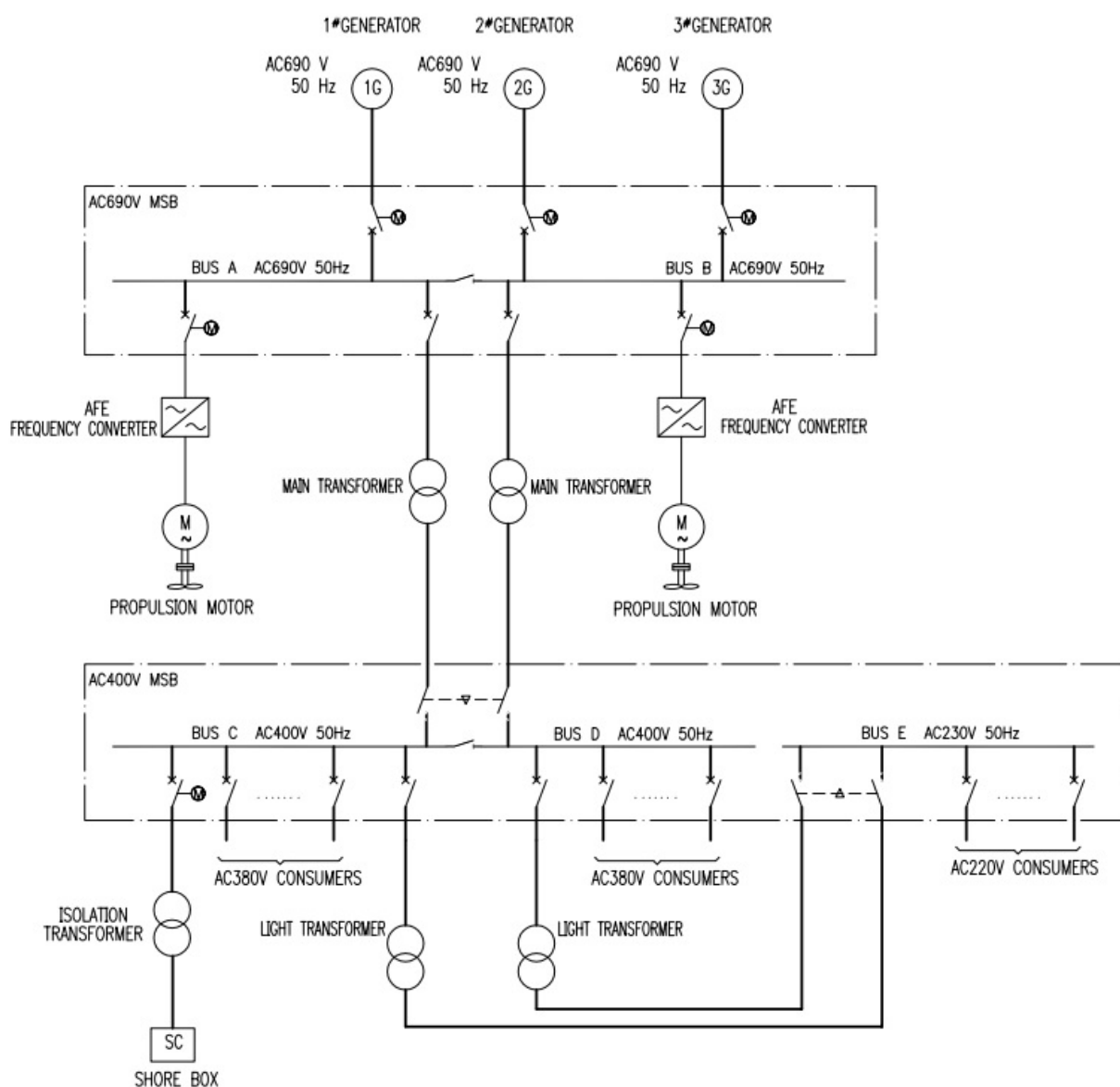


Figure: Single-line diagram of power system

- 7.2.2** The frequency converter for main propulsion system shall be of the active front end (“AFE”) type.
- 7.2.3** The methanol-diesel dual-power system shall use fixed/constant speed generators to supply the required electrical power to the Vessel’s switchboard.
- 7.2.4** Each main propulsion drive system shall be composed of suitably sized variable-frequency drive or frequency converter and the propulsion motor. The propulsion motor is controlled by the variable-frequency drive or frequency converter providing sufficient torque from zero to nominal speed in either direction. The automation system includes a propulsion remote control system, power management system (“PMS”) and Monitoring and Alarm System.
- 7.2.5** The propulsion drive devices include two (2) main propulsion motors and gearboxes with clutches. The automatic control system includes propulsion system controls, instrumentation and controls, power management system, monitoring and alarm system.
- 7.2.6** The vessel shall have three (3) control modes for operation:
- (a) Hotel Mode – demand for the hotel load and the propulsion motor shall be in a state of ready standby at all times.
 - (b) Cruising Mode –vessel speed of 5 to 6 knots; and
 - (c) Full Speed Mode – minimum highest achievable contract speed as specified in Paragraph 2.4.1.
- 7.2.7** The Contractor shall provide a detailed description of the main propulsion system, including the details of the total propulsion power and the control of three (3) modes of operation outlined in Paragraph 7.2.6 in this Part VII. The system will ensure that operational hours are distributed across the various generator sets and failure mode effect analysis (“FMEA”) of the system.
- 7.2.8** The propulsion power of the vessel must not experience a single–point failure that would cause a total failure of the entire power system. The independence/redundancy of the power system can be considered in conjunction with FMEA. FMEA must be approval from RO and the acceptance of GNC prior the pre-shipment trial.
- 7.2.9** The Control System shall have drive control software with system protective functions to detect and prevent the supply network overload, and power limit function to protect against unsafe operation of the system and other system failures. Drive system protection functions act against detected system malfunction or component failures; e.g. low lubrication pressure or high jacket water temperature on any one of the running generator, etc. The protection shall be divided into alarms, trips, interlocking, and power limitation functions.
- 7.2.10** The Contractor shall include in the maintenance plan detailed removal routes for the methanol-diesel dual-fuel engines, electrical motors, methanol storage tanks, and reduction gearboxes (if fitted), specifying procedures for servicing or replacement from the hull. The routes shall meet GNC’s satisfaction.
- 7.2.11** The main propulsion system shall be capable of manually and automatically starting individual or multiple generators. During automatic start-up, the system shall diagnose the status of all generators prior to initiating any start. The starting sequence shall be based on ascending running hours, with the generator having the least operating hours prioritized to start first.
- 7.2.12** Flexible mounting of engines shall be used for controlling the noise levels in wheelhouse compartments not to exceed 85 dB (A).
- 7.2.13** The vessel shall be equipped with an Exhaust Emission Monitoring System to measure emissions

of CO₂, SO₂, NO_x (NO, NO₂), CH₄, and PM from the main propulsion system. The system shall feature local data storage and be capable of transmitting relevant data to the onboard Integrated Automation System. All equipment shall have certificates meeting the requirements of relevant RO regulations and shall be approved to GNC's satisfaction.

- 7.2.14** The main propulsion system shall adopt a modular structure designed for easy integration. It shall comprise components such as the sampling probe unit, dust detector with electric transfer and heating pipelines, and an analysis cabinet unit, which includes the pre-treatment unit, electrical control unit, and analysis instruments, among others.
- 7.2.15** The main propulsion system shall be approved by the RO before submit to GNC for acceptance. The system shall obtain a product approval certificate issued by the RO, which shall be submitted prior to the vessel's delivery and acceptance inspection
- 7.2.16** The engine performance shall meet the following requirement,
- (a) The Tenderer shall submit the estimated propulsive power requirements and characteristic curves of the propulsion motor to demonstrate that the vessel can achieve the contracted speed under the operating conditions as specified in Paragraph 2.3.1;
 - (b) A full power shop trial certificate, verifying a continuous four (4) hour full load test for each engine, shall be submitted to GNC prior to the acceptance trial.
- 7.2.17** The shop trial shall be witnessed by representatives from the RO and MD. At least fifteen (15) calendar days before the trial, the Contractor shall submit the testing plan to GNC for approval. Upon completion, a detailed report documenting the operational parameters shall be provided to GNC for record purposes.
- 7.2.18** The tests shall be carried out with two fuel test, with the requirement including, but not less than the requirement below:
- (a) The governor control must ensure proper regulation when the engine is suddenly unloaded.
 - (b) In such cases, an alarm with both visual and sound indicators shall activate and be signalled in the wheelhouse.
 - (c) If a methanol leakage alarm is triggered, the system shall immediately cut off the methanol fuel supply, and the engine shall switch to diesel mode for operation.

7.3 Propulsion System Controls

- 7.3.1** The controls and instrumentation of all the methanol-diesel dual-electric generators shall be designed for one man remote operation in the wheelhouse control console, information shall be displayed in wheelhouse and main switchboard room; allowing the operator to monitor generators system parameter and alarms information in both wheelhouse control console and in the main switchboard room, instrumentation and the remote controls system shall be ergonomically laid out and grouped around the steering position in the wheelhouse control console.
- 7.3.2** The propulsion motor shall be controlled by the use of the control and monitoring system. The control and monitoring system shall be provided with a type approval certificate issued by the RO covering both hardware and basic software of the system.
- 7.3.3** The control and monitoring system shall provide at the console a control module composed of two dedicated handles for port and starboard propulsion motors respectively for controlling speed of each propulsion motor in forward, neutral and reverse directions through an analogue or a

digital signal. Each control handle shall have an ergonomically shaped. The control handles shall provide operation modes so that two motors are capable to synchronize with each other, and also be capable to work independently from each other. The control handle shall be operative only when there is nil drive start preventions and protective trips of the propulsion motor.

7.3.4 The control handles shall be provided non-follow-up function and follow-up function. The operation of the control handle shall be a horizontal motion along a single axis and there shall be no backlash throughout the whole range of movement of the control handle disregard its direction of motion. The control handle shall be designed to prevent ingress of dust or small debris.

7.3.5 The propulsion control system used for controlling electric propulsion system, shall be based on standard modules and easy to update, can be operated with all information and internal alarms displayed around the steering position in the wheelhouse control console. There are three (3) control positions in the Wheelhouse, and Main Switchboard Station and at Generator Local Control.

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

- (a) Starting and stopping of the propulsion system.
- (b) Emergency stop button with guard cover.
- (c) Wheelhouse / local control change over switch and indicator.
- (d) Linked steering of twin rudders by electro-hydraulic steering under normal condition and emergency hand hydraulic steering.
- (e) Propulsion mode panel
- (f) Speed control device, with an automated system to start and stop generators as required.
- (g) Speed regulation, the speed set-point can be manually and continuously controlled by the lever.
- (h) Rudder angle indicator.
- (i) Each Engine tachometers with running hour meter.
- (j) Monitoring frequency converter parameters and alarm information.
- (k) Monitoring main Switchboard system parameters and alarm information
- (l) Sea water pressure.
- (m) Coolant water temperature and pressure.
- (n) Each engine lubricating oil temperature and pressure gauge.
- (o) High cooling water temperature alarm and de-rate function.
- (p) Each engine low lubricating oil pressure alarm and trip.
- (q) Gearbox lubricating oil low pressure gauge (if fitted).
- (r) Gearboxes lubricating oil low pressure alarm and trip (if fitted)
- (s) Motors Overcurrent or Overload Alarm
- (t) Motor Short circuit Alarm
- (u) Motor Over Temperature Alarm
- (v) Motor Earth Fault Alarm

- (w) Motor Vibration monitor
- (x) Motor bearing temperature monitor
- (y) Ammeter for each engine.
- (z) Engine exhaust gas pyrometer.
- (aa) Fresh water tank content gauge.
- (bb) Diesel fuel tanks' content gauge.
- (cc) Overspeed alarm and trip.
- (dd) Diesel fuel service/storage tanks low level alarm.
- (ee) Different compartments bilge alarms and indications
- (ff) Battery charging control lamps.
- (gg) DC power on light.
- (hh) Central illumination dimmer for all light in the control console.
- (ii) Lamp test.
- (jj) Alarm test and reset.
- (kk) A standard engine maker's control panel to be provided in each of the engine rooms.
- (ll) Any other instrumentation recommended by the engine maker and GNC.
- (mm) Interface junction box for remote data collection.

7.4 Electric Generator Set(s)

- 7.4.1** The electric generator set(s) shall comprise either: **[E]**
- (a) Two (2) methanol-diesel dual-fuel engine-driven generator sets (viz as mentioned in Paragraph 7.2.1 of Part VII) each unit with equal power output rated not less than 1000 kW and one (1) loitering diesel generator set rated not less than 300 kW; **[E]**
- OR
- (b) Three (3) methanol-diesel dual-fuel engine-driven generator sets (viz as mentioned in paragraph 7.2.1 of Part VII) each unit with equal power output rated not less than 550 kW. **[E]**
- 7.4.2** The generator sets shall be electrically started, fresh water-cooled marine generators of adequate power integral with an alternating current alternator to enable the vessel to attain the Contract Speed, whilst all applicable electrical systems are running including AC and DC systems.
- 7.4.3** The main generator sets required for the power plant of Vessel shall comply with annual operation of at least 2,000 hours (8 hours, 250 days/year) specified in Paragraph 2.7 of this Part VII. All generator sets shall meet IMO Tier II emission requirements.
- 7.4.4** The electric generator set(s) shall be electrically started, fresh water cooled and integral with an alternating current alternator, of self-excited, brushless and water-cooled type, to be installed. All electric generator set(s) shall meet IMO Tier II emission requirements with or without NOx after-treatment.
- 7.4.5** The methanol-diesel dual-fuel generators can operate in parallel for a long period, while the one

- (1) loitering diesel generator (if fitted) can operate in parallel with the methanol-diesel dual-fuel generators for a short period.
- 7.4.6** The EIAPP Certificate and technical file shall be supplied by the engine manufacturer upon Vessel delivery.
- 7.4.7** Any one of the electric generator set at its continuous service rating, shall have sufficient capacity for supplying,
- (a) all operational electrical loads of the whole vessel running in standby mode including air conditioning running at full capacity plus not less than a 10% reserve margin; and
 - (b) To permit 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 cruising mode operational electrical loads including air conditioning running at full capacity of the whole vessel.
- 7.4.8** Full electrical load analysis and calculations shall be approved by an RO before submission to GNC.
- 7.4.9** An additional foundation, electrical circuits, control and alarm systems the same as the above electric generator shall be provided to cater for future installation of standby electric generator engine by the Government.
- 7.4.10** Type Approved certificates issued by an RO or other entities acceptable to GNC in compliance to meet IMO Tier II emission requirements shall be provided.
- 7.4.11** The main engine's exhausts and silencers shall be protected according to the requirements of the RO to avoid the hot surface danger to the personnel and minimise the heat transfer into the machinery space. All components of exhaust system shall be mounted or suspended by hangers which will not transmit heat, noise or vibration to the Vessel's structure.
- 7.4.12** The exhaust of the electric generator sets shall be arranged with a water-sealed silencer or equivalent reducing the noise levels.
- (a) The exhaust systems shall be designed appropriately to comply with the engine and exhaust manufacturers' requirements. The engines exhaust system shall be arranged to provide reasonable access to engine room machinery.
 - (b) The exhaust outlets leading to the ship's side are located above the waterline and shall be as high as practicable to prevent standing waves from sealing the outlet. Exhaust pipe outlets shall be at a minimum of 500 mm vertical distance above the loaded waterline and can be arranged via a goose-neck type expansion bellows to the exhaust outlet fitted to shell above the waterline for discharge.
 - (c) Expansion bellows shall be approved by the RO (for example, the goose-neck type in both dry and wet sides).
 - (d) Lagging / Noise control requirements: Flexible sound reduction wrap for exhaust piping works shall be based on manufacturers' / appropriate industrial standards.
 - (e) Under the premise of complying with the engines and exhaust manufacturers' requirements, the exhaust pipe shall be equipped with a water barrier plate to ensure a 100% of prevention of seawater and rainwater from flowing back into the exhaust pipes and the engine.
 - (f) The engines' starting system shall be interlocked with the opening of the water barrier plates to ensure that the engines can only start normally when the water barrier plate is fully opened and in place. After the engine shuts down, the exhaust dampers shall close

automatically.

7.4.13 The electric generator sets shall be equipped with a built-in methanol-diesel dual-fuel system supplied by the same manufacturer, featuring the following:

- (a) Manufactured by the same methanol-diesel dual-fuel engine supplier as specified in Paragraph 7.4.1 above;
- (b) The system shall operate in two (2) modes—"Diesel Mode" and "Methanol Mode"—and allow operator selection via a control panel located in the wheelhouse;
- (c) The system shall ensure rapid and smooth switching between fuels, precise and stable operation of the control system, and reliable performance of the nitrogen purging system;
- (d) It shall be capable of switching swiftly to "Diesel Mode" at any time in the event of a fault in the methanol operating system; and
- (e) Detail shall be discussed in the kick-off meeting.

7.4.14 The display and alarm items of the generator set shall meet the requirements of the RO and shall include at least the following:

- (a) Low inlet pressure of the bearing lubricating oil or high bearing temperature;
- (b) Voltage limit alarm (high/low);
- (c) Frequency limit alarm (high/low);
- (d) Current;
- (e) Power;
- (f) High stator winding temperature (>500kW);
- (g) Generator main switch open/closed;
- (h) Generator running;
- (i) On-grid generator fault;
- (j) Standby generator transfer;
- (k) High temperature of generator cooling medium (if applicable);
- (l) Cooling pump or fan fault (if applicable); and
- (m) Excitation voltage and current (applicable to units equipped with an electrical excitation system)

7.5 Instrumentation and Controls

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

7.5.2 One fire detector panel and one engine room/motor room (if necessary) CO₂ fire-fighting panel shall be installed in the vicinity of the control station.

7.5.3 Additional controls and monitoring devices shall also be provided locally in the vicinity of the machinery, including power management system to suit the electric propulsion system, which is

based on standard modules and shall be easy to update.

7.5.4 All the instruments such as temperature sensors, pressure sensors, depth gauges etc. shall have obtained type approval certificates issued by an 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.

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

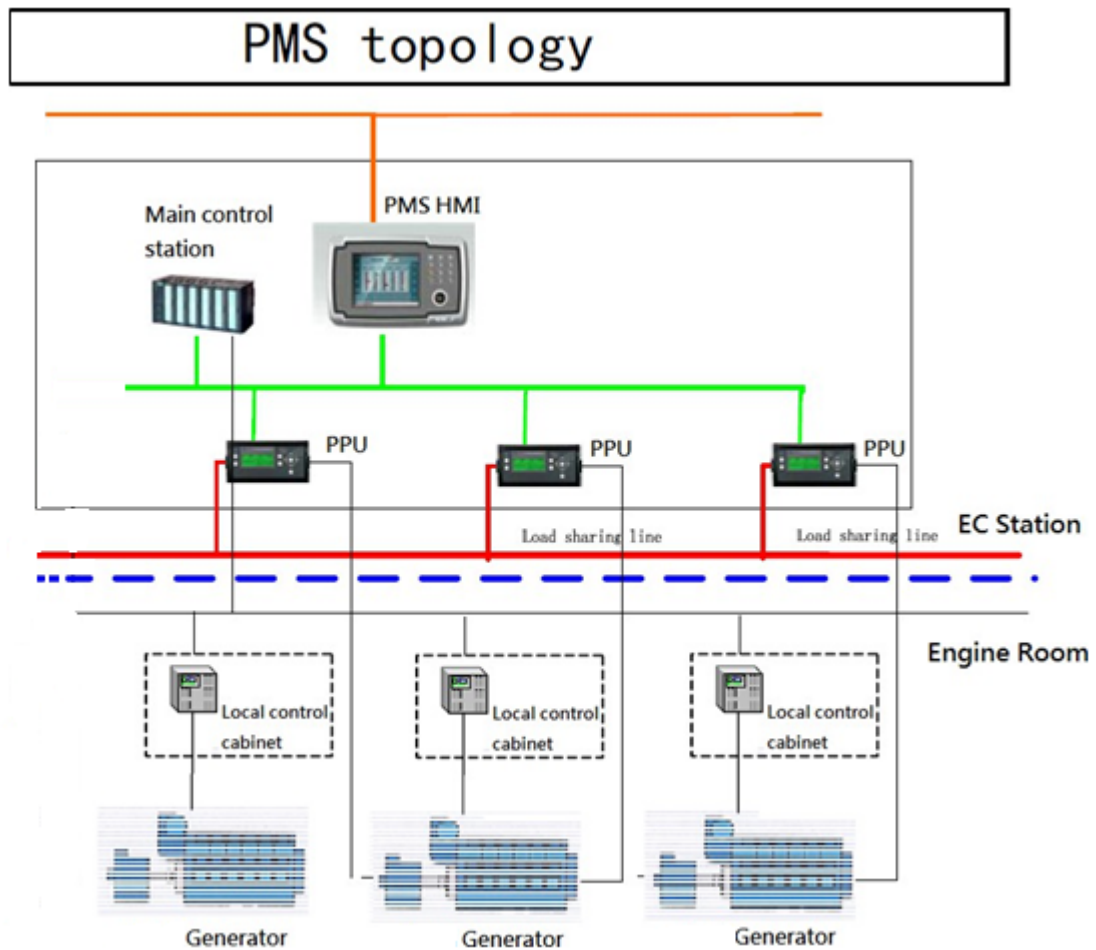
7.5.6 At least two independent means of stopping the electric generators from the wheelhouse control station under any operating conditions shall be available.

7.6 Power Management System ("PMS")

7.6.1 The Power Management System shall be designed to suit the electric propulsion system, and to be based on standard modules and easy to update.

7.6.2 The Power management system shall be located in the Main Switch Board Room or Engine Control Station ("EC" Station), to control and monitor the Generator sets according to the power consumer and requirement of the power plant, and PMS shall also be able to detect fault, issue the alarm of the power plant and protect from the blackout (see section 8.3).

7.6.3 The Power management system shall consist of main control station, controller and input / output module, parallel and protect unit ("PPU") and Human Interface ("HMI") Touch Panel.



7.6.4 Parallel and Protect Unit (“PPU”) shall be functionally arranged, capable to control the Generator sets, and to connect and disconnect by regular the frequency and load sharing, which also protect the Gen-sets from heavy defaults and one PPU for each generator-set. The minimum function provide of PPU as follows;

- (a) Fast over current protection
- (b) Over current inverse protection
- (c) Reverse active power
- (d) Over voltage Protection
- (e) VAR import/export protection
- (f) Synchronizing

7.6.5 Gen-sets parameters shall be displayed on the Human Interface (“HMI”) Touch Panel, enable the operator to monitor the Gen-sets, other power consumers and data management, and allowing the operator to control the Gen-sets manually and modify the parameters.

7.7 Electrical Propulsion Motors

7.7.1 Regardless of whether Paragraph 7.4.1(a) or (b) in this Part VII is applicable, the propulsion

system shall include two (2) electrical propulsion motors each with output power in 600 kW at the least, shall be rigid-mounted to the Vessel structure with minimum degree of enclosure protection. [E]

- 7.7.2** The electric motors shall be fitted with an air-cooling or water-cooling system and temperature sensors. This shall meet all applicable RO requirements for safe operation, and the protection from ingress of dirt, dust and water. It is desirable that the manufactures and makes of engines are the ones commonly used in Hong Kong.
- 7.7.3** Access must be provided to conduct general servicing of the electrical motors in situ; including general inspection and to provide lubrication.
- 7.7.4** The display and alarm items of the propulsion motor shall meet the requirements of the RO and shall include at least the following:
- (a) Low inlet pressure of bearing lubricating oil or high bearing temperature
 - (b) Voltage limit alarm (high/low)
 - (c) Excitation voltage
 - (d) Frequency limit alarm (for propulsion motors controlled by frequency converters, monitoring the output of the frequency converter may be used as a substitute)
 - (e) Armature current
 - (f) Excitation current
 - (g) High stator winding temperature
 - (h) Motor switch open/closed
 - (i) Motor running
 - (j) Motor overspeed
 - (k) On-grid motor fault
 - (l) Standby motor transfer
 - (m) High temperature of motor cooling medium (if applicable)
 - (n) Cooling pump or fan fault (if applicable)
- 7.7.5** Except for the propulsion motor, the display and alarm items of other equipment serving the propulsion electrical system shall meet the requirements of the RO and shall include at least the following:
- (a) Input voltage of the frequency converter
 - (b) Input current of the frequency converter
 - (c) Overload of the frequency converter (alarm before the protection device operates)
 - (d) Distribution switch of the frequency converter open/closed
 - (e) High temperature of the frequency converter's cooling medium (if applicable)
 - (f) Fault of the frequency converter's cooling pump or fan (if applicable)
 - (g) High temperature of the frequency converter's interphase reactor
 - (h) Protection trip of the frequency converter's filter circuit

- (i) High temperature of the propulsion transformer's winding (if applicable)
- (j) Ground fault of the excitation circuit (not required for systems without an excitation system)
- (k) Ground fault of the main propulsion circuit

7.8 Reduction Gearboxes

7.8.1 The reversing reduction gearboxes shall be rigid-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.

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

7.8.3 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.

7.9 Propeller Shafts, Stern Tubes, Propellers

7.9.1 All the components of the shafting system design and installation shall follow the RO Requirements including Torsional Vibration Calculation.

7.9.2 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.

7.9.3 Torsional vibration Calculation shall be submitted to the RO for approval before submission to GNC for record.

7.9.4 Stern tubes

(a) Water lubricated stern tubes with packing type glands shall be of type approved by the RO or other organizations acceptable to GNC. Propeller shaft bearings shall be RO-approved water-lubricated cutless rubber/composite type. Forward and after ends of the 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) or equivalent.

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

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

7.9.7 Rope cutting devices shall be fitted nearby the propellers.

7.9.8 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.

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

7.10 Steering Gear System

- 7.10.1** Steering Gear System will be a twin rudders arrangement and shall comply with the RO Requirements.
- 7.10.2** The electro-hydraulic steering gear, equipped with two (2) independent power units, shall have each operating unit capable of delivering the maximum torque to actuate the twin rudders. Specifically, the rudders shall be capable of turning from 35 degrees on either side to 30 degrees on the opposite side within 28 seconds, with the vessel proceeding ahead at the maximum continuous shaft revolutions per minute (rpm) under the sea trial condition.
- 7.10.3** The steering gear system shall include motor-driven pumps, reservoir/filter units, emergency manual helm pumps, rudder transmitter limit switch, rudder angle indicators, actuating cylinders, master helm control and one non-follow-up controller.
- 7.10.4** 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 wheel may also function as emergency manual helm pump in case of emergency. The power-driven hydraulic pump could be started and stopped both in wheelhouse and in steering gear room. Hydraulic steering wheels type shall be non-skid type of appropriate size acceptable to GNC.
- 7.10.5** The control of the rudder shall be switched from electro-hydraulic steering to emergency hydraulic steering via a change-over switch in the wheelhouse.
- 7.10.6** Separate illuminated rudder angle indicators with dimmer switch, running and overload alarm shall be provided in the wheelhouse.
- 7.10.7** Emergency steering system shall be provided and the emergency system proposal to be acceptable to GNC.
- 7.10.8** A change-over electric switch shall be provided in the wheelhouse for switching the steering control between electric mode and manual mode.

7.11 Rudders and Rudder Stocks

- 7.11.1** The rudders shall be designed to meet the RO Requirements.
- 7.11.2** Rudder angle indicators shall be provided in the steering gear room. The port and starboard degree markings at intervals not greater than one degree shall be permanently marked and distinguished by red (port) and green (starboard) in English and traditional Chinese.
- 7.11.3** Extremes of rudder travel shall be provided by mechanical stoppers.
- 7.11.4** Lower bearings of rudder stock shall be water-lubricated.
- 7.11.5** The rudder stock and rudder blade shall be made of stainless steel 316L and shall be designed in accordance with the RO Requirements.

7.12 Engine Room and Other Machinery Space Ventilation

- 7.12.1** There shall be four (4) sets of marine axial-type A.C. ventilating fans in the engine room. Two (2) sets of supply fans and two (2) sets of exhaust fans. Two (2) of them is to be reversible. All air inlets and outlets shall be equipped with fire dampers.
- 7.12.2** Arrangements shall provide sufficient air to the engine and shall provide adequate protection against damage, as distinct from deterioration, due to ingress of foreign matter.

- 7.12.3** The air supply inlet vents shall be connected to louvers of efficient design to prevent ingress of water during extreme weather conditions. The louvers shall be designed with a drip tray with drain line, which can drain seawater outside. All vents shall meet RO requirements.
- 7.12.4** 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 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).
- 7.12.5** Steering gear room, tank space and engine room 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.
- 7.12.6** For guidance, the ventilation air to the compartment as stated shall:
- (a) Shall limit the temperature rise in a machinery space to 12.5°C above ambient temperature.
 - (b) As the prime movers draw combustion air from within the compartment, the total ventilation air shall be based on ISO 8861 “Shipbuilding-Engine room ventilation in diesel-engine ships - Design requirements and basis of calculations” 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 during the yard trial.
- 7.12.7** Automatic shut-off devices shall be provided according to RO Requirements when CO₂ system is activated.
- 7.12.8** Calculations for the capacity of the fans to meet the minimum air changes requirements shall be submitted to the RO for approval.
- 7.12.9** The air outlet vents shall be connected to louvers of efficient design in preventing ingress of water during extreme weather conditions. The louvers shall be designed for a drip tray with drain line, which can drain sea water outside.

7.13 Diesel Fuel Tanks

- 7.13.1** The Vessel shall be built with hull-structure fuel tanks to service the Vessel’s main propulsion engines and ship service electric generators, with the capacity at least 8m³ or whichever larger in the calculation as specified in Paragraph 2.7.2 in this Part VII, 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, shock, corrosion and movement encountered under normal operating conditions and storage.
- 7.13.2** The tanks shall be interconnected to permit fuel transfer between the tanks.
- 7.13.3** 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.

7.13.4 Earthing device shall be provided for fuel filling system. Grounding wires shall not be clamped between a hose and its pipe or spigot.

7.13.5 Fuel filling systems shall be designed to avoid blowback of fuel through the fill fitting when filling at a rate of 30 L/min at between 1/4 and 3/4 full of the tank capacity.

7.13.6 Provisions of the diesel fuel 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 provided 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 tanks;
- (f) The tanks shall be designed and installed to prevent water from being trapped on the exterior surfaces;
- (g) Sounding pipes with chained caps shall be provided;
- (h) Tank drain shall be provided;
- (i) The compartment or space containing the diesel fuel tank shall be fitted with two (2) ventilating pipes of arrangement acceptable to GNC; and
- (j) The suction of the fuel tank shall be as close to the bottom of the tank. The suction well shall be provided at lowest location of fuel tank.

7.13.7 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) One (1) or two (2) separate diesel fuel tanks built in or integrated to the hull shall be provided. If two independent fuel tanks are installed, the diesel fuel 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 diesel fuel tank level sensor(s), no other wires 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 tanks shall be provided. Fuel supplied shall not be less than requirements of the Vessel's operation as Paragraph 2.7.2 of this Part VII with 10% margin in litres. The unpumpable capacity of each tank shall not be more than 10% of the capacity of that tank.

7.14 Air-Conditioning System

- 7.14.1** 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 Two (2) Sets (ceiling mounted air unit, one of standby mode)
 - (b) DayRoom Two (2) Sets (ceiling mounted air unit, one of standby mode)
 - (c) MSBS Two (2) Set (ceiling mounted air unit)
- 7.14.2** The temperature of the compartments as stated in Paragraph 7.14.1 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.
- 7.14.3** The cooling air capacity shall be designed to ensure even distribution. The total capacity of the air-cooling system shall be not less than 150% of the required cooling capacity. An individual control shall be provided in each compartment.
- 7.14.4** 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.
- 7.14.5** 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.
- 7.14.6** 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.)
- 7.14.7** Stainless steel 316 supporter racks 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.
- 7.14.8** The refrigerant shall be CFC and HCFC free.
- 7.14.9** 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.
- 7.14.10** 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 m³/h per person so as to keep the CO₂ level low enough for health reasons.
- 7.14.11** Bacteria resistant replaceable filters shall be fitted at air inlets.
- 7.14.12** 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 regard 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).

- 7.14.13** Sufficient ventilation shall be provided in case of the air-conditioning breakdown.
- 7.14.14** 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.
- 7.14.15** Install slim duct for cover up exposed refrigerant piping and wirings at outdoor space and vessel cabin. Slim Duct shall be UV resistant and fireproof to BS 476 Part 7 Class I.

7.15 Piping System

7.15.1 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.

7.15.2 All seawater cooling pipelines, bilge pipelines and fire water pipelines shall be made of nickel-copper pipes. Unless otherwise specified in the TS, the pipelines material used in other systems shall be copper chrome plated or stainless steel 316L. The thickness shall in accordance with the RO Requirements.

7.15.3 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.

7.15.4 Suitable provision for expansion shall be made, where necessary, in each range of pipes.

7.15.5 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.

7.15.6 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.

7.15.7 Watertight bulkheads, decks or structural members having pipeline penetration shall be designed and compensated in accordance with RO Requirements. The pipeline penetrations shall not result in any galvanic corrosion to the pipeline and the bulkheads, decks or structural members.

7.15.8 The material of the gaskets shall be capable of resisting chemical attack from the fluid being conveyed. Galvanic corrosion shall be avoided if different materials are used in the system.

7.15.9 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 (2) places.
- (b) Colour coding of machinery and piping shall be in accordance with the following:

Fire main	Red
Sea Water	Dark green
Diesel fuel	Dark brown
Lube Oil	Striped black/yellow
Fresh Water	Blue
Hydraulic Oil	Orange
Methanol	Light tan

7.16 Diesel fuel System

- 7.16.1** The dual-fuel generator sets and the electric generating sets of the Vessel shall be able to use ASTM D975-21 B5 blends diesel fuel (5% biodiesel, 95% diesel labelled B5) and approved by the engine makers.
- 7.16.2** The diesel fuel of the electric generating sets shall be supplied from one or more diesel fuel tanks. Endurance for fuel capacity shall be as stated in Paragraph 2.7.2 of this Part VII.
- 7.16.3** Quick closing valves (control from above the main deck) shall be fitted to the diesel fuel tanks outlets.
- 7.16.4** Boost pumps shall be arranged to lift fuel to the engines through coalescing filters.
- 7.16.5** 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.
- 7.16.6** The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight.
- 7.16.7** Two (2) electric motor-driven pump shall be provided for transferring the fuel.
- 7.16.8** The Contractor shall provide the initial fills of diesel fuel, 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.
- 7.16.9** 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.
- 7.16.10** 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 'diesel fuel' shall be provided at the filling point. Flexible hoses are not permitted as filling pipes. The diesel fuel inlet and inlet pipe size shall be properly enlarged to the satisfaction of GNC and the MD.
- 7.16.11** An easily removable coarse strainer shall be built into the filling line, if required.
- 7.16.12** 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 diesel fuel to the engines.
- 7.16.13** Flexible pipes of approved type shall be used as short joining lengths to the engine where necessary.
- 7.16.14** Water separators shall be fitted to the fuel supply line, if required.

- 7.16.15** Diesel fuel discharge connections to be arranged on the main deck, shall have connection at the lowest location of the diesel fuel tank.

7.17 Fresh Water System

Fresh water tank arrangement

- (a) One (1) 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. If it is an independent fresh water tank, it shall be made of 316 L stainless steel material.
 - (b) It shall be installed in the machine space as indicated on the Guidance General Arrangement Plan.
- 7.17.2** 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.
- 7.17.3** Marine grade stainless steel 316L shall be used for fresh water tank. The fresh water tank shall be flushed clean and inspected before installation and delivery of Vessel.
- 7.17.4** 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; the fresh water filling port shall be kept sufficiently far from the diesel fuel filling port to reduce the risk of confusion. Clear operational instructions shall be provided at the both filling stations to prevent incorrect operation.
 - (c) Air pipe; and
 - (d) A tank content level gauge in litres and low level alarm shall be fitted on the wheelhouse control station.
- 7.17.5** If the tank is designed to be integral with the hull, during installation, it shall be ensured that the loads due to the mass of the full tank are safely induced into the structure.
- 7.17.6** 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.
- 7.17.7** The freshwater tank shall not be directly adjacent to any other tanks carrying liquid of any kind.
- 7.17.8** 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.
- 7.17.9** A capacity indicator calibrated in litres shall be provided.
- 7.17.10** 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.
- 7.17.11** 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.

- 7.17.11** Cold freshwater taps completed with PVC braided / reinforced transparent hoses shall be fitted on the main deck forward and aft, crew space and wheelhouse top to provide a rinse off facility for cleansing purposes.

7.18 Bilge System

- 7.18.1** The Vessel shall be fitted with a bilge system to the requirements of the RO.
- 7.18.2** Two (2) electric bilge pumps are installed in the engine room to pump bilge water in the engine room, steering gear room, machine space and empty tank.
- 7.18.3** A jet pump for pumping bilge water from the bow is installed.
- 7.18.4** Include the chain locker shall be arranged a suitable bilge water suction device shall be provided for each compartments below the main deck.
- 7.18.5** Include the chain locker shall be equipped with bilge water alarms for each compartments below the main deck. A bilge audible and visual alarm panel shall be fitted in the wheelhouse control station for all subdivision compartment spaces.
- 7.18.6** 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.
- 7.18.7** A bilge water holding tank of capacity according to the requirements of RO shall be provided.
- 7.18.8** The bilge of the engine room, machine space 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 to the bilge water holding tank. An electric motor-driven Bilge water pump can pump out bilge water direct overboard in case of emergency affecting the safety of the Vessel.
- 7.18.9** Bilge piping shall be made of nickel-copper.
- 7.18.10** One (1) 24V DC portable bilge pump shall be provided.

7.19 Seawater System

- 7.19.1** 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.
- 7.19.2** It is desirable that sea chests provided for the main and auxiliary machinery should be installed in the vicinity of their respective seawater pump suction but with adequate distance between each other to avoid water flow disturbance. **[D]**
- 7.19.3** Seawater piping shall be made of nickel-copper. A suitable stF (rainer 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.
- 7.19.4** 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.

7.20 Sanitary, Grey and Black Water System

- 7.20.1** There is two (2) toilets located in the crew spaces. The toilets shall use sea water for flushing.
- 7.20.2** One (1) stainless steel SS316L sewage holding tank, with capacity of not less than 600 litres shall be provided. The sewage holding tank shall be fitted with a level gauge and a “Tank Full” indicator with audible alarm installed in a highly visible location in the wheelhouse.
- 7.20.3** Black water and sewage flushed from the toilets shall be designed to discharge into a sewage holding tank. A discharge macerator electric pump shall be provided for pumping out the contents of the sewage holding tank. This shall be primarily led to the shore connection. It shall also be arranged with a backup direct overboard discharge via a non-return valve, as needed.
- 7.20.4** Alternative piping shall be arranged for the toilets to be discharged directly overboard through a non-return shipside valve and a storm valve in case of emergency.
- 7.20.5** Grey water from drains of washroom floor and wash basins shall be discharged overboard.
- 7.20.6** Sanitary, Grey and Black Water piping shall be made of stainless steel 316L.
- 7.20.7** The design of the toilet shall be agreed and acceptable to GNC before installation.

7.21 Open Deck Drainage System

- 7.21.1** The Vessel shall be fitted with an open deck drainage system to the requirements of the RO.
- 7.21.2** Upper deck lines are constructed by aluminium alloy 6061 tubes and thick wall galvanized seamless steel tube if pass through the steel main deck.

7.22 Floor Plates, Handrails and Guards

- 7.22.1** The floor in compartments under main deck shall be covered with unpainted aluminium chequered plates for safe operational use.
- 7.22.2** All boundary bars, handrails, gratings, ladders, platforms, stanchions and vertical supports in the compartments shall be of lightweight construction. Aluminium chequered 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.
- 7.22.3** Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid rattling noise.
- 7.22.4** 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.
- 7.22.5** Components including but not limited to splash plates, casings, fenders and screens shall be provided for the protection of personnel and machinery.
- 7.22.6** Surfaces of machinery, equipment, cabinets, and pipes with a temperature of 60°C or above shall be wrapped with thermal insulation as required to maintain the temperature of internal fluids, protect personnel from burns, and prevent fires. Asbestos and asbestos-based materials shall not be used for insulation, cladding, and sealing throughout the vessel.
- 7.22.7** The exhaust pipes shall be wrapped with detachable aluminium silicate refractory fibers, and the outer layer shall be tightly covered with galvanized thin steel plates, so that the outer surface temperature is lower than 60°C.

7.23 Hydraulic Power Pack Station for Steering Gear System

7.23.1 Hydraulic power pack station consists of:

- (a) Two (2) pumps
- (b) One (1) oil tank
- (c) Two (2) pressure relief valves
- (d) Two (2) oil suction filters
- (e) Two (2) automatic backflush oil filters
- (f) Pressure gauges
- (g) Connection pipe
- (h) One-way valves
- (i) Oil level indication
- (j) Oil temperature indication
- (k) Starter cabinet
- (l) Other items RO required

7.23.2 Hydraulic power pack station shall be remotely controlled from wheelhouse. However, essential local manual controls shall also be provided for emergency operation.

7.23.3 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.

7.23.4 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.

7.23.5 The Steering Gear system including 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 their installations shall comply with the requirements of the RO.
- 8.1.2** All electrical equipment and their installations shall comply with the regulations of the International Electrotechnical Commission (hereinafter referred to IEC), Electrical Installations on Ships in the version as at the Contract Date unless the regulations specify that version of such regulations as at the keel laying date of the Vessel shall apply in relation to the relevant requirements specified therein.
- 8.1.3** 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 circuit conductors before heat can damage the conductor insulation, connections or wiring-system terminals.
- 8.1.4** 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.
- 8.1.5** The tripping and response times of protective devices shall all be taken into consideration in order that electrical faults shall not cause interruption of other electrical circuits so far as is practicable.
- 8.1.6** All electrical apparatus shall be so constructed and installed as not to cause injury when handled or touched in the normal manner.
- 8.1.7** Exposed metal parts of electrical machines or equipment, which are not intended to be live but which are liable under fault conditions to become live, shall be earthed.
- 8.1.8** Three-phase three-wire system with insulated neutral shall be adopted for the AC distribution system. Neither earthed neutral nor hull return system shall be accepted.
- 8.1.9** A two-wire insulated distribution system shall be used for the DC system.
- 8.1.10** All metal sheaths and armour for cables shall be electrically continuous and shall be earthed.
- 8.1.11** All electric cables and wiring external to equipment shall be at least of a flame-retardant type and shall be so installed as not to impair their original flame-retardant properties.
- 8.1.12** Cables and wiring serving essential or emergency power, lighting, internal communications or signals shall so far as practicable be routed clear of galleys, laundries, and other high fire risk areas.
- 8.1.13** Cables and wiring shall be installed and supported in such a manner to avoid chafing or other damage.
- 8.1.14** All components shall be marked in both English and traditional Chinese to indicate their use. Each cable shall be clearly labelled and carry its own unique identification code. The language on all control panels shall be in both English and traditional Chinese.
- 8.1.15** For each main and distribution system, whether primary or secondary, for power, heating or lighting, the insulation level to earth shall be continuously monitored and an audible and/or visual indications of abnormally low insulation values shall be provided.
- 8.1.16** The Contractor shall submit a layout plan showing the exact locations of electrical equipment. All electrical equipment shall be accessed easily and safely for inspection and maintenance. Location of cable transit system where cables pass through at watertight bulb head or deck penetration shall be shown in the layout.

- 8.1.17** Essential drawings and detailed particulars (such as the rating and capacity, type of all electrical equipment as well as the wiring, circuit breakers, lighting and sockets, etc.) shall be submitted to the RO for approval and GNC for endorsement before installation.
- 8.1.18** All installations shall be provided with manuals in both English and traditional Chinese for operation and maintenance.
- 8.1.19** The standard of installation shall enhance the Equipment's safety features. It shall not present any hazards to the operator, e.g. all metal panels exposed to the operator shall be grounded. Warnings of any potential hazards shall be displayed in both English and traditional Chinese, and/or with internationally recognized labels to the satisfaction of GNC.
- 8.1.20** Capacitors used in the system (e.g. electronic equipment, semi-conductor converter, VFD, etc.) shall have a discharge rate in compliance with IEC and RO requirements. Protection shall be provided to avoid personnel coming into contact with the capacitors unless the voltage is at a safe level.
- 8.1.21** All equipment installed onboard shall comply with IEC and RO requirements and be subject to final approval from GNC.
- 8.1.22** All metallic outdoor control panel enclosures shall be made of stainless steel 316, waterproof and with ingress protection rating of at least IP56.
- 8.1.23** All electrical equipment installed in hazardous areas caused by methanol shall meet the equipment protection level of at least Gas Group IIA and Temperature Class T2. For hazardous areas caused by batteries, the electrical equipment shall meet at least Gas Group IIC and Temperature Class T1.

8.2 Electrical Distribution Network

- 8.2.1** The main electrical AC power supply shall be provided by three (3) electric generators. Synchronizing operation is required.
- 8.2.2** The generators shall be sized based on a 10% 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 $\pm 5\%$ over the entire load range and a 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** The switchboard refers to the main and distribution switchboards, providing main power to the electrical systems in accordance with the requirements of the system supplier, the RO and to the satisfaction of GNC.
- 8.3.2** The main and distribution switchboards shall be so arranged as to give easy access to apparatus and equipment, without danger to personnel. The sides, the rear and, where necessary, the front of switchboards shall be suitably guarded. Exposed parts having voltages to earth exceeding 50 V shall not be installed on the front of such switchboards. Where necessary, non-conducting mats or gratings shall be provided at the front and rear of switchboards.
- 8.3.3** 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.
- 8.3.4** Instruments indicating voltage, frequency, current and power, shall be provided for the whole system in accordance with the RO and IEC requirements and agreed by GNC.
- 8.3.5** Under all normal conditions of operation, power is distributed from the main switchboard. The distribution system shall be designed to keep cable costs to a minimum by distributing power panels located close to the user services. Connections and components on panel-boards shall be in locations protected from the expected condition in accordance with IEC 60529.
- (a) IP67 as a minimum, if exposed to short-term immersion;
 - (b) IP55 as a minimum, if exposed to splashing water; and
 - (c) IP22 as a minimum, if located in protected locations inside the Vessel.
- 8.3.6** Switchboards shall be permanently marked with the nominal system voltages.
- 8.3.7** Self-standing marine type switchboards of aluminium construction with adequate ventilation louvers shall be fitted in an accessible and well-ventilated position in the MSBS.
- 8.3.8** Due consideration shall be given in respect of the switchboard location with a view to avoid any risk of damage or electrical fault resulting from oil and water spray, coolant leakage of any kind, or other mechanical hazards. Adequate guardrail(s) and insulated mat(s) shall also be provided. The switchboard location shall be approved by the RO and GNC prior to installation onboard the Vessel.
- 8.3.9** Switchboard panels shall be hinged at the front for easy access. Anti-rattle rubber strips or equivalent shall be fitted to all doors. All parts are to be accessible for inspection, maintenance or replacement to the satisfaction of GNC.

- 8.3.10** Megger tests and other relevant tests shall be carried out and witnessed by GNC. The results of these tests shall form part of the Sea Trial Report, which shall be submitted to GNC before Delivery Acceptance.
- 8.3.11** An appropriate laminated electrical diagram shall be affixed to each switchboard.
- 8.3.12** All switchboard instruments, controls, circuit breakers and fuses, 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 the generator shall be indicated.

8.4 DC Power Source

8.4.1 DC power for Generator Starting:

- (a) An independent bank of 24V batteries shall be provided for starting each of the generators. The arrangements shall be approved by the RO and accepted by GNC.
- (b) The capacity of the supply power shall be sufficient to provide at least three (3) consecutive starts of each of the generators from cold, without recharging.
- (c) The batteries if applicable shall be charged by engine driven alternators with backup service provided by an automatic battery charger. If not inherent in equipment design, 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 engine starting.
- (d) The battery chargers, if provided, shall provide automatic control between float and bulk or absorption charge modes. 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 set of completely discharged starting batteries to a fully charged condition within ten (10) hours. Battery chargers shall be able to perform a quick charge function, which is manually selected as required.
- (e) Batteries, if provided, shall be portable, maintenance-free, heavy duty, deep cycle and produced from environmentally friendly materials. They will have a minimum life expectancy of five (5) years, or 200 full discharge cycles at full load, rated in accordance with the RO requirements.
- (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 minimize 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.
- (h) The ventilation piping shall be routed to / from a protected location where any emitted gases will be safely dispersed. Cable glands are to be provided to maintain the integrity of the battery box ventilation.

8.4.2 DC power for Routine and Emergency supply:

- (a) 24V batteries power supply shall be provided by the main switchboard via AC/DC converter for routine DC supply.

- (b) Dedicated 24V batteries shall be provided for emergency DC supply.
- (c) In the event of a main electrical AC power failure, 24V DC emergency batteries shall act as an uninterrupted emergency supply for all communication equipment, navigation and emergency lighting and other essential equipment (including but not limited to fire monitoring and control system, vital instrumentation and control systems).
- (d) This emergency supply shall come into operation automatically in the event of a main electrical power supply failure. The capacities of these sets of batteries shall be sufficient to maintain the emergency supply in accordance with the RO requirements.
- (e) The emergency battery set shall be capable of maintaining its voltage throughout the discharge period within 12% above or below its normal voltage without recharging. The battery set shall automatically connect to the emergency lighting system in the event of a failure of the main electrical power supply.
- (f) The emergency battery set and its switchboard shall be located above the uppermost continuous deck and shall be readily accessible from the open deck. They shall not be located forward of the collision bulkhead. The battery installation location shall be well ventilated and designed to prevent ingress of water. The batteries shall be positioned and installed in accordance with the RO requirements to the satisfaction of GNC.

8.4.3 DC power for Radio Equipment supply:

- (a) One (1) set of radio battery for the radio equipment, any equipment unrelated to radio equipment shall not be connected to the circuit of the radio battery.
- (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 Emergency 24V DC services shall be supplied from the switchboard through a 2-wire insulated system to the following items:

- (a) Navigation light control panel and navigation lights.
- (b) Horn.
- (c) Emergency lighting.
- (d) Compass light.
- (e) Instrument panel in wheelhouse control console.
- (f) Public address system.
- (g) One hand-held searchlight and fixed searchlight(s).
- (h) Siren.
- (i) Any other navigational and electronic equipment as requested by GNC.

8.4.5 The supplied 12V batteries for configure any battery bank shall be either of 75AH, 100AH, 150AH or 200AH for fit for replacement of HKSAR government dockyard currently batteries AH during maintenance and repair work. Each battery bank shall be labelled for identification of services to be powered up.

8.4.6 The batteries as required in Paragraphs 8.4.1 and 8.4.2 above shall be subject to continuous float charge under normal operation of the Vessel by an automatic battery charger.

8.4.7 Battery charger installations shall meet the RO requirements including:

- (a) The chargers shall be sized such that a completely discharged battery set can be recharged to

80% capacity within eight (8) hours (100% at ten (10) hours). The battery chargers are to use bulk and absorption modes of charging, such that at the end of the charge, the current shall be tapered by a float mode.

- (b) The chargers shall be fitted with a pilot lamp, a charging adjustment device, a voltmeter and an ammeter indicating charging current.
- (c) Discharge protection shall be provided to prevent a failed charger component from discharging the battery set.
- (d) Battery selector / isolator switches shall be provided between battery chargers and the battery sets they serve.
- (e) Provisions shall be made to allow either diesel generator engine to be started by the other engine's starting batteries if applicable.

8.4.8 An instruction plate with a schematic wiring diagram illustrating the operating procedures and precautions for the selection of battery sets and charging of batteries shall be provided in the vicinity of the charger, battery selection switchboard and charging distribution board.

8.4.9 Batteries shall not be installed directly above or below a fuel tank or fuel filter.

8.4.10 Any metallic component of the fuel system within 300 mm above the battery top, if installed, shall be electrically insulated.

8.4.11 Battery cable terminals shall not depend on spring tension for mechanical connection to them.

8.4.12 A battery disconnection switch shall be installed in the positive and negative conductor from the battery, or battery sets, connected to the distribution system. The switch shall be in a readily accessible location, as close as practical to the battery or battery sets.

8.4.13 Local information plates showing the Voltage, Ampere-hour rating, group number and application shall be provided for each battery set.

8.4.14 Ternary lithium batteries shall not be used for all batteries.

8.5 Shore Power Supply and Connection

8.5.1 The shore power shall be capable of supplying the AC loading of the vessel whilst it is berthed alongside.

8.5.2 The minimum capacity of the shore power box shall be 125A, which shall be agreed by GNC at the kick-off meeting.

8.5.3 An isolation transformer shall be fitted. A moulded case circuit breaker for the shore connection box shall be provided on the main switchboard.

8.5.4 The shore connection box shall be capable of receiving 380-415V three-phase 50Hz system, and the cables between the connection box and the switchboard shall be of sufficient capacity to supply the necessary electrical equipment.

8.5.5 The shore power shall be arranged to supply the loading of the vessel whilst the vessel is berthed alongside (i.e. particular distribution panel to be provided). The arrangement shall be such as to avoid the necessity of starting up the generator whilst the vessel is alongside and connected to the shore power. The capacity of the power source and the equipment supplied shall be discussed and agreed by GNC at the kick-off meeting.

8.5.6 An earthing terminal shall be provided for connection of the Vessel's earthing to the shore earthing.

8.5.7 An instruction shall be provided at the connection box to provide full system information and the

procedures for connection.

- 8.5.8** The shore power system shall be interlocked to prevent the Vessel's generators from providing power to the shore at the same time. Indicating lights for "shore power available", "shore power breaker on" and "shore power breaker closed" to be fitted.
- 8.5.9** The Contractor shall provide a 1:1 isolation transformer for the shore power supply to the AC loading. The core of the isolation transformer shall be completely insulated from the case. The isolation transformer enclosure shall be drip-proof. The transformer shall be rated for continuous operation at the full capacity of the shore power connection.
- 8.5.10** The watertight connection box shall be designed with a quick release device.
- 8.5.11** Not less than 30 metres longshore connection power cable of adequate rating with quick release watertight plug shall be provided, the type shall comply with IEC requirements.
- 8.5.12** The shore connection power cable of not less than 30 metres shall be fitted with compatible connections to mate with existing facilities at the Government Dockyard and be identified by GNC. Suitable stowage onboard shall be provided for the cable.

8.6 AC Distribution Boards and Circuit Breakers

- 8.6.1** Several electrical distribution panels shall be installed throughout the Vessel for AC electrical distribution. Panels shall be of a drip-proof steel construction with hinged doors.
- 8.6.2** Moulded case circuit breakers are to 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 are to be clearly labelled with the name of each circuit. Labels are to 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 for essential services shall have separate start and stop push buttons plus running indication lights (with dimmer control) at 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 meet the RO requirements.
- 8.7.3** A circuit diagram shall be placed in the local control box of each electrical installation.
- 8.7.4** The power of the main propulsion motor shall not be less than 600 kW.
- 8.7.5** 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.

8.7.6 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 Cables and Wiring

- 8.8.1** 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 caused by chafing.
- 8.8.2** 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 electronics navigation equipment cables layout, etc. for ease of inspection and maintenance. Location of cable transit system where cables pass through at watertight bulkhead or deck penetration shall be shown in the layout.
- 8.8.3** 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 minimize earth faults.
- 8.8.4** 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.
- 8.8.5** Cables are to be flame-retardant, marine type, low smoke, zero halogen according to IEC 60332-3. Their selection and method of application are to comply with IEC 60092-352 and the RO requirements.
- 8.8.6** Cabling for emergency systems shall also comply with the higher fire survival rate stipulated in IEC 60331 and the RO requirements.
- 8.8.7** 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.
- 8.8.8** 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.
- 8.8.9** 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. Both sheathed and non-sheathed cables are mounted or supported properly to prevent from felling off when the vessel is running at a high speed. Cushioning / protection on the overhead cable trunk for preventing crew head injuries shall be provided in the engine room.
- 8.8.10** 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 1 m from the terminal. Other sheathed conductors shall be supported at maximum intervals of 450 mm.
- 8.8.11** Cabling shall be run along perforated metal trays and shall be secured in such positions as to allow easy maintenance.
- 8.8.12** Cabling inside accommodation areas shall be run behind linings, but shall not be embedded in the insulation, which shall have removable panels for inspection and maintenance.

- 8.8.13** RO approved watertight, fire resistant and gas tight cable sealing systems shall be provided by way of watertight bulkhead or deck penetrations. The penetration shall be located as high as practicable and well clear from the ship side.
- 8.8.14** 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.
- 8.8.15** Separation is to 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.
- 8.8.16** Each electrical cable that is part of the electrical system shall have means to identify its function in the system.
- 8.8.17** 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.
- 8.8.18** Tally plates showing the cable size shall be provided for each of the main power cables.

8.9 Lighting Fixtures

- 8.9.1** 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.
- 8.9.2** 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 maintenance and cleaning.
- 8.9.3** General lighting shall have individual or group switches to conserve power.
- 8.9.4** All lighting in the wheelhouse control panel shall be fitted with dimmer control and switches for night-time operation. It shall also be possible to set internal lights within the wheelhouse and accommodations spaces to red light for night operations.
- 8.9.5** Emergency exit routes shall be identified and illuminated as required by the RO requirements.
- 8.9.6** Suitable lighting shall be provided in all working areas such as galley, crew's desks, chart table and other areas determined by GNC.
- 8.9.7** Controls shall be provided within each compartment for illumination therein. Each light shall be manually controlled by a 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 (double pole). Fixtures shall be installed so that illumination will not be obstructed by fixed pipes, ducts, bins and berths.
- 8.9.8** Fixtures shall be mounted so as not to vibrate in any operating condition and so that the Vessel vibration will not harm the fixtures. Fixtures shall be selected and mounted to maintain the maximum possible headroom.
- 8.9.9** All sockets, terminal blocks, switches and receptacle interiors shall be made of non-flammable phenolic material.
- 8.9.10** The installed lightings at office rooms shall be able to provide lux level of 300-500 lux for normal

desk office work.

- 8.9.11** Exterior lighting fixtures shall be installed to illuminate the walkways and ancillary boat boarding areas.

8.10 Navigation Lights

- 8.10.1** All navigational and signal lights to be provided shall be in compliance with the International Regulations for Preventing Collisions at Sea (1972 as amended) (“COLREGs”) and all applicable (“IMO”) Resolutions. Type Approval certificates in respect of each model of the navigational and signal lights issued by the RO shall be provided on or before the Delivery Acceptance at the latest.

- 8.10.2** 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.

- 8.10.3** Navigation light circuits shall be independent of any other circuits. There shall be two (2) separate power supply systems to the distribution board.

- 8.10.4** The following navigational and signal lights (with double-pole circuit breakers), sound signalling devices and shapes shall be provided:

- (a) Port-side light (double tier, easy to access and the corresponding controls);
- (b) Starboard-side light (double tier, easy to access and the corresponding controls);
- (c) Stern light (double tier, easy to access and the corresponding controls);
- (d) Masthead light (double tier, easy to access and the corresponding controls);
- (e) Anchor light;
- (f) Combined Not Under Command (“NUC”) and diving lights;
- (g) One all-round flashing red light on the mast;
- (h) Black Ball (3 numbers);
- (i) Black diamond;
- (j) Whistle;
- (k) Bell;
- (l) Horn; and
- (m) Any other navigation lights as required.

- 8.10.5** Three (3) sets of spare bulbs shall be provided for the navigational and signal lights.

8.11 Search Lights

- 8.11.1** One (1) proprietary make 220V AC LED remote power-operated searchlight shall be installed on top of the wheelhouse.

- 8.11.2** The searchlight is to be one (1) long range (LED 800W capable of a minimum of 1.5 lux at 5 km) , it shall be fitted at the forward end of the superstructure facing forwards (0°) and capable of turning $\pm 135^\circ$.

- 8.11.3** The search light is to be remotely controlled.

- 8.11.4** Search light controller is to be provided at the wheelhouse control console.

- 8.11.5** High quality cover are to be provided for the searchlight. Suitable fastenings are to be fitted to searchlight/ wheelhouse top to facilitate fitting of searchlight cover.
- 8.11.6** If the fixed searchlight is not feasible. One (1) 24V DC LED portable search light (with luminosity equivalent to not less than 150W conventional type) with trigger switch integrated into the grip for Morse Code operation, a 30 meters waterproof cable reel and plug shall be provided. Portable search light is to be stored in the wheelhouse. The search light can be mounted and plugged on the port side and starboard side of the perimeter guardrails on the bridge outside the wheelhouse.

8.12 Floodlights

- 8.12.1** Appropriate quantities of AC 200WLED floodlights to be fitted. All maker's standard fittings and accessories shall be provided.
- 8.12.2** The floodlights are to be fixed to cover both sides of the ship.
- 8.12.3** The arrangement is to be designed and installed to the satisfaction of GNC.

8.13 Power Receptacles/ Sockets

- 8.13.1** Receptacles/sockets installed in locations likely to be subjected to rain, spray or splashing shall have a minimum protection of IP 55, in accordance with IEC60529 when not in use, e.g. protected by a cover with an effective weatherproof seal.
- 8.13.2** A system of 220V AC 13A and 24V DC 5A socket outlets shall be provided in the engine room, machinery space and steering gear room.
- 8.13.3** Sufficient socket outlets for 220V AC and 24V DC shall be provided in the wheelhouse to the satisfaction of GNC.
- 8.13.4** Socket outlets for 220V AC shall be provided throughout the Vessel as required by GNC.
- 8.13.5** 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 double pole protected and supplied with 13A 3-square-pin fused plugs. The 24V DC socket outlets shall be supplied with fused plugs.
- 8.13.6** Sockets for different voltage systems shall be clearly labelled and with different pin sizes so that one system cannot plug into the other.
- 8.13.7** 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.
- 8.13.8** The following areas are deemed to be hazardous and as such shall not have electrical cables led through unless specifically required for services within the space:
- (a) Deck Store containing paint and / or cleaning fluid; and
 - (b) Any spaces containing flammable / dangerous goods to the discretion of GNC.
- 8.13.9** Only flameproof or intrinsically safe electrical equipment is to be used in hazardous areas.
- 8.13.10** Any cabling which is required within the space is to be screened and earthed in accordance with the RO requirements. Where access to cabling is required, dust tight conduit boxes are to be provided.
- 8.13.11** Starters and socket outlets are not to be installed within hazardous areas.

8.14 Engine Condition Monitoring System (“ECMS”)

8.14.1 The Contractor shall provide an ECMS showing the information and functions specified below:

- (a) All the generator alarm and running parameters;
- (b) All the propulsion motor & Propulsion frequency converter alarm and running parameters;
- (c) All the Gearbox alarm and running parameters;
- (d) Fire detecting system;
- (e) Level alarm and indicator data;
- (f) Bilge alarm; and
- (g) Other relate alarm signals.

8.14.2 When an alarm signal occurs, the audible and visual alarm must be trigger, set mute and confirm button.

8.15 Unmanned Duty Alarm System

8.15.1 When the Vessel is afloat and unmanned, if the bilge-alarm , methanol leakage alarm, watertight door status (Open/close) or fire detecting system trigger, nobody acknowledged after five (5) minutes (can be adjusted), the audible and visual alarm shall be extended externally by 4G/5G system to on-shore command stations and other locations as requested by the GNC. In addition, the audible and visual alarm shall be extended externally to an audible and visual alarm fitted on the top of the deckhouse to attract the attention of persons ashore.

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

8.15.3 DC 24V power supply from DC Power Source.

8.16 Monitoring and alarm system and data transmission by 4G/5G network

8.16.1 Monitoring and alarm system

- (a) The main equipment monitoring and alarm system (including monitoring, alarm and recording points) shall be provided in accordance with the requirement of MD and the maker's recommendation. The monitoring and alarm system of main equipment shall provide acoustic and optical warning signals when the equipment is in an abnormal state. The power of the alarm system shall be from the main power source and with a backup by the battery for at least 15 minutes. The alarm and monitoring system shall at least:
 - (i) Collecting the display and alarm signal including temperature, pressure, liquid level of propulsion motor , Propulsion frequency converter, methanol tank, generator set, steering gear and gear box;
 - (ii) Collecting the navigation data.
 - (iii) Data Transmission by 4G/5G Network
 - (iv) Communication devices shall be provided for the monitoring and alarm system.
- (b) The monitoring and alarm data collected by the system shall be transmitted to the onshore

office by public 4G/5G network by JSON format (or any other data format agreed by GNC).
The 4G/5G network data service shall be separately procured by GNC.

8.16.2 Vessel Monitoring Dashboard

- (a) The Vessel Monitoring Dashboard shall be provided in accordance with the requirement of GNC and the maker's recommendation. The Vessel Monitoring Dashboard shall be deployed to MD's Cloud Computing Platform (or any other platform agreed by GNC).
- (b) The Vessel Monitoring Dashboard shall at least consist of:
 - (i) A web-based dashboard system; and providing the following functions:
 - (ii) Receive the monitoring and alarm data issued by the monitoring and alarm system;
- (c) Display the real-time and historical data including temperature, pressure, liquid level of main engine, generator set, steering gear and gear box;
 - (i) Display the alarm signal;
 - (ii) Display the navigation data;
 - (iii) Comply with MD's Departmental IT Security Policy; and
 - (iv) Comply with IT Security Assessment and Audit arranged by a third-party IT Security Auditor.
- (d) The Contractor shall provide software setup on Vessel Monitoring Dashboard and provide necessary assistance to IT Management Unit of MD.

Chapter 9 Electronic Navigation Equipment

9.1 General Requirement of the Electronic Navigation Equipment

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 with USB or equivalent Player and Public Address System (Paragraph 9.2);
- (b) Magnetic Compass (Paragraph 9.3);
- (c) Fluxgate compass (Paragraph 9.4);
- (d) IMO Compliant Navigation Radar with Automatic Radar Plotting Aid (“ARPA”) (Paragraph 9.5);
- (e) Differential Global Positioning System (“DGPS”) (Paragraph 9.6);
- (f) BeiDou Navigation System (“BDS”) (Paragraph 9.7);
- (g) Real-Time Kinematic (“RTK”) (Paragraph 9.8);
- (h) Electronic Chart Display and Information System (“ECDIS”) (Paragraph 9.9);
- (i) Downward Facing Echo Sounder (Paragraph 9.10);
- (j) Wind Speed/Direction Sensor (Paragraph 9.11);
- (k) Automatic Identification System (“AIS”) Transponder (Include the receiver and transmitter modules) (Paragraph 9.12);
- (l) Conning Data Collection and Information Display (Paragraph 9.13);
- (m) Sound Reception System (Paragraph 9.14);
- (n) International Maritime Mobile (“IMM”) VHF Radio with GMDSS (Paragraph 9.15);
- (o) Marine Band Hand-held Waterproof Radio Transceiver (Paragraph 9.16);
- (p) Radar transponder (Paragraph 9.17);
- (q) CCTV System (Paragraph 9.18);
- (r) Talkback System (Paragraph 9.19);
- (s) Sound power telephone (Paragraph 9.20); and
- (t) Electric horn conforming to IMO requirement (Paragraph 9.21).

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 (t). 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 Paragraph 9.1.1 (a) to (t).

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 with USB or Equivalent Player and Public Address System

- 9.2.1** The Contractor shall supply and install a Loudhailer/Siren System for external broadcast with a Public Address System for on deck and internal broadcast within the Vessel. The systems shall be specially designed for maritime purposes.
- 9.2.2** The Loudhailer/Siren System shall comprise the following:
- (a) a master control unit in the Wheelhouse and two (2) waterproof horn type loudspeakers, in conformance to IP56 or higher, located forward and aft of the Vessel;
 - (b) Shall be capable of generating a 'Yelp' siren and a horn signal sound in manual mode;
 - (c) It shall also have a selection of at least four (4) warning signal sounds in automatic mode, at appropriate selectable time intervals, for general marine navigational use, namely:
 - (i) Under power, under way and making way;
 - (ii) Under power, under way and not making way;
 - (iii) Towing / restricted manoeuvring;
 - (iv) At anchor; and

- (v) Others to be confirmed.
- (d) The system shall support MP3 and WAV audio file formats and shall allow changing siren alarm patterns by updating associated audio files.
- (e) There shall be a volume control for the external broadcasting speakers, which shall be adjustable to full power of the horn type loudspeakers, down to a minimum level when issuing instructions to a vessel in close proximity.
- (f) The master control unit, which shall include a splash-proof fist microphone with push-to-talk (“PTT”) button for delivering speech and a microphone hanger, shall be recessed and mounted in the Wheelhouse control console with the following facilities provided on the front panel:
 - (i) LCD display;
 - (ii) Power ON/OFF;
 - (iii) Hail volume control; and
 - (iv) Function control.
- (g) The horn type loudspeaker shall be IP56 class or higher waterproof reflex type, 8 Ohms impedance with power rating not less than 30 Watts (actual rating shall match with amplifier).
- (h) A USB or equivalent player shall be provided and integrated with the Loudhailer/Siren System in such a configuration that the audio signal from the USB or equivalent player can be broadcast through the Loudhailer/Siren System. The USB or equivalent player shall at least support MP3 and WAV audio file formats. The USB or equivalent player shall be equipped with an SD card drive.

9.2.3 Public Address System

- (a) The Contractor shall supply and install a Public Address System for providing a one-way internal voice broadcast within the Vessel and the on-deck crew from a Public Address System Control Panel installed in the Wheelhouse.
- (b) The Public Address System Control Panel shall have selection buttons to make all zone or selected zone announcements, a push-to-talk button to activate the microphone, a siren button to generate an alarm (all zones), a gooseneck microphone and a volume control.
- (c) The Public Address System shall provide at least six (6) zone selections as well as all zones selection. The Contractor shall discuss and confirm the definition of each zone with GNC during the kick-off meeting.
- (d) The outdoor speakers shall be 15 Watt or more and at least IP56 class waterproofing.
- (e) The positions of the Public Address System Control Panel as well as the quantity and position of the speakers shall be proposed by the Contractor and finalized in the detailed design stage.
- (f) All the areas demanded by RO shall be covered by the Public Address System.

9.3 Magnetic Compass

9.3.1 The Contractor shall provide one (1) magnetic compass and one (1) fluxgate compass with digital display.

9.3.2 The magnetic compass shall be provided with back lighting.

9.4 Fluxgate Compass

- 9.4.1** The fluxgate compass shall consist of at least a sensor unit and a display unit, and be compact and easy to operate. It shall have direct connection to the radar.
- 9.4.2** An electronic display unit shall be installed at a position for easy viewing of Vessel heading by the coxswain.
- 9.4.3** The fluxgate compass shall be electronic such that GPS / DGPS will not cause deviation.
- 9.4.4** The fluxgate compass shall be provided to allow the operation of the radar in north stabilised mode and supply heading direction information to colour plotter system.
- 9.4.5** Performance Requirements of fluxgate compass:

(a) Reference	:	Either magnetic north or true north.
(b) Accuracy	:	±1.0° typical or better.
(c) Resolution	:	0.1° or better.
(d) Deviation Compensation	:	Automatic.
(e) Operating Temperatures	:	0°C to 50°C
(f) Waterproofing	:	IPX5 or better.

9.5 IMO Compliant Navigation Radar with Automatic Radar Plotting Aid (“ARPA”)

9.5.1 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 also be able to detect tiny targets such as small buoys or wooden stakes.
- (d) The Contractors shall ensure that the type and the number of provisions of the radar are appropriate to the class of the Vessel.
- (e) 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.
- (f) 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.
- (g) 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.

- (h) Complete interface kit shall be provided to interface the radar for the fluxgate compass, GPS/DGPS, colour plotter and AIS. 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.
- (i) 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.
- (j) 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 Contractor 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.
- (k) 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 type’s equivalent to NMEA 0183 OR NMEA 2000 is acceptable.
- (l) The power for the equipment shall be supplied from the DC 24V system of the Vessel.
- (m) 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.
- (n) 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.
- (o) 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.
- (p) On the viewing side of the display unit, the following controls shall be provided:
 - (i) Power ON/OFF
 - (ii) Standby/Transmit
 - (iii) Automatic adjustment of gain, sea clutter and tune keeps targets clearly in view
 - (iv) True motion display the Vessel’s movements relative to fixed targets
 - (v) Bearing cursor rotation
 - (vi) Electronic bearing line (“EBL”)
 - (vii) Variable range marker (“VRM”)

- (viii) Range scale selection
- (ix) Display brilliance & illumination
- (x) Selection of background colour and target colour
- (xi) Tuning
- (xii) Heading marker ON/OFF

9.5.2 Performance Requirements

(a) The marine radar shall perform at least or better than the following requirements in Paragraph 9.5.2.

(b) Processor unit:

- | | |
|------------------------------|---|
| (i) Presentation mode: | Head up, course up, north up and true bearing modes (with inputs of compass and speed data) |
| (ii) Range scale: | 0.125 nm to 24 nm |
| (iii) Range units: | Selectable from nautical miles, kilometres, and kilo yards |
| (iv) Minimum range: | 30 m or less |
| (v) Range ring accuracy: | 1.5% or less of the maximum range of the scale in use; or 30 m, whichever is the greater |
| (vi) Radar bearing accuracy: | 1.5 degree or less |
| (vii) Display language: | English Bilingual (English and Chinese) is preferred. |
| (viii) Other: | With adjustable electronic bearing lines and variable range markers features |
| (ix) Operating temperature: | -15°C to +55°C or better |
| (x) Relative humidity: | 90% or better |

(c) Display Unit:

- | | |
|-------------------|------------------------------|
| (i) Display: | Flat panel colour LCD |
| (ii) Screen size: | 15 inches (381 mm) or larger |
| (iii) Resolution: | 1280 x 1024 pixels or better |
| (iv) Brightness: | 700 nits |

(d) Transceiver:

- (i) Operating frequency: 9410±30 MHz (X-band)
- (ii) Peak power output: At least 6 kW (Please note that this specification about peak power assumes a traditional radar (magnetron radar), rather than a solid state radar.)
- (iii) Pulse length: Equipped with long, medium and short pulse modes for close, medium and long range operation
- (iv) Overall noise figure: 6 dB or better
- (e) Antenna:
 - (i) Operating frequency: 9410±30 MHz (X-band)
 - (ii) Aerial type: Open array radar antenna
 - (iii) Horizontal beam width: 2.0 degrees or less
 - (iv) Vertical beam width: 26.0 degrees or less
 - (v) Polarization: Horizontal
 - (vi) 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.
 - (vii) Operating temperature: -15°C to +55°C or better;
 - (viii) Relative humidity: 90% or better
 - (ix) Waterproofing: IPX6
- (f) Heading Marker, Bearing Measurement and Display
 - (i) The thickness of heading marker shall not be greater than 0.5 degree with an accuracy of not greater than 1 degree.
 - (ii) Arrangements shall be provided for bearing measurement with an accuracy of better than degree. Bearing discrimination shall be better than 2.0 degrees.
 - (iii) ARPA (Automatic Radar Plotting Aid) Requirement
 - (iv) Target acquisition: 10 targets (manual)
 - (v) Tracking: Automatic
 - (vi) ARPA range scales: From 0.75 to 12 nautical miles or better

- | | | |
|--------|-----------------------------|--|
| (vii) | Readout of selected target: | Range, bearing, course, speed, CPA (Closest Point of Approach), TCPA (Time to Closest Point of Approach) |
| (viii) | Target vector: | Relative, true |
| (ix) | Intercept mode: | Automatically calculate intercept course and Time to Go (TTG) to tracked target |
| (x) | Adjustable warning limit: | warning 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:
- (i) radar image only,
 - (ii) plotter image only, or
 - (iii) Plotter image overlaid with radar image.

9.6 Differential Global Positioning System (“DGPS”)

9.6.1 The Contractor shall supply and install one (1) 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 MD) 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 of 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:
 - (a) Position (latitude/longitude): to at least four (4) decimal points

- (b) Horizontal position accuracy (at speed of 15kt): less than or equal to 10m
- (c) Course: 1° resolution
- (d) Speed: 0.1 knot or 0.1 km/hour resolutions with at least three (3) digits
- (e) Date and time: selectable as GMT or local mode
- (f) Satellite status information

9.6.4 The DGPS's antenna and receiver shall fulfil the following minimum technical requirements:

- (a) Receiver Type: 8 or more channel parallel receiver
- (b) Receiving Frequency and Code: 1,575.42 MHz (C/A code)
- (c) Position Accuracy: Within + or - 3 metres rms or better 95% of the time
- (d) Warm Start Time: Less than 30 seconds
- (e) Ambient temperature: 0°C to 55 °C or better
- (f) Antenna waterproofing: IPX7 or better

9.7 BeiDou Navigation System ("BDS")

9.7.1 The Contractor shall provide one (1) set BeiDou Navigation System.

9.7.2 The BDS shall integrate with radars, ECDIS, for providing real time Vessel position and clock signal in the NMEA 0183 format. The antennas for the BDS shall be installed on the compass deck.

9.7.3 The BDS 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) Keyboard;
- (c) BDS to be displayed at Wheelhouse Control Station and at Navigation/Communications Console and anywhere else required by GNC;
- (d) Capable of integrating with secure AIS, radar, ECDIS;
- (e) The BDS antenna/receiver shall be connected to the radar for the provision of BDS-related data, such as position fix, time, speed over ground and course over ground;
- (f) The BDS system shall support Serial NMEA 0183 format; and
- (g) The BDS system shall support at least the following data displayed at the BDS display unit and through outputs to the radar display:
 - (a) Position (latitude/longitude): to at least four (4) decimal points;
 - (b) Horizontal Position accuracy (at speed of 15kt): less than or equal to 10m;
 - (c) Course: 1° resolution;
 - (d) Speed: 0.1 knot or 0.1 km/hour resolutions with at least three (3) digits;
 - (e) Date and time: selectable as GMT or local mode; and
 - (f) Satellite status information.

9.7.4 The BDS' s antenna and receiver shall fulfil the following minimum technical requirements:

- (a) Position Accuracy: Within + or - 2.5 metres rms or better 95% of the time;
- (b) Warm Start Time: Less than 30 seconds;

- (c) Ambient temperature: 0°C to 55 °C or better; and
- (d) Antenna waterproofing: IPX6 or better.

9.8 Real-Time Kinematic (“RTK”)

9.8.1 The Contractor shall provide one (1) sets Real-Time Kinematic (RTK).

9.8.2 The RTK (Real-Time Kinematic) system shall include the following components:

- (a) One (1) RTK receiver;
- (b) One (1) GNSS antenna; and
- (c) Supporting application software.

9.8.3 The RTK receiver shall generally be equipped with the following interfaces:

- (a) GNSS Antenna Interface: Connects to an external GNSS antenna;
- (b) 4G Network Antenna Interface: For network-based RTK operation, connects to a cellular network antenna;
- (c) PPS (Pulse Per Second) Interface: Outputs a 1PPS timing signal;
- (d) UHF Interface: For radio-based RTK operation, connects to a UHF radio antenna;
- (e) LAN Port: Standard Ethernet interface for positioning data output;
- (f) COM2 Port: Connects to a standard DB9 serial port for positioning data output and PPS signal transmission;
- (g) PWR COM1 Port: Provides receiver power supply and 5-pin serial data output;
- (h) SIM Card and SD Card Slot: Upper part for Nano SIM card, lower part for SD card; and
- (i) Mini USB Interface: For firmware updates and data download;

9.8.4 The RTK’ s antenna and receiver shall fulfil the following minimum technical requirements:

- (a) Output Format: NMEA-0183, Binary
- (b) Positioning Data Frequency: 1~20Hz
- (c) Static Data Format: GNS, RINEX dual-format static data
- (d) Differential Format: CMR, RTCM2.x, RTCM3.0, RTCM3.2
- (e) StarFire Differential: Supports StarFire differential function
- (f) RTK Positioning Accuracy:
 - Horizontal: $\pm (8 + 1 \times 10^{-6} D)$ mm (where D is the distance between the measured points)
 - Vertical: $\pm (15 + 1 \times 10^{-6} D)$ mm (where D is the distance between the measured points)
- (g) Static measurement accuracy:
 - Horizontal: $\pm (2.5 + 0.5 \times 10^{-6} D)$ mm (where D is the distance between the measured points)
 - Vertical: $\pm (5 + 0.5 \times 10^{-6} D)$ mm (where D is the distance between the measured points)
- (h) Single-point positioning accuracy: Adopting BDS, GPS and GLONASS combined positioning mode
 - Horizontal accuracy: ± 3 m (RMS)

Vertical accuracy: $\pm 5\text{m}$ (RMS)

- (i) Orientation accuracy: $\leq 0.2^\circ$ (orientation version, 1-meter baseline)
- (j) Ambient temperature: 0°C to 55°C or better;
- (k) Antenna waterproofing: IPX6 or better.

9.9 Electronic Chart Display and Information System (“ECDIS”)

9.9.1 The ECDIS shall show the radar, AIS, depth of water by echo sounder and ENC information in one picture.

9.9.2 General Requirements

- (a) One (1) set of Electronic Chart Display and Information System (ECDIS) shall provide the following functions:
 - (i) Navigational calculation
 - (ii) Chart updating
 - (iii) Piloting
 - (iv) Voyage monitoring
 - (v) Create User Charts and Route Plan
- (b) One (1) set of ECDIS with DGPS receiver and echo sounder shall be installed. It shall consist of three (3) 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.
- (c) 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.
- (d) One (1) screen monitor of size not less than 19 inches shall be provided. The screen monitors must fulfil the following features:
 - (i) 1000 nits Brightness;
 - (ii) 610 mm active viewing area;
 - (iii) HDMI, DVI and composite inputs with a pre-installed cable to the Server Rack for transmission of hydrographic survey information as secondary input;
 - (iv) On-class menu keys; and
 - (v) Can be operated as components including but not limited to radar, chart plotter, depth sounder and alarm.

- (e) 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.
- (f) The system shall be equipped with navigational sea charts in details covering the entire Hong Kong Waters.
- (g) The information received by the AIS shall be able to display on the screen monitors of ECDIS.
- (h) Complete interface kit shall be provided to interface with the colour chart plotter for the radar, echo sounder and GPS/DGPS. The colour chart plotter shall accept and display information given by the radar, echo sounder and GPS/DGPS receiver.
- (i) The processor unit of the ECDIS shall accept and display information given by the ENE: Radars, VHF, AIS transponder, DGPS and control console. The processor unit shall have high-performance quad-core processor for rapid, responsive operation of the multiple touch screen monitor.
- (j) One (1) laptop computer with additional LCD display shall be separately installed. The Contractor shall confirm the installation location with the user. This laptop computer shall fulfill the following requirements:

- (i) Operating system: Window 11 Professional (Chinese) or better
- (ii) CPU: Intel Core i7 (Gen 12 or newer) Processor 2.6GHz or better
- (iii) RAM: 8 GB 4800MHz DDR5 or better
- (iv) Display card: Up to 1920 x 1080 HDMI and provide the dual displays function which provide the display signal to the monitor of ECDIS
- (v) Monitor: 15.6 inches or better
- (vi) HDD type: 512 GB SSD
- (vii) HD: 500 GB or above
- (viii) Interface: USB (3.1) x 2, USB (Type C) x 1, Bluetooth (receive NMEA Data from AIS and DGPS, connect the printer, multi-card reader and USB device)
- (ix) Accessories: Multi-card reader (SD / MMC+ / miniSD, Micro SD, Compact Flash I / II, MS PRO / MS PRO Duo)
- (x) Software: Orca Master (ECS Software), Microsoft Office Standard 2019 or the latest version
- (xi) Printer: Multi-functional laser printer (copy, print and scan) connected to personal computer through USB, the print & copy speed at least 35 pages per minute and support auto double-sided printing, copying, and scanning. It is desirable that the dimensions (width, depth and height) of

the printer is 494 mm x 430 mm x 448 mm

(xii) Display: LCD Monitor 32 inches or better

- (k) ECDIS display shall be used for the display of radar, radar tracked target information, AIS and other appropriate data layers to assist in route monitoring.
- (l) ECDIS shall provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment.
- (m) ECDIS is capable of reading and loading IHO S-57 (Version 3.1) ENC data file and update the same where necessary. Also it is able to handle the different chart format such as S-57 digital charts, SevenCs directENC charts, SevenCs Bathymetric ENCs, ARCS charts, VMAP/DNC charts, AML charts, BSB charts, WMS charts and Geo TIFF.
- (n) The chart information to be used in ECDIS shall be the latest edition, can be corrected by official updates (S-57 digital charts, SevenCs directENC charts, SevenCs Bathymetric ENCs) by the MD with records of update shown on the ECDIS.
- (o) ECDIS shall enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. It shall be capable of continuously plotting the ship's position.
- (p) The ECDIS shall be capable of displaying both English and Chinese characters of the ENC.
- (q) ECDIS shall store 12 hours history voyage record and can be reproduced on the ECDIS.

9.9.3 Performance requirements

(a) Navigational Features

- (i) Total waypoints: 2000 or more
- (ii) Routes: 50 route plans or more
- (iii) Alarms: Including but not limited to, proximity alert, cross-track error, and arrival /anchor watch

(b) Environment

- (i) Operating temperature: 0°C to +50°C
- (ii) Storage temperature: 0°C to +60°C

(c) Electrical and Physical

- (i) Power source: 12 - 24V DC (external)

- (ii) Display (screen type): 24 inches or greater diagonal high resolution colour display resolution 1280 x 1024 pixels or better for 4:3 aspect ratio
- (iii) Waterproof rating: IPX6 or greater

(d) GPS Receiver

- (i) GPS receiver type: Equipped with 8 channel parallel receiver or better
- (ii) Frequency range (GPS): 1575.42±1MHz (C/A code), L1
- (iii) Sensitivity (GPS): -130 dBm or better
- (iv) Dynamic range (GPS): 25 dB or better
- (v) Warm start fix time: Less than 30 seconds
- (vi) Cold start fix time: Less than 3 minutes
- (vii) Position accuracy: no greater than 15 m
- (viii) Tracking velocity: 999 knots

(e) Differential Beacon Receiver

- (i) Frequency range: 283.5-325 kHz
- (ii) Frequency step: 500 Hz
- (iii) Position accuracy: No greater than 5 m

(f) Data Display

- (i) Lat/Lon: N or S plus 7 digits E or W plus 8 digits
- (ii) Speed and course: 0.1Kt/h or 0.1Km/h resolution digit 1-degree resolution
- (iii) Cross track error: Graphic or direction indication
- (iv) Bearing: 3 digits, 1-degree resolution
- (v) Range: 4 digits, 0.01-nm resolution
- (vi) CDI: Active perspective view, selectable scale (0.1, 0.3 or 0.5nm)
- (vii) Time: Selectable as GMT or local mode

- | | |
|---------------------------|---|
| (viii) Mapping: | Resident world map in memory (reversible video) |
| (ix) Language for system: | English operation and display Bilingual (English and Chinese) |

9.9.4 The Contractor shall supply the back up for ENC or ECDIS (paper nautical charts).

9.10 Downward Facing Echo Sounder

9.10.1 The Contractor shall supply and install a Downward Facing Echo Sounder System with the sonar unit securely installed on the body of the Vessel. The Downward Facing Echo Sounder shall be as follows:

- (a) The Equipment shall consist of a transducer and a digital depth indicator 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 (3) 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, which shall be selected on the front panel of the Equipment.
- (d) The accuracy of depth readings shall be greater than + 5% of the 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 200 kHz.
- (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 operate and function as in normal working condition.
- (g) The transducer shall not interfere or be interfered with by other Equipment on the vessel.
- (h) The downward facing echo sounder supplied shall be completely compatible with all systems using the NMEA 0183 or 2000 standard and be capable of interfacing with the navigational radar, ECDIS, compass, DGPS and other Equipment as necessary. The downward facing echo sounder supplied shall be connected to the navigation radar display.

9.10.2 Downward Facing Echo sounder display shall be:

- (a) 10.4" 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.

9.11 Wind Speed/Direction Sensor

- 9.11.1** The Contractor shall provide and install a marine type solid state ultrasonic wind speed and wind direction sensor(s). The sensor(s) shall be of high accuracy, robust as well as compact and be mounted on the mast in an unobstructed location.
- 9.11.2** The Contractor shall provide and install a digital display unit in the Wheelhouse to provide a digital display of true and apparent wind speeds and direction.
- 9.11.3** The sensor shall use the NMEA 0183 or NMEA 2000 standard interface to share information with other ENE.
- 9.11.4** The wind speed sensor shall fulfil the following requirements:
- (a) Range: 0-120 knots or above
 - (b) Accuracy: $\pm 2\%$ (at Contract Speed)
 - (c) Resolution: 0.01 knots
- 9.11.5** The wind direction sensor shall fulfil the following requirements:
- (a) Range: 0-359°
 - (b) Accuracy: $\pm 3^\circ$
 - (c) Resolution: 0.1°

9.12 Automatic Identification System (“AIS”) Transponder (Include the receiver and transmitter modules)

9.12.1 General Requirements

- (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, IMO MSC.191(79), ITU-R M.1371, ITU-R M.493, ITU-R M.825 (DSC), IEC 61993-2, IEC60945, IEC 61162-1/2, IEC 62288. The equipment shall be a type approved by the RO.
- (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 transponder (receiver module) supplied shall be equipped with interface connecting to display including the display of the radar system. The AIS shall allow the radar and ECDIS to display AIS information given by the AIS receiver.
- (e) The AIS signal must feed in to the Serial port, USB port, Bluetooth of EDCIS and provide 12 hours history record to ECDIS.
- (f) The AIS supplied shall be compatible with all systems using NMEA 2000 standard and be capable of interfacing with the navigation radar, ECDIS, compass, and DGPS.

- (g) It shall be possible to edit AIS message information relating to navigation and ship information.
- (h) The AIS shall be easy to identify other ship's status by providing electronic chart data.
- (i) The AIS shall have a self-restoring function to enhance stability.
- (j) The AIS shall have a user-friendly one touch keypad (or equivalent).

9.12.2 Each set of AIS shall include:

- (a) A display with minimum dimensions of 250 mm x 130 mm;
- (b) An AIS transponder unit;
- (c) A VHF antenna;
- (d) A GPS antenna; and
- (e) Installation/operation handbook.

9.12.3 The AIS shall be capable of the following performance requirements:

- (a) General Requirements
 - (i) Power Supply: 24V DC
 - (ii) Default Frequencies:

AIS1 (CH 87B):	161.975MHz
AIS2 (CH 88B):	162.025MHz
DSC (CH70):	156.525MHz
(iii) Frequency Range:	155-163MHz
- (b) AIS Transmitter
 - (i) Power Output: 12.5W or 1.0W (δ 1.5dB)

9.13 Conning Data Collection and Information Display

9.13.1 The Conning Information multi-function touch screen shall be adjusted to display the information desired by an operator whether it is one of the items listed below or all. Details will be discussed in the kick-off meeting. The display size shall be not less than 16 inches.

- (a) Vessel speed GPS;
- (b) Distance travelled through the ground;
- (c) Vessel heading;
- (d) Mode of Propulsion;
- (e) Propeller RPM/Load;
- (f) Rudder angle;
- (g) Fuel consumption;
- (h) CCTV; and
- (i) Other information deemed necessary by GNC or proposed by the Contractor.

9.14 Sound Reception System

- 9.14.1** As the Wheelhouse is enclosed, a sound reception system shall be fitted to allow crews to hear sound signals made by other vessels, particularly when operating in restricted visibility.
- 9.14.2** Waterproof noise-cancelling microphones are to be fitted fore on the exterior superstructure of the Vessel.
- 9.14.3** Speakers are to be fitted inside the wheelhouse at the console. A volume control is to be provided to allow crews to adjust the noise level as appropriate.

9.15 International Maritime Mobile (“IMM”) VHF Radio with GMDSS

- 9.15.1** The Contractor shall supply one (1) set console mounted IMM VHF radios equipped with GMDSS functionality.
- 9.15.2** The positions of the one (1) set IMM VHF radios are to be determined and agreed by the GNC during the design of the Wheelhouse and in the mock-up.
- 9.15.3** General Requirements:
- (a) The IMM VHF radio shall meet the licensing requirements of the Office of the Communications Authority of Hong Kong (“OFCA”).
 - (b) The radio shall be fully compatible with the Global Maritime Distress Safety System (“GMDSS”) with a Class A Digital Selective Calling (“DSC”) transceiver fully compliant with the IMO GMDSS carriage requirements.
 - (c) The radio shall be equipped with all the international maritime VHF channels with a fist microphone and press-to-talk switch or telephone handset, mic/handset hanger, mounting bracket and loudspeaker.
 - (d) The radio shall have a dual watch mode selection switch, incorporating Channel 16 with any other selected channel.
 - (e) The following functions shall be available on the front panel of the radio:
 - (i) Power ON/OFF;
 - (ii) Transmit indicator, volume and squelch controls;
 - (iii) Socket for microphone and external speaker plugs;
 - (iv) Quick selector for Channel 16;
 - (v) Channel selector and indicator;
 - (vi) Independent dual watch mode selection switch; and
 - (vii) Transmission power selector for HIGH and LOW Power (25 W/ 1 W).
 - (f) The operating temperature range of the radio shall be -5°C to +55°C. The water ingress protection for the radio shall be IPX5 or higher.
 - (g) The radio shall include an exterior antenna, integrated microphone, loudspeaker, control knobs/keys, display screen and all connectors and accessories to provide the functionality required.
- 9.15.4** Performance Requirements:
- (a) Transmitter Characteristics
 - (i) Frequency Range: 156.000MHz to 157.425MHz, or better

- (ii) Frequency Deviation: Frequency modulation with maximum frequency deviation of +5 kHz
 - (iii) Spurious and Harmonics: -70dB or better
 - (iv) RF Output Power: Transmission power selector for: (a) High at twenty-five (25) watts nominal and (b) Low at one (1) watt nominal.
- (b) Receiver Characteristics
- (i) Frequency Range: 156.000 MHz to 163.425 MHz or better
 - (ii) Sensitivity: Less than -119dBm for 20 dB SINAD or equivalent
 - (iii) Adjacent Channel Selectivity: 65dB or better
 - (iv) Spurious Image Rejection: 65dB or better
 - (v) Intermodulation: 65dB or better
 - (vi) Audio Output: Not less than 1 watt at rated output with less than 10% distortion.
- (c) Aerial and Feeder
- (i) The aerial provided shall be marine type aerial with at least 3dBi gain, vertically polarized, omni-directional and suitable for mounting on the Vessel.
 - (ii) The V.S.W.R. of the aerial and cabling as installed shall be less than 1.5:1.
 - (iii) The aerial feeder shall be RG58U type or equivalent.
 - (iv) Coaxial cable lightning suppresser with appropriate earthing connection shall be provided to protect the radio equipment. All outdoor connector joints shall be suitable for the marine environment (i.e., IP X5 or higher).
- (d) Loudspeaker
- (i) 6W or above.

9.16 Marine Band Hand-held Waterproof Radio Transceiver

9.16.1 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 complete with two sets of rechargeable batteries, battery 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 handheld 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.

9.16.2 Performance Requirements

- (a) The transceiver shall, as a minimum, incorporate the following controls/switches/functions:
 - (i) Power on/off button;
 - (ii) Volume control;
 - (iii) High/low transmitting power switch;
 - (iv) Press to talk switch;
 - (v) Built-in microphone and loudspeaker;
 - (vi) Channel selector operating channel display; and
 - (vii) Sockets for external microphone, press to talk and loudspeaker.
- (b) The transceiver shall comply with the following:
 - (i) Operating frequency range: International Maritime VHF Band;
 - (ii) No. of Operating Channels: 99 (programmable);
 - (iii) Channel spacing: 25 kHz; and
 - (iv) Housing IP Category: IP 57.

9.17 Radar Transponder

9.17.1 The Contractor shall provide one (1) set 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.

9.17.2 General requirements:

- (i) Frequency range: 9,200 MHz to 9,500 MHz
- (ii) Polarization: Horizontal
- (iii) Form of sweep: Saw tooth Fast return: $0.4\mu\text{S} \pm 0.1\mu\text{S}$
- (iv) Sweep rate: $7.5\mu\text{S} \pm 1\mu\text{S}$
- (v) Pulse emission / number of sweep: 100 μS nominal / 12 sweeps
- (vi) Antenna beam width: Vertical beam At least $\pm 12.5^\circ$ Azimuthal beam Omni directional within 2dB
- (vii) Effective isotropic radiated power (EIRP): More than 400 mW
- (viii) Effective receiver sensitivity: Better than -50 dBm
- (ix) Recovery time following excitation: Within $10\mu\text{S}$
- (x) Delay time (radar signal / SART transmission): 0.5 μS or less

9.17.3 Environmental Condition

- (i) Battery: Lithium battery (primary):
- (ii) Nominal voltage 7.2 V, Capacity 3.6 AH Operation life time:
- (iii) 96 hours in stand-by mode, and then at least 8 hours in response mode Useful life time:
- (iv) 5 years after plant delivery
- (v) Temperature range: 30 °C to +65 °C storage
- (vi) -20 °C to +55 °C operation

9.18 CCTV System

9.18.1 The Contractor shall supply and install a CCTV System to provide a 360° 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 these locations. Interior views are to include the engine room, machinery space, the steering gear room, the day room, the monitoring room, the fuel preparation tank and the Wheelhouse.

- (a) The arrangements 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.
- (b) Unless otherwise specified, all CCTV cameras shall comply with the following technical requirements:
 - (i) All cameras shall be IP based, high definition camera (1920 x 1080p), waterproof, vandal-resistant type, Infrared Cut Filter (“ICR”) day and night dome pan-tilt-zoom (“PTZ”) cameras. They shall be marine type and shall be suitable for operation in a rough sea environment.
 - (ii) All cameras shall have an image stabilization function to accommodate rough sea conditions.
 - (iii) All cameras shall be capable of covering diagonal views using wide angle lens or standard lens according to the actual condition.
 - (iv) All camera images shall be recorded within a Network Video Recorder (“NVR”).
 - (v) The NVR shall have sufficient disk space to archive 24/7 round-the-clock of video images recording from all cameras in high definition format at 30 frames per second for thirty (30) days.
 - (vi) CCTV images shall be displayed on relevant multi-function displays on the Wheelhouse Control Station and the conning display. Ship crew can select the exterior CCTV views of the port/starboard/aft areas to be displayed on the Wheelhouse Control Station monitors.
 - (vii) An Uninterruptible Power System (“UPS”) shall be designed, supplied and installed to sustain the operation of the CCTV system for a minimum of thirty (30) minutes.
 - (viii) The CCTV system shall be equipped with a control panel or virtual control panel, installed in the Wheelhouse to allow the operator to control the pan-tilt-zoom function of the selected camera. These requirements will be discussed further during the design phase.
 - (ix) The CCTV system shall be capable of providing an instant playback function from the video file recorded in the NVR. The playback of video footage, which are stored

in NVR, shall not interrupt the normal recording operation.

- (x) The CCTV system shall be provided with time from the DGPS, or network master clock, for clock synchronization, which will be displayed on the recorded images.

9.18.2 CCTV for general purpose:

- (a) The CCTV system shall consist of at least twenty-four (24) channels covering including but not limited to the following areas:
 - (i) At least two (2) cameras on the port side;
 - (ii) At least two (2) cameras on the starboard side;
 - (iii) At least one (1) camera facing aft for navigation purposes;
 - (iv) At least one (1) camera facing forward to view operations on the bow;
 - (v) At least two (2) cameras in the engine room;
 - (vi) At least one (1) camera in the nitrogen generator room;
 - (vii) At least one (1) camera in the steering gear room;
 - (viii) At least one (1) camera in the wheelhouse;
 - (ix) At least two (2) cameras in the MSBS;
 - (x) At least two (2) cameras in the void room;
 - (xi) At least one (1) camera in the fuel preparation tank;
 - (xii) At least one (1) camera in aft for P/V air vent;
 - (xiii) At least two (2) cameras for Davit LARS;
 - (xiv) At least one (1) camera on the aft bunkering station;
 - (xv) Four (4) channels for spare ports and future expansion; and
 - (xvii) Cameras for other interior locations that will be discussed and confirmed with GNC during the kick-off meeting.
- (b) The Contractor shall ensure that at least 95% of each area listed above is properly covered. If this is not possible, additional cameras are to be fitted to the satisfaction of the GNC.
- (c) A dedicated camera shall be installed in a location that best covers the area in front of the Vessel. This camera shall be a fixed camera with a wide field of view of at least 120° and with Infra-Red (“IR”) Light Emitted Diodes (“LEDs”) enabling operations to be conducted in poorly illuminated areas or weather conditions.
- (d) The control and monitoring of the CCTV system shall be from the Wheelhouse.
- (e) Cameras installed in hazardous areas shall be explosion-proof cameras.

9.19 Talkback System

9.19.1 The Talkback System shall be robust, ergonomic and suitable for use in a maritime environment.

9.19.2 The Talkback System shall consist 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.

9.19.3 The Talkback System shall be capable of making a single call, a group call and a call to twenty (20) or more talkback stations. The locations of the operator panel and talkback stations shall be determined in the kick-off meeting or during the design phase after the Contract has been awarded.

9.19.4 The Talkback System shall include but not be limited to having talkback stations at the following locations:

- (a) Steering gear room;
- (b) Engine room;
- (c) Mooring stations (fore and aft);
- (d) Davit LARS;
- (e) Fuel preparation tank;
- (f) Day room;
- (g) Monitoring room;
- (h) Wheelhouse;
- (i) CO₂ room;
- (j) Foam Proportioner Store Room; and
- (k) Machinery space.

9.19.5 The operator panel of the Talkback System shall include the following functions:

- (a) Dimmable backlit panel;
- (b) Buzzer indicating of incoming calls;
- (c) Step volume control;
- (d) Push-to-talk button; and
- (e) Call signal button.

9.19.6 The talkback stations to be installed on the exterior or covered exterior of the vessel shall be IP 56 rated or higher and include a speaker of at least 5W or more.

9.19.7 The talkback stations to be installed internally shall include an indoor speaker that is suitable for use in a maritime environment.

9.19.8 Talkback stations to be installed in the following locations shall be at least IP 44 standard waterproof talkback stations including speakers of 5W 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

9.19.9 Talkback stations installed in hazardous areas shall be equipped with explosion-proof types suitable for such areas.

9.20 Sound Power Telephone

9.20.1 The Contractor shall provide one (1) set sound power telephone system.

9.20.2 One (1) flush type selective sound power telephone shall be installed in the wheelhouse.

- 9.20.3** One (1) flush type selective sound power telephone shall be installed in the monitoring room.
- 9.20.4** One (1) wall mounting type selective sound power telephone shall be installed in the CO₂ room.
- 9.20.5** One (1) headset type selective sound power telephone shall be installed on the port side, starboard side of engine room and the steering gear room respectively. Each of those sound power telephone are equipped with a headphone and an alarm device with light and buzzer.

9.21 Electric Horn Conforming to IMO Requirement

- 9.21.1** One (1) set of maritime type electric horn shall be fitted on the radar mast.
- 9.21.2** One (1) set of horn controller shall be fitted on navigation watching console capable of operating horns.
- 9.21.3** One (1) set of horn push button shall be fitted on appropriate location.
- 9.21.4** The electric horn shall be marine grade and weatherproofed to IP56.
- 9.21.5** The equipment shall be fed from the AC 220V and DC 24V emergency supply system.

Chapter 10 Services Support

10.1 General Requirements

10.1.1 In determining the appropriate design for the Vessel, all of the following factors shall be taken equally into account:

- (a) Vessel performance;
- (b) Operational requirements;
- (c) Initial cost;
- (d) Through life operational costs (e.g. maintenance cost, fuel consumption, spare parts);
- (e) Reliability (frequency and time to repair);
- (f) Time between maintenance periods;
- (g) Time to undertake scheduled maintenance (downtime); and
- (h) That all machinery and Equipment installed in the Vessel shall be serviceable in the HKSAR.

10.1.2 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; and
- (b) Easy access to in-situ service and maintenance within HKSAR.

10.1.3 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 operational profile as specified in Paragraph 2.7.2 of this Part VII.

10.2 Information to be Provided Prior to and at Delivery Acceptance

10.2.1 Not later than six (6) weeks prior to Delivery Acceptance, the Contractor shall supply the Inventory List to the GNC for approval. The detailed Inventory List shall be for the whole Vessel, covering all discrete items down to major component/unit level. Full details of each item shall include:

- (a) Item number;
- (b) Description;
- (c) Type or model (if applicable);
- (d) Serial number(s);
- (e) Quantity;
- (f) Manufacturer;
- (g) Manufacturer's reference number;
- (h) Location of the item in the Vessel;
- (i) Local agent/supplier address, telephone and facsimile numbers as well as email address;
- (j) Order lead time;
- (k) Shelf life; and
- (l) Unit cost.

10.2.2 Four (4) paper copies and one (1) soft copy of the Inventory List shall be provided to GNC.

10.2.3 In conjunction with the Inventory List, to facilitate good stores management and scheduling practices, the Contractor shall supply with the Vessel an Integrated Through Life Maintenance and Support Package, excluding the Spare Parts listed in Part 2 of Schedule 1, that will include, but not be limited to, the following:

- (a) Parts to be stored on the Vessel that may be required for preventive maintenance and consumable replacement;
- (b) Parts to be stored at the base from which the Vessel operates to facilitate frontline preventative maintenance and replacement of consumable parts which cannot be undertaken when operating at sea;
- (c) Parts to be stored at the base from which the Vessel operates as replacement for items that can be anticipated to be required and the interval at which they will likely be required;
- (d) Parts to be stored at the Government Dockyard in anticipation of replacement and the interval at which they will be required;
- (e) The schedule of maintenance and parts required;
- (f) Lead time for delivery of major parts that may be required for replacement during scheduled maintenance;
- (g) This package shall be for the expected service life of the Vessel; and
- (h) Other details the Contractor deems relevant.

10.2.4 “As Fitted” Plans and Drawings including those as listed in (but not limited to) Annex 7 to this Part VII , 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.

10.2.5 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 machinery and electrical equipment. The list shall include:
 - (i) Description;
 - (ii) Type/model;
 - (iii) Makers part number or equivalent;
 - (iv) Location;
 - (v) Quantity;
 - (vi) Supplier or agent’s name and contact address;
 - (vii) Order time;

- (viii) Shelf life; and
- (ix) Unit cost.
- (b) Four (4) copies (at least one original) of maker operation, maintenance and workshop manuals for all machinery / 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:
 - (i) Daily user check and operation procedure;
 - (ii) Operating details of each system; and
 - (iii) 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 document 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.

10.2.6 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.

10.2.7 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.

10.2.8 Photographs

The Contractor shall provide the following upon Delivery Acceptance:

- (a) As-Fitted Photographs
 - (i) 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.
 - (ii) Each print shall be enclosed in a suitable album and labelled showing the position of the content.
- (b) Official Photographs
 - (i) 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.
 - (ii) 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.

- (iii) 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.

10.2.9 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, and 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 machinery, equipment and apparatus of the Vessel (valid for twelve (12) months from the date of 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 VII;
- (k) A full 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.

10.2.10 Ship Model

- (a) The Contractor shall provide the same number of ship model(s) (scale 1:40) for display and training purpose as specified in Schedule 1 of Part V.
- (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, shafts, propellers, 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 11 Additional Personnel Protection for Methanol Ship

- 11.1 The Contractor shall provide four (4) sets of methanol/ethanol-resistant coveralls and appropriate protective equipment for the methanol filling operations for crew members. The protective equipment shall be stored in a dedicated locker near the methanol filling station that are easily accessible.
- 11.2 Such protective equipment mentioned in Paragraph 11.1 above shall not be stored in accommodation spaces and their positions shall be clearly indicated. Donning instructions shall be posted at suitable positions in the Vessel.
- 11.3 Appropriately marked shower and eye-wash facilities shall be provided in the methanol filling station on upper deck. The arrangement of shower and eye-wash facilities shall comply the requirement from RO and/or GNC approval.
- 11.4 The Contractor shall provide sufficient Emergency Escape Breathing Device (“EEBD”) with suitable respiratory toxicological masks and eye protection equipment for each person on board for emergency escape. The type of EEBD and its storage location shall be discussed in the kick-off meeting.
- 11.5 At least four (4) sets of EEBD shall be stored in wheelhouse and an additional twelve (12) sets of EEBD shall be stored in crew spaces that is easily accessible. Each EEBD shall have a continuous operating time capability of not less than 15 minutes.
- 11.6 The Contractor shall provide a training kit containing at least one (1) set of EEBD for training and instructional purposes. It shall be stored in the day room, which shall be easily accessible. The EEBD for training purposes shall be manufactured by the same manufacturer as the EEBD specified in Paragraphs 11.4 and 11.5 in this Part VII.

Chapter 12 Special Requirements for Methanol Ship

12.1 Introduction

- 12.1.1** The Vessel, operating within Hong Kong waters, shall be equipped with the following methanol-diesel dual-fuel electric generators (alternatively known as “methanol system”). The purpose of this chapter is to specify the special requirements for this type of electric generators in addition to the preceding specification requirements in this Part VII. The design criteria set out in this Chapter of Part VII for the Vessel’s methanol fuel systems should be based on the IMO Interim Guidelines for the Safety of Ships Using Methanol/Ethanol as Fuel (“MSC.1/Circ.1621”) and other relevant Recognized Organization (“RO”) requirements as at the Contract Date. The design, construction, and delivery of the Vessel shall adhere to all applicable rules, regulations, and standards in force as at the Contract Date, ensuring safety, reliability, and environmental sustainability.
- 12.1.2** The Vessel shall obtain the appropriate classification notation for the methanol system, from the RO as specified in Part V, Schedule 9.
- 12.1.3** The core of the methanol system is designed to safely and efficiently store, transfer, and manage methanol fuel, ensuring reliable engine operation. As a key component in ships utilizing methanol as fuel, the system’s primary functions include the storage, transfer, and management of methanol, directly impacting the ship’s safety, economy, and environmental performance. The system comprises the methanol fuel supply, storage, drain, monitoring and control, bunkering system, and refuelling skid components, all designed in accordance with the latest RO standards. It shall incorporate provisions for emergency shutdown, leak detection, and safety interlocks, with all components protected against mechanical damage and environmental hazards, thereby supporting safe and sustainable methanol-fuelled operations throughout the Vessel’s lifecycle.
- 12.1.4** The methanol system consists of the following main components:
- (a) Methanol Fuel Supply System (“MFSS”);
 - (b) Methanol Storage System (“MSS”);
 - (c) Methanol Drain System;
 - (d) Methanol Control, Monitoring and Safety Systems (“MCMS”);
 - (e) Methanol Bunkering System;
 - (f) Methanol Refuelling Skid;
 - (g) Nitrogen System;
 - (h) Temperature Control System.

12.2 General Provisions

- 12.2.1** One (1) comprehensive and formal risk assessment shall be conducted to identify, evaluate, and address hazards associated with the use of methanol fuels. The assessment shall cover effects on personnel, the environment, and the structural integrity of the Vessel, and address hazards arising from physical layout, operation, maintenance, and potential failure scenarios, including loss of function, component damage, fire, explosion, toxicity, and electric shock.
- 12.2.2** The assessment shall utilize recognized risk analysis techniques and ensure that measures are implemented to eliminate risks where possible; if elimination is not feasible, risks shall be mitigated to the satisfaction of the GNC.

- 12.2.3** One (1) comprehensive whole-ship risk assessment report shall be prepared and approved by a RO or recognized by a third-party accreditation body confirmed by GNC prior to submission to GNC.
- 12.2.4** The safety, reliability, and dependability of the methanol fuel systems shall be equivalent to those of conventional diesel machinery of similar capacity and operational profile. Hazards such as leaks, vapour accumulation, fire, and explosion shall be minimized through system design, including ventilation, detection, and safety actions. Safety measures shall be capable of prompt initiation in case of fuel leaks or system failures. The safety philosophy shall ensure that risk reduction does not compromise operational power or Vessel safety, and hazardous areas shall be minimized and properly segregated.
- 12.2.5** All equipment located within hazardous zones shall be certified, installed, and maintained in accordance with recognized standards such as IEC or ISO, and shall receive approval from the relevant classification society. Measures shall be taken to prevent unintended accumulation of flammable, toxic vapours, or liquids through effective ventilation, inerting, and leak detection systems. Components shall be protected against external damage and environmental hazards, with ignition sources minimized via intrinsically safe electrical equipment, grounding, and static control measures. Fuel supply, storage, and bunkering arrangements shall be designed for safety, containment, and leak prevention, with provisions for emergency shutdown and containment. Piping, containment, and relief systems shall utilize appropriate materials and design standards.
- 12.2.6** All machinery, systems, and components shall be designed, installed, operated, and maintained to ensure safe, reliable operation. Control, alarm, monitoring, and emergency shutdown systems shall be installed to detect hazards and facilitate safety actions. Fixed vapour and leak detection systems shall be installed and subject to regular testing. Fire detection and suppression measures, including fixed foam systems and portable extinguishers, shall be provided.
- 12.2.7** Commissioning, testing, trials, and maintenance shall adhere to the standards set forth in the MSC.1/Circ.1621, ensuring safety, availability, and reliability. Technical documentation shall demonstrate compliance with applicable standards, safety principles, and design standards. Redundancy and fault-tolerance shall be incorporated to prevent unsafe conditions resulting from single failures.
- 12.2.8** The system and equipment shall adopt widely accepted, standard products with robust local support for spare parts and after-sales service. All components shall comply with the latest RO requirements, with certification documents issued prior to Vessel delivery.
- 12.2.9** The Vessel shall be equipped with all machinery and systems specified, including spare parts that match the original equipment models and standards.
- 12.2.10** The Vessel shall fully comply with the requirements specified in the relevant chapters of MSC.1/Circ.1621, ensuring that in spaces containing potential sources of release and ignition, explosion consequences are effectively limited to prevent damage and maintain Vessel's safety.
- 12.2.11** 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 electric generator set, gearboxes, propulsion motors, methanol storage tank, diesel fuel service tank, diesel fuel storage tanks diesel fuel tank, etc. shall be carefully designed to enable their removal from the Vessel for maintenance in a practicable manner so to avoid the need for the deck or shell plate to be cut.
- 12.2.12** The Contractor shall submit a detailed plan outlining procedures for the removal of major equipment, such as electrical motors, methanol storage tanks, reduction gearboxes (if fitted),

generators, and portable tanks, from machinery spaces and compartments for servicing or replacement, to the satisfaction of GNC.

- 12.2.13** Materials used in methanol-fuel systems shall be resistant to deterioration caused by methanol, and suitable for marine use, including seals such as gaskets, O-rings, and joint rings, which shall be non-wicking. All materials employed shall also be compatible with other liquids or compounds that may contact the system under normal operating conditions, such as grease, lubricating oil, bilge solvents, and seawater. Seals and gasket materials shall be non-fuel absorbent (non-wicking) to prevent absorption and retention of methanol fuel.
- 12.2.14** Remote-controlled valves used in methanol fuel systems and their auxiliary systems shall be operable via pneumatic drives or explosion-proof electric drives, and such drives shall be suitable for hazardous environments.

12.3 Ship Design and Arrangement

- 12.3.1** The Vessel shall fully adhere to the relevant chapters of MSC.1/Circ.1621, including safety, hazard mitigation, and system redundancy requirements.
- 12.3.2** Methanol fuel systems shall meet or exceed the safety, reliability, and dependability standards comparable to traditional diesel systems. The design philosophy shall prioritize hazard mitigation, with redundancy and fault tolerance incorporated to ensure continued safe operation without compromising Vessel integrity or power availability.
- 12.3.3** Design provisions shall ensure safe location, space arrangements, and mechanical protection for power generation equipment, methanol fuel storage, supply systems, and refuelling arrangements.
- 12.3.4** The functional requirements of this section, specifically, shall meet the following provisions:
- (a) The methanol fuel tanks shall be located to minimize damage risk during collision or grounding, considering Vessel operation and hazards;
 - (b) The fuel containment systems, piping, and other potential release sources shall be arranged to direct any vapour or liquid releases safely;
 - (c) Access openings shall be located and designed to prevent escape of flammable, asphyxiating, or toxic vapours or liquids to spaces not designed for such hazards;
 - (d) Fuel piping shall be protected against mechanical damage;
 - (e) The propulsion and fuel supply systems shall be designed so that safety actions after leakage do not cause unacceptable power loss; and
 - (f) The design shall minimize fire or explosion risks in machinery spaces, with particular attention to pump, valve, and connection leakages.
- 12.3.5** General provisions:
- (a) Methanol fuel tanks shall not be located within accommodation or Category A machinery spaces;
 - (b) Independent tanks may be located in non-open-air spaces below the main deck, with protective features against leakage;
 - (c) The containment system shall be located abaft the collision bulkhead and forward of the aft peak bulkhead;
 - (d) Tanks shall be located within the fuel storage tank spaces, complying with fire protection and ventilation standards;

- (e) Fuel spills shall be collected in dedicated tanks (i.e. Methanol Drain Holding Tank);
- (f) Tanks shall be securely supported to withstand static, dynamic, and accidental loads, considering Vessel characteristics;
- (g) Two maintenance access points shall be provided, reasonably separated;
- (h) Machinery and piping shall be designed for safety, ease of inspection, and maintenance, with major equipment removable without major structural modification;
- (i) All parts under internal pressure shall be pressure-tested prior to operation;
- (j) Facilities for cleaning, inspection, and maintenance shall be incorporated;
- (k) Heavy equipment shall be fitted with lifting brackets, load capacity markings, and be tested accordingly; and
- (l) Machinery installations shall support unmanned operation with automated and remote monitoring systems.

12.3.6 Provisions for machinery space:-

- (a) A single failure within the methanol fuel system shall not cause fuel release into machinery spaces;
- (b) All methanol fuel piping within machinery boundaries shall be enclosed in gas- and liquid-tight enclosures per MSC.1/Circ.1621 requirements;

12.3.7 Provisions for Piping Location and Protection:-

- (a) Methanol fuel pipes shall be installed at a minimum distance of 800 mm from the ship's side or as otherwise specified by the RO;
- (b) Piping shall not pass through accommodation, service, electrical, or control spaces, unless protected;
- (c) Piping crossing ro-ro (if any) or special category spaces, or on open decks, shall be protected against mechanical damage; and
- (d) Piping shall comply with;
 - (i) Enclosure in pipes or ducts passing through enclosed spaces;
 - (ii) Self-draining to suitable fuel or collection tanks under normal trim and list conditions; arrangements for drainage shall be accepted by GNC.

12.3.8 Provisions for Fuel Preparation Spaces:-

- (a) Methanol fuel preparation spaces shall be located outside Category A machinery spaces.

12.3.9 Provisions for bilge systems:-

- (a) Bilge systems in areas where methanol fuel leakage may occur with methanol shall be segregated from other bilge systems;
- (b) One or more tanks of sufficient capacity shall be provided for drainage and leakage collection, with means for safe transfer to shore facilities; and
- (c) The bilge system serving the fuel preparation space shall be operable from outside the fuel preparation space.

12.3.10 Provisions for drip trays:-

- (a) Drip trays shall be fitted where leaks/spills may occur, especially around pipe connections;

- (b) Each tray shall have sufficient capacity to contain the maximum spill volume identified in the risk assessment;
- (c) Spill transfer and drainage shall be provided, with backflow prevention;
- (d) For spills less than ten (10) liters, manual emptying is acceptable; and
- (e) Spill tanks shall have level indicators and alarms, and shall be inerted during normal operation.

12.3.11 Provisions for Openings and Entrances:-

- (a) Direct access from non-hazardous to hazardous areas shall be prohibited; where necessary, an airlock compliant with MSC.1/Circ.1621 shall be provided;
- (b) Fuel preparation spaces shall have direct access from open deck, or an airlock with ventilation, oxygen, and gas detection alarms;
- (c) Tank and cofferdam (if any) access shall be from open deck where feasible, with adequate space for evacuation and rescue;
- (d) When no direct open deck access is available, enclosed spaces shall have:-
 - (i) Mechanical ventilation with minimum six (6) air changes per hour, low oxygen, and gas detection alarms;
 - (ii) Sufficient open area for evacuation;
 - (iii) Not be classified as accommodation, service, or machinery spaces of category A;
 - (iv) Cargo spaces may be used if cleared and no cargo operation occurs during entry; and
- (e) Openings shall have a minimum clear opening of 600 mm x 600 mm for horizontal hatches or 600 mm x 800 mm for vertical access, facilitating emergency evacuation.

12.3.12 Provisions for airlocks:-

- (a) Airlocks shall be gastight with two self-closing, gastight doors spaced 1.5–2.5 m apart, with a sill height not less than 300 mm;
- (b) Mechanically ventilated at overpressure relative to adjacent spaces;
- (c) Formed with simple geometry, providing at least 1.5 m² area, for unimpeded passage;
- (d) Equipped with audible and visual alarms indicating door status;
- (e) Upon loss of overpressure or under pressure, alarms shall activate; access shall be restricted until conditions are restored;
- (f) Essential safety equipment shall remain energized and of certified safe type; and
- (g) Electrical equipment not rated for hazardous areas shall not be located within spaces protected by airlocks.

12.4 Explosion Prevention and Hazardous Area Zone

- 12.4.1** The Vessel shall fully comply with the applicable requirements of the relevant chapters of MSC.1/Circ.1621. Hazardous areas shall be minimized in extent, and their location and segregation shall be designed to reduce risks to personnel, the Vessel's structural integrity, and associated equipment. All equipment installed within hazardous area zones shall be certified, installed, and maintained in accordance with recognized standards and approved by the relevant

RO.

- 12.4.2** This section is related to functional requirements 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.8 and 3.2.11 to 3.2.17 of the MSC.1/Circ.1621. The design shall prioritize the minimization of explosion risks through the following measures:-
- (a) Reduction of ignition sources;
 - (b) Prevention of the formation of ignitable fuel/air mixtures; and
 - (c) Use of certified, intrinsically safe electrical equipment suitable for the designated hazardous zone where electrical equipment is necessary.
- 12.4.3** The risk mitigation measures shall be integrated into the system design to ensure prompt safety actions in the event of fuel leaks or system failures, without compromising Vessel safety or operational integrity.
- 12.4.4** The Hazardous Area Zone (“hazardous areas”) of this Vessel shall be classified into Zones 0, 1, and 2 in accordance with the requirements of the RO. If the provisions specified by the RO are deemed by the Contractor to be inappropriate or insufficient, the area classification shall follow the guidelines outlined in IEC 60079-10-1:2015. This classification shall facilitate the appropriate selection of electrical equipment and the design of suitable electrical installations. As mentioned in Paragraph 4.2.19 of this Part VII, and as part of the documents to be provided in Annex 3 to this Part VII, the Contractor shall provide the Hazardous Areas Plan of the Vessel for RO and GNC approval.
- 12.4.5** All hazardous areas shall be clearly marked with warning signs and shall be restricted from access to unauthorized personnel and passengers at all times.
- 12.4.6** Ventilation ducts passing through hazardous or non-hazardous spaces shall have the same classification as the ventilated space, and shall be gastight where passing through more hazardous environments, maintaining overpressure relative to the surroundings.
- 12.4.7** The Vessel shall incorporate measures to prevent the occurrence of explosions and to limit their effects, consistent with the requirements of MSC.1/Circ.1621.
- 12.4.8** Hazardous areas shall be restricted, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board and equipment. Location and segregation shall be optimized during design.
- 12.4.9** Equipment installed within hazardous zones shall be limited to those necessary for operational purposes and shall be certified as compliant with recognized standards such as IEC or ISO. All equipment located in hazardous areas shall receive approval from the relevant RO. Hazardous areas outside the scope of this classification, including open deck spaces, shall be analyzed and classified based on recognized standards, such as IEC 60092-502:1999, Part 4.4, which pertains to environments with flammable gases and vapours.
- 12.4.10** Sources of ignition shall be minimized through design and operational controls to reduce the probability of fire and explosion.
- 12.4.11** The distance between the methanol storage tank vent outlet and any one of the following (which is the shortest of the three) shall be arranged at a minimum distance of ten (10) meters:
- (a) the nearest air intake or opening to accommodation;
 - (b) the nearest air intake or opening to service spaces; and
 - (c) the nearest air intake or opening to ignition sources.

- 12.4.12** The height of the methanol storage tank vent outlet shall be as low as possible up to a minimum cap of not less than three (3) meters above the deck.

12.5 Ventilation System

- 12.5.1** The Vessel shall implement effective ventilation, inerting, and leak detection systems to prevent the accumulation of flammable, toxic vapours, or liquids.
- 12.5.2** Equipment installed within hazardous area zones shall be designed to withstand environmental conditions, with adequate protection against external damage and corrosion.
- 12.5.3** Ventilation inlets and outlets shall be strategically located to prevent vapour build-up, with dedicated systems for hazardous and non-hazardous spaces.
- 12.5.4** Effective ventilation shall be provided to prevent vapour accumulation, with systems designed for both hazardous and non-hazardous areas.
- 12.5.5** Ventilation systems shall be designed based on the total volume of the space. For rooms with complex geometry, increased ventilation capacity shall be provided as necessary to ensure safety. Inlets and outlets shall be positioned to optimize vapour dispersion. Ventilation, inerting, and leak detection systems shall be designed for operational safety and efficiency, ensuring continuous and reliable performance.
- 12.5.6** Air inlets to enclosed spaces classified as hazardous shall be sourced from areas that are non-hazardous. Inlets to non-hazardous spaces shall be located at least 1.5 m from the boundary of any hazardous zone, with ducts gastight and maintained under overpressure relative to the space.
- 12.5.7** Air outlets from non-hazardous spaces shall be located externally, outside hazardous zones. Air outlets from hazardous enclosed spaces shall be located in an open area that, in the absence of the considered outlet, would be of the same or lesser hazard than the ventilated space.
- 12.5.8** Non-hazardous spaces with entry openings to hazardous zones shall be equipped with airlocks, and be maintained at overpressure relative to the external hazardous area. Ventilation operation shall be continuously monitored; upon failure:-
- (a) Audible and visual alarms shall activate at designated locations; and
 - (b) If overpressure cannot be restored immediately, automatic or programmed disconnection of electrical installations in the non-hazardous space shall be implemented in accordance with recognized standards.
- 12.5.9** Double bottoms, cofferdams (if present), duct keels (if any), pipe tunnels (if any), hold spaces, and other enclosed areas where methanol fuel may accumulate shall be adequately ventilated to maintain a safe environment for personnel entry, in accordance with MSC.1/Circ.1621.
- 12.5.10** The Vessel shall provide ventilation sufficient to maintain safe working conditions for personnel and the safe operation of machinery and equipment where Methanol fuels are used.
- 12.5.11** Enclosed spaces within the Liquefied Fuel Storage System ("LFSS") (i.e. Methanol Storage System ("MSS")) area shall be equipped with effective mechanical negative pressure ventilation to prevent the build-up of flammable vapours.
- 12.5.12** Methanol fuel preparation rooms and nitrogen gas rooms shall be fitted with appropriate ventilation systems, comprising ventilators, check valves, fireproof wind baffles, ventilation caps, and pipelines, designed to ensure safety and environmental control.
- 12.5.13** Ventilation inlets and outlets for spaces requiring mechanical ventilation shall be located such

that, in accordance with the International Convention on Load Lines, they do not require closing appliances and are positioned to prevent vapour accumulation.

12.5.14 Ducting used for ventilation of hazardous spaces shall be separate from that used for non-hazardous spaces. Ventilation systems shall operate effectively across the temperature and environmental conditions expected during Vessel operation.

12.5.15 Electrical motors driving ventilation fans located within ventilation ducts for hazardous spaces shall be certified for the same hazard zone as the space served. In general, motors not rated for hazardous zones shall not be installed in such ducts.

12.5.16 Ventilation fans serving spaces where fuel vapours may be present shall be designed to prevent ignition sources within both the ventilated space and the ventilation system. Fans and fan ducts located in the vicinity of the fans shall be constructed of non-sparking materials, as defined by the following criteria:-

- (i) Impellers or housings of non-metallic material, due regard being paid to the elimination of static electricity;
- (ii) Impellers and housings of non-ferrous metals;
- (iii) Impellers and housings of austenitic stainless steel;
- (iv) Impellers of aluminium alloys or magnesium alloys and a ferrous (including austenitic stainless steel) housing on which a ring of suitable thickness of non-ferrous materials is fitted in way of the impeller, due regard being paid to static electricity and corrosion between ring and housing; or
- (v) Any combination of ferrous (including austenitic stainless steel) impellers and housings with not less than 13 mm tip design clearance;
- (vi) In no case shall the radial air gap between the impeller and the casing be less than 0.1 of the diameter of the impeller shaft in way of the bearing but not less than 2 mm; the gap need not be more than 13 mm; and
- (vii) Any combination of an aluminium or magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regardless of tip clearance, is considered a sparking hazard and should not be used in these places.

12.5.17 Venting systems shall comprise independent fans with sufficient capacity to prevent vapour accumulation. The system shall be mechanical exhaust type, with extraction inlets strategically located to avoid vapour build-up from leaks, particularly in spaces containing Methanol.

12.6 Methanol Fuel Supply System (“MFSS”)

12.6.1 The Vessel shall be equipped with a Methanol Fuel Supply System (“MFSS”) (viz Item 8 of Schedule 6 of Part V) compatible with the proposed propulsion system (viz Items 1 to 3 of Schedule 6 of Part V) and compliant with the requirements of RO proposed in Schedule 9 of Part V. **[E]**

12.6.2 The MFSS system shall be integrated into a standard modular arrangement, including all necessary components such as pipelines, pumps, flowmeters, safety devices, and control systems, designed in accordance with the latest applicable standards and RO requirements.

12.6.3 The MFSS system shall be a proprietary made product and shall obtain a product approval certificate issued by the RO. The certificate shall be provided prior to Vessel delivery and acceptance inspection.

12.6.4 The design and construction of the MFSS system and auxiliary equipment shall follow the

procedures outlined below:-

- (i) Drying and inerting of methanol storage tanks;
- (ii) Purging of the methanol storage tank;
- (iii) Loading of methanol fuel;
- (iv) Unloading of methanol storage tanks;
- (v) Methanol fuel supply for the engine.

12.6.5 The MFSS system shall include methanol fuel delivery, pressurization, and temperature control. The conditioning of methanol fuel shall meet the engine manufacturer's specifications to ensure proper operation.

12.6.6 The MFSS system shall provide the engine with a continuous supply of methanol fuel at a stable pressure and temperature, ensuring reliable engine operation.

12.6.7 Methanol fuel piping shall be independent and segregated from all other piping systems to prevent cross-contamination and ensure safety.

12.6.8 The MFSS system shall be designed to minimize the consequences of any methanol fuel release. Access for operation and inspection shall be safe and convenient. The causes and potential consequences of methanol fuel releases shall be a key consideration within the risk assessment.

12.6.9 The piping system for methanol fuel transfer to the consumers should be designed in a way that a failure of one barrier cannot lead to a leak from the piping system into the surrounding area causing danger to the persons on board, the environment or the ship.

12.6.10 Methanol fuel lines shall be installed and protected to reduce the risk of injury to personnel in the event of leakage or failure.

12.6.11 The design of provisions for methanol fuel distribution, i.e. double-walled pipe design, shall comply with following:-

- (a) Inner and outer pipes shall be made from stainless steel suitable for methanol fuel;
- (b) The outer pipe or duct shall be gas- and liquid-tight;
- (c) Leakage detection means shall be installed to monitor the annular space. The annular space in double-walled pipe shall be inerted with nitrogen and connected to the methanol drain holding tank to collect and detect any possible leakage. Alarms shall be activated upon loss of inert gas pressure;
- (d) The double-walled enclosure shall be connected to methanol drain holding tank, equipped with alarm devices for detecting pressure loss or any possible leakage;
- (e) The outer pipe shall be dimensioned for a maximum working pressure, or alternatively, for the maximum potential pressure resulting from rupture of the inner pipe; and
- (f) Methanol fuel piping passing through enclosed spaces shall be configured as double-walled piping. Double-walled piping may be omitted in cofferdams surrounding methanol storage tanks, fuel preparation rooms, or methanol storage tank spaces.

12.6.12 The MFSS system shall incorporate redundancy as follows:-

- (a) Power generation and fuel supply arrangements shall be designed so that failure in methanol fuel supply does not cause unacceptable power loss;
- (b) The MFSS system shall be delivered in skid-mounted modules, with interconnection components such as valves and instruments supplied as loose items for on-site installation;

- (c) All methanol fuel piping and tanks shall be electrically bonded to the ship's hull, maintaining electrical continuity across joints and fittings. The maximum resistance between piping and hull shall be 1 MΩ; and
- (d) Remote-controlled valves within the skid shall be operable via pneumatic or explosion-proof electric drives, suitable for the hazardous environment.

12.7 Methanol Storage System (“MSS”)

- 12.7.1** The Vessel shall be equipped with a Methanol Storage System (“MSS”), comprising the methanol storage tank and associated containment systems. The design shall ensure safety, durability, and compliant with requirements of the RO proposed in Schedule 9 of Part V. [E]
- 12.7.2** The Vessel shall be equipped with one (1) independent stainless steel methanol storage tank, located within underdeck compartments. The tank shall have a minimum capacity of 8 m³ or whichever larger in the calculation as specified in Paragraph 2.7.2 in this Part VII. .
- 12.7.3** The tank shall be constructed from 316L stainless steel or an equivalent higher-grade material to ensure enhanced safety, durability, and corrosion resistance. Each independent stainless steel methanol storage tank installed on the vessel shall be accompanied by a marine product certificate of conformity issued by the RO, to the satisfaction of the RO, to the satisfaction of the GNC.
- 12.7.4** If multiple methanol storage tanks are provided for the vessel, all requirements outlined in this chapter, as well as applicable RO regulations, shall apply to each tank accordingly.
- 12.7.5** For Vessel requiring daily fuel storage, an additional tank may be provided, with capacity designed to satisfy operational needs and in compliance with RO requirements.
- 12.7.6** The tank(s) shall be designed for safe operation within the Vessel's environmental conditions and operational parameters, as determined by the manufacturer and approved by the RO.
- 12.7.7** The storage tank shall be fitted with pressure/vacuum (P/V) relief devices, the set points of which shall be determined based on the system design, standards, and manufacturer's recommendations, with a margin of at least 10% to ensure safety margins.
- 12.7.8** Rigid suction pipes shall be installed near the bottom of the tank to facilitate fuel transfer. Additionally, methanol fuel supply pump(s) shall be provided to transfer methanol between tanks as required. The pump(s) shall be strategically located at appropriate positions to ensure efficient and reliable fuel transfer.
- 12.7.9** Discharge valves with remote-operated quick-closing devices shall be installed for safety.
- 12.7.10** Inerting and atmosphere control systems shall be in accordance with relevant standards.
- 12.7.11** The design and safety considerations of methanol storage tank(s) shall encompass, but are not limited to, the following:-
 - (a) The tank shall be fitted with detection instruments, at least one for each of the following, including sensors for pressure, temperature, liquid level, and oxygen concentration;
 - (b) The methanol fuel preparation room shall house the methanol fuel supply unit, which shall be designed for secure and efficient methanol fuel handling;
 - (c) The tank and associated systems shall be designed to withstand pressure, vibration, shocks, corrosion, and movement encountered during normal operation and storage.
 - (d) The location of the tank shall be approved by the RO and GNC, ensuring safety and

accessibility for maintenance and inspection.

12.7.12 The containment and leakage prevention of methanol storage tank(s) shall encompass, but are not limited to, the following:-

- (a) The methanol fuel containment system shall be designed to minimize risks to the ship, crew, and environment, ensuring leakage from methanol tanks or connections does not endanger personnel or cause environmental damage.
- (b) Potential hazards to avoid include:
 - (i) Flammable fuel spreading to ignition sources;
 - (ii) Toxicity or oxygen deficiency risks;
 - (iii) Restricted access to muster stations, escape routes, or LSAs; and
 - (iv) Reduced availability of lifesaving appliances.
- (c) The tank shall be equipped with ventilation and gas-freeing systems as per the MSC.1/Circ.1621.
- (d) The tank shall be inerted and atmosphere-controlled to prevent vapour accumulation and potential ignition.

12.7.13 The design of the independent methanol fuel tanks shall first be approved by the RO and then accepted by GNC.

12.7.14 The tank shall be a proprietary made product and shall obtain a product approval certificate issued by the RO before the Vessel's delivery and acceptance inspection.

12.7.15 The structural and installation requirements of methanol storage tank(s) shall encompass, but are not limited to, the following:-

- (a) The tank shall be installed in under-deck compartments, ensuring loads are safely transmitted into the Vessel's structure;
- (b) Materials used in methanol-fuel systems shall be resistant to deterioration caused by methanol, including seals such as gaskets, O-rings, and joint rings, which shall be non-wicking. All materials employed shall also be compatible with other liquids or compounds that may contact the system under normal operating conditions, such as grease, lubricating oil, bilge solvents, and seawater. Seals and gasket materials shall be non-fuel absorbent (non-wicking) to prevent absorption and retention of methanol fuel;
- (c) The methanol storage tank shall be hydrostatically tested following an approved standard by GNC, with all connections proven tight;
- (d) Inspection hatches, equipped with gasket covers secured by stainless steel bolts and self-locking nuts, shall allow full inspection of the methanol storage tank interior; and
- (e) Ventilation pipes shall be installed in the compartment containing the tank, approved by the RO.

12.7.16 Electrical bonding shall be applied to all system components to ensure a resistance not exceeding 1 MΩ between piping and hull. An earthing device shall be installed for the methanol bunkering system. Grounding wires shall not be clamped between hoses and pipes or spud fittings. Proper earthing devices and grounding arrangements shall be provided for the bunkering system to ensure safety and prevent static accumulation.

12.7.17 Except the electric wires for the methanol-fuel tank level sensor(s), no other shall pass through

any methanol-fuel tank. Ventilation for the methanol-fuel tank shall comply with national or other acceptable industrial standards to the satisfaction of GNC.

- 12.7.18** Removal routes shall be designed for the safe and practicable removal of the tank, electric generators, reduction gearboxes, and other major equipment, approved by RO and the GNC.
- 12.7.19** Access for inspection, maintenance, and replacement shall be considered, avoiding the need for cutting shell plates.
- 12.7.20** Piping and fittings shall be compatible with methanol, resistant to corrosion, and designed for the operational pressures. All materials in contact with methanol shall be resistant to deterioration.
- 12.7.21** The installation and configuration of pipelines, valves, and other accessories shall comply with the requirements specified by the RO.
- 12.7.22** Forced ventilation shall be provided for fuel tank rooms in accordance with the standards and requirements established by the RO.

12.8 Methanol Drain and Bilge System

- 12.8.1** The Vessel shall be equipped with a Methanol Drain and Bilge System designed to detect, contain, and transfer leaked methanol from various units. The system shall be integrated into a standard modular arrangement, ensuring prompt response to fuel leakage events to maintain safety and environmental protection.
- 12.8.2** The methanol drain and bilge system shall immediately activate upon detection of methanol leakage in any unit. It shall utilize an air-operated diaphragm pump to transfer the leaked methanol into a methanol drain holding tank. The system shall be capable of handling flow rates around 1 m³/h, with a maximum head of around 20 meters.
- 12.8.3** The diaphragm pump shall be constructed from 304 stainless steel or an equivalent higher-grade material, suitable for handling methanol and compatible with marine environments. The pump shall operate at an approximately compressed air pressure of 0.7 MPa. It shall have sufficient airflow capacity to ensure efficient performance during leak collection and wastewater discharge, providing appropriate flow rates and operational reliability.
- 12.8.4** The methanol drain system, including the pump, shall be certified by the RO prior to Vessel delivery.
- 12.8.5** The methanol drain system shall incorporate leak detection devices capable of identifying methanol fuel leaks in any unit. Upon detection, the system shall activate automatically to transfer leaked methanol into the methanol drain holding tank. The integrated design shall ensure rapid containment of leaks, minimizing environmental impact and maintaining safety.
- 12.8.6** The same pneumatic diaphragm pump shall be capable of discharging the contents of the methanol drain holding tank for further treatment, as required.
- 12.8.7** The system shall be designed to operate reliably under all normal Vessel conditions, including vibration and movement.
- 12.8.8** All materials in contact with methanol shall be corrosion-resistant and suitable for marine use.
- 12.8.9** The system shall be designed for ease of maintenance and inspection. The system shall promptly collect leaked methanol, and the arrangement of collection suctions shall include at least the following locations: bunkering station, void room, supply unit collections, electrical generators double-wall pipe interlayers, etc.

12.9 Methanol Control, Monitoring and Safety Systems (“MCMS”)

12.9.1 The Vessel shall be equipped with a comprehensive Methanol Control Monitoring and Safety Systems (“MCMS”) to ensure safe operation, hazard mitigation, and environmental protection.

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12.9.2 The system shall integrate leak detection, disconnection monitoring, vapour monitoring, fire detection, safety controls, alarms, and automatic shutdowns. Each independent safety protection monitoring cabinets equipped within the system shall be accompanied by a marine product certificate of conformity issued be accompanied by the RO, to the satisfaction of the RO, to the satisfaction of the GNC.

12.9.3 The system shall comply with the provisions regarding the layout requirements for control, monitoring, and safety systems specified in MSC.1/Circ.1621 and by the RO, and shall provide support for the effective and safe operation of the fuel-using equipment covered in this chapter.

12.9.4 The methanol fuel safety functions shall be arranged in a dedicated fuel safety system, which shall be independent of the fuel control system. This independence shall cover the power supply as well as input and output signals.

12.9.5 The methanol fuel safety system shall be capable of automatically shutting down the methanol fuel supply system in the event of a system failure that violates the provisions of MSC.1/Circ.1621 and the relevant clauses of the RO regarding control, monitoring, and safety systems, as well as other failures that develop too rapidly to allow manual intervention.

12.9.6 The methanol fuel safety system shall be designed to include field instruments and shall be capable of preventing false shutdowns.

12.9.7 The core purpose of the MCMS shall be to control and reduce risks associated with methanol fuel, including low flash point, flammability, explosiveness, and toxicity. It shall facilitate real-time monitoring, intelligent analysis, and rapid response, ensuring safe operation across all fuel modes (fuel oil and methanol), particularly during fuel handling, storage, and usage.

12.9.8 Experience a single-point failure, the MCMS of the methanol fuel equipment shall ensure that the vessel does not experience unacceptable power loss.

12.9.9 The MCMS shall be equipped with Gas Detection and/ or Methanol Liquid Leak Detection systems. The number and installation locations of gas and/or liquid detectors in each space shall meet the requirements specified in MSC.1/Circ.1621 and the relevant provisions of the RO. Along with corresponding alarm functions, as follows:-

(a) Gas Detection:

- (i) At least one (1) methanol vapour sensor shall be installed in each area susceptible to vapour accumulation, including fuel tanks, containment systems, bunkering stations, fuel preparation rooms, and engine rooms.
- (ii) Detection thresholds shall be set at approximately 10-20% of the Lower Flammable Limit (“LFL”) for low-level alarms, and 30-50% of LFL for high-level alarms, which shall activate audible and visual alarms accordingly.
- (iii) In the event of high-level detection, linked controls such as emergency shutdown shall be automatically triggered.
- (iv) After assessment through risk analysis, the ventilation inlets of accommodation spaces and machinery spaces where fuel gas may be present.

- (v) In other enclosed spaces that contain fuel pipelines and fuel equipment but are not equipped with double-walled pipes.
 - (vi) Sensor locations shall include, at minimum, airlock, the fuel preparation room, double-walled piping, engine room, and fuel tanks.
 - (b) Methanol Liquid Leak Detection:
 - (i) At least one (1) liquid leak sensor shall be installed beneath equipment such as fuel pumps, valves, and pipe flanges to promptly detect seal failures or leaks.
 - (ii) Liquid leak sensors shall be installed in the cofferdams of fuel tank, between the inner and outer pipes of double-walled pipes, in fuel preparation room, and in other enclosed spaces containing fuel piping or fuel equipment without double-walled pipes.
 - (iii) Leakage detection shall be implemented in the space between the inner and outer pipes of double-walled pipes, and this detection system shall be connected to the alarm system. In the event of any leakage, the affected fuel supply pipelines shall be shut off in accordance with the requirements specified in MSC.1/Circ.1621 and the relevant provisions of RO.
- 12.9.10** The system shall be equipped with a liquid level monitoring device in at least one bilge well within the enclosed space where the independent fuel tank is located, and shall be provided with a high liquid level alarm function. The leakage detection system shall be capable of triggering alarm and safety functions in accordance with the requirements of MSC.1/Circ.1621 and the relevant provisions of the RO.
- 12.9.11** Each methanol fuel tank shall be equipped with a closed liquid level measuring device, which shall ensure that a liquid level reading is always obtainable when the fuel tank is in use. The layout of the liquid level measuring device shall be such that necessary maintenance can still be performed on the fuel tank while it is in use.
- 12.9.12** If water injection into the methanol fuel tank is adopted to achieve the gas-freeing function, when the fuel tank triggers the high liquid level alarm and high-high liquid level alarm, audible and visual alarms shall be activated at the water injection control position.
- 12.9.13** Each methanol fuel tank shall be equipped with overpressure/underpressure protection devices that comply with the relevant provisions, and an alarm shall be triggered in the event of overpressure or underpressure.
- 12.9.14** The system shall automatically shut off methanol supply upon detection of hazardous conditions, including high vapour concentration or fire, ensuring immediate hazard mitigation.
- 12.9.15** The control system shall execute programmed logic to ensure proper sequencing during dual-fuel mode switching or startup procedures, including pipeline purging and valve operation, to prevent backflow and ensure safety.
- 12.9.16** The MCMS shall include the function of Emergency Shutdown (“ESD”). The ESD will immediately and automatically trigger an ESD, closing the methanol supply valves and switching the dual-fuel generators back to diesel mode or to a safe shutdown, in the event of:
- (a) Excessively high methanol gas concentration;
 - (b) Fire in the engine room or fuel preparation room;
 - (c) Equipment failure (e.g., fuel pump);
 - (d) In addition to meeting the applicable requirements for diesel engine monitoring specified

in SOLAS Chapter II-1, Part C and by the Recognized Organization (“RO”), indicators shall also be installed in the wheelhouse, central control room, and engine side to display the engine's operating status and operating mode; and

- (e) Manual emergency stop buttons being pressed in key areas, such as fuel preparation room and wheelhouse, etc.

12.9.17 The entire MCMS shall be certified by the RO prior to the Vessel delivery. The product approval certificate shall be provided before acceptance inspection.

12.9.18 The MCMS shall incorporate fire prevention and suppression functions, including a dedicated Fire Detection and Extinguishing System and an Inerting System.

- (a) Dedicated Fire Detection and Extinguishing System:
 - (i) Optical flame detectors capable of recognizing methanol flames (pale blue) shall be installed in relevant areas.
 - (ii) The audible and visual alarms shall be activated to the wheelhouse, MSBS, and the local area, when a fire is detected in the machinery spaces of methanol-fueled engines and the methanol-fuel tank spaces.
- (b) Inerting System:
 - (i) This system is essential for preventing fire and explosion.
 - (ii) It shall continuously supply nitrogen or inert gases into the vapor space of methanol fuel tanks and fuel pipelines after shutdown to reduce oxygen levels, thereby creating an environment incapable of supporting combustion.

12.9.19 The MCMS shall include functions for Ventilation and Gas Management, with the following requirements:-

- (a) Forced Mechanical Ventilation:
 - (i) Enclosed spaces such as fuel preparation rooms and containment systems shall be equipped with continuously operating ventilation systems.
 - (ii) Ventilation shall be conducted before personnel entry, with gas concentrations confirmed safe.
- (b) Negative Pressure and Airlocks:
 - (i) Fuel preparation rooms shall be maintained at negative pressure relative to adjacent compartments to prevent vapour escape.
 - (ii) Airlocks may be installed at personnel access points for added safety.
- (c) Zoning and Compartmentalization:
 - (i) Proper zoning shall be implemented to prevent the accumulation of flammable vapours, with ventilation and inerting systems integrated accordingly.

12.9.20 The MCMS shall be equipped with centralized monitoring and alarm control panels, located in the wheelhouse and monitoring room. These panels shall centrally display all real-time parameters related to the methanol system, including gas concentrations, valve statuses, tank pressures, nitrogen pressures, and other relevant data. The control panels shall be equipped with audible and visual alarms to alert personnel of abnormal conditions. Additionally, the control panels shall be integrated with the vessel's overall safety and control systems to ensure coordinated operation

and response.

- 12.9.21** The MCMS shall continuously record operational data for post-event analysis, diagnostics, and predictive maintenance, aiding crew awareness of system health.
- 12.9.22** The Vessel should be equipped with a methanol fuel electronic control system. The system shall include a fully enclosed, marine-grade steel control cabinet, protected against corrosion. The control unit shall be based on a Programmable Logic Controller (“PLC”) platform, processing all input signals and controlling outputs, which details monitoring of the methanol supply system. The electric control system shall operate with compressed air available on-board for around 0.7 MPa.
- 12.9.23** The control panel of methanol fuel electronic control system includes the following functions, but is not limited to:
- (a) High-level fuel tank;
 - (b) High-high-level fuel tank;
 - (c) Any failures of inert gas seal in annular space of double walled pipes;
 - (d) Gas detection in the annular space of the double wall bunkering line (if any);
 - (e) Loss of ventilation in ventilated areas;
 - (f) Manual shutdown;
 - (g) Liquid methanol detection in the annular space of the double walled bunkering line;
 - (h) Vapour detection in annular spaces of double walled pipes;
 - (i) Vapour detection in cofferdams surrounding fuel tanks. One detector giving 20% of LEL;
 - (j) Vapour detection in airlock;
 - (k) Vapour detection in cofferdams (if any) and other protective spaces surrounding fuel tanks. Two detectors giving 40% of LEL;
 - (l) Vapour detection in ducts around double walled pipes, 20% of LEL;
 - (m) Vapour detection in ducts around double walled pipes, 20% of LEL;
 - (n) Liquid leak detection in annular space of double walled pipes;
 - (o) Liquid leak detection in engine-room;
 - (p) Liquid leak detection in fuel preparation space; and
 - (q) Liquid leakage detection in cofferdams (if any) and other protective spaces surrounding fuel tanks.
- 12.9.24** A warning sign or notice board shall be permanently installed in methanol spaces, stating that lifting operations that may pose a hazard to fuel pipelines are not permitted while the engine is operating on fuel.
- 12.9.25** A sign shall be posted in a visible location in machinery spaces, stating that if methanol fuel supply is cut off due to fuel leakage, the fuel supply shall not be turned on until the leakage point is located and addressed.
- 12.9.26** A visible sign shall be posted at the control position of the methanol fuel supply pipeline shut-off valve, stating that if the fuel supply is cut off due to the activation of the automatic shut-off valve in the methanol fuel supply system, the fuel supply shall not be turned on until the cause of the shut-off is identified and necessary measures are taken.

- 12.9.27** For the methanol fuel supply pumps and fuel supply system, devices capable of manual remote emergency shutdown shall be installed at the following locations: wheelhouse, MSBS, near the exit of the fuel preparation space and other locations that meet the requirements of MSC.1/Circ.1621 and the relevant provisions of the RO.

12.10 Methanol Bunkering System

- 12.10.1** The Vessel shall be equipped with a dedicated methanol bunkering system designed to facilitate the safe and reliable transfer of methanol from external bunker tanks to the ship's onboard storage.

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- 12.10.2** The system shall incorporate emergency shutdown and spill containment features to mitigate hazards during refuelling operations.
- 12.10.3** The bunkering station shall adopt a modular supply mode and include components such as Emergency Shutdown Valves ("ESD"), manual shut-off valves, blank flanges, pressure gauges, and drip trays. The system shall be capable of transferring at bunkering rate approximately 20 m³/h of methanol, with one (1) vapor interface connection, one (1) fluid interface connection, and one (1) shore connection for methanol drain holding tank.
- 12.10.4** Before installation of the methanol bunkering system, the bunkering plan including the bunkering rate should be submitted to GNC for approval.
- 12.10.5** A Ship-Shore Link ("SSL") system shall be installed at the methanol fuel bunkering station to enable safe and controlled ship-to-shore methanol transfer, complying with applicable standards and RO regulations.
- 12.10.6** A drip tray shall be installed beneath the methanol bunkering station, equipped with facilities for spill collection and containment. Spilled methanol shall be drained into the methanol drain holding tank, while rainwater shall be drained overboard, ensuring environmental protection.
- 12.10.7** Proper earthing devices and grounding arrangements shall be provided for the methanol bunkering system to ensure safety and prevent static accumulation.
- 12.10.8** The bunkering area shall be equipped with emergency showers and eye wash stations, operable under all circumstances. In addition, a fixed fire-extinguishing system shall also be equipped near the bunkering area, including alcohol-resistant foam and portable dry chemical extinguishers located near the bunkering station entrance.
- 12.10.9** The Vessel's methanol bunkering plan shall be prepared in accordance with regulation and shall be subject to prior approval by the RO. The plan shall be submitted to GNC for review.
- 12.10.10** Provide an electrostatic discharge device to meet the requirement that all personnel must first discharge static electricity from their bodies before entering the area.
- 12.10.11** A dynamic display LCD screen shall be installed near the bunkering area. When the methanol bunkering is in operation, it can clearly show the status of "refuelling in progress" in the methanol bunkering station.

12.11 Methanol Refuelling Skid

- 12.11.1** A movable, modular methanol refuelling skid, shall be provided for transferring methanol from shore to the Vessel, enabling full replenishment of the ship's onboard methanol storage tank.

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- 12.11.2** The Contractor shall provide the methanol refuelling skid, capable of delivering at a rate of 20 m³/h, include pipelines, pumps, flowmeters, leak detection and collection systems, nitrogen purging systems, and control units designed for safe, efficient, and reliable transfer operations. The skid shall be modular for ease of operation and maintenance.
- 12.11.3** The methanol refuelling skid shall be a proprietary-made product.
- 12.11.4** The methanol refuelling skid shall have the functions, but not limited to, the follows:-
- (a) transfer methanol from tanker trucks to the ship's onboard tank via pressurized pumps and flow control devices;
 - (b) utilize a sophisticated control system to manage start-up, full-load operation, and replenishment, ensuring safety and operational integrity; and
 - (c) be capable of handling both liquid and vapour phases at the interface.
- 12.11.5** The injection delivery system, through the pressurization of the pump, transports the methanol in the tanker to the fuel tank of the receiving Vessel. At the same time, through the control of the controller (a sophisticated and mature product), it controls the start of the injection, the full-load operation, and the replenishment operation, ensuring safety.
- 12.11.6** The movable methanol refuelling skid shall be equipped with functional configurations including a fuel tank gas return line, a flammable gas detector capable of real-time monitoring for internal leakage of the skid, and a nitrogen purging system with functions of pipeline inert before refuelling and pipeline purging after refuelling completion. It must meet the specification requirements and obtain GNC approval.
- 12.11.7** The refuelling skid shall also be equipped with safety equipment such as fire-fighting of alcohol resistant foam type equipment and lighting.
- 12.11.8** Provide an electrostatic discharge device to meet the requirement that all personnel must first discharge static electricity from their bodies before entering the area.
- 12.11.9** A dynamic display LCD screen shall be installed near the bunkering area and the refuelling skid. When the refuelling skid is in operation, it can clearly show the status of "refuelling in progress" near the methanol bunkering station.
- 12.11.10** Before the design of the refuelling skid is accepted by GNC, it shall first be accepted by the RO.

12.12 Nitrogen System

- 12.12.1** The Vessel shall be equipped with a nitrogen inerting and purging system comprising a nitrogen generator and cylinder(s), valves, instrumentation, and pipe accessories. [E]
- 12.12.2** The system shall maintain an inerting gas sealing pressure around 15 kPa and a purge pressure of around 0.7 MPa.
- 12.12.3** The purity of nitrogen produced by the nitrogen system shall be not less than 97%. The design and installation shall be subject to prior approval by the RO before acceptance by GNC.
- 12.12.4** The nitrogen generator or storage facilities shall be installed in a dedicated, separate compartment outside the engine room. The compartment shall be equipped with an independent mechanical extraction ventilation system capable of providing a minimum of six (6) air changes per hour.
- 12.12.5** All methanol fuel tanks shall be able to maintain an inert state at all times during use.

- 12.12.6** During any stage of using inert medium for environment modification, gas displacement, or inerting, the possibility of generating flammable gas mixtures in methanol fuel tanks shall be eliminated through system design.
- 12.12.7** At least one (1) oxygen content monitor with two oxygen sensors shall be installed within this space, with visual and audible alarms located at each entrance and wheelhouse. The alarms shall trigger if oxygen levels fall below 19.5% by volume from the normal atmospheric level of 20.9% by volume.
- 12.12.8** The system shall incorporate detection means to monitor leakage in the annular space of pipelines. Adequate alarms in wheelhouse and local areas shall be provided to alert personnel if nitrogen pressure drops or if leakage is detected, ensuring prompt response to maintain safety.
- 12.12.9** Nitrogen storage tanks shall be installed in the underdeck compartment. Their capacity shall be sufficient to inert the ship's methanol fuel tanks for approximately one (1) month during port stay, considering typical consumption without abnormal leakage.
- 12.12.10** Nitrogen storage facilities for spare shall be provided on the open deck of the ship. Their supply capacity shall be sufficient to maintain the methanol fuel tanks in an inert state for approximately one month during the port stay (while taking into account the minimum port consumption). Interface pipelines for connection to the nitrogen generator shall be reserved. In case of a failure of the nitrogen generator, the nitrogen storage facilities can be connected when necessary to ensure the supply of inert gas.
- 12.12.11** Interface pipelines shall be designated for connection to the nitrogen generator and nitrogen cylinders, enabling manual or automatic connection of a spare nitrogen cylinder on the main deck in the event of nitrogen generator failure. This ensures a continuous inert gas supply for normal ship operations.
- 12.12.12** A rack with securing straps and hose connections for a spare nitrogen cylinder shall be provided on the main deck, arranged in accordance with the acceptance of RO and GNC. The spare nitrogen cylinder rack, including securing straps, shall be of a size compatible with cylinders commonly available in the Hong Kong local market.
- 12.12.13** Prior to system startup and during maintenance, the methanol supply pipelines shall be inerted to eliminate air and oxygen, thereby preventing contact with personnel and minimizing fire or explosion risks. The system shall also be capable of inerting the pipelines before maintenance operations to prevent vapor contact and ensure safety.
- 12.12.14** Nitrogen systems are used for inert and purging methanol fuel tanks, system lines, and bunkering stations to ensure safety and prevent vapor accumulation. The nitrogen system includes a nitrogen generator with cylinder set(s), valves, instrumentation, and pipe accessories necessary for reliable operation.

12.13 Temperature Control System

- 12.13.1** Unless specifically recommended by the dual-fuel engine manufacturer to maintain the methanol temperature within a certain range, the vessel is not required to be equipped with a temperature control system. If installed, the system shall include adequate insulation, temperature monitoring, and safety features to ensure reliable and consistent operation.
- 12.13.2** If applicable, a circulating water system shall be provided, primarily comprising an expansion water tank for storing circulating water and a pump platform for circulation. The system shall be designed to ensure stable temperature control, with provisions for monitoring and safety to

prevent system failure.

12.14 Fire Safety

- 12.14.1** This section establishes the requirements for fire protection, detection, and extinguishment systems related to the storage, handling, transfer, and utilization of methanol as fuel. It aims to ensure effective fire safety measures are implemented in accordance with applicable international regulations, standards and RO requirements.
- 12.14.2** Fire detection and suppression systems, including fixed foam systems and portable extinguishers, shall be installed in accordance with applicable safety standards.
- 12.14.3** Fire detection, suppression, and extinguishing systems, including fixed foam systems and portable extinguishers, shall be installed to address potential methanol and diesel fires effectively.
- 12.14.4** The boundaries of Category A machinery spaces, accommodation spaces, control stations, and spaces with a high fire risk that face the bunkering station shall adopt A-60 class fire-resistant divisions. Such insulation shall extend to the underside of the navigation bridge deck or the actual height of the bulkhead. However, for spaces with a low fire risk (such as liquid tanks, void spaces, auxiliary machinery spaces, sanitary spaces, and other similar spaces), the fire rating of such boundaries may be reduced to A-0 class.
- 12.14.5** These provisions supplement the requirements specified in SOLAS Chapter II-2 and are aligned with the relevant functions outlined in MSC.1/Circ.1621 (Circular of the Maritime Safety Committee).
- 12.14.6** The provisions in this section are additional to those given in SOLAS Chapter II- 2.
- (a) Provision for fire protection:
- (i) For the purposes of fire protection, methanol fuel preparation spaces shall be regarded as machinery space of category A. Shall the space have boundaries towards other machinery spaces of category A, accommodation, control station or cargo areas, these boundaries shall not be less than A-60;
 - (ii) Any boundary of accommodation up to navigation bridge windows, service spaces, control stations, machinery spaces and escape routes, facing methanol fuel tanks on open deck shall have A-60 fire integrity;
 - (iii) For fire integrity, the methanol fuel tank boundaries shall be separated from the machinery spaces of category A and other rooms with high fire risks by a cofferdam of at least 600 mm, with insulation of not less than A-60 class; and
 - (iv) The methanol bunkering unit shall be separated by A-60 class divisions towards machinery spaces of category A, accommodation, control stations and high fire risk spaces, except for spaces such as tanks, voids, auxiliary machinery spaces of little or no fire risk, sanitary and similar spaces where the insulation standard may be reduced to class A-0.
- (b) Provision for firefighting:
- (i) When the methanol fuel storage tank is located on the open deck, isolating valves shall be fitted in the fire main in order to isolate damaged sections of the fire main. Isolation of a section of fire main shall not deprive the fire line ahead of the isolated section from the supply of water;
 - (ii) The alcohol-resistant foam type fire-fighting system shall cover the area below the void

room, fuel preparation space and the space where the methanol fuel engine is arranged where a spill of fuel could be expected to spread;

- (iii) The methanol bunker unit shall have a fixed fire-extinguishing system of alcohol resistant foam type and a portable dry chemical powder extinguisher or an equivalent extinguisher, located near the entrance of the bunkering unit;
- (iv) Suitable detectors shall be selected based on the fire characteristics of the methanol fuel. Smoke detectors shall be used in combination with detector which can more effectively detect methanol fires;
- (v) A fixed fire detection and fire alarm system complying with Fire Safety System Code shall be provided for all compartments containing the methanol fuel system; and
- (vi) Means to ease detection and recognition of methanol fires in machinery spaces shall be provided for fire patrols and for fire-fighting purposes, such as portable heat-detection devices.

12.14.7 Provision for fire extinguishing of engine-room and methanol fuel preparation space

- (a) Machinery space and methanol fuel preparation space where methanol-fuelled engines or methanol fuel pumps are arranged shall be protected by an approved fixed fire-extinguishing system in accordance with SOLAS regulation II-2/10 and the FSS Code. In addition, the fire-extinguishing medium used shall be suitable for the extinguishing of methanol fires.
- (b) An approved alcohol-resistant foam system covering the tank top and bilge area under the floor plates shall be arranged for machinery space category A and methanol fuel preparation space containing methanol.

12.14.8 Fire Detection and Fire Alarm System

- (a) All compartments equipped with methanol fuel systems shall be provided with fixed fire detection and fire alarm systems that comply with the International Code for Fire Safety Systems (“FSS Code”).
- (b) Suitable detectors shall be selected based on the ignition characteristics of alcohols. Smoke detectors shall be used in combination with detectors that can detect methanol fires more effectively.
- (c) Means to facilitate the detection and identification of methanol fires in machinery spaces shall be provided for fire patrol and fire-fighting purposes.
- (d) When the function of identifying individual detectors is not available, each detector shall be configured as a separate loop.
- (e) When a fire is detected in any compartment, the safety measures specified in MSC.1/Circ.1621 (Circular of the Maritime Safety Committee) and the relevant provisions of the Recognized Organization (“RO”) shall be implemented.

Chapter 13 Training

13.1 Training on Electronics Navigational Equipment

13.1.1 General Requirements

- (a) The Contractor shall provide classroom-based and vessel-based training as specified in Paragraphs 13.1.2, 13.1.3 and 13.2 of this Part VII as appropriate before Delivery Acceptance of the Vessel to the GNC 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) 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.
- (c) 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.
- (d) 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.
- (e) The methanol system training shall cover the fuel operation manual and the safe operation of the fuel bunkering, storage, supply, and delivery systems. At least one (1) month prior to the start of the training, the Contractor shall provide the training manual in both Traditional Chinese and English versions, and submit it to GNC for approval as appropriate.
- (f) Training manual in both Traditional Chinese and English shall be provided and submitted to GNC 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:
 - (i) Operator Training
 - (ii) Equipment Maintenance Training

13.1.2 Operator Training Course

- (a) This course shall provide training for trainers in Cantonese.
- (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.

13.1.3 Equipment Maintenance Training Course

- (a) The equipment maintenance training course shall enable the maintenance staff to:

- (i) 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
 - (ii) effectively maintain the ENE. This shall include practical demonstrations and tests.
- (b) The maintenance training shall include, but not limited to the following items:
 - (i) Introduction of the ENE locations;
 - (ii) ENE operational, working principle and functional descriptions;
 - (iii) ENE block and schematic functional descriptions;
 - (iv) ENE adjustment/calibration procedure and parameter settings;
 - (v) ENE construction and mounting;
 - (vi) ENE interfacing and signal interfacing; and
 - (vii) 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.

13.2 Training on Operation and Maintenance of the Vessel

- 13.2.1** In addition to the training to be provided for the ENE, the Contractor shall provide training in relation to the operation of the Vessel and the ancillary boat for the operational staff of the MD, training in relation to maintenance of engine and equipment on board for the technical staff of the MD and for the Maintenance and Support Section of Government Dockyard.
- 13.2.2** 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 50 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.
- 13.2.3** 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 Vessel 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 25 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.
- 13.2.4** 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 ancillary boat's 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 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.

- 13.2.5** 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 in both Traditional Chinese and English shall be provided at least one (1) month prior to commencement of the training, in both paper and CD-ROM format. The training video and manuals for major operations shall be provided onboard.
- 13.2.6** The Contractor shall provide training on methanol filling operations and on handling emergency incidents involving methanol to crew members.

Chapter 14 Abbreviations

µs	Microsecond
µV	Microvolt
3G	3rd Generation
4G	4th Generation
A/C	Alternating Current
ABS	American Bureau of Shipping
AC	Alternating Current
AES	Advanced Encryption Standard
AFFF	Aqueous Film-Forming Foam
AGM	Absorbent Glass Mat
AIS	Automatic Identification System
AIU	Audio Gear Interface Unit
AML	Additional Military Layers
AMS	Asset Management System
ANSI	American National Standards Institute
ARCS	Admiralty Raster Chart Service
ARPA	Automatic Radar Plotting Aid
ASTM	American Society for Testing and Materials
ASWF	American Standard Window Film
AV	Audio Video
AVLS	Automated Vehicle Location System
AWS	American Welding Society
BNC	Bayonet Neill-Concelman
BNWAS	Bridge Navigational Watch Alarm System
BS	British Standards
BSB	Data Encoded in the BSB format
BWA	Beam Waist Analyser
C/A	Course/Acquisition
c/w	Complete With
CABA	Compressed Air Breathing Apparatus
CBRN	Chemical, Biological, Radiological and Nuclear
CCD	Charge-Coupled Device
CCTV	Close Circuit Television
CD	Compact Disc
cd/m ²	Candela per metre squared
CD-ROM	Compact Disc Read-Only Memory
CFC	Chlorofluorocarbon
CH	Channel

cm	Centimetre
CO ₂	Carbon Dioxide
COG	Course Over Ground
CPA	Closest Point of Approach
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CWA	Cognitive Work Analysis
ANMU	Aids to Navigation and Mooring Unit
dB	Decibel
dBi	Decibel Isotropic
dBm	Decibel-milliwatts
DC	Direct Current
DDR	Double Data Rate
deg	Degree
DGPS	Differential Global Positioning System
DHCP	Dynamic Host Configuration Protocol
DISS	DNC Digital Nautical Chart
DPDT	Double-Pole, Double-throw
DRU	Data Recording Unit
DSC	Digital Selective Calling
DTRS	Digital Trunk Radio System
DVD	Digital Versatile Disc
DVI	Digital Video Interface
DVR	Digital Video Recorder
E/R C.C.	Engine Control Area Console
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
EFCP	External Fire-Fighting Control Panel
EFFS	External Fire-Fighting System
EGNOS	European Geostationary Navigation Overlay Service
EIAPP	Engine International Air Pollution Prevention
EMC	Electromagnetic Compatibility
EMSD	Electrical and Mechanical Services Department
EMI	Electromagnetic Interference
ENC	Electronic Navigational Charts
ENE	Electronic Navigation Equipment
EOSS	Electro Optical Sensor System
ERBL	Electronic Range and Bearing Lines
ERC	Engine Control Area
ESS	Energy Storage System

FAT	Factory Acceptance Trials
FD	Frequency Division
FO	diesel fuel
FOV	Field of View
FTP	Fire Test Procedures
g	Gravity
GB	Gigabyte
GeoTIFF	Format File
GGAP	Guidance General Arrangement Plan
GHz	Gigahertz
GLONASS	Global Navigation Satellite System
GM	Metacentric Height
GMDSS	Global Maritime Distress and Safety System
GMT	Greenwich Mean Time
GNC	Government New Construction Section
GPS	Global Positioning System
GRP	Glass-Reinforced Plastic
GZ	Righting Lever
H/V	Horizontal/Vertical
HazMat	Hazardous Material
HCFC	Chlorodifluoromethane
HD	Hard Disk
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
HEPA	High-Efficiency Particulate Arrestance
HPEAFS	High Performance Energy Absorbing Flooring System
HPS	Harbour Patrol Section
HSC	High-speed Craft
HVAC	Heating, Ventilation and Air Conditioning
Hz	Hertz
IC	Intercommunications
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICOMIA	The International Council of Marine Industry Associations
ICR	Information Collection Request
IEC	International Electrotechnical Commission
IHO	International Hydrographic Organization
IMM	International Maritime Mobile
IMO	International Maritime Organisation
INS	Integrated Navigation System
IP	Internet Protocol

IPsec	Internet Protocol Security
IR	Infrared
IRPA	International Radiological Protection Association
IRPCS	International Regulations for Preventing Collisions at Sea
IS	Intact Stability
ISO	International Organization for Standardization
ITTC	International Towing Tank Conference
ITU-R	International Telecommunication Union – Radio communication Sector
JPEG	Joint Photographic Experts Group
K	Kilo
kg	Kilogram
kHz	Kilohertz
km	Kilometre
km/h	Kilometre per hour
kPa	Kilo Pascal
kts	Knots
kW	Kilowatt
k Ω	Kilo Ohm
L/min	Litre per minute
L/s	Litre per second
LCD	Liquid Crystal Display
LCG	Longitudinal Centre of Gravity
LED	Light-Emitting Diode
LO	Lube Oil
LOP	Local Operating Panel
LSA	Lifesaving Appliance
LTE	Long Term Evolution
m	Metre
M/E	Main Diesel Engines
m/s	Metre per Second
m ³	Cubic Metre
MARPA	Mini-Automatic Radar Plotting Aid
MARSAS	Marine Situational Awareness System
MCB	Miniature Circuit Breaker
MD	Hong Kong Marine Department
MED	Marine Equipment Directive (“EU”)
MEI	MEI Corporation
MFD	Multi-Function Display
MHz	Megahertz
MIMO	Multi Input Multi Output

MJ/m ²	Megajoule per Square Metre
MKD	Minimum Keyboard Display
mm	Millimetre
MMC	Multi Media Card
MMSI	Maritime Mobile Service Identity
MOB	Man Overboard
mph	Mile per hour
MS PRO	Memory Stick PRO
MS PRO Duo	Memory Stick PRO Duo
MSC	Maritime Safety Committee
mV	Milli Voltage
NAVSEA	Naval Sea Systems Command
NDT	Non-Destructive Test
NFPA	National Fire Protection Association
NIR	Non-Ionizing Radiation
Nm	Nanometre
NMEA	National Marine Electronics Association
NORSOK	Norsk Sokkels Konkuranseposisjon
ns	Nanosecond
NTRIP	Networked Transport of RTCM via Internet Protocol
NUC	Not Under Command
OBE	On-board Electronics
OC Foam	Oleoresin Capsicum – Pepper Spray
OFCA	Office of the Communications Authority
ohm	Unit of Electrical Resistance
OOW	Officer of the Watch
OSHA	Occupational Safety and Health Administration
p.s.i.	Pounds per square inch
PA	Public Address System
Pa	Pascal
PAL	Phase Alternating Line
PCB	Printed Circuit Board
PCU	Personal Communications Unit
PPI	Plan Position Indicator
PPTP	Point-to-Point Tunnelling Protocol
PTO	Power Take Off
PTT	Press To Talk
PVC	Polyvinyl Chloride
QoS	Quality of Service
RAM	Random Access Memory

RAW	A file format that captures all image data recorded by the sensor when a photograph is taken
RCA	Radio Corporation of America
RF	Radio Frequency
RG58U	RG58U Type Coaxial Cable
RGB	Red Green Blue
RH	Relative Humidity
RM	Relative Motion
RMS	Root Mean Squared
RO	Recognised Organisation
ROT	Rate of Turn
rpm	Revolutions per Minute
RT	Radioactive Test
RTCM	Radio Technical Commission for Maritime Services
SATA	Serial Advanced Technology Attachment
SBAS	Satellite Based Augmentation System
SDME	Speed and Distance Measuring Equipment
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
TBT	Tributyltin
TCG	Transverse Centre of Gravity
TCPA	Time-based Closest Point of Approach
TD	Time Division
TETRA	Terrestrial Trunked Radio
TFT	Thin-Film Transistor
TIFF	Tagged Image File Format
TM	True Motion
TMR	TOPEX/Poseidon Microwave Radiometer
TOPEX	Topology Ocean Experiment
TS	Technical Specifications
UHF	Ultra High Frequency
UPS	Uninterruptible Power System
USB	Universal Serial Bus
UT	Ultrasonic Test
UTC	Coordinated Universal Time

uV	Nano Voltage
UV	Ultraviolet
V	Volt
V.S.W.R.	Voltage Standing Wave Ratio
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
VOC	Volatile Organic Compounds
VoIP	Voice Over Internet Protocol
VOX	Voice Operated Switch
VPN	Virtual Private Network
VRM	Variable Range Marker
VSD	Variable Speed Drive
VTC	Vessel Traffic Centre
VTs	Vessel Traffic Services
W	Watt
W/H E.C.C.	Wheelhouse Engine Control Console
WAAS	Wide Area Augmentation System
WAN	Wide Area Network
WMS	Web Map Service

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 Contractor 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 (1) 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 relevant chapter(s) 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/manufacturers' 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), gearbox(es), propulsion system(s) and other major equipment, 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 two (2) working days (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 three (3) working days after the fault report is first issued. The MD must be informed of what corrective maintenance and rectification actions have been taken within five (5) working days 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 deployed shall originate from the Warranty Spare Parts or otherwise from the manufacturer of the original Warranty Item to be repaired of the same model

and with the same or better specifications and must be able to be found in 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 two (2) working days, 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 ten (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 (7) 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 seven (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 (1) 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 (1) year.
- 1.8.4 The Warranty Period of the Vessel shall be extended if the entire Vessel is out of service for more than twenty-four (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 above, 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 in respect of the first Vessel to be delivered maintain an inventory of spare parts, which shall be brand new items fresh from the factory serving as spare parts of the items as listed in Schedules 6 and 7 in Part V (and complying with the same Overall Specifications as applicable to these items) and in the quantity as found in one Vessel with its local agent in Hong Kong which the Contractor shall use for performing the Warranty Services (viz., Warranty Spare Parts). 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 relevant chapter(s) 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 relevant chapter(s) 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 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

- (c) Renew the lubricating oil and replace the filters for the propulsion engines/motors, generators set, outboard engines in ancillary boat (if applicable) and gearboxes and top up the engine coolant (if applicable) as per the manufacturer's recommendations;
- (d) Clean all the engine air filters and change the filter elements;
- (e) Change all fuel/water separators elements and fuel filters for all engines;
- (f) Flush through the cooling system of the propulsion engines/motors, generators set, outboard engines in ancillary boat (if applicable) and gearboxes and renew all zinc anodes if provided;
- (g) Check all the engines' belts and adjust or renew if necessary;
- (h) Check tappet clearances for the inlet and exhaust valves, ignition timing and idle speed and adjust if necessary;
- (i) Conduct function tests for the engines' protection system and their associated sensors, gauges and other measuring devices;
- (j) 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;
- (k) Repair all damages and leakages in the pipelines; and
- (l) Any other work required or recommended by the engine manufacturer.

All of the work listed at Paragraphs 2.2.1 to 2.2.2 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 (1) 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) above, two coats of touch up primer and one (1) 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) above.

(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 (2) coats of touch up primer and one coat of touch up (finishing) shall be applied;
 - (ii) Two (2) coats of paint shall be applied on the Vessel's name, draft marks and insignia; and
 - (iii) One (1) full coat of anti-slip paint shall be applied to the open and side deck.
- (c) Inspect, clean and polish propellers/waterjet impellers;
 - (d) Inspect, clean and remove obstructed object on the propulsion 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;
 - (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; and
 - (j) In order to facilitate GNC 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

- (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) Functional test of fuel supply emergency shutdown devices;
- (d) Navigational equipment, lights and sound signals;
- (e) Ahead and astern running and crash stop test;
- (f) Steering trial;
- (g) Speed measurement;
- (h) Bilge system function (including high level bilge alarm system);
- (i) Fire pump(s) function (including fire detection system, alarms, ventilation fans /fuel pump remote shutdown);
- (j) Other trials or testing of equipment as required by the Government Representative;
- (k) Any item or component found defective shall be repaired or replaced;
- (l) The Dock Trial and Sea Trial Safety Checklist items, as listed below:

Dock Trial Check List

<i>General items will be checked during dock trial</i>	
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 and windows screen wipers testing
10	Fire protection system check
11	Portable fire extinguishers inspection
12	Life-saving equipment inspection
13	Signal and light testing
14	Engine room ventilation fans testing
15	Air handling unit (if applicable) and air conditioning system testing
16	A/C cooling water pumps testing (if applicable)
17	Bilge system in each compartment testing.
18	Floor plate inspection
19	Cabin lights testing
20	Fuel tanks quick closing valves testing
21	G.S. pumps testing
22	Fire pumps testing
23	Tailshaft cooling water pumps testing (if applicable)
24	Bilge pumps testing
25	Fuel oil pumps testing
26	Waste water pumps testing
27	Steering system power assisted and manual operation testing
28	Emergency steering operation check
29	Sanitary pumps testing
30	Sewage pumps testing
31	Fresh water pumps testing
32	Rudder indicator check (if applicable)
33	Deck cranes testing (if applicable)

34	Sewage pumps testing (if applicable)
35	Methanol Fuel Supply System (MFSS) testing
36	Methanol Storage System (MSS) testing
37	Methanol Drain System testing
38	Methanol Monitoring and Control System (MMCS) testing
39	Methanol bunkering system testing
40	Methanol Refuelling Skid testing
41	Nitrogen System testing
42	Methanol Temperature Control System testing
43	Dual-fuel change-over testing
44	Methanol leakage alarm testing

Sea Trial Safety Check List

<i>General items will be checked during sea trial</i>	
1	Engines start and stop testing
2	Engines emergency stop check
3	Engines speed and clutch unit testing
4	Vessel horn testing and windows screen wipers 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
11	Water tank pressure test
12	Deck cranes testing (if applicable)

- (m) Other trials or testing of equipment as required by the Government Representative; and
- (n) 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 Contract appearing at the top of 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 fourteen (14) days from 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 to be determined by the Government
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 RO's approval and GNC approval	The Contractor shall propose the completion dates of Milestones 6-15 for GNC's approval within two (2) months after the Contract Date.
7	Model tests as specified in Annex 11 to Part VII	
8	Completion of hull and superstructure of the Vessel	

9	Stage 1 of the technical acceptance as described in Paragraph 1.9.2(a) of Part VII	
10	Completion of installation of ENE	
11	Launching of the Vessel	
12	Conduct of all tests, inspections and trials as part of Stage 2 of the Technical Acceptance as described in Paragraph 1.9.2(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 as described in Paragraph 1.9.2(c) of Part VII	
15	Delivery Acceptance in Paragraph 1.9.3 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; and a 3D computer model of the Vessel interior for review	<i>All the drawings are required to be submitted in two (2) months after the Contract Date for GNC's approval/reference.</i>
2.	Lines Plan	
3.	Stability Analysis & Calculations	
4.	Inclining Experiment Report	
5.	Typhoon Mooring Arrangement	
6.	Structural Construction Plan in Mid-Ship and Bulkhead Section	
7.	Construction Profile and Deck Plan	
8.	Shell Expansion Plan	
9.	Stem Construction and Stern Construction Plan	
10.	Deckhouse Construction Plan	
11.	Deckhouse Arrangement and Details	
12.	Fuel Oil tank Construction	
13.	Paint Schedule	
14.	Tank Capacity Plan	
15.	Main Generator Sets Mounting Arrangement	
16.	Power / Speed Estimation and Curve	
17.	Intact and Damaged Stability Plan	
18.	Details of Operational Systems	
19.	Details of Deck Equipment, Outfitting, Furniture, etc.	
20.	Engine Room Arrangement	
21.	Shaft line Arrangement	
22.	Propeller Drawing	
23.	Waterjet and Installation Drawings	
24.	Steering, Rudders and Rudder Stock Arrangement	
25.	Details of Diesel Generator Arrangement	
26.	Control Console Arrangement and Schematic Diagram including Wheelhouse Arrangement Plan	
27.	Instrumentation and Control System	
28.	Calculation of Fuel Oil Capacity and Methanol Fuel Capacity	
29.	Details and Arrangement of Main Generator Sets	
30.	Arrangement of Frequency Converter and Cooling Equipment	
31.	Details of Alarms, Sensors and Protection of Main Generator Sets, Main Propulsion Motors and Reduction Gear Boxes	
32.	Details of Propulsion System - Main Generator Sets, Main Propulsion Motors and Reduction Gear Boxes	

Item No.	Drawings Approval	Completion Date
33.	Details and Schematic Diagram of Methanol Monitoring and Control System (MMCS)	
34.	Details and Arrangement of Main Propulsion System	
35.	Details and Arrangement of Power Management System	
36.	Harmonic Calculation of Electric Propulsion System	
37.	Engine Room Piping Diagrams including sea water system, bilge system, fresh water system and black water system	
38.	Engine Room Ventilation Arrangement	
39.	Calculation of Engine Room Ventilation and Exhaust	
40.	Ship's Ventilation Piping Diagrams and Arrangement	
41.	Details of the Air-Conditioning System	
42.	Machinery Space Lifting Appliance Arrangement	
43.	Details and Arrangement of Cooling Water System	
44.	Details and Arrangement of Working Air	
45.	Lighting Arrangement	
46.	Battery Arrangement	
47.	Navigation and Signal Light Arrangement	
48.	Search Light and Flood Light Arrangement	
49.	Solar Panel Arrangement	
50.	Details of Electrical and Electronic Equipment	
51.	Electrical Load Calculations	
52.	Schematic Layout of Electrical Circuits	
53.	Arrangement of Electric Equipment in the Hazard Area Zone	
54.	Intrinsically Safe Circuit Verification	
55.	Shor-Circuit Calculation	
56.	Protection Device Coordination Study Report	
57.	Lightning Protection Arrangement	
58.	Details of Galvanic Corrosion Prevention	
59.	Torsional Vibration Calculation	
60.	Fire Fighting Arrangement	
61.	Lifesaving Arrangement	
62.	Safety Plan	
63.	Ancillary boat and Davit LARS Arrangement	
64.	Details of Embarkation and Boarding from Shore and Ancillary boat	
65.	Ship Ladder Arrangement	
66.	Tonnage Measurement Calculation	
67.	Freeboard Calculation	

Item No.	Drawings Approval	Completion Date
68.	Fender Arrangement & Details	
69.	Cathodic Protection Arrangement & Details	
70.	Ship's Name & other Tally Plates Details	
71.	Ship's Railing Arrangement & Details	
72.	Wheelhouse Windows & Visibility Diagram	
73.	Insulation & Lining Arrangement & Details	
74.	Hatches & Manholes Arrangement & Details	
75.	Anchoring & Mooring Arrangement	
76.	Monitoring and Alarm System Arrangement	
77.	Hazardous Area Plan and Hazard Area Zone Analysis	
78.	Calculation Of The Discharge Capacity Of A Pressure Relief Valve	
79.	Details and Schematic Diagram of Methanol Bunkering System	
80.	Details and Flow Diagram of Methanol Fuel Tank and Methanol Drain Holding Tank	
81.	Details and Flow Diagram of Void Room and Fuel Preparation Room Bilge and Drainage Piping System	
82.	Details and Flow Diagram of Nitrogen System	
83.	Diagram Of Degassing And Inert Gas Purging System	
84.	Diagram Of Nitrogen Gas-Sealed Double-Walled Pipe System	
85.	Bunkering Station Arrangement	
86.	Void Room And Fuel Preparation Room Arrangement	
87.	Welding and Inspection Plan	
88.	Model Test Plan	
89.	Others as required	

Note: All information to be submitted shall show compliance of the relevant Equipment or the Vessel or any part thereof with all requirements of the Contract.

Part VII - Annex 4 – Main Items Inspection Timetable

VESSEL NAME : “LIGHTHOUSE 1” and “LIGHTHOUSE 2”			Inspection date	Outstanding / Reinspection / Remarks
Item	Items to be inspected			
	Hull Structure, Layout and Outfitting Inspection			
H-1	Model Test			
H-2	Hull Lofting			
H-3	Construction materials – Aluminium/Steel plate mark checking for hull			
	a) Aluminium/Steel plate mark checking for hull			
	b) Material certification verification			
H-4	Construction materials – aluminium/steel plate mark checking for deckhouse			
	a) Aluminium/Steel plate mark checking for deckhouse			
	b) Material certification verification			
H-5	Welding consumables, WPS and welders' certificates verification			
H-6	Keel lay inspection			
H-7	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 structural work inspection			
	h) Plating thickness gauging			
H-8	Engine girder fabrication and welding			
H-9	Deckhouse scantling and welding check			
H-10	Inspection and weld check of connection between deckhouse and main deck			
H-11	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			
	Black water tank			
	a) Tank construction (internal/external/fitting)			
	b) Tank seating construction/securing			
	c) Tank pressure test			
H-12	Hose test for hull and deckhouse			

H-13	Mock-up inspection for the wheelhouse			
H-14	Deckhouse console mock up			
H-15	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-16	Function test of various outfitting items			
H-17	Water-tightness or weathertightness of openings			
	a) Manholes			
	b) Hatches			
	c) Doors			
	d) Windows			
	e) Ventilators and Air pipes			
	f) Cable glands			
H-18	Painting inspection of different layers			
H-19	Zinc anodes and lightning protection			
	a) Installation of zinc anodes			
	b) Lightning protection			
H-20	Vessel dimension verification			
H-21	Draught marks verification			
H-22	Hull completion survey in the presence of GNC officers and users of MD			
H-23	Arrangement of deckhouse, wheelhouse and accommodation to be inspected by GNC officers and users of MD			
H-24	Inspection of fire, heat and sound insulation			
	a) Fire Insulation			
	b) Heat Insulation			
	c) Sound Insulation			
H-25	Interior furnishings			
	a) Wheelhouse			
	b) Crew Space			
H-26	Lifesaving appliances and firefighting appliances			
	a) Lifesaving appliances			
	b) Firefighting appliances			
H-27	Inspection of sea chest and grating			
	a) Sea chest			
	b) Grating			
H-28	Inclining experiment			
H-29	Sea trials including operation of outfitting to be performed in Stage 2 – Technical Acceptance (“Stage 2 sea trial”)			
H-30	Trial of anchor & mooring arrangement in the Stage 2 sea trial			

H-31	Cleanliness inspection before acceptance			
H-32	Inventory check in HKSAR (this is the item to be performed during Delivery Acceptance)			
H-33	Acceptance of all inspection items listed in this Annex 4 as well as in the Programme (as defined in paragraph 1.9 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-34	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 : “LIGHTHOUSE 1” and “LIGHTHOUSE 2”			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 engines/motors			
	b) General inspection of the generator sets			
	c) General inspection of the shafting (including propeller and coupling taper bedding test, coupling and rudder bolts fitting)			
	d) General inspection of propeller			
EM-2	Main Engines/Generators/Motors:			
	a) Test of engine safety devices and alarms			
	b) Test of emergency stop			
	c) Inspection of exhaust pipe before lagging			
	d) Inspection of cooling water system			
EM-3	Hydraulic test of sea water 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			
	i) Functional test of Quick closing valves			
	j) Functional test of fuel tank stripping			
EM-7	Bilge system:			
	a) General inspection and dimension checking of the bilge system			
	b) Bilge tank high level alarm test			
	c) Bilge tank content gauge calibration and test			
	d) Inspection of piping penetration of bulkhead and deck			
	e) Hydraulic test of bilge system piping			
	f) Functional test of bilge system			
	g) Functional test of unmanned bilge alarm			
EM-8	Black water/sanitary system:			
	a) General inspection and dimension checking of the black water/sanitary system			
	b) Inspection of piping penetration of bulkhead and deck			
	c) Hydraulic test of black water/sanitary system piping			
	d) Functional test of black water/sanitary system			
EM-9	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 (internal and external)			
	e) Test of fixed fire extinguishing alarm system			
	f) Test of fire detection (e.g. smoke and heat detection) alarm system			
	g) Functional test of unmanned fire alarm			
EM-10	Hydraulic test of sea water valve			
EM-11	Hydraulic system (if applicable):			
	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-12	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			
	c) Functional test of the fire dampers			
EM-13	Air conditioning system:			
	a) General inspection and dimension checking of the air conditioning system			

	b) Inspection and test of cooling water system (if any)			
	c) Functional test of air conditioning system			
	d) Full test of air conditioning during the Stage 2 sea trial			
EM-14	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/motors and generators consecutive starting by each group of battery (start/stop at remote and local control)			
EM-15	Electrical installation:			
	a) Inspection of lightning protection			
	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-16	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-17	Control console(s):			
	a) Inspection of wheelhouse control console and remote engine control console			
	b) Functional test of wheelhouse console controls and remote console controls			
	c) Inspection of navigation equipment control panel			
EM-18	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-19	Navigation Lights and Signals:			
	a) Inspection and functional test of navigation lights			
	b) Test of horn /whistle			
EM-20	FMEA Report			
EM-21	Electronic Navigational Equipment (ENE) installation and testing by EMSD			
EM-22	Firefighting system insulation and testing			

EM-23	Test of window wipers			
EM-24	Test of noise levels throughout the vessel during the Stage 2 sea trial			
EM-25	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 alignments.			
EM-26	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-27	Methanol System: a) General inspection and dimension check of the fuel system b) Storage tank(s) low level alarm test c) Storage tank(s) final cleaning/internal inspection before filling d) Storage tank(s) high level alarm test e) Storage tank(s) high/over pressure alarm test f) Storage tank(s) content gauge calibration and test g) Storage tank(s) pressure sensors calibration and test h) Inspection of piping penetration of bulkhead and deck i) Hydraulic test of methanol system piping j) Functional test of methanol system and MCMS k) Functional test of Quick closing valves l) Functional test of methanol storage tank stripping m) Functional test of methanol drain and bilge system n) Function test of vapour detection o) Inspection of pressure/vacuum (P/V) relief device p) Inspection and function test of Methanol Refuelling Skid q) Inspection and function test of temperature control system (if fitted)			
EM-28	Ventilation for methanol system: a) General inspection b) Function test for start/stop at control station(s) c) Alarm and tripping system check d) Inspection of ventilation fan installation			
EM-29	Explosive-proof electrical appliances: a) General inspection and function check			
EM-30	Air lock system: a) General inspection and function test b) Alarm test (pressure alarm and door status alarms)			
EM-31	Inerting system and nitrogen system: a) General inspection and function test b) Alarm test			
EM-32	Methanol bunkering system a) General inspection and function test b) Alarm test and shut off valve testing c) Inspection of firefighting appliance and personal safety appliance d) Inspection of the dynamic display LCD screen e) Inspection of the electrostatic discharge device			
	Operational System			
OS-1	Installation inspection and functional test for Electronic Navigational Equipment (ENE) in Operational Systems			
OS-2	Inspection of tally plate and cable label			
OS-3	Inspection of main engine/genset safety alarms on Wheelhouse console			
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 1.9 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	16 Persons (at 75 kg per person and 20 kg personal effect)
2	Diesel fuel oil tanks	not less than 95% tank capacity
3	Methanol fuel storage tank	not less than 95% tank capacity
4	Fresh water tank	not less than 95% tank capacity
5	Black water tank	not less than 10% tank capacity
6	Oily bilge water tank	not less than 10% tank capacity
7	Methanol drain holding tank	Nil
8	Store/Utilities	Nil
9	Sea Conditions	Sea state 0-2 : wave height 0.1 - 0.5 metres; Beaufort Wind scale number 0 to 3

2) Endurance and Performance Test (methanol model)

Conditions at Endurance and Performance Test		
1	Person on board	16 Persons (at 75 kg per person and 20 kg personal effect)
2	Diesel fuel oil tanks	not less than 85% tank capacity
3	Methanol fuel storage tank	not less than 95% tank capacity
4	Fresh water tank	not less than 85% tank capacity
5	Black water tank	not less than 10% tank capacity
6	Oily bilge water tank	not less than 10% tank capacity
7	Methanol drain holding tank	Nil
8	Store/Utilities	800 kg
9	Sea Conditions	Sea state 0-2 : wave height 0.1 - 0.5 metres; Beaufort Wind scale number 0 to 3

3) Endurance and Performance Test (diesel model)

Conditions at Endurance and Performance Test		
1	Person on board	16 Persons (at 75 kg per person and 20 kg personal effect)
2	Diesel fuel oil tanks	not less than 50% tank capacity
3	Methanol fuel storage tank	not less than 50% tank capacity
4	Fresh water tank	not less than 85% tank capacity
5	Black water tank	not less than 10% tank capacity
6	Oily bilge water tank	not less than 10% tank capacity
7	Methanol drain holding tank	Nil
8	Store/Utilities	800 kg
9	Sea Conditions	Sea state 0-2 : wave height 0.1 - 0.5 metres; Beaufort Wind scale number 0 to 3

4) Manoeuvrability Test

Conditions at Forward Turning Circle Test		
1	Person on board	16 Persons (at 75 kg per person and 20 kg personal effect)
2	Diesel fuel oil tanks	not less than 80% tank capacity
3	Methanol fuel storage tank	not less than 80% tank capacity
4	Fresh water tank	not less than 85% tank capacity
5	Black water tank	not less than 10% tank capacity

6	Oily bilge water tank	not less than 10% tank capacity
7	Methanol drain holding tank	Nil
8	Store/Utilities	800 kg
9	Sea Conditions	Sea state 0-2 : wave height 0.1 - 0.5 metres; Beaufort Wind scale number 0 to 3

5) Crash Stop Test / Astern Running Test / Emergency Steering Test

Conditions at Crash Stop Test / Astern Running Test / Emergency Steering Test		
1	Person on board	16 Persons (at 75 kg per person and 20 kg personal effect)
2	Diesel fuel oil tanks	not less than 80% tank capacity
3	Methanol fuel storage tank	not less than 80% tank capacity
4	Fresh water tank	not less than 85% tank capacity
5	Black water tank	not less than 10% tank capacity
6	Oily bilge water tank	not less than 10% tank capacity
7	Methanol drain holding tank	Nil
8	Store/Utilities	800 kg
9	Sea Conditions	Sea state 0-2 : wave height 0.1 - 0.5 metres; Beaufort Wind scale number 0 to 3

Part VII - Annex 6 – Endurance and Performance Tests**(a) Methanol Mode**

Date of Test:				Place of Test:			
Vessel's Identification:				Vessel's Name:			
Conditions at Endurance and Performance Test							
Person On board	16			Dummy Weight	kg		
Fuel (Methanol)				Other Equipment	kg		
Sea Conditions							
Generators:	Port Side	Center[^]	Starboard Side	Electric Motors:	Port Side	Starboard Side	
Maker				Maker			
Type				Type			
Serial Number				Serial Number			
Rated Power				Rated Power			
Rated Speed				Rated Speed			
Engine Load	Motor Speed (rpm)	Vessel Speed (Knots)	Time (Start)	Time (Finish)	Fuel Consumption (litres/minutes)	Generators Oil Pressure (Bar)	Generators (in) CW Temp. (°C)
— % of Rated Power [#]	At Minimum Crushing Speed		10 min				
50% of Rated Power			10 min				
75% of Rated Power			10 min				
100% of Rated Power (Endurance Test)			120 min				
		Remarks:					
Witness by:		MD Representative				Shipyard Representative	

[^]Notes: Apply to the third engine if applicable.

(b) Diesel Mode

Date of Test:					Place of Test:			
Vessel's Identification:					Vessel's Name:			
Conditions at Endurance and Performance Test								
Person On board	16				Dummy Weight	kg		
Fuel (Diesel)					Other Equipment	kg		
Sea Conditions								
Generators:	Port Side	Center[^]	Starboard Side	Electric Motors:		Port Side	Starboard Side	
Maker				Maker				
Type				Type				
Serial Number				Serial Number				
Rated Power				Rated Power				
Rated Speed				Rated Speed				
Engine Load	Motor Speed (rpm)	Vessel Speed (Knots)	Time (Start)	Time (Finish)	Fuel Consumption (litres/minutes)	Generators Oil Pressure (Bar)	Generators (in) CW Temp. (°C)	Others
___ % of Rated Power [#]	At Minimum Crushing Speed		10 min					
50% of Rated Power			10 min					
75% of Rated Power			10 min					
100% of Rated Power (Endurance Test)			120 min					
		Remarks:						
Witness by:		MD Representative				Shipyard Representative		

[^]Notes: Apply to the third engine if applicable.

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 after Delivery Acceptance

1. As-Fitted Drawings

- 1.1 At not less than four (4) weeks before the 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 the 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 Stability information booklet and the 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 clearly 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 Midship section plan
 - 1.2.14 Profile and Deck construction plan.
 - 1.2.15 Steering system and steering arrangement diagrams.
 - 1.2.16 Deckhouse and deck structural and construction plan.
 - 1.2.17 Hull watertight bulkheads construction plan.
 - 1.2.18 Deckhouse to deck connection detailed construction plan.
 - 1.2.19 Deck edge details and construction plan, including detailed structural arrangement drawings of hull to deck connection.
 - 1.2.20 Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.
 - 1.2.21 Mast structural and construction plan and mast equipment arrangement plan.
 - 1.2.22 Anchoring arrangement plan.
 - 1.2.23 Piping diagrams for fuel oil, freshwater, bilge, firefighting, scuppers and drains, sewage system.
 - 1.2.24 Fire prevention, fire control and firefighting system drawings.

- 1.2.25 Drawings of the main switchboard and all other switchboards and the electrical system.
- 1.2.26 Electrical Load Calculation
- 1.2.27 Electrical installation drawings
- 1.2.28 Details of the Operational Systems
- 1.2.29 Operational Systems equipment installation and location drawings, including Electronic Navigation Equipment (ENE), communications, radio terminal and etc..
- 1.2.30 Operational Systems connection drawings
- 1.2.31 Wheelhouse and cabin sound and heat insulation system diagram.
- 1.2.32 Main electric motors and generator sets arrangement and siting plans and drawings of their fuel lines and exhaust gas piping and arrangement.
- 1.2.33 FMEA and test report.
- 1.2.34 Shaft line arrangement.
- 1.2.35 Propeller details and drawings
- 1.2.36 Vessel ventilation drawings for the wheelhouse, crew spaces, machinery spaces and other spaces.
- 1.2.37 Main fuel oil tank drawing and its associated piping and manifold(s), and filling, overflow and ventilation system.
- 1.2.38 Freshwater tank construction plan and its associated piping arrangement.
- 1.2.39 Fuel oil tank(s) construction plan and its associated piping system
- 1.2.40 Black water tank construction plan and its associated piping system
- 1.2.41 Drawings for anchor, windlass and the anchoring system.
- 1.2.42 Lifesaving appliance arrangement plan and fire safety plan.
- 1.2.43 Distress signals, alarm systems, and internal/external communication arrangement and system plan.
- 1.2.44 Navigation lights, sound and signal diagrams.
- 1.2.45 Vessel overall lighting arrangement and light control plan.
- 1.2.46 Vessel alarm and signals, internal communication systems and public address systems plan.
- 1.2.47 General layout and arrangement drawing of the air-conditioning system.
- 1.2.48 Piping layout drawing of the air-conditioning system (if any).
- 1.2.49 Air-conditioning load calculation.
- 1.2.50 CCTV system arrangement.
- 1.2.51 Solar panel system.
- 1.2.52 FMEA report.
- 1.2.53 Methanol Storage tank drawing and its associated piping and manifold(s), and bunkering, monitoring and control, drainage, overflow and ventilation system.
- 1.2.54 Methanol Refuelling Skid drawing and its associated piping and manifold(s) (if any).
- 1.2.55 Nitrogen System drawing and its associated piping and manifold(s).
- 1.2.56 Methanol Temperature Control System drawing and its associated piping and manifold(s) (if any).
- 1.2.57 General arrangement plan for hazard protection zone.
- 1.2.58 Drawings and calculation of ventilation system.
- 1.2.59 Arrangement and protection for containment and leakage prevention of methanol storage tank(s).

The lists are not exhaustive, additional as-fitted drawings may be added if required.

1.3 Documents to be provided by the Contractor

- 1.3.1 In not less than one (1) month before the Delivery Acceptance of the Vessel, the Contractor shall provide for GNC's 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 the 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

This Annex is for Tenderers' reference only. The contents of Table 1 are excerpted from GB/T 4099-2005 Navigation Terms and Symbols in Common Use, a national standard of the People's Republic of China, and those of Table 2 are derived from WMO-No.306 Manual on Codes published by the World Meteorological Organization (WMO).

Table 1: STATE OF THE SEA

Grade	Wave Name	Wave Height Range (H_S is significant wave height) / m
0	Calm(glassy)	0
1	Calm (rippled)	$H_S < 0.1$
2	Smooth (wavelets)	$0.1 \leq H_S < 0.5$
3	Slight	$0.5 \leq H_S < 1.25$
4	Moderate	$1.25 \leq H_S < 2.5$
5	Rough	$2.5 \leq H_S < 4$
6	Very rough	$4 \leq H_S < 6$
7	High	$6 \leq H_S < 9$
8	Very high	$9 \leq H_S < 14$
9	Phenomenal	$H_S > 14$

Table 2: BEAUFORT SCALE OF WIND

BEAUFORT NUMBER	DESCRIPTIVE TERM	VELOCITY EQUIVALENT A STANARD HEIGHT OF 10 METRES ABOVE OPEN FLAT GROUND				SPECIFICATIONS			Probable wave height* in metres	Probable wave height* in feet
		Mean velocity in knots	m s ⁻¹	km h ⁻¹	m.p.h	Land	Sea	Coast		
0	Calm	< 1	0-0.2	< 1	< 1	Calm; smoke rises vertically	Sea like a mirror	Calm	—	—
1	Light air	1-3	0.3-1.5	1-5	1-3	Direction of wind shown by smoke drift but not by wind vanes	Ripples with the appearance of scales are formed, but without foam crests	Fishing smack just has steerage way	0.1 (0.1)	1/4 (1/4)
2	Light breeze	4-6	1.6-3.3	6-11	4-7	Wind felt on face; leaves rustle; ordinary vanes moved by wind	Small wavelets, still short but more pronounced; crests have a glassy appearance and do not break	Wind fills the sails of smacks which then travel at about 1-2 knots	0.2 (0.3)	1/2 (1)
3	Gentle breeze	7-10	3.4-5.4	12-19	8-12	Leaves and small twigs in constant motion; wind extends light flag	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses	Smacks begin to careen and travel about 3-4 knots	0.6 (1)	2 (3)
4	Moderate breeze	11-16	5.5-7.9	20-28	13-18	Raises dust and loose paper; small branches are moved	Small waves, becoming longer; fairly frequent white horses	Good working breeze, smacks carry all canvas with good list	1 (1.5)	3 1/2 (5)
5	Fresh breeze	17-21	8.0-10.7	29-38	19-24	Small trees in leaf begin to sway; crested wavelets form on inland waters	Moderate waves, taking a more pronounced long form; many white horses are formed (chance of some spray)	Smacks shorten sail	2 (2.5)	6 (8 1/2)
6	Strong breeze	22-27	10.8-13.8	39-49	25-31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty	Large waves begin to form; the white foam crests are more extensive everywhere (probably some spray)	Smacks have double reef in mainsail; care required when fishing	3 (4)	9 1/2 (13)
7	Near gale	28-33	13.9-17.1	50-61	32-38	Whole trees in motion; inconvenience felt when walking against wind	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind	Smacks remain in harbour and those at sea lie to	4 (5.5)	13 1/2 (19)
8	Gale	34-40	17.2-20.7	62-74	39-46	Breaks twigs off trees; generally impedes progress	Moderately high waves of greater length; edges of crests begin to break into the spindrift; the foam is blown in well-marked streaks along the direction of the wind	All smacks make for harbour, if near	5.5 (7.5)	18 (25)
9	Strong gale	41-47	20.8-24.4	75-88	47-54	Slight structural damage occurs (chimney pots and slates removed)	High waves; dense streaks of foam along the direction of the wind; crests of waves begin to topple, tumble and roll over; spray may affect visibility	—	7 (10)	23 (32)
10	Storm	48-55	24.5-28.4	89-102	55-63	Seldom experienced inland; trees uprooted; considerable structural damage occurs	Very high waves with long overhanging crests; the resulting foam, in great patches, is blown in dense white streaks along the direction of the wind; on the whole, the surface of the sea takes on a white appearance; the tumbling of the sea becomes heavy and shock-like; visibility affected	—	9 (12.5)	29 (41)
11	Violent storm	56-63	28.5-32.6	103-117	64-72	Very rarely experienced; accompanied by widespread damage	Exceptionally high waves (small and medium-sized ships might be for a time lost to view behind the waves); the sea is completely covered with long white patches of foam lying along the direction of the wind; everywhere the edges of the wave crests are blown into froth; visibility affected	—	11.5 (16)	37 (52)
12	Hurricane	64 and over	32.7 and over	118 and over	73 and over	—	The air is filled with foam and spray; sea completely white with driving spray; visibility very seriously affected	—	14 (—)	45 (—)

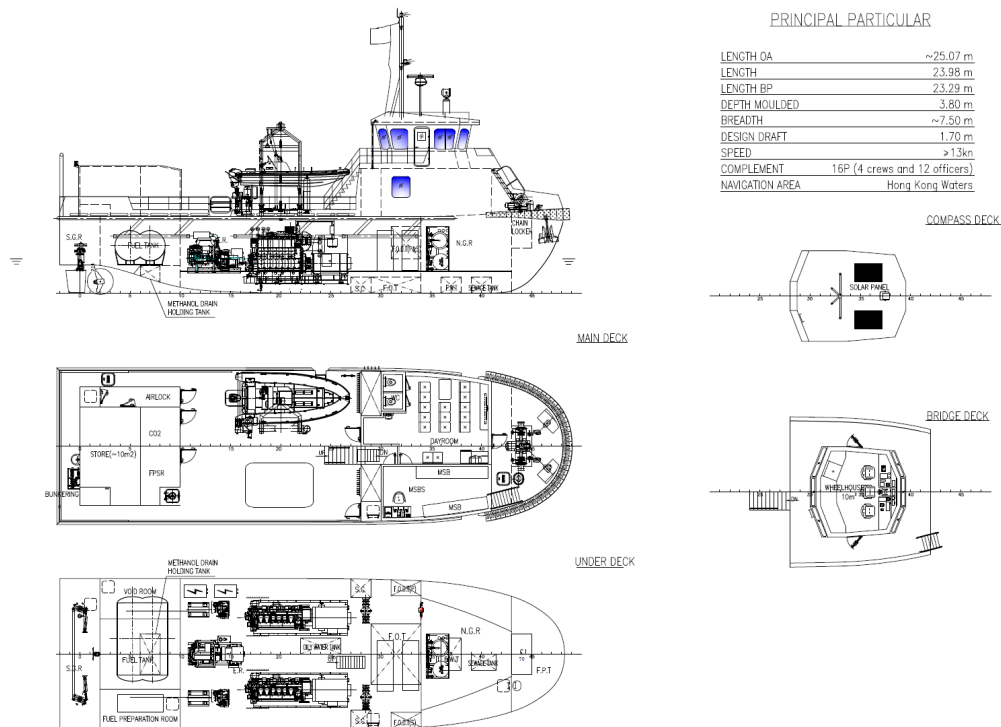
* This table is only intended as a guide to show roughly what may be expected in the open sea, remote from land. It should never be used in the reverse way; i.e., for logging or reporting the state of the sea. In enclosed waters, or when near land, with an offshore wind, wave heights will be smaller and the waves steeper. Figures in brackets indicate the probable maximum height of waves.

Part VII - Annex 9 – List of Recognised Organisations

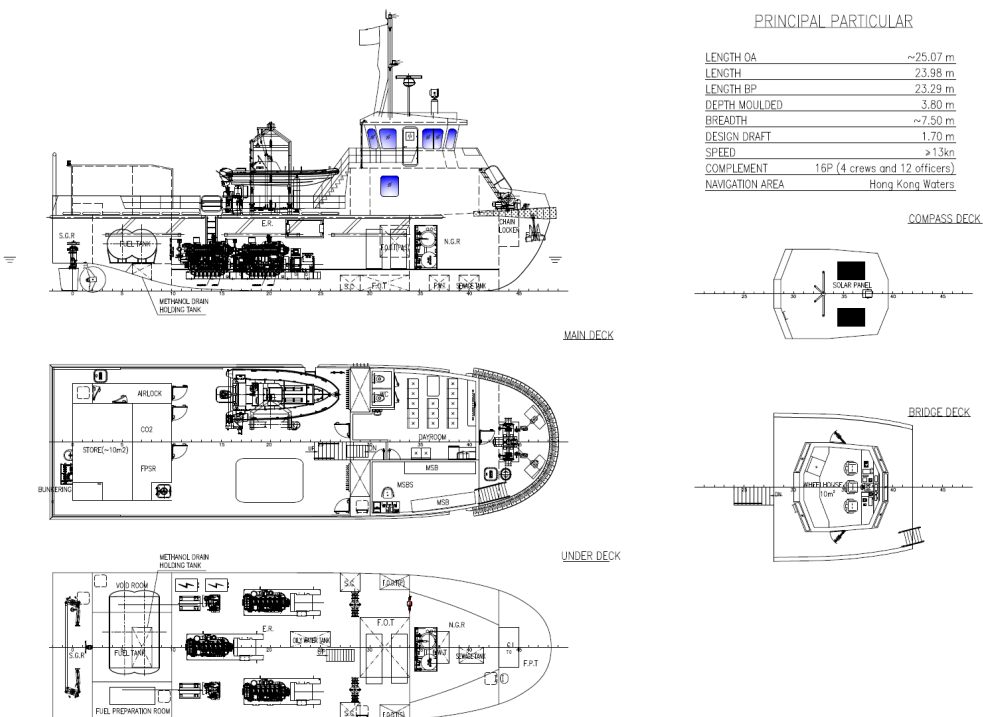
Acronym	Name
ABS	American Bureau of Shipping
BV	Bureau Veritas SA
CCS	China Classification Society
DNV	DNV AS
KR	Korean Register
LR	Lloyd's Register Group Limited
NK	Nippon Kaiji Kyokai
RINA	RINA Services S.p.A.
RS	Russian Maritime Register of Shipping

Part VII - Annex 10 – Conceptual General Arrangement Plan

- a) Conceptual General Arrangement Plan of Two (2) methanol-diesel dual-fuel engine-driven generator sets (viz as mentioned in Paragraph 7.2.1) each unit with equal power output rated not less than 1000 kW and one (1) loitering diesel generator set rated not less than 300 kW.



- b) Conceptual General Arrangement Plan of Three (3) methanol-diesel dual-fuel engine-driven generator sets (viz as mentioned in paragraph 7.2.1) each unit with equal power output rated not less than 550 kW.



Part VII - Annex 11 – Model Test

1. General

- 1.1. The Contractor shall conduct the ship model tests as specified in this Annex 11 of Part VII, including all the tests as mentioned in the second column of Table 1 below (collectively “model tests” (in upper or lower case)) to verify design performance, optimize hull lines, and determine the matching of the propulsion system. The tests shall be performed in accordance with relevant international standards as specified in this Annex (i.e., ITTC recommended procedures or ISO Standard or equivalent.) and the specific requirements of GNC.
- 1.2. The Contractor may propose alternative test plans or modifications. Such alternatives or modifications, shall receive prior approval from GNC before implementation.
- 1.3. The Contractor shall select an official member unit of the International Towing Tank Conference (ITTC) to conduct the model tests in compliance with the ITTC guidelines, with GNC and its consultant as witnesses to the tests.
- 1.4. The model test report shall include, but not be limited to, the following tests,
 - (a) Resistance Test
 - (b) Open Water Test
 - (c) Self-Propulsion Test
- 1.5. The Contractor shall submit a model test report for the Vessel in compliance with the recommended procedures and guidelines of the ITTC to GNC. The model test report shall confirm the ship resistance, Contract Speed, and powering of the Vessel.
- 1.6. The Contractor shall notify GNC at least fifteen (15) working days before commencing the model tests.
- 1.7. The test equipment and test models shall comply with ITTC requirements and be calibrated in accordance with ITTC procedures, or within one (1) year, whichever is sooner.
- 1.8. The Contractor shall submit a “Ship Model Test Plan” for GNC approval at least fifteen (15) working days prior to the commencement of the model tests. The plan shall include sufficient detail to demonstrate that the principal test procedures meet the requirements of the reference documents listed in this Annex and the ITTC standards. Since detailed process of the model tests depends on the practice of each Tenderer, sufficient information is to be included in the document submitted to the GNC to show that the principal scheme of the model test process meets the requirements of the reference documents listed in this Annex and the requirements of the ITTC listed in Table 1 below of this Annex 11. The Ship Model Test Plan shall include following, but not limited to:
 - 1.8.1. Full-scale ship data (e.g. hull parameters, propeller parameters, appendage parameters, etc.); and
 - 1.8.2. (i) the test items to be tested; and (ii) the test specifications comprising (1) test procedures and survey method; (2) test cases; (3) test data; (4) test environment and (5) test entry and termination criteria; and (iii) expected results of the tests. All comments made by the Government Representative on the test plan shall be incorporated in order for the Government to approve the test plan (covering all requirements as set out in this Annex).
- 1.9. The GNC shall submit the proposed schedule of all tests stipulated in the Ship Model Test Plan at least fifteen (15) working days before commencement of tests. The scheduled test shall be carried in the presence of the GNC officers in order to perform the verifications listed in Table 1.

- 1.10. The Contractor shall advise GNC of any changes to the activities agreed in the Ship Model Test Plan. After completion of the model tests, the Contractor shall provide GNC with the model test report and results of trial speed prediction including those test reports as specified in the fifth column of Table 1 below (collectively “model test report”) in compliance with the Procedures and Guidelines of the International Towing Tank Conference (ITTC).
- 1.11. For all test data, both the original measured values and the processed results (i.e. calculations using the Data Reduction Equations, including any correction factors and adopted formulae) together with the test report shall be submitted to GNC for approval.

TABLE 1 Review and witness points

Ref.	Tests to be performed	Survey method	Reference document	Test reports to be prepared for the Government's approval containing the measurements, test results and data as further specified below for the relevant test	Items to be tested
01	Model tests – ship model	Review & witness	Chapter 2 of this Annex	Ship lines plan & offsets table Ship model report	Checks described in Chapter 2.2 of this Annex
02	Model tests – propeller model	Review & witness	Chapter 2 of this Annex	Propeller model report	Checks described in Chapter 2.3 of this Annex
03	Model tests – Resistance test, Propulsion test, Propeller open water test	Review & witness	Chapter 2 of this Annex	Towing tank tests report	Checks described in Chapter 2.4, 2.5 2.6 of this Annex. Note: propeller open water test is not needed if a stock propeller is used. In this case, the open water characteristics of the stock propeller are to be annexed to the towing tank tests report.
04	Programme of sea trials	Review	IMO Verification Guidelines	Programme of sea trials	Checks described in Section 1.8 of the Part VII – Technical Specifications.
05	Sea trials	Witness	ISO 15016:2015 or ITTC 7.5-04-01-01.1 (latest revision)	Sea trials Report	Check: Propulsion power, particulars of the engines; Draught and trim; Sea conditions; Ship speed; Shaft power & rpm; Check operation of means of limitations of engines or shaft power (if fitted)
06	Sea trials – corrections calculation	Review	ISO 15016:2015 or ITTC Recommended Procedure 7.5-04-01-01.1(latest revision)	Sea trials report	Check that the displacement and trim of the ship in sea trial condition has been obtained with sufficient accuracy Check compliance with ISO 15016:2015 or the latest revision of the ITTC Recommended Procedure 7.5-04-01-01.1.

2. Review and witnessing of model test procedures

2.1. The Model Tests are to be witnessed by the GNC representative(s). Special attention is to be given to the following items.

2.2. Ship Model

2.2.1. Hydrodynamic Criteria

- (a) Model Size: The model shall generally be as large as possible for the size of the towing tank taking into consideration wall, blockage and finite depth effects, as well as model mass and the maximum speed of the towing carriage. Refers to ITTC Recommended Procedure 7.5-02-02-01 (Resistance Test);
- (b) Reynolds Number: The Reynolds Number is to be, if possible, above 2×10^6 ; and
- (c) Turbulence Stimulator: In order to ensure turbulent flow, turbulence stimulators have to be applied.

2.2.2. With regard to accuracy the ship model is to comply with the criteria given in ITTC Recommended Procedure 7.5-01-01-01 (Ship Models), Section 2.2.1 - Hull Model. The following points are to be checked by GNC representative(s):

- (a) Main dimensions: Length between perpendiculars (LPP), Breadth (B);
- (b) Surface finish: Model shall be smooth. Particular care shall be taken when finishing the model to ensure that geometric features such as knuckles, spray rails, and boundaries of transom sterns remain well-defined;
- (c) Stations and Waterlines: The spacing and numbering of displacement stations and waterlines shall be properly defined and accurately marked on the model; and
- (d) Displacement: The model shall be tested at the correctly calculated displacement. The model weight shall be within $\pm 0.2\%$ of the calculated displacement weight. If the marked draught is not achieved when the calculated displacement has been established, both the displacement calculation and the model geometry, as compared with the full-scale ship, shall be re-examined (including verification of the offsets).

2.2.3. The following measurements and details of the ship model shall be stated in the test report.

- (a) Identification (model number or similar);
- (b) Materials of construction;
- (c) Principal dimensions;
- (d) Length between perpendiculars (L_{PP});
- (e) Length of waterline (L_{WL});
- (f) Breadth (B);
- (g) Draught (T);
- (h) For multihull vessels, longitudinal and transverse hull spacing;
- (i) Design displacement (Δ) (kg, fresh water);
- (j) Hydrostatics, including water plane area and wetted surface area;
- (k) Details of turbulence stimulation;
- (l) Details of appendages; and
- (m) Tolerances of manufacture.

2.3. Propeller Model

- 2.3.1. The manufacturing tolerances of propellers for propulsion tests shall be in accordance to the ITTC Recommended Procedures 7.5-01-01-01 (Ship Models), Section 2.2.2 - Propeller Model to the satisfactory of GNC.
- 2.3.2. For cavitation tests (if applicable), the manufacturing tolerances of the propeller shall comply with ITTC Recommended Procedures 7.5-01-02-02 (Propeller Model Accuracy). The propeller model used for self-propulsion tests shall comply only with the requirements specified in Paragraph 2.3.1 of this Annex 11.
- 2.3.3. Propeller Model Accuracy
 - (a) Stock Propellers
 - (i) During the stock-propeller testing phase, the geometrical particulars of the final design propeller are normally not available. Therefore, for controllable pitch propellers (CPP), if applicable, the stock propeller pitch is recommended to be adjusted to correspond to the anticipated propeller shaft power and the design propeller rotational speed, in accordance with ITTC Recommended Procedure 7.5-02-03-01.1 (Propulsion/Bollard Pull Test).
 - (b) Adjustable Pitch Propellers (if applicable)
 - (i) Prior to the tests, the pitch setting shall be verified and properly controlled.
 - (c) Final Propellers
 - (i) Propellers having a diameter (D) typically in the range of 150 mm to 300 mm shall be finished to the following tolerances:
 - (1) Diameter (D): ± 0.10 mm;
 - (2) Thickness (t): ± 0.10 mm;
 - (3) Blade width (c): ± 0.20 mm; and
 - (4) Mean pitch at each radius (P/D): $\pm 0.5\%$ of design value.
 - (ii) Special attention shall be given to the accuracy of the blade section geometry in the regions near the leading and trailing edges, as well as to the thickness distribution. The propeller shall normally be finished to a polished surface condition.
- 2.3.4. The following measurements and details of the propeller model shall be stated in the test report.
 - (a) Identification (model number or similar);
 - (b) Materials of construction;
 - (c) Principal dimensions;
 - (d) Diameter;
 - (e) Pitch-Diameter Ratio (P/D);
 - (f) Expanded blade Area Ratio (A_E/A_0);
 - (g) Thickness Ratio (t/D);
 - (h) Hub/Boss Diameter (d_h); and
 - (i) Tolerances of manufacture.

2.4. Resistance Test

- 2.4.1. The Resistance Test shall be performed according to ITTC Recommended Procedure 7.5-02-02-01 (Resistance Test).
- 2.4.2. For the resistance tests, at least three (3) displacement conditions shall be selected, covering the minimum and maximum displacements of the ship. At least ten (10) test points shall be selected for the speed of the resistance tests, covering the ship's cruising speed and design speed.
- 2.4.3. The following documentations shall be included in the report
 - (a) Model Hull Specification:
 - (i) Identification (model number or similar);
 - (ii) Loading condition;
 - (iii) Turbulence stimulation method;
 - (iv) Model scale; and
 - (v) Main dimensions and hydrostatics (refers to ITTC Recommended Procedure 7.5-01-01-01 (Ship Models) and Chapter 2.2 of this Annex 11).
 - (b) Particulars of the towing tank, including length, breadth and water depth.
 - (c) Testing date.
 - (d) Parametric data for the test:
 - (i) Water temperature;
 - (ii) Water density;
 - (iii) Kinematic viscosity of the water;
 - (iv) Form factor (even if $(1+k)=1.0$ is applicable, this is to be stated); and
 - (v) Roughness Allowance (ΔC_F) or Correlation Allowance (C_A).
 - (e) For each speed, the following measured and extrapolated data shall be given:
 - (i) Model speed;
 - (ii) Resistance of the model; and
 - (iii) Sinkage fore and aft, or sinkage and trim.

2.5. Propulsion Test

- 2.5.1. The propulsion test is to be performed according to ITTC Recommended Procedure 7.5-02-03-01.1 (Propulsion Test/Bollard Pull).
- 2.5.2. For the propulsion test, at least two (2) of the three (3) displacement conditions specified in Paragraph 3.3.6 of Part VII shall be tested. For each condition, a minimum of four (4) speed test points shall be selected.
- 2.5.3. The following documentations shall be included in the report:
 - (a) Model Hull Specification:
 - (i) Identification (model number or similar);
 - (ii) Loading condition;
 - (iii) Turbulence stimulation method;
 - (iv) Model scale; and
 - (v) Main dimensions and hydrostatics (see ITTC Recommended Procedure 7.5-01-01-01 (Ship Models) and Chapter 2.2 of this Annex 11).
 - (b) Model Propeller Specification:

- (i) Identification (model number or similar);
 - (ii) Model Scale; and
 - (iii) Main dimensions and particulars (see ITTC Recommended Procedure 7.5-01-01-01 (Ship Models) and Chapter 2.3 of this Annex 11).
- (c) Particulars of the towing tank, including length, breadth and water depth.
- (d) Testing date.
- (e) Parametric data for the test:
- (i) Water temperature;
 - (ii) Water density;
 - (iii) Kinematic viscosity of the water;
 - (iv) Form factor (even if $(1+k)=1.0$ is applicable, this is to be stated);
 - (v) Roughness Allowance (ΔC_F) or Correlation Allowance (C_A); and
 - (vi) Appendage drag scale effect correction factor (even if a factor for scale effect correction is not applied, this shall be stated).
- (f) For each speed the following measured data and extrapolated data shall be given:
- (i) Model speed;
 - (ii) External tow force;
 - (iii) Propeller thrust;
 - (iv) Propeller torque;
 - (v) Rate of revolutions; and
 - (vi) Sinkage fore and aft, or sinkage and trim.
- (g) The extrapolated values are also to contain the resulting delivered power (P_D).

2.6. Propeller Open Water Test

- 2.6.1. In many cases, the propeller open water characteristics of a stock propeller are available, and the propeller open water test need not be repeated for the particular project. In such cases, documentation of the open water characteristics (open water diagram) shall be sufficient.
- 2.6.2. In the case of a final propeller, or where the propeller open water characteristics are not available, the propeller open water test shall be performed in accordance with ITTC Recommended Procedure 7.5-02-03-02.1 (Open Water Test).
- 2.6.3. The following documentations shall be included in the report:
- (a) Model Propeller Specification:
 - (i) Identification (model number or similar);
 - (ii) Model scale;
 - (iii) Main dimensions and particulars (see recommendations of ITTC Recommended Procedure 7.5-01-01-01 (Ship Models) and Chapter 2.3 of this Annex 11); and
 - (iv) Immersion of centreline of propeller shaft in the case of towing tank.
 - (b) Particulars of the towing tank or cavitation tunnel, including length, breadth and water depth or test section length, breadth and height.
 - (c) Testing date.
 - (d) Parametric data for the test:

- (i) Water temperature;
 - (ii) Water density;
 - (iii) Kinematic viscosity of the water; and
 - (iv) Reynolds Number (based on propeller blade chord at 0.7 radius (R)).
- (e) For each test speed, the following data shall be given:
- (i) Speed;
 - (ii) Thrust of the propeller;
 - (iii) Torque of the propeller;
 - (iv) Rate of revolution; and
 - (v) Force of nozzle in the direction of the propeller shaft (for ducted propellers, if applicable).
- (f) Propeller Open Water Diagram.

3. Speed Trial Prediction

- 3.1. The principal steps of the Speed Trial Prediction Calculation are given in ITTC Recommended Procedure 7.5-02-03-1.4 (ITTC 1978 Trial Prediction Method), as amended. The primary objective of the speed trial prediction is to determine the correct propeller loading and to assume an appropriate full-scale wake fraction. Proper propeller loading may be achieved either by increasing the frictional resistance by the estimated added resistance (e.g., wind resistance, etc.) and conducting the self-propulsion test at the corresponding load condition, or by applying the calculation method described in Procedure 7.5-02-03-1.4 (ITTC 1978 Trial Prediction Method), as amended.
- 3.2. A wake correction shall be applied for single-screw ships. For twin-screw ships, the wake correction may generally be neglected, except in cases where the stern configuration is of twin-hull type or of another special form.
- 3.3. The following scheme outlines the principal components of a speed trial prediction. It shall be based on the results of the resistance test, the propulsion test, the open water characteristics of the model propeller used during the tests, and the propeller open water characteristics of the final propeller.
- 3.4. The following measurements and test results shall be included in the test report:
- 3.4.1. Model Hull Specification:
 - (a) Identification (model number or similar);
 - (b) Loading condition;
 - (c) Turbulence stimulation method;
 - (d) Model scale; and
 - (e) Main dimensions and hydrostatics (see ITTC Recommended Procedure 7.5-01-01-01 (Ship Models) and Chapter 2.2 of this Annex 11).
 - 3.4.2. Model Propeller Specification:
 - (a) Main dimensions and particulars (see ITTC Recommended Procedure 7.5-01-01-01 (Ship Models) and Chapter 2.3 of this Annex 11).
 - 3.4.3. Particulars of the towing tank, including length, breadth and water depth.
 - 3.4.4. Resistance Test Identification (Test No. or similar).
 - 3.4.5. Propulsion Test Identification (Test No. or similar).

- 3.4.6. Open Water Characteristics of the model propeller.
- 3.4.7. Open Water Characteristics of ship propeller.
- 3.4.8. Ship Specification:
 - (a) Projected wind area;
 - (b) Wind resistance coefficient;
 - (c) Assumed BF; and
 - (d) Experience-based factors (C_P and C_N) .
- 3.4.9. For each test speed, the following calculated data shall be given:
 - (a) Ship speed;
 - (b) Model wake coefficient;
 - (c) Ship wake coefficient;
 - (d) Propeller thrust on ship;
 - (e) Propeller torque on ship;
 - (f) Rate of revolutions on ship;
 - (g) Predicted power on ship (delivered power on Propeller(s) P_D); and
 - (h) Sinkage fore and aft, or sinkage and trim.

Part VII - Annex 12 – Tenderer's Presentation

1. General

- 1.1 The Tenderers, which have 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. In person face-to-face presentation is preferred, which 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 on presenting the Technical Proposal submitted in respect of its proposed design and solutions to be adopted, Counter-Proposals 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 and Deckhouse
 - (3) General Arrangement
 - (4) Fire Safety Equipment
 - (5) Lifesaving Appliances and Arrangements
 - (6) Machinery
 - (7) Electrical System
 - (8) Electrical Navigation Equipment (Operational Systems)
 - (9) Arrangement for Methanol Ship
 - (10) Innovation Suggestions