Part VII – Technical Specifications

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Chapter 1 General Provisions

1.1 Introduction

1.1.1 This document (or "Technical Specifications" (TS)) sets out the requirements of the Government in relation to **One (1) Fireboat** (viz., "Vessel") for use by the Fire Services Department (**"FSD"** or the "**user department**").

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

(a) Essential Requirements [E];

(b) Those specifications that are not labelled with [E] shall equally form part of the Contract like the specifications labelled as [E] ("Specifications without Label"); and

(c) Desirable Specifications [D].

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(m) unless otherwise expressly stated where the requirement shall apply to both or just the Daughter Boat, all requirements in this TS are for the Vessel but not the Daughter Boat.

1.2 Statement of Purposes of the Vessel

1.2.1 The Vessel will be one of the reserved fireboats in FSD fireboat fleet. She is mainly required to perform standby duty at different Fireboat Stations to replace the on-run fireboats which require to attend the annual docking maintenance or urgent repairing.

1.2.2 The Vessel shall be used by the FSD for firefighting operations in Hong Kong waters.

1.2.3 The Vessel shall be used in the event of an emergency / rescue situation where a vessel is in distress 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 Shipyard

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

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

1.5 Design and Construction Responsibility

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

1.5.2 Unless otherwise expressly specified in this Part VII, references to "RO" in this TS shall mean the Recognised Organisation as specified in Schedule 9 of Part V. References to "RO Requirements" (in upper or lower case) shall mean the requirements of the rules and regulations of the RO as specified in Schedule 9 of Part V. Notwithstanding the foregoing, where it is expressly permitted in this TS, in relation to a particular requirement, the rules and regulations of another RO which is any one of the recognised Classification Societies set out in the interpretation of "Recognised Organisations" under Clause 1.1 of Part IV – Conditions of Contract, may apply but not necessarily the RO specified in Schedule 9 of Part V. References to "IMO requirements" shall mean the latest and as amended requirements published by the IMO and available on its website and applicable to the relevant subject matter in the relevant paragraph where it is required that IMO requirement shall be complied with provided that where the IMO requirements are of any convention or resolution or other multilateral treaty of the IMO (including any amendment thereto), Hong Kong has joined in as a party to such IMO requirements.

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

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

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

1.5.6 The Contractor acknowledges and agrees that the Government relies on the professional judgment and skill of the Contractor to ensure that the Vessel is compliant with all of the requirements of this **TS** and warrants that it will design and construct the Vessel, and install on the Vessel all such equipment, fittings, fixtures, and user interfaces as required by the Government in order to ensure the ultimate fitness for purpose of the Vessel before the Acceptance Certificate is issued.

1.5.7 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.

1.6 Survey and Inspection

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

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

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

1.6.4 The Contactor shall provide

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

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

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

Each one of the above shall be submitted to GNC for approval by the respective deadlines specified in Clause 11 of the Conditions of Contract.

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

1.6.5 A weekly work progress report with photos evidencing the progress and material/equipment procurement status is required to be submitted to GNC during the construction of the Vessel. The weekly report shall be submitted before noon of every Monday.

1.6.6 GNC may designate consultant(s) from private sector who will be authorised to represent the GNC in all technical matters including site supervision and plan approval related to the construction of the Vessel. 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 approved drawings, sketches, correspondence, change notices, change orders, test agendas, schedules etc.

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

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

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

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

1.7 Official Sea Trial, Speed Requirements and Acceptance Test of External Fire-Fighting System

1.7.1 The Contractor shall submit for GNC approval, an Official Sea Trial programme 14 working days in advance of the Official Sea Trial, which shall include details of proposed procedures for carrying out the Official Speed Trial, endurance test, manoeuvrability test, crash stop test, astern running test / emergency

steering test, anchoring tests, other tests as specified in paragraph 1.7.7, bottom survey on the slipway and all other tests as stated in this Part VII, all of which shall be required to be performed as part of the Official Seal Trial and therefore part of the Technical Acceptance (if not earlier). This programme must be submitted to MD in not less than 14 working days before the trials commence. The notification for Official Sea Trial shall include documentary evidence that the Vessel is safe to go to sea for the intended tests and trials specified in the Contract (including the inclining experiment report as mentioned in Paragraph 3.6 of this Part and approved by the RO).

1.7.2 The Contractor shall submit for GNC approval, the acceptance test programme for External Fire-Fighting System (EFFS) 14 working days in advance of the EFFS Test (as defined in paragraph 1.7.8 below) at the original place of construction of the Vessel. Another functional test of EFFS shall be conducted upon delivery to Hong Kong (viz. the Functional Test in Hong Kong as defined in paragraph 1.7.8 below).

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

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

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

1.7.6 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 under the heading of "Conditions for Official Sea Trial".

(b) As part of the Technical Acceptance as specified in Paragraph 1.8.1 of this Chapter 1, the Contractor shall carry out the Official Speed Trial in the presence of GNC officers or their appointed agents.

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

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

(e) The Contract Speed is considered not achieved if the Contract Speed cannot be attained during the Official Speed Trial after a total of FIVE runs.

(f) The Contract Speed to be achieved by the Vessel in the Official Speed Trial shall be the minimum highest achievable speed of 25 knots with the engine power at 100% Maximum Continuous Rating (MCR) and the Vessel under Official Speed Trial Conditions as stated in paragraph 1 of Annex 5 to this Part. If the Vessel fails to achieve the minimum highest achievable speed of 25 knots under the aforesaid conditions in the manner specified in sub-paragraphs (d) and (e) above, the Government will deem that the Vessel has failed to pass the Official Speed Trial and therefore Technical Acceptance.

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

(i) The Contractor provided that the speed measuring device has been calibrated by a certified body in Hong Kong acceptable to GNC; or

(ii) Global Positioning System (GPS) supplied by the Government.

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.

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

(i) The speed, time of the day, engine running conditions, sea condition, etc., shall be properly recorded by the Contractor, and signed as witnessed by GNC surveyor (or GNC representatives) during the Official Sea Trial. A copy of the Official Sea Trial Report as required in Paragraph 1.7.7 below shall be given to GNC before Delivery Acceptance.

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

1.7.7 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 and Performance Test

The Endurance and Performance Test shall be carried out for different engine loading and speeds to obtain the speed/fuel consumption curves (or data) for the Vessel, with the engine(s) operating within the manufacturer recommended engine operating conditions. The test results shall be recorded in accordance with the requirements stipulated in Annex 5 to this Part. The report submitted shall include a curve or curves showing ship speed versus propulsion engine(s) rpm and power, with particulars of the Vessel loading and displacement in the test(s).

(b) Manoeuvrability Test

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

(i) All propulsion engines running; and

(ii) Single engine running.

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

(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) Anchoring Test according to the RO Requirements

(f) Noise Level Test according to the requirement stipulated in Paragraph 4.15 of Chapter 4 of this Part.

1.7.8 The External Fire-Fighting System test shall be conducted as part of the Technical Acceptance ("EFFS Test") to ensure that that the entire EFFS for the Vessel and the EFFS for the Daughter Boats (one on-board and one spare) shall be compliant with all requirements set out in the Offered Specifications including those stated in Chapter 5 of this Part (for the Vessel), and paragraph 4.18.9 (for the Daughter Boat) and in Schedules 6 and 7 of Part V and shall include but not be limited to:

(a) functional test of the external fire pumps of the EFFS for the Vessel to determine full compliance with paragraphs 5.2 and 5.3 of this Part; and

(b) The Functional Test in Hong Kong (as further defined below).

The result of tests shall be proved to the satisfaction of GNC and FSD before delivery of the Vessel and the Daughter Boats (one on-board and one spare) to Hong Kong. Unless otherwise agreed by FSD and GNC, all part of the EFFS Test shall be conducted and completed at the original place of vessel construction in the presence of the (i) Officers of FSD and (ii) Officers of GNC. Some parts of the tests as stipulated by GNC and FSD shall be repeated when the Vessel is delivered to Hong Kong for a second testing as well as those tests which the GNC and FSD agree that they need not be performed at the place of the vessel construction ("Functional Test in Hong Kong" (in upper or lower case)).

1.8 **Acceptance and Delivery**

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

(a) Part 1: Technical Acceptance; and

(b) Part 2: Delivery Acceptance.

1.8.2 Technical Acceptance comprising all of the following tests and trails specified in sub-paragraphs (a) to (f) below:

(a) This includes the satisfactory inspection of all items as listed in Annex 4 to this Part in the version as completed by the Contractor and approved by the Government in accordance with paragraph 1.6.4(c) of this Part;

(b) All the hull construction, mechanical and electrical tests and trials as required in this Part and those considered necessary by the Government (and all of which shall be conducted in Hong Kong waters unless otherwise specified) and the Contractor shall be responsible for all costs in keeping the Vessel in Hong Kong whilst the Technical Acceptance is conducted. These tests and trials shall include without limitation equipment tests, anchoring tests, inclining experiment, the bottom survey (in Hong Kong) on the slipway, the Official Speed Trial as mentioned in Paragraph 1.7.6 of this Part, all of those tests and trials as specified Paragraph 1.7.7 of this Part;

(c) All units of all ENE items and their installations shall be approved and inspected by EMSD as part of the Technical Acceptance including the bench acceptance test and on-site commissioning test for all units of all ENE items as mentioned in Chapter 10 of this Part;

(d) The same Official Speed Trial and other tests as specified in paragraph 1.7.7(a) to (g) above for the Daughter Boats (one on-board and one spare) to prove compliance with paragraph 4.18 and 4.19 of this Part as well as other Offered Specifications;

(e) The External Fire-Fighting System for the Vessel and for the Daughter Boat (one on-board and one spare) shall be approved and tested by GNC and FSD as part of the Technical Acceptance in the manner specified in paragraph 1.7.8 above and all of which shall be conducted at the Vessel construction site except for the Functional Test in Hong Kong;

(f) All other tests whether as specified in this Part or otherwise necessary to determine whether or not the Vessel including the Equipment has been supplied in accordance with all the specifications set out in the Offered Specifications;

(g) 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; and

(h) If the Vessel cannot pass all of the tests comprised in the Technical Acceptance by the Delivery Date specified in the Contract, the options available to the Government are set out in Clause 12 of the Conditions of Contract and other applicable provisions of the Contract.

1.8.3 Delivery Acceptance

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

(b) Certificate of classification for the Vessel with notations as specified in Schedule 9 shall be issued by the RO as specified in Schedule 9 before the Acceptance Certificate is issued by the Government.

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

(d) The Contractor must demonstrate to 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 weeks before the Delivery Acceptance of the Vessel, the Contractor is required to submit to GNC four 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 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 seven days in a satisfactory state. Details of each inventory item shall include: item name, description, type, quantity, manufacture'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 11.2 of Chapter 11, all items specified in Annex 8 to this Part, and all items set out in the Inventory List in the form as approved or stipulated by the Government shall be delivered to GNC at the Delivery Acceptance of the Vessel. The Contractor must provide 14 days advance notice in writing for Vessel delivery when the Vessel is considered to be completed in accordance with the Contract and Ready for Use and to be delivered for the Delivery Acceptance. The Government will not accept delivery if after undergoing the tests and trials in the Technical Acceptance, the Government does not consider that the Vessel is in Ready to Use condition.

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

1.9 Warranty Services During the Warranty Period

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

1.9.2 The full scope of the Warranty Services for the Vessel is set out in Annex 1 to this Part. The full scope of the Warranty Services for the Daughter Boat is set out in Annex 9 to this Part.

1.9.3 The Contractor is responsible for arranging the Vessel and the Daughter Boat for Guarantee Slipping at the end of the 12-month 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 Annexes 1 and 9 to this Part.

1.10 Support Services

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

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

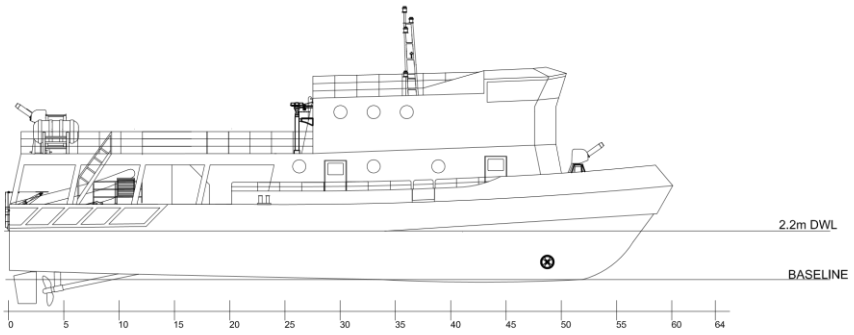
Chapter 2 General Technical Requirements

2.1 Guidance General Arrangement Plan

GUIDANCE GENERAL ARRANGEMENT PLAN

PRINCIPAL PARTICULARS

LOA ---------- 29 - 32 M (INCLUDING FENDERING)
Breadth ---------- ≥ 6.5 M
Max. Draught --- ≤ 2.5 M
Air Draught ------ ≤ 11.7 M, shall be capable of lowering to 7.8M
Speed ---------- 25 knots



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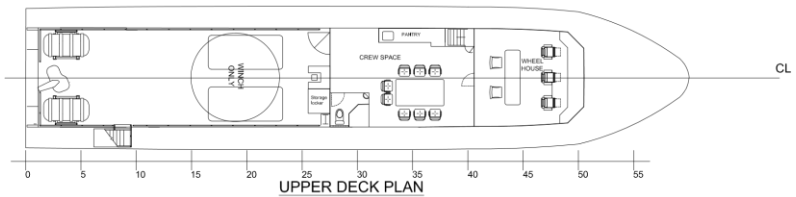

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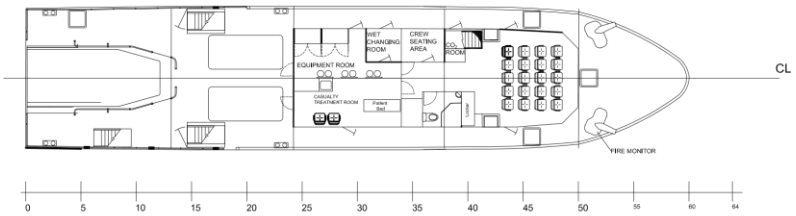
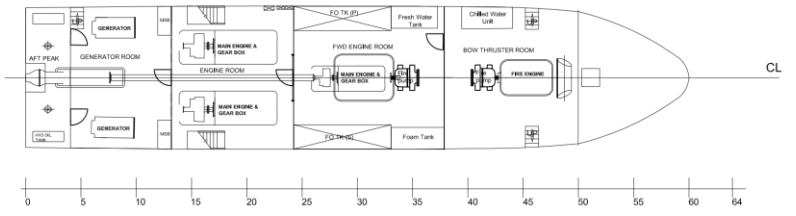


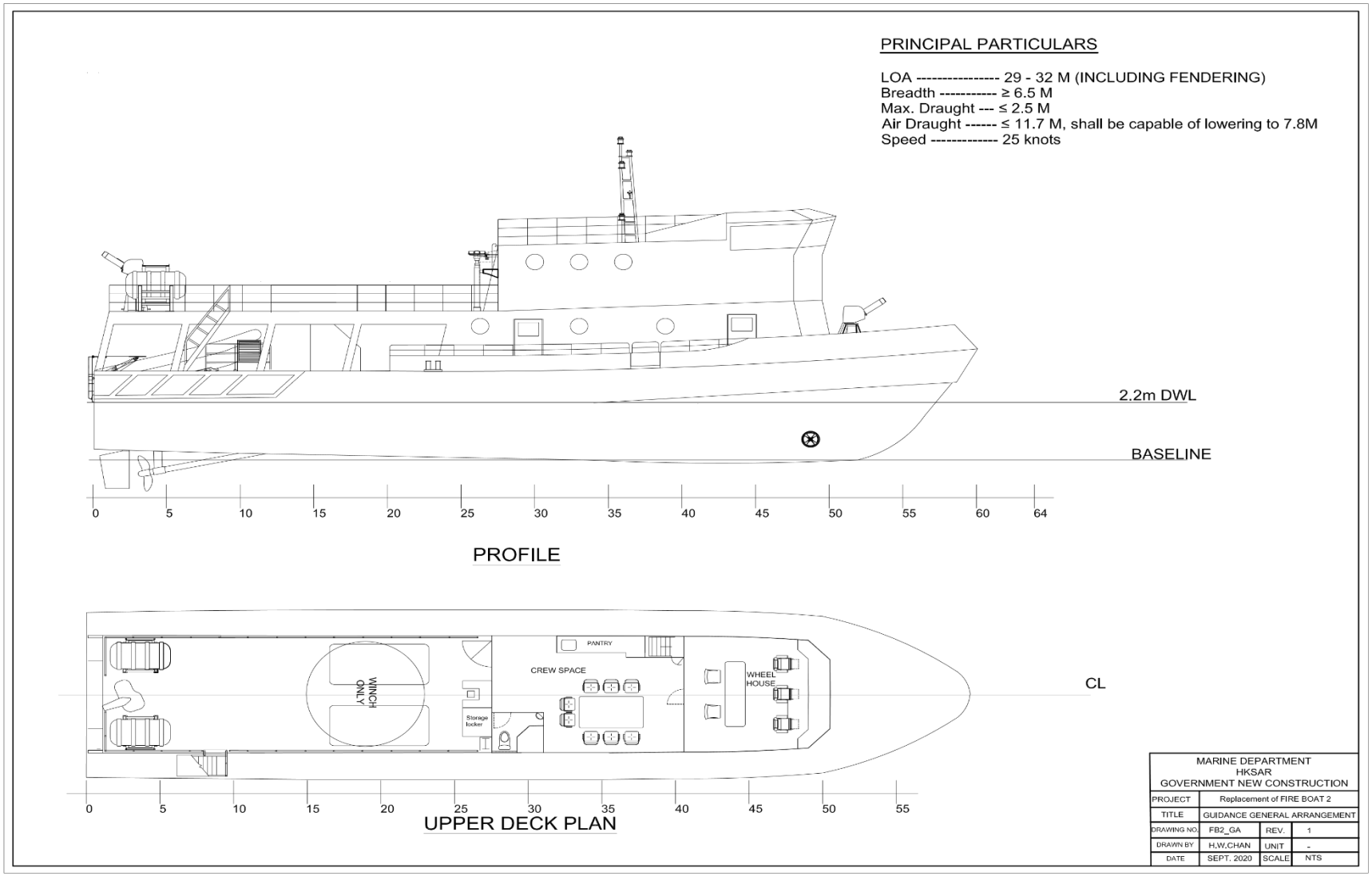
MAIN DECK PLAN



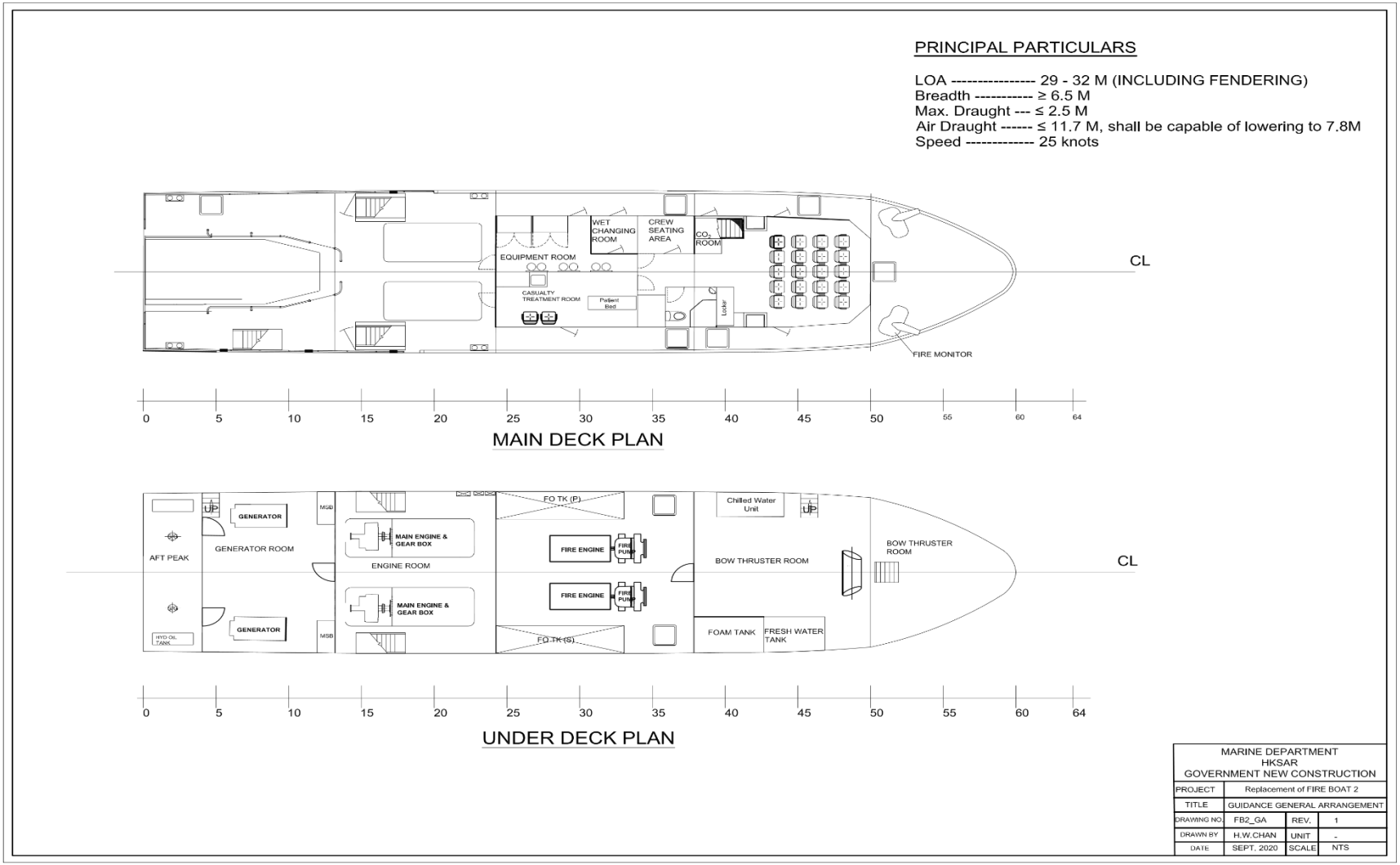
UNDER DECK PLAN

MARINE DEPARTMENT HKSAR GOVERNMENT NEW CONSTRUCTION			
PROJECT	Replacement of FIRE BOAT 2		
TITLE	GUIDANCE GENERAL ARRANGEMENT		
DRAWING NO.	FB2_GA	REV.	1
DRAWN BY	H.W.CHAN	UNIT	-
DATE	SEPT. 2020	SCALE	NTS

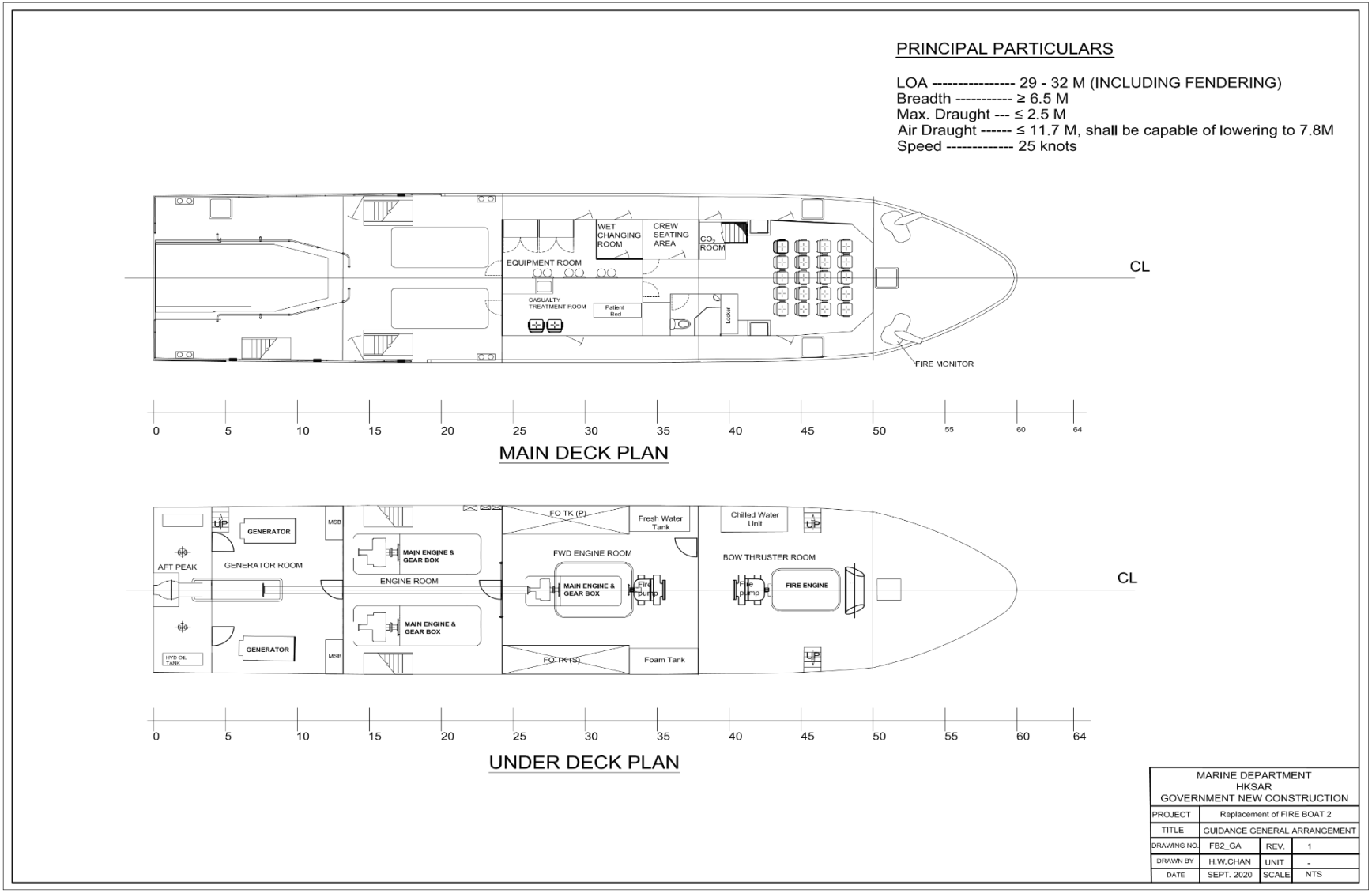
Guidance General Arrangement Plan (A)



Guidance General Arrangement Plan (B1)



Guidance General Arrangement Plan (B2)



2.2 General Provisions

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

2.2.2 The work to be done under this Contract consists of the design, construction, outfit, testing and delivery of One (1) Fireboat for the Fire Services Department. Workmanship, functions, characteristics and performance are to be in accordance with these TS, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.

2.2.3 Whilst the Contractor is required to exercise its professional expertise and knowledge to come up with an appropriate design for the Vessel which can comply with all requirements of the Contract, the Guidance General Arrangement Plan has included both the twin engines and triples engines configuration as stated in Paragraph 2.7. This only serves as guidance and is a reference drawing to help to explain the tender requirements.

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

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

2.3 Rules and Regulations

2.3.1 The Vessel shall be designed and constructed in accordance with the latest edition of the rules and regulations of the RO specified in Schedule 9 of Part V (viz., "RO Requirements" as defined in paragraph 1.5.2 of this Part). By latest edition, it is meant the latest edition as at the keel laying date of the Vessel. The Tenderer shall state in Schedule 9 of Part V which RO and its rules and regulations (viz., the "RO Requirements") and class notations shall be used in the design and construction of the Vessel. The RO to be selected shall be any one of the recognised Classification Societies set out in the interpretation of "Recognised Organisations" under Clause 1.1 of Part IV – Conditions of Contract.

2.3.2 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 these TS, the construction of the Vessel must comply with the rules, regulations, standards, and recommendations of the entities as specified below:

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

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

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

(d) International Regulations for Preventing Collisions at Sea 1972, as amended by International Maritime Organisation (IMO) Resolution A464(XII) and A626(XV).

(e) All equipment/fittings shall be designed and manufactured to at least the standards as specified in these Technical Specifications. When none of the rules and regulations in Paragraphs 2.3.2 (a) to (d) above are applicable, then the applicable standards specified by the applicable organisations below shall be complied with:

BSI British Standards Institute

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

2.4 Contract Speed

2.4.1 The Contract Speed for the Vessel shall not be less than **25** knots when all propulsion engines (viz., the two main propulsion wing engines, and if the three engines' configuration is proposed, also the main propulsion centreline engine) running with the output power at 100% of Maximum Continuous Rating (MCR) in the manner further specified in paragraph 2.4.2 below under the Official Speed Trial Conditions as stated in paragraph 1) of Annex 5 to Part VII under the heading of "Conditions for Official Speed Trial". **[E]**

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

2.4.3 It is desirable that the Tenderer has committed to a higher Contract Speed for the Vessel than that as specified in paragraph 2.4.1 of the Technical Specifications based on the estimated propulsive power and characteristic curves of the main propulsion engines for the Vessel with all two or all three main propulsion engines (depending on the engine configuration adopted) running at 100% MCR submitted in Schedule 7 of Part V. **[D]**

2.5 Principal Dimensions **[E]**

Length Overall*:	-	29 to 32 metres (both figures inclusive and including fendering)
Breadth Overall:	-	Equal or not less than 6.5 metres (including fendering)
Maximum Draught:	-	Equal or not more than 2.5 metres
Air Draught:	-	Must equal or not exceed 11.7 metres and shall be capable of lowering to 7.8 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 any out-fittings (including fendering). The Tenderer shall indicate the length overall of the Vessel in dimension scale in General Arrangement Plan submitted according to Schedule 7 of Part V.***

2.6 Material of the Structure of the Vessel

Material of Hull Structure:	Marine grade steel	**[E]**
Material of Main Deck:	Marine grade steel	**[E]**
Material of Superstructure:	Marine grade steel or Aluminium alloy	**[E]**

2.7 Propulsion System of the Vessel **[E]**

2.7.1 The propulsion system shall comprise two or three marine diesel engines and the Tenderer must choose between the two configurations but not offering both configurations at the same time, failing which the Government will choose either at its option as the Tenderer's offer to the extent possible. If not possible, **the Tenderer's tender will not be considered further.**

2.7.2 In twin marine engines configuration, the following requirements shall be met:

(a) Fixed pitch propellers propulsion shall be adopted for the port (P) and starboard (S) marine diesel engines (main propulsion wing engines).

(b) Each engine of the main propulsion wing engines shall be from the same manufacturer, same model and deliver same horsepower.

(c) Power-take-off (PTO) from the main propulsion wing engines to drive the fire pumps of EFFS is **not** allowed.

(d) Whether during firefighting mode or otherwise, both main propulsion wing engines shall be solely used for manoeuvring of the Vessel at all times.

(e) Two separate marine diesel engines (in addition to the main propulsion wing engines) shall be used to drive the fire pump of the EFFS during the firefighting mode.

2.7.3 In triple main engines configuration, the following requirements shall be met:

(a) Fixed pitch propellers propulsion shall be adopted for the port (P) and starboard (S) marine diesel engines (main propulsion wing engines).

(b) Each engine of the main propulsion wing engines shall be from the same manufacturer, same model and deliver same horsepower.

(c) The centreline engine propulsion can either be water jet or propeller driven by the main propulsion centreline engine different from the main propulsion wing engines.

(d) The main propulsion centreline engine is capable to be used to drive one external fire pump via power-take-off (PTO) device.

(e) During firefighting mode, both main propulsion wing engines shall be solely used for manoeuvring of the Vessel and the centreline engine may be switched between driving the external fire pump or manoeuvring mode. Other than during firefighting mode, all wing engines and centreline engine may be used for manoeuvring of the Vessel or the centreline engine may be switched to idle mode.

2.8 Vessel Operating Profile and Environment

2.8.1 Summary of Operational Hours / Range **[E]**

Number of hours/day	:	10 hours/day
Number of days/year	:	300 days/year
Endurance for fuel capacity	:	12 hours at cruising speed of 20 knots plus 24 hours with both external fire pumps operating at maximum water output

2.8.2 The Vessel shall take on board: (i) 9 crew members;

(ii) 18 land crew for fire-fighting; and

(iii) Life Rafts Rescue Capacity not less than 80 persons but these persons will not board the Vessel **[E]**

2.8.3 Operational environment:

Up to Beaufort wind scale number 9 and Sea State 8

Beaufort number 9	Strong gale	75-88 km/h
		47-54 mph
		41-47 knots
		20.8–24.4 m/s
Sea State 8	9 to 14 metres wave height	Very High

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

External air	+ 40 ºC
Internal air	+ 20 ºC
Machinery space	+ 40 ºC + not more than 10^0 temperature rise (All equipment at full rated power)
Maximum seawater temperature	+ 32 ºC

2.8.5 The Vessel shall operate in various types of waters. The water is expected to include debris, sand and unknown floating objects.

2.9 Failure Mode and Effect Analysis – FMEA

2.9.1 A comprehensive, systematic and documented investigation (Failure Mode and Effect Analysis – FMEA) shall be carried out to establish the important failure conditions of the craft and assesses their significant effect with regard to the safety of the vessel, its occupants and the environment as required. The effect of any likely failure in handling and control devices, services or components shall be assessed to maintain a safe level of craft operation. Failure Mode and Effects Analysis shall include but not limit to:

(a) machinery system and their associated control; and

(b) directional control system.

The Contractor is to work in the submitted FMEA report in carrying out: evaluation, identification, analysis, verification trial and test, recording the test results and submission of relevant document in various stages for the critical system. The FMEA report shall be in accordance with updated HSC code and submit to GNC section and the RO for approval. FMEA conclusion trial shall be conducted and verified in the presence of GNC officers and the RO.

2.10 Markings and Colour Scheme

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

2.10.2 All labelling shall be both in Chinese and English and as per applicable rules and regulations of the RO. The FSD logo shall also be displayed on both sides of the deckhouse and at location as directed by GNC.

2.10.3 The Vessel's name shall be made of cut off steel plate, welded to the hull and painted on both sides of the bow and the transom centre to GNC and FSD's satisfaction. Draught marks shall also be marked at both sides of bow and stern. The full load design draught mark shall be marked at port and starboard amidship. The Vessel's identification shall be marked as large as possible at the deckhouse top for helicopter viewing.

2.10.4 All labelling, stencilling and marking (not limited to the hull but including all aspects of the Vessel) shall be made on separate plaques, boards or labels attached to the structure. By default, all displays,

control actuators, electric switches, valves, and other equipment shall be labelled to indicate their type and function as appropriate.

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

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

2.11 Tally Plates

2.11.1 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.

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

(a) Equipment in the console;

(b) Electrical and communication equipment;

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

(d) All valves and equipment on deck;

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

(f) Any other equipment/fitting as required.

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

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

2.11.4 List of tally plates shall be provided as directed by GNC.

2.12 Other Design Features

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

2.12.2 Permanent list is not allowed.

2.12.3 Permanent ballasts can only be used as agreed by GNC.

2.12.4 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.

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

Chapter 3 Hull and Deckhouse

3.1 Structures of the Hull and Deckhouse

3.1.1 The Vessel shall be designed and built with a mono-hull form. The hull structure shall be constructed of marine grade steel. The superstructure including the deckhouse shall be constructed of marine grade steel or aluminium alloy.

3.1.2 The design stress and load (wave height versus speed); maximum acceleration considered and scantlings calculation including the internal structural members shall be approved by RO. All materials and processes for construction shall comply with an approved standard. Their selection shall recognise the craft through life cycle and service conditions for ease of repair in the event of hull damage.

3.1.3 The hull structure design loads shall be in accordance with the Vessel operational profile and other applicable requirements. Hull construction materials shall be new and of a type which has been certified by RO or other entities acceptable to GNC for shipbuilding purposes.

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

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

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

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

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

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

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

3.2 Hull and Deckhouse Structural Requirements

3.2.1 Hull Structure Construction

General

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

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

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

(d) Sharp corners shall be avoided.

3.2.2 Tightness

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

considered to be a failure of the test and corrective measures shall be taken.

(b) Chalk tests shall be carried out if the above method is not applicable.

(c) All structures and fittings shall withstand the tests described above and any weakness shall be made good by, and at the expense of, the Contractor.

3.2.3 Fairness

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

3.2.4 Decks, Platforms, Flats and Stiffness

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

(b) The main deck shall be fitted with weather-tight hatches for removal of main engines and generators.

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

3.2.5 Through-Hull Fittings

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

(b) If required all through-hull fittings located below the waterline shall be fitted with shut-off valves fabricated of metal and having suitable corrosion protection, such as cathodic protection.

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

3.2.6 Hull Structural Closures

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

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

(c) Flush access to fore peak from the main deck shall be provided.

(d) Two accesses shall be provided from the main deck to the engine room.

(e) Hinged hatch covers shall be provided with means to hold them in the fully opened position.

(f) All access closings shall be able to be opened and closed at both sides.

3.2.7 Deckhouse Closures

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

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

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

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

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

3.2.8 Hull Preservatives and Coverings

(a) Exterior surfaces of the Vessel above the boot top (boot topping being the part of the outside shell of the Vessel between the light and loaded draught, that is, that part of the hull which is exposed alternately to wind and water) shall be painted and prepared to a satin finish/appearance/texture.

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

(c) Wherever paint is used, the Contractor shall propose a suitable paint specification in conjunction with a preferred paint manufacturer for GNC's approval.

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

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

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

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

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

3.3 Weld Quality

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

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

3.3.3 Welding and edge preparations shall be carried out by the RO recognised qualified workers.

3.3.4 Only qualified welders shall perform the cutting and welding work.

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

3.3.6 Welds installed using unqualified procedures or welding performed by non-certified welders shall be subject to removal by the Contractor at its own expense.

3.4 Supervision of Fabrication and Assembly

3.4.1 The items 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 the incoming materials, consumables components and machinery;

(b) Traceability procedures for the use of the materials, and their traceable identification codes;

(c) Lofting, cutting, fitting, welding, forming and dimensions control of all the major structural components;

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

(e) All NDT reports;

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

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

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

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

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

3.5 Stability and Subdivision

(a) The preliminary lines plan and the preliminary calculations for intact and damaged stability information of the Vessel must be submitted with the tender before the Tender Closing Date. The calculations shall be carried out using a proven computer system (viz. recognised by a government authority of the place of origin of the Vessel or the RO). **[E]**

(b) The Vessel is required to comply with the intact and damaged stability requirements stated in this Part.

3.6 Inclining Experiment

3.6.1 As part of the Technical Acceptance, an inclining experiment shall be carried out in near the waters of the Contractor's shipyard, with the attendance of MD officer(s) and/or appointed consultant, according to the guidance and requirements given in the IMO requirements including the latest and as amended IMO Resolution MSC.267(85).

3.6.2 Not less than 14 days before conducting the inclining experiment, a "Scheme of Inclining Experiment" ("the Scheme") shall be submitted to GNC for acceptance. The inclining experiment can only be conducted after GNC has accepted the Scheme.

3.6.3 The Scheme shall include:

(a) The intended date and time, and the place of the inclining experiment;

(b) The anticipated water depth at the time of the inclining experiment;

(c) A recent photograph of the site of inclining experiment;

(d) A recent photograph of the Vessel to be inclined. That includes its external view and hull superstructures and main deck situation;

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

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

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

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

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

(j) The list of data to be measured in accordance with IMO requirements; and

(k) The lightship weight and centre of gravity, the draft and 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.

3.6.4 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.

3.6.5 The PRELIMINARY Inclining Experiment Report which shall be submitted to GNC 14 working days before the Official Sea Trials 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.

3.6.6 The FINAL Inclining Experiment Report shall be approved by the RO before submitting to GNC for further comments and acceptance.

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

3.6.8 In addition to the above the requirements for the conduct of and the report of the Inclining Experiment, the Stability Information Booklet shall also follow any specific requirements given in the TS.

3.7 Stability of the Vessel and the Stability Information Booklet

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

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

3.7.3 All the requirements stipulated in the latest and as amended IMO Resolution (i.e. Code on Intact Stability for All Types of Ships regarding the Stability Information Booklet and the conduct of the inclining experiment and the Inclining Experiment Report) shall be followed.

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

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

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

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

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

(a) **For the avoidance of doubt, in addition to the above requirements**, the Stability Information Booklet in its **final version** shall include (but not limited to): ship particulars, sketch of general arrangement drawing showing different compartment and tank positions, hydrostatic curves, and cross curves;

(b) Tank calibration/sounding tables, fuel oil tank, freshwater tank, etc. 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 a profile drawing of the Vessel and items of deadweight, lightship, displacement, drafts, trim, VCG, GM (solid & fluid), LCG, down-flooding angle, and static stability curves.

(d) Any other information as reasonably required by the RO and/or GNC; and the Inclining Experiment Report approved by the RO.

(e) Both the preliminary and final Stability Information Booklet shall include but not limited to the following loading conditions (and any other conditions as may be required by MD during the design and construction of the Vessel) and their stability results shall be presented in a manner and format as indicated in latest and as amended IMO Resolution (i.e. Code on Intact Stability for All Types of Ships).

Loading Condition	Fuel (%)	Fresh Water (% of 2000 litres)	Crew and Effects	Persons
Lightship	0	0	0	0
Full Load Departure	95	95	#	#
Fully Loaded Arrival	10	10	#	#
Fire-fighting condition	30	10	###	0

Fully Loaded Departure and Arrival Conditions:

(i) 100 % of ALL crew together with;

(ii) 20 kg effects for each crew, for each one of the following conditions:

1. Fire-Fighting, Transportation and Training Mode as specified in Paragraph 2.8.2 of Chapter 2 of Part VII.

Fire-fighting Condition:

(i) Total ALL crew (ship crew and land crew), and 20 kg effects for each crew;

(ii) 500 kg equipment;

(iii) 100% foam tank;

(iv) For the Fire-fighting Condition, the Stability Information Booklet shall provide the stability information of the Vessel when in the above-mentioned loading and when two (2) fire-fighting monitor nozzles facing 90 degrees at beam pointing to the horizontal, ejecting water at full fire pump power. This stability (and heeling) calculation shall be carried out for port and starboard situation. For the heel (or list) calculation the Vessel shall be assumed not in motion (i.e. in still water) and without any assistance from the propulsion engines.

(v) For the above requirements in paragraph 3.7.8 (e), the calculations shall also follow the requirements below:

1. The maximum free surface moments shall be used for calculating the stability of the Vessel in all above conditions.
2. Weight of each crew/person is assumed to be 75 kg, and effects per crew to be 20 kg.
3. VCG of each crew/person shall be assumed as one (1) metre above deck in their most likely condition in an emergency situation. The likely positions of these persons shall be agreed by GNC and FSD.
4. Likewise the LCG of each crew/person shall be in their most likely position on board. The likely positions of these persons shall also be agreed by GNC and FSD.
5. The effect of wind moments in various loading conditions due to 47 knots wind at beam shall be calculated and duly considered in the stability calculations of all the above stated conditions, to the satisfaction of GNC.

(vi) The final Stability Information Booklet shall be approved by the RO before submitting to GNC for comments. The Contractor shall supply to GNC three copies of Stability Information Booklet (for the as-built Vessel), which must be given to GNC.

(vii) The final acceptance of the Stability Information Booklet and the Inclining Experiment Report shall rest with GNC for this Contract.

3.8 Specific Requirements for Stability of the Vessel

3.8.1 In addition to the above requirements, it is also essential that:

(a) at any time the Vessel shall not heel over 7 degrees AND the freeboard at amidships shall not be reduced by more than 70 % in the Fire-fighting mode of operation when any one of or both fire

monitors are in full power operation at any horizontal and vertical ejection angle whether the Vessel is stationary in water or under power moving in any direction and at any forward speed below 5 knots.

(b) in the Rescue Mode operation with the maximum number of persons and crew that can be carried on board according to IMO requirements for passenger carrying vessel, the angle of heel of the Vessel at **full speed turning** shall not be greater than 10 degrees or 80% of angle of deck edge immersion, whichever is the less.

3.8.2 To demonstrate the requirements in Paragraph 3.8.1 (b) is achieved, the Vessel must carry out the actual sea trial test during the Technical Acceptance. The 10 degrees or less than 80% of angle of deck edge immersion requirements must be demonstrated by the sea trials of the Vessel in the Technical Acceptance.

3.8.3 The Contractor must provide GNC the turning stability calculation of the Vessel showing it is safe to conduct the turning test at least 14 working days before the Official Sea Trial.

3.9 Damage Stability

3.9.1 The Vessel shall comply with the latest and as amended IMO International Code of Safety for High Speed Craft after damage.

3.9.2 The Vessel shall also comply with the IMO regulations and requirements where it is applicable to passenger carrying vessel.

3.9.3 The Vessel shall be designed for a one compartment subdivision standard.

3.9.4 Transverse bulkheads shall be arranged to maintain the stability of the Vessel when flooding (i.e. total flooding, partial flooding and progressive flooding) of any one of the under-deck compartment occurs, and when there is asymmetric flooding to any one of the under deck compartments. For this calculation the extent of partial and total flooding shall be decided by GNC.

3.9.5 IT shall be OF THE ESSENCE that the residual stability of the Vessel in the above-mentioned damaged condition shall be sufficient to maintain adequate stability of the Vessel **to continue to operate at sea in any one of operational modes** (except the fire-fighting mode) mentioned in the TS.

3.10 Downflooding Angles and Permeability

3.10.1 The opening(s) to be used to determine the down-flooding points and the angle(s) shall first be agreed by the RO and GNC before carrying out the calculations.

3.10.2 The permeability of each flooded compartment for the stability calculations shall first be agreed by GNC.

Chapter 4 General Arrangement Plan

4.1 General Provision

4.1.1 The Vessel shall be designed and built as a mono-hull high speed light craft. The hull is constructed of certified marine grade steel. And the superstructure is constructed of marine grade steel/ marine grade aluminium alloy plates and specially designed extrusions.

4.1.2 Without prejudice to the requirements set out in this Part VII (whether it be essential or specifications without label or other Offered Specifications) ("Proviso"), to the extent that the arrangement as specified in the Guidance General Arrangement Plan do not show indication concerning compliance with the aforesaid requirements, such arrangement shall be understood to serve as a guide and to help to explain the tender requirements. Without prejudice to the generality of the Proviso as aforementioned, all components of the Vessel as specified in this TS including all furniture, equipment, machineries, facilities, fixture and fittings, and outfitting of the Vessel that are described in the TS, together with their requirements for design and installation standards that are stipulated in the TS including this Chapter are the items that must be included in the complete "As-built" Vessel to be delivered to the Government.

4.1.3 The Tenderer should note that the requirements given in 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.

4.1.4 The Tenderer shall submit with the tender submission a General Arrangement Plan for Government consideration at the tendering stage.

4.1.5 During the design and construction of the Vessel, the Contractor shall again submit detailed General Arrangement Plan to GNC for approval and acceptance.

4.2 General Arrangement

4.2.1 The deckhouse shall be set in to provide a clear deck passageway of not less than 900 mm width on each side of the main/weather deck, extending from bow to stern. Obstructions to this walkway shall be avoided. The covers or doors at the opening along the walkway in no way obstruct the passage of the walkway.

4.2.2 Each hull is to be subdivided by transverse watertight bulkheads into compartments shall not be greater than 40% of Vessel's registered length.

4.2.3 The below subdivisions and accommodation compartments are provided for guidance only. Subject to any express requirements set out in this Part, the Contractor is free to propose different subdivisions and compartments in the GA Plan.

(a) Under Deck compartments:

1. Fore peak;
2. Bow Thruster Room;
3. Engine room;
4. Generator room;
5. Aft peak; and
6. Accommodation/Locker compartments

(b) Accommodation compartments:

(i) On the main deck accommodation there should be comprised of the following compartments:

1. Casualty Treatment room;
2. Equipment room (with air-conditioning facilities provided);
3. HVAC air pre-treatment room;
4. CO_2 locker;

5. Electrical room;
6. Wet Changing Room;
7. Crew seating area; and
8. Toilets / Shower rooms.

(ii) On the bridge deck accommodation there should be comprised of the following compartments:

1. Wheelhouse;
2. Command and control centre; and
3. Port and Starboard Manoeuvring Wing Station.

4.2.4 Final design for subdivisions and accommodation compartments mentioned in Paragraph 4.2.3 above shall be subject to full compliance with the RO requirements in relation to stability and subdivisions.

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

4.2.6 All controls, electrical and mechanical equipment and parts, wiring and piping, rotating parts and assemblies in cabins and compartments shall be properly arranged and placed not to cause injury to persons at all time.

4.2.7 Windows in cabins shall be strong and suitable for the worst intended operation conditions.

4.2.8 Window glass and the frame shall be made of materials which will not break into dangerous fragments when fractured/shattered.

4.2.9 Equipment fixtures and fittings on board shall be fitted properly to avoid injury to persons at all time.

4.2.10 A general emergency visual and audible alarm system shall be provided for the Vessel. The alarms shall be audible throughout the Vessel and sound pressure level shall be at least 14 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 off until it is turned off or is temporarily interrupted by a voice message on the public address system.

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

4.3 **Wheelhouse**

4.3.1 The wheelhouse shall be designed with where possible all-round visibility at the steering/helm position of the console area suitable for safe navigation in all operating conditions.

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

4.3.3 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.

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

4.3.5 The steering and helm position shall be situated at the centreline of the Vessel and be at a forward position close to the front windows in the wheelhouse. The available overall wide-angle visibility of the coxswain is of utmost importance. The steering and main engines control can be carried out by joystick and steering wheel. Back up control of individual steering gear and main engine shall also be provided.

4.3.6 Controls for the coxswain controls and steering shall be easily reachable by a normal Asian (of about 1.67 metres) in the sitting position without the need to unduly extending his arms, and that it would not interfere the coxswain's all-round field of view.

4.3.7 The arrangement of equipment and means for navigation, manoeuvre, control, communication and other essential instruments shall be so designed and located closely together to allow the coxswain and the assisting officer to read/receive all the necessary information, and be able to use/operate the equipment without difficulty and controls while they are seated on the crew seat at the control console.

4.3.8 All instruments/equipment shall be logically/systematically grouped according to their functions. In order to minimise the risk of confusion, instruments/equipment shall not be rationalised by sharing functions or by inter-switching. Proper signage / label showing the name of the control should be prominently displayed next to the equipment.

4.3.9 Instruments required for use by any member of the operating crew shall be plainly visible and easily read from his normal seating position.

4.3.10 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.

4.3.11 Surface finishing and interior linings of the wheelhouse shall be of a matt non-reflecting finish to facilitate night operation.

4.3.12 Pillars are not allowed to be fitted inside the wheelhouse and/or the wheelhouse steering area.

4.3.13 Subject to any other additional or alternative requirements given in TS, the following controls, displays and equipment are required to incorporate in the control console:

(a) Steering controls;

(b) Engine speed and clutch controls;

(c) Steering angle indicators;

(d) Electronic navigation equipment and displays;

(e) Echo sounder;

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

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

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

(i) Exhaust temperature gauges;

(j) Gear box oil pressure indicators alarms that deemed to be required by the equipment manufacturers;

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

(l) Emergency stop switch for accommodation ventilation fans;

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

(n) One colour LED monitor of CCTV for all exposed deck areas and one colour LED monitor of CCTV for inside the engine room from all angle;

(o) Public address system and intercom system to engine rooms;

(p) VHF radio receivers' stowage positions and power sockets;

(q) Electric horn, siren, and flashing beacon control panel;

(r) Watertight openings monitoring system; and

(s) Any other equipment as requested by GNC and FSD.

4.3.14 A separate control console shall be provided in the wheelhouse for the operation of firefighting equipment.

4.3.15 A Wheelhouse Engine control console shall be provided in the wheelhouse for the operation of machinery and electrical system.

4.3.16 Bow thruster control panel shall be provided in the wheelhouse for the operation of bow thruster. This shall be designed as described in Paragraph 8.12 of Part VII.

4.3.17 Two manoeuvring control consoles shall be provided in both sides of the bridge wing for steering, main engine control and bow thruster control. The position of the control console shall facilitate the safe manoeuvring of the vessel. The steering, main engine and bow thruster control shall be carried out by joystick.

4.4 Windows and Visibility

4.4.1 As a minimum requirement, the visibility to outside from inside the cabins and wheelhouse shall be compliant with the IMO requirements.

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

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

4.4.4 Frames at the wheelhouse window separations shall be kept to a minimum, and they shall be of adequate structural strength and stiffness. They shall not be installed immediately in front of the coxswain position.

4.4.5 The positions of window frames shall be agreed by GNC before installation.

4.4.6 The wheelhouse front windows shall avoid reflection.

4.4.7 Throughout the Vessel, polarized and tinted windows are NOT to be fitted.

4.4.8 All window glasses used throughout the vessel shall be hardened and tempered and be of a type suitable and safe for marine use.

4.4.9 At all times regardless of the weather and sea conditions at least two third of the wheelhouse front width in front of the coxswain shall have a clear view.

4.4.10 The following outfitting items shall be provided:

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

(b) Heavy-duty marine type of wipers shall be used. They shall have an interval operation and adjustment functions and be fitted with electrical fresh water window/wiper washing systems. These wipers shall be capable of operating independently of each other. The type and make of wiper must be submitted to GNC for acceptance before they are fitted;

(c) Two sets of spare wiper blades shall be provided for each window wiper installed for the Vessel. One spare unit of wiper for the coxswain front window shall also be provided; all of these items shall be kept on board and forming part of the Equipment to be delivered as part of the Vessel and shall not be separately chargeable;

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

(e) Retractable solar UV roller blinds shall be installed on all cabin windows throughout the Vessel; and

(f) The blinds shall be capable of being retained in position either partially lowered or fully lowered, without swinging due to the Vessel motions at sea.

4.5 Lighting

4.5.1 Adequate lighting intensity and lighting arrangement, as well as any necessary lighting segregation, by means of blinds or other means, shall be provided inside the cabins and wheelhouse spaces to enable the operating personnel to perform their navigation task.

4.5.2 Emergency lighting shall be provided throughout the vessel for its operational needs.

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

4.5.4 A suitable device shall be available to enable the adjustment of lighting intensity and direction in different areas of the compartment.

4.6 Forepeak

4.6.1 The forepeak space shall be watertight and located at the foremost end of the hull, with a watertight collision bulkhead. HSC requirements for collision bulkhead must be complied.

4.7 Crew Space

4.7.1 Unless specified as not required (or otherwise with alternative or additional requirements) in TS, the following furniture, fittings and equipment are required to be provided:

(a) Toilets;

(b) High-density foam seating with cushion;

(c) Marine slave clock and lockers (size and type to be agreed by FSD);

(d) Suitable means of escape (size and arrangement are in accordance with RO and IMO requirements) to the main deck shall be provided for the crew space;

(e) Refrigerator with locking device (Gross Capacity shall not less than 350 L with at least 2 doors as agreed by FSD);

(f) Large rubbish bin with cover (size and type to be agreed by FSD);

(g) Portable cooking power inverter microwave oven (size and type as agreed by FSD); and

(h) Sink, kettle and food preparation area.

4.8 Toilet

4.8.1 Unless specified as not required (or otherwise with alternative or additional requirements) in TS, the following furniture, fittings and equipment are required to be provided:

(a) Toilet exhaust air shall be routed to outside; the size and capacity of the exhaust fan shall be agreed by GNC to be provided in accordance with RO and local statutory regulations;

(b) Sewage flushed from toilets shall either be directly overboard or stored in a sewage (black water) tank;

(c) Non-slip flooring shall be provided;

(d) One stainless steel wash basin with a spring loaded cold freshwater supply tap;

(e) One shower unit (and as per TS requirement);

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

(g) One cabinet with mirror (self-closing with lock);

(h) One toilet paper holder;

(i) One electric exhaust fan;

(j) One ceiling light and one cabinet light;

(k) One stainless steel grip rail;

(l) One liquid soap dispenser; and

(m) Means to avoid water accumulated on the toilet floor together with effective water drain out.

4.9 Tanks Space

4.9.1 The tank space shall include those areas for housing of fuel oil tank, fresh water tank and foam tank etc.

4.9.2 The capacity of fuel oil tank shall be sufficient for the vessel operating 12 hours in term of cruising speed 20 knots plus 24 hours with both external fire-fighting pumps running at maximum output continuously without any re-fuelling.

4.9.3 The capacity of fresh water tank shall not be less than 2,000 L.

4.9.4 The capacity of foam tank shall not be less than 5,000 L.

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

4.9.6 Aluminium chequer plates adjacent to valves, shafts, etc., shall be easily removable for easy maintenance. Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid/minimise rattling noise.

4.9.7 Forced ventilation shall be provided to all tank spaces except for those solely used for void space. This is to prevent any risk occur from occasionally entry to this space.

4.9.8 Ventilation to be provided for tank space in accordance with RO requirements and also to the satisfaction of the GNC.

4.9.9 Explosion proof ventilation fan shall be provided when necessary.

4.9.10 All the ventilation equipment shall comply with RO requirement.

4.9.11 When the machinery space is adopted also as tanks space, both the RO and HSC requirements of tank space and machinery space shall be complied with.

4.10 **Engine Room**

4.10.1 The engine room(s) layout shall be in accordance with IMO and the RO requirements. For the avoidance of doubt the following requirements and the specific requirements given in the TS shall be complied by the vessel.

4.10.2 Engine Room is the location mainly to house but not limited to diesel engines, generator engines and other important machinery e.g. reduction gearing and PTO drive (if applicable) for the external fire pumps of the external fire-fighting system.

4.10.3 If three propulsion engines configuration are adopted, the engine room can be sub-divided into forward and after engine room. And both of them shall comply with the requirements of this section.

4.10.4 Special attention shall be paid to the engine room layout for main engines and machinery maintenance and repair. The main propulsion centreline engine can be transferred from one location to another (e.g. Forward and After Engine Room) for removal ashore. Supporting bracket and rail shall then be fitted to facilitate the transfer shall be provided. The layout of engine room shall be approved by GNC.

4.10.5 The engine room compartment shall be designed for unattended engine room operation and protected by fixed CO_2 flooding system.

4.10.6 The machinery, associated piping system and fittings shall be installed and protected as to reduce to a minimum any danger to persons on board.

4.10.7 All surfaces with temperatures where impingement of flammable liquids may occur as a result of a system failure shall be insulated. The insulation shall be impervious to flammable liquids and vapours.

4.10.8 The floor of this compartment shall be covered with unpainted aluminium chequer plate. Aluminium chequer floor plates shall be secured by fixing with sections but shall be readily removable for access to bilges, pumps, shaft, pipe work and strainers etc. for ease of maintenance.

4.10.9 Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid rattling noise.

4.10.10 Removable guards shall be provided for the protection of working personnel against potential risk i.e. exposed moving parts of the machinery, hot pipe work, etc.

4.10.11 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.

4.10.12 Splash plates, casings, fenders, screens, etc. shall be provided for the protection of personnel and machinery.

4.10.13 Common audible and visual alarms (both siren & beacon) for ALL machinery faults (amber), intercom (blue), fire (red) and CO_2 (red) shall be fitted in the engine room in an easily noticeable position.

4.11 Deck Railing, Mast and Navigational Lights

4.11.1 Unless specified as not required (or otherwise with alternative requirements) in the TS, the following items are to be provided:

(a) Open decks where accessible for persons and crew shall be fitted with strong guard railings at their perimeter for safety of persons on board except where for the convenience of crew operation (e.g. at the bow deck area).

(b) Wheelhouse top shall be fitted with IMO required navigational lights, shapes, sound signals, and radar scanner and other electronic and navigational equipment, including the lightning arrestor, ensign hoist, signal hoists, antennas and UHF mobile transceiver etc. as required by the operation of the vessel.

(c) Safe access for the maintenance and servicing to equipment and its fittings shall be provided.

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

4.12 Access, Doors, Ladders and Hatch

4.12.1 Design of all outfitting including, but not limited to, doors, hatches, ladders, ventilation heads, etc. shall be of a type approved by the RO for this type of vessel, or other entities acceptable to GNC. These shall require GNC acceptance and approval before installation.

4.12.2 Detailed specifications of these items shall be provided to GNC by the Contractor before installation. Any item(s) not acceptable to GNC shall be removed and replaced with the one(s) acceptable to GNC.

(a) Where the use of a hatch is not practical on the weather deck, RO approved type flushed type watertight manhole should be used; and

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

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

4.12.4 All hatches shall be fitted with a hold back device. The door sill should be designed in a way to facilitate the normal passage of the person on board the vessel.

4.12.5 Stairway inclination shall not be more than 50 degrees to the horizontal and shall be fitted with handrails on each side. A minimum width of 600 mm shall be provided between the handrails.

4.12.6 All exterior grab hand rails shall be strongly secured to the deckhouse side to provide support for persons on board, to prevent them from falling or being thrown on deck or overboard in bad weather and sea conditions, and when all these persons are lining up together on one side of the deck in case of an emergency situation at sea.

4.12.7 Vertical ladders, if fitted on board, shall be constructed with thread round bars at suitable step space intervals, adequate footsteps, non-slip features and/or installation and handholds for safety.

4.12.8 All the machinery spaces including engine rooms and all crew spaces shall be provided with two widely separated means of access/escape in accordance with RO and IMO requirement.

4.13 Helicopter Winching

4.13.1 The aft bridge deck is designated for helicopter winching (not for landing or take-off) shall there be any emergency, or evacuation of seriously wounded casualties. There shall be provisions of sufficient area for safe operation, clear visibility, and good communication both for the helicopter's and the Vessel's operators. The platform shall be clear of any projections above the level of deck for the helicopter platform concerned. Suitable arrangements shall be made to minimise the risk of personnel sliding off the platform.

4.13.2 A non-slip surface and anchoring devices shall be provided.

4.13.3 Sufficient lightings with emergency backup power shall be provided for clear indication of the platform location in darkness, raining and foggy conditions.

4.13.4 Arrangements shall be provided for drainage of the platform.

4.13.5 Firefighting equipment suitable for use on flammable liquid fires shall be provided adjacent to the platform.

4.13.6 Railings for protection of crew shall be provided with consideration of sizes and spacing between rails to prevent a person lying on deck from being swept away. Correct deck markings as agreed by FSD.

4.13.7 For the sake of reducing the risk of injuries or accident during helicopter winching operation, flight deck safety net which is openable outwards is to be installed.

4.13.8 Stretcher lift is provided to transfer injured person between main deck and aft bridge deck for helicopter winching. The size of lift has to accommodate the stretcher and the platform shall be operated by hydraulic means with local control panel.

4.14 Furniture and Fittings

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

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

4.14.3 All furniture and seats shall be lightweight, tough and robust.

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

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

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

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

4.14.8 Equipment Room is the space fitted with hose racks, shelves, and bins to store all manner of fire-fighting equipment such as poles, axes, tools, fittings, hoses are stowed in flat racks readily accessible. Air conditioning shall be provided for the equipment room.

4.15 Insulation and Lining

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

4.15.2 Engine room and machinery space bulkheads and crown shall be insulated against fire and sound with asbestos-free materials in accordance with IMO regulations and requirements applicable to the Vessel as a passenger carrying vessel.

4.15.3 The noise level throughout the Vessel shall be in accordance with IMO regulations and requirements applicable to the Vessel as a passenger carrying vessel.

4.15.4 Samples of wall, ceiling panels and joints materials and method of joining shall be submitted to GNC for approval before installation.

4.15.5 The panels shall be fitted to avoid noise generation at all operational speeds. Within reasons, when the noise level is considered unacceptable to GNC officers, the Contractor shall improve the design and fitting methods of the panel/ceilings.

4.15.6 The deck or floor of wheelhouse, main deck cabin and crew space shall be covered with non-skid, wear resistance and fire retardant vinyl PVC sheets that are acceptable to GNC officers.

4.16 **Seating**

4.16.1 Three upholstery seats with dampen capability shall be provided in front of the wheelhouse console for the coxswain, FSD officer and other persons. Requirements of the seats shall be: -

(a) Seats shall be of comfortable type and be designed for protection of crew while the Vessel is operating at its maximum speed and long period of operation;

(b) Adjustable seat height with foot rest;

(c) Backrest angle adjustment around 12°;

(d) Fore and aft adjustment around 160 mm;

(e) Safety belt to be provided;

(f) Adjustable armrests; and

(g) Turntable/Mounting pedestal 0° - 180°.

4.16.2 Two individual seats with backrest shall be provided in the command and control room.

4.16.3 Individual high-density foam seats with cushion and backrest shall be provided in the crew space.

4.16.4 (a) The seat structures shall be permanently fitted to the structure of the Vessel by means of an attachment system which could be dismounted easily.

(b) The seat and the attachment system shall be acceptable by GNC.

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

4.16.6 Seat materials of upholstery shall be of water resistant materials such as fire retardant foam/reinforced nylon laminated neoprene/heavy duty cordura laminate.

4.17 **Open Deck Area**

4.17.1 Permanent (or properly designed detachable type if so required) fore and aft stanchions for crew and personal safely embarkation and disembarkation shall be provided.

4.17.2 The deck floor shall be covered with suitable anti-slip marine material and of weather proof type.

4.17.3 The deck covering material specifications, including the attachment method, shall be provided to GNC for acceptance before fitting onto the deck.

4.18 **Daughter Boat**

4.18.1 One 6 to 7 metres in length (LOA) rigid hull aluminium boat (RHB) ("Daughter Boat") shall be provided complete with one inboard diesel engine of waterjet propulsion. **[E]**

4.18.2 The Daughter Boat shall be equipped with an inflatable self-righting bag.

4.18.3 The Daughter Boat shall be capable to run at 30 knots at 100% MCR and separate Official Speed Trial shall be performed on the same terms set out in paragraph 1.7.6 of this Part to determine compliance.

4.18.4 The passenger capacity shall not be less than 4 persons.

4.18.5 The endurance of the Daughter Boat shall be 4 hours at the maximum speed capability without re-fuelling. The specific fuel consumption of daughter boat engine shall be verified during the endurance and performance test for the Daughter Boat to confirm the compliance of the endurance requirement. Such separate endurance and performance test for the Daughter Boat shall be performed on the same terms set out in paragraph 1.7.7(a) of this Part to determine compliance.

4.18.6 The Daughter Boat shall be fitted with lightning arrestor and shall be deployed and recovered from the ramp at the Vessel stern.

4.18.7 The Daughter Boat shall be designed with strong point lifting attachments permanently fitted to the hull and allowed 4-points lifting method.

4.18.8 Four dampened seats each with a drop-down seat cushion shall be provided immediately in front of the console. These seats shall be designed with progressive damping. The seats shall be fitted with adjustable shock absorbers for light/heavy personnel, a four-point harness, a headrest, hand grips and a dropdown seat base. A high, adjustable footrest attached to the primary console shall also be provided

in front of each seat. All dampened seats above shall have progressive damping travel, height adjustment, fore and aft adjustment.

4.18.9 An External Fire-Fighting System for Daughter Boat ("EFFS for the Daughter Boat") shall be designed solely for marine fire-fighting operation. It shall meet the following requirements:

(a) One electric-priming diesel fire pump rated flow of at least 800L/min at discharge pressure of not less than five (5) bars shall be mounted securely on deck connecting with steel suction pipe from bottom sea chest.

(b) One fire-fighting monitor shall be fitted at the bow of the Daughter Boat and it shall provide an unobstructed range of horizontal operation of at least 240 degrees centered on the bow of the Daughter Boat and shall have a vertical coverage of at least 60 degrees above and 15 degrees below horizontal.

(c) A "Y" shape dividing head shall be fitted to provide connection between the outlet of fire pump and two delivery hoses. The delivery hoses shall be provided to connect the dividing head with (i) fire-fighting monitor and (ii) portable branch.

(d) The external fire-fighting system, including the fire pump outlet, "Y" shape dividing head, delivery hose and fire-fighting monitor, shall be fitted with light alloy instantaneous 70 mm male and female coupling at each end. The specification of couplings shall be complying with British Standard BS 336.

(e) Fire main pipes shall be constructed with marine grade stainless steel.

4.18.10 The Daughter Boat shall be designed to be launched and recovered by stern ramp launch and recovery system as stated in paragraph 4.19 onboard the Vessel. Docking cradle shall also be provided for the spare Daughter Boat as part of the equipment for the spare Daughter Boat to be delivered. A galvanised steel fabricated cradle with rubber, wood or similar material to support the Daughter Boat and the cradle shall be able to rest with rollers on level ground for ease of transportation.

4.18.11 The following equipment shall be supplied together with the Daughter Boat:

(a) Standard aluminium console with bench seat;

(b) Torsional tow bar;

(c) Heavy duty rubbing strakes;

(d) Loudhailer/fog horn;

(e) Gunwale lifting eyes and sling c/w quick release hook;

(f) Mast for navigation lights, red beacon lamp and diver's flag;

(g) Power sockets and portable watertight search lights c/w 20m cable (24v);

(h) Auto draining device;

(i) GPS receiver;

(j) Marine Radar;

(k) Automatic Identification System (AIS) Transponder (include the Receiver and Transmitter Modules);

(l) Electronic Chart Display and Information System (ECDIS) with DGPS;

(m) 12V or 24V sealed type battery for the use of items (d), (f) and (g); and

(n) One 4.5 kg dry powder fire extinguisher.

4.18.12 Self-righting/Aerial Mounting Frame

(a) The Vessel shall be provided with a self-righting system mounted on a frame at the stern of the Vessel, which incorporates an inflatable bag with a heavy-duty coated fabric cover and a CO_2 bottle. In the event that the Vessel capsizes, this self-righting system shall be capable of being activated manually by pulling a release handle. The system shall be dimensioned so that it shall be capable of righting the Vessel in less than 25 seconds at the Light Operational Load Condition;

(b) The self-righting system mounting frame shall be positioned so that the head of a crew member standing at the stern of the Vessel shall not come into contact with the frame during passage in sea conditions up to WMO Sea State 6;

(c) The self-righting/aerial mounting frame shall be a strong and rigid structure to support the self-righting gear, lightning arrestor, navigation lights, search light, sunroof and other electronic and navigational equipment as appropriate;

(d) The self-righting/aerial mounting frame shall be provided with all necessary fittings including but not limited to brackets for all navigation lights and lightning arrestor;

(e) All hardware such as screws, hooks, hasps, hinges, handles and sliding bolts shall be made of stainless steel or corrosion resistant material with galvanic protection between contacts with aluminium hull or corrosion resistant material;

(f) The self-righting/aerial mounting frame shall not cover or be attached to the console and shall not obstruct operations at the coxswain or commander positions; and

(g) The design of the self-righting system and the mounting frame shall be discussed at the kick-off meeting, and shall be submitted to the RO or other entities acceptable by GNC for approval.

4.18.13 The Technical Acceptance of the Vessel shall also cover the Daughter Boat (one on board and one spare) and the EFFS Test for the Vessel shall also cover the EFFS for the Daughter Boat as further specified in in Paragraphs 1.7.8 and 1.8.2(c) of this Part.

4.18.14 One (1) additional Daughter Boat (as spare) with the same specifications as the Daughter Boat on board of the Vessel shall also be provided.

4.19 Stern Ramp Launch and Recovery System (LARS) for Daughter Boat

4.19.1 The Stern Ramp Launch and Recovery System for the Daughter Boat (LARS) shall be designed and manufactured in accordance with RO requirements. The design of LARS shall be able to stand and operate for sea state 4 and to be a proven one which has been used on navy, coastguard or other law enforcement vessels for the launching and recovery of rigid hull aluminium boat (RHB) daughter boat.

4.19.2 The design of LARS shall be capable to be remotely controlled from the wheelhouse and local operating panel which allow the Daughter Boat to be launched and recovered by the coxswain of the Daughter Boat.

4.19.3 The control console of the stern ramp shall be located inside the wheelhouse of the Vessel. A backup control console (local panel) shall be located on the main deck in a position with good visibility of the stern ramp. The control console shall be enclosed in a watertight cabinet.

4.19.4 The hydraulic power unit shall be supplied as part of the LARS, consisting of:

(a) One hydraulic power pack for system operation; and

(b) An emergency means for stern ramp operation; and

(c) Local operation control.

4.19.5 The stern ramp shall be formed of a series of angled brackets of light steel design. Each bracket is angled to suit the shape of the Daughter Boat hull and to be properly protected from physical metallic contact with the Vessel structure during the operation.

4.19.6 The LARS shall be designed so as to ensure:

(a) Very fast launch and recovery of the fully manned Daughter Boat in emergency situations.

(b) This shall be achieved through an intuitive system enabling crews to become proficient operators in a short period of time.

(c) Simplicity of operation so that launching and recovery of the fully manned Daughter Boat shall be achieved by a single operator using either a dedicated control panel on the rear deck, without the need for additional crew to be present on the stern deck or in the slipway, or by a single crewman on board the Daughter Boat.

(d) No other person shall be required to manually assist in any way, during either the launching or recovery operation, except to drive the Daughter Boat away from the stern after launching and on recovery, or to drive the Daughter Boat successfully in contact with the first sets of mechanically driven wheels that will move the Daughter Boat up the slipway for the recovery the Daughter Boat.

(e) Safe operations and crew comfort are imperative in all operational conditions including in both day and night time in the sea states stipulated. The launching and recovery shall be achieved by mechanical means, without the use of suspended loads, hooks, lines or arresting cables during normal operation, reducing the risk of accidents or injuries occurring during launching and recovery.

(f) In addition, to enhance safety during the launching and recovery of the Daughter Boat, the crew

shall be in their seated operating positions on the Daughter Boat, without the need to move about the deck to assist in releasing or attaching the Daughter Boat.

(g) Through life serviceability and ease of maintenance shall be available locally, with minimal downtime due to mechanical, electrical or other defects.

(h) The LARS system shall be able to be adjusted to craft of a similar length to the original Daughter Boat but with different hull shapes and propulsion systems if required in the event that the Daughter Boat is replaced in the future.

4.19.7 The stern ramp shall include the followings:

(a) A stern Slipway: Powered wheel drive system, or other hydraulically mechanical system e.g. hydraulic system operated with submerged slipway cradle system with prior approval by GNC and FSD beforehand, with appropriate size for housing shall be installed on main open deck and integrated into stern door:

(i) The Daughter Boat shall be stowed on, launched and recovered from the stern slipway with a SWL up to 12 tonnes.

(ii) The hydraulically-powered, semi-automatic slipway system shall be part of the hull structure and shall be installed along the centre line of the vessel.

(iii) The system powered wheel drive system shall include a number of hydraulically operated wheel pair assemblies, each including adjustable structural support brackets, rails for deck installation, solid rubber tires on wheel rims, hydraulic motors and gearboxes with overrunning clutches and fail-safe parking brakes. The wheel pair assemblies shall be mounted on rails in parallel rows, with the tilt, height and distance between the wheels capable of being manually adjustable to conform to a range of daughter boat hulls. For other hydraulic system, prior approval has to be obtained from FSD beforehand.

(iv) The stern slipway shall have a slope which shall be enable launching by gravity when required for the range of the operating trims, whilst reducing incidence of swamping by the sea or the daughter boat during launching and recovery in the event of mechanical power being unavailable. The slope angle shall be optimised for ease of launching and recovery operations. The shape of the slipway shall be appropriate to the shape of the bottom of the Daughter Boat as well as any mechanical devices required for launching and recovery.

(v) An emergency boat recovery system and a control system to assist the mechanical launching and recovery of the Daughter Boat shall be installed including emergency launch and recovery by accumulator and uninterrupted power supply.

(vi) On launching, the hydraulically operated wheel units will automatically drive the Daughter Boat down the slipway slope from its parking position until the Daughter Boat floats free.

(vii) When the Daughter Boat enters the slipway from the water, overrunning clutches shall allow free rotation of the wheels in the recovery direction until the boat speed and wheel drive speeds match at which point the hydraulically operated wheel units will automatically drive the Daughter Boat up the slipway slope to its parking position.

(viii) Arrangement shall be provided to operate automatically the recovery system when the Daughter Boat comes into the position for recovery; Stop the Daughter Boat and hold it in position.

(ix) End stoppers shall automatically set the Daughter Boat in the parking and stowage position and engage fail-safe brakes on the drive wheels allowing the safe embarkation and disembarkation of the crew.

(x) Automatic securing means to ensure quick and effective securing of the Daughter Boat in locking position for safe embarkation and disembarkation of the personnel on board the Daughter Boat.

(xi) Sufficient transom slipway immersion shall be provided to achieve a smoother launch and recovery and reduce impacts on the Daughter Boat.

(xii) The stern slipway shall be painted with corrosion resistant marine grade paint. 'Traffic' areas not directly under the daughter boat are to be painted with non-slip paint.

(xiii) Guard rails shall be installed around the stern slipway well to act as a safety barrier to protect the daughter boat and prevent personnel falling into the stern slipway well. Access

gates in the guard rails shall be provided for accessing the Daughter Boat.

(xiv) A system of indicator 'line up' lights shall be positioned indicating the status of the slipway and the angle of approach for the Daughter Boat crew.

(xv) Alternative means shall be provided for recovery of the Daughter Boat in case of failure of hydraulic power system.

(b) Stern door/ Ramp

(i) The stern door/ramp when closed shall protect the stowed Daughter Boat from damage caused by rough sea.

(ii) The stern door/ramp shall be of a bottom hinged type operated by hydraulic cylinders with mechanical securing means to avoid excessive movement of the stern ramp during operation. Limit switch shall be provided to avoid excessive movement of the stern door/ramp.

(iii) The stern door/ramp serves to extend the slipway in the open position and close it when the system is not being operated.

(iv) Guide poles shall be located at the port and starboard extremities of the ramp to guide the Daughter Boat during recovery operations.

(v) Alternative means shall be provided for closing the stern door/ramp in case of hydraulic power failure.

(vi) The stern door/ramp should have an extremely high strength to weight ratio with internal beam web reinforcement with low maintenance requirements.

(vii) The stern door/ramp should be operated by a minimum of two (2) hydraulic cylinders, with two (2) hydraulic locking cylinders with mechanical locks and locking arrangement.

4.20 **Anchor and Windlass**

4.20.1 One high-holding power type, hot dipped galvanised, anchor complying with the RO and the IMO requirements shall be provided.

4.20.2 Anchor with its associated swivel, shackles, stowage cable or cable and warp and means of recovery shall be provided.

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

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

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

4.20.6 An electric/hydraulic 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 matching anchor chain and cables as well as the mooring lines.

4.20.7 The windlass shall be capable of lifting one 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.

4.20.8 Control of the windlass shall be located in the vicinity of the windlass through a starter control unit enclosed in the watertight cabinet.

4.20.9 Emergency stop button for windlass shall be provided in the wheelhouse at the coxswain station position.

4.20.10 A canvas/tarpaulin protection cover for the windlass shall be provided.

4.20.11 The Vessel hull shall be protected against the anchor and cable damaging the hull structure during operation.

4.20.12 Fairleads, bitts and mooring ropes shall be provided and fitted at the appropriated position for the safe mooring operation.

4.20.13 Two stainless steel boat hooks with staves (length to be decided by the user department) and stowage arrangement shall be provided.

4.20.14 One (1) additional Anchor (as spare) with the same specifications above shall also be provided as part of the Equipment for the Vessel to be delivered and shall not be separately chargeable.

4.21 **Fenders**

4.21.1 Pushing Head Fender

(a) The fender shall be designed to absorb stresses exerting into the Vessel.

(b) Top and bottom edges of the fender shall be chamfered back at 45^{o} to half diameter (of round section fenders).

4.21.2 Side and Stern Fenders

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

(b) The hull structures shall be suitably strengthened for the fendering arrangement.

(c) The size and number of rubber tyre fenders specified by FSD shall be provided on each side of the Vessel at the weather deck level, with stainless steel securing devices. The arrangement shall submit to GNC's approval prior to installation.

4.21.3 The number and size of portable air filled fenders specified by FSD shall be provided.

4.22 **Cathodic Protection and Painting**

4.22.1 Underwater cathodic protection (self-sacrificing anodes) suitable for a minimum of one year life shall be fitted at hull bottom.

4.22.2 Good quality epoxy paints shall be used throughout the Vessel and applied in accordance with the manufacturer's specifications.

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

4.22.4 A suitable Tributyltin (TBT) free fouling-release/anti-fouling paint shall be applied on the exterior of the hull below the waterline which is suitable for two years protection against marine growth.

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

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

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

4.22.8 TBT free certificate of the paint materials applied to the Vessel, issued by the paint manufacturer, shall be submitted to MD before the Delivery Acceptance.

4.22.9 A painting report shall be submitted to MD upon the completion of painting work for the Vessel, and it shall be submitted to GNC before the Delivery Acceptance.

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

4.22.11 The colour of the paints shall refer to this Part (Markings and Colour Scheme).

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

4.23 Lightning Protection

4.23.1 The Vessel shall be fitted with a proven lightning protection system as per RO and IMO requirements.

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

4.24 Other Wheelhouse Outfitting

4.24.1 The following fittings and equipment are required to be provided in the wheelhouse:

(a) One display board for posting plans, maps, notices, etc;

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

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

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

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

(f) One magnetic compass with independent illuminated dimmer switch;

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

(h) Two cup holders;

(i) One swing-type metal rubbish bin with cover;

(j) One wooden box with locks for the storage of binoculars, and it shall be fitted within the vicinity of the forward high seats. Two binoculars shall be provided (one for use in day time and one for use in night time); and

(k) Four coat-hooks.

4.25 Basic User Requirements for Treatment Room

4.25.1 The Vessel is to be designed with a treatment room to provide ambulance service to the casualties at scene.

4.25.2 An electrical level adjustable patient bed shall be supplied and installed in the treatment room. The specification and model patient bed shall be confirmed and approved by FSD in the kick off meeting.

4.25.3 The treatment room shall be positioned to facilitate convenient conveyance of casualties on sketcher to and from the main deck to the exterior deck.

4.25.4 The following equipment shall be provided.

(a) Four nos. of automatic Cardiopulmonary Resuscitation (CPR);

(b) Two nos. of Defibrillator-Monitors;

(c) Two nos. of Suction Units; and

(d) One no of Blackboard.

*All the equipment installed on board shall be agreed by GNC and FSD beforehand.

4.25.5 A ceiling mounted surgical light with compatible pendant/suspension system conforming to IEC 60601-1 (Medical Electrical Equipment Part 1 – General Requirements for Safety) and IEC 60601-2-41 (Medical Electrical Equipment Part 2-41 – Particular Requirements for the Safety of Surgical Luminaires and Luminaires for Diagnosis), or other equivalent national or international standard, shall be provided and installed in the treatment room.

(a) The surgical light shall be of LED type and compact design for the small workplace;

(b) Pendant/compatible suspension system of the surgical light shall be fitted with a display arm to support monitor;

(c) The handle shall be removable / sterilizable;

(d) The configuration of the suspension system with the surgical light shall allow the light-head to rotate horizontally and vertically;

(e) The central illuminance shall be no less than 40,000 lux at 1 metre or dimmable to this value;

(f) The colour rendering index (Ra) shall not be less than 94;

(g) The colour temperature shall be within 4,000 K˚ to 4,500 K˚;

(h) The depth of illumination shall not be less than 1,000 mm;

(i) The light field diameter shall be within 70 mm – 160 mm; and

(j) The LED service light shall not be less than 25,000 hours of operation at greater than 80 percent of initial light output.

4.25.6 Medical oxygen supply system shall be designed, provided and installed for the Vessel in accordance with the design, installation and performance requirements of latest edition of the Health Technical Memorandum 02-01: Medical gas pipeline systems in UK or equivalent.

(a) Securing brackets for two G size oxygen cylinders (720 mm long x 180 mm diameter) shall be provided. The cylinders shall be provided by FSD;

(b) A three ways control assembly/connector completed with independent control valves and flexible pipes shall be provided;

(c) A regulator with pin index yoke and DISS outlet fittings, and main isolator coupled with glass cover shall be provided and installed;

(d) Five numbers of flowmeter with straight probe shall be provided and installed;

(e) Plastic/nylon/brass pipework connecting the oxygen outlets and cylinder to run at central level shall be provided and fixed as directed;

(f) A high pressure flexible hose completed with threaded nut connection of approved product shall be provided and fixed as directed;

(g) Each oxygen storage cylinder shall be protected from other cylinders by a partition;

(h) All piping and their connectors shall be easily accessible for service and replacement; and

(i) Five standard oxygen outlets shall be provided and installed.

4.25.7 A minimum 1,000 watts non-flammable surface 220V A.C. wall mounted warmer shall be provided and mounted with detachable device in the treatment room. The warmer shall be equipped with adjustable thermostat and overheat safety protection.

4.25.8 A water sink of stainless steel 316 or better completed with a brass drainage pipe and a fully-fitted cover shall be provided as directed. Water tap shall be of medical use type.

4.25.9 A stainless steel soap dispenser and a stainless steel paper towel dispenser shall be supplied and fitted in the vicinity of the water sink.

4.25.10 One wooden couch of appropriate height for treatment examination with portable step shall be provided and installed in the treatment room. Top of the couch shall be padded with 100 mm thick foam and covered with heavy gauge imitation leather of colour to match with the ward. Storage space with sliding doors shall be provided under the couch.

4.25.11 A full size white board shall be provided and fixed right over the nearside couch in the treatment room.

4.25.12 The partition walls and doors of treatment room shall be of sandwich structure including fire retardant, heat and noise insulation materials in order to maintain a sound level not exceeding 80 dB(A) inside the room.

4.25.13 At least four wooden cupboards completed with transparent acrylic sliding doors shall be provided in the treatment room. The sliding doors shall be fitted with push lock.

4.26 **Forepeak**

4.26.1 The forepeak space shall be watertight and located at the foremost end of the hull, with a watertight collision bulkhead. HSC requirements for collision bulkhead must be complied with.

4.27 **Bow Thruster Compartment**

4.27.1 The Bow Thruster Compartment shall be located under the main deck aft of the fore peak compartment.

4.27.2 The space shall be sufficient at least but not limited to house the followings:

(a) Bow thruster tunnel, propeller and electrical power pack;

(b) External Fire Fighting pump and independent diesel engine drive (if applicable);

(c) Racking and support structure for fitting of local operating panel(s), cabling, junction boxes and any other supporting equipment;

(d) Emergency Fire Pump (with fuel tank); and

(e) Any other equipment as required by the GNC and FSD.

And the IMO 2000 HSC requirement for the installation of the concerned equipment shall also be complied with. The Contractor shall design and install the space in accordance with IMO 2000 HSC Code with respect to the required structural fire protection, fire detection and fire suppression and shall meet the requirements of RO. Noise and vibration transfer to the Superstructure and living spaces shall be avoided.

4.27.3 A watertight hatch shall be fitted flush to the main deck to provide access to the bow thruster compartment for routine service and maintenance.

4.27.4 The compartment shall be designed and fitted out in accordance with RO requirements and to the satisfaction of the GNC.

4.27.5 The bow thruster room shall be adequately spacious to accommodate the bow thruster motor and its associated systems i.e. Variable Frequency Drive (VFD), control panel and cooling system, etc., external fire pumps for external fire-fighting system (if applicable), as well as an emergency fire pump. The bow thruster room shall also be adequately ventilated so as to enable the heat generated by the components e.g. motor, VFD, starter panel etc., and the fire pump engine to be carried away in order to maintain the bow thruster room in similar condition as outside ambient condition.

4.27.6 The ventilation arrangement of the Bow thruster room shall ensure dampness and condensation not to be accumulated to lower the insulation resistance of the motors.

4.27.7 The ventilation arrangement of the bow thruster room shall take into consideration that crew would carry out operation and maintenance work regularly and also in emergency situation. Therefore arrangement shall be proposed to ensure the safety of working personnel and accepted by FSD.

Chapter 5 External Fire-Fighting System (EFFS)

5.1 General Requirements

5.1.1 The design and installation of the external fire-fighting system for the Vessel ("EFFS") shall follow the RO Requirements.

5.1.2 The EFFS shall be designed for fighting marine fire including oil fire/liquified natural gas fire at sea.

5.1.3 The Contractor is required to submit the design of the EFFS in details (General system layout plan, schematic diagram with hydraulic calculation, system piping diagram, components catalogue, laboratory report, test report, test certificate, or any other information regarding the system as requested by GNC or FSD) for GNC and FSD approval at the ship design stage and any time should there be amendment. Installation of the EFFS shall only be proceeded after the approval by GNC and FSD of all of the foregoing items.

5.1.4 The Contractor shall demonstrate at Technical Acceptance to the satisfaction of GNC and FSD that the design of the system, arrangements and equipment of the EFFS are suitable for containing and smothering oil fire/liquified natural gas fire at sea.

5.1.5 The EFFS Test shall cover all components of the EFFS and shall be part of the Technical Acceptance. Unless otherwise agreed by GNC and FSD, all parts of the EFFS Test shall be performed in the presence of the GNC and FSD officers either at the shipyard of the Vessel or in the nearby waters of such shipyard.

5.1.6 To summarise, the EFFS shall meet the following requirements:

(a) Two (2) external fire pumps shall be provided ("external fire pumps" or "fire pumps" or (just in this Chapter) "pumps"). At least one of them shall be independently driven by a marine diesel engine which is not the main propulsion wing engine specified in paragraphs 8.2 and 8.3 of this Part. The other one shall be either power-take-off driven (PTO) from main propulsion centreline engine where the triple engines configuration is adopted or driven by another independent marine diesel engine in twin engines configuration which is not the main propulsion wing engine specified in paragraphs 8.2 and 8.3 of this Part**.** **[E]**.

(b) The two external fire pumps shall altogether have a minimum total water capacity not less than 40,000 L/min. Each external fire pump shall be capable to pump water at least 20,000 L/min for water/foam monitors at a discharge pressure of 10 to 14 bar according to RO and NFPA requirements and also capable to supply water to the fixed self-protection water spray system and fire hydrants for external fire-fighting (half of the total number of hydrants) on board simultaneously. The external fire pumps shall comply with the requirements more particularly specified in paragraph 5.4 below. **[E]**

(c) Each of the external fire pumps shall serve to supply water to the water/foam monitor system, fire hydrant outlets for external fire-fighting and self-protecting water spray system whilst all these systems shall be operated at the same time drawing water supply from each of these external fire pumps concurrently. These systems shall comply with the requirements more particularly described in paragraphs 5.9, 5.10 and 5.12 further below. **[E]**

(d) Two remote water /foam monitors and one manual water/foam monitor shall be provided. The two remote water/foam monitors shall be positioned both on the main deck in front of deckhouse and one manual water/foam monitor shall be positioned at the aft of the upper deck. The water/foam monitors (remote and manual) shall comply with the requirements specified in paragraph 5.15 below. **[E]**

(e) For two remote water/foam monitors, they shall be provided with remote operated control valve and the nozzle which is able to adjust the flows from 5,000 L/min to 20,000 L/min at system pressure 10-14 bars. Regarding manual water/foam monitor, control valve and the nozzle are to be provided to adjust for flows from 5,000 L/min to 20,000 L/min at system pressure 10-14 bars.

(f) All monitors shall be of jet or spray selection type which can produce a jet of throw distance at least 130 m.

(g) The response time of the EFFS shall be as short as technically practical without affecting safety and causing damage to the EFFS:

(i) Time required for ejecting water at water/foam monitors (starting from the fire pumps in

stop and valves in shut position) shall not be more than 120 seconds. The testing procedures for determining compliance with the aforesaid response time shall be approved by the representative of FSD before commencement of the test as part of the EFFS Test.

(ii) The maximum time from actuating the valves of the piping system prior to starting the fire pump to the water filling up the pipe to the monitor shall not be more than 120 seconds. The testing procedures for determining compliance with the aforesaid response time shall be approved by the representative of FSD before commencement of the test as part of the EFFS Test .

(iii) Time required to have Foam solution at foam/water monitors (after the fire pumps start) shall not be more than 120 seconds. The testing procedures for determining compliance with the aforesaid response time shall be approved by the representative of FSD before commencement of the test as part of the EFFS Test .

(l) A total of eight (8) fire hydrant outlets shall be provided for external fire-fighting operation including four (4) fire hydrant outlets of 100 mm diameter and four (4) fire hydrant outlets of 70 mm diameter. Location of the fire hydrant outlets on the fireboat should be agreed by GNC and FSD. The fire hydrant outlet shall be fitted with V-thread male coupling for 100 mm unit and 70 mm male instantaneous coupling for the 70 mm unit. The specification of fire hydrant outlet shall be complying with British Standard BS 336.

(h) Stainless steel shall be used for the piping system.

(i) One or two built-in foam tanks of not less than 5,000 L shall be provided. It shall be fitted with foam capacity indicator and proportioner shall be remotely controlled by the operating system.

(j) Sight-glass shall be fitted at the foam concentrate tank to indicate the liquid level in the tank.

5.2 **Fire Pump Engines**

5.2.1 Electrically started, fresh water-cooled variable speed fire pump engine(s) separate from the main propulsion wing engines shall be provided to drive the fire pumps (each a "fire pump engine"). Whether there shall be one or two fire pump engine depending on whether the two engine configuration (two fire pump engines applicable) or three engine configuration is adopted (one fire pump engine applicable and the other is the PTO driven by the centreline engine). References to "independent fire pump engine" shall exclude the centreline engine.

5.2.2 The power output of each fire pump engine shall be able to meet with the requirement stated in paragraph 5.1.6(b).

5.2.3 The independent fire pump engine(s) shall be set at its continuous service rating.

5.2.4 The exhaust of the independent fire pump engine shall be arranged with a waterlock/lift-silencer with a view to reducing its noise levels.

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

(b) The exhaust systems shall be designed appropriately to comply with manufacturers' requirements.

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

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

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

5.2.5 The design and installation of the independent fire pump engine(s) together with the pumping and piping system shall follow the RO and IMO requirements. For the avoidance of doubt the following requirements shall also be met:

(a) The fire pump engine(s) shall be provided with a type approval certificate issued by one of the recognised Classification Societies set out in the interpretation of "Recognised Organisations"

under Clause 1.1 of Part IV – Conditions of Contract but not necessarily the RO specified in Schedule 9 of Part V.

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

5.2.6 The controls and instrumentation of the fire pump engine(s) shall be designed for one man operation in the wheelhouse, the instrumentation and controls in the control console shall be comprehensive and include all of the following:

(a) Remote start and stop.

(b) Tachometer with running hour meter.

(c) Cooling water temperature gauge.

(d) Exhaust gas temperature gauge.

(e) Lubricating oil pressure gauge.

(f) Battery charger ammeter.

(g) Fault indicating lights and alarms.

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

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

(j) Instrumentation and alarm panel for auxiliary machinery.

(k) The control panel shall contain the following devices:

(i) Voltmeter, Watt metre for fire pump engine;

(ii) Sea water temperature and pressure gauge;

(iii) Fire pump engine expansion tank low-level alarm (audio and visual);

(iv) Fire pump engine starting battery charging ammeter;

(v) DC power on light;

(vi) Any other instrumentation devices required for the safe operation of the Vessel;

(vii) Lamp test switch;

(viii) Alarm reset, and alarm acknowledged push buttons; and

(ix) Dimmer control

5.2.7 Sufficient space and headroom in the vicinity of the fire pump engine(s) shall be allowed for local operation, inspection and routine maintenance for the fire pump engine. Procedures and sequences for (e.g. swing into proper position) complete removal of the fire pump engine(s) and fire pump designed to enable their removal from ships for maintenance without affecting to nearby engine(s). Removal from the front end of superstructure or direct from main deck can be considered but cutting of deck or shell plate is to be avoided. Support bracket and railing shall be provided to facilitate the removal work. The arrangement of piping and cable run shall also take the removal work into account if necessary.

5.3 Pumps and Piping for EFFS and Self-Protecting Water Spray System

5.3.1 Pumps and piping systems of the EFFS shall be solely used for fire-fighting (including the supply for fire hose stations) as well as for the self-protecting water spray system in fire-fighting only.

5.3.2 Both the pipe lines from the fire pumps to the water/foam monitors and the pipe lines of foam concentrate leading to the proportioner shall be suitably designed to avoid large amount of water and foam concentrate retained in the system after use.

5.3.3 The drawings of self-protecting water spray coverage area shall be provided.

5.4 External Fire Pumps

5.4.1 Two (2) external fire pumps shall be provided and they shall be **centrifugal type**. Both external fire pumps shall have identical capacity. The impellers of the fire pumps shall be made of stainless steel suitable for sea water service.

5.4.2 The minimum water pumping capacity of each fire pump and minimum total water pumping capacity shall be the in accordance with paragraph 5.1.6 (b) and 5.4.8.

5.4.3 Each external fire pump shall be provided with its own dedicated and independent sea suction.

5.4.4 The fire pumps shall have piping arrangements to prevent overheating at low pump delivery rates.

5.4.5 The arrangement for the inter-connection shall be designed and arranged to avoid system leakage, water hammer, air entrapped or whatever affecting the performance of the EFFS.

5.4.6 Suction and discharge pressure gauges, relief valves or devices if required, tachometer, and any other gauges and fittings required by the pump manufacturer shall be provided.

5.4.7 The minimum water pumping capacity of each external fire pump shall be 20,000 litres per minute for water/foam monitors at a discharge pressure of 10 to 14 bar according to RO and NFPA requirements, and simultaneously provide sufficient water for self-protecting water-spray system and fire hydrants on board. The external fire pumps shall be designed and manufactured to the satisfaction of the GNC and FSD. By sufficient water, the sufficiency level shall be further discussed at the kick-off meeting with the Contractor.

5.4.8 The discharge capacity of EACH external fire pump shall be adjustable for the range between **5,000 and 20,000 litres per minute,** against a pump discharge pressure for a throw range of **130 metres at 10 to 14 bars** at the monitor**.** This requirement shall be achieved by changing the speed of the external fire pump or by using a type of device acceptable by GNC.

5.4.9 Both external fire pumps shall be arranged so they can provide water supply to all fire hydrant outlets and in case there is a pump failure the system can remain operable to perform same function. The water distribution system of each external fire pump shall be able to be isolated by a motor driven cross-over valve in the event of a failure of any one external fire pump.

5.4.10 Pumps shall be positioned in the hull as low as possible and whenever possible be below the Vessel waterline to ensure positive suction head. If that is impracticable, pump located above waterline shall be provided with an approved self-priming system. In any case, sufficient positive suction head shall be guaranteed.

5.4.11 The materials of the external fire pumps shall be galvanic and physically and chemically compatible to the hull and any material they are associated with.

5.4.12 Net pump pressure of the external fire pumps at their rated capacity shall be **14 bars or greater**.

5.4.13 The pumps and its connecting pipes shall be hydrostatically tested according to the RO's rules or tested to gauge pressure of **15 bar or at 50%** greater pressure than the rated cut-off pressure of the pumps, whichever is greater, and using the different test case scenarios specified in Table 5.4 of Annex 5 to this Part. Hydrostatic test shall be carried out after the EFFS installation is completed. The test report shall be available on or before EFFS Test so to ensure the EFFS safe to be carried out.

5.4.14 The performance of the external fire pumps shall be tested as part of the EFFS in accordance with the NFPA 1925 : 2018 or latest version and using different test case scenarios as specified in Table 5.4 of Part VII Annex 5. The results and data shall be recorded in the Tables 5.1, 5.2 and 5.3 of Part VII Annex 5 and provided to MD and FSD for acceptance before the Vessel is delivered to Hong Kong.

5.5 Piping Systems

5.5.1 Piping systems shall be protected from overpressure.

5.5.2 All piping shall be suitably protected from corrosion and freezing and be capable of being thoroughly drained.

5.5.3 Where pipes supplying water to the monitors are passing through the propulsion machinery spaces, they shall be led through the engine room casings all the way to the monitors. If this requirement is not achievable, the complete design shall be thoroughly discussed with GNC and the FSD and obtain their

agreement before installation. This piping system must be acceptable to FSD and GNC in addition to the RO Requirements.

5.5.4 Piping passing through deck or bulkhead shall be via penetration arrangement approved by the RO and GNC. The arrangement shall not impair the water-tightness and fire insulation integrity of the bulkhead and deck. Also the arrangement shall avoid any galvanic corrosion arise.

5.5.5 Remote operated isolation valves shall be fitted to separate the fire main system from the water monitors and the water sprays systems.

5.5.6 Pressure regulating means shall be used such that the fire main system can operate independently and/or simultaneously with the fire monitors and/or water spray system.

5.5.7 All pipes, flanges, valves etc. in the piping system shall be made of a suitable grade of stainless steel material and thickness and to avoid corrosion happening within expected ship life of 20 years.

5.5.8 Adequate piping support arrangement shall be decided by GNC and FSD in addition to the RO Requirements.

5.5.9 Where flanges are used to join piping or to facilitate removal of valves for service, a support shall be provided not more than 0.6 m from the joint.

5.5.10 Bracing shall be provided to resist the nozzle reaction of discharge devices.

5.5.11 Provision shall be made for the expansion or contraction of piping and for stresses in the piping due to temperature changes or flexing of the hull, in accordance with the RO Requirements.

5.5.12 Drains shall be provided to drain all portions of the discharge and distribution piping.

5.5.13 A small drain line (by a valve) that bypasses each pump check valve shall be provided to permit drainage of the discharge piping.

5.5.14 Fire pump discharge piping shall be designed for a working pressure not less than the maximum cut-off pressure of the pump(s) fitted.

5.5.15 Piping systems shall be designed to avoid water hammer and similar hydraulic shocks within the system and providing the means to purge air from the piping system at low flow velocities.

5.5.16 Piping systems arrangement shall be submitted for the RO, GNC and FSD approval.

5.6 Water Suction and Discharge

5.6.1 Suction pipe lines shall be designed to avoid cavitation.

5.6.2 Fire pump discharge velocity at the water monitors shall not exceed 4 m/s.

5.6.3 Means and/or facilities shall be provided for the gradual filling of the pipe up to the monitor level with water before the full capacity of pump is allowed to be engaged.

5.6.4 The suction arrangement for each pump shall include at least one dedicated sea chest with screened inlet, suction filter, a valve at the sea chest outlet, and a valve vent to atmosphere.

5.6.5 Sea-suction filter shall be provided for each pump and shall be easily accessible for maintenance and operation while the vessel is afloat.

5.6.6 Where looped sea chest outlet piping is needed and provided, a valve shall be provided at or near the suction inlet of each pump.

5.6.7 The opening area of the screen shall be at least two times the cross-sectional area of the suction pipe.

5.6.8 The intakes to all fire pumps shall be fitted with a means of clearing while the Vessel is afloat.

5.7 Sea Chests and Valves

5.7.1 Sea chests for fire-fighting shall not be used for any other purposes.

5.7.2 Sea water inlets for fire-fighting and sea chests shall be arranged as low as practical to avoid clogging due to debris or oil intake from sea.

5.7.3 The location of sea water inlets for fire-fighting and sea chests shall be such that water suction shall not be impeded by ship motions or water flow from water-jet suction.

5.7.4 The design of the sea inlets shall ensure an even and sufficient supply of water quantity to the pumps.

5.7.5 All motor driven valves shall be capable of being operated manually.

5.7.6 **Strainer Plates**: All sea water inlets at sea chests shall be fitted with strainer plates at the Vessel's shell. The strainer plates shall have a clear area of at least twice that of the sea valves. The edges of strainer plate slots or holes shall be rounded to prevent the cavitation. Compressed air or other effective means shall be provided for clearing off the strainer plates.

5.7.7 **Valve**: Each sea water inlet for fire-fighting shall be equipped with a shut off valve. The leading edge of inlet pipe shall be rounded to avoid the formation of cavitation.

5.8 Operation of External Fire Pumps and Valves

5.8.1 The external fire pumps, the sea water shut off valve and the sea water discharge valve shall be operable locally as well as remotely.

5.8.2 All valves shall be remotely controlled where applicable otherwise needs approval by GNC and FSD. All fire pump suction valve, discharge valves and the concerned control valves shall be RO approved motor driven type. The discharge valve shall be with non-return arrangement.

5.8.3 Starting of the external fire pump when the shut off valve is closed must be prevented by providing an interlock system together with audible and visual alarms in the engine room and at the wheelhouse.

5.8.4 All fire pump discharge valves shall be motor driven screw-down non-return type and the suction valves shall be of motor driven globe type.

5.8.5 All motor driven valves shall be capable of being manually operated.

5.8.6 On/Off control and indication for all valve positions shall be provided on the guidance schematic diagram control panel on the External Fire-Fighting Control Panel (EFCP).

5.8.7 The External Fire-Fighting Control Panel (EFCP) drawing shall be approved by the RO and it must also be acceptable to GNC and FSD before the installation of the EFFS.

5.8.8 All the control valve of the system shall be remotely controlled and capable of being locally operated by local control panel with control change-over selector switch and on/off indicator.

5.9 Fire Hydrant Outlet and Hose Station

5.9.1 Eight (8) fire hydrant outlets (three at port side, three at starboard side and two at bow) shall be located on the main deck on each side of the Vessel.

5.9.2 One 70 mm diameter and two 100 mm hydrant outlets at each station of bronze or gunmetal construction with valves at base should be fitted at port and starboard sides. Two 70 mm diameter hydrant outlets at bow station of bronze or gunmetal construction with valves at base shall be fitted.

5.9.3 The 70 mm diameter hydrant outlet shall be fitted with light alloy 70 mm male instantaneous coupling. The 100 mm diameter hydrant outlet shall be fitted with light alloy 100 mm V-thread male coupling. Each hydrant / outlet shall be conformed with BS 336 standard and be controlled by a wheel-operated screw valve designed to open by counter clockwise rotation. The direction of opening the of the valve shall be clearly engraved in both English and Chinese on the wheel of the valve.

5.9.4 The centre of hydrant outlet couplings shall be not less than 800 mm nor more than 1200 mm above the finished deck level. The hydrant shall not obstruct wholly, partly or indirectly any door opening, or the required width of access to and from the bow and stern. The hydrant shall be so sited as not to be concealed by the leaves of an adjacent door when that door is opened.

5.9.5 At least half of the total number of hose connections shall be operated simultaneously with a pressure capable of producing a water jet flow of at least 12 m.

5.9.6 Minimum water flow requirement for the fire hydrant outlet:

(a) For 70 mm diameter outlet, each outlet shall have a flow of 450 L/min at a running pressure of not less than 3.5 bars. All 70 mm diameter outlets shall be operated simultaneously, the aggregate flow of not less than 1,800 L/min.

(b) For 100 mm diameter outlet, each outlet shall have a flow of 1,350 L/min at a running pressure of not less than 3.5 bars. All 100 mm diameter outlets shall be operated simultaneously, the aggregate flow of not less than 5,400 L/min.

A testing scenario as per table 5.4 of Annex 5 to Part VII and water flow rate test shall be performed in accordance with the testing scenario.

5.9.7 The pressure at any fire hydrant outlet shall not exceed 8.5 bars.

5.10 Self-Protecting Water Spray System

5.10.1 For the Fire-fighting Mode operation, a permanently installed Self-Protecting Water Spray System shall be provided to protect all exposed decks and external vertical areas of the hull, superstructure and deckhouses, including water monitor foundations and equipment associated with the water monitors. All the piping, valves and nozzles of the water spray system shall be suitably protected from damage during fire-fighting operations. The system shall be remotely controlled in the EFFS control panel located in the bridge.

5.10.2 During the water spray operations, all round visibility from the navigating bridge and from the monitor's remote-control station shall be maintained.

5.10.3 The system shall avoid the obstruction of sight vision of the coxswain and officer. If this is unavoidable, there shall be provided a remote operated control valve to temporarily shut off the water-spray in front of the navigating bridge.

5.10.4 The fixed self-protection water-spraying system shall be divided into sections so that it is possible to isolate sections covering surfaces which are not exposed to radiant heat. Remote control for sectionalizing the spray system shall be provided in the EFFS control panel.

5.10.5 The water spray system shall be well protected from corrosion. Suitable drainage arrangements shall be arranged on deck.

5.10.6 Extra deck scuppers and freeing ports (in addition to the Vessel's normally designed scupper and drainage system) shall be provided to provide efficient drainage of water from deck when the water-spray system is in operation.

5.10.7 The self-protecting water spray system shall be capable to be drained empty when the system is not in use.

5.10.8 The entire pipeline shall be easily accessible for maintenance. The connection of piping shall be used fitting joint and/or flange.

5.10.9 The piping diagram of the system shall be submitted to GNC and FSD for prior approval before installation.

5.11 External Fire-Fighting Control Panel (EFCP)

5.11.1 Remote control of the EFFS shall be centralised on an "External Fire-Fighting Control Panel" ("EFCP") located in the wheelhouse and in the engine room control console. The system shall be powered by 24 volt DC.

5.11.2 The EFCP shall include the followings:

(a) A miniature diagram of the whole EFFS (from sea suction chest to fire monitor on deck with valve position indicator lamps for all the major valves including suction and discharge valves of all external fire pumps, cross-over valve, isolating valves for fire monitors and fire hydrant outlets on deck, inlet valves for the pump inductors, foam tank outlet valve, all foam supply valves etc.,);

(b) Remote start-stop of PTO external fire pump (if applicable), clutch in or out operation;

(c) Remote start-stop of independent diesel engine driven external fire pump, clutch in or out operation;

(d) Fire main pressure gauges (one gauge for each of the two zones) minimum diameter 100 mm;

(e) Remote controls for all remotely controlled water/foam monitors;

(f) Remote operation for all remotely controlled valves;

(g) Pressure indication for all suction and discharge lines;

(h) Operation of the external fire pump priming unit (if applicable);

(i) Remote speed control of fire pumps;

(j) Fault indicating alarms;

(k) Foam line pressure/vacuum compound gauge;

(l) Foam tank content repeater;

(m) Lamp test button;

(n) Alarm mute push button;

(o) Remote controls for self-protecting water spray system;

(p) Dimmer switch for control panel; and

(q) Protective devices such as overspeed and others as recommended by the manufacturer.

5.12 **Water/Foam Monitor System**

5.12.1 All water/foam monitor system ("water/foam monitor system") (including remotely operated and manually operated) shall provide with foam expansion ratio of 15 to 1 and shall be capable of throw range of 130 m. The performance shall still be maintained when they are operating in simultaneous operation at maximum foam output. The foam concentration tank shall have a minimum capacity for 30 minutes foam production at an assumed admixture of 1 percent.

5.12.2 The water/foam monitor system shall be of a fixed installation design with separate foam concentration tank, foam mixing unit and pipelines to the water/foam monitors. The water supply shall be taken from the fire pumps. Means to reduce supply water pressure shall be provided to assure correct water pressure for maximum foam generation.

5.12.3 The two (2) remote water/foam monitors shall be controlled remotely at the EFCP located in the wheelhouse.

5.12.4 The foam discharging system shall be designed for discharging foam solution (mixture of 1% Alcohol Resistant AFFF Concentrate (foam liquid) and 99% sea water via the EFFS within one (1) minute after starting of fire pump.

5.12.5 Foam concentrate shall be supplied by the Contractor for testing and for the topping up the foam concentrate tank to the operating level as part of the requirements of Technical Acceptance.

5.12.6 A fresh water flushing system for the foam discharge piping shall be provided.

5.12.7 The Vessel shall be capable of supplying the power required by the foam-proportioning system in addition to the requirements of the other power-dependent systems installed on the Vessel.

5.12.8 The materials and system components used in the construction of the foam concentrate storage and proportioning and delivery system shall be compatible with the concentrate as specified by the foam manufacturer.

5.12.9 The foam-proportioning system shall be designed to operate with the type(s) of foam concentrate (specified by the FSD in the kick-off meeting).

5.12.10 At the kick-off meeting, the Contractor shall provide FSD with a list of components of the water/foam monitor system of the EFFS (including pipes, flanges, level meters, valves, pressure gauges and flowmeters) together with catalogue published by the manufacturer indicating the standard achieved by each such component, e.g. British Standard, NFPA, and so on. Relevant test report or test certificate confirming compliance with such standard shall also be provided to FSD during the kick-off meeting.

5.13 **Foam Concentrate Tank**

5.13.1 One or two built-in foam tanks of a total capacity not less than 5,000 L and fitted with foam capacity indicator and proportioner shall be remotely controlled by an operating system.

5.13.2 The foam concentrate tank(s) shall be provided with a protected fill opening that is designed to facilitate the operator's filling the tank from 20 litres foam concentrate containers. A fill opening with an area of at least 2,320 mm^2 shall be provided. The opening shall be protected by a removable cover and screen. The cover shall be attached to the tank by mechanical means to prevent air from entering or escaping during normal service.

5.13.3 The foam concentrate tank(s) shall incorporate an expansion compartment or dome located so that foam concentrate enters this compartment only after the entire main tank compartment is completely filled. The volume of the expansion compartment shall be not less than two (2) percent of the total foam concentrate tank volume. A pressure/vacuum vent shall be provided to adjust automatically for changes in pressure when filling or withdrawing foam concentrate from the tank.

The pressure/vacuum vent shall not permit outside air to enter the tank freely except during operation or for normal changes in volume due to changes in temperature.

5.13.4 The foam concentrate tank(s) shall be designed and constructed to facilitate cleaning the inside of the tank. A removable top allowing access to the tank or a removable personnel access hatch with a minimum inside diameter of 510 mm shall be provided.

5.13.5 The foam concentrate tank(s) shall have a sufficient number of swash partitions so that the maximum dimension of any space in the tank, either transverse or longitudinal, shall not exceed 1,220 mm and shall be not less than 584 mm. The swash partitions shall have vents and openings at the top and bottom to permit movement of air and foam concentrate between compartments to meet the maximum flow requirements of the foam-proportioning system.

5.13.6 The foam concentrate tank(s) outlet connection shall be connected to a sump located in the bottom of the tank and shall permit discharge of at least 95 percent of the tank's capacity. The discharge shall be protected by an anti-swirl baffle in systems where the foam concentrate delivery rate exceeds 20 litres per minute.

5.13.7 The foam concentrate tank(s) inlet connection shall terminate within 51 mm of the tank bottom to prevent aerating the foam concentrate.

5.13.8 A drain valve shall be provided in the sump of the foam concentrate tank.

5.13.9 The foam tank is to be substantially constructed and hydraulically tested to 2.45 metre water head above the top of tank crown or to the top of overflow, whichever is the greater. It shall be provided with the following stainless steel fittings leading to the main deck.

5.14 Foam Concentrate Pump/Foam-Making Circuit

5.14.1 The foam concentrate pump shall operate at a speed that prevents cavitation and foaming in the water/foam monitor system when delivering maximum design flow.

5.14.2 The foam concentrate pump shall deliver the flow and pressure.

5.14.3 The foam concentrate pump shall suitable for 1% to 3% foam concentrate.

5.14.4 A relief valve or other over pressure limiting device shall be provided in the water/foam monitor system to protect the foam concentrate pump.

5.14.5 A strainer designated by the foam concentrate manufacturer shall be installed on the intake side of the foam concentrate pump so that any foam concentrate entering the water/foam monitor system passes through the strainer.

5.14.6 A gauging device for determining remaining foam concentrate volume in the tank or a foam level indicator of an approved type with toughened glass and protection shall be provided.

5.15 Water/Foam Monitor

5.15.1 Two (2) remote water/foam monitors and one (1) manual water/foam monitor shall be provided and installed on main deck in front of deckhouse (remote water/foam monitors) and at the aft upper deck. (manual water/foam monitor) respectively.

5.15.2 All Water/foam monitors shall be located so as to allow for an unobstructed range of operation. Means shall be provided to prevent monitor jets from impinging on the Vessel structures and equipment.

5.15.3 Monitor foundations and structural supports shall be designed for all modes of operation, with particular attention given to loadings at maximum output and water jet reactions. **Calculations demonstrating adequacy of the design, including water jet reaction specified by the monitors' manufacturer,** shall be submitted to GNC and FSD in the design stage for approval. No installation is allowed without any approval from GNC.

5.15.4 Remote water/foam monitors shall be capable of being operated and manoeuvred manually at local station and remote-control from wheelhouse. The monitor remote-control station shall have adequate overall operational visibility, including that of the water trajectory elevation, means of communication and protection from heat and water spray.

5.15.5 Means shall be provided to prevent damage to the vessel's structure or equipment from the operation of the monitors.

5.15.6 Control systems shall be suitably protected from external damage and extreme working environment. Electrical control systems shall be provided with overload and short circuit protection. Shut-off and control equipment shall be clearly marked.

5.15.7 Control for the nozzle rotation, elevation and discharge pattern shall be located not less than 0.9 m and not more than 1.8 m above the deck or platform that serves as the operator's station for that monitor.

5.15.8 Water/foam monitors shall be brass and stainless steel construction suitable for operation at a maximum pressure of 200 p.s.i. (13.788 Bar) and with the following characteristics:

	Remote and Manual Monitors **[at port side and starboard side, see para. 5.1.6 (d)]**
Application	Alcohol Resistant AFFF Concentrate 1% to 3%
Minimum Flow Rate	5,000 L/min at 10 bars
Minimum Throw Range	$\geqslant$ 130 m (Water) with water supply of 5,000 litres/min at 10 bars
Vertical Movement	-20^{o} to $+70^{o}$
Rotation Angle	270^{o} Continuous
Type of Stream	Full Jet / Spray

5.15.9 A remote control valve, pressure gauge and pedestal pipe base of suitable height shall be provided for each monitor.

5.15.10 The Contractor shall demonstrate the following to the satisfaction of GNC during the EFFS Test as part of the Technical Acceptance:

(a) Operating pressure into and discharge from foam proportioning system complying paragraph 5.15.8 of this Part;

(b) Flow rate of foam solution discharge available at each individual outlet equipped with a foam proportioning device complying paragraph 5.15.8 of this Part; and

(c) Concentration of foam solution discharge from proportioning device complying paragraph 5.15.8 of this Part.

5.15.11 All gauges, flow-meters, and indicators shall be located so they are readily visible. All gauges or flow-meters shall be mounted in a manner to protect the gauge from physical damage and from excessive vibration.

5.15.12 A shutoff valve shall be provided in the supply to each monitor.

5.15.13 Each system monitor and nozzle shall be operated and the pressure recorded to verify its performance in accordance with manufacturer's specification.

5.16 Nameplates and Instruction Plates

5.16.1 All labels and markings shall be in both English and in traditional Chinese and be of a type permanent in nature, shall be capable of withstanding the effects of extreme weather and temperature, and shall be attached in a manner that requires mechanical means to remove.

5.16.2 A nameplate shall be provided for each control, gauge, and indicator that is clearly marked with the identification and function of that device.

5.16.3 An instruction plate shall be provided for the water and foam-proportioning system that includes, as a minimum, a piping schematic of the system and basic operation instructions.

5.16.4 Foam concentrate trade names shall not be substituted for foam solution percentage ratios on instruction plates.

5.16.5 A label that reads "Foam Tank Fill" shall be provided at the foam tank fill opening and shall indicate the type and proportioning percentage of concentrate.

Chapter 6 Fire Safety Equipment

6.1 General Provisions

6.1.1 This chapter shall apply to the fire protection system for the Vessel itself.

6.1.2 Engine room compartment 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.

6.1.3 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.

6.1.4 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.

6.1.5 The arrangement of pipes, ducts, electrical cables etc., penetrating into the engine room's 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.

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

6.1.7 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.

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

6.1.9 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.

6.1.10 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.

6.1.11 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.

6.2 Fire Detection System

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

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

6.2.3 The fire 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.

6.2.4 Fire detectors shall be installed in all compartments of the Vessel. Detection system using only thermal detectors shall not be permitted unless in spaces of restricted height and where their use is especially appropriate.

6.3 Fixed Fire-Extinguishing System for Unattended Engine Room

6.3.1 Engine room fire extinguishing systems shall be a fixed CO_2 flooding system complying with the RO regulations for engine room protection. Activation of the CO_2 system shall cause an audio and visual warning alarm in the wheelhouse and the engine room. The system shall be approved by the RO.

6.3.2 The CO_2 bottles for the system should be stowed preferable at the aft as indicate on the Guidance General Arrangement Plan.

6.3.3 The CO_2 bottles shall be properly protected from weather.

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

6.4 Portable Fire Extinguishers

6.4.1 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. In addition, at least one extinguisher suitable for machinery space fires shall be positioned outside each machinery space entrance.

6.4.2 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.

6.4.3 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.

6.5 Fire Pumps

6.5.1 The shipboard systems shall follow the RO classification requirements as well as the IMO requirements for passenger carrying vessel. Unless specified as not required (or otherwise with alternative requirements) in the TS, the following requirements shall be met:

(a) At least two independently driven pumps shall be provided. The arrangement of the pumps shall be such that in the event of a fire in any one compartment, all the fire pumps will not be put out of action.

(b) Isolating valves to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main shall be fitted and easily accessible and tenable position outside the machinery spaces. The fire main shall be so arranged that when the isolating valves are shut all the hydrants on the Vessel, except those in the machinery space referred to above, can be supplied with water by a fire pump not located in this machinery space through pipes which do not enter this space. The spindles of manually operated valves shall be easily accessible and all valves shall be clearly marked.

(c) Hydrants shall be so arranged that any location on the Vessel can be reached by the waterjets from two fire hoses from two different hydrants, one of the jets being from a single length of hose.

(d) Each fire hose shall be provided with a nozzle of an approved dual purpose type (i.e. spray/jet type) incorporating a shutoff.

6.6 Fire Control Plan

6.6.1 The fire control plan shall be permanently displayed for the guidance of the ship's crew at main deck cabin, using graphical symbols in accordance with updated IMO Resolution as amended.

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

6.6.3 The plan shall show the followings (but not limiting to, as agreed by GNC):

(a) Date of the approval of the plan;

(b) The wheelhouse and the control console/station;

(c) Areas and compartments of the Vessel enclosed by fire-resisting divisions;

(d) Particulars and locations of the fire alarms;

(e) Fire detection systems and the location and type of fire detectors;

(f) Location and type of the fixed and portable fire-extinguishing appliances;

(g) Means of access to the various compartments and decks;

(h) Ventilating system and their shut-off, and damper particulars (including particulars of the master fan controls, the positions of dampers and identification numbers of the ventilating fans serving each section of the Vessel);

(i) Position of all means of control referred to in quick closing valve for fuel tanks, engine room ventilation and fans; and

(j) The text of such plan shall be in the languages of English and Chinese.

6.7 Additional Protection

6.7.1 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 minutes (can be adjusted), the audible and visual alarm shall be extended externally to an audible and visual alarm fitted on the top of the deckhouse to bring the attention of the persons ashore or the guard of the Government Dockyard.

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

Chapter 7 Lifesaving Appliances (LSA) and Arrangements

7.1 General Provisions

7.1.1 In addition to the following requirements, LSA shall follow IMO international regulations and requirements as well as the RO Requirements and any additional and/or specific requirements given in the TS.

7.1.2 Wheelhouse shall be provided with a self-igniting light and a self-activating smoke signal. The positioning and securing arrangements of the self-activating smoke signal shall be such that it cannot be released or activated solely by the accelerations produced by collisions or groundings.

7.1.3 At least one lifebuoy shall be provided adjacent to each exit from the main deck cabin and emergency exit from crew space.

7.1.4 Lifebuoys shall be fitted with buoyant lines of at least 30 metres in length.

7.1.5 All lifebuoys shall be fitted with self-igniting lights.

7.1.6 All lifejackets shall be fitted with a light, which complies with the requirements of the LSA Code.

7.1.7 Lifejackets shall be so placed as to be readily accessible and their positions shall be clearly indicated.

7.1.8 In addition to the other lifejacket requirements in the LSA Code, the name of the Vessel shall be painted on each side of the lifejackets on board. The size of the ship name shall be decided by GNC, and the paint quality shall be of a type that would not cause damage to the lifejacket surface material.

7.1.9 Lifebuoys shall be painted with the Vessel's name.

7.1.10 All lifebuoys, lifejackets and life-rafts shall comply with Hong Kong local vessel requirements in terms of their number of supply and the quality standard. Details of these supplies shall be submitted to GNC for approval.

7.1.11 Additional and any specific requirements for the operational requirements of the Vessel given in the TS shall be met.

7.2 Rescue Life Raft

7.2.1 80-person reversible inflatable life rafts (without canopies and survival kits) is to be provided to pick up in –water survivors at the accident spot. The life rafts are then towed to the Vessel for the transfer of survivors by small rescue boats. It is to be stowed on the bridge deck and secured on foldable (extensions) racks in such a manner that launching of the rafts shall not induce any injury to person on board and damage to the Vessel. The stowage arrangement of the life rafts is to be approved by MD.

Chapter 8 Machinery

8.1 General Requirements

8.1.1 The Tenderer should note that the Vessel are for use in Hong Kong and it is desirable that the main engines, gearboxes, water jet (if applicable) together with associated system, electric generator sets and any other machinery offered by the Tenderer are those at present commonly used by ships operating in Hong Kong Waters, and that they have good support for spare parts and after sale services locally in Hong Kong.

8.1.2 The Vessel shall be equipped and fitted with all machineries described each complying with the specifications set out in this Chapter for such machinery. The spare parts to be provided shall be of the model or version of the same product series from the same manufacturer as supplied for the Vessel and shall equally comply with all specifications set out in this TS including this Chapter.

8.1.3 The machinery spaces shall refer to the engine room compartment, Generator Room, Bow thruster Compartment and other all compartment and spaces containing machinery require routine operation and maintenance.

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

8.1.5 Two accesses with reasonable separation shall be provided for the machinery spaces. The design of the engine room layout shall be approved by RO and agreed by GNC. The machinery, associated piping systems and fittings relating to the main engines and electric generator sets shall be of a design and construction adequate for the service for which they are intended and shall be 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.

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

8.1.7 Lifting brackets for moving heavy equipment shall be mounted underneath the deck head of the engine room, the engine room entrance and other appropriate locations. If the routing of engine removal might come into inside of superstructure, lifting bracket and railing shall be provided to facilitate the removal work. The arrangement of piping and cable run shall also take the removal work if necessary. The lifting capacity shall be marked on every of these lifting brackets after a load test.

8.1.8 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 respectively such as the main engines, gearboxes, generator set, fuel oil tanks etc. shall be carefully designed to enable their removal from ships for maintenance in a practicable manner so to avoid the need for the deck or shell plate to be cut.

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

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

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

8.2 Main propulsion System

8.2.1 The main propulsion system comprises two or three marine diesel engines (viz., two wing engines; or two wing engines and one centreline engine, and each a main propulsion engine). Fixed pitch

propellers propulsion shall be adopted for the 'P' and 'S' marine diesel engines (main propulsion wing engines).

8.2.2 The main propulsion centreline engine (applicable where a triple engines configuration is adopted) shall drive a water jet system as specified in paragraph 8.10 of this Part or a propeller system as specified in paragraph 8.11 of this Part.

8.2.3 Each of the main propulsion engines, including the two wing engines, and (where the triple engine configuration is adopted) also the centreline engine, shall be electrically started, fresh water-cooled marine diesel engines and of adequate power, and altogether (viz., all two or all three engines depending on the adopted configuration) shall achieve the Contract Speed at 100% MCR. The two wing engines shall be identical model with same power rating. The rating of the main propulsion engines shall be required for the Vessel with annual operation of 3000 hours. The diesel engines shall meet IMO Tier II emission requirements.

8.2.4 Type-approved certificates issued by any one of the classification society listed in the definition of "Recognised Organisation" in Clause 1.1 of Part IV but not necessarily the RO specified in Schedule 9 of Part V proving compliance with IMO Tier II emission requirements shall be provided and attached to Schedule 7 of Part V.

8.2.5 The Tenderer is required to submit the estimated propulsive power and characteristic curves of the main propulsion engines for the Vessel to support its claim for the achievable 25 knots Contract Speed with all two or all three main propulsion engines (depending on the engine configuration adopted) running at 100% MCR. **[E]**

8.2.6 Manufacturer's full power shop trial certificate for a continuous running test at full load for four hours for each main propulsion engine (viz., the two wing engines and where applicable the centreline engine) must be submitted to MD before the Official Sea Trial.

8.2.7 It is desirable that based on the type approval certificate issued by any one classification society within the definition of "Recognised Organisations" in Clause 1.1 of Part IV, the emission level of each of the offered main propulsion engines (two wing engines and if the Tenderer proposes the three engines' configuration, also the centreline engine) of the proposed Vessel complies with a standard higher than the International Maritime Organization (IMO) Tier II emission requirements. **[D]**

8.3 Main Propulsion Wing Engines

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

8.3.2 Flexible mounting shall be used for containing the noise levels in accommodation spaces not to exceed 80 dB(A).

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

8.3.4 The design of main propulsion wing engines and control system shall be approved by the RO.

8.3.5 The two main propulsion wing engines shall be connected to the propulsor via a reduction gearbox through a flexible coupling.

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

8.3.7 All main propulsion engine's exhausts and silencers shall be protected according to the RO Requirements 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 the hangers which will not transmit heat, noise or vibration to the Vessel' structure. The exhaust outlets shall be designed to be positioned on the shell above the waterline.

8.3.8 The governor control of the propulsion wing engines must be capable of proper control when the engine is suddenly unloaded from a fully load condition due to racing as the propeller suddenly emerges out of water.

8.3.9 In case of any failure of the governor, alarm (which is with individual indication visual and sound signals) shall be sounded and signalled in the wheelhouse.

8.3.10 Main propulsion engines shall always be in a standby mode and being pre-lubricated.

8.4 Wing Engines Propulsion System - Propeller Shafts, Stern Tubes, Propellers

8.4.1 All the components of the shafting system shall be in accordance with the RO Requirements.

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

8.4.3 Stern Tubes

(a) Water lubricated stern tubes shall be Type Approved by the RO. Propeller shaft bearing shall be RO approved, water-lubricated composite type. Forward and after ends of stern tubes shall be bored for bearings and a dripless shaft seal system shall be fitted to the inboard side of each stern tube.

(b) The material of the stern tube should be bronze / stainless steel 316.

8.4.4 The propeller shafts shall be manufactured from corrosion resistant material, such as 316 stainless-steel or equivalent approved by the RO and to satisfaction of GNC.

8.4.5 The propellers shall be of fixed pitch type and designed to minimize the cavitation and vibration in shell plating and hull girder.

8.4.6 Propellers shall turn outboard over the top when the Vessel is moving ahead.

8.4.7 Propellers shall be selected to achieve the Contract Speed with 100% Maximum Continuous Rating.

8.4.8 The materials for shaft brackets, shafts, keys, locking nuts shall be compatible for use with the hull and propeller materials. All components shall be designed and submitted for approval by RO.

8.4.9 Each propeller shall be fitted with a rope-cutting device without inducing adverse flow to the propellers.

8.4.10 The propellers and stern tubes shall be protected by a cathodic protection system for 2 years' service life from Delivery Acceptance.

8.4.11 Torsional vibration analysis of the engine and propeller shafting system shall be submitted to the RO for approval and then submitted to GNC for acceptance.

8.5 Main Propulsion Wing Engine Control

8.5.1 The design and installation shall follow the RO Requirements which has approved the design and IMO requirements (where applicable also complying to HSC requirements).

(a) For the avoidance of doubt the following requirements shall also be met:

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

(ii) The Wheelhouse Engine Control Console (W/H E.C.C.) in wheelhouse shall be designed for one-man operation. The control console and control box shall centralise all the instrumentation and control devices for the remote operation of the main and major machinery on board. There shall be Engine Room Control Consoles (E/R C.C.) for each engine compartment. These E/R C.C. shall be interlinked.

(iii) Comprehensive instrumentation and control devices for the main propulsion engines shall be provided at the W/H E.C.C. for remote operation. There shall also be simplified systems installed at the E/R C.C. for emergency engine room controls in the event of the failure of the remote control system in the wheelhouse.

(iv) For both the W/H E.C.C. and E/R C.C., for each piece of machinery shall be provided for emergency operation in the event of a complete failure of the control systems.

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

(vi) These units shall be the signal sources for the W/H E.C.C. and E/R C.C. gauges and communication panels. If LCD is used for this system, it shall be so arranged that light

signal emitted is easily seen by the operator.

(vii) All rescue and berthing controls shall be controlled from inside the wheelhouse.

(b) General Requirements for the Control System

(i) The W/H E.C.C. shall be arranged at the wheelhouse front at the steering position.

(ii) The E/R C.C. shall be arranged at a suitable location in the engine room.

(iii) The remote control systems at the W/H E.C.C. shall be electronically operated.

(iv) The remote control system shall be a standard control package supplied by the manufacturers of the main engine and the gear box. Technical information of the remote control system shall be submitted to GNC for acceptance and approval before installation.

(v) Control System at Engine Room Control Console (E/R C.C.)

Simplified engine room control system at E/R C.C. shall be provided. They shall operate independent of the W/H E.C.C. system, and they shall be either mechanically or electrically operated (as recommended by the manufacturer).

(vi) Wheelhouse Engine Control Console (W/H E.C.C.)

The following instrumentation and control devices shall be provided at the W/H E.C.C.:

1. Start/stop keys or push buttons to be fitted with guard cover and running / stop indication lamp for each of the four main engines;
2. RPM control device for each of the four main engines;
3. Clutch control and on/off indication devices for each of the clutches used in the propulsion and M/E driven fire pump system;
4. Shaft tachometers; and
5. Wheelhouse/engine room change-over switch and indicator.

(vii) The controls and instrumentation of the main engines are to be designed for one man operation in the wheelhouse, they shall be ergonomically laid out and grouped around the steering position in the W/H E.C.C.

(viii) Instrumentation and controls in the control console shall be comprehensive and shall include:

1. Starting and stopping of main engines from the wheelhouse;
2. Emergency stop button with guard cover;
3. Wheelhouse /engine room control change over switch and indicator;
4. Speed control device;
5. Engine tachometers with running hour meter;
6. Sea water cooling pressure;
7. Coolant water temperature and pressure;
8. Engine lubricating oil temperature and pressure gauges;
9. High cooling water temperature alarm and de-rate function;
10. Engine low lubricating oil pressure alarm and trip;
11. Gearbox lubricating oil low pressure gauge;
12. Gearbox lubricating oil low pressure alarm and trip;
13. Ammeter for each engine;
14. Engine exhaust gas pyrometer;
15. Fresh water tank content gauge;
16. Fuel oil tanks content gauge;
17. Overspeed alarm and trip;
18. Main engine expansion tank low level alarm;
19. Battery charging control lamps;
20. DC power on light;
21. Central illumination dimmer for all light in the control console;
22. Lamp test;

23. Alarm test and reset;
24. An engine control panel in the engine room; and
25. Any other instrumentation recommended by the engine maker and GNC.

8.6 Reduction Gearboxes

8.6.1 One reversible reduction gearbox for each of the main propulsion wing engines and where applicable the main propulsion centreline engine shall be resilient-mounted to the ship's structure (collectively, "reduction gearboxes"). Gearboxes shall be provided with clutches, alarm senders, and switches complying with the following specifications.

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

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

(c) In order to operate at the loitering speed of maximum 5 knots, repeated cycling of the clutches in and out of gear is not permitted in any case to obtain low speed operation. If required the Vessel shall be fitted with a gearbox configured with a trolling clutch to permit low-speed operation.

8.6.2 Each reduction gearbox shall be provided with alarms for low oil level and high oil temperature. Alarms shall be repeated both locally and at the wheelhouse.

8.6.3 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 reduction gearbox.

8.7 Steering Gear System

8.7.1 The steering gear system shall be a twin rudder arrangement. It shall comply with the RO Requirements.

8.7.2 The main steering gear and rudder stock shall be:

(a) Of adequate strength and capable of steering the ship at maximum ahead service speed which shall be demonstrated; and

(b) Capable of putting the rudder over from 35° on one side to 35° on the other side with the ship at its deepest seagoing draught and running ahead at maximum ahead service speed and, under the same conditions, from 35° on either side to 30° on the other side in not more than 28s.

8.7.3 Electro-hydraulic steering gear with two independent power units, each running unit shall be capable of providing the maximum torque operating on the rudders. A selector switch shall be installed in the Wheelhouse to enable the crew to run any of the units or both.

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

8.7.5 The rudder(s) shall be controlled by a helm wheel and joystick in the control station of the wheelhouse. The Coxswain shall be able to use either helm wheel or joystick. The helm wheel shall be of a non-skid type of appropriate size acceptable to GNC. The power electro-hydraulic pumps shall be capable of being started and stopped both in wheelhouse and the steering gear room. Individual back-up control shall also be provided.

8.7.6 Individual illuminated rudder angle indicators with dimmer switch, running and overload alarm should be provided at the Wheelhouse Control station and the steering gear room.

8.7.7 An emergency steering system shall be provided in accordance with the RO Requirements.

8.7.8 A change-over switch shall be provided at the Wheelhouse Control station for switching the steering control between the wheelhouse and local control in the steering gear room.

8.8 Rudders and Rudder Stocks

8.8.1 The rudders shall be designed, manufactured and installed in accordance with the RO Requirements.

8.8.2 Local rudder angle indicators shall be fitted at the suitable locations in the steering gear room with identity of each rudder. The port and starboard degree markings in intervals not greater than one (1) degree shall be permanently marked and distinguished by red (port) and green (starboard) in English and Traditional Chinese.

8.8.3 Extremes of rudder travel shall be provided with mechanical stoppers to the satisfaction of the RO and GNC.

8.8.4 The rudder stock and rudder blade shall be of 316 stainless steel or equivalent and shall be designed, manufactured and installed to meet the RO Requirements.

8.8.5 Upper bearings shall be provided with an automatic greasing unit.

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

8.9 Main Propulsion Centreline Engine

8.9.1 This section applies only if the triples engine configuration is adopted.

8.9.2 The main propulsion centreline engine shall drive a water jet system or propeller system in a triple engine configuration through drive shaft. A flexible coupling shall be fitted between the gear box and impeller/propeller shaft of the propulsor. Where the impeller/propeller shaft penetrate the watertight bulkhead, a watertight bulkhead seal shall be provided.

8.9.3 The main propulsion centreline engine shall be connected to an external fire pump at the other end (or another power-take-off) via a clutch, gearbox, and flexible coupling arrangement.

8.9.4 To avoid overloading the main propulsion centreline engine, an interlocking device, which is subject to MD approval, shall be provided to constrain gearbox clutch-in when the main propulsion centreline engine driven fire pump is engaged.

8.9.5 The main propulsion centreline engine shall comply with the same requirements set out in paragraphs 8.3.1 to 8.3.10, and 8.5.1 of this Part.

8.9.6 The reduction gearbox of the main propulsion centreline engine shall comply with the same requirement set out in paragraph 8.6 of this Part.

8.10 Centreline Engine Waterjet System and Propulsion Controls

8.10.1 This section applies only if (a) the triples engine configuration and (b) the waterjet system are proposed to be adopted.

8.10.2 The design and installation shall follow the RO and IMO requirements (where applicable also complying to IMO requirements in relation to HSC).

8.10.3 For the avoidance of doubt, the following requirements shall also be met:

(a) The propulsion system shall be installed in accordance with the engine maker's instructions and RO Requirements.

(b) The Vessel shall also be provided with the following items:

(i) The design of the whole waterjet propulsion system and the control system shall be of a patent design whose design has been registered as a patent in any applicable place of jurisdiction or the application for registration has been submitted as at the Tender Closing Date and has been approved by the RO.

(ii) The RO's design and construction inspection certificates of the waterjet propulsion units shall be provided to GNC before the Acceptance Delivery.

(iii) The waterjet propulsion system shall be installed in accordance with manufacturer's instructions as well as to the RO's regulations and requirements.

(iv) Torsional vibration calculations approved by the RO for the shafting system shall be provided to GNC before the Acceptance Delivery.

8.10.4 For Waterjet propulsion (if this is proposed to be adopted as opposed to the propeller system as further described in paragraph 8.10.5 below)

(a) General

(i) The waterjet unit shall be driven by the main propulsion centreline engine through marine reduction/ reversible gear and flexible coupling.

(ii) The gearbox shall include the following:

1. A flexible coupling of a well-known proprietary make
2. Built-in gear type oil pump
3. Oil temperature high alarm
4. Higher oil temperature cut out

(iii) The waterjet propulsion system shall include the following alarms with individual warning indications at the navigation bridge (wheelhouse):

1. Power failure of the control system
2. Power failure of the alarm system
3. Low level in lubrication oil tank (if provided)
4. Low lubrication oil pressure (if it is a forced lubrication oil system)
5. Low hydraulic oil pressure
6. Low level in the hydraulic system
7. Power failure safety system

(iv) The waterjet units shall be made of stainless steel cast and that the whole system is well insulated and arranged to prevent galvanic corrosion.

(b) The control system for the waterjet propulsion system

Control and instruments of the main propulsion centreline engine and waterjet units shall be designed for a one-man operation in the wheelhouse.

(i) Talk back unit to emergency steering position.

(ii) One head set shall be provided for each emergency steering position, and be with flashlight and siren.

(iii) Local clutch in and out control shall be provided.

(c) Means shall be provided to allow for continuously running the Vessel with the water jet in idling condition (e.g. mechanical brake, independent LO pump for the shafting system etc.). The arrangement shall be recommended by the manufacturer of the waterjet propulsion system and with the prior written consent from RO and GNC.

8.11 Centreline Engine Propeller System and Propulsion Controls

8.11.1 This section applies only if (a) three engines configuration; and (b) propeller propulsion system are proposed to be adopted.

8.11.2 For Propeller Propulsion, the requirements specified in Section 8.4 shall be complied with.

8.11.3 Means shall be provided to allow for continuously running the Vessel with the centreline propeller in idling condition (e.g. mechanical brake, independent LO pump for the shafting system etc.). The arrangement shall be recommended by the manufacturer of the propeller propulsion system and with the prior written consent from RO and GNC.

8.12 Bow Thruster

8.12.1 One AC electric variable speed type bow thruster is to be fitted for docking and also for the position holding system as more particularly specified in paragraph 8.25 of this Part if the Tenderer elects to propose the same for earning marks under the Marking Scheme.

8.12.2 The bow thruster is to be capable of manoeuvring the Vessel about the stern and shall be suitable for this size of vessel and the corresponding windage area with a thrust capacity not less than 10kN.

8.12.3 The bow thruster system shall be interfaced with the Vessel position holding system if the latter is to be provided. The Contractor needs to ensure the proposed system, component, arrangement and design are all suitable for that purpose e.g. proper interfacing features, frequent start/stop operation etc. The proposed system, component, arrangement and design shall be submitted for RO and GNC approval.

8.12.4 The bow thruster shall keep the Vessel in stationary position when the fire monitor is working horizontally at 45 degrees at the same side plus 15% reserve power for wind and current.

8.12.5 The bow thruster shall be positioned as forward as practicable. It should be located below the waterline with sufficient depth for the prevention of air being sucked into the tunnel but above the keel. And the minimum diameter of propeller should not be less than 500mm.

8.12.6 The bow thruster shall be driven by motor equipped with soft starting arrangement, variable frequency drive (VFD) and joystick control. The VFD shall be RO approved type and equipped with:

(a) Stall prevention;

(b) Current limitation & overcurrent protection;

(c) Short-circuit protection;

(d) Undervoltage & overvoltage protection;

(e) Ground fault protection;

(f) Power supply phase failure protection; and

(g) Motor thermal protection through sensing of the motor winding temperature.

8.12.7 The system shall prevent regenerated power cause any adverse effect on the whole system.

8.12.8 The wheelhouse navigation console for the control of the bow thruster shall be provided with joystick and basic panel with the following features :

(a) VFD alarm;

(b) Motor alarm (e.g. high temp and overload alarm etc.);

(c) Power supply to the control system failure;

(d) Indicator showing direction of thrust;

(e) Load indicator of motor; and

(f) Interface with the position keeping system if the same is to be proposed.

8.12.9 And the concerned alarm and status of bow thruster shall also be provided on the wheelhouse engineer control console.

8.12.10 A steel tube is to be incorporated into the Vessel structure to house the bronze/stainless steel propeller. The tube, if rolled, and welded should be non-destructive tested before installation into the Vessel hull. Once fitted the surrounding weld should be non-destructive tested. This shall be carried out in accordance with the RO Requirements.

8.12.11 A flexible coupling is to be fitted between the bow thruster motor and the drive shaft.

8.12.12 The Contractor shall design and install the space in accordance with IMO 2000 HSC Code with respect to the required structural fire protection, fire detection and fire suppression and shall meet the requirements of the RO. Noise and vibration transfer to the Superstructure and living spaces shall be avoided.

8.13 **Electrical Generator Engines**

8.13.1 Two electrically started, fresh water-cooled electric engines integral with alternating current alternator, of self-excited, brushless and ventilated type shall be installed (collectively "generating sets" or "electric generators").

8.13.2 The capacity of these generating sets shall be such that either one of the two generating sets shall be able to supply all electricity necessary to ensure that normal operational conditions of propulsion and safety can be achieved.

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

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

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

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

8.13.5 The generators exhaust, the generator sets exhaust shall be arranged with a waterlock/lift-silencer with a view to reducing its noise levels. This shall be configured with a hose running from the genset (wet outlet) and a wet hose outlet:

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

(b) The exhaust systems shall be designed appropriately to comply with the generating set and exhaust manufacturers' requirements. The generator set exhaust system shall be arranged to provide reasonable access to engine room machinery.

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

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

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

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

(a) Each generator set shall be provided with a type approval certificate issued by one of the recognised Classification Societies set out in the interpretation of "Recognised Organisations" under Clause 1.1 of Part IV – Conditions of Contract but not necessarily the RO specified in Schedule 9 of Part V.

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

(c) The Vessel's main electrical supply shall be generated and distributed at 380V, 50 Hertz, 3 phase system. Transformed supply of 220V shall be used for lighting and electrical equipment of relevant voltage. A low voltage 24V DC supply shall be provided for the relevant equipment/apparatus.

(d) The Vessel shall fulfil the following requirements for the continuous service rated (CSR) power of diesel generators on board:

(e) To permit the starting of the largest motor without causing interruption to other loading of the Vessel.

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

(g) Shore supply voltage on the Vessel is for the essential electric apparatus when the Vessel stations in Hong Kong. Distribution of 380V 3 phase 3 wire insulated power supply to the electric equipment from the distribution board shall be arranged through circuit breakers. A shore power isolation transformer is arranged to isolated the ship insulated 380V and 220V AC system from shore.

8.14 Electrical Generator Engine Control

8.14.1 The controls and instrumentation of each of the electric generators shall be designed for one man operation in the wheelhouse, the instrumentation and controls in the control console shall be comprehensive and include:

(a) Remote start and stop;

(b) Tachometer with running hour meter;

(c) Cooling water temperature gauge;

(d) Exhaust gas temperature gauge;

(e) Lubricating oil pressure gauge;

(f) Battery charger ammeter;

(g) Fault indicating lights and alarms;

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

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

(j) Instrumentation and alarm panel for auxiliary machinery; and

(k) The control panel shall contain the following devices:

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

(ii) Voltmetre, Wattmetre for each generator;

(iii) Sea water temperature and pressure gauge;

(iv) Auxiliary engines expansion tank low-level alarm (audio and visual);

(v) Auxiliary engine starting battery charging ammeter;

(vi) DC power on light;

(vii) Any other instrumentation devices required for the safe operation of the Vessel;

(viii) Lamp test switch;

(ix) Alarm reset, and alarm acknowledged push buttons;

(x) Dimmer control; and

(xi) Start / stop push buttons with running / stop indication lamps for each hydraulic recess.

8.15 Instrumentation and Control

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

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

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

8.15.4 All the instruments such as temperature sensors, pressure sensors, level gauges etc. shall have obtained type approval certificates by the recognised Classification Societies set out in the Interpretation of "Recognised Organisations" under Clause 1.1 of Part IV – Conditions of Contract (but not necessarily the RO specified in Schedule 9 of Part V) 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.

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

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

8.16 Machinery Space Ventilation

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

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

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

(a) All spaces containing machinery shall be provided with forced ventilation for combustion and ventilation air to meet the requirements of the prime movers and other heat sources. 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 louvres shall be as low as required to avoid flow noise (Typically 5 m/s depending on vent or louvre design).

8.16.4 The steering gear compartment and tank space shall be adequately ventilated for ensuring that the safe operation of the Vessel.

8.16.5 For guidance, the ventilation air to the compartment as stated should:

(a) Limit the temperature rise in a machinery space to 10℃ above ambient temperature; and

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

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

8.17 Air-Conditioning System

8.17.1 A minimum of two (2) sea water cooled chillers central cooling air-conditioning systems are to be provided. Each system shall incorporate with water chiller which equipped with chiller pump circulating chilled water to various fan coil units for temperature control.

8.17.2 Each air-conditioning system shall be independent and have 100% capacity according to the calculated cooling load, which shall ensure that the temperature and humidity within the Deckhouse, Wheelhouse and Accommodation is maintained at the following levels:

Summer

	Value	Notes
External Air Temperature	40°C	85% relative humidity
Internal Air Temperature	20°C	60% relative humidity
Sea Water Temperature	≤32°C	

This is required with a 27 crew on board. An acceptance test of the complete system shall be carried out to verify the effectiveness of the system and in compliance with the requirements set out in Part VII.

8.17.3 The refrigerant shall be CFC and HCFC free.

8.17.4 Emergency stop switches for the system in addition to the normal power "on/off" switches shall be installed at the Wheelhouse Control station, the Wheelhouse Engine Remote Control Console and the Engine Room Control Console.

8.17.5 Mold and bacteria resistant replacement filters shall be fitted at air inlets.

8.17.6 The fan coil blower units within the Wheelhouse, Deckhouse and main deck accommodation compartments shall be carefully located for efficient operation, as recommended by the air-conditioning manufacturer, with due consideration to air moisture in the sea environment. Condensate drains are to be fitted and routed directly overboard. The Contractor is to agree the location of all equipment prior to installation on-board.

8.17.7 The design of the cooling air capacity shall be evenly distributed. An individual control shall be provided in each compartment.

8.17.8 The volume of fresh air shall be treated before led into the system to avoid undue condensation formed on any metallic surface of the vessel. It shall be introduced into the air-conditioned area and shall be based on ISO 7547 standard for Shipbuilding – Air-conditioning and ventilation of accommodation spaces; and there shall be not less than $25m^3$/hr per person so as to keep the CO_2 level low enough for health reasons. Shut-off facilities for fresh air supply shall be provided.

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

8.17.10 All air-intakes for the HVAC system shall be kept away from the machinery exhausts to ensure the on-board air quality.

8.17.11 Air conditioning shall not contain ozone depleting substances.

8.17.12 It is required that independent air-intakes, re-circulation air and blower units are installed in the Stretcher Berth/Treatment Room to reduce the risk of contagious persons infecting other persons living and working on-board the Vessel.

8.17.13 An additional split-type air conditioner shall be installed in the wheelhouse.

8.18 **Piping System**

8.18.1 (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.

8.18.2 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.

8.18.3 Piping material shall be agreed by GNC before installation on board.

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

8.18.5 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.

8.18.6 The arrangement of all piping connection, bulkhead penetration, hangar support with dis-similar materials involved, shall prevent any galvanic corrosion arise and submitted to the RO and GNC for approval.

8.18.7 So far as practicable, pipelines, including exhaust pipes from engines, shall 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. Where it is not practicable to comply with these requirements, drip trays or shields shall be provided as found necessary.

8.18.8 Watertight bulkheads, decks or structural members having pipeline penetration shall be designed and compensated in accordance with the RO Requirements.

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

8.18.10 Machinery and piping designation and marking.

(a) All piping and equipment shall be labelled and colour-coded. And each pipe running through each compartment shall be colour coded, labelled, and have the direction of flow marked in at least two places.

(b) Colour coding of machinery and piping shall be in accordance with the following:

Fire Main	Red
Sea Water	Dark green
Fuel Oil	Dark brown
Lube Oil	Striped black/yellow
Fresh Water	Blue
Hydraulic Oil	Orange

8.19 **Fuel Oil System and Fuel Oil Tank**

8.19.1 As Government Vessel are committed to utilise sustainable / renewable fuel blends, the propulsion engines and the electric generators of the Vessel shall be able to use ASTM D975-08a B5 blends diesel fuel (5% biodiesel, 95% diesel labelled B5) and approved by the engine makers.

8.19.2 The fuel oil of the main engines and generators shall be supplied from one or more fuel oil tanks. Endurance for fuel capacity shall be designed for 12 hours at cruising speed 20 knots together with both external fire-fighting pumps operating 24 hours at maximum throughput. There shall be at least two fuel tanks and the Contractor is free to design location of the fuel oil tanks to fulfil the specification requirements.

8.19.3 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets.

8.19.4 Boost pumps shall be arranged to lift fuel to the engines through coalescing filters (Racor or equivalent).

8.19.5 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.

8.19.6 The tanks shall be hydrostatically tested as required by an approved standard and connections shall be proven tight.

8.19.7 An electric motor-driven pump shall be provided for transferring the fuel.

8.19.8 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.

8.19.9 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.

8.19.10 The filling pipe shall be of metallic construction and a permanent fixture led from the deck and secured to the tank by an approved connection. A screwed cap and name plate inscribed 'Fuel Oil' shall be provided at the filling point. Flexible hoses are not permitted as filling pipes.

8.19.11 An easily removable coarse strainer should be built into the filling line, if required.

8.19.12 Two duplex filters shall be fitted in the oil fuel supply lines to the main and auxiliary engines, and the arrangements shall be such that any filter can be cleaned without interrupting the supply of filtered fuel oil to the engines.

8.19.13 Flexible pipes of approved type shall be used as short joining lengths to the engine where necessary.

8.19.14 Water separators should be fitted to the fuel supply line, if required.

8.19.15 Fuel Oil Tank(s)

(a) Fuel oil tank(s) shall be arranged to allow the Vessel operation at acceptable trim in all conditions of loading and with consideration for the requirements for good static and running trim. The Vessel shall be built with one or more fuel tanks to service the Vessel's main propulsion engines and ship service electric generators. The tank(s), if more than one, shall be interconnected to permit fuel transfer between the tanks.

(b) The fuel oil tank(s) shall be fitted / installed in the tank space, actual location to be designed and approved by the RO and accepted by GNC.

(c) The tank shall not be integral with the hull and shall be installed so that the loads due to the mass of the full tank are safely induced into the hull structures. The thickness shall sustain the loads due to the mass of the full tank with due consideration given to accelerated forces due to the

Vessel's movements at all speeds at sea, without damaging the tank and ship structure.

(d) Provisions to the fuel oil tank:

(i) A tank content gauge and low level alarm shall be fitted on the wheelhouse control station. A level gauge in litres shall be provided for each tank;

(ii) Rigid fuel suction pipes near the tank bottom shall be provided;

(iii) 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;

(iv) Suitable provision such as drip trap shall be made for collecting the oil discharge;

(v) Baffles shall be provided, the total open area provided in the baffles shall be not greater than 30% of the tank cross section in the plane of the baffle;

(vi) Baffle openings shall be designed so that they do not prevent the fuel flow across the bottom or trap vapour across the top of the tank;

(vii) The fuel oil tank shall be tested by a head of water equal to the maximum to which the tank may be subject, but not less than 2.5 metres above the top of the tank. The static test pressure shall be applied for five minutes without pressure drop. After the test, the test fuel tank shall not show any leakage;

(viii) Sounding pipes with chained cap shall be provided;

(ix) Tank drain shall be provided; and

(x) The compartment or space containing the fuel oil tank shall be fitted with two ventilating pipes of arrangement acceptable to GNC.

8.20 **Fresh Water System**

8.20.1 (a) One fresh water tank with a total capacity of not less than 2000 litres shall be arranged in the Vessel to supply fresh water to the main deck, underdeck and crew space.

(b) The fresh water tank should be installed in the compartment space as designed by Contractor according to RO requirements.

8.20.2 The fresh water shall be supplied by a fresh water pump to achieve a pressure at the tap located at the main deck, underdeck and crew space 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.

8.20.3 The fresh water tank shall be flushed clean before installation and delivery of the Vessel.

8.20.4 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 fresh water tank shall be fitted with the following:

(a) Inspection / cleaning access cover;

(b) Filling / sounding pipe; and

(c) Air pipe.

8.20.5 The tank (or tanks – to be used for the benefit of weight distribution) shall be of stainless steel construction.

8.20.6 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.

8.20.7 The fresh water tank shall not be directly adjacent to any other tanks carrying liquid of any kind.

8.20.8 The fresh water 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.

8.20.9 A capacity indicator calibrated in litres shall be provided.

8.20.10 The pressurised unit shall be provided with a starter, pressure switch, pressure gauge, relief valve and suction valves. The fresh water pump shall maintain the pressure automatically.

8.20.11 Domestic fresh water piping shall be made of copper. Certificate of piping material shall be submitted before the delivery of the Vessel. The welding joints of the domestic fresh water piping 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.

8.20.12 Cold fresh water taps completed with PVC braided / reinforced transparent hoses should be fitted on the main deck aft, crew space and wheelhouse top to provide a rinse off facility for cleansing purposes.

8.20.13 A fresh water test shall be carried to validate the pH. Additionally, a legionella test shall be carried out on the tank and its associated piping.

8.21 **Bilge System**

8.21.1 The Vessel shall be fitted with a bilge system designed and installed in accordance with the RO Requirements.

8.21.2 A bilge audible and visual alarm panel shall be fitted in the Wheelhouse Engine Remote Control Console and the Engine Room Control Console covering all lower-deck watertight compartments including, engine room(s), bow thruster room, tank space(s) and fore and aft peak.

8.21.3 When the Vessel is afloat and unmanned, the bilge alarm system shall continue to function. When the audible and visual alarm in not acknowledged after a time period of five (5) minutes, the audible and visual alarm shall be extended externally to an audible and visual alarm fitted on the top of the deckhouse to bring the attention of the persons ashore.

8.21.4 A bilge water holding tank, sized suitably for the Engine room volume to the satisfaction of GNC, shall be provide in the engine room. Marine grade stainless steel 316 shall be used for the bilge water holding tank.

8.21.5 Any bilge water in the engine room(s), bow thruster room, tank space(s) and fore and aft peak shall be pumped to the bilge water holding tank.

8.21.6 All bilge system pipework shall be made of galvanised steel. It is to be designed and installed in accordance with the RO Requirements to the satisfaction of GNC.

8.22 **Seawater System**

8.22.1 All sea valves shall be compatible with the hull material, connected to the sea chests shall be tested according to the RO Requirements.

8.22.2 Sea chests provided for the main and auxiliary machineries should be installed in the vicinity of their respective seawater pump suctions but with adequate distance between each other to avoid water flow disturbance.

8.22.3 Seawater piping shall be constructed of galvanised steel pipe. A suitable strainer with isolation valves and air vent shall be fitted to each seawater system. Due consideration shall also be given for quick and easy access to the seawater strainers.

8.23 **Sanitary, Grey and Black Water System**

8.23.1 One (1) grey/black water holding tank with capacity agreed by GNC shall be installed in the tank space(s) or other compartment (acceptable to GNC) for clean water waste.

8.23.2 Duplicates sanitary/sea water pump shall be installed in the engine room. Each of them shall be capable to supply sea water for sanitary service. Pressurized seawater shall be distributed to toilets through pressure reducing valves or for flushing by direct pressure via flushing valves.

8.23.3 Toilets and toilet room scupper shall be designed to discharge into grey/black water tank and ashore. Alternative piping shall be arranged for grey and black water to discharge directly overboard through non-return shipside valve.

8.23.4 Galley, shower, wet room scuppers and sinks shall be designed to discharge into the grey water holding tank and ashore.

8.23.5 The tank(s) shall be fitted with a level gauge and high-level alarm indicator. These shall be installed at the Wheelhouse Engine Remote Control Console and the Engine Room Control Console.

8.23.6 A discharge macerator electric pump shall be provided for pumping out the contents of the holding tank. This shall be primarily lead to the shore connection, but shall also be arranged with an international shore connection.

8.24 Marine Growth Protection System

8.24.1 The Vessel shall be fitted with a Marine Growth Protection System. The system is to produce copper ion in the water system to protect the pipeline/machinery systems from marine growth.

8.24.2 Within each sea strainer/sea chest, an anode is to be fitted. The anodes are to be controlled by a DC control panel which is to be controlled and managed by the Vessel engineer.

8.24.3 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.

8.24.4 Each anode shall be supplied with an integral nylon mounting arrangement and its own integral cathode to ensure that currents are correctly controlled.

8.25 Position Holding System

8.25.1 The Tenderer is encouraged in Part A(4) of Schedule 11 under the heading "Innovative Suggestions" to offer special equipment capable to hold automatically the Vessel in a predetermined position and heading by controlling the propulsion engines (viz., the two wing engines) and bow thruster. (The centreline main engine has to be reserved for the external fire pump and shall not be used for the aforesaid purpose). The system shall also be capable to be manually controlled by using a joystick control head, or by selecting the position (longitude & latitude) and required heading, via a navigation display/control panel located at the Wheelhouse Control Station ("position holding system"). **[D]**

Chapter 9 Electrical System

9.1 General Requirements

9.1.1 All the electrical equipment and installation shall meet the RO Requirements.

9.1.2 Two 24 volts electrically started, fresh water-cooled diesel engines integral with alternating current alternator, of self-excited, brushless and ventilated type, to be installed. Synchronising and parallel operation is required.

9.1.3 All electrical equipment, fittings, instruments, switches, cables, insulation, sheathing, circuit breakers, rating standards and their installations shall comply with the latest Regulations of the International Electro-technical Commission (hereinafter referred to as IEC), Electrical Installations in Ships.

9.1.4 Protective devices such as circuit-breakers or fuses shall be provided at the source of power, e.g. the switchboard, to interrupt any overload current in the circuit conductors before heat can damage the conductor insulation, connections or wiring-system terminals.

9.1.5 Switches and controls shall be marked to indicate their use, unless the purpose of the switch is obvious and its mistaken operation will not cause a hazardous condition. Each cable shall be clearly labelled and carry its own unique identification code.

9.1.6 The Contractor shall submit a layout plan showing the exact locations of the Equipment. All Equipment shall be accessed easily and safely for inspection and maintenance.

9.1.7 All Equipment installed shall be provided with manuals for operation and maintenance.

9.1.8 The standard of installation shall enhance the Equipment's safety features of not presenting any hazards to the operator, e.g. all metal panels exposed to the operator shall be grounded properly. Warnings of any potential hazards shall be displayed in both English and Chinese, or with universally recognised labels.

9.2 Electricity Distribution Network

9.2.1 The main electrical AC power supply shall be provided by two electric generators. Synchronising and parallel running operation is required.

9.2.2 The generators shall be sized based on a 15% growth margin above the predicted maximum load condition. The Vessel’s electrical load calculation shall include summer and winter, static and transient, loads on AC, DC, shore power, and ship service systems. The Vessel’s electrical load calculation shall be approved by the RO and accepted by GNC.

9.2.3 The generator set will maintain an output voltage within ±5% over the entire load range and frequency within ±1.5 Hz.

9.2.4 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).

9.2.5 The generators shall be protected against short-circuits and overloads by multipole circuit-breakers (overload protector).

9.2.6 The distribution of the electricity to the equipment is through circuit breakers fitted on an electrical distribution board.

9.2.7 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.

9.2.8 Twenty (20) percent of spare circuit breakers or three space circuit breakers, whichever is the greater, shall be provided for each distribution panel, both AC and DC. The Vessel’ ENE shall be supplied from

an independent distribution panel, which shall in turn be supplied from a single breaker in the main DC panel.

9.2.9 Twenty (20) percent of spare wiring penetrations or two spare wiring penetrations, whichever is the greater, shall be provided through each bulkhead except the forward collision bulkhead. Spare penetrations shall be plugged watertight with rubber plugs.

9.2.10 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.

9.2.11 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.

9.3 **Main Switchboard**

9.3.1 Switchboards for main and emergency 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.

9.3.2 Under all normal conditions of operation, power is distributed from the main switchboard and the distribution system shall be designed to keep cable costs to a minimum by distributing to power panels located close to the user services. Connections and components on panel-boards shall be in locations protected from the expected conditions in conformity with IEC 60529:

(a) IP 67 as a minimum, if exposed to short-term immersion;

(b) IP 55 as a minimum, if exposed to splashing water; and

(c) IP 20 as a minimum, if located in protected locations inside the Vessel.

9.3.3 Switchboards shall be permanently marked with the nominal system voltage.

9.3.4 A self-standing dead front marine type main switchboard of aluminium construction with adequate ventilation louvres shall be fitted in an accessible and well ventilated position in the electrical room and shall contain the following:

(a) Sector for three phase supply 380V AC (designed by contractor);

(b) Sector for single phase supply 220V AC (designed by contractor);

(c) Sector for 24V DC supply;

(d) Sector for shore power supply; and

(e) Sector for solar power (if required)

Remark: The AC system is described as 380/220V AC in this Chapter.

9.3.5 Due consideration shall be given in respect of the switchboard location to avoid any risk of damage resulting from oil and water spray or other mechanical hazards. Adequate guardrail(s) and insulated mat(s) shall also be provided.

9.3.6 Megger test and other relevant tests shall be carried out and witnessed by GNC. The results for these tests shall form part of Sea Trial Report that shall be submitted to GNC before Delivery Acceptance.

9.3.7 An appropriate laminated electrical diagram shall be attached on each switchboard.

9.3.8 All switchboard instruments, controls, and all circuit breakers, both on external panels and inside the switchboard, shall be provided with labels of durable flame-retardant material bearing clear and indelible indications. The appropriate ratings of fuses, the setting of adjustable protective devices and the full load current of generators shall be indicated.

9.3.9 Apart from the spare feeder breakers, the switchboard shall contain but not be limited to the following:

(a) Generator set sector shall provide the following:

(i) Air circuit breaker of adequate capacity with over-current trip and short circuit trip;

(ii) Voltmeter, ammeter, wattmeter and frequency meter;

(iii) Indication lights for "Power Available", "Breaker Opened" & "Breaker Closed"; and

(iv) All necessary fittings and any other protective devices.

(b) 380/220V three/single phase sector shall provide the following:

(i) Meters or earth lamps to indicate the state of insulation;

(ii) Moulded case circuit breakers with over-current and short circuit trips for the distribution of AC power supply to lighting services, fans, motors, etc.; and

(iii) Any other necessary fittings and protective devices.

(c) 24V DC Feeders Sector:

(i) Transformer / rectifier of adequate capacity for converting AC power to DC power. The rectifier shall be of 1-phase full wave regulated type with voltage regulation ±5% and ripple factor 4% at 100 Hz;

(ii) Magnetic automatic relay switch for activating emergency 24V DC supply in event of AC power failure;

(iii) Supply source indicator lamp for transformer / rectifier;

(iv) Ammeter for charging unit;

(v) Voltmeter with selector switch;

(vi) Metres or earth lamps to indicate the state of insulation;

(vii) Moulded case circuit breakers with over-current and short circuit trips for 24V DC bus and feeder circuits; and

(viii) Any other necessary fittings and protective devices.

(d) Shore Power Connection Sector:

(i) Moulded case circuit breaker for shore connection box shall be provided on the main switchboard;

(ii) The shore connection box shall be capable of receiving 380V three phase 50 Hz system and the cables between the connection box and the main switchboard shall be of sufficient capacity to supply the necessary electrical equipment;

(iii) An earth terminal with suitable corrosion protective device shall be provided for connection of the Vessel's earth to the shore earth; and

(iv) An instruction shall be provided at the connection box to give full information of the system and the procedures for carrying out the connection.

9.4 **DC Power Source**

9.4.1 Batteries for Main Engines and Electric Generator Sets Starting

(a) Independent bank of 24V batteries shall be provided for starting of each of the main engines and each of the two electric generator sets.

(b) The capacity of the batteries shall be sufficient to provide at least six consecutive starts of each one of the main engines, and at least three consecutive starts of each one of the electric generator sets from cold, without recharging.

(c) Electrical connections shall be arranged so that the batteries can be used to start either main engine or generator engine by operating a manual change-over switch in the engine room.

(d) The batteries shall be charged by engine driven alternators with backup service provided by an automatic battery charger. Interlock or protective devices shall be provided to prevent simultaneous charging from the charger and the alternator. The battery charger shall also be prevented from charging the batteries during main engine starting.

(e) Batteries to be of maintenance-free type:

(i) 24V batteries charged directly from engine driven alternators, generator sets. There shall be one battery set allocated to each engine; and

(ii) Power supply batteries shall be portable, maintenance free, heavy duty, deep cycle and produced from environmentally friendly materials. They will have a minimum life expectancy of five years, or 200 full discharge cycles at full load, rated in accordance with cognizant regulatory body 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 minimise the voltage drop. The battery bank shall be housed in a separate GRP or GRP lined storage box.

Each box shall be provided with a removable cover with locking clips with ventilated pipe fitting to open area for ease of maintenance.

9.4.2 Batteries for Routine and Emergency supply:

(a) 24V battery shall be provided for routine and emergency supply, all emergency equipment shall operate from a dedicated 24V DC power supply.

(b) In event of main electrical AC power failure, 24V DC batteries shall act as an emergency supply for all communication equipment, navigation and emergency lighting, steering, fire monitoring and control system, and other vital instrumentation and control systems for the Vessel to return to base.

(c) This emergency supply shall come into operation automatically in the event of main electrical power supply failure. The capacities of these sets of batteries shall be sufficient to maintain the emergency supply for a period according to RO Requirements.

(d) The batteries shall be installed in a separate compartment located outside of the engine room above deck. The compartment shall be well ventilated and prevent ingress of water.

9.4.3 24V DC services shall be supplied from the switchboard in the steering console through a 2-wire insulated system to the following items:

(a) Navigation light control panel and navigation lights;

(b) Horn;

(c) General lighting;

(d) Compass light;

(e) Instrument panel in control console;

(f) Electric locks;

(g) CCTV;

(h) Public address;

(i) One hand-held searchlight and one fixed searchlight;

(j) Siren; and

(k) Any other ENE (if applicable)

9.4.4 Batteries for 12V Electronic Equipment

(a) 12V battery shall be provided solely for the electronic equipment.

(b) The batteries shall be installed in a separate compartment located outside of the engine room above deck.

9.4.5 The compartment shall be well ventilated and prevent ingress of water.

9.4.6 The batteries as required in Paragraphs 9.4.1 and 9.4.2 above shall be subject to continuous trickle charge under normal operation of the Vessel by an automatic battery charger. Under the battery fully discharged condition, the charger shall be able to perform a quick charge function.

9.4.7 The battery chargers shall provide automatic control between float and boost charges. Each charger shall also be provided with a voltmeter, voltage regulator, selector switch, blocking rectifier, and the required devices for protecting the chargers against short circuit, reverse connection, excessive temperature and overloading. The capacity of each battery charger shall be sufficient for charging one set of completely discharged starting batteries to fully charged condition within ten hours.

9.4.8 Battery charger installations shall meet all cognizant regulatory body requirements including:

(a) The chargers shall be sized such that a completely discharged battery bank can be recharged to 80% capacity within eight hours (100% at ten hours). At the end of the charge, the charge shall be tapered to a trickle value.

(b) The chargers shall be fitted with a pilot lamp, a charging adjustment, a voltmeter and an ammeter indicating charging current.

(c) Discharge protection shall be provided to prevent a failed charger component from discharging the battery bank.

(d) Battery selector/isolator switches shall be provided between battery chargers and the battery banks they serve.

(e) Provisions shall be made to allow either main engine to be started by the other engine's starting batteries.

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

9.4.10 Batteries shall be permanently installed in a dry, ventilated location above the anticipated bilge-water level.

(a) Battery compartment(s) shall be actively ventilated whenever batteries are charging.

(b) Batteries shall be located in areas so as to avoid adjacent heat source and easy access for battery replacement. Emergency batteries shall be located in the area outside the engine room such as, wheelhouse top and open deck area.

(c) All battery storage boxes shall be provided with removable covers and locking clips with ventilated pipes to open area for ease of maintenance.

(d) Drainage shall also be provided to avoid accumulation of moisture.

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

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

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

9.4.14 A battery-disconnect switch shall be installed in the positive conductor from the battery, or group of batteries, connected to the supply system voltage in a readily accessible location, as close as practical to the battery or group of batteries except the circuits for engine starting and navigation lighting and electronic devices with protected memory and protective devices such as bilge-pumps and alarms, if individually protected by a circuit-breaker or fuse as close as practical to the battery terminal.

9.4.15 Local information plates showing the voltage, ampere-hour rating, group number and application shall be provided for each battery set.

9.5 Shore Power Supply and Connection

9.5.1 The electrical system shall include the provision for shore power supply (380V AC, 50 Hz) designed to an approved standard. A shore power isolation transformer shall be included in the shore supply line.

9.5.2 The shore power system shall be interlocked to prevent the Vessel's generator from providing power at the same time with the shore power supply. Indicating lights for "shore power available", "shore power breaker on" and "shore power breaker closed" to be fitted.

9.5.3 The watertight connection box shall be designed with a quick release receptacle.

9.5.4 Not less than 20 metres long shore connection power cable of adequate rating with quick release watertight plug shall be provided.

9.5.5 The 20 metres shore connection power cable terminating at compatible connections to mate with existing facilities on Government Dockyard identified by GNC. Suitable stowage on board shall be provided for the cable.

9.6 Circuit Breaker

9.6.1 All circuit breakers shall have time delay thermal overload trip and instantaneous short circuit current trip. The overload trip 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.

9.6.2 Circuit breaker shall act as a protective device only and shall not use for switching purposes. An individual On/Off switch shall be installed for each electrical fitting.

9.7 Motor and Control Gear

9.7.1 Where a starter is situated remotely from the motor, stop and start buttons shall be provided near the motor for local operation. All electric motors of essential services shall have separate start and stop push buttons plus running indication lights (with dimmer control) inside the wheelhouse.

9.7.2 Motors installed in the engine room and other enclosed spaces shall be of semi-enclosed drip-proof type. Motors installed in locations exposed to weather or moisture shall be of waterproof construction. Insulation of motors shall not be less than Class B standard under IEC Regulations for the Electrical and Electronic Equipment.

9.7.3 A circuit diagram shall be placed in the local control box of each electrical installation.

9.8 Cable, Wiring and Fuse

9.8.1 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 by chafing.

9.8.2 Where cables are protected by pipe conduits, the space factors of the pipe conduit shall conform to IEC regulations in order to prevent bunching of wires and to minimise earth faults.

9.8.3 Cables shall have minimum dimensions in accordance with IEC regulations or other equivalent international standard acceptance 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.

9.8.4 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.

9.8.5 The metallic sheathing, armour or braid of cable shall be properly earthed at both ends. All bare terminals shall be properly insulated by cable insulators approved by GNC or the RO specified in Schedule 9.

9.8.6 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.

9.8.7 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 one metre from the terminal. Other sheathed conductors shall be supported at maximum intervals of 450 mm. Sheathed engine starter conductors constitute an exception to this requirement.

9.8.8 Wiring shall be run along perforated metal trays and shall be secured in such positions as to allow easy maintenance.

9.8.9 Wiring shall not be installed below the engine room floor plates.

9.8.10 Cables and wiring inside accommodation areas shall run behind linings which shall have removable panels for inspection and maintenance.

9.8.11 Where electric cables have to be fitted on the decorative surface of bulkheads, they shall be enclosed in conduits.

9.8.12 (a) RO approved watertight cable glands shall be provided in way of watertight bulkhead or deck penetrations.

(b) The penetration shall be located as high as practicable and well clear from the ship side.

9.8.13 Each electrical cable shall have a means to identify its function in the electrical system, except for conductors integral with engines as supplied by their manufacturers.

9.8.14 Cables and the wiring terminals of different AC and DC power supply voltages in the junction box, fuse box as well as the equipment terminal box shall be laid separately and shall have a distinctive code and labelling system for easy identification to facilitate tracing.

9.8.15 Tally plates showing the cable size and the number of cores shall be provided for each of the main power cables.

9.8.16 All fuses shall preferably be of cartridge type and rated adequately for the protected circuits.

9.8.17 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.

9.9 Lighting Fixtures

9.9.1 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.

9.9.2 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 re-lamping and cleaning.

9.9.3 General lighting shall have individual or group switches to conserve power, unless agreed with GNC, all light sources, including signalling, shall be of LED type.

9.9.4 All lighting in the wheelhouse control panel shall be fitted with a dimmer control at night. Emergency lighting of 24V DC supply shall be provided for all compartments, emergency embarkation stations and open decks as per the RO Requirements.

9.9.5 Emergency exit routes shall be identified and illuminated as required by the RO Requirements.

9.9.6 Suitable lighting shall be provided in crew space above the desks and working areas such as, chart table.

9.9.7 Controls shall be provided within each compartment for the illumination therein. Each light shall have a manually controlled switch located at the primary entrance to that compartment and switches for this purpose shall be installed near the access and located so as not to be obscured when the door is open. A separate switch shall be provided in each compartment to control each group of lights. Switches shall break both sides of the circuit. Fixtures shall be installed so that illumination therefrom will not be obstructed by fixed pipes, ducts, bins, berths, etc.

9.9.8 Fixtures shall be mounted so as not to vibrate in any operating condition and so that the Vessel vibration will not harm the fixture. Fixtures shall be selected and mounted to maintain the maximum possible headroom.

9.9.9 All sockets, terminal blocks, and switch and receptacle interiors shall be made of non-flammable phenolic material.

9.10 Navigation Light

9.10.1 All navigational and signal lights to be provided shall be in compliance with the International Regulations for Preventing Collisions at Sea 1972 as amended (COLREGSs) and all applicable IMO Resolutions. Type-approved certificate 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.

9.10.2 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.

9.10.3 Navigation light circuits shall be independent of any other circuit. There shall be two essentially separate power supply systems to the distribution board: one from the main AC power source and one from the emergency DC power source.

9.10.4 The following navigational and signal lights (with double-pole circuit breakers) and shapes shall be provided:

(a) Port-side light;

(b) Starboard-side light;

(c) Stern light;

(d) Masthead light;

(e) Anchor light;

(f) Combined NUC and diving lights as follows: three all-round lights in a vertical line where they can best be seen. The highest and lowest of these lights shall be red and the middle light shall be white, all lights shall be independently operated for different use;

(g) One all round flashing red light on top of mast without restriction, indicating the Vessel is on duty;

(h) Black ball (3 nos);

(i) Black diamond;

(j) Whistle;

(k) Bell; and

(l) Any other navigation lights as required.

9.10.5 Three sets of spare bulbs (one per light) shall be provided for the navigational and signal lights.

9.11 Searchlight

9.11.1 A set of 1000 watt marine use mercury xenon search light mounted on the wheelhouse with remote control and indication inside the wheelhouse for rotation (at least 300 degree), tilting (pitch downward of 25 degree) is to be provided for illumination of the sea during sea surface searching. Another two sets of at least 370 watt marine use LED search light mounted on the wheelhouse with remote control and indication inside the wheelhouse for rotation (at least 300 degree), tilting (pitch downward of 25 degree) is to be provided for illumination of the sea during sea surface searching.

9.11.2 The searchlight shall be installed on the top of the wheelhouse. The switch for the searchlight shall be mounted adjacent to the searchlight control handle/joystick. The searchlight shall be remotely controlled by handle/joystick located in the wheelhouse control station for turning and tilting.

9.11.3 Tarpaulin covers shall be provided for the searchlights.

9.11.4 One 24V DC LED portable search lights (with luminosity equivalent to not less than 150 W conventional type) with 30 meters waterproof cable reels and plugs shall be provided in the wheelhouse.

9.12 Floodlight

9.12.1 One set of 6 x 2000W marine use weathertight floodlights (or same illumination level marine LED floodlights) mounted on a telescopic mast with remote control and indication inside the wheelhouse for rotation (360 degree), titling (down-seeing capability) and elevation shall be provided for illumination of the sea during rescue operation. The telescopic mast shall be operated by hydraulic pump and its extended height is about 7 metres from bridge deck. All maker's standard fittings and accessories shall be provided.

9.13 Power Receptacles / Sockets

9.13.1 Receptacles/sockets installed in locations subject 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.

9.13.2 A system of 380/220V AC and 24V DC socket outlets shall be provided in the engine room, fore and aft ends of the Vessel on the main deck and in the fore peak of the Vessel.

9.13.3 Socket outlets for 220V AC and 24V DC are needed in the wheelhouse.

9.13.4 Sockets shall be provided in the officer’s cabin for printer, personal computers, charger for portable VHF, charger for digital camera, charger for mobile phone, desk lamp, spare etc.

9.13.5 The crew space requires 220V AC power sockets for the portable apparatus and the domestic equipment, etc.

9.13.6 Each socket outlet shall be integrated with an 'On/Off' switch to facilitate local switching of the electrical equipment. The 220V AC socket outlets shall be supplied with 13A 3-square-pin fused plugs. The 24V DC socket outlets shall be supplied with fused plugs.

9.13.7 Sockets for different voltage systems shall be clearly labelled and with different pin sizes so that one system cannot plug into the other.

9.13.8 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.

Chapter 10 Electronic Navigational Equipment

10.1 Description of Electronic Navigational Equipment (ENE) System

10.1.1 The Contractor shall be responsible for the supply, delivery, testing, installation, commissioning and a 12-month warranty from the date of the Acceptance Certificate and provision of operational and maintenance service manual and training of all of the following equipment ("Electronic Navigation Equipment" or "ENE" or "Equipment") to be fitted on board the Vessel for FSD:

(a) Loudhailer/Siren and Public Address System with USB Player;

(b) Magnetic Compass and Fluxgate Compass;

(c) Gyro Compass System;

(d) Marine Radar;

(e) 3D High Resolution Sonar System;

(f) Electronic Chart Display and Information System (ECDIS) with DGPS, Echo Sounder & Depth Indicator;

(g) International Maritime Mobile (IMM) VHF Radio with Global Maritime Distress Safety System (GMDSS);

(h) Automatic Identification System (AIS) Transponder (include the Receiver and Transmitter Modules);

(i) CCTV Systems;

(j) Wind Speed / Direction Indicator;

(k) Electronic Marine AM/FM Radio Broadcast Receiver;

(l) Marine Band Hand-held Waterproof Radio Transceiver;

(m) Thermal Night Vision System;

(n) Voyage Data Recorder;

(o) Third Generation Mobilising System and Digital Trunk Mobile Radio System;

(p) Wired Intercom System;

(q) Wireless Intercom System; and

(r) Visual Augmentation System.

10.1.2 The Contractor shall provide all labour, materials, transportation, installation, calibration, testing and commissioning, Warranty Services in Warranty Period and test equipment etc. which are necessary to complete the work required in this chapter.

10.1.3 An integrated system is preferred, so that information and also the display monitors of different systems, such as ECDIS, radar system, AIS receiver, can be shared in order to utilise the limited space available in coxswain operation area and to provide users a better displaying interface. The Contractor may refer to Annex 6 of Part VII – Technical Specifications for the conceptual block diagram of electronic equipment for the Vessel as reference.

10.1.4 All Equipment offered shall be designed for marine applications and shall allow effective operation under most arduous condition i.e. poor weather, strong winds and heavy rains, severe vibration, etc. Exposed components shall be weather-proof and adequate protection against splash and water shall be provided for all electronic equipment fitted on board.

10.1.5 All components of the Equipment exposed to the weather shall be sea water resistance. Internal components shall be fully enclosed (IP65) with heavy duty seals and sufficient heat dissipation mechanism (e.g. ventilation, conduction, etc.) to protect the Equipment.

10.1.6 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. All radar and radio equipment shall meet the licensing requirements of the Office of the Communications Authority of Hong Kong.

10.1.7 All siting, installation and cabling in respect of compass, VHF, radar, etc. shall comply with the relevant rules and regulations of Hong Kong.

10.1.8 All ENE and electrical appliances shall have Hong Kong warranty and their on-site maintenance shall be locally available.

10.1.9 When the generation / use of calendars are employed for logging of reports, activation of 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.

10.1.10 The circuit-breaker for the ENE shall equip with lockout device so that the breaker can be locked during the equipment maintenance.

10.1.11 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.

10.1.12 Equipment supplied shall complete with all standard and/or maker recommended accessories as required for normal operation.

10.2 **Loudhailer / Siren and Public Address System with USB player**

10.2.1 The system shall function as a loudhailer/siren system for external broadcast specially designed for maritime purposes. The system shall also consist of a public address system for internal broadcast in the crew area.

10.2.2 Loudhailer/Siren

(a) The system shall comprise a master control unit in the wheelhouse and two weather proof horn type loudspeakers, in conformance to IPX5 or better, located at forward and aftward of the Vessel respectively.

(b) The system shall have the capacity to generate a "Yelp" siren and a horn signal sound in manual mode. It shall also have a selection of at least six warning signal sounds in automatic mode for general marine navigational uses, namely Underway, Stopped, Sail, Tow, Anchored, and Aground.

(c) There shall be a volume control on external broadcasting speaker so it shall be adjustable to full power for messages to be heard 0.5 km away from the Vessel and down to minimum for night operations.

(d) The master control unit, which shall be completed with fist microphone and microphone hanger, shall be recessed mounted in the wheelhouse with the following facilities provided at the front panel:

(i) Power ON/OFF;

(ii) Hail volume control; and

(iii) Function control.

(e) Speech shall be delivered through a fist microphone hanging on the console. The fist microphone shall be splash-proof, and preferably water-proof.

(f) The output power of the amplifier shall be no less than 30 watts and shall have the following characteristics:

(i) Hail sensitivity Not greater than 30 mV for 30 watts output at 1 kHz

(ii) Hail distortion Not greater than 10% at 30 watts output at 1 kHz

(g) The horn type loudspeaker shall be weatherproof reflex type, 8 ohms impedance with power rating not less than 30 watts (actual rating shall match with the amplifier).

(h) A USB player shall be provided with the system in such a configuration that the audio signal from the USB player can be broadcasted through the loudhailer system.

(i) An electric fog horn shall be installed.

10.2.3 Public Address System

(a) There shall be at least two speakers installed around the crew area for a one-way internal broadcast to the crew from the microphone at the control panel. There shall be volume control for these internal broadcast speakers for adjusting acoustic levels to comfortable levels for the crew and at the same time avoid excessive acoustic feedback to the microphone. These internal broadcast speakers shall be waterproof to IPX5 or better and suitable for the location of

installation.

(b) The positions of the master control unit of the loudhailer/siren system, control panel and both the position & quantity of speakers of the public address system shall be finalised in the detailed design stage.

10.3 Magnetic Compass and Fluxgate Compass

10.3.1 The Contractor shall provide one magnetic compass and one fluxgate compass with digital display.

10.3.2 The magnetic compass shall have a direct-read dial with dial size of at least 2 inches.

10.3.3 The magnetic compass shall have a green night lighting function.

10.3.4 The magnetic compass shall have a built-in compensator to adjust for deviation.

10.3.5 The power of the equipment shall be supplied from the 12 or 24 V DC system of the Vessel.

10.3.6 The compass dome shall be constructed of heavy duty, optically clear polymer, and shall provide clear and accurate magnification of the dial.

10.3.7 Performance requirements of magnetic compass:

(a) Resolution: 2° or better

(b) Mounting option: Binnacle or flush or bulkhead mount

(c) Waterproofing: IPX5 or better

10.3.8 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.

10.3.9 An electronic display unit shall be installed at a position for easy viewing of the Vessel heading by the coxswain.

10.3.10 The fluxgate compass shall not be unduly interfered with by other equipment on board the vessel especially the GPS/DGPS.

10.3.11 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.

10.3.12 Performance Requirements of fluxgate compass:

(a)	Reference	:	Either magnetic north or true north.
(b)	Accuracy	:	$\pm 1.0^{0}$ typical or better.
(c)	Resolution	:	0.1^{0} or better.
(d)	Deviation Compensation	:	Automatic.
(e)	Operating Temperatures	:	0℃ to 50℃
(f)	Waterproofing	:	IPX5 or better.

10.4 Gyro Compass System

10.4.1 The gyro compass system shall be typed approved in accordance with the IMO high speed craft code.

10.4.2 The gyro compass system shall consist of a gyro compass, an operator unit and a distributor unit.

10.4.3 The system shall allow integration of additional sensors such as magnetic compass, satellite compass and external rate-of-turn gyro.

10.4.4 The system shall equip with automatic speed and latitude error correction.

10.4.5 The system shall be able to connect to other navigation equipment on board, including but not limited to, radar, ECDIS and GPS etc, through NMEA ports.

10.4.6 Performance Requirements of gyro compass system:

(a)	Reference	:	Either magnetic north or true north.
(b)	Accuracy	:	$\pm 0.1^{0}$ typical or better
(c)	Resolution	:	0.1^{0} or better

(d)	Deviation Compensation	:	Automatic.
(e)	Operating Temperatures	:	-10℃ to 55℃
(f)	Waterproofing	:	IPX5 or better
(g)	Output port	:	NMEA and RS232C

10.5 **Marine Radar**

10.5.1 The Contractor shall supply two radars, one is X-band and one is S-band. Both radars shall have an independent transceiver, a scanner and a colour display unit which satisfy the following requirement.

10.5.2 General Requirements for X-Band and S-Band Radar :

(a) The equipment shall be a relative motion high performance radar suitable for the Vessel and comprises a transceiver, an antenna and a colour display unit, suitable for bright daylight and night viewing.

(b) The radar shall have interface to accept navigation data such as latitude/longitude position of the Vessel given by the GPS receiver.

(c) The radar shall be able to track high speed small crafts easily.

(d) The radar shall also be able to detect tiny targets such as small buoys or wooden stakes.

(e) The radar shall be using solid state technology or equivalent technology such that the warm up time from power on to operation is less than 1 minute or better.

(f) The Contractor shall ensure that the type and the number of provisions of the radar are appropriate to the class of the Vessel.

(g) The radar shall be equipped with a collision avoidance function that is an Automatic Radar Plotting Aid – ARPA or other equivalent function capable of tracking at least 20 targets.

(h) The collision avoidance function shall be able to display the “no go areas” directly on radar screen. This function shall support the navigator finding a save way and avoiding situations of possible collision. This function shall also analyse the movement of the plotted objects and determine in which areas the danger causes by a possible crash is exceptional high. These areas are displayed as a hatched field. If the navigator avoids these so-called “no go areas”, it navigates most probably on a safe route. This function shall show true zones (in relation to other true objects e.g. chart underlay, buoys, true marks, traffic separation zones, navigation lines).

(i) 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.

(j) The radar scanner unit shall be installed well clear of obstruction 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.

(k) Complete interface kit shall be provided to interface the radar for the gyro compass, 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.

(l) There shall be interface provided to the radar for AIS. The radar shall have interface to accept and display AIS information such as the Vessel names, call signs, heading, destination, maritime mobile service identity (MMSI), latitude, and longitude and other navigation data given by the AIS.

(m) The Contractor shall pay special attention to any possible radar blind zone, and shall address this during the design stage and verify it after installation, and rectify it if required. The Contactor shall pay special attention to the Equipment installed before the radar scanner like flood lights and/or horn speakers. Care shall also be taken to ensure the mounting does not obstruct the navigation lights.

(n) The radar shall have standard NMEA 0183 OR NMEA 2000 interface ports, capable of accepting navigational data from a wide selection of GPS/DGPS receivers and electronic compasses, AIS and to output comprehensive data on all tracked targets in the form of a track table to a wide

selection of electronic chart plotters. However, connection of the radar system to the other systems supplied under this Contract via other standard or proprietary interface types equivalent to NMEA 0183 OR NMEA 2000 is acceptable.

(o) The power of the equipment shall be supplied from the DC 24V system of the Vessel.

(p) 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 vessel enter the zones set.

(q) 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.

(r) The display unit shall be a high resolution Thin-Film Transistor (TFT) colour display, combining brilliant display quality and compact design with a long life time.

(s) 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; and

(xii) Heading marker ON/OFF.

(t) The marine radar system shall comply with latest International Maritime Organization (IMO) regulations and requirements on IMO Res. A.823(19), MSC 64 (67) Annex 4, MSC.192(79) and A.820 (19)-High Speed Craft Code.

10.5.3 Performance Requirements

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

(b) Display Unit

(i) Display	:	TFT colour LCD
(ii) Screen Size	:	19 inch or larger
(iii) Resolution	:	1280 x 1024 pixels or better
(iv) Range	:	0.125 nm – 96 nm
(v) EBLs (Electron Beam Lithography)	:	2
(vi) VRMs (Voltage Regulator Module)	:	2
(vii) Parallel Index Lines	:	2
(viii) Display Presentations	:	RM (R), RM (T), TM
(ix) Display Heading Modes	:	H Up, N Up, C Up, R Up
(x) Gyro Input	:	NMEA, Fast NMEA
(xi) Log Input	:	NMEA, pulse

(c) X-band Transceiver

(i) Radar Max Range	:	72nm or better
(ii) Receiver Noise (dB)	:	6.0 or better
(iii) Pulse Width (μsec)	:	Short: 0.08 or better
		Med 1: 0.3 or better
		Med 2: 0.6 or better
		Long: 1.2 or better

(d) S-band Transceiver

(i) Radar Max Range	:	96nm or better
(ii) Receiver Noise (dB)	:	5.0 or better
(iii) Pulse Width (μsec)	:	Short: 0.06 or better
		Med 1: 0.25 or better
		Med 2: 0.5 or better
		Long: 1.0 or better

(e) Antenna for X-band Radar

(i) Operating Frequency	:	X–band
(ii) Scanner Size	:	6 feet
(iii) Horizontal Beam Width	:	1.2 deg or less
(iv) Vertical Beam Width	:	25 deg or less
(v) Polarisation	:	horizontal
(vi) Rotation Rate (RPM)	:	24 – 48 or better (It shall be adjustable according to the selected range scale or pulse length for optimum detection)
(vii) Wind Load	:	100kts

(f) Antenna for S-band Radar

(i) Operating Frequency	:	S–band
(ii) Scanner Size	:	12 feet
(iii) Horizontal Beam Width	:	1.9 deg or less
(iv) Vertical Beam Width	:	26 deg or less
(v) Gain (dB)	:	28 dB or better
(vi) Polarisation	:	horizontal
(vii) Rotation Rate (rpm)	:	24 – 48 or better (It shall be adjustable according to the selected range scale or pulse length for optimum detection)
(viii) Wind Load	:	100 kts

(g) 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 1.5 degree. Bearing discrimination shall be better than 2.0 degrees.

(h) ARPA (Automatic Radar Plotting Aid) Requirement

(i)	Target Acquisition	:	70 targets or better
(ii)	Tracking	:	Automatic
(iii)	ARPA Range Scales	:	From 0.75 to 12 nautical miles or better
(iv)	Readout of Selected Target	:	Range, bearing, course, speed, CPA (Closest Point of Approach), TCPA (Time to Closest Point of Approach)
(v)	Target Vector	:	Relative, true
(vi)	Intercept Mode	:	Automatically calculate intercept course and Time to Go (TTG) to tracked target Adjustable warning limit – warming for CPA to a desired adjustable limit

(i) 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.

(j) The following standard interfaces shall be provided:

(i) USB interface for external units or updating by USB stick;

(ii) CAN Bus (Controller Area Network);

(iii) Video Graphics Array (VGA) video output to add remote display or connect Voyage Data Recorder (VDR);

(iv) Alarm output via National Marine Electronics Association (NMEA);

(v) Connection to gyro or Global Positioning System (GPS), via NMEA, or Fast NMEA; and

(vi) SENC (System Electronic Navigation Chart) data input from Synapsis ECDIS (Electronic Chart Display Information System).

(k) The following system integration function shall be provided:

(i) AIS (Automatic Identification System) display of AIS targets, additional information to provide a better overview of traffic situation;

(ii) ECDIS / GPS Display route coming from ECDIS / GPS;

(iii) ARCP-Panel (Autopilot Remote Control Panel) Autopilot operation directly from radar workplace; and

(iv) SENC-Data (System Electronic Navigation Chart-Data) Input of selected chart symbols from ECDIS.

10.6 **3D High Resolution Sonar System**

10.6.1 General Requirements

(a) The 3D high resolution sonar system shall be able to generate 3D image ahead of the Vessel at navigation significant field of view up to 90°. It shall be able to display the range, bearing and depth of the obstacles ahead and to the side of the Vessel.

(b) The system shall allow overlaying its data on top of a nautical chart. Chart overlay shall include displaying the seafloor and in-water obstacles.

(c) The system shall be able to generate the 3D image of the volume of interest ahead of the Vessel with a single ping.

(d) The transducer module of the system shall be protected by rugged stainless steel.

(e) Interfaces shall be provided to integrate with other navigational equipment on board.

(f) The system shall be able to indicate the position of the Vessel and the target located by Lat/Lon.

10.6.2 Performance Requirement

The 3D high resolution sonar system shall perform at least or better than the following requirements in this paragraph.

(i) Field of View	:	90° or better
(ii) Operational Speed	:	up to 25 knots or better
(iii) Bottom Mapping Ration	:	8x water depth or better
(iv) Maximum Depth Detection	:	50 m or better
(v) Operating Frequency	:	61kHz
(vi) Angular Accuracy	:	1.6° or better

10.7 **Electronic Chart Display and Information System (ECDIS) with Differential Global Positioning System and Echo Sounder**

10.7.1 General Requirements

(a) One set of ECDIS must provide the following functions:

(i) Navigational calculation;

(ii) Chart updating;

(iii) Piloting; and

(iv) Voyage monitoring.

(b) The ECDIS shall be installed with DGPS receiver and echo sounder. It shall consist of a multi-touch screen monitor, a remote GPS antenna and differential beacon receiver, an echo sounder and a processor unit with controller.

(c) The ECDIS shall be able to show the radar, AIS, depth of water by echo sounder and ENC information. Different display options shall be allowed, including but not limited to the following combinations:

(i) Electronic Chart only

(ii) Electronic Chart + Radar A

(iii) Electronic Chart + Radar B

(iv) Electronic Chart + AIS

(d) The information received by the Global DGPS receiver shall be input to the marine radar and display on the marine radar and the multi-touch screen monitor of ECDIS. 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.

(e) One multi-touch screen monitor of size not less than 600mm (24 inches) diagonal high resolution colour LCD for the Vessel. The multi-touch screen monitor must fulfil the following features:

(i) Multi-touch screen

(ii) 1000 nits Brightness

(iii) 610mm active viewing area or better

(iv) HDMI, DVI and Composite inputs

(v) On-class menu keys

(vi) Can be operated as radar, chart plotter, depth sounder, alarms etc.

(f) The ECDIS 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.

(g) The ECDIS shall be equipped with navigational sea charts in details covering the entire Hong Kong Waters.

(h) The information received by the AIS shall be able to display on the multi-touch screen monitor of ECDIS.

(i) Complete interface kit shall be provided to interface with the colour chart plotter for the navigation equipment on board, including but not limited to, the radar, echo sounder, AIS, GPS/DGPS and 3D sonar. The colour chart plotter shall accept and display information given by the radar, echo sounder, AIS, GPS/DGPS receiver and 3D sonar.

(j) The processor unit of the ECDIS shall accept and display information given by the ENE equipment: Radars, VHF, AIS transponder, DGPS and three control consoles. The processor unit shall have high-performance quad-core processor for rapid, responsive operation of the multiple touch screen monitor.

(k) The ECDIS should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment.

(l) The ECDIS shall be 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 e.g. S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetic ENCs, ARCS charts, VMAP/DNC charts, AML charts, BSB charts, WMS charts and Geo TIFF.

(m) The chart information to be used in ECDIS should be the latest edition, can be corrected by official updates (S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetic ENCs) by the Marine Department Hong Kong Hydrographic Offices of MD with records of update shown on the ECDIS.

(n) The ECDIS should enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. It should be capable of continuously plotting the ship‘s position.

(o) The ECDIS should be capable of displaying both English and Chinese characters of the ENC.

(p) The EDCIS should store 12 hours history voyage record and can be reproduced on the EDCIS.

(q) The Contractor shall provide software updates to ensure the ECDIS is at its latest version.

10.7.2 Performance requirements

(a) Navigational Features

Total Waypoint	:	2000 or more
Routes	:	50 route plans or more
Alarms	:	including but not limited to, proximity alert, cross-track error, and arrival /anchor watch

(b) Electrical and Physical

Power Source	:	12 - 24V DC (external)
Display (Screen Type)	:	24 inch or greater diagonal high resolution colour display, resolution 1280 x 1024 pixels or better

(c) Environmental

Operating Temperature	:	-10 ºC to +50 ºC
Storage Temperature	:	-20 ºC to +60 ºC

(d) GPS Receiver

GPS Receiver Type	:	Equipped with 8 channel parallel receiver or better
Frequency Range (GPS)	:	1575.42±1MHz (C/A code), L1
Sensitivity (GPS)	:	-130 dBm or better
Dynamic Range (GPS)	:	25 dB or better
Warm start fix time	:	less than 30 seconds
Cold start fix time	:	less than 3 minutes
Position Accuracy	:	no greater than 15m
Tracking Velocity	:	999 kt

(e) Differential Beacon Receiver

Frequency range	:	283.5-325 kHz
Frequency Step	:	500 Hz
Position Accuracy	:	no greater than 5m

(f) Data Display

Lat/Lon	:	N or S plus 7 digits
	:	E or W plus 8 digits
Antenna Height	:	4 digits, 1m resolution
Speed and Course	:	0.1 Kt or 0.1 Km/h resolution
	:	3 digit 1-degree resolution
Cross Track Error	:	Graphic or direction indication
Bearing	:	3 digits, 1-degree resolution
Range	:	4 digits, 0.01-nm resolution
CDI	:	Active perspective view, selectable scale (0.1, 0.3 or 0.5 nm)
Time	:	Selectable as GMT or local mode
Mapping	:	Resident world map in memory (reversible video)
Language for system	:	(i) English operation and display
		(ii) Bilingual (English and Chinese) is preferred

(g) Echo Sounder & Depth Indicator

(i) The proprietary make equipment shall consist of a transducer and a digital depth indictor which is recessed mounted at the steering console and capable of providing readout of sea depth in feet, fathoms and meters.

(ii) The measuring depth shall be from 3 feet to 999 feet or equivalent fathom or metre with at least three selectable ranges to indicate shallow, mid and deep ranges. The unit of measurement shall be selected at the front panel of the equipment.

(iii) Shallow and deep water audible alarms shall be provided. Setting of the alarm depth shall be at the front panel of the equipment.

(iv) The electronic accuracy of depth reading shall be better than + 5% of full scale range.

(v) 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.

(vi) There should be an isolating switch to switch off the recorder in case of shortage of recording paper but the equipment for sensing and indicating the depth shall still be operating and functioning as in normal working condition.

(h) Electronic Charts Requirement – Livechart or equivalent

(i) Fully legal, vectorised and layered digital charts compiled according to International Hydrographic Organization (IHO) standards, such as S52, S57 and DX90, shall be required.

(ii) The charts shall accurately reproduce all the colours and details of the standard on paper charts referenced by the Hydrographic Office of MD and shall be identified by their original numbers.

(iii) The charts showing Hong Kong and nearby water shall be required.

(iv) Full chart update service shall be provided by the Contractor. Details of such service shall be submitted to the Government for approval.

10.8 **International Maritime Mobile (IMM) VHF Radio with GMDSS**

10.8.1 The Contractor shall supply five sets of International Maritime Mobile (IMM) VHF radio with GMDSS, one set serving as the shipboard radio station and the other four being portable radios. The portable radios shall meet the requirements of Clause 10.13, whereas the shipboard radio station shall meet the requirements of Clauses 10.8.3 and 10.8.4.

10.8.2 The Contractor shall provide proper stowing space and facilities for keeping of the portable radio and the spare battery such that the crew can take the portable radio out for use when necessary.

10.8.3 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 Global Maritime Distress Safety System (GMDSS)with a class A Digital Selective Calling (DSC) transceiver fully compatible with the International Maritime Organization (IMO) GMDSS carriage requirements.

(c) The radio shall be equipped with all the international maritime VHF channels completed with fist microphone with press-to-talk switch or telephone handset, mic/handset hanger, mounting bracket and loud speaker.

(d) The radio shall have an independent dual watch mode selection switch that incorporate with Channel 16 and shall be able to dual watch on any other selective channel.

(e) The following facilities shall be provided at the front panel of the radio:

(i) Power ON/OFF;

(ii) Transmit indicator, volume and squelch controls;

(iii) Socket for plug for microphone and external speaker;

(iv) Quick selection of Channel 16;

(v) Channel selection and indicator;

(vi) Independent dual watch mode selection switch;

(i) Transmission power selector for HIGH and LOW Power (25 W/ 1 W);

(f) The operating temperature of the radio shall be -5℃ to +55℃ or better. The water ingress protection for the radio shall be IPX7 or better.

10.8.4 Performance Requirements

(a) Transmitter Characteristics

Spurious and Harmonics	:	-70 dB or better emissions
RF Output Power	:	25 W / 1 W (High / Low)

(b) Receiver Characteristics

Sensitivity	:	Less than 1 uV for 20 dB SINAD or equivalent
Adjacent Channel Selectivity	:	60 dB or better
Spurious Image Rejection	:	65 dB or better
Intermodulation	:	65 dB or better
Audio Output	:	Not less than 1 Watt at rated audio power output with less than 10% distortion

(c) Aerial and Feeder

(i) The aerial provided shall be marine type aerial with at least 3 dBi gain, vertically polarised, omni-directional and suitable for mounting on the Vessel.

(ii) The V.S.W.R. of the aerial 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 for protecting the radio equipment. All outdoor connector joint shall be properly covered by waterproof tape or material.

10.9 **Automatic Identification System (AIS)**

10.9.1 General Requirements

(a) The equipment shall receive navigation information from local AIS-equipped vessel.

(b) The equipment shall be a Class A universal AIS complying with IMO MSC. 74(69) Annex3, IEC 61993-2, ITU-R M.1371-3, ITU-R M.493-13, ITU-R M.825(DSC), IEC 60945, IEC 61162-1/2.

(c) The AIS transponder (receiver module) shall be able to receive AIS information from AIS-equipped Vessel nearby such as 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 names, type of ship, call signs, length and beam, heading, destination, latitude, and longitude, location of position-fixing antenna on the ship), short safety-related messages and other navigation data, from the Vessel nearby.

(d) The AIS supplied shall be completely compatible with all systems using NMEA standard and be able to interface with radar, ECDIS, gyro compass, and external GPS, etc.

(e) Edition of user message on navigation & ship securities shall be available.

(f) The AIS shall be easy to identify other ship's status by providing electronic chart data.

(g) The AIS shall have self-restoring function to enhance stability.

(h) The AIS shall adopt user-friendly one touch keypad (or equivalent).

(i) The AIS shall be weather-proof suitable for outdoor use for ship or Vessel (or equivalent).

(j) Each set of AIS shall include:

(i) Not less than 14" AIS LCD colour graphic display unit;

(ii) AIS transponder unit;

(iii) VHF antenna;

(iv) GPS antenna; and

(v) Installation / operation handbook.

10.9.2 Performance Requirements

(a) The AIS shall comply with the following specifications:

(i) General

Power Consumption	:	50W peak / 10W average (Main Unit)
Power supply	:	12V DC + 10%

Default Frequencies	:	AIS1 (CH 87B) : 161.975 MHz AIS2 (CH 88B) : 162.025 MHz DSC (CH70) : 156.525 MHz
Frequency range	:	156.025 ~ 162.025 MHz
Transponder size/weight (+ 2%)	:	221 x 165 x 95 mm, 1.5 kg
MKD Display	:	5.6”(or larger) Colour TFT LCD
MKD size/weight (+ 2%)	:	255 x 162 x 75 mm, 0.9 kg
GPS size/weight (+ 2%)	:	90 x ∅ 65 mm (+140 mm mounting bar), 0.2 kg

(ii) AIS Transmitter

Power output	:	12.5W or 1.0W (41 dBm ±1.5 dB or 30 dBm ±1.5 dB)
Antenna impedance	:	50 ohms (SO-239)
Channel spacing	:	25 kHz

(iii) AIS Receiver

Sensitivity	:	(PER) < 20% at -107 dBm
Modulation	:	GMSK
Data rate	:	9600 bits/s
Frequency stability	:	< ±1 ppm
Co-Channel	:	10 dB
Adjacent Channel	:	70 dB
IMD	:	65 dB
Blocking	:	84 dB

(iv) DSC Receivers

Sensitivity	:	BER <10-4 at 107 dBm
Modulation	:	FSK (1300 Hz / 2100 Hz)

(v) Serial inputs/outputs

SENS1/2/3/4	:	IEC61162-1/2 (input only)
LONG/AUX/PILOT/RTCM	:	IEC61162-1/2 (input & output)
Display	:	RS422 non-isolated

(vi) GPS Antenna & Receiver

Antenna	:	PATCH ANTENNA / TNC (RG-58U)
Receiver Type	:	16 channel, L1 frequency, C/A code
Accuracy	:	Acquisition -140 dBm / Tracking -150 dBm

(vii) Environment

Operation temperature	:	-15℃ to +55℃
Storage temperature	:	-25℃ to +75℃
Vibration	:	IEC 60945

(b) Aerial and Feeder

(i) The aerial provided shall be marine type aerial with at least 3 dBi gain, vertically polarised, omni-directional and suitable for mounting on the launch.

(ii) The V.S.W.R. of the aerial 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 for protecting the radio equipment. All outdoor connector joint shall be properly covered by waterproof tape or material.

10.10 **CCTV System**

10.10.1 General

(a) The Contractor shall provide one set of CCTV system for general monitoring of the Vessel from the wheelhouse and from the Command Post.

(b) The Contractor shall finalise the locations of the cameras with FSD during the design stage.

(c) Unless otherwise stated, all cameras shall be high-resolution, each with at least 4 mega-pixel colour imager, water-proof, vandal-resistant type, ICR day and night dome pan tilt zoom camera with auto-focus. They shall be of the marine type, to at least IP66, and shall be suitable for operation in rough sea environment. The camera shall be capable of H.264 and preferably also H.265 video coding. Zoom lenses shall be capable of a zoom ratio of 20x or better.

(d) All cameras shall have image stabilisation function to accommodate the rough sea conditions.

(e) Camera lenses with appropriate ranges of field of view (FOV) shall be selected according to the actual FOV coverage that is needed.

(f) All camera signals should route through a network video recorder (NVR) for recording.

(g) The NVR shall have sufficient disk space for archive of 30 days video image for all cameras at 1 mega-pixel resolution and 50 frames per second. Also, real-time HD image at 25 frames per second for viewing shall be provided.

(h) LCD monitor, screen with not less than 21 inches diagonal measurement, shall be provided for display of video image.

(i) After installation of the system, the Contractor shall provide free on site operational training on the Vessel to ensure proper operation of the system until MD's satisfaction.

(j) An Uninterruptible Power System (UPS) shall be designed, supplied and installed to sustain the operation of all the equipment of CCTV system for a minimum of 60 minutes.

10.10.2 CCTV for general purpose

(a) The CCTV system shall consist of cameras at least in the following areas:

(i) At least two cameras on port side;

(ii) At least two cameras on starboard side;

(iii) At least one camera for aft-side of the Vessel;

(iv) At least one camera for helicopter winching;

(v) At least one camera for daughter boat launching;

(vi) At least one camera for forward side of the Vessel; and

(vii) At least two camera in each engine room.

The Contractor shall ensure that at least 95% of each area listed above shall be properly covered. The Contractor shall propose the number of camera required if the above is deemed not sufficient.

(b) The camera above the wheelhouse functions as a "voyage video recorder", which shall be a fixed camera with a wide field of view of at least 120° and with IR LEDs which allow operation at poorly illuminated conditions. The camera shall be so installed that it covers the area in front of the Vessel.

(c) The control and monitoring of the CCTV for general purpose shall be located in the wheelhouse

and at the Command Post. The Contractor shall finalise the locations with FSD during the design stage.

10.11 Wind Speed and Direction Indicator

10.11.1 A marine type wind speed and direction indicator of proprietary make shall be provided and the wind speed data shall be shown in the ECDIS.

10.11.2 The indicator shall interface to the ECDIS.

10.11.3 The indicator shall provide on board with data display being installed inside the wheelhouse.

10.11.4 The indicator shall be mast mounted at unobstructed position.

10.12 Electronic Marine AM/FM Radio Broadcast Receiver

10.12.1 General Requirement

(a) The equipment shall consist of a marine type AM/FM radio broadcast receiver of proprietary make, a DVD player and two speakers located at the wheelhouse.

(b) The equipment shall be weather proof and IPX5 water resistant.

(c) Language of the user interface shall be in English.

(d) The interface of the equipment shall be user friendly and there shall be buttons/control for audio playback and AM/FM radio tuning.

(e) The positions of the AM/FM radio equipment shall be finalised in the detailed design stage.

10.13 Marine Band Hand-held Waterproof Radio Transceiver

10.13.1 General Requirement

(a) The Contractor shall provide 4 sets of GMDSS VHF waterproof Marine band handheld transceivers.

(b) Each portable maritime VHF transceiver shall be of proprietary make and completed with two sets of rechargeable batteries, batteries charger, helical antenna with V.S.W.R. not exceeding 1.5:1 and carrying case (with shoulder strap or belt clip).

(c) The operation period of each fully charged battery shall not be less than 8 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. Normally the battery charger shall be not in use and shall be stowed on the Vessel with stowing space and facilities provided by the Contractor.

(d) The portable transceiver shall be at least able to transmit and receive on all the 55 International Maritime VHF channels, together with the private maritime VHF single frequency channels 96 (157.925 MHz) and/or 99 (157.975 MHz).

(e) The transceiver shall be of robust, waterproof, light weight design and made with shock proof material suitable for hand held radio communication 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 meet the licensing requirements of OFCA for maritime frequency band application.

10.13.2 Performance requirement

(a) The transceiver shall at least incorporate with the following controls / switches / facilities:

(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 and operating channel display; and

(vii) sockets for external microphone, press to talk switch and loudspeaker.

(b) The transceiver shall at least comply with the following technical specifications:

<u>General</u>		
Operating Centre Frequency Range	:	International Maritime VHF Band
No. of Operating Channel	:	99 (Programmable)
Operating Mode	:	Simplex or Two Frequency Simplex
Channel Spacing	:	25 kHz
Frequency Stability	:	+/- 8 ppm between 0 and 50°C
Housing IP Category	:	IP 57
<u>Transmitter</u>		
RF Transmitting Power	:	2 Watts at High Power Mode 1 Watt at Low Power Mode
Adjacent Channel Power	:	Below -65 dBC
Spurious and Harmonic Emission	:	Below 25 W
FM Hum & Noise	:	40 dB or better
<u>Receiver</u>		
Receiver Sensitivity	:	0.3 dB V or better for 12 dB SINAD
Receiver adjacent channel selectivity	:	70 dB or better
Intermodulation Response Rejection	:	70 dB or better
Blocking/Desensitisation Level	:	90 dB V or better
Spurious Response	:	70 dB or better
Spurious Emission	:	Below 20 nW
Total Harmonic Distortion	:	Less than 10 %
Signal/Noise Ratio	:	40 dB or better

10.14 **Thermal Night Vision System**

10.14.1 General Requirement

(a) Each set of thermal imaging camera system shall include :

(i) Thermal night vision camera;

(ii) Touch screen multi-function display (MFD);

(iii) Joystick control unit for touch screen MFD display;

(iv) External GPS antenna for touch screen MFD display; and

(v) Hong Kong water charts for touch screen MFD display.

(b) It shall be long-range thermal night vision with a colour zoom camera and gyro-stabilization.

(c) The active gyro-stabilization shall provide steady imagery, even in rough seas.

(d) The thermal night vision camera shall come with a colour television camera with 10X optical zoom which shall provide continuous zoom and shall match the thermal night vision camera's e-zoom for easy operation when switching between cameras.

(e) Colour on-screen symbols shall be provided for detailed 3D colour on-screen symbols giving users instant access to system status, position and configuration.

10.14.2 Technical Requirement

(a) Thermal Night Vision Camera:

Thermal Imaging

Sensor Type	:	640 X 480 Vanadium Oxide (VOx) Microbolometer
Field of View (FOV)	:	18 º X 14 º (NTSC)
Focal Length	:	35mm
e-zoom	:	2x & 4x
Frame Refresh Rate	:	< 9Hz or better

Colour Daylight Imaging Camera

Detector Type	:	Colour CCD
Field of View (FOV)	:	58 º (h) X 43 º (v) with 10x optical zoom slaved to thermal night vision camera or better
Lines of Resolution	:	530 or better
Minimum Illumination	:	1.4 Lux or better

System

Stabilisation	:	2-Axis Gyro-Stabilization
Pan/Tilt Coverage	:	360 º Continuous Pan +/- 90º Tilt
Video Output	:	NTSC or PAL
Accessories	:	BNC with BNC-to-RCA adapter included for video out
Power Requirements	:	compatible with the Vessel's power supply
Colour Mode	:	5 different Colour Mode : Greyscale, Red (night mode), GlowBow, Rainbow & Fusion (Note : each also has a polarity inversion ; greyscale <=> WhiteHot and BlackHot)
Camera Modes	:	Pause, Reverse (Rearview)

Environmental

Operating Temperature Range	:	-25 ºC to +55 ºC (per IEC 60945)
Automatic Window Defrost	:	Standard
Sand/Dust	:	Mil-Std-810E
Water Ingress	:	IPX6 or better
Shock	:	15g vertical, 9g horizontal or better
Vibration	:	IEC 60945; MIL-STD-810E
Lightning Protection	:	IEC 60945
Salt Mist	:	IEC 60945
Wind	:	100 knots (115.2 mph)
EMI	:	IEC 60945

Range Performance

Detect Man (1.8m x 0.5m)	:	up to 4,000 ft. (1.2km)
Detect Small Vessel (4m x 1.5m)	:	up to 2.4 miles (3.9km)

(b) Touch screen MFD shall:

(i) Control directly the thermal night vision camera;

(ii) Be touch screen and non-touch screen with keypad buttons control selectable;

(iii) Have built in wifi to take full control and monitoring of the thermal night vision camera / touch screen mfd from smartphone or tablet via free-of-charge mobile apps;

(iv) Have built in gps / chartplotter features;

(v) Be easy to customise the touch screen mfd with full or split screen, windows of charting, gps, thermal night vision camera and colour daylight imaging camera; and

(vi) Display : 17 inches TFT backlit, at least 1280 X 800 pixels, LCD multi-function color display unit

(1)	Viewing Angles	:	80^o left/right and 80^o 60^o top/bottom
(2)	Networking Capability	:	Yes
(3)	Waterproofing	:	IPX6
(4)	Mounting Methods	:	Surface mount. Trunnion mount with bracket
(5)	Cartography	:	Hong Kong Water Chart Datum
(6)	Wireless Connectivity	:	WiFi 802.11b/g;
(7)	Bluetooth	:	AVRCP 2.1+EDR power class 1.5
(8)	GPS	:	Built-in 50 channels; WAAS, EGNOS and MSAS. Automatic signal acquisition and almanac update; Operating frequency: 1575.42MHz; Geodetic Datum: WGS-84, Active Jamming Reduction; Ceramic Chip antenna; Accuracy: without SBAS < 15m 95% of the time. With WAAS/EGNOS <5m 95% of the time.

(c) Joystick Control Unit for Touch Screen MFD Display:

(i) Dedicated thermal camera controller, featuring 3 axis puck control, function keys and an LCD;

(ii) Compatible with the thermal night vision camera and touch screen MFD; and

(iii) To provide the controls to operate and configure the camera.

(d) External GPS Antenna for Touch Screen MFD Display:

(i) To provide information to the thermal imaging camera system; and

(ii) Compatible with the thermal imaging camera system.

(e) Hong Kong Water Charts for Touch Screen MFD:

(i) To provide digital chart data of Hong Kong Water information to the thermal imaging camera system; and

(ii) Compatible with the thermal imaging camera system.

10.14.3 Functional Requirement

(a) In surveillance mode the thermal night vision camera (the Camera) shall pan left and right continuously. The Camera shall continue to pan until surveillance mode is disabled, or the JCU (Joystick Control Unit) is used to move the Camera. When this occurs the Camera does not automatically resume surveillance mode and the mode must be enabled again if required.

(b) The Camera shall include a mechanical stabilisation feature. The mechanical stabilisation feature shall improve image stability by compensating for the Vessel motion and keeping the Camera aimed at the point of interest. Mechanical stabilisation shall have two aspects: horizontal

(azimuth) and vertical (elevation).

(c) Point mode function shall be provided to turn off the horizontal (pan) stabilisation while retaining the vertical (tilt) stabilisation. This can be helpful when users use the Camera as an aide to navigation and keep the camera pointing in the same position relative to the Vessel as it turns.

(d) A user shall be able to reverse the polarity of the video image to change the appearance of objects on-screen. The reverse video option (video polarity) shall switch the thermal image from white-hot (or red-hot if the colour mode setting is active) to black-hot.

(e) The Camera shall have a home position which is a preset position. The home position usually defines a useful reference point. A user shall be able to return the Camera to the home position at any time.

(f) The Camera shall have a rear view mode function to flip the video image horizontally, providing a "mirror image". This is useful when the Camera is rear-facing and a user is viewing the image on a forward–facing monitor.

(g) When user touches the touch screen MFD (cue) and the Camera shall automatically move to the cursor position (slew) so that it shall allow the user to keep chart objects like buoys or obstructions in constant view.

(h) The Camera shall have a target tracking function so that the Camera shall automatically keep "cued" targets in view at all times.

(i) The Camera and the touch screen MFD Display shall auto slew to dangerous MARPA and AIS targets, keeping dangerous targets in the Camera's sight during limited visibility situations.

10.15 **Voyage Data Recorder (VDR)**

10.15.1 General Requirement

(a) The voyage data recorder shall collect data from all interfaced sensors on the Vessel, storing it in an external Data Recording Unit (DRU).

(b) The DRU shall be tamperproof and be able to withstand the extreme impact, pressure, shock and heat, which may happen during incident.

(c) The voyage data recorder shall comply with the IMO performance standards for VDR.

10.15.2 Performance Requirement

(a) The VDR shall satisfy the following minimum performance requirement:

(i) Data Collecting Unit (DCU)

Recording period	:	720 hours or better
Interface	:	Ethernet, serial input, digital and analog input

(ii) Data Recording Unit

Recording period (for fixed and float-free DRU)	:	48 hours or better
Protection	:	IP56 or better

(iii) Remote Alarm Panel

Display	:	4.3 inches colour LCD or better

10.16 **Fourth Generation Mobilising System (4GMS), Third Generation Mobilising System (TGMS) and Digital Trunk Radio System (DTRS)**

10.16.1 The Contractor shall provide cable trunking, conduit and wiring and to install the equipment listed in the corresponding locations to the satisfaction of MD officer & EMSD officers.

10.16.2 Unless otherwise specified, the equipment set out in this Paragraph 10.16 shall be supplied by FSD. The Contractor shall liaise with FSD for the equipment during construction stage.

10.16.3 Technical Requirement of 4GMS / TGMS and DTRS

(a) Equipment in Wheelhouse

Category	**Item**	**Equipment**	**Working Voltage (V)**	**Working Power (Watt)**	**Standby Current (Amp)**	**Size (mm) Depth x width x height**	**Weight (kg)**	**Quantity**	**Remark**
4GMS / TGMS	1	4GMS / TGMS Mobile Data Terminal (MDT)	12 / 24	65	0.7	23.8 x 317 x 215 / 35 x 270 x 256	1.39 / 2.2	1	
	2	4GMS / TGMS OBE Box containing AVLS OBU, TMR and DC-DC converter	12 / 24	60	1	450 x 360 x 300	12.5	1	
	3	Dedicated RS232 GPS Data output Port (Data format shall be NMEA 0183 OR NMEA 2000). Serial port baud rate :9600 bit/Sec, 8 bit data, No Parity and 1 stop bit.						1	
						Total weight (Approximately) :	14.7 kg		

Category	Item	Equipment	Working Voltage (V)	Working Current (Amp)	Standby Current (Amp)	Size (mm) Depth x width x height	Weight (kg)	Quantity	Remark
DTRS	1	Mobile Radio Terminal Enhanced Control Head	12 N/A	2.2 N/A	0.5 N/A	169 x 170 x 45 31 x 188 x 60	1.07 0.23	2 2	Power of Control Head shall be directly fed from the attached radio terminal unit.
DTRS	2	Mobile Repeater Terminal Enhanced Control Head	12 N/A	2.2 N/A	0.5 N/A	169 x 170 x 45 31 x 188 x 60	1.07 0.23	1 1	Power of Control Head shall be directly fed from the attached radio terminal unit.
DTRS	3	Portable Repeater (PR)	N/A	N/A	N/A	341 x 244 x 430	15	1	
Marine Radio	4	Marine Radio	12	3	1	250 x 190 x 65	1.6	1	
						Total weight (Approximately):	20.5kg		

Category	Item	Equipment	Working Voltage (V)	Working Current (Amp)	Standby Current (Amp)	Size (mm) Depth x width x height	Weight (kg)	Quantity	Remark
DTRS	1	Multi-unit Charger (6 Pockets)	220	3	0.5	288 x 445 x 158	3.8	2	For Charging of portable radios
						Total weight (Approximately):	7.6kg		

(b) Equipment on roof or pole of the Vessel

Equipment	Category	Size (mm)	Weight (kg)	Quantity	Remark
Antenna	**4GMS / TGMS**	Approximately 30 diameters, 760 height	1.2	4 sets / 2 set	Different antennas shall be separated with each other at least 300 mm. The weight of the antennae are estimated for reference only.
	WDN		0.8		
	DTRS	Approximately 30 diameters, 660 height	0.5	3 set	
	DTRS				
	GPS	Oval shape approximately 60(L) x 50(W) x 30(D)	0.8	1 set	
		Total weight (Approximately):	7.1 kg		

10.16.4 Physical Installation (4GMS / TGMS)

(a) Mobile Data Terminal (MDT)

(i) An intelligent remote data terminal enabling FSD staff to send and receive data, provide dispatch information, process and display location on map, etc;

(ii) The MDT shall be installed in the cabinet of the Vessel for the crew to operate safely and conveniently; and

(iii) The MDT shall be attached onto a pre-fabricated metal mounting bracket as shown in the diagram below. The Contractor shall provide a mounting platform or area for the metal bracket to fix on.

(b) 4GMS / TGMS On Board Equipment Metallic Box

A metallic box shall be installed in the cabinet of the Vessel. 4GMS / TGMS equipment TMR, AVLS OBU and DC-DC converter will be mounted inside the metallic box.

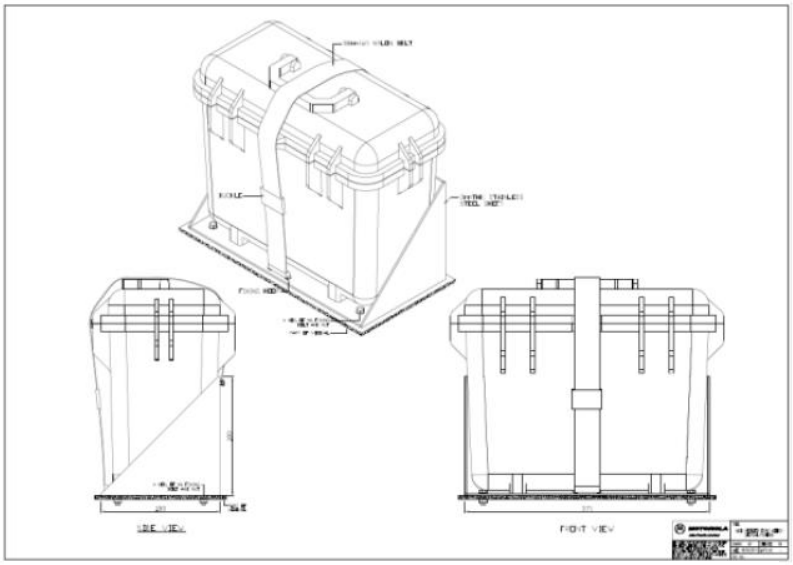
(c) TETRA Mobile Radio Units (TMRU)

A TETRA Mobile Radio consists of enhanced control head and radio terminal. The enhanced control head shall be flush mounted on metal plate in the cabinet while radio terminals are mounted inside the cabinet just behind the enhanced control head. The opening of base plate of the mounting plate shall be around 155 x 35 mm for each enhanced control head.

(d) DTRS Portable Repeater (PR)

It is a box with dimension about 430 mm(Height) x 244 mm(Width) x 341 mm (Depth) to be mounted on the compartment. The Contractor shall provide accommodation for the PR as in recommended in the figure below.

DTRS Portable Repeater



Recommended fixing method of DTRS Portable Repeater

(e) Antenna

There are 3 DTRS TERTA antennae, 1 DTRS GPS antenna and 4 4GMS / TGMS TETRA antennae to be mounted on roof or pole of the Vessel. TETRA antennae are marine type dipole antenna which shall be mounted at a minimum separation of **30 cm** from the other antennas.

4GMS / TGMS TMR antenna

DTRS TETRA antenna

DTRS GPS antenna

(f) Interfacing to Electrical Devices of the Vessel

4GMS / TGMS GPS signal from the Vessel's GPS

The signal of the Vessel's GPS shall be made available to the OBE box. GPS data format shall be NMEA0183 and serial port shall be RS232. The serial port configurations are as follows:

- Baud Rate : 9600
- Data bits: 8
- Parity : None
- Stop bits: 1

(g) Connecting Cables

(i) The Contractor shall supply all power cables for installation of 4GMS / TGMS equipment through suitable independent fuses.

(ii) The Contractor shall supply and install all RF signal antenna cables. The cables shall be use coaxial cables. (The model currently use is RG type cable.)

(iii) The Contractor shall supply and install all data cables in the table below. The cables shall be of the model specified below or equivalent data cables.

(iv) The routing of the conduits/trunking and cabling shall suit the contour interior compartment to ensure that a proper installation layout can be affected.

(v) The termination of all cables shall be carried out by the Contractor. At least 2m cable should be extended from the termination of each end to facilitate the equipment interface.

(vi) The Contractor shall test and certify all installed RF and data cable on the aspect of conductivity, resistance level, Vertical Standing Wave Ratio (VSWR) etc to ensure the

quality of work. For VSWR, the measurement result shall not be bigger than 1.5.

(vii) The Contractor shall provide suitable accessories, trunking/conduit facilities and openings for the connecting cables tabulated below:

Summary of Conduits for Wiring Connections

Item	From	To	Purpose	Cable Type	Termination Connector	Diameter (mm)	Minimum Bending Radius (mm)	Diameter of conduit (mm)	Maximum Length (m)
1	WDN Antenna	4GMS / TGMS OBE Box	RF Signal	RG58A/U	TNC	5	50	25	10
2	DTRS Antennas	TMRU	RF Signal	RG58	BNC	5	50	25	10
3	MDT	4GMS / TGMS OBE Box	Data (OBU)	Shielded RS232	FQN14-9Z (Water Proof Connector)	7	75	25	20
4	MDT	4GMS / TGMS OBE Box	Data (Radio)	Shielded RS232	RS232 DB9 (Female)	7			20
5	TMRU	Main Power	Power	Two Ways Power Cable	Free End	8	50	16	8
6	4GMS / TGMS OBE Box	12 / 24 VDC Main Power w/switch from the Battery for 4GMS / TGMS	Power	Welding Power Cable	Free End	4	50	16	8

(h) Power Supply

(i) The Contractor shall provide power supply to TGMS and DTRS equipment for operation.

	DC Voltage	Current
4GMS/TGMS	24 Volt	15 Ampere
DTRS Radio	12 Volt	10 Ampere
Portable Repeater	To be advised	To be advised

(ii) Power supply to 4GMS/TGMS, DTRS and Portable Repeater shall be provided through separate supply phase or fuse point so as to avoid single point of failure.

10.17 Wired Intercom System

10.17.1 General requirement

(a) The intercom system shall consist of at least two master stations and eight slave stations.

(b) All stations (both master and slaves) shall be able to communicate with each other. In addition the master station shall be able to give an emergency call-out to all the slave stations simultaneously.

(c) Weatherproof type enclosure shall be provided for all the stations.

(d) Incoming calls shall be signalled by audible tone.

(e) Incoming calls shall be signalled by visual means with integral flashing indicator.

10.17.2 Specific requirement

(a) The locations of master and slave stations of the intercom system shall be determined in the kick-off meeting after Contract is awarded.

(b) All stations shall be provided with handset type intercom units with weatherproof type enclosure except the following location, where headset type unit shall be provided :-

(i) Engine Room Control Console (E/R C.C.).
(ii) Emergency Steering Position.
(iii) Fire Monitor Platform.
(iv) Fire deck (aft) for daughter boat recovery.

10.18 Wireless Intercom System

10.18.1 Specific requirement

(a) The system shall consist of an antenna system and mobile radios.

(b) One master station shall be provided at the wheelhouse.

(c) Six mobile radio using hands-free headsets (earphones) with microphones for internal communication between the wheelhouse and crew members on main deck shall be provided by the Contractor.

(d) The antenna system shall pick up the radio signal of mobile radios and distribute it throughout the whole Vessel to allow radio communication at different locations in the Vessel.

(e) The coverage of the antenna system shall be at least 99% of the Vessel.

(f) The wireless intercom system shall not interfere with the DTRS of FSD. Detailed design of the system shall be proposed by the Contractor.

(g) The Tenderer shall submit the wireless intercom system design in the tender submission.

10.19 Visual Augmentation System

10.19.1 General requirement

(a) The visual augmentation system shall consist of a night vision camera, an infrared searchlight and a payload platform.

(b) The system shall be weatherproof.

(c) The system shall be certified for the HSC Code 2000 or equivalent standard.

10.19.2 Specific requirement

(a) The night vision camera shall satisfy the following minimum requirements:

(i) Sensitivity: 0.000001 lux or better;

(ii) Spectral Response: 450 nm- 950 nm;

(iii) Resolution: 756 x 484 or better;

(iv) Field of view: 20° or better; and

(v) Focus: Fixed at infinity.

(b) The infrared searchlight shall satisfy the following minimum requirements:

(i) Candlepower: 6,000,000 or better;

(ii) Short-Arc Lamp: 75-watt Xenon or better; and

(iii) Beam Width: Adjustable.

(c) The payload platform shall satisfy the following minimum requirements:

(i) Dimensions: 45 cm x 55 cm x 35 cm (Depth x Height x Width);

(ii) Tilt Range: -25° to +15°;

(iii) Pan Range: ±100° from heading;

(iv) Operating Temperature Range: -15°C to +55°C; and

(v) Pressurised camera and searchlight enclosures.

10.20 Installation Requirements

10.20.1 The control panel of all Equipment shall be installed and flush-mounted in the coxswain operation area unless otherwise specified. The mounting screw shall be detachable from the front of the Equipment and the Equipment shall be taken out at the front for further checking or replacement. The Contractor shall submit a layout plan showing the exact locations of the Equipment.

10.20.2 Equipment supplied shall be completed with all standard and/or maker recommended accessories as required for normal operation.

10.20.3 The Equipment supplied shall be completed with all the auxiliary items required for normal operation including connectors, circuit breakers, power sockets, interface device, plugs and cables with conduits. Additional power conditioners, filtering devices, power stabiliser or regulator shall be provided and installed at no extra cost if required.

10.20.4 RF connectors of suitable impedance shall be provided and used for connections of the RF cables, antennae and radio equipment. Connectors between the feeder cables and antennae shall be protected by weatherproof material to avoid water seepage.

10.20.5 All wiring shall be finished in a neat and appropriate manner approved by the Government.

10.20.6 Adequate measures, including but not limited to the following, to prevent interference between the electronic equipment shall be taken:

(a) Separate screened conduits or trunkings shall be provided.

(b) Rules, regulations and recommended practices regarding screening of electric wiring must be observed.

(c) Receiving apparatus and other electronic equipment which may be affected by radio frequency induced voltages must be effectively earthed, screened and protected against such voltages.

(d) Lightning protection devices shall be fitted.

10.20.7 All sitting, installation and cabling work shall be undertaken to the highest standard to ensure:

(a) Satisfactory performance of the Equipment.

(b) Protection from mechanical and water damages.

(c) Ease of accessibility for maintenance and repair.

(d) Manufacturers' recommendations shall be strictly observed.

10.20.8 (a) The power, signal and control cables connecting to the flush-mounted equipment shall be long enough to let the equipment wholly place on a safe place like on the panel, table, etc. with valid cable connections for fault finding and equipment testing. These extended cables shall be properly managed and resided inside the console.

(b) Induced mutual interference should be within an appropriate level which would not affect normal operation

10.20.9 Installation Location

(a) Installation location of the Equipment shall be easily accessible for inspection and maintenance. Exact location shall be subject to the approval of the Government.

(b) Installation location of the Equipment shall not cause interference to other Equipment by way of the emitted interference.

10.20.10 Material and Workmanship

(a) Material and Equipment shall be of high quality, and shall comply with, where applicable, the appropriate British Standards and Code of Practice, together with any amendments made thereto, suitable for installation in the Vessel.

(b) All the designs shall be subject to the approval of the Government and the respective works shall be carried out in progress.

(c) The Government reserves the right to reject any part of the installation not comply with these TS. The Contractor shall carry out the necessary remedial work or replacement at its own cost and expense and without delay.

(d) The Contractor shall provide all installation materials including cables, casing, mounting accessories and etc. which are durable and fire retarding. Where it is impracticable for signal cables for data to be run inside conduits, PVC insulated and sheathed with armoured cable shall be used.

10.20.11 Equipment Fixing and Interconnection

(a) All switches, connectors, jacks and receptacles shall be clearly, logically and permanently marked during installation. All wires and cables shall be identified at every termination and connection point with permanent type markers suitable for installation in the Vessel.

(b) Interconnection of various items of Equipment shall be mechanically and electrically connected by multi-pin connectors or terminals.

(c) All cables shall be joined by properly designed connectors or inside joint boxes. Where terminal blocks are used for connection cables, the tip of each conductor shall be crimped with a suitable terminal pin before it is inserted into the terminal block.

(d) The Contractor shall be responsible for providing and installing properly rated power cables from the power points to its own equipment.

10.20.12 Electricity

(a) The power supply shall be compatible with Vessel's DC electrical system.

(b) The Equipment shall be protected by appropriately rated fuses. The fuses shall be contained in independent fuse holders which are easily accessible.

10.20.13 Cable

(a) All exposed cables and wiring shall be sheathed or protected by metal conduits.

(b) Watertight cable glands shall be provided by way of watertight bulkhead or deck penetration.

(c) Signal wiring shall be separated from power supply cables and housed in separate screened conduits or cable trunks.

(d) Cables and wirings shall run behind the compartment lining. Where electric cables are necessary to be fitted on the decorative surface of bulkheads, they shall be enclosed in proper metal conduits.

10.20.14 Labelling and Marking

(a) Each cable shall be clearly labelled and carry its own unique identification code.

(b) Polarity of power cables shall be labelled.

10.21 **Acceptance Test**

10.21.1 The acceptance tests of the ENE as part of the Technical Acceptance shall comprise the following:

(a) A bench acceptance test which includes functional tests and detailed measurements of the performance of each unit of each item of the ENE to verify that each unit of each item of the

ENE complies with the Offered Specifications including all the required performance specifications as set out in this Chapter and other Offered Specifications.

(b) On-site commissioning test shall be carried out by the Contractor in the presence of the EMSD representatives after completion of the installation of each ENE. The overall installation standard and operational features of each ENE shall be evaluated. The test shall be carried out at the same time as the Official Sea Trial.

10.21.2 The Contractor shall submit test reports of bench acceptance test signed off by the manufacturer and the Contractor on the compliance with the functional requirements as stated in this Chapter and other Offered Specifications and performance of each unit of each item of the ENE and deliver the test reports and equipment to the EMSD representatives for approval prior to the installation.

10.21.3 The Contractor shall submit schedule of commissioning test of the ENE installed on board at least one month prior to the on-site commissioning test date.

10.21.4 The Contractor shall provide all the necessary test equipment and tools for carrying out the acceptance tests at no extra cost to Government.

10.21.5 At least one month before the end of the Warranty Period, the Contractor shall arrange and perform final acceptance test in the presence of the representatives from EMSD. Should any defects be found during the final acceptance test, the Contractor shall fix the defects as soon as possible, and in any event no later than the time prescribed by the EMSD representatives. The Warranty Period shall be extended if the defects are not cleared or fixed by the Contractor.

10.21.6 For significant defects (e.g. involving the replacement of Space Parts/ Equipment etc.) found during the final acceptance test, the Warranty Period of the Equipment shall be properly extended as determined by EMSD.

10.22 Documentation & Quotation For the Proposed Equipment

10.22.1 Unless proposed by the Tenderer and agreed by the Government in the Contract, the Contractor shall as part of the Delivery Acceptance, supply three sets of operation manual, service manual and integrated system/equipment schematic diagram in English (at least two sets of which shall be original), giving full details on:

(a) Operations and working principals;

(b) Equipment functional description;

(c) Equipment specifications;

(d) Schematic block diagrams and circuit diagrams with sufficient information and details for Equipment maintenance and repairing;

(e) Calibration procedures;

(f) Equipment (adjustment/mounting procedure) and parameter settings;

(g) Part list with part numbers and locations (the adjustment/calibration tools/kit/program shall also be included);

(h) Maintenance and troubleshooting instructions;

(i) Equipment interfacing with wiring diagram with clear signal labelling;

(j) Software operation manual for Equipment driven by application software;

(k) As fitted conduit/trunking route diagrams for the electronic equipment installed on board for the purpose of future maintenance; and

(l) The design conduit/trunking route diagrams submitted to MD and EMSD for approval during construction stage.

Chapter 11 Services Support

11.1 General Requirement

11.1.1 In determining the appropriate design for the Vessel, all of the following factors shall equally be taken into account without one outweighing another.

(a) Vessel performance (e.g. engine rating, size, etc.).

(b) Initial cost.

(c) On-going cost (e.g. maintenance cost, petrol consumption, spare parts, etc.).

(d) Reliability (frequency and time to repair breakdown).

(e) Time between maintenance periods.

(f) Time to undertake scheduled maintenance (downtime).

(g) All machineries and equipment installed in the Vessel shall be serviceable in the HKSAR.

11.1.2 Allowable Vessel downtime (including scheduled preventive maintenance and unscheduled repair and maintenance) shall not exceed 10% of the total hours of operation per month based on the operation profile as specified in Paragraph 2.8.1 of Chapter 2 to the TS.

11.1.3 Maintainability - The Vessel shall be easy to maintain by ensuring that there shall be:

(a) Good access to all installed items for monitoring, service and overhaul.

(b) Ease access to in-situ service and maintenance in the HKSAR.

11.2 Information to be Provided Prior to and at Delivery Acceptance

11.2.1 Information provided prior to Delivery Acceptance:

(a) Detailed inventory list for the whole Vessel to be submitted to the Government for approval.

(b) The Inventory List shall cover all discrete items down to major component/unit level.

(c) Full details of each item includes:

(i) Item number.

(ii) Description.

(iii) Type/model.

(iv) Quantity.

(v) Manufacturer.

(vi) Manufacturer's reference number.

(vii) Location in Vessel.

(viii) Local agent/supplier address, telephone and fax numbers.

(d) **FOUR** paper copies and **ONE** soft copy of the Inventory List shall be provided to GNC.

11.2.2 "As Fitted" drawings and other information shall be supplied.

The Contractor shall supply the following items as well as those items listed in Annex 8 to this Part upon Delivery Acceptance of the Vessel:

(a) **FOUR** complete sets of paper print drawings of the Vessel and **TWO** soft copy in Compact Disk (CD-ROM).

(b) **FOUR** complete sets of paper print as fitted electrical schematic, cabling, wiring and single line diagrams for electrical equipment installed on board and conduit / trunk route diagram and **TWO** soft copy in CD-ROM as per the Vessel delivered.

(c) **FOUR** copies of ship equipment list for all bought-in machineries and electrical equipment. The list shall include:

(i) Description;

(ii) Type/model;

(iii) Makers part no. or equivalent;

(iv) Location;

(v) Quantity; and

(vi) Supplier or agents name and contact address.

(d) **FOUR** copies (at least one original) of maker operation, maintenance and workshop manuals for all machineries / equipment in English.

(e) **FOUR** paper copies and **TWO** soft copy in CD-ROM as the Vessel delivered of "Docking Plan" which shall include the profile, plan and sections shall be prepared by the Contractor.

(f) **FOUR** copies of On board Operator's Manual (English and Chinese) covering:

(i) Daily user check and operation procedure.

(ii) Operating detail of each system.

(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.)

(g) The first draft of the On board Operator's Manual (in both English and Chinese) shall be submitted to GNC for approval one month before documentation acceptance.

(h) The documentation for all Equipment, spares and stores, special tools and test equipment shall be provided at the Delivery Acceptance of the Vessel.

11.2.3 Tools & Test Equipment for Electronics

(a) Delivery of all test and tool equipment for the electronics equipment of the Vessel shall be directly to EMSD.

(b) All items shall be properly documented, preserved and packed.

11.2.4 Photographs

(a) As-Fitted Photographs

(i) Two 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 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 200 mm x 150 mm colour photographs with specifications of the Vessel particulars showing the profile of the Vessel in HKSAR Waters shall be provided upon Delivery Acceptance.

(iii) Four 150 mm x 100 mm colour photographs showing the profile of the Vessel in Hong Kong Waters shall be provided upon Delivery Acceptance.

(c) Softcopy of Photographs
All photographs as required in the sub-paragraphs (a) and (b) above shall be taken by way of digital camera in JPEG format at a resolution of not less than 5.0 Mega pixel. The photographs shall be stored in Compact Disk (CD-ROM) and forwarded to GNC at the time of Delivery Acceptance.

11.2.5 Certificates and Reports

Copies of the following documents (one original with two copies and one softcopy stored in CD-ROM), filed in clear folders, shall be forwarded to GNC at the time of Delivery Acceptance:

(a) Associated test certificates.

(b) Test performance certificates of equipment (e.g. electronics, switchboards, etc.).

(c) Main engines performance test certificates.

(d) Complete record of the trial commissioning tests.

(e) Original copy of the warranty certificates of all machineries, equipment and apparatus of the Vessel (valid for 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) Hull construction material issued by the RO.

(k) 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 and the Daughter Boat during the Warranty Period in the HKSAR as stipulated in Annex 1 and Annex 9 of this Part VII - Technical Specifications.

(l) Any other certificates as appropriate.

11.2.6 Ship Model

(a) The Contractor shall provide four ship models (scale 1:50) for display and training purpose.

(b) The purpose of the ship model is to provide a reasonable realistic appreciation to the viewer (who cannot see the actual Vessel) about the shape, scale, construction of the Vessel and the machinery installations and fittings therein. Hence the model shall include the position and look of the major external fittings including but not limited to the skeg, appendages, water-jet, 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.

Chapter 12 Training

12.1 Training on Electronics Navigational Equipment (ENE)

12.1.1 General requirements

(a) All training courses shall be held in Hong Kong.

(b) The Contractor shall provide appropriate classroom as well as on board training to the operational and technical staff to familiarise officers with the operation and maintenance of the ENE being supplied and installed. The trainer shall be able to communicate with the local trainees effectively.

(c) It is anticipated that two distinct types of training shall be required, namely:

(i) Operator Training

(ii) Equipment Maintenance Training

(d) The training proposal shall include details of the depth and duration of the training course, qualifications of the instructor and the qualification requirements of the trainees. The Contractor shall submit a detailed course syllabus and a schedule for conducting the training course after installation of ENE onboard.

(e) Each trainee shall receive one copy of comprehensive training documents before the start of each course.

(f) Training manual in Chinese and English shall be provided and submitted to MD and EMSD for approval at least one month prior to commencement of the aforementioned two types of training respectively.

12.1.2 Operator Training Course

(a) This course shall provide training for trainers.

(b) The course shall provide a full knowledge and appreciation of the day-to-day operation of all ENE. This shall include hands-on demonstrations and operation of all ENE including the necessary routine cleansing requirement.

(c) The course shall be held immediately before the commissioning of the ENE on the Vessel.

(d) A total of up to 30 trainees will attend the course. The training course shall accommodate the specified number of trainees.

12.1.3 Equipment Maintenance Training Course

(a) The Contractor shall provide full training facilities (e.g. accommodation, facilities and equipment) with a training schedule. The course shall enable the maintenance staff to acquire full knowledge and appreciation of all aspects on 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. 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 30 trainees will attend the course. The training course shall accommodate the specified number of trainees.

12.1.4 The ENE suppliers of the radar(s), and DGPS will propose a training programme for GNC's consideration. The purpose of the training is to ensure that the Government maintenance staff acquire full knowledge and appreciation of all aspects of the design, day to day operation, breakdown and routine maintenance, and fault diagnosis of the system/equipment installed.

12.2 Training on Operation and Maintenance of the Vessel

12.2.1 In addition to the training to be provided for the ENE, the Contractor shall provide training in relation to the operation of the Vessel for the operational staff of the user department, training in relation to maintenance of engine and equipment on board for the technical staff of the user department and for the Maintenance Section of Government Dockyard.

12.2.2 In order to ensure the navigational work-up team of the MD acquires full knowledge and appreciation of all aspects of the manoeuvrability, Vessel handling, turning characteristics, engines, etc., the Contractor shall provide an appropriate training course for 30 officers of the MD in the HKSAR upon the Delivery Acceptance of the Vessel. An operation training programme shall be proposed for consideration by GNC which shall include details of depth and duration of the training course. The training instructors must possess suitable qualifications acceptable to MD. A certificate shall also be issued to the trainees by the training instructor or his organisation upon completion of the training course for proof of competence and satisfactory completion of the course.

12.2.3 In order to ensure the engineering work-up team and the front-line maintenance teams of the MD and the maintenance personnel of the Government Dockyard acquire full knowledge and appreciation of all aspects of the designs, day to day operation, breakdown, routine maintenance and fault diagnosis of the engine/electrical distribution system, hull structural repair, etc., the Contractor shall therefore provide appropriate train-the-trainer courses for a total of 30 engine operators and 15 maintenance personnel from the Government Dockyard in the HKSAR or overseas at the delivery of the Vessel. A certificate shall also be issued to the trainees by the training instructor or his organisation upon completion of the training course for proof of competence and satisfactory completion of the course.

12.2.4 All facilities, venue, and materials necessary for the above-mentioned training courses and otherwise required in these Technical Specifications shall be provided by the Contractor unless otherwise specified. The training shall also be conducted in Chinese and/or English with relevant training materials to be supplied by the Contractor. The training materials shall be provided before the training, in both paper and CD-ROM format.

Chapter 13 Abbreviations

ABS	American Bureau of Shipping
AC	Alternating Current
AFFF	Aqueous Film-Forming Foam
AIS	Automatic Identification System
AML	Additional Military Layers
ARCS	Admiralty Raster Chart Service
ARPA	Automatic Radar Plotting Aid
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
BS	British Standards
BSB	Data encoded in the BSB format
BWA	Beam Waist Analyzer
CCD	Charge-coupled device
CCTV	Close Circuit Television
CD	Compact disc
cd/ m2	Candela per square metre
CD-ROM	Compact Disc Read-Only Memory
CFC	Chlorofluorocarbon
CH	Channel
cm	Centimetre
CO2	Carbon Dioxide
COG	Course over ground
CPA	Closest Point of Approach
CPU	Central Processing Unit
CRT	Cathode ray tube
c/w	Come with
CWA	Cognitive Work Analysis
dB	Decibel
dBi	Decibel isotropic
dBm	Decibel-milliwatts
DC	Direct Current
DDR	Double Data Rate
deg	Degree
DGPS	Differential Global Positioning System
DISS	DNC Digital Nautical Chart
DPDT	Double-pole, double-throw
DSC	Digital Selective Calling
DTRS	Digital Trunk Radio System

DVD	Digital Versatile Disc
DVI	Digital Video Interface
DVR	Digital video recorder
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
EFFS	External Fire-Fighting System
EFCP	External Fire-Fighting Control Panel
EGNOS	European Geostationary Navigation Overlay Service
ENC	Electronic Navigational Charts
ENE	Electronic Navigational Equipment
E/R C.C.	Engine Room Control Console
FTP	Fire Test Procedures
FO	Fuel oil
FOV	Field of View
g	Gravity
GB	Gigabyte
GeoTIFF	Format File
GHz	Gigahertz
GM	Metacentric Height
GMDSS	Global Maritime Distress Safety System
GMT	Greenwich Mean Time
GPS	Global Positioning System
GRP	Glass-reinforced plastic
GZ	Righting Lever
HazMat	Hazardous Material
HEPA	High-efficiency particulate arrestance
HCFC	Chlorodifluoromethane
HD	Hard Disk
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
HPS	Harbour Patrol Section
HSC	High-speed Craft
HVAC	Heating, ventilation and air conditioning
Hz	Hertz
ICR	Information Collection Request
IHO	International Hydrographic Organization
IMM	International Maritime Mobile
IMO	International Maritime Organisation
IEC	International Electrotechnical Commission
IP	Ingress Protection
IPX	Internetwork Packet Exchange
IR	Infrared
IS	Intact Stability
ISO	International Organization for Standardization

ITU-R	International Telecommunication Union – Radiocommunication Sector
K	Kilo
kΩ	Kilo Ohm
kg	Kilogram
kHz	Kilohertz
km	Kilometre
km/h	Kilometre per hour
kts	Knots
kW	Kilowatt
L/min	Litre per minute
LO	Lube oil
LCD	Liquid Crystal Display
LCG	Longitudinal Centre of Gravity
LED	Light-emitting Diode
L/s	Litre per second
LSA	Lifesaving Appliances
m	Metre
m/s	Metre per Second
m3	Cubic Metre
M/E	Main engines
MARPA	Mini-automatic Radar Plotting Aid
MCR	Maximum Continuous Rating
MEI	MEI Corporation
MFD	Multi-function Display
MHz	Megahertz
MJ/ m2	Megajoule per Square Metre
MKD	Minimum Keyboard Display
mm	Millimetre
MMC	Multi Media Card
MMSI	Maritime mobile service identity
mph	Mile per hour
MS PRO	Memory Stick PRO
MS PRO Duo	Memory Stick PRO Duo
MSC	Maritime Safety Committee
mV	Milli Voltage
NAVSEA	Naval Sea Systems Command
NIR	Non-Ionizing Radiation
Nm	Nanometre
NFPA	National Fire Protection Association
NMEA	National Marine Electronics Association
ns	Nanosecond
NTRIP	Networked Transport of RTCM via Internet Protocol
NUC	Not Under Command
OBE	On-board electronics

OSHA	Occupational Safety and Health Administration
Pa	Pascal
PAL	Phase Alternating Line
p.s.i.	Pounds per square inch
PTO	Power take off
PVC	Polyvinyl Chloride
RAM	Random Access Memory
RCA	Radio Corporation of America
RGB	Red Green Blue
RF	Radio Frequency
RG58U	RG58U Type Coaxial Cable
RH	Relative Humidity
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 systems
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
TCG	Transverse Centre of Gravity
TCPA	Time of Closest Point of Approach
TFT	Thin-Film Transistor
TIFF	Tagged Image File Format
TMR	TOPEX/Poseidon Microwave Radiometer
TS	Technical Specifications
UHF	Ultra High Frequency
UPS	Uninterruptible Power System
USB	Universal Serial Bus
UTC	Coordinated universal time
uV	Nano voltage
UV	Ultraviolet
VAC	Voltage of Alternating Current
VCG	Vertical Centre of Gravity
VDC	Voltage of Direct Current
VDR	Voyage Data Recorder
VGA	Video Graphics Array
VHF	Very High Frequency
VMAP	Vector Map

V.S.W.R.	Voltage Standing Wave Ratio
VTC	Vessel Traffic Centre
VTS	Vessel Traffic Services
W	Watt
WMS	Web Map Service
W/H E.C.C.	Wheelhouse Engine Control Console

Part VII - Annex 1 - Warranty Services and Guarantee Slipping (Vessel)

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 an authorised agent to perform the Warranty Services, the Contractor shall ensure that the authorised 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. The Warranty Services and Guarantee Slipping for the Daughter Boat are separately set out in Annex 9 to Part VII. Reference to "Vessel" in this Annex 1 shall exclude the Daughter Boat.

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.

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 in the Warranty Period applicable to such items.

1.4 During the Warranty Period, when the Vessel is handed over for the Warranty Services and/or Guarantee Slipping, the Contractor shall be responsible for the due return of the Vessel in good order. 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 free of charge Warranty Services for one year after the date of the issue of the Acceptance Certificate in respect of the Vessel. The Warranty Services shall cover the entire Vessel and all its Equipment (including all major Equipment specified in Schedules 6 and 7 in Part V and electronic navigational equipment), fittings and outfit (including spare parts, and documentation) (collectively, "Warranty Items") against defects of 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. Notwithstanding and without prejudice to the Contract on warranty obligations for the total Vessel, any individual equipment supplier/manufacturer's warranty extending beyond the one year total Vessel warranty must be assigned to the Government as appropriate.

1.6 Procedures for Warranty Claim

Without prejudice to the provisions of the Contract, a detailed procedure for dealing with warranty claims must be proposed by the Contractor and agreed by MD before the issuance of the Acceptance Certificate of the Vessel. This shall be 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 to examine the defect and the Contractor shall propose the appropriate and necessary remedial action to the satisfaction of MD.

1.6.3 The Contractor shall undertake on-site Warranty Services (including provision of all replacement Warranty Items, spare parts, labour, materials, test equipment, and transportation) wherever, at the option of the Government, the Vessel is berthed in the Government Dockyard or maintenance bases of the user department. Taking the Vessel to the shipyard of the Contractor 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.

1.7 Throughout the Warranty Period, the Contractor shall be responsible for the provision of free of charge corrective maintenance and rectification of all defects in all and any of the Warranty Items including repair and replacement as necessary. This shall, at no cost to the Government, include Warranty Services to be performed by the Contractor described in the following sub-paragraphs:

1.7.1 To attend to the Vessel for inspection and repair within 24 hours (excluding Hong Kong public holidays) of receiving the report of a fault ("fault report") and to take immediate action to rectify the defect after inspection. Unless otherwise agreed by the Government, all corrective maintenance and rectification must be effected within 48 hours after the fault report is first issued. The MD must be informed of what corrective maintenance and rectification actions have been taken within 72 hours of receiving the relevant fault report.

1.7.2 To provide all necessary transport, replacement Equipment, spare parts, labour and materials, tools and testing instruments required for the corrective maintenance and rectification.

1.7.3 Any replacement item or part to be used shall originate from the manufacturer of the original Warranty Item to be repaired and must be 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.

If the Contractor fails to respond to any reported warranty claims within 48 hours, the MD may arrange corrective maintenance and rectification of the defect either on its own or by deploying a third party contractor as deemed appropriate with a view to minimising any downtime incurred. In such case, the Contractor shall compensate the Government for the full cost of such repairs plus 10% as and for liquidated damages but not as a penalty no later than 10 working days after a written demand has been served on the Contractor by MD.

1.8 Extension of Warranty

1.8.1 The Warranty Period for any Warranty Item shall be suspended whilst and if the Contractor fails to repair and correct satisfactorily the defects in such Warranty Item within seven working days counting from the date when the relevant fault report was first issued.

1.8.2 Warranty Items which are electronic equipment sub-assemblies, modules or components and which are replaced during the Warranty Period shall have a new warranty period of one year commencing from the date of replacement.

1.8.3 In relation to a Warranty Item, references to Warranty Period shall be construed to include such extended warranty period as mentioned in Paragraph 1.8.1 and/or 1.8.2 above, depending on whichever is applicable.

1.8.4 Equipment which is found to be defective during the trials at the Guarantee Slipping as mentioned in Paragraph 2.2.5 below shall have an extension of warranty of one year.

1.9 Recurrent Defects

During the Warranty Period, should a second and similar defect arise in relation to a Warranty Item, this shall be construed as conclusive evidence of the Warranty Item's unsuitability for the purpose intended, and the Contractor shall take immediate steps to conduct a thorough investigation jointly with MD at the Contractor's expense, to ascertain the reasons for any such defect and shall forthwith at the MD's option and the Contractor's expense, procure and deliver another replacement Warranty

Item with a new design suitable for the purpose intended to replace the original defective Warranty Item.

1.10 In the event that the Contractor proposes to modify any Warranty Item or any part of the Vessel in order to repair or replace the same or another Warranty Item, the Contractor shall obtain the Government's advance written consent to the proposed modification.

1.11 Throughout the Warranty Period, the Contractor shall maintain an inventory of spare parts, which shall be the same items as listed in Schedules 6 and 7 in Part V and in the same quantity in the shipyard of the Contractor which the Contractor shall use for performing the Warranty Services. 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

Please refer to the Chapter 10 of the TS.

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 regardless of any subsequent extension in relation to any Warranty Item under the terms of the Contract.

2.2 At the Guarantee Slipping, the Contractor shall carry out the following work and provide all necessary materials, spare parts, labour and equipment in order to carry out such work:

2.2.1 Pre-guarantee slipping inspection and trial

(a) Joint inspection with trial to confirm the list of guarantee slipping items; and

(b) Collect vessel performance information beforehand for comparing when guarantee slipping completion

2.2.2 Engines and Gearboxes

(a) Renew the lubricating oil and replace the filters for the main engines and gearboxes and top up the engine coolant as per the manufacturer's recommendations;

(b) Clean all the engine air filters and change the filter elements;

(c) Change all fuel/water separators elements and fuel filters for all engines;

(d) Clean the coolers of the engines and gearboxes and renew all zinc anodes if provided;

(e) Check all the engines' belts and adjust or renew if necessary;

(f) Check tappet clearances for the inlet and exhaust valves, ignition timing and idle speed and adjust if necessary;

(g) Conduct function tests for the engines' protection system and their associated sensors, gauges and other measuring devices;

(h) Disconnect and remove all engines and gearboxes sea water pipes (suction & discharge) for inspection, and clear off marine growth and obstructive materials in all pipes and fittings;

(i) Repair all damages and leakages in the metal and fibreglass pipelines; and

(j) Any other work required or recommended by the engine manufacturer.

All of the work listed at Paragraphs 2.2.2(a) to (j) shall be carried out by the manufacturer's authorised agent/dealer. All the work procedures and the spare parts used shall comply with the manufacturer's specifications and requirements.

2.2.3 Hull and Deck Items (where applicable)

(a) Paint Under the Water Line

(i) Paint under the water line shall be checked by the paint manufacturer's representative for the effectiveness of one year's protection against marine growth;

(ii) The hull shall be cleaned and readily for inspection of paint damage;

(iii) Damaged paint shall be repaired according to the paint manufacturer's procedures;

(iv) After the repair of the damaged paint as specified at Paragraph 2.2.3(a)(iii), two coats of touch up primer and one coat of touch up shall be applied; and

(v) One touch up anti-fouling paint of finishing coat shall be applied to the damaged paint as specified at Paragraph 2.2.3(a)(iii).

(b) Paint Above the Water Line

(i) Damaged paint on the hull above the water line and deckhouse shall be repaired properly. After repair, two coats of touch up primer and one coat of touch up (finishing) shall be applied;

(ii) Two coats of paint shall be applied on the Vessel's name, draft marks and insignia; and

(iii) One full coat of anti-slip paint shall be applied to the open and side deck.

(c) Inspect and clean and polish propellers.

(d) Inspect, clean and remove obstructed object on the propeller shaft.

(e) Water jet tunnel and impeller(s) inspection and cleaning (if applicable).

(f) 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.

(g) Renew all zinc anodes on hull, rudder(s) and tail shaft(s).

(h) 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)

(i) Free, clean and repaint the anchor chain and swivel set.

2.2.4 Mechanical, Electrical & Air-conditioning

(a) Dismantle all overboard valves for inspection and renew the defective parts;

(b) Check and clean the sea water system (including the grating, sea chest internal, sea suction and strainers) complete with renew their zinc anodes;

(c) Each of the compartment bilge suction to be checked and free of rubbish;

(d) Generator megger test and electrical circuit earth leak test; and

(e) Batteries condition check and switch over test.

2.2.5 The following shall be tested at the dock trial / sea trials as part of the Guarantee Slipping:

(a) Engine control and steering system including emergency/alternative method;

(b) Engine alarm and shut down function (including emergency stopping of engines at wheelhouse);

(c) Hybrid System

(d) Battery Generator

(e) Navigational equipment, lights and sound signals;

(f) Ahead and astern running and crash stop test;

(g) Steering trial;

(h) Speed Measurement;

(i) Bilge system function (including high level bilge alarm system);

(j) Fire pump(s) function (including fire detection system, alarms, ventilation fans /fuel

pump remote shutdown);

(k) The Dock Trial and Sea Trial Safety Checklist items, as listed below;

Dock Trial Check List

General items will be checked during dock trial	
1.	Engines start and stop testing
2.	Engines emergency stop check
3.	Engines speed and clutch unit testing
4.	Engines speed high and low idle speed testing
5.	Engines gauges and alarm check
6.	Propulsion system testing
7.	Anchor windlass testing
8.	Navigation lights testing
9.	Wheelhouse horn and windows screen wipers testing
10.	Fire protection system alarm check
11.	Portable fire extinguishers inspection
12.	Life-saving equipment inspection
13.	Engine room ventilation fans testing
14.	Air compressor and air conditioning system testing
15.	Cabin lights testing
16.	Bilge system in each compartment testing.
17.	Floor plate inspection
18.	Fuel tanks quick closing valves testing
19.	G.S. pumps testing
20.	Bilge pumps testing
21.	A/C cooling water pumps testing
22.	Tailshaft cooling water pumps testing
23.	Fire pumps testing
24.	Fuel oil pumps testing
25.	Sanitary pumps testing
26.	Sewage pumps testing
27.	Fresh water pumps testing
28.	Waste water pumps testing
29.	Steering system power assisted and manual operation testing
30.	Emergency rudder operation check
31.	Rudder indicator check

Sea Trial Safety Check List

General items will be checked during sea trial	
1.	Engines start and stop testing
2.	Engines emergency stop check
3.	Engines speed and clutch unit testing
4.	Wheelhouse horn 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 is full

(l) Other trials or testing of equipment as required by the Government Representative; and

(m) 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.

Milestones		Completion Dates
1	Kick-Off Meeting	To be held within two (2) months after the Contract Date at the Government Dockyard or the Contractor's Shipyard
2	Completion of hull structures	The Contractor shall propose the completion dates of Milestones 2-8 for GNC's approval within two (2) months after the Contract Date.
3	Completion of installation of main machinery system	
4	Completion of installation of electronic navigation equipment	
5	Sea trial	
6	Pre-shipment Construction and Handling Inspection	
7	Shipment to Hong Kong	
8	Official sea trial	
9	Delivery Date	The Delivery Date for the Vessel shall be no later than the date set out in Schedule 2 (Delivery Schedule) of Part V

Item No.	Drawings Approval	Completion Date
	General Arrangement Plan	All the drawings are required to be submitted in two months after Signing of Articles of Agreement for GNC's approval / reference.
	Lines Plan	
	Structural Construction Plan in Mid-Ship bulkhead section	
	Daughter Boat Drawings	
	Construction Profile and Deck Plan	
	Shell Expansion Plan	
	Tank Capacity Plan	
	Engine Mounting Arrangement	
	Power / Speed Estimation and Curve	
	Intact, Damaged Stability Plan and Self Righting Stability Criteria	
	Details of Navigational / Communication Equipment	
	Details of Deck Equipment, Outfitting, Furniture, etc.	
	Details of Engines' Arrangement	
	Control Console Arrangement and Schematic Diagram	
	On board Fire System Diagram / Schematic diagram / External Fire Fighting System Schematic diagram and layout Plan	
	Hydraulic Calculations of Water/Foam Pipework System	
	Piping Arrangement	
	Instrumentation and Control System	
	Calculation of Fuel Capacity	
	Details of Electrical and Electronic Equipment	
	Electrical Load Calculations	
	Schematic Layout of Electrical Circuits	
	Paint Schedule	
	Lightning Protection Arrangement	
	Torsional Vibration Calculation (if applicable)	
	Others as required	

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "FIRE BOAT 2"				Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected				
	Hull Structure, Layout and Outfitting Inspection				
H-1	Mould Lofting		P2		
H-2	Construction Materials – steel/aluminium plate mark checking for hull & superstructure				
	a.	Steel/aluminium plate mark checking for hull & superstructures	P2		
	b.	Material certificates verification	P2		
H-3	Welding consumables & welders certificates		P2		
H-4	Keel laying for hull		P2		
H-5	Fabrication of hull up to main deck in stages of work, including:				
	a.	Alignment	P2		
	b.	Edge Preparation	P2		
	c.	Welding	P2		
	d.	Workmanship	P2		
	e.	Compliance with approved plans	P2		
	f.	NDT (X-ray) of welds	P2		
	g.	Hull internal steel work inspection	P2		
	h.	Plating thickness gauging	P2		
H-6	Engine bearers fabrication / welding		P2		
H-7	Superstructures scantlings & welding checking		P2		
H-8	Welding construction and pressure tests of tanks				
	Fuel oil tank				
	a.	Tank construction (internal/external/fitting)	P3		
	b.	Tank pressure test	P3		
	Freshwater tank				
	a.	Tank construction (internal/external/fitting)	P3		
	b.	Tank pressure test	P3		
	Grey (sewage) water tank				
	a.	Tank construction (internal/external/fitting)	P3		
	b.	Tank seating construction/securing arrangement	P3		
	Oily Water tank (if any) and oily water separator (if any)				
	a.	Tank construction (internal/external/fitting)	P3		
	b.	Tank seating construction/securing arrangement	P3		
H-9	Hose test for hull & superstructures		P3		
H-10	Mock up inspection for the wheelhouse		P3		
H-11	Installation of various outfitting items				
	a.	Anchor and chain	P4		
	b.	Windlass	P4		
	c.	Hand pumps	P4		

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "FIRE BOAT 2"				Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected				
	d.	Hatches	P4		
	e.	Doors	P4		
	f.	Windows	P4		
	g.	Ventilators	P4		
	h.	Seating of heavy equipment and masts	P4		
H-12	Function tests of various outfitting items		P4		
H-13	Watertightness or weathertightness of openings				
	a.	Manholes	P4		
	b.	Hatches	P4		
	c.	Doors	P4		
	d.	Windows	P4		
	e.	Ventilator & air pipes	P4		
H-14	Painting inspection of different layers		P4		
H-15	Draught marks and vessel dimensions verifications		P4		
H-16	Arrangement of wheelhouse and accommodation		P4		
H-17	Zinc anodes and lightning system				
	a.	Installation of zinc anodes	P4		
H-18	Inspection of fire, heat and sound insulation				
	a.	Fire insulation	P4		
	b.	Heat and Sound insulation	P4		
	c.	Galvanic corrosion prevention insulation	P4		
H-19	Interior furnishings (also attended by two Immigration Dept officers)				
	a.	Console area	P4		
	b.	Wheelhouse	P4		
	c.	Passenger space	P4		
	d.	Toilets and pantry	P4		
H-20	Life saving appliances and fire fighting appliances				
	a.	Life saving appliance	P4		
	b.	Fire fighting appliance	P4		
H21	Inspection of Sea Chest and grating				
	a.	Sea chest			
	b.	Grating			
H-22	Inclining experiment		P4		
H-23	Sea trials including operation test of outfitting equipment		P4		
H-24	Tests for superstructures windows and doors weathertight		P4		
H-25	Cleanliness inspection before acceptance		P4		
H-26	Inventory check in the HKSAR		P4		
H-27	Acceptance and delivery		P4		

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "FIRE BOAT 2"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
H-28	Acceptance of As-Fitted drawings and Engines/Equipment Manuals and documentations.	P4		
	Machinery and Electrical Installation			
EM- 1	General inspection on installation of Machinery:	P3		
(a)	General inspection on installation of main engines	P3		
(b)	General inspection on installation of generator sets			
(c)	General inspection on installation of auxiliary engines	P3		
(d)	General inspection on installation of shafting	P3		
(e)	Impeller bedding test			
(f)	Coupling taper bedding test			
EM- 2	Main engines:	P4		
(a)	Test of engine safety devices and alarms	P4		
(b)	Test of emergency stop	P4		
(c)	Inspection of exhaust pipe before lagging	P4		
EM- 3	Hydraulic test of sea valve	P4		
EM- 4	Inspection of sea water suction strainer	P4		
EM- 5	Freshwater system:	P4		
(a)	General inspection & dimension checking of freshwater system	P4		
(b)	Freshwater tank low level alarm test	P4		
(c)	Freshwater tank final cleaning/internal inspection before filling	P4		
(d)	Freshwater tank high level alarm test	P4		
(e)	Freshwater tank content gauge calibration and test	P4		
(f)	Inspection of piping penetration of bulkhead and deck	P4		
(g)	Hydraulic test of freshwater piping	P4		
(h)	Functional test of freshwater system	P4		
(i)	Drinking water suitable for human consumption test.	P4		
EM- 6	Fuel oil system:	P4		
(a)	General inspection & dimension checking of fuel oil system	P4		
(b)	Fuel oil tank low level alarm test	P4		
(c)	Fuel oil tank final cleaning/internal inspection before filling	P4		
(d)	Fuel oil tank high level alarm test	P4		
(e)	Fuel oil tank content gauge calibration and test	P4		
(f)	Inspection of piping penetration of bulkhead and deck	P4		
(g)	Hydraulic test of fuel oil piping	P4		
EM- 7	Bilge system:	P4		
(a)	General inspection & dimension checking of bilge system	P4		
(b)	Bilge tank high and low level alarms test	P4		
(c)	Inspection of piping penetration of bulkhead and deck	P4		
(d)	Hydraulic test of piping	P4		

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "FIRE BOAT 2"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
(e)	Functional test of bilge system	P4		
EM- 8	Sanitary system:	P4		
(a)	General inspection & dimension checking of sanitary system	P4		
(b)	Inspection of piping penetration of bulkhead and deck	P4		
(c)	Hydraulic test of piping	P4		
(d)	Functional test of sanitary system	P4		
(e)	Functional test of sanitary sewage tank	P4		
EM- 9	External Fire-fighting system:	P4		
(a)	General inspection & dimension checking of fire line system (including the emergency fire line system)	P4		
(b)	Inspection of piping penetration of bulkhead and deck	P4		
(c)	Hydraulic test of fire line	P4		
(d)	Function test of fire line(including emergency fire line)	P4		
(e)	Fire pump test	P4		
(f)	Foam pump test and foam-proportioning system test			
(g)	Functional test of water/foam monitors			
(h)	Functional test of hydrant outlets and spray systems			
(i)	Inspection and functional test of External Fire-Fighting Control Panel			
EM- 10	Fire extinguishing system:	P4		
(a)	General inspection & dimension checking of (gas) fire extinguishing system	P4		
(b)	Hydraulic & blow test of gas fire extinguishing piping	P4		
(c)	Test of (gas) fixed fire extinguishing alarm system	P4		
(d)	Test of fire detection (smoke & heat detectors) alarm system	P4		
EM- 11	Functional test of drainage system	P4		
(a)	Vessel deck drainage system	P4		
EM- 12	Hydraulic system	P4		
(a)	General inspection & dimension checking of hydraulic system	P4		
(b)	Inspection of piping penetration of bulkhead and deck	P4		
(c)	Hydraulic test of piping	P4		
(d)	Functional test of hydraulic system	P4		
EM- 13	E/R ventilation system:	P4		
(a)	Inspection of E/R ventilation fans installation	P4		
(b)	Function test of start/stop at remote and local control for E/R ventilation fans	P4		
EM- 14	Air Conditioning system:	P4		
(a)	General inspection of air-conditioning system	P4		
(b)	Inspection and hydraulic test of cooling water system	P4		
(c)	Function test of air-conditioning system	P4		

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "FIRE BOAT 2"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
(d)	Air Conditioning full load test during sea trial	P4		
EM- 15	Batteries:	P4		
(a)	Inspection of battery connectors and housing boxes	P4		
(b)	Inspection of battery charger	P4		
(c)	Operational test of battery charger Test of main engines and generator consecutive starting by each group of battery (start/stop at remote and local control)	P4		
EM- 16	Electrical Installation:	P4		
(a)	Inspection of lightning conductor	P4		
(b)	General inspection of cable layout & checking of cable sizes	P4		
(c)	Inspection of cable penetrations of bulkhead and deck	P4		
(d)	Inspection of transformers	P4		
(e)	Inspection of tally plates	P4		
EM- 17	Main switchboard & panels:	P4		
(a)	Main switchboard & panels - high voltage injection test	P4		
(b)	Cable size checking of electrical switchboard installations	P4		
(c)	Inspection of AC distribution panel	P4		
(d)	Inspection of DC distribution panel	P4		
(e)	Megger test of the electrical system	P4		
(f)	Earthing test of the electrical system	P4		
EM- 18	Control Console:	P4		
(a)	Inspection of wheelhouse control console	P4		
(b)	Functional test of wheelhouse console controls	P4		
(c)	Inspection of navigation equipment control panel	P4		
EM- 19	Lighting:	P4		
(a)	Inspection and functional test of general lighting	P4		
(b)	Inspection and functional test of emergency lighting	P4		
(c)	Inspection and functional test of floodlight installation	P4		
(d)	Inspection and functional test of searchlight installation	P4		
EM- 20	Navigational Lights and Signals	P4		
(a)	Inspection and functional test of Navigational lights	P4		
(b)	Test of horn/whistle	P4		
EM- 21	Shafting (impeller shaft and coupling) system:	P4		
(a)	Marking/Stamping and material check	P4		
(b)	Dimension check and taper bedding test	P4		
(c)	Shaft line checking of stern/shaft bracket and alignment of main engines and impeller shafts	P4		
EM- 22	Test of window wipers	P4		
EM- 23	Inspection of lightning conductor	P4		
EM- 24	Electronic equipment tested by EMSD	P4		

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "FIRE BOAT 2"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
EM- 25	Test of noise level during sea trial	P4		
EM- 26	Any other items that are specific to the design and construction, and the operation/duties of the Vessel.	P4		
	(a) Technical Test of the complete External Fire Fighting System in Hong Kong before Delivery Acceptance.	P4		
	(b) Test of the Jason Ladder and Inflatable Raft deployment (Rescue Mode) in Hong Kong before Delivery Acceptance.	P4		
	(c) Launching and recovery trials of the daughter boat.	P4		
EM-27	Inclining Experiment			
EM-28	(a) Official Speed Trial			
	(b) Other Official Sea Trials			

Note:
The inspection items are not exhaustive. Any items found necessary to be included at a later stage shall be added to this list.

Part VII - Annex 5 - Official Sea Trial, Endurance and Performance Tests

Official Sea Trial, Endurance and Performance Tests							
Date of Test:				Place of Test:			
Vessel's Identification:				Vessel's Name:			
Conditions at Endurance and Performance Test (Official Sea Trial)							
Person on board	**27**			Dummy Weight			
Fuel (Diesel)	**Not less than 50% of Fuel and Water Tank**			Other Equipment	**500 kg**		
Sea Conditions	**Calm sea with wind speed below 6 knots / maximum wave height of less than 0.5 m / Sea Water Depth not less than 5 meters**						
Engines:	'P'	'S'	Centreline (if applicable)	Propulsion:	'P'	'S'	Centreline (if applicable)
Maker				Maker			
Type				Type			
Serial Number				Diameter (if applicable)			
Rated Power				Pitch (if applicable)			
Rated Speed				Direction of Rotation			

Engine Load	**Engine Speed (rpm)**	**Vessel Speed (Knots)**	**Time (Start)**	**Time (Finish)**	**Fuel Consumption (litres/mintue)**	**Engine Oil Pressure (Bar)**	**Engine (in) CW Temp. (ºC)**	**Others**
__% of rated Power								
50% of Rated Power			Not less 15 minutes					
75% of Rated Power			Not less 20 minutes					
100% of Rated Power (Endurance Test)			Not less 30 minutes					
Remarks:								

Witness by:	MD Representative	Shipyard Representative	User Dept Representative

Course	0	45	90	135	180	225	270	315	360
Time Taken Ahead turning to (starboard)									
Course	0	45	90	135	180	225	270	315	360
Time Taken Ahead turning to (port)									

Turning diameter: Ahead turning to (starboard)	Ship length
Engine R.P.M. (Starboard)	rpm
Engine R.P.M. (Port)	rpm
Max heeling angle	degree
Turning diameter: Ahead turning to (port)	Ship length
Engine R.P.M. (Starboard)	rpm
Engine R.P.M. (Port)	rpm
Max heeling angle	degree

Conditions for Official Sea Trial

1) Official Speed Trial

Conditions at Speed-Trial		
1	Person on board	27 Persons, each person with 20 kg effect. (There shall be at least 7 persons. Dummy weight of 75 kg plus 20 kg effect for each person to be added if person on board is less than 7)
2	Fuel, Fresh Water and other liquid tanks at the start of the test	Fuel: Not less than 60% of fuel capacity for the required Endurance Range Fresh water: The total capacity of fresh water.
3	Other Equipment	500 kg
4	Sea Conditions	Calm sea with wind speed below 5 metres per second and maximum wave height of less than 1 m

2) Endurance and Performance Test

Conditions at Endurance and Performance Test		
1	Person on board	27 Persons (There shall be at least 7 persons. Dummy weight of 75 kg plus 20 kg effect for each person to be added if person on board is less than 7)
2	Fuel at the start of the test	Not less than 50 % of fuel capacity for the required Endurance Range
3	Other Equipment	500 kg
4	Sea Conditions	Calm sea with wind speed below 5 metres per second and maximum wave height of less than 1 m

3) Manoeuvrability Test

Conditions at Forward Turning Circle Test		
1	Person on board	27 Persons (There shall be at least 7 persons. Dummy weight of 75 kg plus 20 kg effect for each person to be added if person onboard is less than 7)
2	Fuel at the start of the test	Not less than 35 % of fuel capacity for the required Endurance Range
3	Other Equipment	500 kg
4	Sea Conditions	Calm sea with wind speed below 5 metres per second and maximum wave height of less than 1 m

4) Crash Stop Test / Astern Running Test / Steering Test

Conditions at Crash Stop Test / Astern Running Test / Steering Test		
1	Person on board	27 Persons (There shall be at least 7 persons. Dummy weight of 75 kg plus 20 kg effect for each person to be added if person onboard is less than 7)
2	Fuel at the start of the test	Not less than 20 % of fuel capacity for the required Endurance Range
3	Other Equipment	500 kg
4	Sea Conditions	Calm sea with wind speed below 5 metres per second and maximum wave height of less than 1 m

5) Pump Performance Test

5.1 - Pump Engine 1 driving one external fire pump

Date of Test :				**Place of Test :**		**Rated Capacity**				**Fire Monitor Flow Rate**			**Total Flow Rate (L/min)**
Vessel's Identification :				**Vessel's Name :**									
Duration	**Time**	**Engine Revolution (r.p.m.)**	**Pump Revolution (r.p.m.)**	**Revolution Ratio (P ÷ E)**	**Pump Body Temperature (˚C)**	**Pump Outlet Flow Rate (litre/minute)**		**Pump Outlet Pressure (Bar)**		**Remote Monitor 1 (L/min)**	**Remote Monitor 2 (L/min)**	**Manual Monitor (L/min)**	
0 Minute	:						100%		≥10				
30 Minutes	:						100%		≥10				
60 Minutes	:						100%		≥10				
90 Minutes	:						100%		≥10				
120 Minutes	:						100%		≥10				
150 Minutes	:						70%						
180 Minutes	:						50%						

Remark: The performance of the fire pump shall be tested according to the clause 19.3.31 of NFPA 1925 : 2018 or latest version.

5.2 – Fire Pump Engine 2 (or centreline engine) driving the other external fire pump

Date of Test :				**Place of Test :**		**Rated Capacity**				**Fire Monitor Flow Rate**			**Total Flow Rate (L/min)**
Vessel's Identification :				**Vessel's Name :**									
Duration	**Time**	**Engine Revolution (r.p.m.)**	**Pump Revolution (r.p.m.)**	**Revolution Ratio (P ÷ E)**	**Pump Body Temperature (℃)**	**Pump Outlet Flow Rate (litre/minute)**		**Pump Outlet Pressure (Bar)**		**Remote Monitor 1 (L/min)**	**Remote Monitor 2 (L/min)**	**Manual Monitor (L/min)**	
0 Minute	:						100%		≥10				
30 Minutes	:						100%		≥10				
60 Minutes	:						100%		≥10				
90 Minutes	:						100%		≥10				
120 Minutes	:						100%		≥10				
150 Minutes	:						70%						
180 Minutes	:						50%						

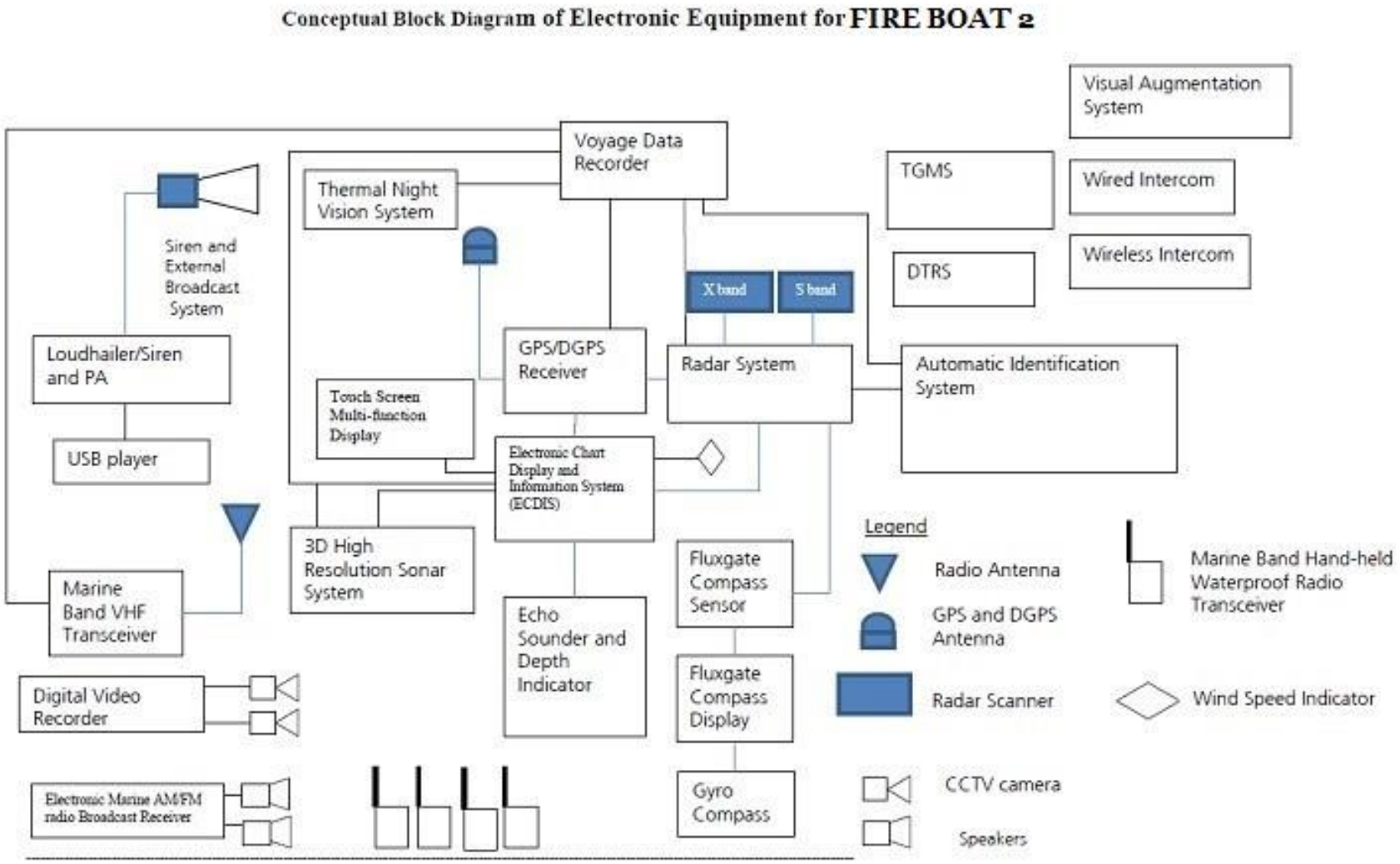
5.3 - Fire Pump Engine 1 + Fire Pump Engine 2 (or centreline engine) (Run Together Simultaneously)

Date of Test :				**Place of Test :**		**Rated Capacity**		**Fire Monitor Flow Rate**			**Total Flow Rate (L/min)**
Vessel's Identification :				**Vessel's Name :**							
Duration	**Time**	**Engine Revolution (r.p.m.)**	**Pump Revolution (r.p.m.)**	**Revolution Ratio (P ÷ E)**	**Pump Body Temperature (℃)**	**Pump Outlet Flow Rate (litre/minute)**	**Pump Outlet Pressure (Bar)**	**Remote Monitor 1 (L/min)**	**Remote Monitor 2 (L/min)**	**Manual Monitor (L/min)**	
0 Minute	:										
15 Minutes	:										
30 Minutes	:										
45 Minutes	:										
60 Minutes	:										

5.4 - Testing Scenarios for EFFS pressure test and flow rate test as specified in paragraphs 5.4.13 and 5.4.14 of Part VII

	Case I	**Case II**	**Case III**
Water / Foam Monitor(s)	3 × 5,000 L/min	-	1 × 20,000 L/min (one by one Water / Foam Monitor)
Fire Hydrant	**50 % of Rated Flow Capacity** 900 L/min (70 mm) + 2,700 L/min (100 mm)	**100 % of Rated Flow Capacity** 1,800 L/min (70 mm) + 5,400 L/min (100 mm)	-
Self-Protection Water Spray System	**100 % of Rated Flow Capacity**	**100 % of Rated Flow Capacity**	**100 % of Rated Flow Capacity**

Annex 6 – Conceptual Block Diagram of Electronic Equipment



Part VII - Annex 7 – Definitions of Wave and Sea

Beaufort scale number	Description	Wind speed	Wave height	Sea conditions	Land conditions
0	Calm	< 1 km/h (< 0.3 m/s) < 1 mph < 1 knot < 0.3 m/s	0 m 0 ft	Flat.	Calm. Smoke rises vertically.
1	Light air	1.1–5.5 km/h (0.3–2 m/s) 1–3 mph 1–3 knot 0.3–1.5 m/s	0–0.2 m 0–1 ft	Ripples without crests.	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
2	Light breeze	5.6–11 km/h (2–3 m/s) 4–7 mph 4–6 knot 1.6–3.4 m/s	0.2–0.5 m 1–2 ft	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
3	Gentle breeze	12–19 km/h (3–5 m/s) 8–12 mph 7–10 knot 3.5–5.4 m/s	0.5–1 m 2–3.5 ft	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended.
4	Moderate breeze	20–28 km/h (6–8 m/s) 13–17 mph 11–16 knot 5.5–7.9 m/s	1–2 m 3.5–6 ft	Small waves with breaking crests. Fairly frequent whitecaps.	Dust and loose paper raised. Small branches begin to move.
5	Fresh breeze	29–38 km/h (8.1-10.6 m/s) 18–24 mph 17–21 knot 8.0–10.7 m/s	2–3 m 6–9 ft	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway.
6	Strong breeze	39–49 km/h (10.8-13.6 m/s) 25–30 mph 22–27 knot 10.8–13.8 m/s	3–4 m 9–13 ft	Long waves begin to form. White foam crests are very frequent. Some airborne spray is present.	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.
7	High wind, moderate gale, near gale	50–61 km/h (13.9-16.9 m/s) 31–38 mph 28–33 knot 13.9–17.1 m/s	4–5.5 m 13–19 ft	Sea heaps up. Some foam from breaking waves is blown into streaks along wind direction. Moderate amounts of airborne spray.	Whole trees in motion. Effort needed to walk against the wind.
8	Gale, fresh gale	62–74 km/h (17.2-20.6 m/s) 39–46 mph 34–40 knot 17.2–20.7 m/s	5.5–7.5 m 18–25 ft	Moderately high waves with breaking crests forming spindrift. Well-marked streaks of foam are blown along wind direction. Considerable airborne spray.	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	Strong gale	75–88 km/h (20.8-24.4 m/s) 47–54 mph 41–47 knot 20.8–24.4 m/s	7–10 m 23–32 ft	High waves whose crests sometimes roll over. Dense foam is blown along wind direction. Large amounts of airborne spray may begin to reduce visibility.	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over.

10	Storm, whole gale	89–102 km/h (24.7-28.3 m/s) 55–63 mph 48–55 knot 24.5–28.4 m/s	9–12.5 m 29–41 ft	Very high waves with overhanging crests. Large patches of foam from wave crests give the sea a white appearance. Considerable tumbling of waves with heavy impact. Large amounts of airborne spray reduce visibility.	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	Violent storm	103–117 km/h (28.6-32.5 m/s) 64–73 mph 56–63 knot 28.5–32.6 m/s	11.5–16 m 37–52 ft	Exceptionally high waves. Very large patches of foam, driven before the wind, cover much of the sea surface. Very large amounts of airborne spray severely reduce visibility.	Widespread damage to vegetation. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	Hurricane	≥ 118 km/h (≥ 32.8 m/s) ≥ 74 mph ≥ 64 knot ≥ 32.7 m/s	≥ 14 m ≥ 46 ft	Huge waves. Sea is completely white with foam and spray. Air is filled with driving spray, greatly reducing visibility.	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris and unsecured objects are hurled about.

World Meteorological Organization (WMO) Sea State Code		
Sea State Code	Wave Height (meters)	Characteristics
0	0	Calm (glassy)
1	0 to 0.1	Calm (rippled)
2	0.1 to 0.5	Smooth (wavelets)
3	0.5 to 1.25	Slight
4	1.25 to 2.5	Moderate
5	2.5 to 4	Rough
6	4 to 6	Very rough
7	6 to 9	High
8	9 to 14	Very high
9	Over 14	Phenomenal

Character of the Sea Swell		
	0. None	
Low	1. Short or average 2. Long	
Moderate	3. Short 4. Average 5. Long	
Heavy	6. Short 7. Average 8. Long	
	9. Confused	

Annex 8: As-fitted Drawings and Machinery/Equipment documents and information literature to be delivered to the Government upon Delivery Acceptance

1. As-Fitted Drawings

1.1 Upon delivery of the Vessel, the Contractor shall deliver to the Government four (4) hard copies and two (2) soft-copies in pdf. and dwg. files of the following plans and drawings that contain the technical information of the Vessel and where applicable of the Daughter Boat and its machinery and equipment as they are when the Vessel and where applicable the Daughter Boat 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 during the design and construction of the Vessel and where applicable the Daughter Boat and before the Vessel and where applicable the Daughter Boat 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 wheelhouse, cabins, decks showing the disposition of all main equipment, fittings and fixtures, furniture, doors, windows, hatches, manholes and access openings. The down-flooding openings (points) shall be clearing indicated on the drawings.
1.2.9 Equipment layout diagram.
1.2.10 Hull structural construction and hull scantlings drawings.
1.2.11 Hull shell and frames and the framings arrangement and construction plan.
1.2.12 Hull shell expansion plan.
1.2.13 Keel construction plan.
1.2.14 Steering system and steering arrangement diagrams.
1.2.15 Superstructures and deck structural and construction plan.
1.2.16 Hull watertight bulkheads construction plan.
1.2.17 Superstructures to deck connection detailed construction plan.
1.2.18 Deck edge and bulwark (if any) details and construction plan, including detailed structural arrangement drawings of hull to deck connection.
1.2.19 Detailed cathodic corrosion prevention and arrangement plans and drawings for the Vessel throughout.
1.2.20 Mast structural and construction plan and mast equipment arrangement plan.
1.2.21 Anchoring arrangement plan.
1.2.22 Piping diagrams for fuel oil, freshwater, lubrication oil, bilge, firefighting, scuppers and drains, sewage system.
1.2.23 Fire prevention, fire control drawings
1.2.24 Drawings of the main switchboard and all other switchboards and the electrical system.
1.2.25 Wheelhouse and cabin sound and heat insulation system diagram.
1.2.26 Main engines and generator sets arrangement and sitting plans and drawings of their fuel lines and exhaust gas piping and arrangement.
1.2.27 Vessel ventilation drawings for the wheelhouse, cabins and other spaces.
1.2.28 Main fuel oil tank drawing and its associated piping and manifold(s), and filling, overflow and ventilation system.
1.2.29 Freshwater tank and its associated piping arrangement.
1.2.30 Fuel oil tank(s) and its associated piping system.
1.2.31 Drawings for anchor, windlass and the anchoring system.
1.2.32 Lifesaving appliance arrangement plan and fire safety plan.
1.2.33 Distress signals, alarm systems, and internal/external communication arrangement and system plan.
1.2.34 Navigation lights, sound and signal diagrams and any other external lighting arrangement plan.

1.2.35 Vessel overall lighting arrangement and light control plan.
1.2.36 Vessel alarm and signals, internal communication systems and public address systems plan.
1.2.37 General layout and arrangement drawing of the air-conditioning system.
1.2.38 Refrigerant piping layout drawing of the air-conditioning system.
1.2.39 Air-conditioning load calculation.
1.2.40 Drawings of waterjet system.
1.2.41 Drawings of the external fire-fighting system for the Vessel and for the Daughter Boat.
1.2.42 Foam concentrate tank(s) and its associated piping system.
1.2.43 Drawing of external fire-fighting control panel (EFCP) for the EFFS for the Vessel.
1.2.44 Stern Launch and recovery system for the Daughter Boat.
1.2.45 FMEA Report.

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 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 9 – Warranty Services and Guarantee Slipping (Daughter Boat)

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 an authorised agent to perform the Warranty Services, the Contractor shall ensure that the authorised 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 9. Reference to "Vessel" in this Annex 9 shall mean the Daughter Boat.

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.

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 fire fighting 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 in the Warranty Period applicable to such items.

1.4 During the Warranty Period, when the Vessel is handed over for the Warranty Services and/or Guarantee Slipping, the Contractor shall be responsible for the due return of the Vessel in good order. 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 free of charge Warranty Services for one year after the date of the issue of the Acceptance Certificate in respect of the Vessel. The Warranty Services shall cover the entire Vessel and all its Equipment (including all major Equipment specified in Schedules 6 and 7 in Part V which are for the Daughter Boat and electronic navigational equipment for the Daughter Boat), fittings and outfit (including spare parts, and documentation) (collectively, "Warranty Items") against defects of 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. Notwithstanding and without prejudice to the Contract on warranty obligations for the total Vessel, any individual equipment supplier/manufacturer's warranty extending beyond the one year total Vessel warranty must be assigned to the Government as appropriate.

1.6 Procedures for Warranty Claim

Without prejudice to the provisions of the Contract, a detailed procedure for dealing with warranty claims must be proposed by the Contractor and agreed by MD before the issuance of the Acceptance Certificate of the Vessel. This shall be 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 to examine the defect and the Contractor shall propose the appropriate and necessary remedial action to the satisfaction of MD.

1.6.3 The Contractor shall undertake on-site Warranty Services (including provision of all replacement Warranty Items, spare parts, labour, materials, test equipment, and transportation) wherever, at the option of the Government, the Vessel is berthed in the Government Dockyard or maintenance bases of the user department. Taking the Vessel to the shipyard of the Contractor 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.

1.7 Throughout the Warranty Period, the Contractor shall be responsible for the provision of free of charge corrective maintenance and rectification of all defects in all and any of the Warranty Items including repair and replacement as necessary. This shall, at no cost to the Government, include Warranty Services to be performed by the Contractor described in the following sub-paragraphs:

1.7.1 To attend to the Vessel for inspection and repair within 24 hours (excluding Hong Kong public holidays) of receiving the report of a fault ("fault report") and to take immediate action to rectify the defect after inspection. Unless otherwise agreed by the Government, all corrective maintenance and rectification must be effected within 48 hours after the fault report is first issued. The MD must be informed of what corrective maintenance and rectification actions have been taken within 72 hours of receiving the relevant fault report.

1.7.2 To provide all necessary transport, replacement Equipment, spare parts, labour and materials, tools and testing instruments required for the corrective maintenance and rectification.

1.7.3 Any replacement item or part to be used shall originate from the manufacturer of the original Warranty Item to be repaired and must be 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.

If the Contractor fails to respond to any reported warranty claims within 48 hours, the MD may arrange corrective maintenance and rectification of the defect either on its own or by deploying a third party contractor as deemed appropriate with a view to minimising any downtime incurred. In such case, the Contractor shall compensate the Government for the full cost of such repairs plus 10% as and for liquidated damages but not as a penalty no later than 10 working days after a written demand has been served on the Contractor by MD.

1.8 Extension of Warranty

1.8.1 The Warranty Period for any Warranty Item shall be suspended whilst and if the Contractor fails to repair and correct satisfactorily the defects in such Warranty Item within seven working days counting from the date when the relevant fault report was first issued.

1.8.2 Warranty Items which are electronic equipment sub-assemblies, modules or components and which are replaced during the Warranty Period shall have a new warranty period of one year commencing from the date of replacement.

1.8.3 In relation to a Warranty Item, references to Warranty Period shall be construed to include such extended warranty period as mentioned in Paragraph 1.8.1 and/or 1.8.2 above, depending on whichever is applicable.

1.8.4 Equipment which is found to be defective during the trials at the Guarantee Slipping as mentioned in Paragraph 2.2.3 below shall have an extension of warranty of one year.

1.9 Recurrent Defects

During the Warranty Period, should a second and similar defect arise in relation to a Warranty Item, this shall be construed as conclusive evidence of the Warranty Item's unsuitability for the purpose intended, and the Contractor shall take immediate steps to conduct a thorough investigation jointly with MD at the Contractor's expense, to ascertain the reasons for any such defect and shall forthwith at the MD's option and the Contractor's expense, procure and deliver another replacement Warranty

Item with a new design suitable for the purpose intended to replace the original defective Warranty Item.

1.10 In the event that the Contractor proposes to modify any Warranty Item or any part of the Vessel in order to repair or replace the same or another Warranty Item, the Contractor shall obtain the Government's advance written consent to the proposed modification.

1.11 Throughout the Warranty Period, the Contractor shall maintain an inventory of spare parts, which shall be the same items as listed in Schedules 6 and 7 in Part V and in the same quantity in the shipyard of the Contractor which the Contractor shall use for performing the Warranty Services. 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

Please refer to Chapter 10 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 regardless of any subsequent extension in relation to any Warranty Item under the terms of the Contract.

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 Engines and Gearboxes

(a) Renew the lubricating oil and replace the filters for the main engines and gearboxes as per the manufacturer's recommendations;

(b) Clean all the engine air filters and change the filter elements as necessary;

(c) Clean the coolers of the engines and renew all zinc anodes if provided;

(d) Check all the engines' belts and adjust if necessary;

(e) Check tappet clearances for the inlet and exhaust valves, ignition timing and idle speed and adjust if necessary;

(f) Conduct function tests for the engines' protection system and their associated sensors, gauges and other measuring devices; and

(g) Any other work required or recommended by the engine manufacturer.

All of the work listed at Paragraphs 2.2.1(a) to (g) shall be carried out by the manufacturer's authorised agent. All the work procedures and the spare parts used shall comply with the manufacturer's specifications and requirements.

2.2.2 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 two years' protection against marine growth;

(ii) The hull shall be cleaned;

(iii) Damaged paint shall be repaired according to the paint manufacturer's procedures;

(iv) After the repair of the damaged paint as specified at Paragraph 2.2.2(a)(iii) above, two coats of touch up primer and one coat of touch up shall be applied; and

(v) One full coat of finishing paint shall be applied to the hull below the water line.

(b) Paint Above the Water Line

(i) Damaged paint on the hull above the water line shall be repaired properly. After repair, two coats of touch up primer and one coat of touch up shall be applied;

(ii) Two coats of paint shall be applied on the Vessel's name, draft marks and insignia; and

(iii) One full coat of anti-slip paint shall be applied to the open and side deck.

(c) Inspect, clean and polish propellers.

(d) 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.

(e) Renew all zinc anodes.

2.2.3 The following shall be tested at the dock trial / sea trials as part of the Guarantee Slipping:

(a) Engine control and steering system;
(b) Engine alarm and shut down function (including emergency stopping of engines);
(c) Navigational equipment, lights and sound signals;
(d) Ahead and astern running and crash stop test;
(e) Steering trial;
(f) Speed measurement;
(g) Other trials as required by the Government Representative; and
(h) Any item or component found defective shall be repaired or replaced.