

Supply of One (1) Steel Launch for the Immigration Department

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 of the Hong Kong Special Administrative Region of the People’s Republic of China (“Government”) in relation to One (1) Steel Launch (“Vessel”) for use by the Immigration Department (“IMMD”).
- 1.1.2 Unless otherwise specified in the TS, all the specifications stated in this Part VII of the Tender Documents are classified and labelled as follows:
- (a) Essential Requirements [E];
 - (b) Those specifications which are without any label (viz., [E] or [D]) shall equally form part of the Contract like the specifications labelled as [E], but the Government will not conduct checks at the tendering stage whether the products offered comply with those specifications not labelled with [E]; and
 - (c) Desirable Specifications [D].
- 1.1.3 All this Part VII shall form part of the Contract. As part of the tender evaluation during the tendering stage (viz., completeness check), the Tenderer shall submit all the information in sufficient detail to substantiate that the product and the services offered meet the Essential Requirements as stipulated in Annex C to Part II, failing which its tender will **not** be considered further.
- 1.1.4 The whole of this Part VII, including all Essential Requirements, those without any label (viz., [E] or [D]) and the Desirable Specifications labelled with [D] (if and to the extent the Contractor has indicated compliance in its tender), shall also form part of the Contract and be of equal materiality and importance upon the award of the Contract. The non-compliance with any specifications set out in these TS shall have the same consequences as specified in the Contract. Save during the tendering stage in the manner as mentioned in Paragraph 1.1.2 (b) above, no differentiation shall be made based on the classification unless otherwise expressly specified.
- 1.1.5 The Vessel shall be Ready for Use before the Delivery Date and delivered by the Delivery Date as per the schedule stipulated under Schedule 2 – Delivery Schedule of Part V.
- 1.1.6 Unless otherwise expressly defined in the Contract, all technical terms and expressions used in this Part VII shall be interpreted in accordance with the professional or common usage in naval architecture, marine engineering, nautical navigation and the shipbuilding industry.
- 1.1.7 For the avoidance of doubt, references to “tests” throughout the Tender Documents and the Contract shall include all inspections, surveys, assessments, trials and experiments.

1.2 Statement of Purposes of the Vessel

- 1.2.1 The Vessel shall be safe, fit and suitable for the purposes it is intended for, namely to be used by the Immigration Department anywhere within Hong Kong Waters, for the purposes of preserving and administering the integrity of the HKSAR Boundary of Administration and performing law enforcement and surveillance duties. The Vessel shall perform immigration clearance mainly at the Western Quarantine and Immigration Anchorage (WQIA), the Eastern Quarantine and Immigration Anchorage (EQIA) and Tuen Mun Immigration Anchorage (TMIA), screen incoming and outgoing persons and vessels, and such other duties would necessitate Immigration Officers to board, and to depart from, other vessels of various size and freeboard height, including foreign vessels moored at buoy/berth/anchorage.

- 1.2.2 The Vessel shall be used for detaining and repatriating certain individuals under the HKSAR laws, and to serve as a transport launch for Immigration Officers. In addition, it will serve as a stationary vessel for Immigration Officer's shift changing at anchorages in Hong Kong Waters.
- 1.2.3 The Contractor acknowledges and agrees that the Government relies on the professional judgement and skill of the Contractor to ensure that the Vessel is compliant with all requirements of the Contract including without limitation the Warranties, this Part VII and the Schedules. The Contractor further warrants that it will alter, modify or otherwise change aspects of the Vessel's fittings, fixtures, user interface as required by the Government within the scope of the requirements of the Contract in order to ensure the ultimate fitness for purpose of the Vessel before the Acceptance Certificate is issued.

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.
- 1.3.2 GNC may delegate the 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 Navigation Equipment ("ENE") technical acceptance.

1.4 Shipyard

- 1.4.1 The Contractor's nominated shipyard building the Vessel must have the essential shipbuilding and workshop facilities such as lifting gears, hull construction and calibration equipment, machinery installation and calibration equipment and 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 Vessel construction.

1.5 Design and Construction Responsibility

- 1.5.1 The Vessel shall be designed and constructed for a service life of not less than fifteen (15) years under reasonable maintenance.
- 1.5.2 It is the SOLE responsibility of the Contractor to supply a Vessel which is safe, fit and suitable for the operation of the of the IMMD as set out in Paragraph 1.2 above and which meets all the relevant regulations and the specifications in this Part VII, which include without limitation requirements for safety, health, environmental protection, hull form design features, structure, method and materials for construction and fitting out, stability, sub-division and operational efficiency.
- 1.5.3 The Vessel shall be designed and constructed in accordance with the latest edition of the rules and regulations of the Recognised Organisation (RO), or a standard covering hull structure and propulsion machinery acceptable to the RO, as specified in Schedule 9. Unless otherwise expressly stipulated in this Part VII, **(a) references to "RO" in this Part VII shall mean the RO as specified in Schedule 9; and (b) references to "RO Requirements" shall mean the requirement of the rules and regulations of the RO as specified in Schedule 9.** Notwithstanding the foregoing, where it is expressly permitted in this Part VII that in relation to a particular requirement, instead of the RO specified in Schedule 9, another RO which is any one of the ROs listed in Paragraph 2.2.3 (a) to (i) of this Part VII may be designated for compliance with the relevant requirement, references to "RO" shall mean such other RO.

- 1.5.4 The Vessel is required to be issued with a certificate of class with notations, or a product certificate, by the RO as specified in Schedule 9. All plans, particulars and documentation which are required for the classification of the Vessel, or for issuance of a product certificate for the Vessel, by the RO, in addition to those listed in Annex 3 to this Part VII shall be approved by the RO before submission to MD for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions shall be treated in the same manner. Those drawings which are not required for approval by the RO shall be submitted to MD for approval before work is carried out.
- 1.5.5 The Vessel shall be issued with a certificate of class with notations, or a product certificate, by the RO as specified in Schedule 9. All plans, particulars and documentation which are required for the classification of the Vessel, or for issuance of a product certificate for the Vessel, by the RO, in addition to those listed in Annex 3 to this Part VII shall be approved by the RO before submission to MD for endorsement and final approval prior to commencement of work. Any subsequent modifications or additions shall be treated in the same manner. Those drawings which are not required for approval by the RO shall be submitted to MD for approval before work is carried out.
- 1.5.6 The Contractor shall design, build and supply the Vessel in full compliance with all requirements of the Contract including without limitation the Warranties, this Part VII and the Schedules; and even if any of them 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 this Part VII, this Part VII shall prevail unless GNC stipulates or agrees otherwise.
- 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 relevant RO in respect of that 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 representatives as part of the Technical Acceptance.
- 1.6.3 Subject to Paragraph 1.6.7 of this Part VII, an advance written notice of not less than five (5) working days (if the Vessel is located in Asia), and ten (10) working days (if the Vessel is located other than Asia) must be given to GNC before the representatives of 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 Contractor shall provide
- (a) an Implementation Timetable, in the form set out in Annex 2 to this Part VII, setting out the major milestones and their scheduled completion dates and incorporating the Delivery Dates specified in Schedule 2;
 - (b) the Drawing Submissions Timetable in the form set out in Annex 3 to this Part VII ; and
 - (c) the Main Items Inspection Timetable in the form set out in Annex 4 to this Part VII.

Each one of the above shall be submitted to GNC for approval 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 shall be submitted to MD during the construction of the Vessel. The weekly report shall be submitted before noon of every Monday.
- 1.6.6 MD 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 and other necessary documents where applicable.
- 1.6.7 After arriving at the site for a survey visit, if MD officers / consultants consider 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 an RO which are necessary in order to fulfil any obligation of the Contractor under the Contract, the Contractor is responsible to pay the RO all such fees, charges and associated expenses. Such fees shall include charges for drawing approval, surveys (if deemed necessary), issue of certificates, and any other expenses payable to the RO.
- 1.6.9 The Contractor shall provide office space for MD officers, IMMMD officers and consultants during their survey visits and construction progress visits to the Vessel at the shipyard where the Vessel is constructed. The office space shall include, but not be limited to, two (2) desks, four (4) chairs, one (1) telephone, one (1) conference table, drinking facilities, power supply and one (1) cupboard for storage of documents and working clothes. The space provided by the Contractor shall also be fitted with air conditioning, 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 GNC officers, IMMMD officers or consultants 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 officers and consultants can be carried out with maximum efficiency and a minimum of interference with the Contractor's work.

1.7 Official Sea Trial and Speed Requirements

- 1.7.1 The Contractor shall submit an Official Sea Trial program for GNC approval, at least 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, ship handling at sea and performance tests, manoeuvring test, crash stop test, astern running test / emergency steering test, anchoring tests and other tests as stated in this Paragraph. This programme must be submitted to MD in not less than 14 working days before the trials commence. The permitted speed and rudder angle should be measured when the return angle is less than 12 degrees. The notification for Official Sea Trial shall be included evidence that the Vessel is safe to go to sea for the intended tests and trials specified in the Contract.
- 1.7.2 As in all other tests and trials to be conducted as part of the Technical Acceptance, the Contractor shall carry out the full Official Sea Trial in Hong Kong at its own expense (including the expense of fuel, lubrication oil, crew and other necessary expenses), in the presence of GNC officer(s), IMMMD officer(s), surveyor of RO and the consultant. The Contractor shall observe the local requirements on navigation before the sea trial, including the third party insurance in accordance with the laws of Hong Kong.

1.7.3 The Contractor shall provide to MD officers, the name, post, duty and experience of each 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 officers. The location of each person on board, which can affect the centre of gravity of the Vessel under trial, will need to be first agreed by the GNC.

1.7.4 The Contractor shall provide a trial report to GNC after completion of the above tests. The report shall contain information regarding the method of test, engine(s) running condition, sea condition, weather condition and wind condition, 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 the GNC appointed consultant during the tests; and such information shall be prepared in a format agreed by GNC.

1.7.5 Official Speed Trial

- (a) The Official Speed Trial shall be carried out in the Hong Kong Waters.
- (b) As part of the Technical Acceptance as specified in Paragraph 1.8.2 of this Part VII, the Contractor shall carry out the Official Speed Trial in the presence of GNC officers or their appointed consultant(s).
- (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 shall 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 in each direction.
- (f) The Contract Speed to be achieved by the Vessel in the Official Speed Trial shall be the minimum highest achievable speed of 17 knots with the engine power at 95% Maximum Continuous Rating (MCR) and the Vessel under Official Speed Trial Conditions as stated in Annex 5 to this Part. If the Vessel fails to achieve the speed of 17 knots under the aforesaid conditions, the Government will deem that the Vessel has failed to pass the Official Speed Trial and Technical Acceptance.
- (g) The instrument used 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 and is acceptable to GNC; or other speed measuring methods acceptable to GNC.

- (h) All Equipment shall also be in operation during the Official Sea Trial unless explicitly exempted by MD. This Equipment shall have passed the Technical Acceptance. The information including but not limited to the speed, time of the day, engine running conditions and sea condition shall be properly recorded by the Contractor, and signed as witnessed by the GNC surveyor (or the GNC representatives) during the Official Sea Trial and shall form part

of the Official Sea Trial Report. A copy of the Official Sea Trial Report as required in Paragraph 1.7.6 below shall be given to GNC before Delivery Acceptance. Upon successful completion of the Official Speed Trial in Hong Kong, the Contractor shall arrange GNC officers to carry out hull bottom inspection on the vessel to check for any hull damage before delivery.

1.7.6 The following tests shall be conducted by the Contractor as part of the Technical Acceptance and the testing results shall be recorded and form part of the Official Sea Trial Report:

(a) Endurance Test

The Endurance Test shall be carried out for different engine loading and speeds to obtain the speed/fuel consumption curves (or data) for the Vessel, with the engine(s) operating within the manufacturer recommended engine operating conditions. The test results shall be recorded in accordance with the requirements stipulated in Annex 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) both 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.

(e) Emergency Steering Test

An emergency steering test shall be carried out to ascertain that the Vessel shall be steered satisfactory when the electrical power supply to the steering system has been disabled.

(f) Starting Tests for Main Engines and Electric Generator Engines

(g) Anchoring Test

(h) Noise Level Test as per the requirements in Paragraph 4.1.2(ix)(a)(3) of Chapter 4 of this Part VII.

(i) Megger Test as mentioned in Paragraph 8.3.7 of Chapter 8 of this Part VII.

1.8 Acceptance and Delivery

1.8.1 Acceptance of the Vessel (including all Equipment) shall be carried out in two (2) parts:

- (a) Technical Acceptance; and
- (b) Delivery Acceptance

1.8.2 Technical Acceptance

- (a) This includes all the hull construction, mechanical and electrical tests and trials as required in this Part and those considered necessary by the Government, including equipment tests, anchoring tests, inclining experiment and bottom survey on the slipway in Hong Kong, the Official Speed Trial as mentioned in Paragraph 1.7.5 of this Chapter shall be conducted in Hong Kong Waters, the Endurance Test, Manoeuvrability and Crash Stop Tests as mentioned in the Paragraphs 1.7.6 (a), (b) and (c), the bench acceptance test and on-site commissioning test for ENE as mentioned in Chapter 9 of this Part VII and all other verification tests to determine whether or not the Vessel including the Equipment has been supplied in accordance with all the specifications set out in these Technical Specifications.
- (b) All electronic items and their installations shall be approved and inspected by EMSD as part of the Technical Acceptance.
- (c) The Contractor shall supply all necessary equipment and labour at its own cost for carrying out the tests and trials stated in Paragraph 1.8.2 (a) and (b) above.
- (d) 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, 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, at the discretion of Government, the Contract may be terminated according to the applicable terms stipulated in the Contract.
- (b) Classification with notations for the Vessel shall be issued by the relevant RO as specified in Paragraph 2.2.3 of this Part VII 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 shall 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 MD 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 MD 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 10.2 of Chapter 10 of this Part VII, 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 subject to GNC satisfaction.
- (h) 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 once the Director of Marine has issued the Acceptance Certificate.

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 GNC upon Delivery Acceptance.
- 1.9.2 The full scope of the Warranty Services is set out in Annex 1 to this Part.
- 1.9.3 The Contractor is responsible for arranging the Vessel for Guaranteed 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 the Part IV (Conditions of Contract), the Contractor shall also be responsible for the rectification of any defects found in the course of Guaranteed Slipping. The full scope of the Services to be provided as part of the Guaranteed Slipping is set out in Annex 1 to this Part VII.

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.

1.11 Asbestos Free

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

Chapter 2 - General Technical Requirements

2.1 Introduction

- 2.1.1 Without prejudice to the generality of Chapter 1 of this Part VII, this Chapter contains the more particular technical specification for the Vessel. The significance of Essential Requirements is explained in Paragraph 1.1 of Chapter 1 above.
- 2.1.2 The work to be done under this Contract consists of the design, construction, outfit, testing and delivery of one steel launch for Immigration Department (IMMD). Workmanship, functions, characteristics and performance shall be in accordance with this Part VII, best marine construction practices, and the regulatory standards herein specified or otherwise applicable.
- 2.1.3 Whilst the Contractor shall 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. Unless otherwise specified in the TS, the Conceptual General Arrangement Plan (“GA”) at Annex 6 only serves as guidance and a reference drawing to help to explain the tender requirements stated in this Part VII.
- 2.1.4 During the design and construction of the Vessel, the Contractor shall submit a detailed General Arrangement Plan (GA Plan) for GNC approval and acceptance.
- 2.1.5 All the machinery, equipment and facilities, furniture, fixtures and fittings, including outfitting of the Vessel that are described in the TS, together with their requirements for design and installation standards that are stipulated in this Chapter of this Part VII and in any other parts of the TS, are the items that must be included in the complete “As-built” Vessel delivered to the Government.

2.2 Rules and Regulations

- 2.2.1 The Vessel shall be designed and constructed in accordance with the latest edition of the rules and regulations of a Recognized Organization (RO) acceptable to MD. The hull (including equipment) and machinery (including electrical installations) of the vessel shall be assigned with appropriate class notations. The Tenderer shall state in Schedule 9 which RO and its rules and regulations and class notation shall be used in the design and construction of the Vessel.
- 2.2.2 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 this Part VII, the final decision shall rest with GNC.
- 2.2.3 Without prejudice to the general requirement that the Contractor shall perform all Work in full compliance with all applicable laws and regulations, and in full compliance with the requirements of the Contract including this Part VII. The construction of the Vessel must comply with the requirements of the RO specified in Schedule 9 or the requirements of any of the RO listed below (where it is expressly specified in this Part VII in relation to a particular requirement, another RO which is any one of the ROs listed in sub-paragraphs (a) to (i) below may be designated for compliance with the relevant requirement), and also the requirements further specified in sub-paragraphs (j) to (n) below:
- | | |
|---|-------|
| (a) American Bureau of Shipping | ABS |
| (b) Bureau Veritas | BV |
| (c) China Classification Society | CCS |
| (d) Det Norske Veritas Germanischer Lloyd | DNVGL |
| (e) Korean Register of Shipping | KR |

- | | |
|---|------|
| (f) Lloyd's Register | LR |
| (g) Nippon Kaiji Kyokai | NK |
| (h) Registro Italiano Navale | RINA |
| (i) Russian Maritime Register of Shipping | RS |

and other entities as specified below:

- (j) International Electrotechnical Commission (IEC) Regulations for the Electrical and Electronic Equipment.
- (k) International Telecommunications Union recommendations in the International Radio Regulations (ITU-R).
- (l) Quality and standards of the welding shall comply with the rules of an RO or American Welding Society (AWS) or other applicable international standards or rules acceptable by MD.
- (m) International Regulations for Preventing Collisions at Sea 1972, and all the effective Resolution as amended by International Maritime Organization (IMO).
- (n) ISO 12215-4 “Small Craft – Hull Construction and scantlings – Part 4 Workshop and Manufacturing”.
- (o) All equipment/fittings shall be designed and manufactured to at least the standards as specified in these Technical Specifications. When none of the rules and regulations in Paragraphs 2.2.3 (i) to (v) above are applicable, then the applicable standards specified by the applicable organizations 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

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

2.3 Contract Speed

- 2.3.1 Not less than 17 knots when both of the engines running with the output power at 95% of Maximum Continuous Rating (MCR) under Official Speed Trial Conditions as stated in Annex 5 to this Part VII. [E]
- 2.3.2 The aggregate propulsive power of the main engines shall not be more than 900 kW. [E]
- 2.3.3 The guaranteed speed prescribed above shall be achieved without porpoising, or other dynamic instabilities. The propeller shall match the engine profile and avoid cavitation as far as possible.

2.4 Principal Dimensions

The Principle Dimensions of the Vessel shall be:

Length Overall (LOA):	16.0 – 16.5 metres	(Fenders included)	[E]
Breadth (B):	4.4 – 4.6 metres		[E]

Depth (D): 2.6 – 2.8 metres

Draught (T): Design to suit

2.5 Material of the Structure

Material of Hull Structure: Marine Steel [E]

Material of Superstructure: Marine Aluminium alloy [E]

2.6 Vessel Operating Profile and Environment

2.6.1 The Vessel shall be designed for deployment by the IMMD at least 335 days per year including overnight voyages. The Vessel shall be designed and built to operate in Hong Kong Waters.

Summary of Operational Hours / Range

Number of hours/day: 18 hours/day

Number of days/year: 335days/year (excluding overhaul)

Endurance for fuel capacity: at least 12 hours at 17 knots [E]

2.6.2 The Vessel shall be able to operate safely within the Hong Kong Waters in weather conditions up to and including the conditions equivalent to Beaufort wind force scale (“Beaufort scale”) number 6. Total carrying capacity of the Vessel is 22 persons including 3 crew to operate the Vessel.

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

External air 0 - +40 °C

Internal air 0 - +35 °C

Machinery space ≤45 °C (All equipment at full rated power)

Maximum seawater temperature +32 °C

2.7 Markings and Colour Scheme

2.7.1 Marking and colour scheme for the Vessel shall be in accordance with the requirements given in this part VII.

2.7.2 The Contractor shall provide the markings and colour scheme for the Vessel. Colour scheme shall be approved by GNC before application. All painting colour scheme for fittings shall be agreed by GNC.

2.7.3 All labelling shall be both in Chinese and English and as per applicable rules and regulations. The IMMD logo shall also be displayed on both sides of the Vessel or elsewhere as directed by MD and IMMD. The colour used for the crest of Immigration Department should be durable type.

2.7.4 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 IMMD’s satisfaction. Draught marks shall also be marked at both sides of bow and stern in the same manner as the vessel name. The full load design draught mark shall be marked at port and starboard amidship.

2.7.5 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.

- 2.7.6 Exits shall be identified and labelled. Stowage locations for life jackets and quantities of life jackets contained therein shall be identified as per SOLAS.
- 2.7.7 Safety markings for the prevention of person tripping in the Vessel shall be provided where necessary.

2.8 Tally Plates

- 2.8.1 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.
- 2.8.2 Tally plates in both English and traditional Chinese characters shall be fitted for spaces and 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.

- 2.8.3 Tally plates exposed to weather shall be made of durable and weatherproof material and be securely fastened.
- 2.8.4 List of tally plates shall be provided to GNC for approval.

2.9 Other Design Features

- 2.9.1 Berthing requirement of the Vessel shall match with the designated point of berth at the Government Dockyard.
- 2.9.2 Permanent list is not allowed, and where it is not practical to achieve this requirement, the maximum permanent list of the Vessel in its lightship condition must not be greater than 0.5 degree.
- 2.9.3 The use of permanent ballasts on the Vessel shall only be used as agreed by GNC.
- 2.9.4 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.
- 2.9.5 Both air and structural induced noise shall be kept to a minimum level in the officer cabin and in the wheelhouse.

Chapter 3 - Hull and Deckhouse

3.1 General Requirements

- 3.1.1 The Vessel shall be designed and built with a mono-hull form and the hull structure shall be constructed of marine steel, the deckhouse shall be constructed of marine aluminium alloy. All materials shall be new and of a type which has been certified by an RO or other entities acceptable to GNC for shipbuilding purposes. Build processes for construction shall comply with an approved standard. Their selection shall recognize the craft through life cycle and service conditions for ease of repair in the event of hull damage.
- 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 an RO before submitting to GNC for approval.
- 3.1.3 The hull structure design loads shall be in accordance with the Vessel operational profile and other applicable requirements.
- 3.1.4 Records of the structural materials used for vessel construction and up-to-date copies shall be provided to RO surveyor and GNC's representative for inspection during the construction stage of the Vessel. Materials for composite structures construction shall be traceable to ensure quality, and follow good materials handling procedures, for example: workshop conditions, material storage and handling, and requirements for the manufacturing of the craft. Humidity and temperature shall be continuously recorded during the build process and shall be referenced against the composite parts built at any one time.
- 3.1.5 The Contractor shall carry out quality control throughout the construction 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 RO approved devices and be so arranged to ensure the bulkhead to be entirely watertight and strength maintained. All watertight bulkheads shall be permanently marked "WT BHD" in a conspicuous position as agreed by GNC.
- 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 in Hong Kong.
- 3.1.11 All welding and fabrication shall be carried out according to the rules of an RO to oversee the construction work, for example, "Part 2 - Rules for Materials and Welding of Steel Vessels under 90 Meters in Length of American Bureau of Shipping" or American Welding Society (AWS) or other international standards acceptable to MD. Welding scheme shall be approved by the RO before work is carried out.

3.1.12 Welded joints shall be carefully designed and constructed to conform to the latest established standards to prevent fatigue failure. Cutting for edge preparation shall be performed by qualified person to achieve correct angle, shape and smooth finish of the edges. Only qualified welders shall perform the welding work.

3.1.13 Certification of the qualifications of each individual welder and inspector shall be submitted to GNC by the Contractor. Welds carried out by unqualified procedures or welding performed by non-certified welders shall be removed by the Contractor at his own expense.

3.1.14 The structural fabrication shall include but not be limited to the following:

- (a) Inventory of incoming material, consumables components and machinery;
- (b) Traceability procedures for materials together with traceability identification codes which shall be serial and indexed to the controlled manufacturing procedures;
- (c) Lofting, cutting, fitting, welding, forming and dimensions of structural components, measures shall be taken to avoid deformation of structure during fabrication and welding;
- (d) Welding and inspection procedures identifying clearly the type and extent of Non-Destructive Test (NDT) inspection carried out on the Vessel structure according to RO applicable requirement stipulated in paragraph 2.2.3 of this Part VII. GNC may extend the NDT deemed subject to the quality of the welding. The Contractor shall submit a NDT inspection plan to GNC for approval before inspection. NDT shall be carried out by an agent approved by the national authority or RO and the Contractor shall submit an inspection report to GNC on their findings;
- (e) Welding, machining, measuring and inspection equipment maintenance and calibration;
- (f) Machining, finish surfaces, bolting;
- (g) Procedures for work quality non-conformance reporting and records of rectification of defects; and
- (h) The design and manufacturing drawing control procedures, including any of its revisions and updates, and records for any re-issue of drawings.

3.2 Hull and Deckhouse Structure

3.2.1 General Workmanship

- (a) Trunks, coamings, and openings where applicable shall have radius corners as large as possible.
- (b) Fittings and openings through decks and bulkheads for pipes and cables shall be properly designed to maintain watertight integrity, reduce transmission of heat, and to minimize transfer of machinery vibration and noise to the hull structure.
- (c) Drain holes and air holes shall be provided as necessary to ensure proper venting and drainage of all tanks, compartments, pockets, and voids. All tanks shall have drain holes and air holes of adequate size for full capacity flow to suction and vent lines. There shall be no pockets where water can be trapped at any normal list or trim to be encountered in service.
- (d) Sharp corners shall be avoided.

3.2.2 Tightness

- (a) Tanks shall be tested by pressurizing to a head of water in accordance with RO requirements. If pressurized by air, all fittings and welding shall be checked by application of a soap solution. No leakage is permitted.
- (b) The weather-tightness of any fittings on the weather deck and deckhouse shall be demonstrated by directing a water stream from a 12 mm diameter nozzle at all parts of the exterior including all windows, doors, and hatches. Any leakage will be considered to be a failure of the test and corrective measures shall be taken.
- (c) Chalk tests shall be carried out if the above two methods are not applicable.
- (d) All structures and fittings shall withstand the tests described as above.

3.2.3 Fairing

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

3.2.4 Decks, Platforms, Flats and Stiffness

- (a) All decks, platforms and passage shall be sufficiently reinforced to prevent deflection that might be caused by an individual walking or standing on the deck and/or by structural 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 and where relevant cabin roof shall be fitted with watertight covers for removal of main engines, and generators without shifting the main engine.
- (c) The deck area shall have a camber of 1/50 of breadth and slope up towards the bow at forward part.
- (d) 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 Penetration of Hull Fittings

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

3.2.6 Hull Structural Closures

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

- (b) Access to hull compartments from the main deck shall be provided by watertight deck hatches.
- (c) Flush deck watertight cover fitted with soft patch or gasket shall be provided for engine and equipment removal or maintenance purposes on top of the engine room. Soft patches or gasket shall be secured properly and to GNC's satisfaction.
- (d) Flush deck access fitted with watertight cover to fore peak/after peak tank/Oil-water tank from main deck shall be provided.
- (e) Two watertight covers shall provide for access from the main deck to the engine room.
- (f) Hinged hatch covers shall be provided with means to hold them in the fully opened position. Protective means should be provided to prevent the crew from accidentally dropping into the opening after opening the hatch.

3.2.7 Deckhouse Closures

- (a) The weather-tight doors complied with the requirements of RO shall be provided for access into the deckhouse.
 - (i) Aft deck space to/from officer cabin with a minimum 650 mm x 1750 mm clear opening;
 - (ii) From side deck to/from officer cabin (port & starboard), one sliding weather-tight door with window shall be provided at each side. The size shall be agreed by GNC depending on final arrangement. The clear opening shall be a minimum of 650 mm x 1750 mm.;
- (b) Doors giving access to the deckhouse shall have a coaming as per RO Requirements above the finished main deck surface.
- (c) Appropriate locking devices shall be provided for all access doors.
- (d) Deckhouse shall be 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. [D]

3.2.8 Hull Preservatives and Coverings

- (a) Exterior surfaces of the Vessel above the fully loaded draught shall be painted and prepared to a satin finish/appearance/texture.
- (b) Antifouling paint for a minimum of two years' service life shall be provided by the Contractor to paint manufacturer and to GNC's satisfaction.
- (c) Wherever paint is used, the Contractor shall propose a suitable paint specification (including hull, superstructure, outfittings and equipment, etc.) in conjunction with a paint manufacturer for GNC's approval before painting. Painting report prepared by the paint supplier shall be submitted to GNC for record.
- (d) All coatings shall be applied as specified by the manufacturer including temperature and humidity at time of application, coverage/rate, wet and dry film thickness, recoat time and application equipment and rate, etc.
- (e) The paint of the Vessel shall 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) All steel walls and floor plates shall be degreased and sand blasted to Sa 2.5 and cleaned before painting. Painting Schedule shall be proposed by the Contractor in consultation with the paint suppliers/manufacturers and submitted for GNC's 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 onboard.

3.3 Stability and Subdivision

3.3.1 The Preliminary Lines Plan as well as Offset Table of the Vessel and the preliminary stability information, including damaged stability for each compartment and taking into account of wind force effect, of the Vessel shall be submitted with the tender. All calculations and drawings must be in metric units. [E]

3.3.2 The Vessel shall comply with the intact and damaged stability requirements stated in this Part VII and RO Requirements.

3.3.3 Inclining Experiment:

- (a) An inclining experiment shall be carried out according to the guidance of Annex I of IMO Resolution MSC.267(85) in conducting such an inclining experiment, to determine the lightship weight and the position of the centre of gravity of the Vessel.
- (b) Before conducting the inclining experiment, the "Scheme of Inclining Experiment" shall be approved by the RO and submit to GNC for approval. The Scheme shall include following:
 - (i) the Vessel's intended loading condition during the inclining experiment;
 - (ii) the proposed locations and movements of the inclining weights;
 - (iii) the calculation of the estimated heel of the Vessel before and during the inclining experiment;
 - (iv) the proposed number, location and lengths of pendulum used; or other methods of measuring heel angles;
 - (v) the list of data to be measured (i.e. draught, specific gravity of floating water, etc.).

The lightship weight and centres of gravity shall be calculated and presented in the inclining experiment report. The GM of the Vessel after each and every shift of inclining weight shall be preliminarily determined. Free surface effects of all liquids on board shall be taken into account in all calculations.

- (c) The inclining experiment shall be witnessed and conducted to the satisfaction of GNC and RO.
- (d) The inclining experiment report shall be produced and has obtained the RO's approval before submitting to GNC for further comments. The report 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. No Official Speed Trials shall be conducted until GNC, based on the information given in the inclining experiment report, agrees it is safe to carry out such tests and trials.

3.3.4 Stability Information Booklet

The Vessel shall comply with the stability criteria mentioned in this Part or other applicable IMO regulations (International Code on Intact Stability, 2008 - 2008 IS Code). Furthermore, stability due to wind and ship rolling for the required service environment of the Vessel shall be calculated. In addition to the requirements stated above, the booklet in its final version shall include:

- (a) The Vessel's particulars, sketch of general arrangement drawing showing different compartment and tank positions, hydrostatic curves, and cross curves;
- (b) Tank calibration/sounding tables include but not limited to fuel oil tank, freshwater tank. These tables shall consist of the locations of tanks (in terms of frame numbers), levels from tank bottom, capacity, VCG/LCG/TCG and free surface moments, and the location of the sounding points. The trim and heel of the Vessel for which these tables are applicable shall be stated clearly;
- (c) Stability calculations for each loading condition shall include but not limited to a profile drawing of the Vessel and items of deadweight, lightship, displacement, drafts, trim, VCG, GM (solid & fluid), LCG, down-flooding angle, maximum static stability - GZ curves; and
- (d) Any other information as reasonably required by the RO and/or GNC.

3.3.5 In the preliminary stability information booklet and in the final stability calculations, the estimated and the final (obtained after conducting an inclining experiment) lightship data shall be used respectively. Both the preliminary and final stability information booklet shall include the following loading conditions (and any other conditions as may be required by GNC during the construction of the Vessel) and their stability results shall be presented as per on intact stability as mentioned in paragraph 3.3.6.

	Loading Conditions	Fuel Oil (%)	Freshwater (%)	Black Water (%)	Persons & Effects
1	Lightship	Nil	Nil	Nil	Nil
2	Full Load Departure	98	98	10	22 x 85 kg
3	Full Load Arrival	10	10	90	22 x 85 kg
4	Mild way	50	50	50	22 x 85 kg
5	No Load Departure	98	98	10	3 x 85 kg
6	No Load Arrival	10	10	90	3 x 85 kg

- (a) The maximum free surface moments shall be used for calculating the stability of the Vessel in all the above conditions.
- (b) Weight of each person is assumed to be 75 kg with effects 10 kg (22 persons in total).
- (c) VCG of each person shall be assumed as 1000 mm above the deck they are likely situated. LCG of each person shall be in their most likely position on board.
- (d) Wind moments in various loading conditions due to Beaufort scale number 6 shall also be considered in the stability calculations.
- (e) The final stability information booklet shall be approved by the RO before submitting to GNC for approval. The Contractor shall supply to GNC four (4) copies of stability information booklet (as built), which must be given to GNC at Delivery Acceptance.

3.3.6 Intact Stability Criteria

- (a) Stability and freeboard shall only be considered satisfactory if the following criteria are complied with, after taking into account of free surface effects and wind moment at Beaufort scale number 6, for loaded conditions as specified above.
 - (i) The maximum righting lever (GZ) occurs at an angle of heel of not less than 25 degrees;
 - (ii) The righting lever GZ shall be at least 200 mm an angle of heel equal to or greater than 30 degrees;
 - (iii) The area under the GZ curve shall not be less than:
 - 1. 0.055 metre-radian up to an angle of heel of 30 degrees;
 - 2. 0.090 metre-radian up to an angle of heel of 40 degrees or the angle at which the lower edges of any openings in the hull, deck, deckhouses, being openings which cannot be closed watertight, are immersed if that angle be less;
 - 3. 0.030 metre-radian between 30 and 40 degrees or such lesser heeling angles referred to in (2) above;
 - (iv) The initial transverse metacentric height shall not be less than 0.15 metre.
- (b) If there are difficulties to comply with the above requirements, the Contractor may alternatively choose to apply related rules and regulations in stability requirements of the RO or ISO 12217 Part 1, subject to GNC's prior written approval.

3.3.7 Damage Stability Criteria

- (a) Transverse bulkheads shall be arranged to maintain the stability of the Vessel when flooding of any one under-deck compartment occurs, and when there is asymmetric flooding to any one of the under-deck compartments. The residual stability of the Vessel shall be considered satisfactory if the following criteria are complied with, after taking into account of free surface effects and wind moment at Beaufort scale number 6, for loaded conditions as specified above.
 - (i) The residual transverse metacentric height shall not be less than 0.05 metre;
 - (ii) The inclination angle should not exceed 10 degrees; and
 - (iii) The final water line is located below any inlet opening.
- N.B. The opening(s) to be used to determine the down-flooding angle(s) shall first be agreed by the RO and GNC before carrying out the calculations.
- (b) The inlet opening means an opening through which progressive flooding may take place is immersed. This would not be an opening closed by a watertight manhole cover or a vent fitted with an automatic closure.

Chapter 4 - General Arrangement

4.1 Arrangement on Main Deck and Under-deck

4.1.1 Unless otherwise specified in the TS, the Conceptual General Arrangement Plan in Annex 6 of this Part VII only serves as guidance and is a reference drawing to help to explain the tender requirements. It shows a desirable layout of the accommodation and compartment arrangement of the Vessel with following maximum or minimum dimensional guidance considered:

<u>Dimension</u>	<u>Guidance</u>
Side deck walkway width	Minimum 700 mm
Clear headroom for deckhouse	Minimum 2.0 m
Number of crew and IMMD Officers	Maximum 22

- (a) The Tenderer shall submit the General Arrangement Plan for Government considerations at the tendering stage. During the design and construction of the Vessel, the Contractor shall submit a detailed General Arrangement Plan for GNC's approval and acceptance.
- (b) It is a contractual requirement that ALL the furniture, equipment and facilities, 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 of Part VII and in any other parts of the TS must be included in the complete "As-built" Vessel delivered to the Government.
- (c) The deckhouse comprises of the following compartments:
 - (i) Wheelhouse; and
 - (ii) Officer cabin
- (d) Subject to full compliance with the requirements of stability and subdivision, the under-deck shall be divided by transverse watertight bulkheads into five compartments as follows:
 - (i) Fore peak;
 - (ii) Crew Space;
 - (iii) Tank space;
 - (iv) Engine room; and
 - (v) Steering Engine room

4.1.2 General Provisions

- (a) External deck spaces shall include:
 - (i) Clean and simple bow deck area for efficient boarding and mooring operation
 - (ii) Clean and simple aft deck area for efficient boarding and mooring operation
 - (iii) Side walkway around deck facility (700 mm wide minimum) which provides easy access to fore deck or aft deck. The walking area on deck shall be well illuminated in dark environments.

- (iv) The side deck geometry of the Vessel shall be carefully designed to facilitate safe boarding/landing to GNC's satisfaction.
- (v) The main deck and the top deck external spaces shall be provided with railings to GNC's satisfaction.
- (vi) The fore deck shall exhibit a flush deck to avoid tripping by anchoring / mooring equipment.
- (vii) All exterior deck areas shall be covered by an appropriate anti-slip surface for boarding / landing and deck covering requirements. The anti-slip paint shall be to GNC's satisfaction.
- (b)
 - (i) All cabins shall be designed and arranged so as to protect the occupants from injury due to bad weather and sea conditions, and minimize risk of injury.
 - (ii) Natural light should be allowed as far as possible in the crew space. [D]
- (c) All interior decks shall be covered by vinyl composition sheet colour to be selected by GNC.
- (d) All controls, electrical equipment, high-temperature parts and pipelines, rotating assemblies or any other items in cabins and compartments shall be properly placed not to cause injury.
- (e) Windows
 - (i) All windows shall be of RO approved type.
 - (ii) All wheelhouse front windows and forward part of the side windows shall be provided with wipers with fresh water washing facilities.
 - (iii) Windows shall be strong and suitable for the worst intended operating conditions. Window glass and the frame shall be made of materials which will not break into dangerous fragments when fractured/shattered.
 - (iv) All windows of the wheelhouse and officer cabin shall be fitted with curtain (coxswain's should not be affected/blocked).
 - (v) A basic layout of the windows is shown in the Conceptual General Arrangement Plan. Details of the all windows shall be submitted to GNC for approval. Tightness test shall be carried out after windows installation as per RO Requirements.
- (f) Lighting
 - (i) Adequate lighting intensity and lighting arrangement, as well as any necessary lighting segregation by means of blinds or through the use of other means, shall be provided inside the wheelhouse, officer cabin and crew cabin to enable the operating personnel to perform their task at all times and places. Only limited (and suitably reduced) illumination of the essential gauges instruments and controls for monitoring likely system fault situations are allowed.
 - (ii) Care shall be taken to avoid large shadows as well as glare and stray image reflections in the operating area environment. High contrast in brightness between work area and surroundings shall be avoided. Non-reflective or matt surfaces shall be used to reduce indirect glare to a minimum.

- (iii) A suitable degree of flexibility within the lighting system shall be available to enable the operating personnel to adjust lighting intensity and direction in different areas of the compartment, and such arrangements shall also be available for individual instruments and controls.
- (iv) Sufficient amounts of flood lights to GNC's satisfaction shall be arranged on the main deck to ensure sufficient lightings at night.
- (g) Equipment on board shall be fitted properly to avoid injury to persons at all times either during normal or failure-mode operation, especially when the Vessel moves off quickly or during emergency crash stops, and during ship manoeuvres.
- (h) Furniture and Fittings
 - (i) Built-in furniture shall be adequately secured against ship impacts in case of ship collision or bad weather and sea conditions. All seats shall be strongly secured against 45 degrees of inclination in all directions when all seats are occupied by seated persons. All furniture and seats shall be lightweight, tough and robust. Upholstery such as seat cushion, back rests and settees shall be fire self-extinguishing, e.g. urethane foam to BS 3379 or equivalent, and be of thickness not less than 100 mm; and be covered with leather.
 - (ii) Lockers shall be provided with built-in locks and keys. They shall be designed and fitted to the satisfaction of GNC officers.
 - (iii) All hardware including screws, hooks, hasps, hinges, handles, sliding bolts, etc. shall be made of brass with chrome plated finish, or in stainless steel.
 - (iv) All fittings and hardware fitted on board the Vessel (e.g. coat hooks, ceiling lights, bulkhead mounted lights, etc.) shall be of a high quality chrome finish. They shall be properly fitted in the accommodation spaces and any other spaces as appropriate and as directed by GNC officers.
 - (v) Colour and decoration schemes (or a furnishing sample board showing materials and colour to be used) for furniture and fittings shall be submitted to GNC for approval before installation/fitting.
 - (vi) All furniture should be fitted as to allow removal of the under-deck machineries and tanks. [D]
 - (vii) Rails, Stanchions
 - (1) Handrails shall be provided where necessary for safety during voyage.
 - (2) Grab rails to be positioned internally and externally deemed necessary the Vessel to GNC's satisfaction.
- (i) Insulation and Lining
 - (i) Insulation:
 - (1) Boundaries and ceilings around the inside of the deckhouse shall be insulated against heat and sound, to be fitted with rock wool of appropriate thickness (minimum 50 millimetres) or equal; and be lined with protective/decorative panel linings of hard wearing surface and water sealing.
 - (2) Engine room and machinery space shall be effectively protected from fire and sound insulated with asbestos-free materials of adequate thickness, pinned and

wire-mesh secured, and lined with incombustible sheathing in accordance with RO Requirements and acceptable to GNC.

- (3) The noise level in the wheelhouse, officer cabin and crew space shall not exceed 75 dB when the Vessel is operating at all speeds. The Contractor shall make all reasonable efforts to minimize noise and vibration in the Vessel.

(ii) Lining:

- (1) Panels for wall, ceiling and their joint materials shall be readily removable. The joining method shall provide long-lasting firm and strong attachments between the adjoining members and parts against excessive vibration, and withstand temperature changes and wear and tear within the life expectancy of the Vessel. The panels shall be fitted to avoid noise generation due to its own vibration or in resonance response to the overall vibratory mode of the Vessel. This requirement applies to all operational speeds of the Vessel. If the noise level is considered unacceptable to GNC, the Contractor shall improve the design and fitting methods of the panel/ceilings. Colour of the lining material shall also be agreed by GNC.
- (2) The deck or floor of the wheelhouse, officer cabin, crew cabin shall be covered with non-skid, wear resistant and fire retardant vinyl PVC sheets that are acceptable to GNC. Colour of the floor covering shall be agreed by GNC.

(j) Access, Doors, Ladders and Hatches

- (i) Design of all outfitting including, but not limited to, doors, hatches, ladders, ventilation heads, etc. shall be of a type approved by an RO for this type of vessel, or other entities acceptable to GNC.
- (ii) Detailed specifications of these items shall be provided. They shall include the structural arrangement, scantlings, material and welding procedures. These shall be in accordance with RO Requirements or other international standards acceptable to GNC.
- (iii) Flush RO approved type watertight manhole covers shall be used while necessary.
- (iv) Where the covers and doors are used for the purpose of escape, they shall be fitted with manual means of locking; and shall be able to be quick opened from both inside and outside of compartment. All covers and doors shall be fitted with a hold back device. Hatches/covers for access to the watertight compartments below the main deck level shall be type approved by the RO. Watertight and weather-tight deck covers shall be of hinged type as far as practical.
- (v) All deck hatches shall be fitted with a high quality stainless steel or bronze commercial-grade marine-type lock. Locking of hatch cover(s) affecting escape shall be prohibited. Three sets of keys shall be provided. All keys shall be tagged for identification.
- (vi) All doors opening to the side deck shall be of a sliding type with width acceptable to GNC and with lock/padlock with hasp and three sets of key shall be provided. Door to aft deck to be RO approved outwardly opening weather-tight type. All doors shall be fitted with hooks or other means to hold them in the fully open position.
- (vii) All exterior doors shall be fitted with high quality stainless steel or bronze commercial-grade marine lever-type locksets. Three sets of keys shall be provided. All keys shall be tagged for identification and all locks shall all be keyed alike.

- (viii) Stairway slopes shall be acceptable to GNC and shall be fitted with handrails on each side. Minimum Width of 600 mm shall be provided between the handrails.
 - (ix) All handrails shall be of stainless steel 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 deteriorated weather and sea conditions, the design to consider the circumstances when all persons on board are lined up together on one side of the deck in case of an emergency situation at sea.
 - (x) Vertical ladders, if provided, shall be constructed with non-slip purpose with suitable step space intervals, adequate footsteps and handholds for safe access to the compartments and locations of equipment etc.
 - (xi) The engine room and the crew cabin shall be provided with two separated means of access/escape.
- (k) Ventilation
- (i) The requirements for ventilators and the ventilation system shall comply with RO Requirements.
 - (ii) The wheelhouse, officer cabin, crew cabin shall be protected from gas or vapour fumes from machinery, engine-exhaust gas and smells from the fuel system.
 - (iii) The toilet shall be fitted with an exhaust fan of not less than 36 air changes per hour; and a louver at the lower portion of the toiler door shall be provided. There shall be covers for the exhaust fans capable of being closed to prevent rain water and seawater spray.
 - (iv) Air pipes shall be fitted to all tanks, void spaces, and all spaces and compartments which are not fitted with other types of ventilation arrangement.
 - (v) The lower edge of openings in all exterior air pipes and trunks shall be at least 650 mm above the main deck and comply with RO requirements.
 - (vi) All ventilators shall be provided with weather-tight covers.

4.2 Wheelhouse

- 4.2.1 The Contractor shall build and carry out mock up test of the wheelhouse including the equipment arrangement, seats and other fittings as required under these TS. The mock up shall be inspected and agreed by GNC
- 4.2.2 The outside configuration of the wheelhouse shall be of a design that reduces air resistance, to deflect rain and seawater during heavy weather; and to provide practically all-round visibility at the steering/helm position of the console area. Pillars are not allowed to be fitted inside the wheelhouse.
- 4.2.3 The wheelhouse shall be designed with a wheelhouse control station for one-man operation comprising controls and instruments for navigation, manoeuvring, communication and machinery operation.
- 4.2.4 (a) Three heavy duty pedestal seats with hydraulic damping system, arm-rest and with safety belts for the crew are required;
- (b) The seats should have high density foam cushions, adjustable back rest, folding arms, lumbar support and adjustable footrest; and [D]

- (c) Height and direction of these seats shall be adjustable.
- 4.2.5 The wheelhouse control station shall be situated at the centreline of the Vessel and be at a forward position in the wheelhouse. Controls for the steering shall be easily reachable by a person of normal Asian stature in the seated position without needing to extend his arms, and without obstructing the coxswain and the assisting look-out crew all-round field of view.
- 4.2.6 The equipment and means for navigation, manoeuvring, control, communication and other essential instruments shall be located sufficiently close together to enable the coxswain and the assisting officer to read/receive all the necessary information, and be able to use the equipment and controls while they are seated.
- 4.2.7 Instruments, instrument panels and controls shall be permanently mounted in the consoles, taking into account operational, maintenance and environmental needs.
- 4.2.8 All instruments shall be logically grouped according to their functions. In order to reduce to a minimum the risk of confusion, instruments shall not be rationalized by sharing functions or by inter-switching.
- 4.2.9 Instruments required for use by any member of the operating crew shall be plainly visible and easily read with minimum practicable disposition from his normal seating position and deviation from line of vision, i.e. they will cause minimum risk of confusion under all likely operating conditions.
- 4.2.10 The instrument panels for the emergency controls and the monitoring of the fire-fighting systems shall be in a separate position, and shall be in clearly defined locations agreed by GNC.
- 4.2.11 The instruments and controls shall be provided with screen and dimming facilities to minimize glare and reflections and prevent them from being obscured by strong light.
- 4.2.12 The surfaces of console tops and instruments shall have dark glare-free colour. Surface finishing and interior linings of the wheelhouse should be of a matt non-reflecting finish to facilitate night operation;
- 4.2.13 The following controls, displays and equipment are required to be incorporated into the wheelhouse control station so that all relevant controls can be reached from a fixed working position (e.g. sitting, standing or both):
- (a) Steering is controlled by steering wheel and quick action lever control (Joystick);
 - (b) Engine speed and clutch controls;
 - (c) Rudder or steering angle indicators;
 - (d) Electronic navigation equipment and displays;
 - (e) Speed log;
 - (f) Echo sounder;
 - (g) Lighting control panel incorporating controls for navigation lights, and alarms, search lights and flood lights;
 - (h) Main and auxiliary engines monitoring indicators and tachometers;
 - (i) Instrument & control and alarming system for major machinery containing start/stop switches;

- (j) Exhaust temperature gauges;
- (k) Gear box oil pressure indicators alarms;
- (l) Fire detection system and CO2 flooding system control panel;
- (m) Emergency stop switch for accommodation ventilation fans;
- (n) Meter/Gauge indicating the quantity of fuel remained in the fuel tank;
- (o) One colour LED monitors of CCTV for the engine room;
- (p) Public address system and intercom system to the engine room;
- (q) VHF radio receivers stowage positions and power sockets; and
- (r) Electric horn, siren, and flashing beacon control panel.

4.2.14 Visibility

- (a) The visibility from the wheelhouse shall not be obstructed.
- (b) Large Side rear view mirrors shall be provided at locations to allow the coxswain to safely manoeuvre the craft to a berth and have a clear rear view during operation.
- (c) One each large sliding window shall be fitted at port and starboard side to facilitate direct downward viewing to the side of the Vessel.
- (d) 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.
- (e) All equipment fitted in the vicinity of the control console should not obstruct the view of the coxswain and the commander. [D]

4.2.15 Windows

- (a) Frames at the wheelhouse window separations shall be kept to a minimum, and of adequate structural strength and stiffness. They shall not be installed immediately in front of any workstation.
- (b) All wheelhouse windows shall be provided with sunscreens of the readily adjustable type. Forward facing windows shall be inclined forward and provide visibility free of any glare under all operating condition. The wheelhouse front windows shall be inclined from a vertical plane topside out to reduce unwanted reflection, at an angle of not less than 10° and not more than 25°.
- (c) Windows shall be provided at the wheelhouse to allow for 360 degree vision as far as practical and to GNC's satisfaction.
 - (i) at all times, regardless of the weather conditions, all wheelhouse front windows shall provide a clear view without obstruction; and
 - (ii) Where practical, depending on the design of the wheelhouse configuration, more windows are preferred to provide a wider clear view. [D]
- (d) Deckhouse side windows shall be of RO approved sliding type to provide ventilation while the air-conditioning system is not operating excluding the forward section of the side

windows fitted with heavy duty straight line type wipers. The sliding windows shall be able to maintain weather-tight integrity in rainy weather.

- (e) Throughout the vessel polarized and tinted windows are not to be fitted. Details of the all windows should be submitted to GNC for approval and window glass thickness should be verified in accordance with the submitted information before installation.
- (f) The following items/requirements shall be provided:
 - (i) Heavy-duty marine type(preferable of straight-line type) wide span and large area wipers with D.C. electrically operated fresh water window washing systems shall be fitted for ALL the wheelhouse front windows as well as the forward section of the port and starboard side windows shall be provided. They shall have an interval operating function with electrical fresh water window/wiper washing systems. These wipers shall be capable of operating independently of each other.
 - (ii) Two sets of spare wiper blades shall be provided for each window wiper installed for the Vessel.
 - (iii) Retractable transparent solar blind (American Standard Window Film ASWF, Sunny-Kool or equivalent) shall be installed inside of all wheelhouse front windows.
 - (iv) Retractable solar UV roller blinds shall be installed on all side windows throughout the Vessel including the ship's officer cabin. The blinds shall be capable of being retained in position either partially lowered or fully lowered, without swinging due to vessel motions at sea.
 - (v) The height of the lower edge of the wheelhouse front windows above the main weather-deck shall be, where practical, kept as low as possible for a better view forward. Care should be given to ensure the lower edge will not present an obstruction to the forward view.

4.2.16 The following fittings and equipment shall be provided in the wheelhouse:

- (a) One display board for posting plans, maps, notices, etc.;
- (b) Two wall mounted fans of dia. 300 mm;
- (c) One set of pigeon holes for stowage of international code flags;
- (d) One set of international code flags suitable for the mast;
- (e) One shelves for the stowage of log books and files;
- (f) One dial type inclinometer and one thermometer for marine use;
- (g) One electric powered marine wall-mounted clock;
- (h) Four cup holders;
- (i) One rubbish bin with cover shall be stored inside a cabinet/locker;
- (j) One metal box for keys shall be provided and fitted inside the wheelhouse;
- (k) One wooden box with locks for the storage of binoculars, and it shall be fitted within the vicinity of the forward high seats. One waterproof and fog proof 7x50 marine binoculars for day time use shall be provided;

- (l) Four coat-hooks;
- (m) A number of storage lockers;
- (n) One framed safety plan of appropriate size;
- (o) Air conditioning unit;
- (p) Non-skid handholds at suitable locations for crew movement in rough sea conditions;
- (q) Access door to be provided at wheelhouse aft end; and
- (r) One approved type first aid box.

4.3 Officer Cabin

4.3.1 The officer cabin is part of the deckhouse of the Vessel, and it shall be located on the main deck abaft of wheelhouse, which can accommodate 19 persons. The fitting of all the facilities in the Ship's officer cabin shall facilitate the removal of engines from the engine compartment to workshop for maintenance and repair work.

4.3.2 Notwithstanding anything in these TS to the contrary, the officer cabin shall have the following features:

- (a) Two settees for 13-persons, with cushion backrest shall be provided; 3 individual folding chairs; 3 individual deck mounted seats. Two seats of the three shall with hydraulic damping system and arm rest for the officers. All the seats and settees shall be with safety belts;
- (b) One settee table with lockers;
- (c) Drawers for IMMMD Officers documents storage;
- (d) Multi-tray cabinet for duty officers;
- (e) 1 x Bookshelf (as a minimum able to store 12 standard A4 file holders);
- (f) 1 x Photocopying machine for A4 size (220VAC);
- (g) 1 x note computer;
- (h) 1 x Fixed office desks with drawers. 350 mm of desk top is foldable with locking device;
- (i) One electric powered marine wall-mounted clock;
- (j) Four wall mounted fans of dia. 300 mm;
- (k) Stairways located at forward of the officer cabin shall be provided for access to the wheelhouse and to the crew space below;
- (l) Doors located at forward of the officer cabin shall be provided for access to the wheelhouse and to main deck. One weather-tight door at the aft of the officer cabin for access to open deck shall be provided;
- (m) Windows with roller blinds (fabric type not acceptable) at port and starboard side; There shall be arrangement to prevent the roller blinds swinging due to ship motion;

- (n) Wall-mounted electrical sockets (220VAC and 24V D.C.) shall be provided. The number of and the location of sockets shall be proposed by the Contractor and be subject to GNC approval; and
- (o) Twenty coat hooks fitted on the wall;

4.4 Chain Locker and Fore Peak Compartment

- 4.4.1 The Chain Locker and Forepeak space shall be arranged at the foremost of the hull. The position of the collision bulkhead and its construction shall be complied with the RO Requirements.
- 4.4.2 A flush watertight hatch cover shall be provided on the main deck for access to the fore peak. Access ladder shall be provided.
- 4.4.3 A store space with steel walls shall be arranged inside the fore peak compartment. Suitable sparred wooden shelves and perforated marine ply wood flooring shall be provided for storing the anchor chains.
- 4.4.4 Racks for stowage of navigational equipment shall be provided inside this compartment.
- 4.4.5 Racks for signal shapes and spare fire extinguishers shall be provided inside the fore peak.
- 4.4.6 A flush watertight hatch should be provided for access to the chain locker compartment by ladder.

4.5 Crew Cabin

- 4.5.1 The crew cabin shall be located Under-deck (or partially under-deck) aft of the fore peak compartment.
- 4.5.2 Toilet in crew cabin
 - (a) Toilet room shall be well ventilated. One electric exhaust fan shall be provided and the exhaust air shall be routed to outside of the Vessel.
 - (b) Aluminium toilet door shall be fitted with louver and opened outward with locks which could be released from outside.
 - (c) Sewage flushed from toilet shall be stored in black water tank and have an option to discharge direct overboard where required.
 - (d) A toilet with non-slip flooring and waterproof grating shall be provided with following installations and fittings:
 - (i) One stainless steel wash basin with a spring loaded cold freshwater supply tap;
 - (ii) One water delivery point under basin with a plastic hose for toilet cleaning;
 - (iii) One cabinet with mirror with vanity lights;
 - (iv) One toilet paper holder;
 - (v) Sufficient lighting;
 - (vi) One liquid soap dispenser;
 - (vii) Drain(s) to be provided to avoid water accumulation on the toilet floor and floor covering shall pitch to a floor drain piped to the black water collection tank;

- (viii) 1x deep bowl water closet;
- (ix) Stainless steel handrails as appropriate to allow safe use of the facilities while at sea;
- (x) 3 x coat hooks;
- (xi) One paper towel waste bin;
- (xii) One bulkhead mounted fresh water supply valve for washing purpose;
- (xiii) 50L electric water heater; and
- (xiv) Shower with hot and cold water.

4.5.3 Notwithstanding requirements specified in other sections, the crew cabin shall include the following:

- (a) One settee for 4 person, with cushion backrest shall be provided by a table in front. The seat shall be robust and easy to be clean by cleaning agent. Seats and table shall be secured in place.
- (b) Minimum 4 x Storage lockers to be fitted where spaces are available. Luggage / cabinets for crew bag storage to fit standard Marine Department bags (approximate dimension 500 x 300 x 300).
- (c) 1 x emergency escape hatch to the exterior deck with fixed escape ladder.
- (d) A stairway with handrail shall lead directly from the upper deck to the crew space.
- (e) The crew cabin shall be ventilated by a split-type air-conditioning plant. 1 x 240 V (AC) wall mounted 300 mm diameter fan.
- (f) Grab rails should be provided where necessary. [D]
- (g) The following facilities shall be provided and fitted in the crew cabin:
 - (i) One large rubbish bin with cover;
 - (ii) 1 x Microwave oven;
 - (iii) 1 x Refrigerator with positive latches (total net capacity not less than 110 litres);
 - (iv) 1 x 240V (AC) electric tea kettles securely fixed in location;
 - (v) 1 x Stainless Steel kitchen sink;
 - (vi) One drawers at least;
 - (vii) 1 x Ventilating fan; and
 - (viii) Appropriate number of electric sockets should be provided. [D]

4.6 Tank Space

4.6.1 The tank space shall be designed to accommodate:

- (a) Fuel oil tank(s) with manhole cover;
- (b) Independent stainless steel fresh water tank with manhole cover; and

(c) Independent stainless steel black water tank.

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

4.6.3 The hatch shall be wide enough and to GNC's satisfaction.

4.6.4 Aluminium chequer plate floor shall be fitted inside tank space.

4.6.5 Adequate ventilation shall be provided in this space in accordance with RO Requirements.

4.7 Steering Gear Room

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

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

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

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

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

4.8 Side Deck

4.8.1 The width of the passage deck on both sides should be at least 700 mm for providing safe passages for crew persons to walk through (measuring from moulded deck edge to side wall of the deckhouse). [D]

4.8.2 Sufficient illumination lights shall be provided at each side. And illumination lights should not obstruct the movement of personnel. [D]

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

4.9 Mast and Open Deck

4.9.1 Open decks, shall be fitted with guard railings at their perimeter for the safety of persons on board to GNC's satisfaction.

4.9.2 A stair/ladder is located near the stern for access to the upper open deck from the weather deck. Suitable guard rails should also be provided at the upper deck. Open decks shall be covered with non-slip material or paint.

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

4.9.4 One self-supporting mast shall be fitted on the wheelhouse top with navigational lights, sound signals, radar scanner and other electronic and navigational equipment, including the lightning arrestor, ensign hoist, two signal hoists, the antennas, GPS and UHF mobile transceiver (as indicated in the Conceptual General Arrangement Plan).

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

- (a) The mast shall have streamline shape and permits navigation light bulbs to be changed by an individual standing on the wheelhouse top and to permit the servicing of any equipment it carries. Facilities for access to high location shall be provided where necessary.
- (b) The mast shall be constructed such that no vibration is experienced in any operating condition including in harbour. The mast design shall be of appropriate size/strength to suit its purpose.
- (c) The mast is designed to accommodate all the navigation lights and lights indicating types of operation. Arrangement shall also be provided for hoisting of navigational signal shapes.
- (d) Access for maintenance and servicing of equipment and its fittings shall be provided.
- (e) The arrangement shall be such that the equipment on the mast shall not interfere with each other.
- (f) All equipment and their cables, conduits, connectors, junction boxes, glands and fittings etc., shall be water proof and be able to function in all weather conditions at sea.

4.9.6 Ensign staff for flags shall be supplied, length and size to be confirmed by GNC. All hardware for ensign staff, such as screws, hooks, hasps, hinges, handles, sliding bolts etc. shall be made of stainless steel.

4.9.7 The solar panel system shall be fitted on the top of the deckhouse as shown in the Conceptual General Arrangement Plan. The solar panel shall be fitted as much as possible.

4.10 Seating

4.10.1 Three upholstery seats shall be provided in front of the wheelhouse console for the coxswain, IMMMD officers. Requirements of the seats shall be as follows:

- (a) Seats shall be of comfortable type;
- (b) Adjustable seat height with foot rest;
- (c) Backrest angle adjustable;
- (d) Fore and aft adjustable;
- (e) Safety belt should be provided;
- (f) Adjustable armrests; and
- (g) Turntable/Mounting pedestal 0° -180°.

4.10.2 One settee for 4-person, with cushion backrest shall be provided in the crew cabin.

4.10.3 Three individual high-density foam deck mounted seats with cushion and backrest and safety belts shall be provided in the officer cabin cabin.

4.10.4 Two high-density foam settee which could accommodate not less than 13 persons shall be provided in the officer cabin cabin.

4.10.5 Three (3) individual folding chairs shall be provided in the officer cabin cabin.

4.10.6 The seat structures shall be permanently fitted to the structure of the Vessel by means of an attachment system which could be dismantled easily. The seat and the attachment system should be acceptable by GNC.

4.10.7 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 or overboard.

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

4.11 Bow and Stern

4.11.1 The deck floor shall be covered with anti-slip material and to GNC's satisfaction.

4.11.2 Notwithstanding requirements specified in other sections, the aft deck shall have the following fittings:

- (a) 1x bilge hand pump;
- (b) 1x fire hand pump;
- (c) 1x 24 V(DC) waterproof power socket;
- (d) 1x 240 V(AC) waterproof power socket; and
- (e) 1 x waterproof shore connection.

4.12 Anchoring, Mooring and Towing

4.12.1 Anchor

- (a) At least one high holding power type anchor approved by an RO for this type of vessel and acceptable to GNC shall be provided with its associated swivel, shackles, stowage cable or cable and warp and means of recovery.
- (b) The Vessel shall be provided with adequate and safe means for releasing the anchor and its cable and warp.
- (c) The means of release shall be capable of safe operation even when the anchor cable or warp is under load.
- (d) Adequate means and arrangements shall be provided to secure the anchor under all operational conditions.
- (e) Adequate stainless steel chain with shackle shall be provided. All equipment to be sized as per RO Requirements.
- (f) The anchor shall be handled by use of an electric windlass and associated fittings. A flush type watertight cover shall be fitted on the deck leading down to chain and lines locker.

4.12.2 Windlass

- (a) An electric windlass with its associated gypsy and warping drum, cable stopper, hawse pipe, bollards and fairleads shall be provided to give an easy run for anchor chain cables and mooring lines. The windlass shall be fitted with an emergency manual operating mechanism.

- (b) The windlass shall be capable of lifting one anchor with sufficient length of chain, at a speed of at least 9 metres per minute.
- (c) Control of the windlass shall be located in the vicinity of the windlass through a starter control unit enclosed in the watertight cabinet.
- (d) Emergency stop button for the windlass shall be provided at wheelhouse control station and locally.
- (e) Windlass canvas shall be provided.

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

4.12.4 Where necessary, suitable fairleads, bitts and mooring ropes shall be provided and fitted according to the requirements of an RO or other international standards, all appropriately sized and arrangement to GNC's satisfaction.

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

4.12.6 The size of chain locker shall be suitable for self-stowing of chain by gravity in all sea conditions. The chain locker shall be fitted with a hard wood grating not less than 50 mm thick on the bottom.

4.12.7 Two stainless steel boat hooks with 3-metre staves and stowage arrangement shall be provided.

4.12.8 Minimum four deck cleats on deck shall be provided with eight nylon 40m long (minimum) mooring ropes. All appropriately sized to GNC's satisfaction.

4.13 Fenders

4.13.1 Side and bow Fenders :

- (a) Fixed hollow D shape rubber fenders of size (e.g. 300 mm high x 150 mm deep) or other size acceptable to GNC shall be fitted continuously along the ship sides and bow at main deck level. Adequate foundations shall be provided.
- (b) Internal steel stiffeners shall be suitably provided to strengthen the hull structures.
- (c) The fender arrangement plan shall be submitted for approval by GNC.

4.13.2 Additional Rubber Tyre Fenders at Bow, Stern and Ship's Sides:

In addition to the rubber fender sufficient amounts of appropriate size rubber tyre fenders with stainless steel securing ring shall be provided, one (1) of them shall be fitted on bow forward and the others on stern and ship's sides at the weather deck level. The size and arrangement shall submit to GNC for approval prior to installation.

4.13.3 At least six units of portable air filled fenders shall be provided.

4.14 Cathodic and Hull Surface Protection

4.14.1 The steel hull, shaft brackets, propellers, tailshafts, stern tubes and the lightning protection system underwater shall be protected by a cathodic protection system for two years from the date of Delivery Acceptance.

4.14.2 No toxic substances are released from sacrificial anodes.

4.15 Lightning Protection

4.15.1 The Vessel shall be fitted with a lightning protection system acceptable to an RO to protect the persons on board and the electronic equipment installed.

4.15.2 Methods and working principles of protection shall be submitted for GNC approval before the installation of the protection system.

4.16 Miscellaneous

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

4.16.2 A full set of maritime signal flags shall be provided and properly stowed in the wheel house of the Vessel.

Chapter 5 - Fire Fighting System

5.1 General Provisions

- 5.1.1 Engine room compartment shall be enclosed by fire-resisting divisions complying with the requirements of the International Code for the Application of Fire Test Procedures (FTP Code), as defined in Chapter II-2 of SOLAS and RO Requirements.
- 5.1.2 Fire-resisting bulkheads and decks shall be constructed to resist exposure to the fire as per RO Requirements for that specific location. The main load-carrying structures shall be arranged to distribute load such that there will be no collapse of the construction of the hull and deckhouse when it is exposed to fire.
- 5.1.3 The hull, structural stiffeners, bulkheads, decks, deckhouses and pillars shall be constructed of approved non-combustible materials as required in the FTP Code and having adequate structural properties.
- 5.1.4 The arrangement of pipes, ducts, electrical cables etc., penetrating into 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.
- 5.1.5 All furniture shall be constructed entirely of approved non-combustible or fire-restricting materials to meet with requirements of RO and SOLAS.
- 5.1.6 All upholstered furniture, draperies, curtains, suspended textile materials shall have the qualities of resistance to the propagation of flame in accordance with the FTP Code.
- 5.1.7 All deck finish materials shall comply with the FTP Code.
- 5.1.8 All the exposed surfaces and surfaces in concealed or inaccessible spaces in corridors and stairway enclosures, and of bulkheads (including windows), wall and ceiling linings in all compartments shall be constructed of materials having low flame-spread characteristics as required in FTP Code.
- 5.1.9 Any thermal and acoustic insulation shall be of non-combustible or of fire-restricting material. Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings for cold service systems need not be non-combustible or fire restricting, but they shall be kept to the minimum quantity practicable and their exposed surfaces shall have low flame spread characteristics.
- 5.1.10 Exposed surfaces in corridors and stairway enclosures, and of bulkheads (including windows), wall and ceiling linings, in all compartments shall be constructed of materials which, when exposed to fire, are not capable of producing excessive quantities of smoke or toxic products, this being determined in accordance with the FTP Code.

5.2 Fire Detection System

- 5.2.1 An approved automatic fire detection system shall be provided in the Vessel at appropriate locations in accordance with RO Requirements. The fire detection system shall comply with the rules of an RO or other international standards acceptable to MD.
- 5.2.2 The fire detection panel shall be installed in the wheelhouse.
- 5.2.3 The detection system shall initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the wheelhouse control station.

5.2.4 Fire detectors shall be installed in the engine room, tank room, wheelhouse, officer cabin and crew cabin. Detection system using only thermal detectors shall not be permitted unless in spaces of restricted height and where their use is especially appropriate.

5.3 Fixed Fire-Extinguishing System for Unattended Engine Room

5.3.1 Fire extinguishing systems in the engine room shall be a fixed CO₂ flooding system complying with applicable RO Requirements for engine room protection. Activation of the CO₂ system shall cause an audio and visual warning alarm in the wheelhouse and the engine room. The system shall be approved by an RO. The CO₂ bottles for the system shall be stowed preferable at the aft as indicated on the Conceptual General Arrangement Plan and shall be properly protected from weather.

5.3.2 Ventilation systems for the engine room shall automatically shut down upon activation of the CO₂ flooding systems or manually from controls at the control station.

5.4 Portable Fire Extinguishers

5.4.1 Adequate number of portable fire extinguishers shall be provided to serve all compartments in the vessel and so positioned, as to be readily available for immediate use. In addition, at least one extinguisher suitable for machinery space fires shall be positioned outside each machinery space entrance.

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

5.4.3 Carbon dioxide fire extinguishers should not be placed in the wheelhouse, officer cabin and crew cabin.

5.4.4 In the wheelhouse control station and other spaces containing electrical or electronic equipment or appliances necessary for the safety of the Vessel, fire extinguishers should be provided with extinguishing media which are neither electrically conductive nor harmful to the equipment and appliances.

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

5.4.6 Portable fire extinguishers should be provided with devices to identify whether they have been used.

5.5 Fire Pumps

5.5.1 One AC electric fire pump located outside of the machinery space shall be provided to have sufficient capacity to pump water from the sea chest to deck hydrant with a jet throw of at least 12 metres. The fire pump shall be controlled from the wheelhouse. The fire main and fire pump design shall meet RO and relevant regulatory body requirements.

5.5.2 A semi-rotary hand pump of brass casing shall be provided on deck for fire fighting purposes. The pump shall be able to produce a flow jet of at least 6 metres distance. The suction sea chest of the hand pump shall be fitted outside the engine room and the suction valve shall be operated by an extended spindle on deck. Installation shall comply with an RO Requirements.

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

5.5.4 A deck washing pipe line shall be branched off from a fire main line.

5.6 Safety Plan

5.6.1 A safety plan approved by RO in frame shall be permanently exhibited for the guidance of the vessel's crew at the wheelhouse, using graphical symbols in accordance with IMO Resolution A.654(16).

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

5.6.3 The text of the safety plan shall be in English and Traditional Chinese.

5.7 Additional Protection by Alarm System

5.7.1 When the Vessel is afloat and unmanned, the fire detection system and the bilge alarm system shall continue to function, when the audible and visual alarm is not acknowledged after a time period of 5 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. The signals of fire detection system and bilge alarm system shall be sent to the shore office or supervisor automatically.

5.7.2 The additional protection should be able to be turned on and off when required. [D]

Chapter 6 - Lifesaving Appliances (LSA) and Arrangements

6.1 General Provisions

- 6.1.1 Lifesaving appliances shall be provided in the Vessel at appropriate locations in accordance with RO Requirements.
- 6.1.2 Lifesaving appliances shall be of approved types conforming to the International Life-Saving Appliance Code (LSA Code) adopted by the Maritime Safety Committee of the Organization by Resolution MSC.48(66) and approved by an RO.
- 6.1.3 Life jackets shall be so placed as to be readily accessible and their positions shall be clearly indicated.
- 6.1.4 Donning instructions shall be posted at suitable positions in the Vessel.
- 6.1.5 A Lifesaving Arrangement Plan approved by RO in frame shall be permanently exhibited for the guidance of the vessel's crew at the wheelhouse.

Chapter 7 - Machinery

7.1 General Requirements

- 7.1.1 The Contractor should note that the Vessel is for use in Hong Kong and it is desirable that the main engines, gearboxes, electric generator sets and any other machinery offered by the Contractor 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.
- 7.1.2 The Vessel shall be equipped and fitted with all machineries described in this Chapter 7 each complying with the specifications set out in this Chapter in Part VII for such machinery. The Spare Parts to be provided shall be of the same model as supplied for the Vessel and shall equally comply with all specifications set out in this Chapter of Part VII.
- 7.1.3 Two accesses with reasonable separation shall be provided for the engine room. The design of the engine room layout shall be approved by an 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.. Cushion/protection on the overhead cable trunk for preventing head injury of crew shall be provided.
- 7.1.4 Sufficient space and headroom in the vicinity of the machinery for local operation, inspection and routine maintenance for all the machinery shall be provided. Procedures and sequences for complete removal of the major items such as the main engines, gearboxes, generator set, fuel oil tanks, etc. shall be carefully designed and provided 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.
- 7.1.5 All parts of machinery, hydraulic, control and other systems and their associated fittings which are under internal pressure shall be subjected to appropriate tests including a pressure test before being put into service for the first time.
- 7.1.6 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.
- 7.1.7 Lifting brackets for moving heavy equipment shall be provided under the head of the engine room, the engine room entrance and other locations as deemed necessary. The lifting capacity shall be marked with its maximum load after a load test to GNC's satisfaction.
- 7.1.8 The machinery installation shall be suitable for operation as in an unmanned machinery space. The monitoring and control, including automatic fire detection system, bilge alarm system, remote machinery instrumentation and alarm system shall be centralized in the control station of the wheelhouse.

7.2 Main Propulsion Engines

- 7.2.1 The Vessel shall be equipped with two (2) electrically started, fresh water cooled marine diesel engines of adequate power for the Contract Speed. The rating of the engines shall be required for the Vessel on the Contract Speed with annual operation of 3,000 hours. The diesel engines shall meet IMO Tier 2 emission requirements. **[E]**
- 7.2.2 Type approved certificates issued by an RO or other entities acceptable by GNC in compliance to meet IMO Tier 2 emission requirements shall be provided.

7.2.3 The aggregate propulsive power of the main engines shall not be more than 900 kW. [E]

7.2.4 The main engines shall drive the propellers through reduction gears.

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

7.2.6 Main engine shall be resilient-mounted to the ship's structure.

7.3 Main Engines Control

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

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

- (a) Starting and stopping of main engines from the wheelhouse;
- (b) Emergency stop button with guard cover;
- (c) Wheelhouse /local control change over switch and indicator;
- (d) Speed control device;
- (e) Rudder angle indicator;
- (f) Engine tachometers with running hour metre;
- (g) Sea water cooling pressure;
- (h) Coolant water temperature and pressure;
- (i) Engine lubricating oil temperature and pressure gauges;
- (j) High cooling water temperature alarm and de-rate function;
- (k) Engine low lubricating oil pressure alarm and trip;
- (l) Gearbox lubricating oil low pressure gauge;
- (m) Gearbox lubricating oil low pressure alarm and trip;
- (n) Ammeter for each engine;
- (o) Engine exhaust gas pyrometer;
- (p) Fresh water tank content gauge;
- (q) Fuel oil tanks content gauge;
- (r) Over speed alarm and trip;
- (s) Main engine expansion tank low level alarm;

- (t) Battery charging control lamps;
- (u) D.C. power on light;
- (v) Central illumination dimmer for all light in the control console;
- (w) Lamp test;
- (x) Alarm test and reset;
- (y) A standard engine maker's engine control panel to be provided in the engine room;
- (z) Any other instrumentation recommended by the engine maker and GNC.

7.4 Electric Generator Engines

- 7.4.1 Two (2) electrically started, fresh water cooled electric engines integral with alternating current alternator of self excited, brushless and ventilated type, shall be installed. Synchronizing operation is not required. [E]
- 7.4.2 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.
- 7.4.3 Each electric generating set at its continuous service rating, shall have sufficient capacity for:
- (a) Supplying all full operational electrical load of the whole Vessel including air conditioning running at full capacity plus not less than a 15% reserve margin, and
 - (b) Permitting the starting of the largest motor without causing any motor to stall or any other device to fail due to excessive voltage drop of the system when the electric generating set is supplying full operational electrical load including air conditioning running at full capacity of the whole Vessel.
- 7.4.4 Electrical load analysis and calculations shall be approved by an RO before submission to GNC.

7.5 Electric Engine Control

- 7.5.1 The controls and instrumentation of the generator engines 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 over speed, low lubricating oil pressure trip, etc. as recommended by the engine builder; and

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

7.6 Instrumentation and Control

- 7.6.1 A control station in the wheelhouse shall be provided with comprehensive instrumentation and controls for remote operation and monitoring of the main engines, electric generator sets and other auxiliaries to facilitate for unattended engine room operation.
- 7.6.2 One fire detector panel and one engine room carbon dioxide fire fighting panel shall be installed in the vicinity of the control station.
- 7.6.3 Additional controls and monitoring devices shall also be provided locally in the vicinity of that machinery or equipment.
- 7.6.4 All the instruments such as temperature sensors, pressure sensors, level gauges, etc. shall have obtained type approval certificates by an RO or the manufacturer's certificate complying with the national standards of the place of manufacture of the relevant instrument. The Contractor shall provide copies of the type approval certificates or the manufacturer's certificate to GNC on or before the Delivery Acceptance.
- 7.6.5 All indication lights, illumination of instrumentation gauges fitted on the consoles of the wheelhouse control station shall be fitted with dimmers for day and night operation.
- 7.6.6 At least two independent means of stopping the main engines from the wheelhouse control station under any operating conditions shall be available.

7.7 Reduction Gearboxes

- 7.7.1 The reversing reduction gearboxes shall be resilient-mounted to the ship's structure. Gearboxes shall be provided with clutches, alarm senders, and switches.
 - (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, shafts shall rotate outboard when the Vessel is moving forward.
- 7.7.2 The gearbox shall be provided with alarms for low oil level and oil temperature. Alarms shall be repeated both locally and at the wheelhouse.

7.8 Propeller Shafts, Stern Tubes, Propellers

- 7.8.1 All the components of the shafting system shall be in accordance with RO Requirements.
- 7.8.2 All the components of the shafting system shall be of adequate strength and stiffness to enable it to withstand the most adverse combination of the loads without exceeding acceptable stress levels for the material concerned.
- 7.8.3 Stern Tubes
 - (a) Water lubricated stern tubes with packing type glands shall be of type approved by an RO or other organizations acceptable to GNC. Propeller shaft bearings shall be RO approved water-lubricated cutlass rubber/composite type. Forward and after ends of stern tubes shall be bored for bearings and a dripless shaft seal system shall be fitted to the inboard side of each stern tube.

- (b) The material of the stern tube should be bronze, stainless steel 316L with antifouling protection. [D]
- 7.8.4 The propeller shafts shall be manufactured from corrosion resistant material, such as 316L (austenitic) stainless steel or equivalent material. [D]
- 7.8.5 The propellers shall be a fixed pitch type with the design to minimize the vibration in shell plating and hull girder.
- 7.8.6 Propellers shall turn outboard when the Vessel is moving ahead.
- 7.8.7 Propellers shall be selected to achieve the Contract speed when 95% of Maximum Continuous Rating (MCR) engine power.
- 7.8.8 The propeller shaft brackets shall be of stainless steel construction. The materials for shaft brackets, shafts, keys, locking nuts, etc. shall be compatible for use with the propeller material.
- 7.8.9 Grease or packing containing graphite shall not be used with these shafts.
- 7.8.10 Each propeller shaft shall be fitted with a rope-cutting device.
- 7.8.11 The propellers and stern tubes shall be protected by a cathodic protection system for 2 years service life from the date of Delivery Acceptance.
- 7.8.12 Torsional vibration analysis of the shafting system shall be submitted to an RO for approval if required.
- 7.8.13 Analysis of cyclotron vibration of the shafting system shall be submitted to an RO for approval if required.

7.9 Steering Gear System

- 7.9.1 The steering gear system will be a twin rudders arrangement and shall comply with RO Requirements.
- 7.9.2 Electro-hydraulic steering gear with two independent power units, each running unit is capable of providing the maximum torque operating on twin rudders.
- 7.9.3 The system should 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. [D]
- 7.9.4 Rudders are controlled by steering wheel and joystick in the control station of the wheelhouse. Coxswain shall be able to use steering helm wheel or joystick at the same time. Steering helm wheel may also function as emergency manual helm pump in case of emergency. The power hydraulic pump could be started and stopped both in wheelhouse and in steering gear room. Steering wheel type shall be non-skid type of appropriate size acceptable to GNC.
- 7.9.5 The control of the rudder shall be switched from electro-hydraulic steering to emergency hydraulic helming via a change-over switch in the wheelhouse.
- 7.9.6 Separated illuminated rudder angle indicator with dimmer switch, running and overload alarm should be provided in the wheelhouse. [D]
- 7.9.7 Emergency steering system shall be provided.
- 7.9.8 A change-over electric switch shall be provided in the wheel house for switching the steering control between electric mode and manual mode.

7.10 Rudders and Rudder Stocks

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

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

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

7.10.4 The rudder stock and rudder blade shall be made of 316L stainless steel and shall be designed in accordance with RO requirements.

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

7.11 Engine Room Ventilation

7.11.1 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.

7.11.2 The air supply inlet vents shall be connected to louvers of efficient design in preventing ingress of water during extreme weather conditions. All vents shall be provided with weather-tight covers, fire dampers and coaming of adequate height (Trunks shall be at least 600 mm above the main deck.).

7.11.3 Engine room compartment shall be adequately ventilated so as to ensure that when machinery therein is operating at full power in all weather conditions, including heavy weather, an adequate supply of air 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 minimize pressure drops and flow noise. For design purpose, air flow rates in ducting shall be kept at 10 m/s or less. Airflow rates at vents and louvers shall be as low as is required to avoid flow noise (Typically 5 m/s depending on vent or louver design).

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

7.11.5 For guidance, the ventilation air to the compartment as stated should limit the temperature rise in a machinery space to 10°C above ambient temperature. [D]

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 should not be less than that required for combustion plus 50%.

7.11.6 Automatic shut-off device shall be provided according to RO Requirements when CO₂ system activated.

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

7.12 Air-Conditioning System

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

- | | | |
|-----|---------------|--------|
| (a) | Wheelhouse | 1 unit |
| (b) | Officer cabin | 2 unit |
| (c) | Crew cabin | 1 unit |

Air-cooled type air-conditioning units are preferred. [D]

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

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

7.12.4 The location of air-conditioning indoor and outdoor units shall not create obstructions to the removal of any hatch covers or direct maintenance of any major machinery and equipment.

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

7.12.6 The supporter rack for each outdoor unit shall be provided. Removable covers shall be provided for protection the external unit of air-conditioner from sunlight / rain.

7.12.7 The refrigerant shall be CFC and HCFC free.

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

7.12.9 Sufficient fresh air induced to the air-conditioned area shall be based on ISO 7547 "Standard for Shipbuilding - Air-conditioning and ventilation of accommodation spaces", all compartment; and there shall be not less than 25 m³/hour per person so as to keep the CO₂ level low enough for health reasons.

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

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

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

7.13 Piping System

7.13.1 Pipes connection and bending.

- (a) Piping connections and joints shall be constructed and designed in accordance with the rules of an RO.
- (b) Pipe bends should be kept to a minimum and have sufficient radius to facilitate smoothness of flow. [D]

7.13.2 The piping material shall be copper chrome plated or stainless steel 316L. The thickness accords with RO Requirements.

7.13.3 All pipes for essential services shall be secured in position to prevent chafing or lateral movement. Long or heavy lengths of pipe shall be supported by bearers so that no undue load is carried by pipe connections or pumps and fittings to which they are attached.

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

7.13.5 Where expansion pieces are fitted, arrangements shall be provided to protect against over extension and compression. The adjoining pipes shall be suitably aligned, supported, guided and anchored, where necessary, expansion pieces of the bellows type shall be protected against mechanical damage.

7.13.6 As far as practicable, pipelines, including exhaust pipes from engines, are not to be routed in the vicinity of switchboards or other electrical appliances in positions where the drip or escape of fluids or gas from joints or fittings could cause damage to the electrical installation.

7.13.7 Watertight bulkheads, decks or structural members having pipeline penetration shall be designed and compensated in accordance with RO Requirements. Watertight and structural integrity must be maintained and approved by RO.

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

7.13.9 Machinery and piping designation and marking.

- (a) All piping and equipment shall be labelled and colour-coded. And each pipe running through each compartment shall be colour coded, labelled, and have the direction of flow marked in at least two places.
- (b) Colour coding of machinery and piping shall be in accordance with the following:
 - (i) Fire main Red
 - (ii) Sea Water Dark Green
 - (iii) Fuel Oil Dark brown
 - (iv) Lube Oil Striped Black/Yellow
 - (v) Fresh Water Blue
 - (vi) Hydraulic Oil Orange

7.14 Fuel Oil System and Fuel Oil Tank

- 7.14.1 As Government vessels 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% bio-diesel, 95% diesel labeled B5) and approved by the engine makers.
- 7.14.2 The fuel oil of the main engines and generators shall be supplied from one or more fuel oil tanks. The Contractor is free to design the number and location of the fuel oil tank to fulfil the specification requirement.
- 7.14.3 Quick closing valves (control from above the main deck) shall be fitted to the fuel oil tanks outlets with drip trays.
- 7.14.4 Boost pumps shall be arranged to lift fuel to the engines through coalescing filters.
- 7.14.5 Fuel filters shall be mounted near the fuel tank on the suction side of the fuel pump. The system design and filtration systems shall be approved by the engine and generator system manufacturer.
- 7.14.6 The tanks shall be hydro-statically tested as required by an approved standard and connections shall be proven tight.
- 7.14.7 An electric motor-driven pump shall be provided for transferring the fuel.
- 7.14.8 The Contractor shall provide the initial fills of fuel oil, lube oil, coolant, and hydraulic fluids using fluids and additives prescribed by engine manufacturer. The Contractor shall provide a summary listing of all fluids and quantities used.
- 7.14.9 All materials used in fuel systems shall be resistant to deterioration by its designated fuel and to other liquids or compounds with which it may come into contact under normal operating conditions, e.g. grease, lubricating oil, bilge solvents and sea water.
- 7.14.10 The filling pipe shall be of metallic construction and a permanent fixture led from the deck and secured to the tank by an approved connection. A screwed cap and name plate inscribed 'Fuel Oil' shall be provided at the filling point. Flexible hoses are not permitted as filling pipes.
- 7.14.11 An easily removable coarse strainer shall be built into the filling line.
- 7.14.12 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.
- 7.14.13 Where necessary, flexible pipes of approved type may be used as short joining lengths to the engine. [D]
- 7.14.14 Water separators should be fitted to the fuel supply line, if required. [D]
- 7.14.15 Fuel piping material shall be 316L stainless steel. The thickness accords with RO Requirements.
- 7.14.16 Independent Fuel Oil Tank(s)
- (a) Independent fuel oil tank(s) shall be arranged to allow 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 tank 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 independent fuel oil tank(s) shall be fitted / installed in the tank space, it should not use the hull structure as the boundary of fuel oil tank, actual location to be designed and approved by an RO and accepted by GNC.
- (c) 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) Internal surfaces of the fuel oil tank shall be left unpainted and shall be cleaned thoroughly to the satisfaction of GNC.
- (e) Provisions to the fuel oil tank
 - (i) A tank content level gauge in litres and low level alarm shall be fitted on the wheelhouse control station. The level gauge of each fuel oil tank shall be marked with markings of level;
 - (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;
 - (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, or access for internal inspection;
 - (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 m above the top of the tank. The static test pressure shall be applied for 5 minutes without pressure drop. After the test, the test fuel tank shall not show any leakage;
 - (viii) Sounding pipes with heel pad welded on hull bottom completely, and 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.

7.15 Fresh Water System

7.15.1 Fresh water tank arrangement

- (a) One independent stainless steel fresh water tank with a total capacity of not less than 1,000 litres shall be arranged in the Vessel to supply fresh water to the main deck, under-deck and crew space.
- (b) It should be installed in the tank space as indicated on the Conceptual General Arrangement Plan.

7.15.2 The fresh water shall be supplied by a fresh water pump to achieve a pressure at the tap located at main deck, under-deck and crew space to GNC's satisfaction. This system act as the potable fresh water system and a hose which freely reaches all parts of the Vessel shall also be provided.

- 7.15.3 Marine grade stainless steel 316L shall be used for fresh water tank. The fresh water tank shall be flushed clean before installation and delivery of Vessel.
- 7.15.4 The fresh water tank shall be designed to easily accessible for maintenance. It shall also be arranged with its own fill and vent pipes with gauze to prevent ingress of material / bugs to the tank. The freshwater tank shall be fitted with the following:
- (a) Inspection / cleaning access cover;
 - (b) Filling / sounding pipe;
 - (c) Air pipe; and
 - (d) A tank content level gauge in litres and low level alarm shall be fitted on the wheelhouse control station.
- 7.15.5 The tanks shall not be integral with the hull and shall be installed so that the loads due to the mass of the full tank are safely induced into the structure.
- 7.15.6 The thickness shall sustain the loads due to the mass of the full tank with due consideration given to upward and downward acceleration due to the Vessel's movements at maximum speed in the sea without damaging the integrity of the tank and ship's structure.
- 7.15.7 The freshwater tank shall not be directly adjacent to any other tanks carrying liquid of any kind.
- 7.15.8 The freshwater tank shall be tested without leakage by a head of water equal to the maximum to which the tank may be subject, but not less than 2.5 m above the top of the tank. The static test pressure shall be applied for 5 minutes without pressure drop.
- 7.15.9 A capacity indicator calibrated in litres shall be provided.
- 7.15.10 The impressed unit shall be provided with a starter, pressure switch, pressure gauge, relief valve and suction valve. The freshwater pump shall maintain the pressure automatically.
- 7.15.11 Domestic freshwater piping shall be made of copper or stainless steel 316L. Certificate of piping material shall be submitted before the delivery of the Vessel. The welding joints of the domestic fresh water piping's shall be free from lead. The domestic fresh water from the fresh water tank shall be free from any substance harmful to health and shall comply with the Government requirements for domestic water.
- 7.15.12 Cold freshwater taps completed with PVC braided / reinforced transparent hoses should be fitted on the main deck aft, crew cabin and wheelhouse top to provide a rinse off facility for cleansing purposes. [D]

7.16 Bilge System

- 7.16.1 The Vessel shall be fitted with a bilge system to the RO Requirements.
- 7.16.2 A bilge audible and visual alarm panel shall be fitted in the wheelhouse control station for engine room, steering gear room, crew cabin, fore peak and tank space.
- 7.16.3 When the Vessel is afloat and unmanned, the bilge audible and visual alarm system shall continue to function, when the audible and visual alarm is not acknowledged after a time period such as 5 minutes (can be adjusted), the audible and visual alarm shall be extended externally to an audible and visual alarm fitted on the top of the deckhouse to bring the attention of the persons ashore or the guard of the Government Dockyard. The additional protection shall be able to be turned on and off when required.

- 7.16.4 A bilge water holding tank of minimum of 900 litres in capacity shall be provided in the engine room. Marine grade stainless steel 316L shall be used for bilge water holding tank.
- 7.16.5 The bilge of the engine room and steering gear room shall lead to the bilge water holding tank. An electric motor-driven pump with associated piping shall be provided in pumping out the bilge water ashore pass through International oil and water connection. A direct overboard shall be provided in case of emergency affecting the safety of the Vessel.
- 7.16.6 Bilge piping shall be made of stainless steel 316L.

7.17 Seawater System

- 7.17.1 All sea valves shall be compatible with the hull material, connected to the sea chests shall be tested according to RO Requirements.
- 7.17.2 Sea chests provided for the main and auxiliary machines should be installed in the vicinity of their respective seawater pump suction but with adequate distance between each other to avoid water flow Disturbance.
- 7.17.3 Seawater piping shall be constructed of copper pipe. A suitable strainer with isolation valves and air vent shall be fitted to each seawater system. Due consideration shall also be given for quick and easy access to the seawater strainers.
- 7.17.4 Cathodic protection shall be provided as necessary.

7.18 Sanitary, Grey and Black Water System

- 7.18.1 One stainless steel gray / black water holding tank with capacity of not less than 500 litres shall be installed in the tank space or other compartment for sanitary purposes.
- 7.18.2 A sanitary/sea water pump shall be installed in the engine room to supply sea water for sanitary service. Pressurize seawater shall be distributed to the toilets through pressure reducing valves or for flushing by direct pressure via flushing valves.
- 7.18.3 Toilet, basin and galley sink shall be designed to discharge into the 500 litres gray / black water holding tank and ashore. Alternative piping shall be arranged for the wash basins to be discharged directly overboard through a non-return ship-side valve.
- 7.18.4 The tank shall be fitted with a level gauge and a "Tank Full" indicator installed in a highly visible location in the wheelhouse. And high level alarm shall be fitted on the wheelhouse.
- 7.18.5 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 a backup direct overboard discharge via non-return valve. The shore connection shall be arranged with an international shore connection.
- 7.18.6 Sanitary, Grey and Black Water piping shall be made of stainless steel 316L.

7.19 Open deck drainage system

- 7.19.1 The Vessel shall be fitted with an Open deck drainage system to the RO Requirements.
- 7.19.2 Upper deck lines are constructed by AL5083 and thickened galvanized seamless steel tubes are constructed below the main deck.

7.20 Floor Plates, Handrails and Guards

- 7.20.1 The floor of the engine room shall be covered with unpainted aluminium chequer plate for safe operational use.
- 7.20.2 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. 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.
- 7.20.3 Hinged access plates shall be fitted in way of valves. Suitable arrangements shall be provided for hinged plates to avoid rattling noise.
- 7.20.4 Removable guards for the protection of personnel and machinery shall be provided over exposed moving parts of the machinery, hot pipe work, etc.
- 7.20.5 Splash plates, casings, fenders, screens, etc. shall be provided for the protection of personnel and machinery.

Chapter 8 - Electrical System

8.1 General Requirements

- 8.1.1 All the electrical equipment and installation shall meet the RO Requirements.
- 8.1.2 All electrical equipment, fittings, instruments, switches, cables, insulation, sheathing, circuit breakers, rating standards and their installations shall comply with the latest Regulations of the International Electrotechnical Commission (hereinafter referred to as IEC), Electrical Installations in Ships.
- 8.1.3 Protective devices such as circuit-breakers or fuses shall be provided at the source of power, e.g. the switchboard, to interrupt any overload current in the circuit conductors before heat can damage the conductor insulation, connections or wiring-system terminals.
- 8.1.4 Switches and controls shall be marked to indicate their use, unless the purpose of the switch is obvious and its mistaken operation will not cause a hazardous condition. Each cable shall be clearly labelled and carry its own unique identification code. The language on control panel shall be both English and traditional Chinese.
- 8.1.5 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.
- 8.1.6 Essential drawings and detailed particulars (such as the rating and capacity, type of all electrical Equipment as well as the wiring, circuit breakers, lighting and sockets, etc.) shall be submitted to RO approval and GNC endorsement before installation.
- 8.1.7 Detailed wiring diagrams of the complete supply and distribution network, including wire size, insulation and sheathing shall be submitted for RO approval and GNC endorsement before commencement of the installation.
- 8.1.8 All Equipment installed shall be provided with manuals for operation and maintenance.
- 8.1.9 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 traditional Chinese, or with universally recognized labels.

8.2 Electricity Distribution Network

- 8.2.1 The main electrical AC power supply shall be provided by two electric generators (220V AC, 50 Hz, single phase, 2-wire insulated system). The generators shall have unrestricted continuous rating and be located in the engine room.
- 8.2.2 The generators shall be sized based on a 15% growth margin above the predicted maximum load condition. The Vessel's electrical load calculation shall include summer and winter, static and transient, loads on AC, D.C., shore power, and ship service systems. The Vessel's electrical load calculation shall be approved by an RO and accepted by GNC.
- 8.2.3 The generator set will maintain an output voltage within ± 5 percent over the entire load range and frequency within ± 1.5 Hz.
- 8.2.4 The generators starting circuit shall be 24 VDC. Starting and normal shutdown controls shall be mounted on the generator along with generator oil pressure and water temperature gauges; AC voltmeter and ammeter shall be directly connected to existing wiring systems with the use of a

double-pole, double-throw (DPDT) transfer switch / centre-off switch for an ammeter to read both legs (AC Volts readings).

- 8.2.5 The generators shall be protected against short-circuits and overloads by multipole circuit-breakers (overload protector).
- 8.2.6 The distribution of the electricity to the equipment is through circuit breakers fitted on an electrical distribution board.
- 8.2.7 Power distribution panels / electrical distribution boards shall be positioned in the wheelhouse Console.
- 8.2.8 Circuit breakers shall be provided for each circuit. Circuit breakers shall be of the proper voltage rating, manual reset type, designed for inverse time delay, instantaneous short circuit protection, and capable of repeatedly opening the circuit in which it shall be used without damage to the circuit breaker. Circuit breakers shall indicate whether they are in the open or closed position. All circuit breakers shall be labelled to identify the circuit being protected.
- 8.2.9 Twenty percent (minimum of three) spare circuit breakers shall be provided in each distribution panel, both AC and D.C. The Vessel's electronic navigation equipment shall be supplied from an independent distribution panel, which shall in turn be supplied from a single breaker in the main D.C. Panel.
- 8.2.10 All supply panels shall be fitted with a miniature circuit breaker of double-pole type with over-current and short circuit trips. All junction boxes shall be readily accessible and the prime supply panel shall be positioned inside the wheelhouse. A special arrangement is required for the navigational lights supplied from this prime panel.

8.3 Main Switchboard

- 8.3.1 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.
- 8.3.2 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 and in general located in the engine room. Connections and components on panel-boards shall be in locations protected from the expected conditions in conformity with IEC 60529:
- (a) IP 67 as a minimum, if exposed to short-term immersion; IP 55 as a minimum, if exposed to splashing water;
 - (b) IP 20 as a minimum, if located in protected locations inside the Vessel.
- 8.3.3 Switchboards shall be permanently marked with the nominal system voltage.
- 8.3.4 A self-standing dead front marine type main switchboard of steel and aluminium construction with adequate ventilation louvres shall be fitted in an accessible and well ventilated position in the engine room and shall contain the following:
- (a) Sector for generator sets 220V AC;
 - (b) Sector for 24V & 12V D.C.;
 - (c) Sector for shore power; and
 - (d) Sector for solar power.

- 8.3.5 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.
- 8.3.6 Switchboard panels shall be hinged at the front for easy opening.
- 8.3.7 Megger test and other relevant tests shall be carried out and witnessed by GNC. The results for these tests shall form part of Sea Trial Report that shall be submitted to GNC before Delivery Acceptance.
- 8.3.8 An appropriate laminated electrical diagram shall be attached on each switchboard.
- 8.3.9 All switchboard instruments, controls, and all circuit breakers, both on external panels and inside the switchboard, shall be provided with labels of durable flame-retardant material bearing clear and indelible indications. The appropriate ratings of fuses, the setting of adjustable protective devices and the full load current of generators shall be indicated.
- 8.3.10 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) Circuit breaker of adequate capacity with over-current trip and short circuit trip;
 - (ii) Air circuit breaker of adequate capacity with over-current trip and short circuit trip;
 - (iii) Interlock device to ensure only one generator is connected to the busbar;
 - (iv) Voltmeter, ammeter, wattmeter and frequency meter;
 - (v) Indication lights for "Power Available", "Breaker Opened" & "Breaker Closed"; and
 - (vi) All necessary fittings and any other protective devices.
 - (b) 220V 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 220V AC power supply to lighting services, fans, motors, etc.; and
 - (iii) Any other necessary fittings and protective devices.
 - (c) 24V and 12V D.C. Feeders Sector:
 - (i) Transformer / rectifier of adequate capacity for converting AC power to D.C. power. The rectifier shall be of 1-phase full wave regulated type with voltage regulation $\pm 5\%$ and ripple factor 4% at 100 Hz;
 - (ii) Magnetic automatic relay switch for activating emergency 24V D.C. 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 D.C. 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 220V single phase 50 Hz 30 Amp current on (b) 2-wire 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 shall be provided for connection of the Vessel's earth to the shore earth.
 - (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.

8.4 D.C. Power Source

8.4.1 Batteries for Main Engines and Electric Generator Sets Starting

- (a) Independent bank of 24V batteries shall be provided for starting of each of the two 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
- (f)
 - (i) There will be four sets of 24V batteries charged directly from engine driven alternators, generator sets. There shall be one battery set allocated to each engine.
 - (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.
- (g) Each engine driven alternator shall have its own built-in voltage regulators, automatic cut-off, and any other required protective devices.
- (h) The batteries shall be located as close as practicable to the engines in order to minimize the voltage drop. The battery bank shall be housed in a separate GRP or GRP lined storage box. Each box shall be provided with a removable cover with locking clips for ease of maintenance.

8.4.2 Batteries for Routine and Emergency supply

- (a) 24V battery shall be provided for routine and emergency supply, all emergency equipment shall operate from a dedicated 24V D.C. power supply.
- (b) In event of main electrical AC power failure, 24V D.C. 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 not less than six hours.
- (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.

8.4.3 Batteries for 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. The compartment shall be well ventilated and prevent ingress of water.

8.4.4 12/24V D.C. 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) Public address;
- (g) One hand-held searchlight and one fixed searchlight;
- (h) Siren; and
- (i) Any other navigational and electronic equipment (if applicable).

8.4.5 The batteries as required in Paragraphs 8.4.1 and 8.4.2 shall be 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.

8.4.6 Apart from the charger, a provision shall also be made to allow the batteries to be charged by an engine driven alternator. The battery chargers shall provide automatic control between float and boost charges. Each charger shall also be provided with a voltmeter, voltage regulator, selector switch, blocking rectifier, and the required devices for protecting the chargers against short circuit, reverse connection, excessive temperature and overloading. The capacity of each battery charger shall be sufficient for charging one set of completely discharged starting batteries to fully charged condition within 10 hours.

8.4.7 Battery charger installations shall meet all cognizant regulatory body requirements including:

- (a) The chargers shall be sized such that a completely discharged battery bank can be recharged to 80% capacity within 8 hours (100% at 10 hours). At the end of the charge, the charge shall be tapered to a trickle value.
- (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 charging facilities will be available via the main propulsion engines and the 220V AC generators. Battery chargers shall not be mounted directly over batteries.
- (e) Battery selector/isolator switches shall be provided between battery chargers and the battery banks they serve.
- (f) Provisions shall be made to allow either main engine to be started by the other engine's starting batteries.

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

8.4.9 Batteries shall be permanently installed in a dry, ventilated location above the anticipated bilge-water level.

- (a) Battery compartment(s) shall be actively ventilated whenever batteries are charging.
- (b) Batteries shall be located in areas so as to avoid heat soak. Emergency batteries shall be located in the area outside the engine room such as, wheelhouse.
- (c) All battery storage boxes shall be provided with removable covers and locking clips for ease of maintenance.
- (d) Drainage shall also be provided to avoid accumulation of moisture.

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

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

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

8.4.13 A battery-disconnect switch shall be installed in the positive conductor from the battery, or group of batteries, connected to the supply system voltage in a readily accessible location, as close as practical to the battery or group of batteries except the circuits for engine starting and navigation lighting and electronic devices with protected memory and protective devices such as bilge-pumps and alarms, if individually protected by a circuit-breaker or fuse as close as practical to the battery terminal.

8.4.14 Local information plates showing the voltage, ampere-hour rating, group number and application shall be provided for each battery set.

8.5 Shore Power Supply and Connection

- 8.5.1 The electrical system shall include the provision for shore power supply (220 VAC, single phase, 50 Hz) designed to an approved standard.
- 8.5.2 The shore power system shall be interlocked to prevent the Vessel's generator from providing power to the shore. Indicating lights for "shore power available", "shore power breaker on" and "shore power breaker closed" to be fitted.
- 8.5.3 The Contractor shall provide a 1:1 isolation transformer for the shore power supply. The earth wire of the shore power cable shall be connected to the shielded core of the isolation transformer. The core of the isolation transformer shall be completely insulated from the case. It shall be convection cooled and shall have no moving parts. The transformer enclosure shall be drip-proof and the isolation transformer shall be rated for continuous operation at full capacity of the shore power connection.
- 8.5.4 The watertight connection box shall be designed with a quick release receptacle.
- 8.5.5 Not less than 20 metres long shore connection power cable of adequate rating with quick release watertight plug shall be provided.
- 8.5.6 The 20 metres shore connection power cable terminating at compatible connections to mate with existing facilities on Government Dockyard, to be identified by GNC. Suitable stowage on board shall be provided for the cable.

8.6 Circuit Breaker

- 8.6.1 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.
- 8.6.2 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.

8.7 Motor and Control Gear

- 8.7.1 Where a starter is situated remotely from the motor, stop and start buttons shall be provided near the motor for local operation. All electric motors of essential services shall have separate start and stop push buttons plus running indication lights (with dimmer control) inside the wheelhouse.
- 8.7.2 Motors installed in the engine room and other enclosed spaces shall be of semi-enclosed drip-proof type. Motors installed in locations exposed to weather or moisture shall be of waterproof construction. Insulation of motors shall not be less than Class B standard.
- 8.7.3 A circuit diagram shall be placed in the local control box of each electrical installation.

8.8 Cable, Wiring and Fuse

- 8.8.1 Cables which may be exposed to physical damage shall be protected by sheaths, conduits or other equivalent means. Cables passing through bulkheads or structural members shall be protected against damage to insulation by chafing.
- 8.8.2 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 minimize earth faults.
- 8.8.3 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.

- 8.8.4 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.
- 8.8.5 The metallic sheathing, armour or braid of cable shall be properly earthed at both ends. All bare terminals shall be properly insulated by approved cable insulators.
- 8.8.6 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. Cushion/protection on the overhead cable trunk for preventing head injury of crew shall be provided in the engine room.
- 8.8.7 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 1 m from the terminal. Other sheathed conductors shall be supported at maximum intervals of 450 mm. Sheathed engine starter conductors constitute an exception to this requirement.
- 8.8.8 Wiring shall be run along perforated metal trays and shall be secured in such positions as to allow easy maintenance.
- 8.8.9 Wiring shall not be installed below the engine room floor plates.
- 8.8.10 Cables and wiring inside accommodation areas shall run behind linings which shall have removable panels for inspection and maintenance.
- 8.8.11 Where electric cables have to be fitted on the decorative surface of bulkheads, they shall be enclosed in conduits.
- 8.8.12 (a) RO approved watertight, Fire resistant and gastight cable transit system shall be provided in way of watertight bulkhead or deck penetrations.



- (b) The penetration should be located as high as practicable and well clear from the ship side. [D]
- 8.8.13 Each electrical cable that is part of the electrical system shall have a means to identify its function in the system, except for conductors integral with engines as supplied by their manufacturers.
- 8.8.14 Cables and the wiring terminals of different AC and D.C. power supply voltages in the junction box, fuse box as well as the equipment terminal box shall be laid separately and shall have a distinctive code and labelling system for easy identification to facilitate tracing.
- 8.8.15 Tally plates showing the cable size and the number of cores shall be provided for each of the main power cables.
- 8.8.16 All fuses shall preferably be of cartridge type and rated adequately for the protected circuits.
- 8.8.17 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.

8.9 Lighting Fixtures

- 8.9.1 General lighting shall be provided for all compartments and shall be arranged to give sufficient illumination to all working areas for normal operation. All lighting shall be equipped with LED bulbs including the navigation lights.
- 8.9.2 The general lighting system described herein shall be composed of fixtures permanently installed as necessary to provide the levels of illumination required to an approved standard. The system shall include fixtures, switches, panels, boxes, and cabling for the distribution system supplying the lighting fixtures. Fixtures shall be accessible for re-lamping and cleaning.
- 8.9.3 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.
- 8.9.4 All lighting in the wheelhouse control panel shall be fitted with a dimmer control at night. Emergency lighting of 24V D.C. supply shall be provided for all compartments, emergency embarkation stations and open decks as per RO Requirements.
- 8.9.5 Emergency exit routes shall be identified and illuminated as required by RO Requirements.
- 8.9.6 Suitable lighting shall be provided in the escort officer's cabin and the crew cabin above the desks and working areas such as chart table.
- 8.9.7 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 there from will not be obstructed by fixed pipes, ducts, bins, berths, etc.
- 8.9.8 Fixtures shall be mounted so as not to vibrate in any operating condition and so that the Vessel vibration will not harm the fixture. Fixtures shall be selected and mounted to maintain the maximum possible headroom.
- 8.9.9 All sockets, terminal blocks, and switch and receptacle interiors shall be made of non-flammable phenolic material.

8.10 Navigational Light

- 8.10.1 All navigational and signal lights to be provided shall be in compliance with the International Regulations for Preventing Collisions at Sea 1972 and all the effective Resolution as amended by International Maritime Organization (IMO). Type approved certificate in respect of each model of the navigational and signal lights issued by an RO shall be provided on or before the Delivery Acceptance at the latest.
- 8.10.2 The lighting shall be controlled from a control and alarm signal panel in the wheelhouse. Each navigation light circuit shall be provided with a switch, protection fuse, indicating lamp and alarm. A dimmer for the panel indication lights, buzzer stop and lamp test buttons shall be fitted.
- 8.10.3 Navigation light circuits shall be independent of any other 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 D.C. power source.

8.10.4 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; and
- (l) Any other navigation lights as required.

8.10.5 Three sets of spare bulbs (one per light) shall be provided for the navigational and signal lights.

8.11 Searchlight

8.11.1 One proprietary make 220V AC 600 W adjustable remote control searchlight shall be provided.

8.11.2 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 electrically remotely controlled by handle/joystick located in the wheelhouse control station for turning and tilting.

8.11.3 Tarpaulin covers shall be provided for the searchlights.

8.11.4 One 24V D.C. LED portable search lights (with luminosity equivalent to not less than 150 W conventional type) with 30 meters water proof cable reels and plugs shall be provided in the wheelhouse.

8.12 Floodlight

8.12.1 Two proprietary make 220V AC LED remote power-operated floodlights (with luminosity equivalent to not less than 300 W conventional type) shall be installed on the top of the wheelhouse.

8.12.2 One floodlight shall be fitted at the forward end of the Vessel on the embarkation handrail to illuminate boarding and landing operations. The orientation of this floodlight shall be manually adjustable.

8.12.3 Sufficient amounts of flood lights to GNC's satisfaction shall be arranged on the main deck to ensure sufficient lightings at night.

8.13 Power Receptacles / Sockets

8.13.1 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.

8.13.2 A system of 220V AC 13A and 24V D.C. 5A socket outlets shall be provided in the engine room.

8.13.3 Socket outlets for 220V AC, 24V D.C. and 12V D.C. are needed in the wheelhouse.

8.13.4 Sockets shall be provided in the officer's cabin for photocopier, fax, scanner, printer, personal computers, charger for portable VHF, charger for digital camera, charger for mobile phone, desk lamp, spare etc.

8.13.5 The crew space requires 220V AC power sockets for the portable apparatus and the domestic equipment, etc.

8.13.6 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 D.C. socket outlets shall be supplied with fused plugs.

8.13.7 Sockets for different voltage systems shall be clearly labelled and with different pin sizes so that one system cannot plug into the other.

8.13.8 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.

8.14 The solar systems

8.14.1 The solar battery systems must have the ability to be charged from the solar panels. The solar panel system shall be fitted to the roof of the deckhouse as per Conceptual General Arrangement Plan and utilise maximum practical roof space for maximum solar collection.

8.14.2 A solar panel system to convert solar energy sufficiently to power shipboard AC220V lighting and others, such as cabin lighting, fans, the portable apparatus and the domestic equipment, etc.

8.14.3 Rigid service walkway and platforms shall be provided for maintenance.

8.15 Monitoring and alarm system and data 3G\4G network transmission system

8.15.1 Monitoring and Alarm System

- (a) The main equipment alarm system (including monitoring and alarm- and recording points) to be provided in accordance with the requirement of MD and maker's recommendation.
- (b) The main equipment alarm system shall provide an optical and an audible signal of unacceptable deviations from operation figures.
- (c) The alarm system to be supplied from the main power source with battery backup for at least 15 minutes.
- (d) The alarm and monitoring system include:

- (i) Temperature, pressure, liquid level display and alarm signal collection of main engine, generator set, steering gear and gear box;
 - (ii) Engine room oil tank display and alarm signal acquisition; and
 - (iii) Navigation data collection.
- (e) Computer based alarm and monitoring system include
- (i) Host computer;
 - (ii) VDU (17 inches, two sets);
 - (iii) Date logger and alarm printer; and
 - (iv) Keyboard etc.

8.15.2 Data 3G/4G Network Transmission System

According to the actual needs of the user, the ship transmits the monitoring and alarm system data collected by the monitoring computer to the onshore office site through the use of public network 3G/4G communication means.

Chapter 9 - Electronic Navigation Equipment

9.1 Description of Electronic Equipment System

9.1.1 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 the following equipment/systems to be fitted on board the Vessel:

- (a) Loudhailer/Siren and Public Address System with USB player;
- (b) Magnetic Compass and Fluxgate Compass;
- (c) Marine Daylight Viewing Colour Radar with Differential Global Positioning System (DGPS);
- (d) Electronic Chart Display and Information System (ECDIS) with DGPS, Echo Sounder & Depth Indicator;
- (e) International Maritime Mobile (IMM) VHF Radio with Global Maritime Distress Safety System (GMDSS);
- (f) Automatic Identification System (AIS);
- (g) The Contractor shall provide all labour, material, 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. References to “Equipment” in this Chapter 9 of Part VII shall mean the above-mentioned Equipment in (a) to (f). References to “Electronic Navigation Equipment” or “ENE” or “Electronic Navigational Equipment” throughout the Tender Documents or Contract shall mean each set of the above-mentioned Equipment in (a) to (f).

9.1.2 (a) An integrated system covering all ENE is preferred, so that information and also the display monitors of different systems, such as colour plotter system, radar system, can be shared in order to utilise the limited space available in coxswain operation area and to provide users a better displaying Interface. [D]

(b) The Contractor shall refer to the conceptual block diagram of ENE equipment for the Vessel as reference.

9.1.3 All ENE 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.

9.1.4 All components of the Equipment exposed to the weather shall be sea water resistance. Internal components shall be fully enclosed with heavy duty seals and sufficient heat dissipation mechanism (e.g. ventilation, conduction, etc.) to protect the Equipment.

9.1.5 The Contractor shall pay attention to the compass safe distance of the Equipment and the radiation hazard zone of the radar scanner in the Vessel design.

9.1.6 All radar and radio equipment shall be of a type approved by the Office of the Communications Authority of Hong Kong.

9.1.7 All sitting, installation and cabling in respect of compass, VHF, radar, etc. shall comply with the relevant rules and regulations of Hong Kong.

- 9.1.8 All ENE shall have warranty support services in Hong Kong and on-site maintenance shall be available in Hong Kong.
- 9.1.9 When the generation / use of calendars are employed for logging of reports, activation off equipment, or as any essential part of logic for the proper functioning of the system, then the calendar generation shall function without any error or manual intervention for all leap years.
- 9.1.10 The circuit-breaker for the ENE equipment shall equip with lockout device so that the breaker can be locked during the equipment maintenance.
- 9.1.11 Lightning protection shall be provided and installed wherever applicable. The lightning arresters for all outdoor antennas shall be installed at the antenna ends.
- 9.1.12 Equipment supplied shall complete with all standard and/or maker recommended accessories as required for normal operation.

9.2 Loudhailer / Siren System and Public Address System with USB Player

- 9.2.1 The system shall function as a loudhailer/siren system for external broadcast specially designed for maritime purposes. The system shall also consist of a public address system for internal broadcast in the crew area.
- 9.2.2 Loudhailer/Siren
- (a) The system shall comprise two master control units in the wheelhouse and two weather proof horn type loudspeakers, in conformance to IPX5 or better, located at forward and afterward 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) Two master control units, which shall be completed with fist microphone and microphone hanger, shall be recessed mounted in the wheelhouse console 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) Auxiliary sensitivity: 775 ± 50mV rms 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 broad casted through the loudhailer system.

9.2.3 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 either of two control panel units. There shall be volume control for these internal broadcast speakers for adjusting acoustic levels to comfortable levels for the crew and at the same time avoid excessive acoustic feedback to the microphone. These internal broadcast speakers shall be waterproof to IPX5 or better and suitable for the location of installation.
- (b) The positions of two master control units of loudhailer/siren system, control panel and both the position and quantity of speakers of the public address system shall be finalised in the detailed design stage.

9.3 Magnetic Compass and Fluxgate Compass

- 9.3.1 The Contractor shall provide one magnetic compass and one fluxgate compass with digital display.
- 9.3.2 The fluxgate compass shall consist of at least a sensor unit and a display unit, and be compact and easy to operate. It shall have direct connection to the radar.
- 9.3.3 (a) An electronic display unit shall be installed at a position for easy viewing of Vessel heading by the Coxswain.
(b) Digital display is preferred. [D]
- 9.3.4 The fluxgate compass shall be electronic such that GPS/DGPS will not cause deviation.
- 9.3.5 The fluxgate compass shall be provided to allow the operation of the radar in north stabilized mode and supply heading direction information to the colour plotter system.
- 9.3.6 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°C to 50°C
 - (f) Waterproofing : IPX5 or better

9.4 Marine Radar

9.4.1 General Requirements

- (a) The equipment shall be a relative motion high performance radar suitable for small vessels and comprise a transceiver, an antenna and a colour display unit, suitable for bright daylight and night viewing.
- (b) The radar shall be able to track high speed small crafts easily.

- (c) The radar shall be equipped with a collision avoidance system that is an Automatic Radar Plotting Aid – ARPA or other equivalent function capable of tracking at least 10 targets.
- (d) The transceiver shall be housed in the scanner unit and shall be designed for aloft mounted construction and capable of satisfactory operation at high wind speeds. The scanner assembly shall be housed in a weatherproof housing.
- (e) The radar scanner unit shall be installed well clear of obstructions to minimize undue interference and Non-Ionizing Radiation (NIR hazards). Care shall also be taken to ensure the scanner mounting does not give excessive shadow sectors for navigation lights.
- (f) Complete interface kit shall be provided to interface the radar for the fluxgate compass, GPS/DGPS, colour plotter and AIS. The radar shall have interface to accept and display navigation data such as latitude and longitude positions of the Vessel given by the GPS/DGPS receiver.
- (g) There shall be interface provided to the radar for AIS. The radar shall have interface to accept and display AIS information such as Vessel names, call signs, heading, destination, maritime mobile service identity (MMSI), latitude, and longitude and other navigation data given by the AIS.
- (h) The Contractor shall pay special attention to any possible radar blind zone, and shall address this during the design stage and verify it after installation, and rectify it if required. The Contractor shall pay special attention to the Equipment installed before the radar scanner like flood lights and/or horn speakers. Care shall also be taken to ensure the mounting does not obstruct the navigation lights.
- (i) The radar shall have standard NMEA 0183 interface ports, i.e. National Marine Electronics Association (NMEA) Standard, capable of accepting navigational data from a wide selection of GPS/DGPS receivers and electronic compasses, AIS and to output comprehensive data on all tracked targets in the form of a track table to a wide selection of electronic chart plotters. However, connection of the radar system to the other systems supplied under this Contract via other standard or proprietary interface types equivalent to NMEA 0183 is acceptable.
- (j) The power for the equipment shall be supplied from the D.C. 24V system of the Vessel.
- (k) The radar transceiver shall be housed in a radome antenna/scanner unit of maritime type. It shall be designed for aloft mounted construction and capable of satisfactory operation at high relative wind speeds of not less than 70 knots.
- (l) Guard zones and alarm functions shall be provided in the radar. The zone shall be set and shown on the display screen. Audible alarm shall be activated if other vessels enter the zones set.
- (m) The radar 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, etc.
- (n) 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.

9.4.2 Performance Requirements

The marine radar shall perform at least or better than the following requirements.

(a) Display Unit

Display:	Flat panel colour LCD
Screen size:	15 inch (381 mm) or larger
Resolution:	1280 x 1024 pixels or better
Display mode:	Head up, Course up, North up and True Bearing Modes (with inputs of compass and speed data)
Range scale:	0.125 nm to 24 nm
Range units:	Selectable from nautical miles, kilometres, and kilo yards
Minimum range:	30 m or less
Range ring accuracy:	1.5% or less of the maximum range of the scale in use; or 30 m, whichever is the greater
Radar bearing accuracy:	1.5 degree or less
Display language:	English (English and traditional chinese)
Others:	With adjustable electronic bearing lines and variable range markers features
Operating temperature:	-15°C to +55°C or better
Relative humidity:	90% or better

(b) Transceiver

Operating frequency:	9410±30 MHz (X-band)
Peak power output:	at least 6 kw
Pulse length:	equipped with long, medium and short pulse modes for close, medium and long range operation
Overall noise figure:	6 dB or better

(c) Antenna

Operating frequency:	9410±30 MHz (X-band)
Aerial Type:	Open Array radar antenna (6 ft or less)
Horizontal beam width:	2.0 degrees or less
Vertical Beam width:	24.0 degrees or less
Side lobes:	Attenuated more than -28 dB within ±10 degrees of the main beam and better than -32 dB outside ±10 degrees of the main
Polarization:	Horizontal
Rotation Speed:	Not less than 24 rpm within satisfactory operation at relative wind speed up to 70 knots. Manual and automatic selection of antenna rotation speed (for example, 24 rpm, 36 rpm / 48 rpm) shall be available according to detection range
Operating temperature:	-15°C to +55°C or better
Relative humidity:	90% or better

(d) 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.

(e) ARPA (Automatic Radar Plotting Aid) Requirement

Target Acquisition:	10 targets (manual)
Tracking:	Automatic
ARPA Range Scales:	From 0.75 to 12 nautical miles or better
Readout of Selected Target:	Range, bearing, course, speed, CPA (Closest Point of Approach), TCPA (Time to Closest Point of Approach)
Target Vector:	Relative, true
Intercept Mode:	Automatically calculate intercept course and Time to Go (TTG) to tracked target
Adjustable warning limit:	Warning for CPA to a desired adjustable limit.

(f) The crew operator shall be able to select the following modes of presentation at the radar display:

- (i) radar image only;
- (ii) plotter image only; or
- (iii) plotter image overlaid with radar image.

9.5 Electronic Chart Display and Information System (ECDIS) with Differential Global Positioning System (DGPS) and Echo Sounder with one personal computer

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

9.5.2 General Requirements

- (a) One set of ECDIS must be provided with the following function:
 - (i) Navigational calculation;
 - (ii) Chart updating;
 - (iii) Piloting; and
 - (iv) Voyage monitoring.
- (b) One set of ECDIS with DGPS receiver and echo sounder shall be installed. It shall consist of three DGPS display control units, a remote GPS antenna and differential beacon receiver, colour chart plotter with electronic chart cartridges for Hong Kong Waters, and echo sounder.
- (c) The information received by the DGPS receiver shall be input to the marine radar and display on the marine radar and the screen of colour plotter. The output of the receiver shall give the Vessel position in a format compatible to marine radar in the "American Standard for Interfacing Marine Electronic Navigational Devices" NMEA 0183 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 is acceptable.
- (d) One screen monitor of size not less than 610 mm (24 inches) shall be provided. The screen monitor must fulfil the following features:
 - (i) 1000 nits brightness;
 - (ii) 610 mm active viewing area;
 - (iii) HDMI, DVI and composite inputs;
 - (iv) On-class menu keys; and
 - (v) Can be operated as radar, chart plotter, depth sounder, alarm etc.
- (e) The system shall be provided with "speed logs and electronic compass interface" or "gyro and its interface" to support the "dead reckoning" mode operation, if GPS satellite signal is absent for a period greater than 10 minutes.
- (f) The system shall be equipped with navigational sea charts in details covering the entire Hong Kong Waters.
- (g) The information received by the AIS shall be able to display on the screen monitors of ECDIS.
- (h) Complete interface kit shall be provided to interface with the colour chart plotter for the radar, echo sounder and GPS/DGPS. The colour chart plotter shall accept and display information given by the radar, echo sounder and GPS/DGPS receiver.
- (i) The processor unit of the ECDIS shall accept and display information given by the ENE equipment: Radars, VHF, AIS Transponder, DGPS and control console. The processor unit shall have high-performance quad-core processor for rapid, responsive operation of the screen monitor.

- (j) One personal computer must be separately installed. The Contractor shall confirm the installation location with the user. This personal computers must fulfill the following requirement:

Operating system:	Window 7 Professional (traditional Chinese) or better
CPU:	Intel Core i5 Processor 3GHz or higher
RAM:	8 GB or better
Display card:	Up to 1920 x 1080 HDMI, DVI interface, VGA and provide the dual displays function which provide display signal to the multi-touch monitor of ECDIS
Monitor:	At least 19 inch
HDD Type:	SSD
HD:	500 GB or above
Interface:	Serial port x 1, USB (3.0) x 3, USB (2.0) x 4, Bluetooth (receive NMEA Data from AIS and DGPS, connect the printer, multi-card reader and USB device)
Accessories:	Multi-card reader (SD/MMC+/mini SD, Micro SD, Compact Flash I/II, MS PRO/MS PRO Duo)
Software:	Orca Master (ECS Software), Microsoft Office Standard 2013
Printer:	Multi-Functional Laser Printer (copy, print and scan) connect to personal computer through USB, the print & copy speed at least 35 pages per minutes and support auto double-sides printing, copying and scanning. The dimension (width, depth and height) of the printer is about 494 mm x 430 mm x 448 mm

- (k) ECDIS display may also be used for the display of radar, radar tracked target information, AIS and other appropriate data layers to assist in route monitoring. [D]
- (l) ECDIS should provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment. [D]
- (m) ECDIS is capable of reading and loading IHO S-57 (Version 3.1) ENC data file and update the same where necessary. Also it is able to handle the different chart format e.g. S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetric ENCs, ARCS charts, VMAP/DNC charts, AML charts, BSB charts, WMS charts, Geo TIFF, etc.
- (n) The chart information to be used in ECDIS shall be the latest edition, can be corrected by official updates (S-57 digital charts, SevenCs directENC charts, SevenCs Bathmetric ENCs) by the MD with records of update shown on the ECDIS.
- (o) 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. [D]
- (p) The ECDIS shall be capable of displaying both English and traditional Chinese characters of the ENC. ECDIS should store 12 hours history voyage record and can be reproduced on the ECDIS. [D]

9.5.3 Performance Requirements

- (a) Navigational Features
- | | |
|-----------------|---|
| Total Waypoint: | 2000 or more |
| Routes: | 50 route plans or mor |
| Alarm: | including but not limited to, proximity alert, cross-track error, and arrival /anchor watch |
- (b) Electrical and Physical
- | | |
|------------------------|---|
| Power Source: | 12 – 24V D.C. (external) |
| Display (Screen Type): | 24 inch or greater diagonal high resolution colour display resolution 1280 x 1024 pixels or better for 4:3 aspect ratio |
- (c) Environmental
- | | |
|------------------------|------------------|
| Operating Temperature: | -10 °C to +50 °C |
| Storage Temperature: | -20 °C to +60 °C |
- (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 15 m |
| Tracking Velocity: | 999 knots |
- (e) Differential Beacon Receiver
- | | |
|--------------------|---------------------|
| Frequency Range: | 283.5-325 kHz |
| Frequency Step: | 500 Hz |
| Position Accuracy: | No greater than 5 m |
- (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 knots/hour or 0.1 Km/hour resolution 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: (1) English operation and display
(2) Bilingual (English and traditional Chinese) is preferred [D]

(g) Echo Sounder & Depth Indicator

- (i) The equipment shall consist of a transducer and a digital depth indicator which is recessed mounted at the steering console and capable of providing readout of sea depth in feet, fathoms and metres.
- (ii) The measuring depth shall be from 3 feet to 999 feet or equivalent fathom or metre with at least 3 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 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 shall be an isolating switch to switch off the recorder in case of shortage of recording paper but the equipment for sensing and indicating the depth shall still be operating and functioning as in normal working condition.

9.6 International Maritime Mobile (IMM) VHF Radio with Global Maritime Distress Safety System (GMDSS)

9.6.1 Equipment quantity

The ship is equipped with one set of VHF, one for the navigation equipment installed in the wheelhouse console.

9.6.2 General Requirements

- (a) The IMM VHF radio shall be a type approved make by the Office of the Communications Authority of Hong Kong.
- (b) The radio shall be fully compatible with GMDSS and equipped with a lithium battery with a lifetime of at least five years from the date of Delivery Acceptance.
- (c) The radio shall be fully compatible with GMDSS, which is a class A Digital Selective Calling (DSC) transceiver fully compatible with the International Maritime Organization (IMO) GMDSS carriage requirements.
- (d) The radio shall be equipped with all the international maritime VHF channels complete with fist microphone with press-to-talk switch or telephone handset, mic/handset hanger, mounting bracket and loud speaker.
- (e) 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.
- (f) The radio shall be completed with antenna and integrated microphone, loudspeaker, control knobs/keys, display screen, re-chargeable battery, etc., necessary for a stand-alone portable radio. The radio shall be equipped with a 220 VAC battery charger (for battery charging on shore) and one extra set of spare re-chargeable battery. The Contractor shall provide proper

stowing space and facilities for keeping of the portable radio and the spare battery such that the crew can take the portable radio out for use when necessary.

- (g) The operating temperature shall be -5°C to $+55^{\circ}\text{C}$ or better. The water ingress protection shall be IPX7 or better.
- (h) The radio shall be supplied with a belt clip and a shoulder carrying case.
- (i) The Contractor shall also supply a D.C. battery charger (one for each Vessel extra to the 220 VAC battery charger) which can be readily and directly connected to a D.C. power outlet at each Vessel such that the portable radio can be charged on the Vessel if necessary. Normally the D.C. battery charger shall be not in use and stowed on the Vessel with stowing space and facilities provided by the Contractor.
- (j) 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;
 - (vii) Transmission power selector for HIGH and LOW Power (25 W / 1 W).

9.6.3 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 a marine type aerial with at least 3 dB gain, vertically polarized, 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 joints shall be properly covered by waterproof tape or material.

9.7 Automatic Identification System (AIS)

9.7.1 General Requirements

- (a) The equipment shall receive navigation information from local AIS-equipped vessels.
- (b) The equipment shall be a Class A universal AIS complying with IMO MSC. 74(69) Annex 3, IEC 61993-2, ITU-R M.1371-3, ITU-R M.493-13, ITU-R M.825(DSC), 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 vessel nearby.
- (d) The AIS supplied shall be completely compatible with all systems using NMEA standard and be able to interface with RADAR, ECDIS, 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) AIS 5.6" (or larger) LCD Colour Graphic Display Unit
 - (ii) AIS Transponder Unit
 - (iii) VHF antenna
 - (iv) GPS antenna
 - (v) Installation / operation handbook

9.7.2 Performance Requirements

- (a) The AIS shall comply with the following specifications :
 - (i) General
 - Power Supply: 12 - 24V D.C.
 - 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: 4.3"(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 ±1.5dB) |
| 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 (RG58U) |
| Receiver Type: | 16 channel, L1 frequency, C/A code |
| Accuracy: | Acquisition -140 dBm / Tracking -150 dBm |
- (vii) Environment
- | | |
|------------------------|-----------------|
| Operation Temperature: | -15°C to +55°C |
| Storage Temperature: | -25 °C to +75°C |
| Vibration: | IEC 60945 |
- (b) Aerial and Feeder
- (i) The aerial provided shall be marine type aerial with at least 3 dB gain, vertically polarized, 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.

9.8 Installation Requirements

9.8.1 General

- (a) The control panel of all Equipment shall be installed and flush-mounted in the coxswain operation area unless otherwise specified. The mounting screw shall be detachable from the front of the Equipment and the Equipment shall be taken out at the front for further checking or replacement. The Contractor shall submit a layout plan showing the exact locations of the Equipment before installation.
- (b) Equipment supplied shall be completed with all standard and/or maker recommended accessories as required for normal operation.
- (c) The Equipment supplied shall be completed with all the auxiliary items required for normal operation including connectors, circuit breakers, power sockets, interface device, plugs and cables with conduits. Additional power conditioners, filtering devices, power stabilizer or regulator shall be provided and installed at no extra cost if required.
- (d) RF connectors of suitable impedance shall be provided and used for connections of the RF cables, antennae and radio equipment. Connectors between the feeder cables and antennae shall be protected by weatherproof material to avoid water seepage.
- (e) All wiring shall be finished in a neat and appropriate manner approved by the Government.
- (f) Adequate measures to prevent interference among the equipment shall be taken, which include but not limited to the following:
 - (i) Separate screened conduits or trunking shall be provided.
 - (ii) Rules, regulations and recommended practices regarding screening of electric wiring must be observed.
 - (iii) 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.
 - (iv) Lightning protection devices shall be fitted.
- (g) All sitting, installation and cabling work shall be undertaken to the highest standard to ensure:
 - (i) Satisfactory performance of the Equipment.
 - (ii) Protection from mechanical and water damages.
 - (iii) Ease of accessibility for maintenance and repair.
 - (iv) Manufacturers' recommendations shall be strictly observed.

- (h) (i) The power, signal and control cables connecting to the flush-mounted equipment shall be long enough to let the equipment wholly rest 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.
- (ii) Induced mutual interference should be within an appropriate level which would not affect normal operation. [D]
- (i) Installation location
 - (i) Installation location of the Equipment shall be easily accessible for inspection and maintenance. Exact location shall be subject to the approval of the Government.
 - (ii) Installation location of the Equipment shall not cause interference to other Equipment by way of the emitted interference
- (j) Materials and Workmanship
 - (i) Materials 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.
 - (ii) All the designs shall be subject to the approval of the Government and the respective works shall be carried out in a first class workman-like manner.
 - (iii) The Government reserves the right to reject any part of the installation not compliant with the TS. The Contractor shall carry out the necessary remedial work or replacement at its own cost and expense and without delay.
 - (iv) 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.
- (k) Equipment Fixing and Interconnection
 - (i) 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.
 - (ii) Interconnection of various items of Equipment shall be mechanically and electrically connected by multi-pin connectors or terminals.
 - (iii) 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.
 - (iv) The Contractor shall be responsible for providing and installing properly rated power cables from the power points to its own equipment.
- (l) Electricity
 - (i) The power supply shall be compatible with Vessel's D.C. electrical system.
 - (ii) The Equipment shall be protected by appropriately rated fuses. The fuses shall be contained in independent fuse holders which are easily accessible.

(m) Cable

- (i) All exposed cables and wiring shall be sheathed or protected by metal conduits.
- (ii) Watertight cable glands shall be provided by way of watertight bulkhead or deck penetration.
- (iii) Signal wiring shall be separated from power supply cables and housed in separate screened conduits or cable trunks.
- (iv) Cables and wiring shall run behind the compartment lining. Where electric cables are necessary to be fitted on the decorative surface of bulkheads, they shall be enclosed in proper metal conduits.

(n) Labelling and Marking

- (i) Each cable shall be clearly labelled and carry its own unique identification code.
- (ii) Polarity of power cables shall be labelled.

9.9 Acceptance Test

9.9.1 The acceptance tests shall comprise the following:

- (a) A bench acceptance test which includes functional tests and detailed measurements of the performance of the Equipment to verify that each item of Equipment complies with all the required performance specification.
- (b) On-site commissioning test shall be carried out by the Contractor in the presence of the EMSD representatives after completion of the installation of each set of Equipment. The overall installation standard and operational features of each set of Equipment shall be evaluated. The test shall be carried out during sea trial in Hong Kong.

9.9.2 The Contractor shall deliver each set of Equipment to the EMSD representatives for bench acceptance test prior to the installation on the Vessel. Where the test is failed (i.e. the Equipment does not comply with any requirements as set out in this Chapter of Part VII or in other applicable part of the Contract), the Contractor shall provide a brand new replacement to the EMSD for reconduct of the bench acceptance tests.

9.9.3 The Contractor shall submit a schedule of commissioning tests of the ENE installed on board of the Vessel at least one month prior to the on-site commissioning test date.

9.9.4 The Contractor shall provide all the necessary test equipment and tools for carrying out all tests as mentioned in this Chapter 9 of Part VII at no extra cost to Government.

9.9.5 At least one month before the end of the Warranty Period, the Contractor shall arrange and perform confirmation test in the presence of the representatives from EMSD. Should any defects be found during the confirmation test, the Contractor shall fix the defects as soon as possible and in any event no later than the time prescribed by the EMSD's representatives. The Warranty Period shall be extended correspondingly for so long as the defects are not fixed by the Contractor.

9.9.6 For defects found during the confirmation test, the Equipment or its parts shall be repaired or replaced, and the Warranty Period of the Equipment shall be extended for one more year.

9.10 Documentation for the Proposed Equipment

9.10.1 The Contractor shall supply the following documentation:

- (a) Technical and proposed equipment information including integrated system equipment schematic diagram of all these general electronic equipment, in English and sufficiently detailed to enable a technical appraisal of the Equipment in this Chapter of Part VII to be made.
- (b) Lists of Equipment as required in this Chapter in Schedule 6.

9.10.2 The Contractor shall upon delivery of the Vessel, supply three sets of Operation Manuals, Service Manuals 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 GNC and EMSD for approval during construction stage.

Chapter 10 - Services Support

10.1 General Requirements

10.1.1 In determining the appropriate design for the Vessel, all of the following factors shall 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 Hong Kong.

10.1.2 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 2.6.1 of Chapter 2 of Part VII.

10.1.3 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; and
- (b) Ease access to in-situ service and maintenance in the HKSAR.

10.2 Information to be Provided Prior to and at Delivery Acceptance

10.2.1 Information provided prior to Delivery Acceptance:

- (a) Detailed Inventory List for the whole Vessel to be submitted to the MD and IMMD 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;
 - (ix) Order time;
 - (x) Shelf life;

(xi) Unit cost.

(d) FOUR paper copies and ONE soft copy of the Inventory List shall be provided to GNC.

10.2.2 “As Fitted” Plans and Drawings in accordance with those given in (but not limited to) Annex 7 of the TS, and any other relevant information required by GNC shall be supplied as follows:

(a) Not less than 4 weeks before the Delivery Acceptance of the Vessel, the Contractor shall provide a list of all “As Fitted” Plans and Drawings to GNC for acceptance. Four (4) hard copies of final version of the “As fitted” Plans and Drawings and one soft copy in compact Disk (CD-ROM) shall be provided by the Contractor to GNC upon delivery of the Vessel to the Government Dockyard.

(b) At Delivery Acceptance, the Contractor shall provide to GNC all the necessary service and repair manuals, operational guides, spare parts information of all engines, machinery equipment, electrical equipment, steering, windlass, electronics and navigational lights and lightings and the outfitting items of the Vessel.

10.2.3 In addition to the abovementioned items, upon Delivery Acceptance, the Contractor shall also supply the following:

(a) 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;
- (vi) Supplier or agents name and contact address;
- (vii) Order time;
- (viii) Shelf life; and
- (ix) Unit cost.

(b) FOUR copies (at least one original) of maker operation, maintenance and workshop manuals for all machineries / equipment in English.

(c) FOUR paper copies and ONE soft copy in CD-ROM as per the Vessel delivered of “Docking Plan” which shall include the profile, plan and sections shall be prepared by the Contractor.

(d) FOUR copies of On Board Operator’s Manual (English and traditional Chinese) including:

- (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.)

(e) The first draft of the On Board Operator’s Manual (in both English and traditional Chinese) shall be submitted to GNC for approval one month before documentation acceptance.

(f) The documentation for all Equipment, spares and stores, special tools and test equipment shall be provided at the Delivery Acceptance of the Vessel.

10.2.4 Spare Parts and Consumable Parts for the Main Engines:

- (a) All items of Spare Parts and Consumable Parts for the main engines shall be delivered to the Government Dockyard as per the requirements stipulated in Schedule 2, Delivery Schedule of Part V.
- (b) All items supplied shall be identical in make, quantity and size to the parts currently in use. All items shall be properly documented, preserved and packed.

10.2.5 Tools & Test Equipment for Electronics

- (a) All test and tool equipment for the electronics equipment of the Vessel shall be delivered directly to EMSD.
- (b) All items shall be properly documented, preserved and packed.

10.2.6 Photographs

The Contractor shall provide the following upon Delivery Acceptance.

(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. Two high resolution soft copies of As-Fitted photographs on CD shall also be provided.
- (ii) Each print shall be enclosed in a suitable album and the hard copy and soft copy photographs should be 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 clearly the running profile and name of the Vessel in Hong Kong Waters.
- (ii) Four 200 mm x 150 mm colour photographs with specifications of Vessel particulars showing the profile of the Vessel in Hong Kong Waters.
- (iii) Four 150 mm x 100 mm colour photographs showing the profile of the Vessel in Hong Kong Waters.

(c) Soft copy 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.

10.2.7 Certificates and Reports

Copies of the following documents (one original with two copies and one soft copy stored in CD-ROM), filed in clear folders, shall be forwarded to GNC at the time of Delivery Acceptance:

- (a) Associated test certificates;
- (b) Test performance certificates of equipment (e.g. electronics, switchboards, etc.);
- (c) Main engines performance test certificates;

- (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 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 during the Warranty Period in the HKSAR as stipulated in Annex 1 of this Part VII - Technical Specification.
- (l) Certificate of Class issued by the relevant RO;
- (m) Any other certificates as appropriate.

10.2.8 Ship Model

- (a) The Contractor shall supply two (2) ship models (scale 1:25) for display and training purpose.
- (b) The purpose of the ship model shall 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. The Ship Model shall include the position and look of the major external fittings including but not limiting to the ship name, skag, appendages, shafts, propeller (propulsion units), rudders, fender, windows and wipers, lifesaving, fire fighting, piping on deck, mast, mast fittings, radar, navigation lights etc. to the satisfaction of the Government. The Vessel shall be made to an overall exact scale standard relevant to model making.

Chapter 11 - Training

11.1 Training on Electronics Navigational Equipment (ENE)

11.1.1 General Requirements

- (a) All training courses shall be held in Hong Kong and delivered by qualified instructors.
- (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 Equipment 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; and
 - (ii) Equipment maintenance training.
- (d) The Contractor shall submit a detailed course syllabus and a schedule for conducting the training course.
- (e) Each trainee shall receive one copy of comprehensive training documents before the start of each course.
- (f) Training manual in traditional Chinese and English shall be provided and submitted to GNC and EMSD for approval at least one month prior to commencement of the aforementioned two types of training respectively.

11.1.2 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 Equipment. This shall include hands-on demonstrations and operation of all Equipment including the necessary routine cleansing requirement.
- (c) The course shall be held immediately before the commissioning of the Equipment on the Vessel.
- (d) A total of up to 20 trainees will attend the course. The training course shall accommodate the specified number of trainees.

11.1.3 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 of the design considerations, day-to-day operation, inter-connected system operation, fault breakdown, routine maintenance and fault finding/ repairing procedures of the Equipment being offered; and to effectively maintain the Equipment. This shall include practical demonstrations and tests.
- (b) The maintenance training shall include, but not be limited to the following items:
 - (i) Introduction of the Equipment locations;
 - (ii) Equipment operational, working principle and functional descriptions;

- (iii) Equipment block and schematic functional descriptions;
 - (iv) Equipment adjustment/calibration procedure and parameter settings;
 - (v) Equipment construction and mounting;
 - (vi) Equipment interfacing and signal interfacing; and
 - (vii) Preventive maintenance and trouble-shooting
- (c) The course shall be held immediately after the commissioning of the Equipment on the Vessel.
- (d) A total of up to 15 trainees will attend the course. The training course shall accommodate the specified number of trainees.

11.2 Training on Operation and Maintenance of the Vessel

- 11.2.1 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.
- 11.2.2 In order to ensure the navigational work-up team of the MD acquires full knowledge and appreciation of all aspects of the manoeuvrability, vessel handling, turning characteristics, engines, etc., the Contractor shall provide an appropriate training course for 25 officers of the MD in the HKSAR within one week after the Delivery Acceptance of the Vessel. An operation training program shall be proposed before the delivery of the Vessel 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. Upon completion of the training course, a certificate shall also be issued to the trainees by the responsible trainer or organization for proof of competence and satisfactory completion of the course.
- 11.2.3 In order to ensure the engineering work-up team and the front-line maintenance teams of the MD and the maintenance personnel of the Government Dockyard acquire full knowledge and appreciation of all aspects of the designs, day to day operation, breakdown, routine maintenance and fault diagnosis of the engine/electrical distribution system, hull structural repair, etc. The Contractor shall therefore provide appropriate train-the-trainer courses for a total of 25 engine operators and 10 maintenance personnel from the Government Dockyard in Hong Kong or overseas within one week after the Delivery Acceptance of the Vessel. Upon completion of the training course, a certificate shall also be issued to the trainees by the responsible trainer or his organization for proof of competence and satisfactory completion of the course.
- 11.2.4 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 traditional 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 12 - Abbreviations

AC	Alternating Current
AIS	Automatic Identification System
AML	Additional Military Layers
Amp	Ampere
ARCS	Admiralty Raster Chart Service
ARPA	Automatic Radar Plotting Aid
ASTM	American Society for Testing and Materials
ASWF	American Standard Window Film
AUX	Auxiliary
AV	Audio Visual
AWS	American Welding Society
BS	British Standards
BSI	British Standards Institute
CAT	Categorisation
CCTV	Close Circuit Television
CDI	Course Deviation Indicator
CD-ROM	Compact Disc Read-Only Memory
CFC	Chlorofluorocarbon
CH	Channel
CO ₂	Carbon Dioxide
COG	Course over Ground
CPA	Closest Point of Approach
CPU	Central Processing Unit
dB	Decibel
dBm	Decibel-milliwatts
D.C.	Direct Current
DGPS	Differential Global Positioning System
dia.	diameter
DNC	Digital Nautical Chart
DPDT	Double-pole, Double-throw
DSC	Digital Selective Calling
DVI	Digital Video Interface
EBL	Electronic Bearing Line
ECDIS	Electronic Chart Display and Information System
ECS	Electronic Chart System
ENC	Electronic Navigational Charts
ENE	Electronic Navigational Equipment

FTP	Fire Test Procedures
GB	Gigabyte
GHz	Gigahertz
GM	Metacentric Height
GMDSS	Global Maritime Distress Safety System
GMSK	Gaussian Minimum Shift Keying
GMT	Greenwich Mean Time
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GZ	Righting Lever
HCFC	Chlorodifluoromethane
HD	Hard Disk
HDD	Hard Disk Drive
HDMI	High Definition Multimedia Interface
Hz	Hertz
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
IHO	International Hydrographic Organization
IMD	Intermodulation Distortion
IMM	International Maritime Mobile
IMO	International Maritime Organisation
IP	Ingress Protection
IPX	Internetwork Packet Exchange
IS	Intact Stability
ISO	International Organization for Standardization
ITU-R	International Telecommunication Union – Radiocommunication Sector
JIS	Japanese Industrial Standards
kg	Kilogram
kHz	Kilohertz
Km	Kilometre
kw	Kilowatt
LCD	Liquid Crystal Display
LCG	Longitudinal Centre of Gravity
LED	Light-emitting Diode
LSA	Life-Saving Appliance
m	Metre
m/s	Metre per Second
m ³	Cubic Metre
MCR	Maximum Continuous Rating
MHz	Megahertz
MJ/m ²	Megajoule per Square Metre

MKD	Minimum Keyboard Display
mm	Millimetre
MMC	Multi Media Card
MMSI	Maritime Mobile Service Identity
MS PRO	Memory Stick PRO
MS PRO Duo	Memory Stick PRO Duo
MSC	Maritime Safety Committee
NDT	Non-Destructive Test
nm	nanometre
NMEA	National Marine Electronics Association
NUC	Not Under Command
PIC	Persons in Custody
ppm	Part per Million
PVC	Polyvinyl Chloride
RF	Radio Frequency
RG58U	RG58U Type Coaxial Cable
ROT	Rate of Turn
rpm	Revolutions per Minute
RT	Radioactive Test
RTCM	Radio Technical Commission for Maritime Services
SINAD	Signal-to-noise and Distortion Ratio
SOG	Speed over Ground
SOLAS	Safety of Life at Sea
SSD	Solid-state Drive
SS	Stainless Steel
TCG	Transverse Centre of Gravity
TCPA	Time to Closest Point of Approach
TFT	Thin-film Transistor
TIFF	Tagged Image File Format
TS	Technical Specifications
TTG	Time to Go
TV	Television
UHF	Ultra High Frequency
UPS	Uninterruptible Power System
USB	Universal Serial Bus
UT	Ultrasonic Test
UTC	Coordinated Universal Time
UV	Ultraviolet
V	Volt
VAC	Voltage of Alternating Current
VCG	Vertical Centre of Gravity

VDC	Voltage of Direct Current
VGA	Video Graphics Array
VHF	Very High Frequency
VIPs	Very Important Persons
VMAP	Vector Map
VRM	Variable Range Marker
V.S.W.R.	Voltage Standing Wave Ratio
WT BHD	Watertight Bulkhead
WT	Watt
WMS	Web Map Service
XGA	Extended Graphics Array

Part VII - Annex 1 - Warranty Services and Guarantee Slipping

1. Warranty Services

- 1.1 The Contractor shall provide Warranty Services in relation to all aspects of the Vessel during the Warranty Period, including Guarantee Slipping as stipulated in this Annex. 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.
- 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 Schedule 6 in Part V and electronic navigational equipment), fittings and outfit (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, 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, 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 Schedule 6 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 Paragraphs 9.1.1 in Chapter 9 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, labour and equipment in order to carry out such work:
- 2.2.1 Engines
- (a) Renew the lubricating oil and replace the filters for the main engines 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 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 one year's 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 and clean waterjets.
 - (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) Other trials as required by the Government Representative; and
 - (g) Any item or component found defective shall be repaired or replaced.

Milestones		Completion Dates
1	Issuance of "Notification of Conditional Acceptance"	To be advised after Tender Evaluation
2	Contract Date (the date of the last party signing the Articles of Agreement)	The date when the last party signs the Articles of Agreement. The Government will not sign the Articles of Agreement until and unless the Contractor fulfils all of the conditions precedent as specified in Clause 25.2 of Part II Conditions of Tender (save to the extent waived by the Government, if any).
3	Kick-Off Meeting	To be held within two (2) months after the Contract Date at the Government Dockyard or the Contractor's Shipyard
4	Completion of hull structures	The Contractor shall propose the completion dates of Milestones 4-8 for GNC's approval within two (2) months after the Contract Date.
5	Completion of installation of engines, propellers and steering gear	
6	Completion of installation of electronic navigation equipment	
7	Pre-shipment Construction and Handling Inspection	
8	Shipment to Hong Kong	
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

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 and Bulkhead Section	
Construction Profile and Deck Plan	
Shell Expansion Plan	
Tank Capacity Plan	
Engine Mounting Arrangement	
Power / Speed Estimation and Curve	
Intact and Damaged Stability Plan	
Details of Navigational / Communication Equipment	
Details of Deck Equipment, Outfitting, Furniture, etc.	
Details of Engines' Arrangement	
Control Console Arrangement and Schematic Diagram	
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 : "IMMIGRATION 4"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
	Hull Structure, Layout and Outfitting Inspection			
H-1	Mould Lofting			
H-2	Construction Materials – steel plate mark checking for hull & superstructure			
	a.	Steel plate mark checking for hull & superstructure		
	b.	Material certificates verification		
H-3	Welding consumables & welders certificates			
H-4	Keel laying for hull			
H-5	Fabrication of hull up to main deck in stages of work, including:			
	a.	Alignment		
	b.	Edge Preparation		
	c.	Welding		
	d.	Workmanship		
	e.	Compliance with approved plans		
	f.	NDT (X-ray) of welds		
	g.	Hull internal steel work inspection		
	h.	Plating thickness gauging		
H-6	Engine bearers fabrication / welding			
H-7	Superstructure scantling & welding checking			
H-8	Welding construction and pressure tests of tanks			
	Fuel oil tank			
	a.	Tank construction (internal/external/fitting)		
	b.	Tank pressure test		
	Freshwater tank			
	a.	Tank construction (internal/external/fitting)		
	b.	Tank pressure test		
	Grey water tank			
	a.	Tank construction (internal/external/fitting)		
	b.	Tank seating construction/securing arrangement		
	Oily Water tank			
	a.	Tank construction (internal/external/fitting)		
	b.	Tank seating construction/securing arrangement		
H-9	Hose test for hull & superstructure			
H-10	Mock up inspection for the wheelhouse			
H-11	Installation of various outfitting items			
	a.	Anchor and chain		
	b.	Windlass		
	c.	Hand pump		
	d.	Hatches		
	e.	Doors		
	f.	Windows		
	g.	Ventilators		
	h.	Seating of heavy equipment and masts		
H-12	Function tests of various outfitting items			

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "IMMIGRATION 4"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
H-13	Watertightness or weathertightness of openings			
	a.	Manholes		
	b.	Hatches		
	c.	Doors		
	d.	Windows		
	e.	Ventilator & air pipes		
H-14	Painting inspection of different layers			
H-15	Draught marks and vessel dimensions verifications			
H-16	Arrangement of wheelhouse and accommodation			
H-17	Zinc anodes and lightning system			
	a.	Installation of zinc anodes		
H-18	Inspection of fire, heat and sound insulation			
	a.	Fire insulation		
	b.	Heat insulation		
	c.	Sound insulation		
H-19	Interior furnishings			
	a.	Console area		
	b.	Wheelhouse		
	c.	Passenger space		
	d.	Toilets and pantry		
H-20	Lifesaving appliances and fire fighting appliances			
	a.	Lifesaving appliance		
	b.	Fire fighting appliance		
H21	Inspection of sea chest and grating			
	a.	Sea chest		
	b.	Grating		
H-22	Inclining experiment			
H-23	Sea trials including operation test of outfitting equipment			
H-24	Towing hook static bollard pull test			
H-25	Site towing demonstration trial			
H-26	Cleanliness inspection before acceptance			
H-27	Inventory check in the HKSAR			
H-28	Acceptance and delivery			
H-29	Acceptance of As-Fitted drawings and Engines/Equipment Manuals and documentations.			
	Machinery and Electrical Installation			
EM- 1	General inspection on installation of machinery:			
	(a)	General inspection on installation of main engines		
	(b)	General inspection on installation of generator sets		
	(c)	General inspection on installation of auxiliary engines		
	(d)	General inspection on installation of shafting		
	(i)	Propeller taper bedding test		
	(ii)	Coupling taper bedding test		
	(iii)	Coupling and rudder bolts fitting		

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "IMMIGRATION 4"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
EM- 2	Main engines:			
(a)	Test of engine safety devices and alarms			
(b)	Test of emergency stop			
(c)	Inspection of exhaust pipe before lagging			
EM- 3	Hydraulic test of sea valve			
EM- 4	Inspection of sea water suction strainer			
EM- 5	Freshwater system:			
(a)	General inspection & dimension checking of freshwater system			
(b)	Freshwater tank low level alarm test			
(c)	Freshwater tank final cleaning/internal inspection before filling			
(d)	Freshwater tank high level alarm test			
(e)	Freshwater tank content gauge calibration and test			
(f)	Inspection of piping penetration of bulkhead and deck			
(g)	Hydraulic test of freshwater piping			
(h)	Functional test of freshwater system			
EM- 6	Fuel oil system:			
(a)	General inspection & dimension checking of fuel oil system			
(b)	Fuel oil tank low level alarm test			
(c)	Fuel oil tank final cleaning/internal inspection before filling			
(d)	Fuel oil tank high level alarm test			
(e)	Fuel oil tank content gauge calibration and test			
(f)	Inspection of piping penetration of bulkhead and deck			
(g)	Hydraulic test of fuel oil piping			
EM- 7	Bilge system:			
(a)	General inspection & dimension checking of bilge system			
(b)	Bilge tank high and low level alarms test			
(c)	Inspection of piping penetration of bulkhead and deck			
(d)	Hydraulic test of piping			
(e)	Functional test of bilge system			
EM- 8	Sanitary system:			
(a)	General inspection & dimension checking of sanitary system			
(b)	Inspection of piping penetration of bulkhead and deck			
(c)	Hydraulic test of piping			
(d)	Functional test of sanitary system			
EM- 9	Fire fighting system:			
(a)	General inspection & dimension checking of fire line system (including the emergency fire line system)			

Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "IMMIGRATION 4"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
(b)	Inspection of piping penetration of bulkhead and deck			
(c)	Hydraulic test of fire line			
(d)	Function test of fire line (including emergency fire line)			
EM- 10	Fire extinguishing system:			
(a)	General inspection & dimension checking of (gas) fire extinguishing system			
(b)	Hydraulic & blow test of gas fire extinguishing piping			
(c)	Test of (gas) fixed fire extinguishing alarm system			
(d)	Test of fire detection (smoke & heat detectors) alarm system			
EM- 11	Functional test of drainage system			
EM- 12	Hydraulic system			
(a)	General inspection & dimension checking of hydraulic system			
(b)	Inspection of piping penetration of bulkhead and deck			
(c)	Hydraulic test of piping			
(d)	Functional test of hydraulic system			
EM- 13	E/R ventilation system:			
(a)	Inspection of E/R ventilation fans installation			
(b)	Function test of start/stop at remote and local control for E/R ventilation fans			
EM- 14	Air conditioning system:			
(a)	General inspection of air-conditioning system			
(b)	Inspection and hydraulic test of cooling water system			
(c)	Function test of air-conditioning system			
(d)	Air conditioning full load test during sea trial			
EM- 15	Batteries:			
(a)	Inspection of battery connectors and housing boxes			
(b)	Inspection of battery charger			
(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)			
EM- 16	Electrical installation:			
(a)	Inspection of lightning conductor			
(b)	General inspection of cable layout & checking of cable sizes			
(c)	Inspection of cable penetrations of bulkhead and deck			
(d)	Inspection of transformers			
(e)	Inspection of tally plates			
EM- 17	Main switchboard & panels:			
(a)	Main switchboard & panels - high voltage injection test			

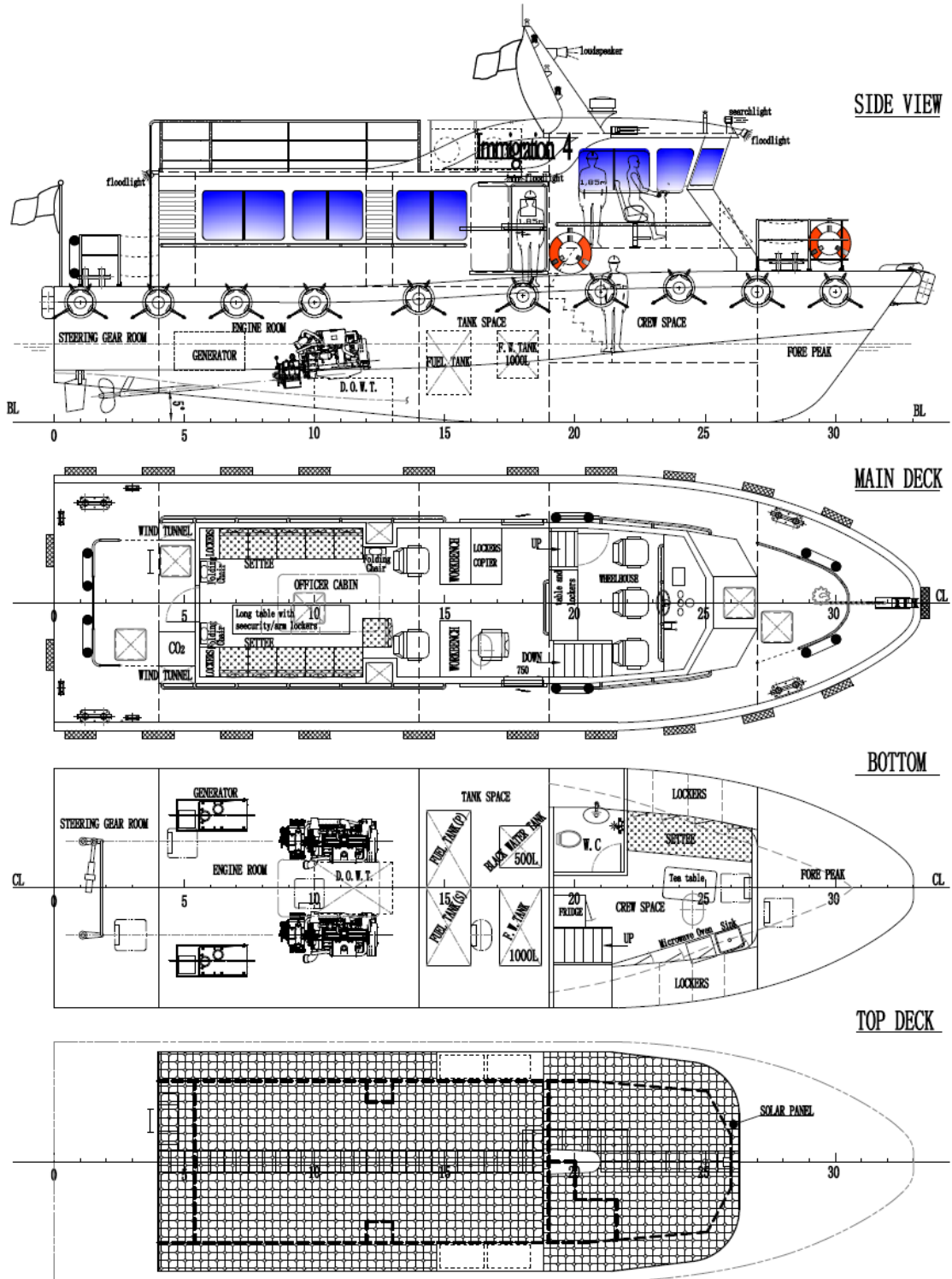
Part VII - Annex 4 - Main Items Inspection Timetable

VESSEL NAME : "IMMIGRATION 4"			Inspection date	Outstanding/ Re-inspection/ Remarks
Item	Items to be inspected			
(b)	Cable size checking of electrical switchboard installations			
(c)	Inspection of AC distribution panel			
(d)	Inspection of DC distribution panel			
(e)	Megger test of the electrical system			
(f)	Earthing test of the electrical system			
EM- 18	Control Console:			
(a)	Inspection of wheelhouse control console			
(b)	Functional test of wheelhouse console controls			
(c)	Inspection of navigation equipment control panel			
EM- 19	Lighting:			
(a)	Inspection and functional test of general lighting			
(b)	Inspection and functional test of emergency lighting			
(c)	Inspection and functional test of floodlight installation			
(d)	Inspection and functional test of searchlight installation			
EM- 20	Navigational Lights and Signals			
(a)	Inspection and functional test of navigational lights			
(b)	Test of horn/whistle			
EM- 21	Shafting (tailshaft and coupling) system:			
(a)	Marking/Stamping and material check			
(b)	Dimension check and taper bedding test			
(c)	Shaft line checking of stern/shaft bracket and alignment of main engines and tailshafts			
EM- 22	Test of window wipers			
EM- 23	Inspection of lightning conductor			
EM- 24	Electronic equipment tested by EMSD			
EM- 25	Test of noise level during sea trial			
EM-26	Inclining Experiment			
EM-27	(a) Official Speed Trial			
	(b) Other Official Sea Trials			

Note:

The inspection items are preliminary and not exhaustive, any items found necessary to be included at a later stage will be added to this list.

Annex 6 – Conceptual General Arrangement Plan



*The hull (including equipment) and machinery (including electrical installations) of the vessel shall be assigned with appropriate class notations.

NOTE:
 THIS DRAWING IS INTENDED TO BE USED AS AN ILLUSTRATION OF GNC'S REQUIREMENT.
 IT IS PROVIDED FOR INFORMATION ONLY.

Part VII - Annex 7 - As-fitted Drawings and Machinery/Equipment documents and information literature to be delivered to the Government after Delivery Acceptance

1. As-Fitted Drawings

- 1.1 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 its machinery and equipment as they are when the Vessel is on the day accepted by the MD. These are termed the final version of the “As-Fitted” Plans and Drawings, and they must consist of the following ones as well as any other additional ones that may be required by GNC/MD during the design and construction of the Vessel and before the Vessel is accepted by the Government.
- 1.2 The as-fitted plans and drawings shall be prepared by professional ship draughtsmen and they shall be prepared in a professional manner, scale, size and style normally required of in the ship design and construction business sector. All plans and drawings shall show and be clearly marked for the profile, plan, and section views of the layout, arrangement details, and construction details in a manner required by GNC officer.
 - 1.2.1 General Arrangement Plan
 - 1.2.2 Lines plan and offsets data and table.
 - 1.2.3 Stability information booklet and the inclining experiment report.
 - 1.2.4 Hydrostatics, cross curves and intact and damage stability calculations for all ship loading conditions specified in the Technical Specifications.
 - 1.2.5 Vessel subdivision drawings and stability calculations.
 - 1.2.6 Painting scheme of the whole Vessel.
 - 1.2.7 Vessel draught marking diagram.
 - 1.2.8 Detailed arrangement and layout plan of the 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 clearly indicated on the drawings.
 - 1.2.9 Equipment layout diagram.
 - 1.2.10 Hull structural construction and hull scantlings drawings.
 - 1.2.11 Hull shell and frames and the framings arrangement and construction plan.
 - 1.2.12 Hull shell expansion plan.
 - 1.2.13 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 and firefighting system 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 Navigational 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 Any drawing as required by GNC.
- 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 8 – 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)	0 m	Flat.	Calm. Smoke rises vertically.
		< 1 mph			
		< 1 knot	0 ft		
		< 0.3 m/s			
1	Light air	1.1–5.5 km/h (0.3–2 m/s)	0–0.2 m	Ripples without crests.	Smoke drift indicates wind direction. Leaves and wind vanes are stationary.
		1–3 mph			
		1–3 knot	0–1 ft		
		0.3–1.5 m/s			
2	Light breeze	5.6–11 km/h (2–3 m/s)	0.2–0.5 m	Small wavelets. Crests of glassy appearance, not breaking	Wind felt on exposed skin. Leaves rustle. Wind vanes begin to move.
		4–7 mph			
		4–6 knot	1–2 ft		
		1.6–3.4 m/s			
3	Gentle breeze	12–19 km/h (3–5 m/s)	0.5–1 m	Large wavelets. Crests begin to break; scattered whitecaps	Leaves and small twigs constantly moving, light flags extended.
		8–12 mph			
		7–10 knot	2–3.5 ft		
		3.5–5.4 m/s			
4	Moderate breeze	20–28 km/h (6–8 m/s)	1–2 m	Small waves with breaking crests. Fairly frequent whitecaps.	Dust and loose paper raised. Small branches begin to move.
		13–17 mph			
		11–16 knot	3.5–6 ft		
		5.5–7.9 m/s			
5	Fresh breeze	29–38 km/h (8.1–10.6 m/s)	2–3 m	Moderate waves of some length. Many whitecaps. Small amounts of spray.	Branches of a moderate size move. Small trees in leaf begin to sway.
		18–24 mph			
		17–21 knot	6–9 ft		
		8.0–10.7 m/s			
6	Strong breeze	39–49 km/h (10.8–13.6 m/s)	3–4 m	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.
		25–30 mph			
		22–27 knot	9–13 ft		
		10.8–13.8 m/s			
7	High wind, moderate gale, near gale	50–61 km/h (13.9–16.9 m/s)	4–5.5 m	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.
		31–38 mph			
		28–33 knot	13–19 ft		
		13.9–17.1 m/s			
8	Gale, fresh gale	62–74 km/h (17.2–20.6 m/s)	5.5–7.5 m	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.
		39–46 mph			
		34–40 knot	18–25 ft		
		17.2–20.7 m/s			
9	Strong gale	75–88 km/h (20.8–24.4 m/s)	7–10 m	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.
		47–54 mph			
		41–47 knot	23–32 ft		
		20.8–24.4 m/s			

10	Storm, whole gale	89–102 km/h (24.7-28.3 m/s)	9–12.5 m	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.
		55–63 mph			
		48–55 knot	29–41 ft		
		24.5–28.4 m/s			
11	Violent storm	103–117 km/h (28.6-32.5 m/s)	11.5–16 m	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.
		64–73 mph	37–52 ft		
		56–63 knot			
		28.5–32.6 m/s			
12	Hurricane	≥ 118 km/h (≥ 32.8 m/s)	≥ 14 m	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.
		≥ 74 mph	≥ 46 ft		
		≥ 64 knot			
		≥ 32.7 m/s			

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	