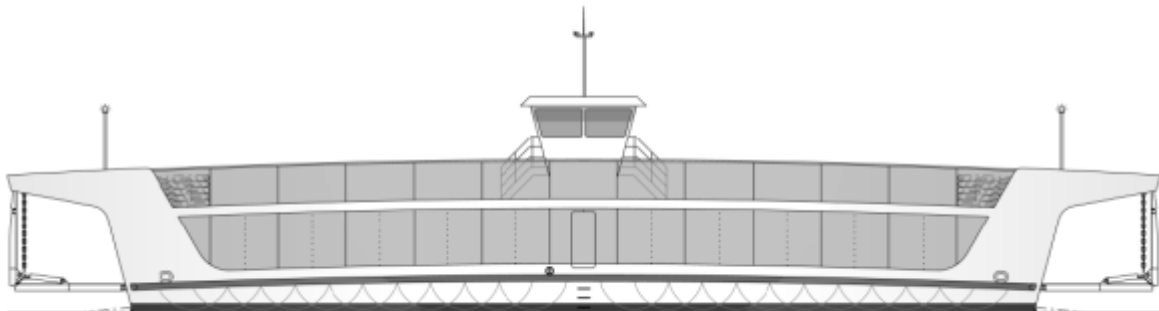


REPLACEMENT FLOATING BRIDGE
Technical Specification Rev 0
BCP/J/10384/00



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TECHNICAL SPECIFICATION

REPLACEMENT FLOATING BRIDGE FOR ISLE OF WIGHT COUNCIL

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G.1. GENERAL DESCRIPTION

G.1.1. DESCRIPTION OF OPERATIONAL REQUIREMENTS

- G.1.1.1. The replacement floating bridge (hereafter called “the Vessel”) is to be configured as a drive through, roll-on roll-off chain ferry with articulated hydraulically operated loading and unloading ramps at each end of the vehicle deck with an enclosed weather proof passenger shelter and an offset Pilot House. The ferry is designed for the carriage of vehicles and passengers between East Cowes and West Cowes across the River Medina on the Isle of Wight.
- G.1.1.2. The Vessel is to be capable of carrying a nominal 20 cars with their occupants and 140 passengers over a crossing distance of approximately 165m. Each vehicle is to have a space allowance of 4900 x 2500 mm on the vehicle deck. The vessel is also to be able to accommodate 400 people with no vehicles when used for special events.
- G.1.1.3. The Vessel is to be designed on the roll-on/roll-off principle with a prow at each end. An independent slipway survey conducted in 2011 has been supplied by the client, which shows that the slipway gradient is an average of 1:8 on the East Cowes side and 1:10 on the West Cowes side. The prows are to be designed to suit the shore ramp gradients, whilst maintaining an adequate underkeel clearance. A copy of the survey data is available on request.
- G.1.1.4. The vehicle deck to be arranged as a roadway for 4 lanes of vehicles with space on the vehicle deck allocated for the stowage of motorbikes, scooters and bicycles. There are to be four lanes for cars each lane widths of 2x 2.5m x 29.7m and 2 x 2.5m x 22.0m.
- G.1.1.5. Accommodation for passengers to be provided on the North side of the vehicle deck and on the passenger deck above.
- G.1.1.6. A single Pilot House is to be situated on a raised platform at amidships on the North side of the vessel. Access to the Pilot House is to be provided for the crew only.
- G.1.1.7. The vessel is to be propelled by two chain wheels, each driven by a hydraulic motor.
- G.1.1.8. The movement of the vessel is to be provided by the chain drive wheels only using the existing size chain.
- G.1.1.9. The vessel to be designed to carry conventional vehicles and long wheel based ‘Sprinter’ vans, with a maximum weight of 7.5 tonnes.
- G.1.1.10. The vessel must be designed so all that systems are easy to operate and provide maximum serviceability/reliability, suitable to be operated by crew who do not hold Marine Certificates.
- G.1.1.11. The builder is to ensure that the vessel can dry out and refloat from either slipway without damage to the hull or slipway.

G.1.2. PRINCIPAL DIMENSIONS - APPROXIMATE

a.	Length over Prows (ramps raised)	37.40 metres
b.	Length over Hull	29.7 metres
c.	Breadth Moulded (Vehicle Deck)	14.00 metres
d.	Depth Moulded	2.65 metres
e.	Height of Passenger Deck above Vehicle Deck	2.35 metres
f.	Height of Pilot House above Passenger Deck	3.35 metres
g.	Draft loaded with design payload	approx. 1.40 metres
h.	Inverse parabolic sheer on Vehicle Deck	0.4 metres in 14.85 m

G.1.3. ENVIRONMENTAL CONDITIONS

G.1.3.1. All equipment and machinery should be designed to operate at their designed rating for the following ambient conditions: -

a.	Air Temperature	35°C (max)
b.	SW Temperature	25 °C (max)
c.	Air Temperature	-5 °C (min)
d.	SW Temperature	0 °C (min)

G.1.3.2. The Vessel is to be designed so that the service can be maintained under the following combined environmental conditions: -

a.	Tidal Stream: Southbound (flooding)	4 knots
b.	Tidal Stream: Northbound (ebbing)	5 knots
c.	Wind Speed iwo vessel	Up to 55knots steady wind
d.	Max. Wave height	0.5 metres

G.1.4. INTERNAL HEADROOM

G.1.4.1. Clear height in all internal accommodation spaces to be not less than 2.10m.

G.1.4.2. Clear height in the Pilot House is not to be not less than 2.10m.

G.1.4.3. Clear height in main machinery spaces to be not less than 1.90m.

G.1.5. DRAFT AND DEADWEIGHT

G.1.5.1. The vessel to be capable of carrying a total deadweight of not less than 52.65 tonnes on a mean moulded draught of approx. 1.40 metres in salt water of specific gravity 1.025, as follows:

- | | | |
|----|--|--------------|
| a. | Road vehicles (based on 20x1.5 Tonne vehicles) | 30.0 tonnes |
| b. | 4 Passengers per vehicle | 6.0 tonnes |
| c. | Passengers(140) and crew (2) | 10.65 tonnes |
| d. | Oil fuel (Density 0. 84) | 6.0 tonnes |
| e. | TOTAL DEADWEIGHT | 52.65 tonnes |

G.1.5.2. In addition, the Vessel's lightship should allow for 9 tonne chain weight, at midships, mid voyage at high water. The chain weight is estimated to reduce to approximately 5 tonnes on the outward end.

G.1.5.3. The contractor is to supply, fit and secure to the Client's / Classification Society satisfaction, a quantity of permanent ballast to ensure the vessel floats with zero trim in the lightship condition and a heel angle which allows for any offset weight due to the asymmetric layout, machinery arrangement and tank distribution.

G.1.6. CAPACITIES

G.1.6.1. The vessel shall have a payload capacity of not more than:

- a. 140 passengers and 20 cars (<2.3m), or
- b. Combinations of cars and long wheel based vans with a maximum weight of 7.5 Tonnes.
- c. 400 passengers and no vehicles.

G.1.6.2. The mass of each passenger shall be taken as 75kg.

G.1.6.3. The arrangement of vehicles on the vehicle deck shall provide a minimum space of 800mm between vehicles and ferry structure.

G.1.6.4. The vessel is to be designed with minimum stowage of the following consumables:

- | | | |
|----|---------------------------------|-------------------------------------|
| a. | Oil fuel - two tanks each | 3.0 m ³ |
| b. | Bilge Retention Tank | 1.0 m ³ |
| c. | Hydraulic oil working reservoir | As per manufacturers specifications |

G.1.7. SPEED AND PERFORMANCE

G.1.7.1. Vessel to be designed to achieve a crossing time of no more than 2.5 minutes, at half tide, when carrying the design deadweight with level trim on a draught not exceeding 1.40m, with the main engine operating at not more than 85% Maximum Continuous Rating (MCR).

G.1.8. ENDURANCE

- G.1.8.1. The capacities of all on board storage tanks shall be sufficient for an interval of not less than 7 days between replenishments allowing for a 5% margin on manufacturer's quoted fuel consumption and 10% fuel remaining based on the summer operational profile.

G.2. CLASSIFICATION, REGISTRATION & CERTIFICATION

- G.2.1. The hull, machinery and electrical installation to be built and installed in accordance with the rules and requirements of a major European Classification Society, which is a member of IACS, agreed by the Client prior to the award of contract, depending on the place of build.
- G.2.2. The vessel is to be UK registered by the Maritime & Coastguard Agency (MCA) and shall comply with the MCA Code of Practice for the construction, machinery, equipment, stability and operation of Chain/wire ferries, carrying passengers and vehicles.
- G.2.3. Vessel to be constructed in accordance with, but not necessarily limited to, the latest of the following regulations:
- a. UK MSN 1823(M) "Safety Code for passenger Ships Operating Solely in UK Categorised Waters" as applicable to operation in Category C waters including Annex 5 & 6.
 - b. UK MGN 306(M) "Designing and Operating Smaller Passenger Vessels: Guidance on Meeting the Needs of Persons with Reduced Mobility".
 - c. EU Marine Equipment Directive 96/98 EC and amendments
 - d. IMO Resolution A468 (XII) Code on Noise Levels on board ships
 - e. Convention on the International Regulations for Preventing Collisions at Sea 1972 – 2004 Consolidated Edition, where applicable.
 - f. ISO 6954 – Guidelines for the overall Evaluation of Vibration in Merchant Ships 1984
 - g. International Electrotechnical Commission Publications and Amendments:
 - i. IEC Publication 92 – Electrical Installation in Ships
 - ii. IEC Publication 363 – Short Circuit Current Evaluation
 - iii. IEC Publication 439 – Low Voltage Switchgear and Control Gear Assemblies
 - h. Institution of Electrical Engineers Regulations for the Electrical and Electronic Equipment of Ships with Recommended Practice for their Implementation

- G.2.4. Latest or current rules means those in force, including any circular in force and any changes or additions to the Rules which are known to be coming into force, during the duration of the Shipbuilding Contract.
- G.2.5. If the need to obtain any dispensations or equivalencies from any of the Regulations listed above is foreseen, the Contractor to notify the Client.
- G.2.6. All costs associated with gaining the above certification to be to the Contractor's account.
- G.2.7. All lifting gear and securing points to be load tested, permanently labelled adjacent to the fitting and all certificates to be provided and handed over prior to delivery.
- G.2.8. Upon completion of the Vessel the Contractor to supply in duplicate all applicable Registration and Statutory Certificates.
- G.2.9. In addition, the vessel is to comply with:
 - a. The Health and Safety Executive Recommendations
 - b. The safety standards and equipment based on the latest requirements of the U.K. MCA Code of Practice for Chain / Wire Ferries.
 - c. Classification Society requirements for ramps.
 - d. The lifting operations and lifting equipment regulations 1998 – SI2307
 - e. The provisions and use of work equipment regulations 1998 – SI2306.
- G.2.10. The Contractor is to pay all survey fees and provide all the necessary certificates on completion of the Vessel.
- G.2.11. The Contractor is not to apply for or implement any deviation from the text of the Classification Society Rules or Regulatory Body requirements without the prior agreement of the Client.

G.3. DESIGN STANDARDS

G.3.1. HULL FORM

- G.3.1.1. The Hull is to be of hard chine construction generally as indicated on the General Arrangement drawing.
- G.3.1.2. The Hull is to be sub-divided by 6 transverse watertight bulkheads and 2 partial watertight longitudinal bulkheads in order to restrict the heel and trimming effects of two-compartment damage including the machinery spaces. See General Arrangement and Machinery Arrangement drawings for details.
- G.3.1.3. Hull form to have Transverse Asymmetry to balance the weight distribution of the offset superstructure. See General Arrangement Drawing.

G.3.2. WEIGHT CONTROL

- G.3.1. In order that the Vessel can meet the specified deadweight on the design draft and the stability requirements, weight control is to be exercised by the Contractor, in drawing, constructing and fitting out the Vessel.
- G.3.2. Vessel is to be built strictly in accordance with the scantlings as required by Class, plus any Client's extras as specified herein.
- G.3.3. Within 30 days of Contract signing, the Contractor is to submit to the Client a detailed weight estimate for the Vessel in support of the information provided with their tender. The Contractor to be held responsible for any weight gain which may affect performance, deadweight or stability.
- G.3.4. The Contractor, in exercising weight control during the period of design and construction, is to continuously update the predicted lightship weight, deadweight and associated centres and advise the Client on a monthly basis or as problems or difficulties arise. Full analysis of the effects of these variations to be identified at the time of notification.
- G.3.5. No solid permanent ballast to be carried without the prior approval of the Client. Location and method of securing of any permanent ballast to be submitted to the Client for comment and approval.

G.3.3. NOISE AND VIBRATION

- G.3.3.1. The Vessel is to operate near residential areas and the contractor is to take all reasonable precautions to ensure the noise emission from the vessel is kept to an absolute minimum.
- G.3.3.2. Maximum noise levels throughout the Vessel under normal operating conditions with the main engines developing 80% MCR must not, as a minimum standard, exceed those values stated in the IMO Code on Noise levels on Board Ships Resolution A.468 (XII).
- G.3.3.3. Noise level limits on the vessel are dependent on an area's functionality. Noise level limits are presented in Table 1. These levels represent the maximum permissible average overall A-weighted sound pressure level in an area due to the combination of structure borne noise and airborne noise. Table 2 shows the locations for noise measurements to be taken.

Area	Noise Limit (dBL _{Aeq})
Vehicle Deck and Passenger Upper Deck	70
Pilot House	60
Machinery Spaces	105
Passenger Seating Areas (Enclosed)	65
At corners adjacent to chain entry	85

Table 1: Area Noise Limits

Area	Location
Vehicle Deck	Centre of vehicle deck
Upper Deck	Centre of Upper Deck
Pilot House	At control position
Engine Room – Normal Operation	1.0 m from running machinery.
Passenger Seating Areas (lower, enclosed)	Centre of space
At each corner adjacent to chain entry	Over chain trough, 1m from chain entry point.

Table 2: Noise Measurement Locations

- G.3.3.4. All measurements to be carried out generally in accordance with the procedures set out in IMO Resolution A.468 (XII) – Code on Noise levels on Board Ships.
- G.3.3.5. Special attention to be given to noise emission from the machinery spaces ventilation fan intakes and discharges on open decks. With the Vessel operating at the service speed and with all machinery working, the noise level measured at 1.0m from the intakes / outlets louvres not to exceed 75dB(A).
- G.3.3.6. Special attention is to be given to the noise emission from the passage of the chain through the cheek plates, over/under the various jockey wheels and along the chain troughs. It is anticipated that noise attenuation measures will include, but not necessarily be limited to, resilient mounting of the jockey wheels and insulation of the chain troughs.
- G.3.3.7. External noise readings also to be taken by the Contractor in generally still air conditions generally in accordance with BS4142 "Method of Rating Noise Affecting Mixed Residential and Industrial Areas".
- G.3.3.8. Contractor to take noise level readings as set out in Table 2 during operational trials, after installation onto the chains, at Cowes. All results to be submitted to the Client for approval.
- G.3.3.9. If the specific noise levels are exceeded, the Client will require the Contractor, at his expense, to arrange for additional silencing, insulation or other modifications as may be necessary to reduce the noise levels.
- G.3.3.10. Vibration calculations, incorporating finite element methods, are to be carried out by the Contractor or by a specialist vibration consultant to show that the main hull critical frequencies will be sufficiently clear of all major excitation frequencies. Also, no fundamental or lower order hull girder modes of vibration of the Vessel should have natural frequencies which coincide with any (fixed) major equipment running speeds.
- G.3.3.11. Maximum vibration levels throughout the Vessel under normal operating conditions must not, as a minimum standard, exceed those defined in ISO 6954-1983(E) "Guidelines for overall evaluation of vibration in Merchant Ships" corresponding to "Adverse Comments not Probable" i.e. peak values are to lie below the shaded zone.
- G.3.3.12. Contractor to take all precautions to ensure that excessive local vibration does not occur and to rectify any excessive local vibration at his expense.
- G.3.3.13. Contractor to measure levels of vibration in all spaces throughout the Vessel during operational trials. Number and location of measuring points to be agreed with the Client.
- G.3.3.14. The trial results to be evaluated and remedial action, as necessary, to be taken by the Contractor, at his expense.
- G.3.3.15. If necessary, further trials at the Contractors expense to be undertaken to verify that remedial action has been effective for both noise and vibration considerations.
- G.3.3.16. Torsional frequencies are to be calculated and proven to be acceptable.

G.3.3.17. The Contractor is to provide the Client with copies of the calculations results, and all other information necessary for an independent assessment of the calculated noise and vibration levels. Where required the calculations may be tabled for inspection.

G.3.3.18. Suitable measures to be taken to dampen noise and vibration where ever possible, such measures should include but not be limited to:

- a. Chain trough structure.
- b. Selecting well balanced machines which impart least vibration energy into the ships structure.
- c. Resilient mounts for the main engines and generator sets.
- d. All hydraulic piping to be supported by means of a proprietary clamping system which limits vibration transmission.
- e. Ramp lifting chain mechanism

G.3.3.19. The vessel is to comply with the general provisions of the Code of Practice for Noise Levels in Ships. The Noise at Work Regulations are applicable and cover the legal obligation of employers to prevent damage to hearing of their employees when at work and also cover noise exposure to any persons as a result of work, activities or operation of plant/equipment (e.g. passengers on the vessel).

G.3.4. STABILITY AND TRIM

- G.3.4.1. The vessel to be designed to have adequate positive stability to enable the vessel to proceed safely under all normal service conditions and to achieve a two compartment damage stability standard. It is to be considered that the vessel could have an initial trim of $\pm 150\text{mm}$. The Vessel is to comply with the requirements of the MCA Code, except that after two compartment damage the margin line may be immersed provided that it is limited in extent, there is no danger of progressive flooding within the immersed area and all other stability criteria are met.
- G.3.4.2. However, it is noted that when damaged, the chain wheel drive compartment amidships downfloods in the equilibrium condition within the 15° range of heel required by the MCA Code. This is not acceptable and requires progressive flooding of this space to be considered in order that other stability criteria can be evaluated for compliance. Cross-flooding of wing void spaces may be required for compliance with the Code criteria.
- G.3.4.3. Deck wetness values in the final damaged condition are to be less than 300mm. This is not an invitation to target 300mm and every opportunity should be taken to reduce wetness as far as practicable. In addition:
- a. The vehicle deck is to be a continuously welded watertight structure with access only arranged below to the engine room and drive wheel compartments. Access to void spaces shall be via bolted watertight manhole covers from the engine room.
 - b. Where necessary, void space air pipes shall be raised sufficiently high to ensure non-immersion within the residual range specified in the Code.
 - c. Emergency equipment shall be relocated away from areas subject to immersion at equilibrium or within the residual range specified.
- G.3.4.4. Contractor to submit to the Client for approval not later than 30 days after contract, detailed predictions of lightship and conditions of loading. The lightship calculations are to include any margins required by the MCA Code, and any trim or heel correction ballast necessary.
- G.3.4.5. When the Vessel is substantially completed but before operational trials an inclining experiment to be performed on the Vessel by the Contractor at their expense to determine the vertical, longitudinal and transverse positions of the centres of gravity and the lightweight of the vessel and available deadweight. The experiment is to be performed in the presence of the MCA Surveyor and the Client's representative. Certificates for inclining weights are to be provided.
- G.3.4.6. Contractor to prepare and submit to the Flag Authority and the Client for approval a report of the inclining experiment detailing the lightweight and centres of gravity for the "as built" Vessel.

- G.3.4.7. Based on the approved lightship weight and centres, the Contractor is to prepare a Trim and Stability Booklet, for MCA approval, in accordance with statutory requirements detailing the various operational conditions of loading including dry-docking condition, for the guidance of ship's personnel. The Booklet is to include all intact and damage stability data necessary to permit the safe and efficient operation of the Vessel. Booklet to include an assessment of ship survivability in all conditions of damage.

G.4. CONSTRUCTION

G.4.1. MATERIALS AND WORKMANSHIP

- G.4.1.1. All materials to be of a quality complying with the requirements of the Classification Society and/or the relevant International Standard and/or specification. Steelwork and hull construction, as a minimum, to be in excess of IACS No. 47 "Shipbuilding & Repair Quality Standard".
- G.4.1.2. All items of equipment and outfit to be manufactured, installed, tested and completed in accordance with the Classification and Statutory Requirements and to the satisfaction of the Manufacturers' and Client's representatives.
- G.4.1.3. Special attention to be given to the finish of steel structure to give a neat appearance. All exposed plate edges to be well rounded to allow for adequate paint adhesion and any sharp corners on steel structure to be well rounded to prevent a safety hazard to passengers and crew and provide for minimum maintenance.
- G.4.1.4. Steel structure, including decks, shell and superstructure, to be faired to the satisfaction of the Client's representative.
- G.4.1.5. Special attention to be given to the steel structure with regard to plate deflections between stiffeners. Every effort is to be made to minimise plate deflection on visible structure, especially on the ship's side, and on decks to avoid 'puddling' due to rain.
- G.4.1.6. Lugs temporarily welded to permanent steel parts for positioning or mounting to be carefully removed by flame cutting and finally ground flush.
- G.4.1.7. All materials and items of equipment used in the construction of the Vessel to be new, undamaged and of marine quality for the specified purpose.
- G.4.1.8. All equipment to be fixed by means of bolts and nuts and not welded studs.
- G.4.1.9. Except where forming an integral part of the sub-contractor's standard construction, all bolts, studs and nuts to have metric threads to S.I. standard.
- G.4.1.10. Dogs, bolts, studs, cap nuts, pins, hinge pins, screws, hooks etc. subject to corrosion, sticking or freezing in damp or exposed locations are to be of sea water resistant stainless steel 316L, and are to be assembled using an anti-seize compound.
- G.4.1.11. Special attention to be given to the standard of installation and finish of equipment, piping, ducting and cabling within machinery spaces and the provision of access for operation and maintenance.
- G.4.1.12. Instruments, gauges and measuring devices are to be from one supplier and to read in metric/SI units. Switches, fuses, indicator lights, contactors, etc., are to be standardised on all equipment.

G.4.1.13. All major equipment and major components are to carry a prominent identification stamped-in, or on an engraved plate, showing the manufacturer's name, the model, size and type. Where this identification is obscured the Contractor is to supply engraved plates repeating this information and to permanently attach the plates to the items of equipment in a fully visible location, or alternatively relocate the existing plates. All name plates are to be mechanically attached.

G.4.1.14. Special attention to be given to the standard of finish and neat appearance of outfit and fittings throughout the passenger and crew accommodation, pilot house and working spaces. Finish throughout is to be attractive and durable, arranged for easy cleaning and minimum of maintenance.

G.4.1.15. All materials intended for, or allocated for the construction of the Vessel, to be properly stored and protected from the environment immediately upon arrival at the Contractor's yard. All equipment to be protected against damp and condensation.

G.4.1.16. Any items supplied by the Client for installation in the Vessel by the Contractor to be similarly stored and protected from weather immediately upon delivery to the Contractor's yard. The Contractor to be responsible for insurance, storage, handling, installation, testing and commissioning costs of these items.

G.4.2. INSPECTION AND SUPERVISION

G.4.2.1. For the purpose of supervision during the building, launching, outfitting and commissioning of the Vessel, the Client or their representatives shall, during all reasonable times, be given free access to all premises of the Contractor and to the premises of sub-contractors where equipment is under manufacture or test.

G.4.2.2. The Contractor is to afford every facility for such inspections at all stages of the build process and as a minimum at all sites where the Vessel may be designed, constructed and fitted out to provide separate offices for Client's representatives and Client's stand-by staff, each complete with storage, internal and external telephone, e-mail, toilet and wash facilities. The cost of all services and consumables in relation to the office shall be for the account of the Contractor except that the Client shall be responsible for providing or meeting the cost of stationery.

G.4.2.3. The Client's representatives are to have authority to reject or have corrected defective workmanship, methods and materials which do not conform with specified shipbuilding standards or with the intent of the approved plans and specifications.

G.4.2.4. The Client reserves the right to make reasonable changes without incurring extra charges providing that these alterations are arranged before work is commenced or materials for the same have been ordered or, alternatively, to make other alterations subject to cost variations being approved in writing by the Client.

G.4.2.5. The Contractor is to take into account all reasonable requests from the Client or their representatives regarding the materials used and the execution of the work.

- G.4.2.6. The Client or their representatives are to put all their requests in writing. The Contractor is to reply to such requests in writing.
- G.4.2.7. All variations to contract (VTC) and proposed variations to contract which entail extras or rebates to be recorded on a VTC form agreed between the Client and the Contractor and submitted to the Client for approval. Such forms are to detail effects on contractual requirements including delivery, deadweight, draft, speed and stability etc.
- G.4.2.8. "No cost variations" to be similarly recorded and submitted to ensure that all variations from the Contract Specification are approved by the Client and their contents minuted.
- G.4.2.9. The Contractor is to nominate for the Client's consideration a Project Co-ordinator with authority to co-ordinate all design and construction work of all trades and to be in a position to make immediate decisions on the project. The Co-ordinator must be thoroughly familiar with the work of various trades and with the work to be done under these specifications and be fluent in the English language.
- G.4.2.10. The winning contractor, led by the project co-ordinator, will be invited to visit the Cowes site prior to the contract being signed. Any of the potential contractors may visit the site as part of their tender preparations having agreed timings with the Client.
- G.4.2.11. The Contractor to maintain a Database in an agreed format to record all defects and non-conformities, proposed actions and rectifications and a record of close-out. The database to be the responsibility of the Contractor but to be accessible by the Client Representatives in read only format.

G.4.3. INDEX

- G.4.3.1. The Contractor is to keep a Database of the type, serial number and other identification of all material and equipment and component parts used in the construction and outfitting of the Vessel. This record is to provide the base reference system to which all other documentation is to conform. All documentation to be in English using the S.I. system of metric units. This record to show the manufacturer's address, telephone, telefax numbers and e-mail addresses, together with details of any warranties relevant to materials and equipment which are to be passed on to the Client.

G.4.4. SPECIFICATION

- G.4.4.1. The Contractor is to supply as soon as practical, but not later than one month after the date of contract, electronic copies of the Building Specification in .pdf and text format.
- G.4.4.2. The Contractor is to continuously update the Building Specification to incorporate alterations as the work progresses, in general within 5 working days of an agreed variation to contract (VTC).

G.4.4.3. On completion of the Vessel the Contractor to supply three "as fitted" (including all VTCs) hard copies of the specification and electronic copies in an in .pdf and text format.

G.4.5. CLIENT SUPPLY DRAWINGS

G.4.5.1. The following technical information is attached to the technical specification for the guidance of the contractor and is also to be used to assist the Contractor in the preparation of the production design and drawings: -

- | | | |
|----|---|--------------------------------|
| a. | Guidance General Arrangement - | Drawing No. BCP/J/10384/00/001 |
| b. | Guidance Outline Machinery Arrangement | Drawing No. BCP/J/10384/00/200 |
| c. | Outline Details of Owner Supply Items | Drawing No. BCO/J/10384/00/201 |
| d. | Chain Drive Wheel, Cast Segment Details | Drawing No. To Follow |
| e. | Chain Support Wheel Details | Drawing No. To Follow |
| f. | Chain Support Wheel Bearings | Drawing No. To Follow |

G.4.5.2. Client's representative to supply winning contractor guidance hull and super structure geometry drawings.

G.4.6. CONTRACTOR SUPPLY DRAWINGS – WORKING DRAWINGS

G.4.6.1. Prior to contract the Contractor is to submit to the Client for approval a complete list of all major and minor construction and working drawings, technical orders, and other supporting technical information which he will prepare for the execution of the contract. A detailed and dated schedule for submission of such data to be forwarded for approval.

G.4.6.2. Electronic copies (in native CAD of agreed format and in .pdf format) of all major construction and working drawings necessary for the construction and fitting out of the Vessel to be submitted to the Client for approval. The Client or their representatives are to return a copy of each drawing to the Contractor within 14 days of receipt, with amendments and "Approved", "Approved as amended" or "Not Approved" indicated thereon.

G.4.6.3. Drawings which are further amended by the Contractor after submission to be re-submitted with details of such amendments added and the area of modification outlined in colour for easy identification. Re-submissions of drawings to be processed in the same way as first submissions.

G.4.6.4. "Approved" and "Approved as amended" will entitle the Contractor to proceed with the work so detailed but the Contractor to guarantee that all consequences resulting from the use of unapproved drawings, either in his organisation or by his sub-Contractor, to be for the Contractor's account and not subject to force majeure considerations.

- G.4.6.5. Approval of any document by the Client will not relieve the Contractor of his contractual responsibility in performing such items of work that may have been overlooked in examining that document, or make necessary modifications because of malfunctioning or interference with other parts or lack of accessibility, all at Contractor's expense, to complete Vessel to best accepted standards as required by the specification.
- G.4.6.6. Electronic copies (in .pdf format) of all relevant calculations including weights and centres, stability, performance, vibration, noise predictions, torsional calculation, etc., are to be submitted to the Client for consideration.
- G.4.6.7. The Contractor is to submit for Client's consideration copies of all orders for items of equipment to be fitted in the Vessel, complete with all technical details, but without price.
- G.4.6.8. The Contractor is to be responsible for submitting all necessary working drawings to the Classification Society and Flag Authority. One electronic copy of each approved drawing is to be forwarded to the Client via their representatives for their information. In general these drawings are to receive Class or Authority approval prior to submission for Client approval.
- G.4.6.9. The Client's representatives will check all work and installation of equipment on the basis of the approved drawings supplied to the Client.
- G.4.6.10. The shipyard is to reply to the Client's comments in writing within ten working days of receipt.

G.4.7. CONTRACTOR'S SUPPLY DOCUMENTS – "AS FITTED"

- G.4.7.1. On completion of the Vessel the Contractor to provide two (2) sets of white paper prints of the "as fitted" drawings and technical documents, each set to be neatly folded, indexed and stowed in boxes of approved size.
- G.4.7.2. One set of "as fitted" drawings and technical documents are to be kept on board the Vessel; the remaining sets are to be despatched to the Client for use ashore.
- G.4.7.3. Additionally the Contractor is to supply one complete set of "as fitted" drawings and technical documents in an agreed CAD and .pdf format.
- G.4.7.4. "As fitted" drawings are to include, but not be limited to, the following:-
- a. General Arrangement
 - b. Accommodation Arrangement
 - c. Lines Plan
 - d. Capacity Plan
 - e. Fire & Safety Plan

- f. Docking Plan (detailing all shell openings, transducers, impressed current anodes and appendages)
- g. Life Saving Arrangement
- h. Structural Sections
- i. Profile and Decks
- j. W.T. Bulkheads
- k. Shell Expansion
- l. Prow Ramp and Fingerplates Structural Arrangement including Hinges
- m. Structural Arrangement of Mast
- n. Painting Specification
- o. Paint Lines and Draft Marks
- p. Position and Details of Windows Glazing
- q. Structural Fire Protection
- r. Thermal & Acoustic Insulation
- s. W.T. Doors
- t. Deck Machinery
- u. Layout of Pilot House
- v. W.T. Hatches
- w. Position of Fixed Lifting Eyes and Pads
- x. Mechanical Ventilation Arrangement
- y. Machinery Arrangement
- z. Isolation Mounts for Main & Auxiliary Machinery
- aa. Bilge Diagrammatic
- bb. Fire and Washdeck Diagrammatic
- cc. Fuel Oil Filling and Fuel Oil System Diagrammatic
- dd. Hydraulic System Diagrammatic
- ee. Arrangement of Scuppers & Discharges
- ff. Air/Sounding Pipes
- gg. Pilot House Window Washing System
- hh. Machinery Spaces Ventilation Arrangement
- ii. Exhaust Pipes and Silencer Arrangement
- jj. Main Chain Motor Remote Control Diagram
- kk. Main Chain Wheel Arrangement

- ll. Chain Trough, Guide Wheels and Cheek Plate Arrangement
- mm. Main Switchboard
- nn. Electrical. Distribution schematic.
- oo. Shore Supply System
- pp. Aerial Layout
- qq. Arrangement of Pilot House Consoles
- rr. A.C. Distribution System (415V, 230V, & 110V)
- ss. D.C. Distribution System (24V)
- tt. P.A. System "Talk back" System
- uu. Position of Radiographs Taken During Construction

G.4.7.5. "As fitted" technical documents are to include, but not be limited to, the following:-

- a. MCA approved Trim and Stability Book (including report of Inclining Experiment)
- b. Trials Reports (Yard, Dock and Operational)
- c. Noise & Vibration Reports
- d. Hydraulic Hose Register listing Cure Date, Life and Location
- e. Register of Lifting Eyes/Pads

G.4.7.6. Framed copies of the following "As Fitted" drawings mounted behind a shatter resistant plastic glazing to be supplied and fitted, in locations as agreed with the Client:-

- | | | |
|----|-------------------------|-----------------|
| a. | Fire & Safety Plan | Pilot House |
| b. | Life-Saving Arrangement | Passenger Space |

G.4.7.7. A "Fire Wallet" to be supplied and stowage arranged in a plastic W.T. container adjacent to the emergency position and to contain Fire & Safety Plan. Similar "Fire Wallet" is to be supplied by Contractor for use ashore.

G.4.8. INSTRUCTION MANUALS

G.4.8.1. The Contractor is to supply three (3) sets of all manufacturers' construction, operation and maintenance manuals, handbooks, brochures, pamphlets and drawings for all items of equipment, machinery and outfit. All documentation is to be in English. Provision is to be made to stow one set on board the Vessel. The remaining sets are to be forwarded to the Client for use ashore. A .pdf format electronic version of the manuals shall also be supplied, either on DVD or memory flash drive.

G.4.8.2. Sets to be indexed and stowed in boxes of approved size.

G.4.8.3. These documents to be ordered at the same time as the equipment and one copy of each to be supplied to the Client's representative standing by the Vessel well in advance of the completion of the Vessel.

G.4.8.4. In addition to the manufacturers operating and maintenance manuals the Contractor is to provide concise operating instructions mounted on individual plastic covered sheets for the following systems and equipment:

- a. Firefighting operations covering full sequence of events from initiation to closedown
- b. Lifesaving covering deployment of Buoyant Apparatus.
- c. Communications covering, radios etc.
- d. Chain Drive Wheel System covering Pilot House control and local control.
- e. Deck machinery including prow ramps, etc.

G.4.9. SPARE GEAR LISTS AND SPECIAL TOOLS

G.4.9.1. A List of spare gear and special tools are to be prepared by the Contractor for all equipment fitted and referenced in accordance with the General Index. The lists to contain the following:-

- a. Part Description/Equipment Number.
- b. Manufacturer's Reference Number.
- c. On Board Spares as Advised by the Client.
- d. Listing of parts to be stored ashore.

G.4.9.2. The Contractor is to supply the completed list in electronic format with search and reference capability, supported by two (2) hard copies.

G.4.10. PHOTOGRAPHS

G.4.10.1. Once a month during the construction of the Vessel the Contractor to submit to the Client digital colour photographs showing the progress of construction of the hull, outfit and installation of main and auxiliary machinery in digital format on CD.

G.4.10.2. On completion of the Vessel the Contractor to provide, in electronic format on CD, photographs of the completed Vessel including accommodation, machinery spaces and equipment.

G.5. TESTS AND TRIALS

G.5.1. GENERAL

- G.5.1.1. On completion of construction, all oil fuel tanks, and void spaces to be pressure tested and inspected, according to Classification Society requirements and prior to the application of the paint system. Prior to testing all tanks to be thoroughly cleaned with the removal of all, grit and debris followed by fresh water washing and drying. The Client's representative is to approve such tests and cleaning of each space before the paint system is applied.
- G.5.1.2. All piping systems to be hydrostatically tested according to Classification Society requirements, fully flushed and openings sealed to prevent ingress of foreign materials all in the presence of Client's representative.
- G.5.1.3. All hydraulic and fuel oil systems to be flushed with an appropriate flushing fluid after installation. After flushing, new filter elements to be fitted throughout each system. Flushing to the specified standards to be completed before connecting the system.
- G.5.1.4. For hydraulic oil systems the flushing to be carried out by the equipment/system supplier and comprise a two stage process. Contractor's pipe system to be flushed to an acceptable standard with slave filters in use, then the entire system to be flushed, using slave filters to a standard acceptable to the relevant manufacturer, Classification Society and Client's representative. Details of proposed methods and acceptance standards to be subject to the Client's Representative's approval. Final particle count to conform to ISO 4406 (BS5540)
- G.5.1.5. Contractor to issue commissioning programme at least one month before commencement of commissioning. Contractor to prepare and submit to Client for approval, detailed test protocols listing prerequisite parameters to be measured and recorded during tests. Protocol to list specified allowable tolerances and actual measurements obtained.
- G.5.1.6. Machinery installation to be tested on completion to demonstrate satisfactory working and compliance with specification requirements. Representatives of the sub contract items to be in attendance at dock and on-site commissioning trials at Contractor's expense.
- G.5.1.7. Electrical machinery, equipment, alarm and monitoring systems and circuits to be tested after installation to demonstrate compliance with specified requirements.
- G.5.1.8. The main diesel engines, auxiliary diesel alternator sets, and switchboards are required by the Client to be subject to shop tests at manufacturers' works. A complete record of test data including verification of noise and vibration levels, to be supplied to the Client and their representatives, who are to be invited to witness these tests.
- G.5.1.9. The Contractor is to give the Client and their representatives a minimum of seven days' notice of any shop test or trial of machinery and equipment.

- G.5.1.10. The Contractor is to maintain a record of all tests and trials including Non Destructive Testing (NDT) of the structure, whether performed by themselves or manufacturers and be responsible for recording and collating all such data. Contractor to obtain from the manufacturers all readings and data of various tests performed prior to the installation of the equipment in the Vessel and these to be supplied to the Client prior to installation.
- G.5.1.11. All data recorded during the trials and commissioning of the Vessel to be neatly tabulated and analysed by the Contractor and issued as a trials report to be forwarded electronically to the Client at delivery of the Vessel. Report to include:-
- Manufacturers' Test Reports of all engines, alternators, motors and equipment carried out before installation in the Vessel.
 - Reports of all results obtained during commissioning and dock trials.
 - Reports of all results obtained during operational trials.
- G.5.1.12. The Contractor is to closely co-operate with equipment manufacturers to obtain operating range of speed, temperatures, pressure and other necessary data, to be provided to the Client.
- G.5.1.13. Contractor to supply all fuel oils, lubricating oils, hydraulic oils, flushing oils and greases for the duration of the trials and any subsequent re-trials. Brand and grade of oils and greases used during the trials to comply with the Client lubricating schedule and requirements in accordance with the Machinery & Equipment manufacturers recommendations for the intended service. The Contractor is to supply corrosion inhibitors and distilled water for the engine cooling systems until acceptance of the Vessel by the Client. Brand and grade of each treatment to be subject to machinery manufacturer's and Client's approval.
- G.5.1.14. All header tanks, sump tanks and systems to be maintained at normal operational level until time of acceptance.
- G.5.1.15. All expenses incurred in connection with the trials programme, any retrials, and period up to delivery of the Vessel to be borne by the Contractor, who is to be responsible for the supply of all necessary instrumentation, Fuel, Lub. Oil, Hydraulic Oil, crew, stores, pilotage, towage, harbour dues, etc.
- G.5.1.16. Qualified representatives of the manufacturers of sub-contract items are to be in attendance during commissioning, dock trials and operational trials at the Contractor's expense. The Contractor is to obtain a written statement from sub-contractors' representatives that equipment has been installed, tested and commissioned to their satisfaction, with a copy to the Client.
- G.5.1.17. All data recorded during the trials and commissioning of the vessel is to be neatly tabulated and analysed by the Contractor and issued as a trials report. Three (3) copies are to be forwarded to the Client at delivery of the vessel. Reports to include:

- a. Manufacturer's Test Reports of all engines and equipment carried out before installation in the vessel.
- b. Reports of all results obtained during dock trials.
- c. Reports of all results obtained during operational trials.

G.5.2. DOCK TRIALS

- G.5.2.1. Dock trials to be held prior to operational trials and a detailed test programme to be prepared by the Contractor and submitted to the Client for consideration and approval at least 30 days prior to the commencement of the trials.
- G.5.2.2. During the dock trials programme and before operational trials are commenced an Inclining Experiment is to be carried out to obtain the lightship particulars of the Vessel.
- G.5.2.3. Dock trials to be carried out in accordance with the requirements of the Classification Society, equipment manufacturers and Client and to be witnessed by Client's representatives. Operation of all machinery and equipment to be conducted by the Contractor or his sub-contractor
- G.5.2.4. All systems essential to the operation and seaworthiness of the Vessel to be tested as far as is practicable during dock trials. The trials to include at least the following:
 - a. Main Machinery each engine to be run continuously for one hour.
 - b. Chain drive wheel motors to be run and direction controls demonstrated.
 - c. Prow hydraulic system and prow operation to be demonstrated from each control location.
 - d. Final alignment checks on the chain sheaves and main drive chain wheels
 - e. Function tests of generator sets
 - f. Switchboard load trials and function test
 - g. Emergency power supply from blackout, via automatic alternative generator start-up.
 - h. All pumps and other engine room system function tests
 - i. Test and calibration of all alarm systems, data channels etc.
 - j. Automatic controls, calibration and function tests
 - k. Firefighting/safety equipment and fire/smoke alarm systems.
 - l. Watertight Doors
 - m. Ventilation Systems
 - n. Check of all accommodation spaces.
 - o. All electrical, lighting, navigation and communication equipment.
 - p. Lighting levels – accommodation, working spaces and external decks to be recorded and verified against specified requirements.

q. Environmental Noise – in port noise to be measured at 65m from the Vessel in still air conditions, with an auxiliary generator running at 100% MCR and air conditioning and ventilation operational.

r. Test of all eye plates, D rings, lashing pots, lifting beams etc.

G.5.2.5. All systems are to be tested during dock trials, prior to delivery to Cowes. It is recognised that it may not be possible to properly test some systems before putting the vessel on the chains, but all systems essential to the operation of the vessel are to be tested as far as is practicable during dock trials.

G.5.3. LAUNCHING AND DRYDOCKING

G.5.3.1. The Contractor is to satisfy the Client by means of calculation or otherwise that no undue stress or point loading will be imposed on the vessel during the launching.

G.5.3.2. The vessel is to be dry-docked not more than 30 days prior to operational trials to remove any launch fittings.

G.5.3.3. Should the period between launch/float out and the operational trials exceed 60 calendar days, then the Contractor to dry dock the Vessel for cleaning of the underwater hull and making good the anti-fouling coating.

G.5.4. DELIVERY TO COWES

G.5.4.1. The Contractor is to deliver the completed vessel to the operation location for operational trials. The Contractor is to be responsible for making all the necessary preparations for the delivery voyage, ensuring that the preparations are to the satisfaction of the Regulatory Authority and the Insurance Underwriters and all such other Acts which apply. The cost of delivering the vessel from the Contractor's Yard to the vessel crossing is to be paid by the Contractor.

G.5.4.2. At least 8 weeks before delivery, a fully detailed delivery plan is to be presented to the Client, showing weather limits, ports of refuge, expected timescale, etc.

G.5.4.3. If required, temporary navigation lighting and power supply during towage are to be installed. Note that the on-board generators and power should not be used during an un-manned tow.

G.5.5. CLIENT'S ACCEPTANCE OPERATIONAL TRIALS

G.5.5.1. If the Contractor elects to carry out Contractor's operational trials prior to the Client's acceptance trials, the Client's Representatives may attend on board to witness proceedings.

G.5.5.2. A detailed Client's acceptance operational trials programme is to be prepared by the Contractor and submitted to the Client for consideration and approval at least four weeks prior to the commencement of the operational trials.

G.5.6. OPERATIONAL TRIALS AT COWES

- G.5.6.1. Contractor to arrange for vessel to be towed to the vessel crossing and attached to the chains.
- G.5.6.2. The Client's personnel will attach the vessel to the chains.
- G.5.6.3. At the commencement of operational trials, radio equipment is to be adjusted and calibrated where applicable. Operation of all machinery and equipment to be conducted by the Contractor or their Sub Contractors.
- G.5.6.4. Arrangements to be made to obtain during the operational trials all data required to determine compliance with the contract requirements for crossing time, power, deadweight, internal and external noise, vibration and also to obtain as far as practical any additional data which would be useful to the Client for subsequent operation of the Vessel.
- G.5.6.5. Based on the inclined lightship particulars, the Contractor is to submit for Client's approval a Trials Condition of Loading. The Vessel to be trimmed level and loaded with 53.0 tonnes (plus chain weight) of deadweight.
- G.5.6.6. Upon delivery of the Vessel to Cowes, satisfactory berthing is to be demonstrated to verify compliance with prow/slipway geometry at both slipways during a period approximately one hour before and one hour after both high and low water.
- G.5.6.7. Loaded speed trials to be carried out to establish the crossing time of the vessel at various tide levels.
- G.5.6.8. To achieve the loaded trials at the specified deadweight, loaded pallets may be placed on the vehicle deck.
- G.5.6.9. From the data recorded on the operational trials it is to be demonstrated that the vessel at the design draft of approx. 1.40 metres is capable of achieving a normal crossing time of not more than 3 minutes at High Water in either direction.
- G.5.6.10. The loading prows to be tested for clearance when loading and unloading vehicles. Particular emphasis is to be given to low cars and trailers.
- G.5.6.11. Where excessive local vibration in structure, equipment and/or installations is noted during the trials, measurements are to be taken by the Contractor and rectification work agreed with the Client. This work is to be carried out at the contractor's expense, and within an acceptable timescale.
- G.5.6.12. The Contractor should allow for an operational trial period of three days, and three extra days for crew training and instruction.

- G.5.6.13. On completion of the operational trial, or after six months in service to the Client's agreement, a partial examination of the main machinery is to be carried out. The examination is to consist of LO and vibration analysis. If such examination indicates concerns, then further examination is to be carried out as necessary, including (but not limited to) removal of main engine pistons and removal of main bearings (both halves) from each engine.
- G.5.6.14. Electrical insulation measurements to be taken and recorded before and after each trial for each item of electrical machinery and associated circuits where practical and two copies of the report handed to the Client.
- G.5.6.15. If the entry into service of the Vessel exceeds fourteen days from the completion of the trials, a new set of insulation readings of major electrical equipment to be taken and appended to the trials report.
- G.5.6.16. If defects are noted during the operational trials the Client reserves the right to demand further trials to demonstrate that the rectification of defects has been carried out to the Client's satisfaction.
- G.5.6.17. The Contractor is to provide all personnel and pay all expenses for the trials at the Contractors Yard and the trials at Cowes.
- G.5.6.18. During the operational trial, records of the noise level in each space of the accommodation, working spaces, machinery spaces and open decks to be made by the Contractor and verified against the specified requirements. Where recorded noise levels exceed the specified requirements remedial action to be taken by the Contractor as defined in G.3.3.3.
- G.5.6.19. During the operational trial, measurement of vibration levels at agreed points throughout the Vessel to be made by the Contractor and compared against specified requirements. Where excessive local vibration in structure, equipment and/or installations is noted during the trials remedial action to be taken by the Contractor as defined in G.3.3.3.
- G.5.6.20. Other tests and trials to be carried out by the Contractor to include the following:-
- a. Ventilation trials to be conducted during the operational trial, with air flows and temperatures recorded.
 - b. Engine room ventilation trial to be conducted during the operational trial. Air supply and exhaust to the machinery spaces to be measured and recorded by the Contractor. Air pressure in the machinery space to be recorded and compared with the ambient pressure. Both Ambient and Engine room temperatures to be recorded at inlet, engine combustion intake and engine room exhaust locations for each engine room.

G.5.6.21. On completion of operational trials a partial examination of electrical equipment to be made at the discretion of the Client. In general, the examination to consist of visual examination of components through inspection openings and racking of switch gear from the working position. The parts to be opened out for Client's inspection to be finalised after satisfactory operational trials have been completed.

G.6. COMPLETION AND FINAL ACCEPTANCE

- G.6.1. The Vessel is to be completed in accordance with the approved plans and specifications to the satisfaction of the Client.
- G.6.2. The Client will conduct a final inspection of all compartments prior to acceptance. Any remaining defects to be made good at the Contractor's expense.
- G.6.3. Client's inspection to be shown on the Cardinal Date Program.
- G.6.4. Before acceptance The Contractor is to clean all compartments in the ship including passenger spaces, accommodation spaces, stores, tanks, bilges and tank tops and remove all rubbish, to the Client's satisfaction. All external paint work to be fresh water washed and touched up according to paint specification.
- G.6.5. Prior to acceptance, the Contractor to remove ashore any surplus domestic consumable stores left on board.
- G.6.6. At the time of acceptance those quantities of fuel, lubricating oils and hydraulic fluids remaining in storage tanks and bunkers may be taken over by the Client at invoiced cost.
- G.6.7. Before final acceptance, Contractor to have placed on board the following items:-
 - a. Trim and Stability Book
 - b. Capacity Plan
 - c. Fire & Safety Plan
 - d. Life Saving Arrangement
 - e. Fire Plan Wallet
 - f. One complete sets of "as fitted" drawings, plus electronic copies
 - g. Trials and Test Report
 - h. One complete set of maintenance and instruction booklets, plus electronic copies
 - i. One copy of Ship's Index
 - j. Two copies of spare parts list
 - k. Original and duplicate copies of all Classification Certificates
 - l. Two copy of all Contractor's Certificates
 - m. Passenger Certificate
 - n. Equipment and Material Index
 - o. Certificates for lifting gear together with certificates for wires where used
 - p. Four sets of keys, clearly labelled.
 - q. Any further documentation required for the clearance of the Vessel from the port of building/acceptance.

G.7. CONTRACTOR'S RESPONSIBILITY

G.7.1. CONTRACTOR'S RESPONSIBILITY

- G.7.1.1. Vessel is to be built generally in accordance with the specifications and attached drawings, but the Contractor is to be responsible for meeting all specified requirements both in tendering and in building and therefore must fully satisfy themselves that the design and attached drawing as presented comply fully with the operational requirements and relevant regulations.
- G.7.1.2. In selecting items of machinery, equipment and outfit, the Contractor is to be responsible for ensuring and demonstrating to the Client that the manufacturer is well represented in the U.K. relating to spares and maintenance.
- G.7.1.3. The Contractor is to be responsible for meeting the Client's requirements and for fulfilling the regulations and requirements of the Classification Society and the U.K. Maritime and Coastguard Agency and to be responsible for all costs associated with this requirement.
- G.7.1.4. The Contractor is to be responsible for the liaison between sub-contractors of equipment, requiring interlinking, to ensure proper interfacing and compatibility of equipment. The Contractor is to be responsible for ensuring there is no conflict between installed systems and be responsible for all costs associated with this requirement.
- G.7.1.5. The Contractor is to be responsible for ensuring that sub-contractors adhere to the standardisation of components agreed between himself and the Client with regard to the type of switches, indicators, gauges, controls, instrumentation, sensors, screw threads, grease nipples, colour of equipment, etc.
- G.7.1.6. The Contractor alone is to be responsible for the construction and quality of work for the ship. The fact that drawings and data have been shown to the Client or approved by the Client or their representative does not relieve the Contractor in any way from the above mentioned responsibility.
- G.7.1.7. The hull and its equipment to be constructed and fitted out in accordance with the provisions of the specification and the contract documents. The Vessel to be completed and made ready for sea in accordance with the specification, Class and regulatory requirements.
- G.7.1.8. The Contractor, in developing the layout of equipment within compartments, is to give special consideration to the access to all equipment for inspection and maintenance including areas for component withdrawal, together with identifiable routes for ease of removal and replacement of such items of equipment.
- G.7.1.9. No additions involving extra costs, or changes in weight, performance or delivery etc. is to be supplied and fitted without previous confirmation in writing from the Client or their delegated representative.

- G.7.1.10. During the building and outfitting of the Vessel, the Contractor to exercise due care and diligence in the protection and the cleanliness of all items of equipment being installed in the Vessel. Particular care to be taken to protect equipment from moisture and dust ingress, weld spatter, paint and general mechanical damage to Client's approval. Any damage to be made good to Client's satisfaction, at Contractor's expense.
- G.7.1.11. Anything not mentioned in the specification but which is required by the Classification Society, the Registration Authority or for the safe and efficient navigation and working of the vessel, is to be supplied and installed at the Contractor's expense.
- G.7.1.12. Construction of the Vessel is to be planned using project management software. All work is to be formally scheduled in a manner which will permit the evaluation of actual progress against plan and monitoring of the Contractor's resources, and which will identify the interdependencies of individual activities and the projected dates upon which payment of each instalment of the Contract Price shall fall due.
- G.7.1.13. At monthly intervals throughout the construction of the Vessel, the Contractor shall present to the Client's Representative a summary plan covering the construction programme for the Vessel. Activities with zero float should be identified and the effects of agreed Variations to Contract incorporated.
- G.7.1.14. The Contractor is to develop and implement the use of a unique database for the recording of defects and/or deficiencies highlighted and recorded at each programmed inspection. The Contractor is to provide a copy of and shared access to this database to the Client, including all intellectual property and other rights necessary for its safe and legal operation both during the currency of and after conclusion of this Agreement (whether concluded by due performance or termination by either Party). A mechanism for the clearing of these defects/deficiencies is to be set up and agreed between the Contractor and Client.

G.7.2. EQUIPMENT SELECTION & ORDERING

- G.7.2.1. The Vessel to operate in the Isle of Wight. It is imperative that all equipment manufacturers/suppliers can offer full spares and support services within the UK.
- G.7.2.2. Items of equipment having a proven record of service, efficiency and reliability in the same or a similar service are essential to the correct functioning of the Vessel.
- G.7.2.3. Before ordering major items of machinery and other principal items of ship equipment, the Contractor is to submit to the Client, for approval, full details of the proposed equipment. These details to include a specification, an arrangement and performance curves as applicable. These details to apply to the particular machinery proposed. General Catalogues will not be acceptable.
- G.7.2.4. The Contractor is to submit for the Client's consideration copies of all orders for items of equipment to be fitted in the Vessel, complete with technical details.

G.7.3. IDENTIFICATION

- G.7.3.1. Machinery and equipment to be referred to as North, East, South, West or Centre and not by numbers.
- G.7.3.2. Decks to be referred to as Upper Deck and Vehicle Deck.
- G.7.3.3. All machinery, valves, switchgear, control gear, metering, etc., to bear identification based on the above. All labels and written information to be in English.

G.7.4. SPARE GEAR AND TOOLS

- G.7.4.1. The Contractor, at his expense, to furnish all spare parts and special tools for the vessel in accordance with Manufacturer's recommendations for two years operation and as nominated by the Client. The agreed list of spares is to be delivered to the vessel company by acceptance of the Vessel.
- G.7.4.2. The Client nominated spare gear is to be ordered at the same time as the equipment to which it applies. These are to include: -
- a. 1 set of cheek plates (8), complete with casting pattern of each size fitted
 - b. 1 off Prow Ramp cylinder - complete
 - c. 1 off flexible hose of each size fitted
 - d. 2 sets of 2 years consumables for the Main engines
- G.7.4.3. Client spares are to be preserved, packaged, identified and delivered for stowage ashore.
- G.7.4.4. Long Term spares are to be preserved for long term storage ashore, packed in wooden boxes and identified. The Contractor is to arrange at his expense transport to the Client's ashore storage.
- G.7.4.5. All spare parts including the recommended additional spare parts are to be protected against damp in tropical packings and suitably cased for transit and storage. Individual parts to be clearly marked with untarnishable labels embedded in protective material with transparent covers. If tie-on labels are used, they are to be of metal or plastic and to be securely wired to the individual part to ensure that labels cannot be accidentally removed. A complete list of all spare parts, stowage position, serial number, type, maker's name, address, fax & phone to be prepared by the Contractor in agreed electronic format and additionally 3 hard copies supplied to the Client.
- G.7.4.6. The Contractor is to make and fit tool boards for secure stowage of all tools arranged on board the Vessel.

G.7.5. TRAINING

- G.7.5.1. The Contractor is to include in their bid costings for the training of the Client's nominated crew in the operation and maintenance of the following specialised equipment and installations:-

- a. Communications Systems
- b. Diesel Engines
- c. Switchboard and Electrical system
- d. Alarm, Monitoring & Control Systems
- e. Ramp System

G.7.5.2. Training is to be undertaken at the manufacturer's premises and/or on board during familiarisation periods as appropriate.

G.7.6. CLIENT'S SUPPLY ITEMS

G.7.6.1. The Contractor at his expense is to provide safe, dry and suitable stowage for Client's supply equipment and to install and commission, where necessary, those items supplied by the Client.

G.7.6.2. The Contractor is to be responsible for the insurance, storage, handling and installation of these items after delivery to the yard.

G.7.6.3. The Contractor is to supply the Client with list within one month of Contract stating required delivery dates at shipyard for items of Client's supply.

G.7.7. GUARANTEE

G.7.7.1. The Contractor is to guarantee all materials, equipment and workmanship used in the construction and outfitting of the Vessel for a period of 12 calendar months from the date of acceptance by the Client of the Vessel.

G.7.7.2. The Contractor is to guarantee the paint system for a period of 5 years after delivery to and acceptance of the ferry by the Owner at Cowes.

G.7.7.3. The Owner is to receive the benefit of any guarantee given by subcontractors.

G.7.7.4. The Contractor is to guarantee the Main Engines as set out in the Machinery section of this Technical Specification.

G.7.7.5. The Contractor is to negotiate and pass on to Client extended warranties/guarantees on major items such as main engines, bridge equipment, electrical outfit and paint.

G.7.8. MOCK UPS

G.7.8.1. The contractor is to produce a full size mock-up of the Pilot House. The mock up is to include consoles, layout of instruments and controls, bulkheads, windows, etc. As necessary.

HULL SPECIFICATION

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H.1. Hull Construction

H.1.1. Scantlings and Construction

- H.1.1.1. The vessels hull and superstructure to be built of steel construction.
- H.1.1.2. All structural scantlings to be determined for a scantling draft of 1.50m.
- H.1.1.3. All structural scantlings to be determined in accordance with the requirements of the Classification Society.
- H.1.1.4. Steelwork and hull construction, as a minimum, to be in accordance with IACS No.47 "Shipbuilding and Repair Quality Standard".
- H.1.1.5. The continuity of main structural members to be maintained whenever possible and where unavoidably broken, compensation to be provided to Classification Society requirements and to the Client's satisfaction. No "Egg boxing" of the structure is to be used.
- H.1.1.6. Insert plates and local stiffening are to be fitted where necessary, in way of shell and deck openings, fendering and under deck machinery, bollards and mast, etc. In general doublers are not to be used in the construction of the vessel.
- H.1.1.7. All steel used in the construction of the vessel shall be standard strength hull structural steel grade A (minimum yield strength 235 N/mm²), manufactured in accordance with the requirements of the Classification Society and shall be grit blasted and primed prior to fabrication in accordance with the paint specification.
- H.1.1.8. Provision is to be made for adequate access to all parts of the vessel including tank spaces and voids for inspection and maintenance both during construction and when the vessel enters service.
- H.1.1.9. The Vessel to be designed to take the ground on a hard slipway. Bottom structure is to be designed accordingly to Classification Society requirements.

H.1.2. Welding

- H.1.2.1. All welding to be double continuous up to Main Deck level and in all exposed areas including weather decks and superstructures within the accommodation.
- H.1.2.2. All electrodes shall be in accordance with Classification Society requirements.
- H.1.2.3. Only tested operators, welding equipment and electrodes to be used. Individual operators' certificates are to be available for inspection and approval by the Client.
- H.1.2.4. Special attention is to be paid to minimisation of distortion and residual stresses due to welding.
- H.1.2.5. All plate edge preparation is to be in accordance with Classification Society requirements, and all materials to be free from oil, grease, or other harmful material at the weld joint.
- H.1.2.6. Welding is not to be carried out in wet, windy or cold weather without adequate protection. In cold weather below 5°C pre-heating and shielding to be provided, in accordance with Classification Society requirements.

- H.1.2.7. Automatic and semi-automatic welding of prefabricated sections are to be used where practical.
- H.1.2.8. Manual welding is to be down hand welding where possible, and sections to be turned accordingly.
- H.1.2.9. The welding acceptance and rejection criteria to be in accordance with Classification Society standards.
- H.1.2.10. A planned programme, in accordance with Class society requirements, of radiograph examinations to be carried out at the Contractor's expense, and the results made available to the Client for approval.
- H.1.2.11. Repaired welds are to be radiographed each time until accepted.
- H.1.2.12. UST may be substituted for radiograph examination at the discretion and approval of the Classification Society and the Client.
- H.1.2.13. Slot welds, where deemed necessary, are to be filled and faired.

H.1.3. Framing

- H.1.3.1. Frame spacing nominated in the General Arrangement drawing is 550mm.
- H.1.3.2. Drain holes are to be cut in the bottom deep structure and frames to ensure satisfactory drainage. Particular attention is to be paid to ensure satisfactory drainage around the chain wheels. In way of prime movers, main drive arrangement, the drain holes are to be closed in sections to form oily bilges. Note: local oil bunds with no drainage to be arranged under diesel engines, hydraulic pumps and chain wheels.

H.1.4. Shell Plating

- H.1.4.1. Scantlings of bottom and side shell plating to be to Classification Society regulations.
- H.1.4.2. Bottom shell is to be specially considered in relation to the vessel taking the ground
- H.1.4.3. Insert plates of increased thickness are to be fitted in way of sea inlet arrangement, chain entry ports and midship tug mooring points. Any towing attachments used during the construction or delivery voyage are to be designed for permanent use for refits during the life of the Vessel, to Classification Society requirements.
- H.1.4.4. Sea inlet boxes to be arranged in bottom plating to suit requirement of main and auxiliary machinery and fire/deck wash systems.
- H.1.4.5. Grids to be manufactured from polyethylene and secured by sea water resistant bronze studs and nuts. Nuts to be locked with wire of same material.
- H.1.4.6. The area of any welded closing plates to be kept to a minimum. Closing plates are to be continuously welded between each frame/floor. Slot welding in general is not acceptable.

H.1.5. Bottom Structure

- H.1.5.1. Girders and floors, bottom stiffeners are to be arranged in accordance with Classification Society requirements. In way of the machinery spaces, girders are to be arranged in conjunction with the machinery seatings.

H.1.5.2. Openings in deep structure for pipe runs are to be adequately compensated to Class and clients approval.

H.1.5.3. Limber holes are to be arranged in solid floors to allow drainage to bilge suctions.

H.1.5.4. Bottom structure is to be strengthened for the vessel to be capable of taking the ground.

H.1.6. Pillars and Girders

H.1.6.1. Pillars and girders to be fitted in accordance with Classification Society requirements.

H.1.6.2. All penetrations in girders and transverses to be adequately compensated to Classification Society approval.

H.1.7. Watertight Bulkheads

H.1.7.1. Vessel is to be subdivided by watertight transverse and longitudinal bulkheads as necessary.

H.1.7.2. Subdivision is to provide the required two compartment damage stability standard.

H.1.8. Main and Auxiliary Engine Seatings

H.1.8.1. The main engines, drive motors, chain wheels and auxiliary machinery seatings to be arranged to suit the requirements of the equipment manufacturers.

H.1.8.2. Cross-sectional area of top plates are to be in accordance with Classification Society and engine manufacturers recommendations.

H.1.8.3. Tripping brackets on main engine foundations and other main foundations are to be positioned clear of holding down bolts.

H.1.8.4. For machinery/equipment fitted with flexible mountings, the seatings are to be designed and constructed with such stiffness as to ensure that the natural frequency of the seatings is sufficiently in excess of the natural frequency of the mounting system that no resonant frequencies are excited.

H.1.8.5. Seats to Classification Society and Client's requirements to be built where required for all auxiliary engines and equipment.

H.1.9. Tanks

H.1.9.1. All tanks to be arranged with access manholes, drain holes, vent holes, filling, transfer and overflow connections, air and sounding pipes to the requirements of the Classification Society. In general two manholes per tank are to be provided to ensure through ventilation.

H.1.9.2. All air pipes are to terminate, as a minimum, at rule height above the first open deck above the tank in question.

H.1.9.3. All air pipes are to terminate, as a minimum, at rule height above the first open deck above the tank in question.

H.1.9.4. Lightening/access holes, to provide access to all parts of the tanks, are to be as large as practicable with a minimum size of 600 x 400mm. No pipes to pass through access/lightening holes.

H.1.9.5. Tanks are to be fitted with access ladders and/or hand rungs to provide safe access to all parts of the tank.

H.1.9.6. The top and bottom of tanks are to be clear of vehicle deck and bottom shell plating.

H.1.10. Void Spaces

H.1.10.1. Void spaces are to be arranged as shown on the General Arrangement Plan.

H.1.10.2. All void spaces are to be fitted with sounding pipes.

H.1.10.3. Air and sounding pipes and bilge suctions are to be provided in accordance with Classification Society and MCA requirements where applicable.

H.1.10.4. Access manholes and galvanised steel ladders to be provided.

H.1.11. Oil Fuel Tanks

H.1.11.1. Oil fuel to be carried in independent tanks arranged above floor level and clear of the ship's hull as shown on the General Arrangement Plan.

H.1.11.2. Two oil fuel tanks, each with an approximate useable capacity of 3.0m³, to be provided.

H.1.11.3. Air pipe vent heads are to have metal float, metal to metal seat, stainless steel gauze flame screen, and self-closing "fire-safe" features.

H.1.11.4. Oil fuel tanks are to be thoroughly cleaned and coated with tank contents immediately before closing. Tanks are to be finally inspected by the Client's Representative prior to coating.

H.1.12. Miscellaneous Tanks (Oily Bilge Retention & Hydraulic Reservoir)

H.1.12.1. All tanks to be located remote from side shell, bottom shell and deck plating.

H.1.12.2. A loose oily bilge retention tank is to be arranged in the machinery space.

H.1.12.3. All tanks are to be fitted with local contents measuring arrangements.

H.1.12.4. Interior of tanks are to be cleaned, prepared and coated.

H.1.13. Hatches and Access Panels

H.1.13.1. Emergency escape hatches of 600 x 600mm clear opening, complete with vertical steel ladder to be provided from machinery spaces and the drive wheel space, to the south side of the Vehicle Deck.

H.1.13.2. Hinged emergency escape hatches to be fitted with closing mechanisms which may be easily operated by hand from below and with key wrench operation from above. Holdbacks to be fitted.

H.1.13.3. All dogs and hinge pins to be of stainless-steel with nylon or bronze bushing arranged for grease nipple lubrication. Rest bars, hold backs etc. to be 316 stainless steel.

H.1.13.4. Three flush bolted machinery space access panels to be arranged in the main deck as shown on the General Arrangement Drawing, sized to suit the removal of the main engines, generators and drive wheel equipment.

H.1.13.5. Panels to be of watertight steel construction, suitably strengthened for the specified deck loading. Panels to be secured using recessed hex-socket countersunk bolts.

H.1.13.6. When fitted on the vehicle deck, all hatches and portable panels are to be designed for regular vehicular traffic and are to be capable of supporting the design load of the vehicle deck.

H.1.14. Manholes

H.1.14.1. Manholes to be arranged to give easy access to all closed compartments, tanks and voids, etc.

H.1.14.2. Manholes to be 600 mm x 400 mm clear opening conforming to ISO 5894.

H.1.14.3. Jointing material for manholes for all tanks holding oil fuel or lubricating oil, to be fire-resistant and impervious to mineral oils.

H.1.14.4. Where it is necessary to locate fuel oil tank manholes on vertical sides of tanks, an oil tight saveall to be fitted below the manhole.

H.1.14.5. Ladders/climbing rungs and hand grabs to be fitted in all necessary locations to ensure easy access to, and passage through, manholes. Where manholes are located on vertical tank surfaces hand grabs to be fitted above manhole openings, both inside and outside the tank.

H.1.14.6. Manholes to be secured using steel nuts/bolts.

H.1.14.7. Each manhole cover to be fitted with identification in bead welding identifying the tank/space/void and its contents. A similar identification shall be welded to the tank structure adjacent to the manhole opening.

H.1.14.8. Manhole covers to be fitted with two lifting handles. Where fitted to vertical bulkheads, hand grabs above and steps below to be fitted internally and externally to assist access. Savealls to be fitted below vertical manholes to oil fuel tanks.

H.1.14.9. Access to manholes is not to be impeded by pipework, machinery, equipment, structure or ladders etc.

H.1.15. Chain Troughs

H.1.15.1. Chain troughs to be fitted North & South sides, below the Vehicle Deck, as shown on the General Arrangement.

H.1.15.2. The centreline span between the chains in the troughs is to be 8.75m.

H.1.15.3. The chain troughs are to extend the full length of the vessel,

H.1.15.4. Chain trough to have a minimum depth of 650mm, and a standard width of approximately 400mm.

H.1.15.5. The standard width and depth are to be sufficient to allow for resilient mounting of the jockey wheels and to provide sufficient access for maintenance/changing of the wheels, and to allow easy removal of accumulated seaweed.

H.1.15.6. Trough to be coated in bitumastic or similar sound deadening material.

H.1.15.7. Portable noise insulated plates complete with quick release 'dog' fixings are to be fitted over the trough, to allow fitting of the drive chain and maintenance of the main chain wheels and associated guide wheels. The panel's size is to be small enough to be manhandled.

H.1.15.8. The opening above the chain wheel is to be large enough to allow the installation / removal of the chain drive wheel segments.

H.1.15.9. Easy access is to be provided into the chain drive wheel space from above to facilitate maintenance, and inspection of the chain wheel segments, and inspection / cleaning of the chain wheel space.

H.1.15.10. Provision is to be made for fitting blanking plates to both outboard and inboard ends of the chain troughs during coastal voyages under tow. Contractor to provide secure stowage for blanking plates during normal service.

H.1.16. Cheek Plates

H.1.16.1. Cast steel cheek plates for guidance of the chains are to be secured to fabricated steel support structure in the fashion of the existing vessel.

H.1.16.2. These cheek plates are to be vibration isolated, and flared to reduce wear and noise.

H.1.16.3. The Contractor is to provide the casting pattern of the Cheek Plates for each size fitted.

H.1.17. Decks

H.1.17.1. All scantlings to be in accordance with Classification Society requirements.

H.1.17.2. Upper deck and Pilot House top to be arranged with straight line camber

H.1.17.3. Decks to be stiffened to Classification Society requirements with increased local stiffening and thick insert plates in way of bollards and masts etc.

H.1.17.4. All openings cut into decks to have well radiused corners.

H.1.17.5. Pilot House top and Upper Deck to have upstands and scuppered drainage.

H.1.18. Vehicle Deck

H.1.18.1. Vehicle Deck to be arranged as shown on the General Arrangement plan as a roadway for private and small commercial vehicles.

H.1.18.2. Deck structure to be designed to take vehicles with a gross vehicle weight of up to 7.5 tonnes, with a maximum single axle load of 6.0 tonnes.

H.1.18.3. A parabolic deck inverse sheer is to be provided.

H.1.18.4. Particular attention is to be paid to the rigidity of the deck in way of the vehicle loading ramp hinge arrangement.

H.1.18.5. Kerbs are to be positioned North and South on the vehicle deck and ramps as indicated on the General Arrangement Plan.

H.1.19. Loading Ramps

H.1.19.1. Vessel to be fitted at both ends with loading ramps. Vessel structure is to be strengthened to withstand loads applied by the ramps during loading.

- H.1.19.2. The design of the ramps is critical to the satisfactory operation of the Vessel. The Contractor is to demonstrate the proper loading of the vehicles.
- H.1.19.3. The ramps are to be designed to optimise the loading and unloading of vehicles, so that no other wheel boards or similar are needed.
- H.1.19.4. The ramps are to comprise of three components; inner ramp, outer ramp and finger flaps.
- H.1.19.5. The inner ramp is to be approximately 3.5m long and to be approximately 7.7m wide along its full length.
- H.1.19.6. The outer ramp is to be approximately 2.5m in length. It is to be approximately 7.7m wide at its inner hinge and approximately 7.0m at the finger flap connection.
- H.1.19.7. Approximately 1.0m long 'fingers' are to be hinged from the outer ramp. To be designed to give minimum noise impact from self-induced and slipway impact noise.
- H.1.19.8. The ramps are to be of welded structure, plated on top and with an open bottom structure. The ramp profile is to prevent any grounding of vehicles during loading and unloading. The minimum clearance of the design vehicles to the ramps is to be at least 50mm.
- H.1.19.9. The structure is to be adequate to support a maximum single axle load of 6.0 tonnes and to be complete with sacrificial grounding bars to effectively spread the ramp load over the slipway.
- H.1.19.10. The ramp structure is to be designed such that no additional support is required for coastal voyages under tow, when the ramps are to be in the fully raised position.

H.1.20. Ramp Operation

- H.1.20.1. In normal operation, the ramps will be set up so that when lowered, the loading and unloading of vehicles can be accomplished.
- H.1.20.2. The time to operate the ramps is not to exceed 10 seconds in normal operation.
- H.1.20.3. The whole ramp arrangement to be raised to a high position when under coastal tow or for river traffic clearance operation.
- H.1.20.4. A fail safe device is to be fitted on the end of each ram. This system is to provide mechanical support to restrict the lowering of the ramps in the event of a failure.
- H.1.20.5. Provision is to be made for the fitting of an emergency support bar which is to be used to support the ramp whilst a hydraulic ram is replaced, or under maintenance. This locking bar is to be of a suitable length so that a ram can be changed with the Vessel in location at Cowes.

H.1.21. Superstructure

- H.1.21.1. The superstructure to be of steel construction with scantlings to the requirements of the Classification Society.
- H.1.21.2. Special consideration to be given to the construction of the Pilot House and windows, etc. to ensure maximum vision consistent with the strength of the structure.
- H.1.21.3. Passenger access openings are to be arranged at amidships of the superstructure, north and south sides, to facilitate emergency evacuation to buoyant apparatus.

H.1.22. Pilot House

- H.1.22.1. A Pilot House of rectangular shape to be positioned at amidships on a raised platform of the craft on the north side.
- H.1.22.2. The Pilot House is to be on a raised deck approximately 1000mm above and parallel to the Upper Deck.
- H.1.22.3. Each face of the Pilot House is to slope outwards at an angle of 15° to the vertical.

H.1.23. Machinery Ducts and Trunks

- H.1.23.1. Machinery vent ducts to extend from Vehicle Deck level to Upper Deck level, and to be of steel flat plate welded stiffener construction to Classification Society requirements.
- H.1.23.2. Ducts serving the machinery space to be arranged with appropriate ventilation fire dampers.
- H.1.23.3. Ducts to be insulated to prevent heat, noise and vibration penetrating accommodation and to be insulated to comply with the fire protection requirements of MCA and Classification Society.
- H.1.23.4. Main access to be arranged adjacent to the drive wheel space, with a vertical emergency escape to be arranged on the opposite side of the drive wheel space, as shown on the General Arrangement Plan.
- H.1.23.5. Access plates are to be provided in all ventilation trunks to enable routine cleaning.

H.1.24. Mast

- H.1.24.1. A portable mast is to be arranged which meets the requirements of the Classification Society, MCA and the Collision regulations, for when the Vessel is being towed.
- H.1.24.2. A freestanding mast is to be installed on the top of the Pilot House for normal operation. This mast is to mount whistles and aerials as described in the Electrical section of this Specification.

H.1.25. Fender Bars

- H.1.25.1. On both North and South side, steel fender bars are to be fitted upon which to secure a 'D' - Section rubber fender.
- H.1.25.2. Welded eye plates to be fitted to the underside of the lower steel fender bar to secure grab lines.

H.1.26. Grounding Bars

- H.1.26.1. Grounding bars are to be fitted to prevent damage to the bottom of the vessel when grounding on a concrete slipway.

H.1.27. Savealls

- H.1.27.1. In general, deck savealls to be provided in locations where oil or hydraulic fluid etc. might leak, such as in way of hydraulic connections to ramps, etc.

H.1.27.2. Raised savealls to be arranged with drain cocks and deck savealls to be arranged with screwed stainless steel plugs and keep chains.

H.1.28. Anchor and Chain Stowage

H.1.28.1. One anchor stowage location, on West end on vessel on South side, to be arranged to suit specified anchor.

H.1.28.2. Shell inserts of increased thickness are to be arranged in way of anchor stowage.

H.1.28.3. A chain pipe is to be provided and to be of ample diameter to suit specified chain.

H.1.29. Chain Locker

H.1.29.1. One chain locker is to be arranged in close proximity to the anchor stowage.

H.1.29.2. Provision to be made for securing cables to substantial point in the structure. Securing arrangements to be such that cables may be released quickly in an emergency from outside the chain locker.

H.1.29.3. Chain locker to be cleaned, prepared and coated.

H.2. Equipment and Hull Fittings

H.2.1. Anchor & Cable

- H.2.1.1. One in number, high holding power type anchor, of weight in accordance with Classification Society requirements to be supplied.
- H.2.1.2. Anchor cable to be of length and diameter to Classification Society requirements.
- H.2.1.3. Cable "bitter end" to be secured to the bulkhead of the chain locker, and be arranged for emergency slipping from outside the chain locker.
- H.2.1.4. Test certificates to be supplied for anchor, cable and joining shackles.

H.2.2. Bollards & Fairleads

- H.2.2.1. Four 200mm bollards in association with four fairleads to be fitted at Vehicle Deck level at the ends of the vessel, as per the General Arrangement Plan.
- H.2.2.2. All fairleads are to be provided with closing plates for use during coastal tows and for passenger safety. A suitable stowage for the closing plates is to be provided on board for normal service. All mooring pipes to have full radiuses on entry and exit corners to prevent damage to ropes, etc.
- H.2.2.3. Bollards to be of double type on single fabricated base plate constructed in accordance with ISO standard, positioned as indicated on the General Arrangement drawing.
- H.2.2.4. All welding and sharp corners on bollards to be ground to a smooth finish to prevent damage to hawsers, etc.
- H.2.2.5. Underdeck stiffening to be arranged in way of all bollards and fairleads to Classification Society requirements.
- H.2.2.6. Towing Eyes to be fitted amidships on North and South side above rubber fenders.

H.2.3. Passenger Areas Guard Rails, Stanchions and Walkways

- H.2.3.1. Guard rails and stanchions to be of galvanised steel construction.
- H.2.3.2. A Stainless Steel top rail is to be fitted on the Upper Deck glass bulwarks
- H.2.3.3. Railed access to the Pilot House is to incorporate an access restriction chain to segregate passenger and crew spaces.

H.2.4. Vehicle Deck gates

- H.2.4.1. Manually operated, side hinging double gates of tubular galvanised steel construction are to be fitted at each end of the vehicle deck. The gates are to be mounted on the inner part of the ramp and are to include a locking drop bolt of 25 mm section. Each gate is to be hung on three heavy-duty hinges with bearing grade nylon bushes.
- H.2.4.2. The hinges are to be designed so the gates will not sag, and the bushes will not require frequent replacement.
- H.2.4.3. Means is to be provided for securing gates in both the closed and open positions. A substantial locking facility to maintain gates in closed position to be provided.

H.2.5. Ladders and Stairways

- H.2.5.1. Passenger stairways from the Vehicle to the Upper deck are to be of steel plate construction.
- H.2.5.2. Stairways are to be fitted with stainless steel tubular hand rails and with steps fitted with non-slip tread.
- H.2.5.3. The slope of the main stairways is to be 45° maximum with a clear width of 900mm.
- H.2.5.4. Ladders are to be fitted giving access to the drive wheel room and machinery spaces, as per the General Arrangement Plan.
- H.2.5.5. Vertical ladders are to be fitted to give access to the buoyancy apparatus on the South side of the vessel.
- H.2.5.6. Ladders and associated handrails are to be bolted top and bottom and are to be capable of removal. All securing nuts and bolts are to be of stainless steel.
- H.2.5.7. Vertical steel ladders are to be fitted in the emergency escapes from all machinery spaces.
- H.2.5.8. Vertical ladders are to have a clear width of 300mm and to be bolted to welded lugs.
- H.2.5.9. Ladder rungs to be fitted to the side shell, North and South, in way of the midships glazed door between fender line and water line.

H.2.6. Doors

- H.2.6.1. All Watertight, Weathertight and Splashtight doors to be located and constructed in accordance with Classification Society and MCA requirements.
- H.2.6.2. All doors to have published Rule height sills.

H.2.7. Splashtight and Weathertight Doors

- H.2.7.1. Steel Splashtight doors to be fitted for access to deck lockers and Pilot House as shown on the General Arrangement drawing. Top of doors to be 2000mm above finished deck level. Doors to be fitted with hold backs.
- H.2.7.2. Steel Weathertight door to be fitted for access to Machinery Space as shown on the General Arrangement Plan. Top of door to be 2000mm above finished deck level. Door to be fitted with hold backs.
- H.2.7.3. Door fitted to the machinery space entrance to be complete with the necessary acoustic, thermal and fire insulation to the requirements of MCA.
- H.2.7.4. Pilot House doors to have rectangular windows and be fitted with locks.

H.2.8. Watertight Doors

- H.2.8.1. Steel watertight doors to the requirements of Class/MCA to be fitted for access to the East and West engine rooms from the Drive Wheel Space.
- H.2.8.2. Doors to be provided with open/closed indication in the Pilot House.

H.2.9. Superstructure Glazing

- H.2.9.1. Vessel to be fully glazed along both the North and South topsides at Vehicle Deck level, extending to Upper deck level.
- H.2.9.2. Outboard and inboard bulwarks are to be fitted at Upper deck level on the North Side, to be fully glazed and incorporating a stainless steel top handrail 1300mm above deck.
- H.2.9.3. Glazing to have a flush frameless appearance with a grey tint colour and as necessary a printed frit margin to be used to help obscure attachment to surrounding structure and especially in the accommodation area.
- H.2.9.4. Glass is to be manufactured to the latest ISO 614 standard, consisting of approx. 15mm thick glazed laminated panels with a maximum size of 1.3m x 2.6m.
- H.2.9.5. Consideration to be given to the most suitable choice of glass laminates to allow for easy or self-cleaning and adhesion of perforated window graphics by the client.
- H.2.9.6. Both North and South topsides to incorporate a flush partially glazed door midships to match surrounding glazing for use as an escape or for crew access purposes.

H.2.10. Pilot House Windows

- H.2.10.1. Pilot House windows to be in accordance with ISO 3254 and ISO 3903.
- H.2.10.2. Pilot House sides to be sloped outwards at 15 degrees to the vertical, as shown on the General Arrangement drawing.
- H.2.10.3. Both lower and upper window sight lines to be submitted by Contractor for the Client's approval.
- H.2.10.4. Pilot House windows to incorporate demist facility, both by direct electric elements and by blown air.
- H.2.10.5. All Pilot House windows to be fitted with straight-line wipers.
- H.2.10.6. Pilot House windows to be fitted with solar anti-glare roller blinds.
- H.2.10.7. All Pilot House windows to be fitted with fresh water window washers.
- H.2.10.8. Vessel Lockers and Stores
- H.2.10.9. Stores and lockers to be arranged as shown on the General Arrangement drawing.
- H.2.10.10. Stores and lockers to be fitted with spalshtight doors where accessed from the open deck.
- H.2.10.11. Lockers to be fitted out with shelves and racks to Client's approval.
- H.2.10.12. Decks to be bare steel prepared and painted in accordance with the paint specification.

H.2.11. Battery Locker

- H.2.11.1. A ventilated battery locker to be arranged under the Pilot House with weathertight access hatch.
- H.2.11.2. Store to be arranged with suitable racks to secure batteries.

H.2.11.3. Deck to be bare steel prepared and painted in accordance with the paint specification.

H.2.12. Direction Indication Lights

H.2.12.1. All round orange high intensity rotating flashing lights are to be situated at each end on the top of the prow arms. The lights are to be equally visible in both daylight and the hours of darkness. The flashing lights are to be integrated with the propulsion controls systems to indicate the direction in which the vessel is proceeding. Special consideration is to be given to the location so that the lights are visible from all angles both upstream and downstream on the River.

H.2.13. Freeboard Marks

H.2.13.1. Freeboard marks to be arranged on the North and South sides at midships of the Vessel.

H.2.13.2. Freeboard marks to be of 6 mm plate, continuously welded and painted white.

H.2.14. Name Plates/Notices

H.2.14.1. Laminar plastic name plates to be fitted to identify access to all tanks, stores, hatches and to indicate vents and air pipes. All name plates are to be mechanically attached.

H.2.14.2. Air sounding and filling pipe deck fittings/caps to be engraved.

H.2.14.3. Engraved name plates to be fitted to the doors of all compartments, etc. to identify each space.

H.2.14.4. All emergency escape hatches and escape routes to be clearly marked.

H.2.14.5. All escape signs to be photoluminescent. Sufficient tactile signs to be provided in all areas to meet the needs of the visually impaired in accordance with regulatory requirements.

H.2.14.6. "No access for passengers" notices to be located leading to the Pilot House and on doors leading to machinery space and crew stores.

H.2.14.7. A Warning notice is to be attached to outboard side of vehicle deck gates - wording to the Clients approval.

H.2.15. Ramp Supporting Arms

H.2.15.1. Arms to be fitted outboard North and South of the ramps, as shown on the General Arrangement Plan.

H.2.15.2. Lugs to be fitted at inboard, underside of the arms to allow lifting gear to be fitted for the raising and removal of the drive chain.

H.2.16. Lifting Gear

H.2.16.1. Welded eye plates to be arranged in the underside of the Pilot House overhang, over the chain trough in way of the main chain wheel and guide (jockey) wheels. S.W.L. of eye plates to be compatible with weight of wheels they are to lift, including lifting gear. Lifting arrangements for the main chain wheel segments, guide wheels, and securing and manipulation of the chain during such operations are to be specially considered for the open deck side chain and to be to the client's approval.

H.2.16.2. Welded eye plates of 9T S.W.L. to be fitted on each ramp supporting arm and amidships in locations to the Owner's approval for use in connecting/disconnecting the vessel from the drive chains - allow 20 in number.

H.2.16.3. Welded eye plates are to be fitted in the machinery space East and West of the main chain drive wheels to act as chain stoppers preventing chain movement due to wind & tide during maintenance.

H.2.16.4. Eye plates to be located in deckhead above the generators and at suitable intervals across the width of the machinery space, designed to move equipment to the soft plate locations. The SWL is to be compatible with the equipment installed in the machinery spaces.

H.2.16.5. All lifting equipment to be subject to statutory load test and certificates to be supplied by the Contractor.

H.2.16.6. All lifting equipment to be clearly marked with its safe working load.

H.2.17. Lashing Points

H.2.17.1. Eight off flush lashing eyes to be arranged on vehicle deck, either side of the south chain trough. (For use with the owners supply portable chain equipment lifting frame etc.) Locations to be agreed with the client.

H.2.18. Fendering

H.2.18.1. 200mm x 200mm rubber 'D' Fendering to be arranged on North and South side of the Vessel.

H.2.18.2. Fendering to be attached to hull between Fendering bars.

H.3. Fire Protection, Detection & Extinction

H.3.1. General Requirements

- H.3.1.1. The complete fire protection, detection and extinction arrangements to be in accordance with the requirements of the Classification Society and MCA to meet the rules and regulations for an EU Class C Passenger Vessel as per Directive 2010/36/EU of the European Parliament and the MCA rules and regulations contained in the Code of Practice for Chain Ferries.
- H.3.1.2. Machinery Spaces to be protected by a fixed 'NOVEC' gas total flooding installation meeting MCA requirements.
- H.3.1.3. All accommodation spaces are to be protected by a fixed fire detection and fire alarm system meeting MCA requirements.

H.3.2. Hydrants, Hoses and Extinguishers

- H.3.2.1. Fire pump(s), as detailed in the Machinery Specification to be fitted and connected to the fire main which is to be distributed throughout the vessel as necessary.
- H.3.2.2. Fire hydrants, to meet statutory requirements, to be arranged throughout the vessel. The number and position of hydrants to be such that two jets of water not emanating from the same hydrant, one of which shall be from a single length of hose, shall reach any part of the vessel normally accessible to the passengers or crew during operation whilst all watertight doors are closed.
- H.3.2.3. One fire hose of approved synthetic material and one approved type dual purpose 10mm nozzle to be supplied for each fire hydrant on the vessel. Couplings to be of the instantaneous type and hoses to be of approved length to allow two jets of water to be directed at the seat of any fire.
- H.3.2.4. Hoses on outside decks to be reeled flat in weather-tight hose boxes of GRP construction. Each hose box to be coloured red, clearly marked and fitted with drain holes.
- H.3.2.5. Portable and non-portable fire extinguishers to be provided and distributed throughout the working spaces, accommodation and machinery space to regulatory requirements. Extinguishers in accommodation to be stowed within flush recesses clearly marked.
- H.3.2.6. Open vehicle deck to be provided with additional portable fire extinguishers with a total capacity of at least 12 kg of dry powder.
- H.3.2.7. At least one refill for each extinguisher on board to be supplied and stowed in the safety locker.
- H.3.2.8. Contractor to supply and provide stowage in the safety store for the following equipment:
 - Spare washer, seals and nozzles.
 - Safety tool kit comprising wrecking bar, crowbar, bolt cutters, etc.
- H.3.2.9. Approved copies of the Fire and Safety plan to be provided. Framed copies to be hung in the Pilot House and one in a plastic watertight tube. Location to be advised by the client.

H.4. Accommodation

H.4.1. General

- H.4.1.1. Passenger and crew accommodation to be arranged generally as shown on the General Arrangement Drawing.
- H.4.1.2. Accommodation to meet the rules and requirements of the MCA.
- H.4.1.3. The design, layout and arrangement of the passenger space and the fixtures and fittings are to meet applicable regulations for meeting the needs of persons with reduced mobility as far as practicable.
- H.4.1.4. Passenger's accommodation to comprise a single open ended space on the Vehicle Deck and on open area on the upper deck.
- H.4.1.5. Minimum headroom throughout accommodation spaces to be 2100mm. Deckhead fittings including lights and smoke detectors not to infringe specified clear headroom.
- H.4.1.6. Items such as fire extinguishers and waste bins etc. to be recessed into bulkheads and linings where possible.
- H.4.1.7. The contractor is to give special consideration to the colour co-ordination of outfit, furnishing and fabrics, used in the outfit of the accommodation. Contractor to submit to the Client, at an early stage in the contract, the general proposals for interior decoration.
- H.4.1.8. Materials used for the outfit and furnishing of the accommodation in general to be fire resistant and non-combustible in accordance with the IMO FTP Code.
- H.4.1.9. Materials used for bench seating and floor coverings to be hard wearing and easy to clean.
- H.4.1.10. The contractor is to pay particular attention to the finish of steelwork and outfit items in accommodation to avoid sharp or potentially dangerous edges, corners, etc.

H.4.2. Bulkheads/Linings/Ceilings

- H.4.2.1. Linings are to be fitted in the Pilot House.
- H.4.2.2. All divisional bulkheads, linings and ceilings to have required fire resistance and insulating properties in accordance with the requirements for an EU Class C passenger Vessel. Finishing colours to be to Clients' approval.
- H.4.2.3. Ceilings with wipe clean semi-matt finish to be fitted under the beams in the Pilot House. Pilot House deckhead to be non-reflective.

H.4.3. Insulation

- H.4.3.1. No asbestos based products to be used for insulation or for any purpose in the vessel.
- H.4.3.2. Steel structure including the ship's side, deckheads, casing, main machinery spaces, etc., to be fitted with approved fire, acoustic and thermal insulation as appropriate, in accordance with statutory requirements and the detailed requirements of this specification.
- H.4.3.3. Contractor to detail all insulation systems to meet statutory and Client's requirements, described in these specifications and submit full particulars to the Client for approval. A

record of all insulation materials and their location to be provided by the Contractor to the Client on completion of the vessel.

- H.4.3.4. Special consideration to be given to the insulation of the vessel to prevent noise and heat from the machinery spaces being transmitted to the accommodation space and the vehicle deck.
- H.4.3.5. All spaces emitting noise and heat to be adequately insulated. The insulation materials used to be approved by the Client and to be incombustible, vermin and damp proof and suitably protected against mechanical damage. Insulation to be well fitted around beams, stiffeners, girders, etc., to the satisfaction of the Client's representative.
- H.4.3.6. The Main engine waste heat recovery Calorifier to be lagged with fixed foam type thermal insulation clad with galvanised steel protection.
- H.4.3.7. Where insulation is subject to mechanical damage, it is to be covered with alloy sheet.
- H.4.3.8. All pipe insulation in machinery spaces to be painted. Surface of insulation to be vapour and oil tight.
- H.4.3.9. In general insulation of hot surfaces to be designed such that resultant surface temperature does not exceed 20° above ambient temperature.

H.4.4. Fire Insulation

- H.4.4.1. The fire integrity of bulkheads and decks to meet the requirements for an EU Class C Passenger Vessel.
- H.4.4.2. Structural fire protection including fire insulation of approved type and thickness to be arranged in way of machinery space boundaries in full compliance with MCA requirements.

H.4.5. Thermal Insulation

- H.4.5.1. Thermal insulation is to be installed in the Pilot House.
- H.4.5.2. Thermal insulation to be of incombustible vermin proof, mineral wool in standard bats or blanket form. Insulation adjacent to weather boundaries to be vapour sealed.
- H.4.5.3. For insulation of engine exhaust pipes, see Machinery Specification.

H.4.6. Acoustic Insulation

- H.4.6.1. All accommodation and working space bulkheads and decks to be acoustically insulated as necessary to meet the noise levels specified in Clause G.3.3.
- H.4.6.2. Acoustic insulation to be of non-combustible vermin proof material of the long fibre minimum resin content, fibre glass type.
- H.4.6.3. Insulation to be securely installed using welded stud pins, washers and wire mesh. Exposed insulation in the machinery spaces to be sheathed to Clients' approval.
- H.4.6.4. Contractor to be responsible for meeting noise level requirements laid down in the General Specification.
- H.4.6.5. Upgrading of thermal/fire insulation in terms of acoustic performance may be proposed.

H.4.7. Floor Coverings

- H.4.7.1. Non slip flooring to be laid over underlay in the Pilot House. Sheet seams to be properly sealed and flooring taken up to form coving at all bulkhead attachments to prevent water ingress.
- H.4.7.2. External weather doors leading to the Pilot House areas are to have threshold matting fitted on the internal side.
- H.4.7.3. Design, quality and colour of sheet flooring to be to Clients' approval.

H.4.8. Furniture

- H.4.8.1. All furniture is to comply with IMO FTP Code certification. Furniture to be of durable construction, aesthetically pleasing, easy to clean and all to be submitted for the Clients approval.
- H.4.8.2. Passenger accommodation to be fitted with bench seating as shown on the General Arrangement drawing.
- H.4.8.3. Pilot House watch keeping chair to be heavy duty, upholstered, swivel, height adjusting type with hinged arms, arranged on fore and aft slides.
- H.4.8.4. Additional fold away seating to be arranged in the Pilot House for use by the crew.
- H.4.8.5. Samples of all materials to be used in the accommodation to be submitted to the Client for approval prior to purchase.

H.4.9. Hardware

- H.4.9.1. All hardware to be of good standard, non-corrodible heavy duty marine quality, compatible with adjacent furniture and fittings.
- H.4.9.2. Door locks, plus additional secure type padlock and hasp (SS 316) fittings to be provided at entrance to all weatherdeck stores, machinery space and Pilot House.
- H.4.9.3. All locks throughout the vessel to have common keys and eight spares provided.
- H.4.9.4. Door locks and keys to be sourced from one manufacturer and easily replaced within 24 hours of loss.
- H.4.9.5. All hardware exposed to the weather to be of brass, or other approved material. Weather door locks to be of high quality brass with cast brass casings of the heavy duty type.

H.4.10. Accommodation Layout

- H.4.10.1. Accommodation spaces are to be laid out as shown on the General Arrangement drawing.

H.4.11. Passenger Accommodation

- H.4.11.1. Covered Passenger Accommodation to be provided at Vehicle deck level on the North side as shown on the General Arrangement drawing.
- H.4.11.2. Seating to be arranged for approximately 66 persons.

H.4.11.3. Dedicated seating to be provided for disabled persons with handholds and suitable signage. One space for a wheelchair to be provided.

H.4.11.4. Access for persons with reduced mobility to be in accordance with MSN 1823 Safety code for Passenger Ships Operating Solely in UK Categorised Waters.

H.4.11.5. The design and layout of the accommodation and details of the arrangements and colour coordination of the walls, ceilings, floor colour, seat coverings etc. to be submitted to the Client for approval.

H.4.11.6. Four waterproof, video display screens are to be fitted in the Passenger Accommodation.

H.4.12. Passenger Open Deck Areas

H.4.12.1. Open deck area for passenger use to be provided at upper deck North side, as shown on the General Arrangement drawing.

H.4.12.2. Open upper deck area to be arranged with fixed weatherproof seating modules for approximately 36 persons.

H.4.13. Stores/Lockers

H.4.13.1. Stores and lockers to be arranged as shown on the General Arrangement drawing.

H.4.13.2. Lockers to be fitted out with shelves and racks to Client's approval.

H.4.14. Electrical/ Control Duct

H.4.14.1. A duct to be run vertically through vehicle deck and upper deck level for routing of electrical and control cables between decks and between Pilot House and machinery space.

H.4.15. Pilot House

H.4.15.1. A fully enclosed Pilot House to be arranged at Upper deck level and to be designed to give optimum visibility.

H.4.15.2. The basic philosophy for the Pilot House is to have the most ergonomic layout possible. The Pilot House is also to contain machinery control and alarm areas.

H.4.15.3. Pilot House to be provided with external access, via hinged splashtight doors at East and West ends.

H.4.15.4. Pilot House to have good all round visibility as shown. Pilot House windows to be as specified in the window Section.

H.4.15.5. Window washing system to be fitted to all the pilothouse windows with push button controls arranged in adjacent consoles. System to have separate controls for each direction.

H.4.15.6. Maximum use of space to be attained including installation of sufficient purpose designed lockers to satisfactorily stow all items of equipment mentioned in this Specification.

H.4.15.7. Cabinets/Consoles housing all equipment to be constructed of electro-zinc coated steel plate on a steel angle bar framework and be aesthetically pleasing in finish to Client's approval.

H.4.15.8. Contractor to be responsible for co-ordinating the appearance and finish of all consoles, radio and safety equipment and outfit, including instrument size, and display.

H.4.15.9. Consoles to be fitted with hinged and/or lift-off access doors, ventilation grills and substantial grab rail in front.

H.4.15.10. Console instrumentation, controls and alarms to be tested and calibrated prior to installation of console aboard vessel.

H.4.15.11. Instruments to be calibrated in metric scales. Each control and instrument to be identified by a machine engraved lamella or plastic nameplate, black through white.

H.4.15.12. Consoles to be fitted with switched internal lighting and mechanical ventilation where required.

H.4.15.13. Within six weeks of date of contract, Contractor to submit to the Client for approval, the complete layout of the Pilot House with position, type and manufacturer of all items of outfit and equipment.

H.4.16. Main Control Console

H.4.16.1. Control console to be arranged for one operator. Twin "East and West" consoles to have sloping back to include screen displays (alarms & monitoring), and to contain the following:-

- Twin Propulsion Joystick controls
- Ramp controls
- Main Engine and Generator Data and monitoring displays.
- Alarm monitoring panel
- Emergency stops (shrouded) for main and generator engines complete with run indicator lights.
- Electric whistle control.
- Talk-back and PA system between the Pilot House and each loading ramp.
- VHF Radio
- Controls for window wipers, For each window section
- Controls for window wash system, For each window section
- Controls for window demist
- Light dimmer controls (red filter deckhead and instruments)
- General lighting control panels.
- 2 x CCTV monitors and master control.
- Pedestal type swivel Helmsman chair complete with back rest and foot bar. Height of stool to be arranged such that the eye level of a seated person is similar to that of a standing person.

H.4.16.2. Deckhead mounted console to be arranged outboard with good visibility from helmsman's position and to contain the following:

- Clock
- Wind speed and direction indication

H.5. Ventilation and Heating

H.5.1. System Details

- H.5.1.1. The vessel to be provided with a heating system using waste heat from the operational main engine to supply radiators or matrix heaters serving the passenger accommodation. See also Machinery Section M.23
- H.5.1.2. Battery store, located below the Pilot House, to be ventilated.
- H.5.1.3. An electric heater is to be provided in the Pilot House.

H.5.2. Natural Ventilation

- H.5.2.1. In addition to natural ventilation to mechanically ventilated spaces, natural ventilation to be arranged to the following spaces:
 - Minor deck lockers
 - Void spaces within hull
- H.5.2.2. All deck ventilators to be fitted with weather-tight covers and stainless steel rat-proof wire mesh guards. Open/shut indicators to be fitted.

H.6. Lifesaving Equipment

H.6.1. General

- H.6.1.1. Vessel to be equipped with lifesaving equipment and arrangements, including escape, muster and embarkation, to comply with the requirements of the MCA Code of Practice for Chain Ferries.
- H.6.1.2. Float free buoyant apparatus of moulded glass fibre construction to be provided for a total complement of 402. The buoyant apparatus is to be stowed at Upper Deck level.
- H.6.1.3. All buoyant apparatus are to be fitted with retro-reflective marking in accordance with Marine Guidance Note 105.
- H.6.1.4. Grab lines to be fitted North & South to the underside of the fender. The lines are to be sized such that the loops are 100mm clear of the design waterline.
- H.6.1.5. All lifesaving appliances are to be fitted with bowsing lanyards of a length compatible with the passenger mustering arrangements on the Vessel.

H.6.2. Lifebuoys

- H.6.2.1. Eight in number, 760 mm diameter lifebuoys to be fitted, two in number with self-igniting indicating light and smoke signal. Two in number complete with 30m of buoyant safety line. The two lifebuoys (with indicating light and smoke signals) to be quick release from Pilot House.

H.7. Painting and Protection

H.7.1. Preparation of Steelwork

H.7.1.1. Prior to fabrication all steel plate and sections to be used in the construction of the vessels are to be grit blasted to SA 2.5 standard and immediately coated with a pre-construction primer to the approved thickness.

H.7.1.2. During construction of the vessel, where the pre-construction shop primer is damaged by burning, welding or mechanical damage, the following treatment is to be carried out prior to the application of the protective coatings.

- General – all welding beads to be deslagged and thoroughly cleaned by power wire brushing and immediately stripe coated with construction primer.
- Exterior Hull – all exterior hull and exposed deck weld butts and seams are to be grit blasted to SA 2.5 minimum standard, followed by the application of the first coat of the subsequent paint system.
- All other areas – all damaged areas of shop primer, i.e. weld seams, burn marks, rusted areas, mechanically damaged areas, etc., are to be cleaned to S.T.2 standard followed by a touch-up with the first coat of the subsequent paint system.
- All damaged and heat affected coatings to be fully repaired to the satisfaction of the Client's representative.
- After blasting all spent shot or grit to be removed by vacuum cleaning or airline and brush. In the event that any grit or shot is found embedded in the finished paint film, the affected area is to be re-blasted and the full paint system re-applied.

H.7.1.3. After erection and prior to coating all oil, grease and other contaminants to be removed by thoroughly degreasing with approved solvent. Any bare areas, surfaces damaged during construction, weld seams, sharp edges, cut-outs, backs of bars and burn marks, etc. to be thoroughly mechanically cleaned to the standards set out below and cleaned of all dust and arisings prior to coatings with the first coat of the system, following by the application of the ensuing system.

- General - all welding beads, etc. to be cleaned by power wire brushing (stainless), needle gun or discing.
- All areas to be lightly abraded (180-220 grade paper) to an average maximum peak roughness of 1-1.5 mil. Remove dust and wash down with fresh water.

H.7.2. Deck Markings

H.7.2.1. Roadway to have lane markings as per local highway requirements, segregating the vehicle deck into four lanes. The lane widths to be 2 x 2.5m.x 29.7m and 2 x 2.5m x 22.0m with 400mm yellow lane demarcation, as shown on the General Arrangement Plan.

H.7.2.2. Two designated cyclist areas to be marked out on the vehicle deck. Location as shown on the General Arrangement Plan.

H.7.3. Coatings in Tanks

H.7.3.1. Void spaces within the hull to be coated.

H.7.3.2. No painting is to be carried out in tanks until completion of tank testing and subsequent inspection and approval by the Clients' representative.

H.7.4. Paint Application

H.7.4.1. All paint materials are to be mixed in accordance with the manufacturer's recommendations and instructions. Paint materials are not to be thinned or added to in any way, unless on the instruction of the paint manufacturer's representative.

H.7.4.2. All paint to be stored where it will not be subject to extremes of temperature.

H.7.4.3. Full and comprehensive records of the climatic conditions at the time of paint application to be maintained by the Contractor and presented to the Client on request.

H.7.4.4. Thickness of coating applied to be monitored during application and checked against Paint Specification before application of the next coat. Results to be presented to paint supplier's representative and Clients' representative for approval before any remedial action is taken or the next coat applied. Any remedial action to be undertaken by the Contractor at his cost.

H.7.4.5. WTF combs to be readily available and used by all painters to establish correct film thickness.

H.7.4.6. Contractor in constructing the vessel and applying paint coatings to take special care that all hot work in a particular area is complete before application of coating.

H.7.4.7. Contractor to arrange strict control of access to areas where coatings are being applied and to ensure co-ordination of trades accordingly.

H.7.4.8. No paint runs, or rough/unsightly painting will be accepted.

H.7.4.9. Special attention is to be given to the exterior underwater hull area:-

- On the building berth, following the cleaning of welds and the application of the first coat, intermediate coats and one coat of anti-fouling is to be applied in accordance with the dry film thicknesses specified.
- Care is to be taken to ensure that all areas in way of building blocks are prepared and coated similarly.
- At pre-delivery dry docking, the anti-fouling area is to be fresh water washed to remove any contaminants. Damaged areas of the coating system are to be prepared and touched up in accordance with the paint specification and the requirements of the paint supplier's representative, followed by the application of the final full coat of anti-fouling to achieve full specification thickness.
- Areas in way of keel blocks are to be similarly treated.

H.7.4.10. Contractor is to make all necessary provisions to protect the cleaning and painting operation from the environment, to provide dry surfaces for the application of each new coat of paint and to provide the curing conditions required for the successful application of the paint

system. Paint manufacturer's representative is to confirm that conditions are suitable for the application of paints of varying specifications.

- H.7.4.11. Contractor is not to apply any paint to outside surfaces during weather that might cause dust and dirt in appreciable quantities to be blown/deposited upon the paint.
- H.7.4.12. Contractor is not to apply any paint to outside surfaces during weather which may cause the vessel to be contaminated by over spray from this vessel or other construction taking place in the construction facility.
- H.7.4.13. The finishing coats of paint are not to be applied in areas where equipment is to be installed, until after the termination of all installation work.
- H.7.4.14. Contractor is to adequately protect all installed equipment against entrance of dirt and dust during cleaning and touch-up operations and from paint during the subsequent application of the paint systems. After termination of the painting of structural steel, the protective covering is to be carefully removed from the equipment, the equipment to be thoroughly cleaned and painted parts of the equipment touched up in matching colours, or re-painted as may be required to restore to the original finish.
- H.7.4.15. All threads on securing toggles, screws, etc., are not to be painted.
- H.7.4.16. All electric cables, either loose cable tails or cables secured to cable trays are not to be painted.
- H.7.4.17. Any hardwood is to be coated as follows:-
- 1 coat alkyd varnish (thinned by 10%)
 - 4 coats alkyd varnish
 - Surfaces to be lightly rubbed down between coats and left full gloss, well sealed around all securing's.

H.7.5. Paint Specification

- H.7.5.1. Contractor is to submit to the Client for approval a complete Paint Specification detailing the paint manufacturer and product description, number of coats and D.F.T.
- H.7.5.2. All paints used throughout the machinery spaces and accommodation are to be of the fire retardant type.
- H.7.5.3. Vehicle Deck paint coating to be of a high profile type using not less than 1.5mm aggregate.
- H.7.5.4. Passenger walkways are to be painted with an anti-slip deck paint.
- H.7.5.5. Paint manufacturer to provide a guarantee as defined in the Vessel Construction Contract.
- H.7.5.6. All welds and edges to be stripe coated with a minimum of two brushed coats, for tanks & areas subject to exposure. One stripe coat to be applied in internal dry space areas.
- H.7.5.7. Where more than one coat is applied, each coat is to be in a contrasting colour.
- H.7.5.8. Contractor to supply marine paints of international repute.
- H.7.5.9. Anti-fouling system to be selected to suit the intended operational profile of the vessel.

H.7.6. Paint Lines

H.7.6.1. Paint lines on external shell are to be marked by intermittent welds, each 75mm long spaced 2500mm.

H.7.6.2. Freeboard marks East and West are to be painted white/black.

H.7.6.3.

H.7.7. Specific Paint Areas

H.7.7.1. All fire damper controls, fire hose stowages, fire hydrants and fire extinguisher stowages to be painted red and clearly marked.

H.7.7.2. Kerbs on the Vehicle Deck to be painted hazard yellow.

H.7.7.3. Designated walkways on Vehicle Deck to be painted hazard yellow. Passenger walkways are to be painted of a colour as specified by the client.

H.7.7.4. Tie-down points on working decks are to be painted yellow.

H.7.7.5. All fire damper controls, fire hose stowage's and fire extinguisher stowage's are to be painted red and clearly marked.

H.7.8. Galvanising

H.7.8.1. Galvanising is to be carried out, using the hot dip method, with a coating weight not less than 610gm/m².

H.7.8.2. Galvanising is to be done after all bending and welding and working of the components have been completed.

H.7.8.3. The following items are to be galvanised:

- All mild steel piping with welded flanges (excluding fuel oil pipes)
- Guard rails, Stairway handrails and all stanchions.
- Ladders and grab rails
- Sea suction grids
- Scupper & Mooring pipe grids
- Cable trays and conduits

H.7.9. Cathodic Protection

H.7.9.1. The vessel hull to be protected by a cathodic protection system with anodes sized to give at least three years protection.

H.7.9.2. Anodes to be of the bolt on type and distributed to give good coverage to the hull and in way of all the sea inlets.

H.7.9.3. Size and position of anodes to be according to manufacturer's recommendations.

H.7.9.4. Hull of the vessel is to be cathodically protected whilst the vessel is being outfitted.

MACHINERY SPECIFICATION

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M.1. General Description

- M.1.1. The vessel is to be propelled by a hydraulic drive system via two chain drive wheels along fixed chains. Independent chain drive wheels operating in tandem to be arranged to the north and south sides of the Vessel. The chain drive hydraulic motors to be powered by one of two, main diesel engines each driving a hydraulic pump (DE) and. All hydraulic system pressures to be kept as low as possible.
- M.1.2. The hydraulic pump controls to be arranged for local, and remote control from the Pilot House.
- M.1.3. The auxiliary electrical requirements will be powered from two auxiliary diesel driven generators, 230volt, single phase, 50 Hz.
- M.1.4. The vessel is to be designed and equipped for unattended machinery space operation meeting the requirements for UMS class notation but without certification. All machinery and equipment is to be supplied and installed under Class survey and is to meet the requirements of the MCA Code for Chain Ferries. The Classification Society to be agreed with the Owner on placement of contract.
- M.1.5. Two electric motor driven fire pumps to be arranged with sea inlets and strainers.
- M.1.6. Two electric motor driven bilge pumps to be arranged with sea inlets and strainers.
- M.1.7. The power of each of the two main diesel engines is to be based upon one main engine supplying the full power required to drive the vessel at the design 2.5 minute crossing speed at half tide. With the other engine in standby mode.
- M.1.8. The main and auxiliary diesel engines to be arranged for independent keel cooling.
- M.1.9. The hydraulic system be arranged for keel cooling as described in M.11.
- M.1.10. The engines to be fitted with all necessary equipment to minimise fouling of engines (including inlet ports) with a typical load profile of 2.5 minutes crossing time with one engine giving up to 80% continuous rated output, followed by 10minutes discharge/loading time on low power at idle speed.
- M.1.11. The Pilot House is to be thermally insulated, and provided with controls for:
 - a) Direction control switch, along with speed ahead and astern of the available chain drive
 - b) Hydraulically raising and lowering the prow ramps.

The following are also to be provided:

- c) Necessary communication equipment.
- d) Grade B AIS Unit.
- e) Machinery group alarm panel with visual and audio indication.

- f) Main Engine and Auxiliary Generators start/ stop buttons, with running indication
 - g) Chain drive hydraulic system pressure indication.
 - h) Fire detection system alarm master unit.
 - i) CCTV control panel
- M.1.12. The auxiliary generators are to be connected to the main switchboards, arranged for short term synchronising for transfer only, parallel running of the generators is not required. Auto closing of breaker on remote start of generator onto a dead board to be provided.
- M.1.13. The main engines are to be located in a mechanically ventilated Machinery Space below the Vehicle Deck. The machinery space to be enclosed by, acoustically insulated, A15 minimum boundaries.
- M.1.14. The following auxiliary equipment to be provided, arranged for maximum redundancy and easy access for maintenance, in the machinery spaces:
- a) One hydraulic reservoir serving the chain drive hydraulic system and the prow ramp hydraulic system.
 - b) One oily Bilge water retention tank.
 - c) Two electric motor driven bilge pumps.
 - d) Two electric motor driven Fire pumps
 - e) Bilge manifolds arranged in the Drive wheel space, for all voids spaces, engine rooms and drive wheel space.
 - f) One electric motor driven oily bilge pump for transfer to the bilge retention tank, and discharge to shore via an IMO deck fitting.
 - g) Two Chain Drive Wheel Space manual activation bilge pumps, each pump serving one space and provided with direct overboard discharges.
 - h) Machinery space mechanical ventilation, comprising three inlet fans, one for each engine room and one for the drive wheel space.

M.2. TESTS AND TRIALS AND GUARANTEE

- M.2.1.1. All machinery and electrical installations are to be thoroughly tested after installation to demonstrate satisfactory workmanship with proper working order in compliance with the regulations of the Specification. Any defects which may develop or become apparent from these shall be made good by the builders.
- M.2.1.2. The main diesel engine driven hydraulic-electric power sets are to be subject to shop trials and a complete record of all data to be furnished to the Owners. The Owners' Representatives are to have the opportunity to witness the engine trials.
- M.2.1.3. The complete machinery, electrical installation and equipment is to be guaranteed for one year by the Shipbuilder from the date of Owners' acceptance after trials at the River Medina. Note this should exclude the owners supplied Chain drive wheel segments and chain guide wheels and bearings.
- M.2.1.4. Dock trials to be held prior to Vessel leaving the builder yard and a detailed test programme to be prepared by the builder and submitted to the clients for consideration and approval at least 30 days prior to the commencement of the trials.

M.3. PLANS AND INSTRUCTION BOOKS

- M.3.1.1. All major plans are to be provided by the Builders and submitted to the Owners for their approval. All necessary minor plans are to be similarly submitted.
- M.3.1.2. Two complete sets of "as-fitted" white prints of all machinery and electrical installations and pumping arrangement are to be supplied. Two electronic sets of "as fitted" drawings are to be supplied in both pdf format and native CAD of a format to suit the Owner.
- M.3.1.3. Two sets of instruction booklets and spare parts lists, details of trials performance data, schematic piping diagrams, and schematic electrical wiring diagrams are to be provided.
- M.3.1.4. Two complete sets of makers' handbooks, brochures, etc., covering all machinery and auxiliary equipment are to be supplied. Also electronic versions in pdf format.

M.4. MAIN MACHINERY

M.4.1. Design and General

- M.4.1.1. The machinery is to be arranged in three machinery spaces, two containing the main engines and auxiliary generators and one containing the main chain drive motors and wheels.
- M.4.1.2. All engines are to be suitable for operation, in compliance with MARPOL VI, Regulation 13, on Marine Gas Oil fuel conforming to ISO 8217:2010, Class DMA
- M.4.1.3. All engines and machinery are to be built to the manufacturers' latest design and in accordance with Classification Society.
- M.4.1.4. Items not specifically mentioned but required by statutory regulations for the Vessel, are to be included.
- M.4.1.5. The machinery installation is to be designed, constructed, installed and commissioned under Classification Society survey.
- M.4.1.6. Where the equipment performance is prefixed by "minimum", it is the intention that this stated capability be fully met notwithstanding the requirements of the rules and operation of the Vessel.
- M.4.1.7. The interfacing of all equipment and systems is to be the Contractor's sole responsibility.
- M.4.1.8. The design is to take into account safety of operation, minimum maintenance and ease of accessibility of all installed equipment. Special attention is to be given to the arrangement of machinery so that all routine in-service maintenance can be carried out with the minimum expenditure of manpower. In particular, equipment is to be arranged with ease of access for maintenance and provision is to be made for material handling such that heavy machinery parts can be removed, and withdrawn from the machinery spaces.

M.4.2. Main Engines

- M.4.2.1. The two main engines are to be unidirectional marine diesel engines.
- M.4.2.2. The diesel engines are to be, four stroke cycle, electronically controlled, direct fuel injection, turbo charged, charge air cooled, compression ignition marine diesel engines.
- M.4.2.3. The diesel engines are to be to the manufacturer's latest design, and are to develop the required power when operating at a maximum of 1800rpm.
- M.4.2.4. The diesel engines are to be rated with maximum air intake temperature of 45°C, sea water temperature of 32°C and 50mbar exhaust back pressure at the maximum engine rating.
- M.4.2.5. The fuel consumption at the engines maximum continuous rating, is to be stated in accordance with ISO 3046, and fuel in accordance with ISO 8217.

- M.4.2.6. The diesel engines are to be arranged for electric starting, with local start/stop controls and remote start/stop from the Pilot House. Local Isolation device to safeguard personnel during maintenance.
- M.4.2.7. The engines are to be IMO rated and built to manufacturer's latest design, in accordance with their latest publications and specifications, type approved by the Classification Society and by the Owners. Due consideration to be given to the availability of spares and service in the proximity of Isle of Wight.
- M.4.2.8. The engines are to be fresh water cooled using a keel cooling system and are to be arranged for electric starting.
- M.4.2.9. Engines to be equipped as for U.M.S. notation, all necessary sensors, alarms and sheathed fuel pipework are to be fitted.
- M.4.2.10. Engines to be supplied with bell house mounted variable displacement hydraulic pump (DE).
- M.4.2.11. Engines to be secured to a rigid fabricated under base supporting diesel engine and hydraulic pump. The engines and aforementioned equipment to be aligned by using solid mild steel chocks and locating dowels.
- M.4.2.12. Each engine sub frame is to be resiliently mounted to the vessel with noise isolation resilient mounts.
- M.4.2.13. Engines to operate on gas oil and to be supplied from the fuel tanks via primary duplex coalescing type filters to the fuel inlet of each engine. Filters to be fitted with sensors and alarms for the presence of water. Filter bodies to be made of mild steel or cast steel. Savealls to be fitted under filters.
- M.4.2.14. The diesel engines are to be fitted with the manufacturer's standard local instrumentation. The following are to be provided as a minimum:-
 - a. Tachometer
 - b. Running hours meter
 - c. Lubricating oil pressure
 - d. Lubricating oil temperature
 - e. Cooling water temperature
- M.4.2.15. All instruments to be vibration proof and preferably mounted off the engine on a local panel.
- M.4.2.16. Engines to be fitted with emergency shut downs for low lube oil pressure, high lube oil temperature, high engine temperature and overspeed, all to engine builder's recommendation. Shut down to be a two stage system, giving alarm first, prior to shut down.
- M.4.2.17. Engines to be fitted with engine builder's recommended air inlet filters/silencers.
- M.4.2.18. Engines to be fitted with a hand barring gear for turning the engine when under maintenance.

- M.4.2.19. Engines to be fitted with crankcase breather emission filter system approved by the engine builder.
- M.4.2.20. Exhaust systems to be dry silenced, having one or more silencers providing a sound attenuation to meet the specified noise level but not less than 45 dB(A) arranged to discharge on the South side of the Vessel, clear of vent intakes and the Pilot House.
- M.4.2.21. Each main engine is to be fitted with an engine heater.
- M.4.2.22. Removable lightweight guards are to be fitted over exposed shafts and engine flywheels with a timing aperture arranged as required.

M.4.3. Auxiliary Generator Diesel Engines

- M.4.3.1. Two auxiliary generators, operating at a maximum of 1500rpm and having an output as required to meet the emergency load at a maximum of 85% of the engine MCR at an ambient temperature of 45° C is to be fitted in the Engine Room.
- M.4.3.2. The diesel engines are to have automatic electric start. Local starting and stopping facilities are also to be provided. Engine running and stopped lights are to be incorporated in the emergency switchboard and on a Pilot House generator status mimic panel.
- M.4.3.3. Battery starting arrangements are to be separate from those required for emergency lighting, communications, and Vessel service, and are to be provided with a dedicated battery charging system.
- M.4.3.4. The diesel engine and alternator are to be skid mounted on resilient mountings and fitted with flexible pipe connections.
- M.4.3.5. The diesel engines are to be fresh water cooled, fed from an independent keel cooling system.
- M.4.3.6. The diesel engines are to be complete with a dry type air filter with service indicator.
- M.4.3.7. Engines to operate on gas oil and to be supplied from the fuel tanks via primary duplex coalescing type filters to the fuel inlet of each engine. Filters to be fitted with sensors and alarms for the presence of water. Filter bodies to be made of mild steel or cast steel. Savealls to be fitted under filters and primary coalescing fuel filter.
- M.4.3.8. The diesel engine is to be fitted with alarms for low lubricating oil pressure, and overspeed.
- M.4.3.9. The diesel engines are to be fitted with a shutdown system for low lubricating oil pressure and overspeed, if permitted by the Classification Society.
- M.4.3.10. The diesel engines are to be fitted with the manufacturer's standard local instrumentation. The following are to be provided as a minimum:-
 - a. Tachometer
 - b. Running hours meter
 - c. Lubricating oil pressure

- d. Lubricating oil temperature
- e. Cooling water temperature

- M.4.3.11. Exhaust systems to be dry silenced, having one or more silencers providing a sound attenuation to meet the specified noise level but not less than 45 dB(A) arranged to discharge on the South side of the Vessel, clear of vent intakes and Pilot House.
- M.4.3.12. Removable lightweight guards are to be fitted over exposed shafts and engine flywheels with a timing aperture arranged as required.

M.5. CHAIN DRIVE SYSTEM

M.5.1. Chain Drive System

- M.5.1.1. The Vessel is to be propelled by two chain drive wheels powered by independent hydraulic motors for each chain drive wheel. The Chain is to have 4 link engagement with the chain wheel, the relative position of the chain drive wheel and the two 'pressure' guide wheels being arranged accordingly. Provision is to be made for the fitting of pressure wheels in the positions indicated on the G.A. The pressure wheels, bearings, and mountings are to be identical to the entry guide wheels. Bearing sites are to be included, wheels axles and bearings are to be supplied loose for installing by the build yard. The chain trough is to be arranged with top access suitable for fitting/replacing all the guide wheels, and for routine chain inspections.
- M.5.1.2. The hydraulic motors to be radial piston cam-lobe type motors suitable for variable speeds.
- M.5.1.3. The hydraulic motors to be driven by any one of the hydraulic pumps coupled to the drive end of the respective main engine.
- M.5.1.4. All hydraulic pipe work to be flushed in accordance with section M.16 before commissioning.
- M.5.1.5. The hydraulic pumps are to be pressure sensing, variable flow, swash plate type. Both pumps being connected to the hydraulic pressure main. The displacement and flow control is to be controlled locally and remotely from the Pilot House.
- M.5.1.6. A system of piloted check valves are to be arranged to connect the duty hydraulic pump to the drive motors without the need for manual operation of high pressure valves.
- M.5.1.7. The chain drive shafts are to be supported by one fixed and one expansion split roller bearing. The drive motors are to be arranged within the drive wheel space.
- M.5.1.8. A raw water chain wash high pressure system is to be provided, comprising of suitably positioned spray nozzles in both East and West sections of both chain chutes. Water to be supplied at a suitable flow rate and pressure to dislodge as much weed, mud and debris as possible by a dedicated pump drawing water from the main sea suction through suitable strainers. The pump to be controlled locally and from the Pilot House.
- M.5.1.9. Chain Wheel Segments and Chain Guide wheels to be free issue items from the client. Drawing details for these items to be supplied separately by the client. Free issue items include the following:
- Chain Drive Wheel Segments
- Chain Guide Wheels
- Pressure Wheels

M.5.2. Main Drive Wheels

- M.5.2.1. The main drive wheels N&S are to be of a fabricated steel construction onto which four cast iron segments are to be bolted – suitable to accommodate 1 ¼" (32mm) diameter H.T. steel electrically welded chains with links accurately gauged 191mm x 112mm outside, 6 link pitch 825mm overall, to BS1663. The chain wheel is to be stressed relieved after welding and then machined, to prevent in service distortion.
- M.5.2.2. Each main drive wheel is to be supported on two pedestal bearings, with structure arranged to suite.
- M.5.2.3. The four cast iron segments are to have a pitch centre diameter P.C.D. of about 2577 mm for the chain drive, providing pockets for 32 links around the circumference.
- M.5.2.4. The Segments are to be radially bolted onto the rim of the drive wheel.
- M.5.2.5. Lifting holes are to be provided in each segment, to facilitate the replacement of worn segments.
- M.5.2.6. To enable the hoisting of the chain wheel segments, a lifting arrangement is to be provided, On the North side this will be lifting points under the Pilot House.
- M.5.2.7. The pattern used by the Contractor to produce the cast iron segments is to become the property of the Owner.
- M.5.2.8. A water trough is to be fitted under the chain wheel, to collect water and seaweed and prevent it entering the machinery space through the chain troughs. The trough is to be arranged to provide clear access to work on either side of the chain wheel, and to allow the passage from one side to the other of the wheel from inside the trough.
- M.5.2.9. The watertight trough is to be fitted with a 316 Stainless Steel seaweed/debris strainer plate and sump fitted with manual electric submersible pump arranged to discharge directly overboard. An easily removable panel is to be arranged to facilitate the cleaning of the strainer plate.
- M.5.2.10. An 'idler' jockey wheel is to be fitted N & S outboard of each main drive wheel to enable changing of the chain. The arrangement is to be generally as fitted on the existing Vessel.

M.5.3. Chain Guide (Jockey) Wheels

- M.5.3.1. Chain Guide Wheels are to be supplied, four in number N & S to be positioned in the chain trough and four in number N & S outer entry guide wheels as per the General Arrangement. The Vessel chain is currently 1 ¼" diameter high tensile, electrically welded, hardened and tempered, black (see H.2.1 for chain specification).
- M.5.3.2. Dimensions of the guide wheels to be arranged for minimum noise and to suit the main drive chains. The chain trough wheels are to have no less than 355 mm effective diameter, and 460 mm maximum diameter.

- M.5.3.3. Spare guide wheels to be provided, see clause G.21.
- M.5.3.4. All guide and pressure wheels are to be resiliently mounted to minimise structure borne noise (see Section G.10).
- M.5.3.5. The chain guide wheels are to be of fabricated steel construction, with “stellite” hard facing welded onto the bearing area.
- M.5.3.6. In addition, four in number pressure wheels are to be fitted P&S at approximately Frames 13 & 34. These pressure wheels are to be fitted above the chain to maintain the chain engagement on the chain drive wheel. In order to allow for fine tuning of the system on site, the mounting arrangements for these wheels are to be designed so that there is the possibility of adjusting the height of the wheels by $\pm 250\text{mm}$ from the nominal height. The pressure wheels are to have the same specification as the guide wheels.

M.6. RAMP HYDRAULIC LIFTING SYSTEM

M.6.1. General

- M.6.1.1. The vehicle ramps are to be raised and lowered by hydraulic rams, supplied by pressure from the hydraulic main.
- M.6.1.2. Each ramp section is to be operated by a pair of hydraulic rams controlled from the Pilot House and locally adjacent to the ramps on the vehicle deck. In addition, a lock or catch, released hydraulically, is to be fitted to mechanically hold the ramps in the raised position from the Pilot House.
- M.6.1.3. The control valve for each ramp section to be so arranged that the ramps can be set and held in any desired position without manually holding the control lever.
- M.6.1.4. A system of piloted check valves are to be arranged to connect the duty hydraulic pump to the ramps without the need for manual operation of high pressure valves
- M.6.1.5. One diesel engine will be selected daily as the duty engine. The duty engine hydraulic working pump will run continuously, the other diesel engine will be on standby.
- M.6.1.6. Solenoid operated control valves to be located in the South side Prow arms directly adjacent to each prow ramp located on the vehicle deck. Final location to be agreed with the owner's representative.
- M.6.1.7. The inner section of the ramp is to be hoisted using a pair of chains connected, located each side of the ramp, to a pair horizontal rams which are located at the ends of the vessel on the Upper Deck Level.

M.7. CONTROL SYSTEM

M.7.1. General

- M.7.1.1. The vessel to be fitted with an independent machinery alarm system. The fitted system is to provide machinery alarm functions in a clear, concise and easily readable manner and to be in full compliance with the Classification Society Rules and Regulations for an unmanned machinery space. The machinery alarm system is to be based on a hard wired alarm system of commercial 'off the shelf' equipment.

M.7.2. Hydraulic System

- M.7.2.1. The chain drive hydraulic pump capacity and diesel engine speed to be controlled from the Pilot House.
- M.7.2.2. The controls to be mounted in a console to provide direction and speed control. The console to be fitted with chain drive hydraulic system pressure gauge.

M.7.3. Engine System

- M.7.3.1. The diesel engines are to be arranged for local and remote controls as required for UMS, and to be fitted with the manufacturer's standard instrument / alarm panel with cut-out mechanisms for overspeed, low lubricating oil pressure and high coolant temperature. All instrumentation to be vibration proof and mounted off engine on a local panel. The following instruments are to be provided as a minimum:-
- a. Tachometer
 - b. Running hours meter
 - c. Engine lubricating oil pressure
 - d. Engine lubricating oil temperature
 - e. Cooling water pressure
 - f. Cooling water temperature
 - g. Start battery voltage
 - h. Start battery charging current

M.7.4. Emergency Shut Downs

- M.7.4.1. The main engines are to be arranged with automatic shutdown mechanisms in accordance with engine manufacturer's recommendations and Classification Society requirements. The operation of the shutdowns shall be independent of the machinery alarm and monitoring system.
- M.7.4.2. In general shut-downs are to be limited to overspeed, cooling water high temperature and lubricating oil low pressure. The shut-down is to be in two stages, 1st stage alarm, 2nd stage shut-down.
- M.7.4.3. Emergency stop buttons of positive lock-in type with flaps, are to be fitted in following locations:-
- Engine local control panels
 - Pilot House Control Station
 - Emergency control station
- M.7.4.4. Shutdown devices are to be arranged with transducers and/or micro switches as appropriate, connected to the machinery alarm and monitoring system.

M.8. HYDRAULIC OIL SYSTEM

M.8.1. General

- M.8.1.1. A hydraulic system is to be provided for operating the Chain Drive Wheels and the Loading Ramps.
- M.8.1.2. The hydraulic system is to be powered from the main engine pumps, each one to be capable of providing the required power.
- M.8.1.3. Both pumps shall be connected to the hydraulic pressure main. One pump to be in use and the other nominated as standby with changeover selection.
- M.8.1.4. All hydraulic system pressures to be kept as low as practical.
- M.8.1.5. Pipes to be arranged as to allow for movement such as flexing of the hull, expansion/contraction due to temperature, pressure fluctuation, etc.
- M.8.1.6. Pressure and return feeds to each end user are to have independent pipework led from the engine room, isolation valves to each system are to be fitted in the engine room. Pressure relief valves to be incorporated into the isolating valves.
- M.8.1.7. Each system supply is to have pressure available indication locally and in the Pilot House.
- M.8.1.8. Any flexible hoses proposed are to be to the Clients approval and so located and arranged to facilitate renewal without draining of the system. Splash guards to be fitted around hoses where required. Hoses to be approved by the Client and the Classification Society.
- M.8.1.9. Small pipes connected by unions to be precision drawn solid pipes.
- M.8.1.10. Details of the hydraulic oils proposed details to be submitted to the Client for approval.
- M.8.1.11. Components in the systems to be preferably from one manufacturer and standardised wherever practical.
- M.8.1.12. The loading ramps are to be arranged for operation by hydraulic rams arranged North and South of the prow. Hydraulically operated mechanical latching devices are to be fitted to provide mechanical securing in the raised position. The latches are to have interface switches to prevent ram operation when the prow is locked open.
- M.8.1.13. Additional manually operated latching system to secure the prows in the raised position is to be provided.
- M.8.1.14. Normal operation to involve raising and lowering a prow ramp every 3 minutes.
- M.8.1.15. Rams to be of stainless steel for marine use and protected by synthetic rubber gaiters. Exposed valves and fittings to be wrapped in tape or equal upon completion of all tests and trials. Ram Hydraulic ports are to have pilot operated check valves.

M.8.1.16. Flexible hoses to be kept as short as possible.

M.8.1.17. Each ramp to be controlled primarily for the Pilot House but have additional local control from weathertight control stations located on the South Side of the vehicle deck adjacent to each ramp in a location to the Clients approval. Each local control station to have a lockable cover and a key operation to change over control from the Pilot House to local control. Note the operator, when using local control, should be visible from the Pilot House.

M.8.1.18. Emergency hand operated hydraulic latch release and prow lowering control valve units are to be provided adjacent to the ramps in a position approved by The Client. Units are to be housed in weathertight cabinets that are tamper proof with full operating instructions engraved, red on white, inside door.

M.8.2. Hydraulic Pumps

M.8.2.1. The hydraulic system is to be supplied by two hydraulic pumps, driven mechanically from each of the main engines.

M.8.2.2. Each pump is to be sized to operate the complete system, including raising/lowering of the prows over the normal operating range at engine idle, in between 10 and 20 seconds adjustable during commissioning.

M.8.2.3. An override switch it to be provided locally to disable this function if required by the operator. Indication of the hydraulic pump clutches, Engaged / Tripped / Override, is to be provided locally and at the Pilot House console.

M.8.3. Hydraulic System Coolers

M.8.3.1. The hydraulic system is to be fitted with a keel cooler (if required). Cooler materials to be suitable for the marine environment. Material specifications to be to The Clients approval.

M.8.3.2. The hydraulic system manufacturer's recommended temperature control systems to be fitted. Each essential hydraulic system to be fitted with a high temperature alarm sensor connected to the machinery alarm system.

M.8.4. Hydraulic Oil Storage Tank

M.8.4.1. Tank to be fitted with high level alarm, low level alarm and low low (shut down) level alarms and level gauges.

M.8.4.2. Pumps to be fitted with suction strainers. Systems to be protected by discharge line filters. By-pass type filters in the pump discharge lines are not permitted. System return/drain lines to be fitted with filters incorporating by-pass valve and high pressure differential alarm.

M.8.4.3. The systems to be fitted with high temperature alarms and high differential pressure across filter alarms, together with any other alarms recommended by the hydraulic systems manufacturer.

M.8.4.4. Valves and components to be located on panels with engraved labels identifying the components.

- M.8.4.5. Arrangements to be made to transfer the contents of the hydraulic oil storage tank to a stand pipe on deck by means of a semi rotary hand pump of about 1m³/h capacity.

M.9. FUEL SYSTEM

M.9.1. General

- M.9.1.1. Two main tanks each of a capacity as stated in the Hull Specification to be fitted, as shown on the General Arrangement Drawing, complete with all necessary filling, sounding and air pipes. The air pipes, sized for powered filling, are to terminate at deck level with flameproof gauzes. Shut-off valves on the bunker tanks are to be arranged for quick closing from deck.
- M.9.1.2. The tanks to be fitted with dial type contents gauges, to owners' approval and graduated sight glasses with automatic isolating valves. The bunkering station to be arranged for bunkering from a vehicle tanker on the vehicle deck. The station is to be mid-ships on the north side and accessible from the Vehicle Deck.
- M.9.1.3. Each tank to have a sloping bottom to a sump of not less than 5 litres, with a self-closing drain and isolation valve.
- M.9.1.4. A balance pipe is to be fitted between the two tanks to allow for cross flow between the two tanks.
- M.9.1.5. A hand pump is to be arranged as an alternative method for transferring fuel between tanks and to disembark fuel oil.
- M.9.1.6. Sounding pipes to be led to vehicle deck and arranged with brass flush deck fittings, clearly engraved with tank identification.
- M.9.1.7. The supply to each engine to be by gravity via a hydraulically operated quick closing remotely operated shut-off valves, with the fuel returns led back to the tanks through check valves. The static head on the engine fuel systems is to be in accordance with the engine manufacturers recommendations.
- M.9.1.8. Fuel oil piping is to be solid drawn steel, and all valves and fittings are to be steel or gunmetal. Screwed connections are only to be used in positions approved by the Owner. Flexible connections to the resiliently mounted sets are to be as short as possible and of a type approved by Class. Engine high pressure fuel pipes are to be double walled and monitored for leakage.
- M.9.1.9. In addition to the diesel engine manufacturer's engine mounted, duplex, particulate filters, duplex coalescing filters (with water alarm) and magnetic fuel conditioners are to be provided in the fuel supply line to each diesel engine.

M.10. LUBRICATING OIL SYSTEM

M.10.1. General

- M.10.1.1. Lubricating oil storage is to be arranged within the workshop space. With the provision of racking to accommodate two 208 Litre drums horizontally with lockable self-closing taps for manual replenishment of engine oil.
- M.10.1.2. A saveall is to be arranged beneath the drum stand, and stowage provided for oil transfer containers.
- M.10.1.3. The diesel engines are to be force lubricated on the wet sump principle. Sump capacity is to be maker's largest available in order to maximise the period between oil changes. Cooling of the engine lubricating oil is to be incorporated in the engine cooling system. Electric pre-lubricating oil pumps are to be provided if required.
- M.10.1.4. Each engine sump is to be provided with a permanently piped suction connection and oil draining pump, to local hose connection.
- M.10.1.5. Each diesel engine is to be fitted with the engine manufacturer's full-flow lubricating oil filters and lubricating oil suction strainer.

M.11. MACHINERY COOLING SYSTEM

M.11.1. General

- M.11.1.1. Each diesel engine is to be fresh water cooled on a closed circuit keel cooled system. Each engine is to be complete with a fresh water header tank with sight glass and level sensor, and engine driven fresh water pump.
- M.11.1.2. Each engine is to be provided with connections from the fresh water cooling system for waste heat recovery via heat exchanger.
- M.11.1.3. PT100 sensors are to be fitted in fresh cooling water system at the inlet and outlet to the heat exchanger, in suitable pockets provided for connection to the machinery alarm and monitoring system.

M.11.2. Keel Coolers

- M.11.2.1. Five in total keel coolers to be provided. Two for the main engines and two for the auxiliary generators and one for hydraulic oil system.
- M.11.2.2. Keel coolers are to be sized to provide sufficient cooling for the machinery operating at MCR.
- M.11.2.3. Each main engine is to be independently fresh water cooled, circulated by the engine driven cooling water pump.
- M.11.2.4. Each of the engine cooling systems is to be totally enclosed and arranged for individual cooling of the engine cooling water through keel cooler channel bar sections welded directly to the hull. The cooling surface area to be 25% in excess of design to ensure adequate cooling during crossing and whilst stationary on the slipway. The keel cooling system to be arranged in accordance with the engine builder's recommendations and to their approval.
- M.11.2.5. Thermometer pockets are to be fitted before and after keel coolers. One thermometer with suitable scale is to be fitted in each pocket. Thermometer is to be visible in the engine room from above floor plates.
- M.11.2.6. Each of the four systems to be provided with a header tank complete with contents level sight gauge, air vent, chemical additive filling tundish, low level alarm, and fresh water filling connection comprising local shut off ball valve and short length of flexible hose to the filling tundish.
- M.11.2.7. The connections to, from, and interconnecting the keel cooling channels are to be made internal inside the hull of the vessel to avoid damage. Isolating valves are to be fitted at each connection.
- M.11.2.8. Provision is to be made for the release of any entrapped air from the coolers.

M.12. EXHAUST SYSTEM

M.12.1. General

- M.12.1.1. The exhaust system from each main engine and auxiliary generator is to be discharged above the glass height on the south side of the ferry via dry type silencers. The exhaust piping to be arranged to avoid any sharp bends and is to be approved by the engine builders, and provide a minimum attenuation of 45 dB(A) (Twin silencers if necessary to achieve the attenuation).
- M.12.1.2. Particular care is to be taken in locating the exhaust outlets in order that no exhaust gas is drawn into the Passenger accommodation during the crossing or whilst stationary on the slipway.
- M.12.1.3. Exhaust piping is to be of heavy gauge steel with flexible expansion bellows fitted adjacent to each main engine. The pipes and silencers are to be suitable clipped and supported to allow for expansion and any attachments to accommodation bulkheads are to be insulated.
- M.12.1.4. Internally sleeved convoluted stainless steel bellows expansion compensators are to be fitted at all necessary positions in exhaust piping.
- M.12.1.5. Exhaust piping is to be adequately dimensioned to achieve a maximum backpressure of 50 mbar and arranged with large radius bends.
- M.12.1.6. The exhaust piping and silencers are to be efficiently lagged and covered with cloth. Removable mats to be fitted in way of all flanged joints and expansion bellows.
- M.12.1.7. Exhaust pipes to be effectively secured and provided with sliding feet or resilient supports allowing for thermal expansion. Thermal insulation to be fitted to supports to prevent heat transference into structure. Exhaust systems to be in addition resiliently mounted to give the necessary acoustic isolation.
- M.12.1.8. Where exhaust pipes penetrate steel structures efficient thermal insulation to be provided preventing heat transmission into the structure. Temperature of structure adjacent to such penetrations not to be more than 30°C above ambient air temperature.
- M.12.1.9. All external exhaust pipe work and bracketry is to be stainless steel 316L.

M.12.2. Exhaust Silencers

- M.12.2.1. Each diesel engine is to be fitted with an exhaust silencer arranged in accordance with the engine manufacturer's recommendations. The silencer is to have a noise attenuation of not less than 25 dB(A).
- M.12.2.2. The exhaust silencers are to be fully insulated with mineral wool covered with glass fibre cloth and retained with galvanised wire netting.
- M.12.2.3. The system is to be designed so that the noise from the diesel exhausts meets the requirements set out in the General Section of the specification.

M.13. ENGINE ROOM VENTILATION

M.13.1. General

- M.13.1.1. Forced supply and natural exhaust ventilation is to be provided for each machinery space to allow the machinery to operate at maximum power and efficiency with all doors closed. One inlet and one exhaust fans are to be arranged in each machinery space to limit engine room temperature rise to 12°C, and maintain a slight positive pressure within the machinery space under all operating conditions.
- M.13.1.2. Closing arrangements are to be fitted to suit the regulations in case of fire.
- M.13.1.3. All machinery space fans shall be frequency controlled via a PLC, with the fan speed being limited to that required to retain the specified conditions.

M.14. FIRE SYSTEM

M.14.1. Fire Main

- M.14.1.1. A dry fire main system is to be fitted and is to comply with the requirements of the MCA.
- M.14.1.2. The fire main of approved dimensions is to be installed though out the Vessel served by the fire pumps with isolation valves to separate the section of the fire main within the engine rooms.
- M.14.1.3. The fire hydrants throughout the Vessel are to be bronze soft-seated hydrant valves with 2.5" instantaneous couplings with blanking cap retained on keep chains. Hydrants and couplings to be the same standard as used by the local Fire Brigades, at the vessel operating area.
- M.14.1.4. Hydrants are to be located around the Vessel to ensure suitable hoses with 10mm nozzles are capable of reaching any position on board. Location also to enable hoses to be used to clean out chain troughs.
- M.14.1.5. All piping to be galvanised after all bending and fabrication is complete.

M.14.2. Fire Pumps

- M.14.2.1. Two electric driven centrifugal pumps, having a capacity in accordance with the Classification Society and Flag Authority requirements but not less than 25m³/h when working against a head of 30m. Each one to be located in separate engine room compartments.
- M.14.2.2. Pumps are to be vertical or horizontal self-priming pumps with gunmetal casings, aluminium bronze impellers, stainless steel shaft and ceramic faced mechanical shaft seal.
- M.14.2.3. Each Fire pump is to be located in separate Engine Rooms. Pumps are to be arranged for remote starting and stopping from the Pilot House and the Emergency Control Position.
- M.14.2.4. The self-priming function to be built with the pump system with no external assistance (wet ring system).
- M.14.2.5. Pumps are to have connections as follows:
 - Suction: Sea
 - Bilge Direct
 - Discharge: Fire main
 - Overboard Discharge

M.15. FIXED FIRE FIGHTING SYSTEM

M.15.1. General

M.15.1.1. A fixed fire suppression system is to be provided for the machinery spaces.

M.15.1.2. A fire control station is to be provided outside of the machinery space. The control station is to be arranged for shutting down of ventilation fans, the closing of all quick closing valves, a warning siren before the release of the firefighting system and the activation of the suppression system. Instructions are to be provided for the securing and ventilation openings, and the venting of the compartment prior to re-entering.

M.15.2. Machinery Spaces

M.15.2.1. Engine Room to be protected by a fixed gas total flooding installation using NOVEC gas, meeting Flag Authority and Classification Society requirements.

M.15.2.2. NOVEC gas to be discharged throughout the machinery space via shielded multi-jet nozzles.

M.15.2.3. NOVEC bottles to be stowed in one of the machinery spaces. The store is to be complete with bottle securing brackets, spacers, distribution manifold and a bottle weighting device.

M.15.2.4. Control box for discharge of NOVEC gas to be arranged adjacent to the machinery space main entrance. Control box to be kept locked with key kept in break glass box adjacent to control box.

M.15.2.5. Each Engine room is to have one portable foam applicator unit.

M.15.3. Accommodation Spaces

M.15.3.1. Fire extinction to be provided by fire hydrants and hoses and fire extinguishers to regulatory requirements. See hull section H.4.2.

M.15.4. E.R. Emergency Control Position

M.15.4.1. An engine room emergency control position to be arranged adjacent to the engine room entrance.

M.15.4.2. The control position to include the following:

- ER ventilation fan stop, with running indication
- ER ventilation damper controls, with open/closed indication
- Bilge pump and valve controls
- Fuel oil quick closing valves
- Emergency fire pump start
- Hard copy of Safety Plan

M.15.4.3. Emergency control position to include 24V emergency lighting, emergency hand lamp, instruction plates.

M.16. BILGE SYSTEM

- M.16.1.1. The bilge system is to meet all requirements of the Classification Society and the MCA.
- M.16.1.2. The system is to be served by two bilge and two fire pumps .Each pump to be electric motor driven, self-priming, centrifugal, pumps and are to be fitted of rule capacity for bilge duty, of a make and type approved by the Owners. Pumps to be arranged with overboard discharges and discharge to the dedicated bilge retention tank for disposal ashore. The shore connection for the discharge of the bilge retention tank is to be a standard IMO flange, and is to be grouped with other waste discharges, that is waste oil on the North side, accessible from the vehicle deck. Pump bilge main suction and fire main discharge valves are to be interlocked such that bilge water cannot be discharged to the fire main.
- M.16.1.3. All compartments below the main deck level are to be fitted with at least one bilge suction, connected to a common bilge main. The end of bilge suction pipes to spaces outside of the engine room are to be fitted with collapsible type strum boxes. Engine Room bilge main suctions are to be fitted with a mud box, directly coupled to the bilge suction valve. Void space suctions to be led to bilge main manifolds located N&S and E&W in the Engine Room.
- M.16.1.4. A bilge strainer with quick removable cover is to be fitted in an easily accessible place in the common bilge main before the bilge pumps.
- M.16.1.5. The bilge suction and overboard discharge piping to be of heavy gauge, Schedule 80, steel, galvanised after all bending and fabrication.
- M.16.1.6. Bilge suction valves and valve chests are to be of non-return type and manufactured from high quality cast iron with gunmetal fittings. Valve spindles are to be of external thread type with indicators showing 'Open' and 'Closed' positions.
- M.16.1.7. An integral, epoxy coated mild steel, bilge retention tank to be fitted, the tank is to have inlets from the bilge system, and be fitted with a valve capped suction connection on deck for shore disposal. The tank is to be vented, the vent being fitted with a flame proof gauze. Tank to be provided with a sounding pipe, contents gauge, and a high level alarm switch connected to the alarm panel.
- M.16.1.8. Independent submersible, manually operated pumps are to be installed in the chain drive wheel spaces arranged to discharge directly overboard, the function of the pumps being to clear the spaces of entrained water from the chains. In order that the pumps are not blocked by weed the lower section of the spaces are to incorporate debris strainers/weed tray of 316L stainless steel debris strainers to be readily removable for cleaning on a daily basis. Bilge level alarms to be incorporated into the bilge alarm system.

M.17. SEA INLET CHESTS AND STRAINERS

M.17.1. Sea Chests

- M.17.1.1. Four main sea suction chests are to be fitted, two in each engine room.
- M.17.1.2. Each sea inlet chest is to be sized for 100% duty. The diameter of each sea suction valve is to be calculated on the basis of total sea water velocity through valve not exceeding 1.8m/sec.
- M.17.1.3. Each main sea suction chest is to be fitted with one air vent, one sea water flushing valve and anodes. Air vent pipes are to be terminated above the main deck in a protected location.
- M.17.1.4. Sea inlet grids are to be secured by corrosion resistant fastenings. Clear area through inlet grids is to be not less than four times bore area of sea suction valves. The sea inlet grids are to be designed for easy removal, handling and refitting from inboard with the Vessel afloat
- M.17.1.5. A main sea suction valve is to be fitted to each sea suction chest.
- M.17.1.6. Shiplside valves are to be fixed directly to pads or short, straight, spigot pipes welded on the hull. Valves are to be attached by bolts or studs but these are not to penetrate through the hull pad.
- M.17.1.7. Sea inlet cross connection pipe to be fitted between each engine room pair of inlet boxes. All users are to draw water from this cross main via individual strainers and valves.

M.17.2. Main Sea Inlet Strainers

- M.17.2.1. The sea inlet strainers are to be provided at each sea inlet.
- M.17.2.2. The sea inlet strainers are to be simplex type with cast iron body, quick release stainless steel swing bolts and captive wing nuts. The strainer elements are to be copper nickel alloy or Monel with 4mm perforations and a minimum of four times the free cross sectional area of the pipe.
- M.17.2.3. The sea inlet strainers are to be fitted with a drain valve, vent and differential pressure gauge with isolating valves.

M.18. PUMPS PIPING, VALVES AND FITTINGS

M.18.1. Pumps

- M.18.1.1. Pumps handling sea water are to have bronze or gunmetal casing, bronze impeller and wear rings, and stainless steel shaft with mechanical shaft seals.
- M.18.1.2. Pumps are to be arranged to ensure that rotating elements may be removed without dismantling floorplates, ladders, gratings, pipework, other machinery etc.
- M.18.1.3. Each pump is to be fitted with separate suction and delivery gauges with isolating cocks.
- M.18.1.4. Each pump is to be fitted with isolating valves at suction and discharge branches. Discharge valves are to be non-return type where appropriate.
- M.18.1.5. Pumps speeds are not to exceed 1500 rpm except where otherwise specified.

M.18.2. Piping

- M.18.2.1. All pipes and piping systems are to be designed and installed to meet the Classification Society's rules.
- M.18.2.2. Pipes passing through decks and bulkheads are not to form rigid connections between deck/bulkhead and any internal structure.
- M.18.2.3. Joint flanges of deck pieces and pipes are to be at least 150mm clear of decks and tank tops.
- M.18.2.4. Pipe runs under engine room floorplates are to be arranged in vertical tiers wherever possible to ensure maximum area of access to tank top plating and shell plating.
- M.18.2.5. Pipe runs are to contain sufficient joints for simple removal and renewal of pipes and overhaul of machinery and equipment.
- M.18.2.6. Pipes are to be routed clear of designated walkways, access routes, headroom, withdrawal spaces, doors, manholes and cleaning spaces for heat exchangers. The Contractor is to be responsible for all necessary modifications which become apparent subsequent to installation of pipework.
- M.18.2.7. Installation of liquid medium pipes is to be avoided above and in the vicinity of electronic and electric switchboards in order to reduce the risk of damage due to pipe failure.
- M.18.2.8. Low points of all systems subject to freezing are to have drains permitting drainage and drying out of the system during prolonged shut-down periods. These drains are to be piped direct to bilge wells.
- M.18.2.9. Thermometers are to be arranged, submerged in pockets screwed into pipe lines.
- M.18.2.10. All piping and fittings are to be securely supported and suitably mounted to prevent the transfer of heat and vibration to the supporting structure.

M.18.2.11. On completion all piping is to be hydraulically pressure tested in accordance with Classification Society requirements with all pumps, etc. isolated.

M.18.2.12. Heavy zinc rings or short, heavily galvanized pipe sections are to be fitted between dissimilar metals in sea water, sanitary, bilge and ballast piping systems.

M.18.2.13. Electrical systems and equipment are not to be earthed to, or attached to piping systems.

M.18.2.14. Pipe bends are to be formed by cold bending of tubes, and the use of butt welding fittings is to be strictly to the approval of the Client's Representative. All bends are to be smooth with a minimum radius of two times the pipe diameter. Bend radii of less than 2 times the pipe diameter are to be individually approved by the Client's Representative if required.

M.18.2.15. Where pipe cross sections change, tapered reducer pieces are to be fitted, the length of the taper is to be not less than the diameter of the larger of the two pipes.

M.18.2.16. All galvanised piping is to be hot dipped galvanised after all bending, shaping and welding is completed and is to comply with BS.729:1971.

M.18.2.17. Rubber hose connectors with clips are not to be used

M.18.2.18. Use of ferrous screwed pipe fittings is not permitted in sea water systems. Screwed bonnet valves in general are to be avoided, but if fitted, are to have substantial bonnet locking plates.

M.18.3. Piping Material Schedule

SYSTEM	PIPE MATERIAL
Sea water cooling system	CuNiFer 90/10
Bilge system	Galvanized mild steel
Exhaust gas pipes	Black steel
Air pipes from oil fuel and lub. oil tanks	Black steel
Sounding pipes from oil fuel and lub. oil tanks	Black steel
Engine room oil and oily/water drain systems	Black steel
Waste heat recovery from cooling system	Cunifer 90/10
Domestic heating circuits (within machinery space)	Copper pipes
Domestic heating circuits (Outside machinery space)	Copper or polypropylene pipes
Fire/wash deck systems	Galvanized mild steel
Hydraulic pipe systems	Solid drawn steel in mach. Spaces Tungum on weather Deck

M.18.4. Pipe System Colour Coding

- M.18.4.1. Piping systems are to be colour coded with printed ethyl cellulose tape bands in accordance with ISO 14726:2008.
- M.18.4.2. Valve hand wheels and operating levers are to be painted black, emergency controls are to be red and valve bodies in similar colours to pipe colour bands.
- M.18.4.3. Colour code charts are to be printed on plastic to Client's approval. Charts are to be fixed at prominent positions in machinery space and at two other locations nominated by Client's representative.

M.18.5. Pipe Cleanliness

- M.18.5.1. All pipes are to be cleaned to an appropriate standard after manufacture, ends are to be sealed and pipes stored in clean, dry conditions until required for assembly. Water systems are to be flushed with Potable water to approval of Client's Representative.
- M.18.5.2. Hydraulic and Lubrication oil systems are to be flushed by two-stage process by which the Vessel's pipework is first flushed to an acceptable standard with slave filters in place, then the entire system is to be flushed, using slave filters, to a standard acceptable to the relevant machinery manufacturer and Client's Representative.

M.19. Air Pipes

- M.19.1.1. Air pipes generally two per tank, and of cross-sectional area in accordance with Classification Society requirements to be arranged at opposite ends of tank.
- M.19.1.2. Air pipes to be carried up close to the ship's side, and in general are to terminate at Rule height above the level of the weather deck.
- M.19.1.3. All air pipes to be fitted with Winel type heads or equal.
- M.19.1.4. Heads to fuel oil tanks to be fitted with anti-flash gauzes.
- M.19.1.5. For pipe materials, dimensions, penetrations, etc., of air pipes to water tanks, oil tanks, and void tanks see Machinery Section.
- M.19.1.6. The first length of all air pipes to be attached to tanks by means of flanged connection.
- M.19.1.7. Engraved plate to be fitted to each air pipe head to show the tank or space that is served.

M.20. Sounding Pipes

- M.20.1.1. 50mm bore sounding pipes to be arranged and fitted to all tanks, cofferdams, voids and bilge wells.
- M.20.1.2. Lead of the pipes to be kept as straight as possible, and to be adequately clipped and protected.
- M.20.1.3. Sounding pipes to be arranged with closed ends and suction slots.
- M.20.1.4. Sounding pipes terminating on the weather decks to be fitted with brass or stainless steel screw caps complete with 25 mm square machined head and keep chain attached to pipe, so positioned as to be clear of the marked vehicle lanes.
- M.20.1.5. Sounding pipes terminating in machinery spaces are to extend above the floor plate/deck level, with top of the pipe at 760 mm above floor plate/deck level, and to be fitted with weighted self-closing cocks, test valves and brass/stainless steel screw caps.
- M.20.1.6. Each sounding pipe head to be engraved to show the name/number of the tank or space that is served.
- M.20.1.7. The first length of sounding pipe to be attached to all tanks by means of a flanged connection.

M.21. Filling Stations

- M.21.1.1. A bunkering station is to be provided with connections for Fuel Oil, clean Lube. Oil and clean Hydraulic Oil. The bunker station is to be near amidships in a recess with a weatherproof door.
- M.21.1.2. Discharge line for Dirty Oily Bilge water is to be provided in the same space.
- M.21.1.3. All filling and discharge lines are to be provided with standard caps with the facility for individually locking each one with a padlock.

M.22. Scuppers and Drains

- M.22.1.1. Upper deck to be drained to the main deck, the Pilot House top to be drained to the Upper deck.
- M.22.1.2. 50 mm scuppers, complete with strainer plate to be arranged in all spaces where water may accumulate under normal conditions of operation.
- M.22.1.3. Scuppers to be positioned at lowest point of each space, and additional scuppers arranged in spaces where water could drain to more than one point. Scuppers to be flush with top of deck covering.
- M.22.1.4. Scuppers from accommodation space to be grouped where possible and arranged for overboard discharge above the waterline.
- M.22.1.5. All scuppers to be spigotted through the shell plating.
- M.22.1.6. Flanged cover clean-outs to be fitted to scuppers at each bend to facilitate cleaning.
- M.22.1.7. All scuppers to be fitted with stainless steel grids secured by stainless steel screws.

M.23. HEATING AND COOLING

M.23.1. Passenger Accommodation

- M.23.1.1. An independent fresh water heating system is to be provided, with heating supplied by both main diesel engines via waste heat recovery, to provide heating to the passenger accommodation space.
- M.23.1.2. The fresh water heating system is to be a closed circuit system with heating of the fresh water provided from the main diesel engine fresh water circuit via a heat exchanger. The system is to be complete with a fresh water pressurised header tank fitted with pressure gauge and electric circulating pump.
- M.23.1.3. Passenger accommodation area, is to be heated from the fresh water heating system via convection radiators or matrix heaters. The fresh water heating system is to be arranged to maintain a constant temperature in the space by means of thermostatic control valves.
- M.23.1.4. The fresh water heating system shall have a temperature control on the 'engine circuit' side of the system via thermostatic controlled diverter valves to limit the system temperature

M.23.2. Pilot House

- M.23.2.1. An independent thermostatically controlled, electric heater will be provided for the Pilot House.
- M.23.2.2. A Separately Costed Option for the Pilot House for an independent air conditioning unit is to be provided in the Quotation package.

M.24. MISCELLANEOUS

M.24.1. Floor Plates, Gratings, Ladders and Handrails

- M.24.1.1. The machinery spaces to be fitted out with painted mild steel, 6.5mm thick, chequer plate with portable access panels where required.
- M.24.1.2. Polished steel handrails and guards are to be fitted in way of all items of moving machinery to Owners' approval.

M.24.2. Machinery Removal Routes

- M.24.2.1. The Contractor is to indicate on drawings shipping/removal routes for major equipment.

M.24.3. Machinery Guards

- M.24.3.1. All exposed machinery parts are to be fitted with guards of appropriate design to ensure safety of engine room personnel in accordance with the Factories Act. (Health & Safety).
- M.24.3.2. Guards may be constructed of sheet metal or galvanized expanded metal mesh and to incorporate all necessary features for adequate inspection and operation of machinery. Guards that form a natural access route around the engine space are to have sufficient strength to form a step to enable safe access.
- M.24.3.3. Guards to be easy demountable to facilitate maintenance.

M.24.4. Engine Room Work Bench / Storage

- M.24.4.1. One heavy duty steel workbench is to be provided in the engine room fitted with the following equipment:
- Trough with drain led to a removable 20 litre polyethylene waste oil container below, suitable secured in place
 - One lockable cupboard under, having one shelf and 75mm deep sump tray
 - One 150mm cast-steel vice with quick release action
 - One overhead mounted adjustable work lamp
 - Two power sockets
- M.24.4.2. A workshop storage area of approximately 1m² is to be provided adjacent to the workbench, consisting of the following:
- One galvanised sheet steel rag storage bin approx. 50 litres capacity.
 - Various stowage hooks and shadow boards to be fitted on available vertical surfaces for stowage of a range of tools and components.

- Multiple-tier heavy-duty adjustable steel racking/shelving to accommodate spare equipment storage boxes. Shelving to be arranged with drop-in storm rails all round.

M.24.5. Machinery Identification

M.24.5.1. Each machine, heat-exchanger, tank, etc. to be clearly identified by name and where applicable, number on an engraved polished brass or stainless-steel nameplate having figures not less than 25mm high.

M.24.5.2. Nameplates to be affixed, preferably on the identified equipment or, alternatively, in a prominent position on adjacent structure.

M.24.6. Spares and Tools

M.24.6.1. The Contractor is to supply all manufacturer's recommended special tools and equipment for normal service requirements.

M.24.6.2. Spare parts required by the Classification Society and Flag Authority are to be supplied and stowed on board.

M.24.6.3. All spare parts shall be suitably protected, crated and identified by the Contractor.

M.24.7. Acoustic and Thermal Insulation

M.24.7.1. For Acoustic and Thermal insulation details of the machinery spaces and chain troughs, please refer to section H.9.

ELECTRICAL SPECIFICATION

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E.1. General Requirements

E.1.1. Voltage

- E.1.1.1. The electrical distribution system for the vessel is to be single phase, two wire, with earthed neutral supplied from a generator at a voltage of 230V at a frequency of 50 hertz.

E.1.2. General

- E.1.2.1. A 230V isolated AC power installation of ample capacity is to be provided for all electrically driven machinery and equipment.
- E.1.2.2. The Contractor is to provide all necessary information and guidance to ensure that alternator capacity together with respective matching control gear has necessary characteristic to provide satisfactory discrimination in vessels electrical power system.
- E.1.2.3. The machinery and electrical installation to be built and installed in accordance with the Rules and Requirements of the Classification Society and IEC Rules section 60092, 'Electrical Installation in Ships'.
- E.1.2.4. Items not specifically mentioned, but required by statutory regulations or for the safe and satisfactory operation of the vessel, are to be included.
- E.1.2.5. A load analysis, including details of individual equipment and diversity factors used, is to be supplied prior to confirmation of generator and alternator capacities.
- E.1.2.6. A detailed as built electrical drawing package is to be provided and is to include the following: -
- a. Cross references to all manufacturers' equipment drawings and internal wiring diagrams.
 - b. Unique part numbers are to be shown on drawings adjacent to all electrical equipment and a parts list which details manufacturer, manufacturer's part number, voltage, current and IP rating is to be produced. The parts list is also to include cross references to drawings where items appear.
 - c. General arrangement or other drawings which show electrical items are to include a cross reference or cross references to the relevant electrical drawing(s) detailing wiring and connection details.
 - d. Cable numbers are to be unique and include the system drawing number to facilitate traceability and drawing navigation. Cable numbers are to also include an EMC separation category suffix (in line with the requirements of IEC 60533 Annex C) which denotes which category they belong to.
 - e. Nomenclature is to be consistent throughout the drawing pack.

E.1.3. Voltage Distribution

- E.1.3.1. Distribution is to be arranged as follows;

- a. Main Power/Lighting: 230 Volts, 1 Phase, 50 Hertz, AC
- b. Control Power: 110 Volts, 1 Phase, 50 Hertz, AC
- c. LED Lighting: 24 Volts DC
- d. Low Power, Alarms, etc. 24 Volts DC
- e. LED Emergency Lighting: 24 Volts DC via emergency battery

E.1.4. Cables and Wiring

E.1.4.1. Cables are to be manufactured by approved manufacturers and are to comply with requirements of the Classification Society.

E.1.4.2. Except for the exceptions listed below all cable is to have insulation complying with the requirements of IEC60332-3 or IEC60331 as applicable. Minimum size of power and control cabling for fixed wiring is to be 1.5mm². Minimum size for data cables to be 0.75mm², all data cables are to be twisted pairs unless specified otherwise by the manufacturer.

Exceptions

- i. Flexible cable between connection boxes and high power lighting fittings such as Halogen floodlights are to be silicone rubber insulated and glass fibre braided.
- ii. In high temperature locations (50°C and above) suitable high temperature rated cabling is to be used.
- iii. Equipment where specialist cables have been specified by equipment manufacturer(s) but only if a marine approved equivalent is not available.

E.1.4.3. Multicore cables in low power and control circuits are to have two spare cores minimum. Fillers are to be non-hydroscopic.

E.1.4.4. All cable to be class 2 standard type. Cables over 50mm² cross sectional area to be flexible class 5 type. All cables connected to resiliently mounted equipment are to be class 5 type.

E.1.4.5. Cables are to be selected, installed and tested in accordance with IEC 60092-352 and IEC60092-401.

E.1.4.6. All cable runs are to be in one length without joints, any short cables are to be replaced.

E.1.4.7. In internal areas, cables are to be secured to perforated galvanised admiralty pattern steel cable tray using plastic cable ties spaced 150mm apart. In addition to the plastic ties, stainless steel fire ties are to be fitted at 800mm spacing. External cabling is to be installed in watertight 316L grade stainless steel conduit pipe.

E.1.4.8. Cables are not to be installed under floor plates in machinery spaces, unless specifically supplying equipment items located under floor plate level. Cables which have to run under floor plates are to be mechanically protected in watertight galvanised steel conduit pipes secured to structure.

- E.1.4.9. Wherever possible cables in accommodation and control areas are to be concealed behind linings. If this is not possible surface trunking or conduit can be used, this should match the colour of the décor as much as is possible.
- E.1.4.10. Cables runs on tray where liable to mechanical damage are to be protected by substantial steel cover plates.
- E.1.4.11. Multiple cable runs through decks and watertight bulkheads are to be led through Classification Society approved multi-cable transit glands (MCT Brattberg or similar) to the Client's approval. Small penetrations are to be effected by single watertight glands or deck tubes.
- E.1.4.12. Cables are to be labelled at each end in accordance with as fitted drawings using approved weather, heat and oil resistant plastic or stainless steel markers fixed using cable ties.
- E.1.4.13. All cable conductors are to terminate in crimped cable connectors of approved type and are to be identified by permanent marks corresponding to "as fitted" wiring diagrams. All terminal connections are to be the spring loaded maintenance free type (Weildmuller or similar type).
- E.1.4.14. Internal distribution and control panel enclosures are to be painted sheet steel and ingress protected to a minimum IP44.
- E.1.4.15. All electrical equipment cables glands are to match the ingress protection rating of their respective enclosure i.e. an IP44 enclosure must have as a minimum IP44 rated cable glands.

E.1.5. Shore Supply, (For "Dry Dock" use)

- E.1.5.1. Shore supply connection box is to be fitted. Cable entry tube to be 150mm diameter with IP68 screw cap and is to be arranged in a suitable location in an external bulkhead.
- E.1.5.2. Shore supply connection and equipment is to be arranged to accept a 230 volt, 1 phase, 50 Hertz, 2 wire + earth AC supply from shore. An isolation transformer of suitable capacity is to be included.
- E.1.5.3. Capacity of shore supply cable and equipment sized in accordance with an approved load analysis, but not less than a 32 amp supply.
- E.1.5.4. Length of shore power cables approx. 25m, to be agreed with the Client.
- E.1.5.5. Connection box is to be ingress protected to IP56 and fitted with air-break circuit breaker, LED type red shore power available indication, voltmeter, ammeter and male socket connector to accept the female shore supply cable plug.
- E.1.5.6. Connection box labels are to be black through white traffolyte material. Voltage warning labels are to be black through yellow. Safety labels are to be white through red. All labels are to be secured with stainless steel self-tapping screws.
- E.1.5.7. Shore supply is to be interlocked with alternator breaker to prevent simultaneous closure.

E.1.6. Emergency Radio Batteries & DC Distribution Board

- E.1.6.1. Two sets of 24 volt AGM batteries suitable for deep discharge duty and sized in accordance with an approved load analysis are to be fitted. One to supply transitional power to equipment required by SOLAS to operate in an emergency, the other to supply transitional power to the radio equipment. Batteries for supply to emergency equipment are to be secured and stored in the Battery Locker on the upper deck, in storage compartment below Pilot House. Batteries for supply to radio equipment are to be secured and stored in a GRP box on the Upper deck in storage compartment below Pilot House, and vented to atmosphere.
- E.1.6.2. Fully automatic intelligent battery chargers, one per battery set, are to be installed. Battery charger capacity to be such that if one battery charger should fail the remaining charger can support both system via a battery charger isolator.
- E.1.6.3. The emergency batteries are to be connected via a fused link box to the DC Switchboard.
- E.1.6.4. The radio batteries are to be connected via a fused link box to the Radio distribution board.
- E.1.6.5. The DC distribution board and radio distribution board are to include charging supply on (red) indication, voltmeters, charging/discharging ammeter and earth fault monitoring units with an output to the machinery alarm system. Indication lamps are to be LED type.
- E.1.6.6. Outgoing circuits in both the DC and Radio distribution boards are to be controlled and protected by circuit breakers incorporating overload and short circuit protection and are to be capable of being key locked in the “off” position for safety/maintenance purposes.
- E.1.6.7. Battery discharge monitoring systems are to be fitted to the emergency and radio battery systems. These are to include displays in the Pilot House to indicate batteries are charging, charging current, battery discharge indication with remaining capacity. Battery discharge and battery approaching critical level of discharge alarms are also to be provided. A battery discharge alarm output to the alarm system is also to be included.
- E.1.6.8. Battery charger failure alarms are to be provided with an output to the machinery alarm system.

E.1.7. Propulsion Engine and Auxiliary Generator Start Batteries

- E.1.7.1. Four sets of 24 volt AGM starting duty batteries sized in accordance with an approved CCA load analysis are to be installed for main engine starting. One set for each propulsion engine and one set for each Aux generator engine. Batteries are to be securely installed in vented GRP boxes in the engine room.
- E.1.7.2. Propulsion engine and aux generator engine banks are to be of a similar size, and are to have a paralleling facility for emergency/backup use.
- E.1.7.3. 24 volt AGM starting duty batteries sized in accordance with an approved CCA load analysis are to be installed in accordance with Classification Society rules for auxiliary generator starting. Batteries are to be securely installed in vented GRP boxes in the Engine Rooms.

- E.1.7.4. Fully automatic intelligent battery chargers, one per battery set, are to be installed for charging batteries when engines are not running. Engine alternators are to charge batteries when engines are running. Battery charger failure and battery discharge alarms are to be provided with an output to the machinery alarm system.

E.2. Main AC Distribution Boards & Motor Starters

E.2.1. Main AC Distribution Boards

- E.2.1.1. All the main distribution board components are to be Classification Society approved and suitable for marine use.
- E.2.1.2. The two main AC distribution boards are to be designed to allow all operation and maintenance procedures to be carried out from the front. One AC distribution board is to be installed in each engine room connected to the other via a tie line cable. Under normal circumstances one generator (duty machine) will run to provide power to the vessel supplying both main AC distribution boards. In the event of a failure the standby generator is to start automatically and connect to its respective main AC distribution board to restore power as soon as possible without operator intervention.
- E.2.1.3. The main AC distribution boards are to be sheet steel, painted and ingress protected to IP44.
- E.2.1.4. Internal wiring is to be of the stranded type of 1.0mm² minimum category 5 with flame retardant insulation to BS 6231, complete with numbered ferrules and crimped terminals at each end. Wiring is to be run in looms, securely cleated, or in trunking. Where internal wiring passes between sections, which may be split for shipping or installation, fixed terminal blocks are to be provided. Terminal blocks for control wiring are to be of the spring loaded contract type. Cable terminations are to be suitable for the circuit voltage and current fault levels.
- E.2.1.5. The main AC distribution boards are to include two sections, an incomer/tie line section and a distribution section.
- E.2.1.6. The distribution board incoming section to include a circuit breaker, power on (red) LED indication, voltmeter, frequency meter, ammeter kW and earth fault monitor complete with an alarm output to the machinery alarm system.
- E.2.1.7. Instruments are to be flush mounted, with rectangular or square dials and black numerals on white background. Normal and or full load levels are to be clearly indicated on voltage, frequency, current, kW and earth monitoring instrument dials.
- E.2.1.8. Busbars are to be sleeve-insulated, hard-drawn, high-conductivity tinned copper and of sufficient cross sectional areas to ensure temperature rise does not exceed 45°C. Busbars are to be braced in order to withstand prospective short circuit current.
- E.2.1.9. Mimic diagram of AC supply system engraved on melamine plastic laminate (white with black core) together with brief operational instructions is to be fixed to front of the distribution board in a suitable position.
- E.2.1.10. Each instrument, fuse, control and indicator lamp is to be clearly identified by a firmly affixed plastic traffolyte plate engraved with the circuit/current rating, etc.

E.2.1.11. Outgoing circuits are to be controlled and protected by circuit breakers incorporating overload and short circuit protection and are to be capable of being key locked in the "off" position for safety purposes.

E.2.1.12. Adequate provision is to be made for main and control cable access with cable supports provided as necessary. Cable entry is to be via suitable gland plates in all sections, with adequate provision for earthing cable screens where this is a requirement. Cables are to be individually glanded or glanded using a cable transit gland system MCT Brattberg or similar, glands must meet or exceed the IP rating of the distribution board enclosure.

E.2.2. Starters

E.2.2.1. Starters are to be located adjacent to the equipment they serve.

E.2.2.2. Each starter is to be fitted with an isolation switch, HRC fuses, start/stop buttons, overload protection with manual reset, power and motor running lamps. Auto/hand changeover switches are to be fitted where necessary. All starters are to be fitted with time delayed under-voltage release.

E.2.2.3. External circuits with emergency remote individual stop buttons are to be fitted for fuel oil transfer pump (if fitted) and engine room ventilation fans. Emergency stop buttons are to be mounted in glass-fronted case adjacent to fire-fighting gas release panel.

E.2.2.4. Starters are generally to be direct-on-line type except for the chain wash, bilge and fire pump motors which are to be arranged to minimise the starting currents as much as possible using VSD type starting modules.

E.2.2.5. Starters in dry, well ventilated spaces are to have drip-proof IP23 enclosures. In damp or exposed locations starter boxes are to have an IP44 splash-proof or IP56 waterproof enclosure as appropriate.

E.2.2.6. Starters in damp locations, exposed locations and those subject to extended shut-down periods are to be fitted with standstill heaters.

E.2.2.7. All control and indication circuits within starters and external to starters to be 110 volts AC supplied by a double wound transformer within each starter.

E.2.3. Alternators

E.2.3.1. Two Diesel driven Main generators are to be fitted, sized in accordance with the load analysis to supply the vessels AC distribution system.

E.2.3.2. The AC alternators are to be a static-excited, air cooled, single bearing, constant voltage, self-ventilated marine alternator ingress protected to IP23 enclosure with class F insulation.

E.2.3.3. The AC alternator is to provide power at 230 volts, 1 phase, 50 Hertz at 0.8 power factor.

E.2.4. Motors

E.2.4.1. Motors are to be NEMA standard marine type to Client's approval.

- E.2.4.2. Motors in exposed locations are to be ingress protected to IP56. All other motors unless specified or agreed otherwise are to be totally enclosed fan cooled type and ingress protected to IP44.
- E.2.4.3. AC motors are to be capacitor start, capacitor run type.
- E.2.4.4. Motors are to have Class “F” insulation of better. Armatures and cooling fans are to be dynamically balanced.
- E.2.4.5. Horizontal mounted motors are to be arranged with axis in fore and aft direction (this is the equivalent of East - West).
- E.2.4.6. Motors and control gear in exposed locations or subject to extended shutdown periods are to be fitted with standstill heaters.

E.2.5. Standstill Heaters

- E.2.5.1. Equipment listed below is to be fitted with standstill heaters;
- Main Hydraulic propulsion Diesel Engines
- E.2.5.2. Standstill heaters are to be non-luminous type, connected to a separate supply from equipment they serve. Heaters are to be supplied through ancillary contacts on starter contactors to ensure that heaters are switched on automatically when equipment is not running.
- E.2.5.3. Each starter serving equipment with standstill heater is to be fitted with heater isolating switch and “heater on” indicating lamp.
- E.2.5.4. Starters and motors fitted with standstill heaters are to be fitted with firmly affixed red notice plate with legend;
- “WARNING – HEATER TERMINALS ALIVE WHEN MACHINE IS STOPPED”
- E.2.5.5. Supply to standstill heaters is to be taken from 230 volt system.

E.3. Lighting and Sockets

E.3.1. Lighting

- E.3.1.1. Wherever possible LED lighting is to be used, to reduce the power requirements to a minimum and to maximise life in service.
- E.3.1.2. Fittings in machinery spaces, working spaces, etc. are to be of robust quality and suitable for a marine environment.
- E.3.1.3. General illumination level in machinery spaces and Propulsion drive space is to be not less than 250 lux. LED well glass lamp fittings are to be fitted below floor plates over bilge suction.
- E.3.1.4. General illumination level in store spaces is to be not less than 160 lux with local absolute minimum of 55 lux.
- E.3.1.5. The Contractor is to check and report lighting intensities to the Client prior to acceptance trials of the vessel.
- E.3.1.6. Pilothouse lighting to have low level red illumination for night time operation.
- E.3.1.7. Lighting is to be on a minimum of two circuits arranged with consecutive luminaries on different circuits.
- E.3.1.8. The passenger lounge deckhead lights are to be controlled from the Pilot House.
- E.3.1.9. The "Navigation" and travel directional strobe lights are to comply with MCA guidance regulations for Chain Ferries. Travel strobe lamps are to be individually controlled from a common control panel in Pilot House incorporating indicator lamps, switches and lamp failure alarm indication and buzzer. See also section E.4.
- E.3.1.10. Search light, 1 off as follows:-
- One 650 watt column-mounted searchlight with Pilothouse lever control is to be fitted on Pilothouse top nominally in a centrally mounted.
- E.3.1.11. Ten watt IP56 marine grade aluminum LED floodlights are to be fitted to illuminate the vehicle deck and embarkation ramps. A minimum of 10 units are envisaged. Suitable locations are to be proposed for Client's approval. Floodlights are to be controlled from the Pilothouse.
- E.3.1.12. Flood lighting is to be screened as necessary to eliminate night glare to the Pilot House.
- E.3.1.13. Emergency lighting is to be fitted in accordance with Classification and SOLAS requirements. Emergency transitional lighting is to be supplied from 24 volt emergency batteries. One 24v DC 30 watt LED IP56 adjustable spotlight is to be fitted adjacent to each escape position on the South and North vessel sides amidships.
- E.3.1.14. Emergency light fittings are to be obtrusively marked.
- E.3.1.15. All Pilot House instrument lighting is to be fitted with dimmer controls.

E.3.1.16. Light fittings and switches in machinery, store and on open deck are to be corrosion proof UV resistant and ingress protected to IP56.

E.3.1.17. One hand held 10 watt, 24 volt DC LED wandering lead spotlight with a twenty meter cable and plug to fit watertight socket is to be supplied, stowed in the workshop area.

E.3.2. 230V AC Plugs and Sockets

E.3.2.1. All main sockets used shall be impact resistant plastic UK standard BS1363, 13 ampere type and are to be double pole switched and double socket type and ingress protected to IP44.

E.3.2.2. All socket circuits are to be protected by RCBOs supplied via a dedicated 230/230V socket transformer with secondary side grounded to permit RCBO function.

E.3.2.3. All necessary sockets are to be fitted for equipment that requires them such as portable VHF chargers etc.

E.3.2.4. In addition to those in E.3.2.3, general purpose sockets are to be fitted throughout as follows;

- a. Four in the Pilot House
- b. Two in the each engine room and drive wheel space (6 in Total in machinery spaces)
- c. Four sockets above the workbench in the Drive Wheel Space.
- d. One in each Prow arm space (Four in total).
- e. Four on the car deck, (Two South and Two North), Midships. (for portable chain hoist winch and/or temporary additional Lighting)

E.3.3. 24V DC Plugs and Sockets

E.3.3.1. Watertight IP66 24 volt DC sockets are to be fitted in each engine room and drive wheel spaces for a wandering lead inspection lamp. One socket is to be fitted in each machinery space. Stowage hook for inspection spotlight is to be fitted to each socket.

E.3.3.2. Dual output, 5V 2.1A/1A, USB charger sockets are to be fitted throughout as follows;

- a. One in the Pilot House.

E.3.3.3. All necessary sockets are to be fitted for equipment that requires them such as hand held lamps etc.

E.4. Direction Indicating Lights and Sound Signals

E.4.1. General

- E.4.1.1. Direction Indicating lights to comply with International Regulations for Prevention of Collisions at Sea. Direction Indicating lamps to be individually controlled from a common control panel in Pilot House incorporating indicator lamps, changeover switches and lamp failure alarm buzzer.
- E.4.1.2. All lights and sound signals to be in accordance with international requirements.
- E.4.1.3. Direction Indicating light control panel with dual supplies and supply changeover switch including switches and pilot lamps are to be fitted in the main navigation console, complete with dimmer covers and audible alarm.
- E.4.1.4. Lighting to be appropriate for a vessel involved in passenger transport and cargo transit.
- E.4.1.5. Locations and mounting arrangements to be suitable for safe maintenance of the equipment, and to be submitted to the Client for approval.

E.4.2. Direction Indicating and Signal Lights

- E.4.2.1. All lenses to be of approved type in accordance with latest International Regulations for Prevention of Collision at Sea.

E.4.3. Arrangement of Lights

- E.4.3.1. The Directional Indicating lights are to be switched as follows;
 - Underway: Two white strobe lights, switched for direction of travel and both off when loading.
- E.4.3.2. Provision of 10 off underwater lights, five each side (North and South) to be included as a separately priced option.
- E.4.3.3. All lights are to be easily accessible with maximum safety of personnel.

E.4.4. Searchlights

- E.4.4.1. One IP66 stainless steel, column-mounted searchlight of not less than 200mm diameter with Pilot House control are to be fitted on the Pilot House top nominally in a centrally mounted position.

E.4.5. Whistle

- E.4.5.1. Two electro-pneumatic horns are to be installed, one positioned facing East and one positioned facing West with push buttons at each control position in the Pilot House.

E.5. Navigating Equipment

E.5.1. General

- E.5.1.1. All manufacturer recommendations and instructions for installation and operation to be obtained and implemented.
- E.5.1.2. All electronic navigation and communication equipment to be provided with connections to main and emergency power supplies as required by the Classification Society.

E.5.2. Anemometer, Thermometer & Barometer

- E.5.2.1. One anemometer of the solid state electronic type to be fitted with wind velocity and direction display arranged in the main central control console in the Pilot House.
- E.5.2.2. Velocity display to be calibrated 0 to 60 knots, and also in equivalent kilometers per hour.
- E.5.2.3. The display is to include temperature and barometric pressure readings.

E.5.3. Automatic Identification System

- E.5.3.1. One AIS Automatic identification system (Class B) to be installed complete with the required antennae for the unit's operation.
- E.5.3.2. System to include antennae connectors, coaxial antennae cable, data cable and power cable.
- E.5.3.3. System to interface with all necessary shipborne sensors, including travel direction.
- E.5.3.4. Display unit to be fitted in the main Pilot House central console.

E.5.4. Slipway Depth below 'keel' Sounding equipment

- E.5.4.1. An indicator is to be provided that shows the clearance below the hull to the slipways at each end of the floating bridge.
- E.5.4.2. Client to advise the particular system to be installed.

E.6. Radio and Communications Equipment

E.6.1. VHF Radio Telephone with DSC

- E.6.1.1. One (1) VHF DSC radiotelephone is to be provided.
- E.6.1.2. In addition the Contractor is to provide telephone style handset with keypad base with distress button, loud speakers, mounting hardware, all cable, connectors and test leads.
- E.6.1.3. Provide one (1) omni-directional antennae, vertically polarized, together with all mounting clamps, ancillaries and cable.
- E.6.1.4. Remote speaker to be located centrally and to be clearly heard throughout the Pilot House.
- E.6.1.5. Power supply backup to be from the 24VDC system battery.

E.6.2. VHF Hand Held Transceivers (Shipboard Service)

- E.6.2.1. VHF hand held transceiver equipment to serve as two-way radio telephone apparatus for general shipboard service.
- E.6.2.2. Two (2) hand held type radios nested in standard rate chargers (230 VAC), to be located in the Pilot House. VHF's to be pre-programmed to all of the operators private channels.

E.6.3. Radio Data Link Equipment

- E.6.3.1. Radio Data link is required for synchronising data from the passenger / Vehicle Ticketing systems, Basic details as below subject to confirmation from the Ticketing specialist supplier
- E.6.3.2. A Pilot House top radio antenna is to be installed to suit a Data link to the West Cowes shore station.
- E.6.3.3. Radio / comms. unit CPU to be installed in the Pilot House.

E.7. Closed Circuit Television

E.7.1. The following are provisional locations for the Colour CCTV outfit of cameras. These are based on each camera being able to pan as stated.

Location	No Off	Suggested Position's	Pan Angle
Engine Room	2	Centre Line (1 in each)	180
Propulsion Drive Space	1	East Bulkhead – Centre Line	180
West Embarkation Ramp	1	TBA with Clients representative	90
East Embarkation Ramp	1	TBA with Clients representative	90
Up river view (Looking South)	1	TBA with Clients representative	180
Down river view (Looking North)	1	TBA with Clients representative	180
Passenger Lounge	1	East end, looking West, Ceiling Mount	0
South Mast	1	For West Approach road view	180
Passenger Lounge	1	West end, Looking East, Ceiling Mount	0
Passenger Deck – Upper	2	West End & East End, On low mast	180
Chain Drive wheel view (For PAX Info screen)	1	TBC	0
Sub Total	12		
Spare channels	4	For future addition of extra inputs	
Total channels	16		

- E.7.2. Remote control and monitoring of all CCTV cameras is to be provided in the Pilot House displayed on two off 16" colour monitor each with independent multi split screen facility. And switching panel
- E.7.3. All cameras are to be Low Lux type with Full colour with auto switching to Monochrome in low light levels
- E.7.4. A compatible hard disc recording facility is to be provided, housed in a lockable cabinet, capable of recording all channels simultaneously, with a minimum capacity of 28 days rolling storage.
- E.7.5. The ability to copy from the hard disc, to an external device, flash drive and/or DVD.
- E.7.6. Suitable signs are to be provided and displayed throughout the Vessel showing that CCTV is in operation.
- E.7.7. CCTV camera's on open deck to be enclosed in watertight enclosures, suitable for a marine environment, complete with wiper/wash facility.
- E.7.8. CCTV camera's in passenger spaces to be of robust and temper proof design.
- E.7.9. Optional Transmission via the Data link to the shore office/station.

E.8. Alarms, Monitoring and Control Equipment

E.8.1. Machinery Alarm System

- E.8.1.1. All diesel engine and generator alarms are to be connected to the machinery alarm monitoring and control system.
- E.8.1.2. Alarm system is to include all specified, statutory and Classification Society required alarms, all manufacturer's recommendations and all other alarms listed in this specification.
- E.8.1.3. Alarm types to include analogue and digital input signals. The Contractor is to ensure all equipment which provides an alarm output can interface correctly with the alarm system.
- E.8.1.4. The system is to be integrated with the bilge suction remote control valves and pump control.

E.8.2. Fire Fighting Gas Extinguishing Alarm

- E.8.1. Firefighting gas release alarm siren is to be fitted in each engine room including strobe light and sound output.
- E.8.2. Noise intensity of siren is to be sufficient to overcome all machinery noise.
- E.8.3. Power supply is to be 24 volt DC taken from the vessel's emergency battery.

E.8.3. Intercom System

- E.8.3.1. An intercom system incorporating talkback/listening feature is to be fitted between the following positions;
 - Pilot House
 - Main Deck Prow Control Position (West)
 - Main Deck Prow Control Position (East)
 - Crew Room

E.8.4. Public Address System

- E.8.4.1. A public address system with general alarm facility shall be provided for communication between the skipper in the Pilot House and crew and passengers on the open deck and in all spaces normally accessible during operation.
- E.8.4.2. The public address system is to be capable of broadcasting pre-recorded safety messages, stored on solid state memory.
- E.8.4.3. A flashing beacon shall be provided in each engine room and the drive wheel room.
- E.8.4.4. The total number of speakers and location to be approved by the MCA.

E.8.5. Fire Detection System

- E.8.5.1. Electrically operated siren alarms to be installed in the machinery spaces for the purpose of warning personnel to vacate the space prior to the discharge of the NOVEC GAS. The alarm is to be arranged to sound automatically when the door to the control box is opened. Arrangements are to be made to ensure that opening of the NOVEC GAS control box door also stops the machinery space ventilation fans. Indication, linked to the discharge manifold pressure sensor is to be displayed in the Pilot House, to show that the system has been operated.
- E.8.5.2. Accommodation space, Engine Room and Drive Wheel space within the hull and superstructure to be protected by integrated, addressable, automatic fire detection system which meet Flag Authority and Classification Society requirements for an EU Class C Passenger Vessel.
- E.8.5.3. Each space to have at least one individual detector fitted. Engine Rooms to be fitted with at least two sensors. The installation, number and type of sensors to be selected from a range of equipment giving fast response for the area and fire risk designated. Engine room to be protected with a mixture of UV flame detectors, heat detectors and smoke detectors. Detector sensitivity limits to comply with Classification Society requirements except that heat detectors in mechanically ventilated machinery spaces to be certified not to operate until the temperature exceeds 60°C.
- E.8.5.4. A fire detection system master panel to be arranged in the Pilot House, with visual and audible alarms, identifying the deck and compartment housing the source of the fire. A repeater panel to be arranged in the Crew Room. The fire detection system to be linked with the alarm and monitoring system. Alarm acknowledgement to be possible only at the Pilot House panel.
- E.8.5.5. The fire detection system to be connected to the vessels 24V DC supply.
- E.8.5.6. Manually operated fire alarms consisting of bell push buttons (manually operated lever type in machinery space) to be distributed throughout the accommodation and Machinery Spaces. Alarm indication to be arranged in the Pilot House with alarm tones generated throughout the vessel.
- E.8.5.7. A tone generated alarm, actuated from the Pilot House, to be distributed throughout the accommodation, Upper Deck, Vehicle Deck areas and Machinery Spaces to Flag and Classification Society requirements.
- E.8.5.8. One fire alarm indicating panel is to be fitted in the Pilot House.
- E.8.5.9. Visual and audible alarms are to be distinctive from all other alarms.
- E.8.5.10. Fire alarm panel is to be fitted with power failure alarm and test push-button.
- E.8.5.11. Power supply is to be from two sources, 230 V single phase AC and 24 V DC with auto changeover in event of main power failure.

E.8.6. Pilot House Heating and Ventilation

- E.8.6.1. One low level heater to be provided in the Pilot House with adjustable thermostat and console mounted switching. Power to be from the 230v AC system.
- E.8.6.2. De Fogging blowers to be fitted to all Pilot House windows, outlets to be mounted over each window blowing downwards.

E.8.7. Passenger lounge 'Infotainment' screens.

- E.8.7.1. Two off, LED type Visual display Panels, each of a minimum size of 40" with a display resolution of 1080P minimum.
- E.8.7.2. Video feed to each panel to be a simultaneous signal from a Video source unit mounted in a crew only accessible space, (Location to be agreed with the Owners representative). Auto timed viewing to switch from various sources, to include Drive wheel view from the CCTV and a sponsors advertising video. Held on the main video source unit.
- E.8.7.3. A Terrestrial TV reception Aerial (Omnidirectional) is to be mounted on the Pilot House top. For future addition of Live TV reception.

E.9. Miscellaneous

E.9.1. Spare Parts

E.9.1.1. Spare parts are to be supplied in accordance with Classification Society requirements for short voyage ships plus manufacturers' recommendations for two years' service.

E.9.1.2. Following consumable spares are to be supplied:

- Searchlight Lamp 1
- Floodlight Lamp 4
- Other Lamps 50% spares.
- Directional Strobe Lamps 100% spares.
- Fuses 50% spares.

E.9.1.3. Manufacturers' spare parts are to be preserved for long term storage, identified, listed, and packed in locked steel storage cases and to be stowed in the West Cowes workshop packaging, preservation and labelling to the satisfaction of the Client's representative.

E.9.1.4. Consumable items are to be stowed aboard by the Contractor.

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Appendix 1 GENERAL ARRANGEMENT PLAN

Drawing No. J10384/02/001 Rev 0



MIDSHIP VIEW LOOKING EAST

SOUTH SIDE
Up River

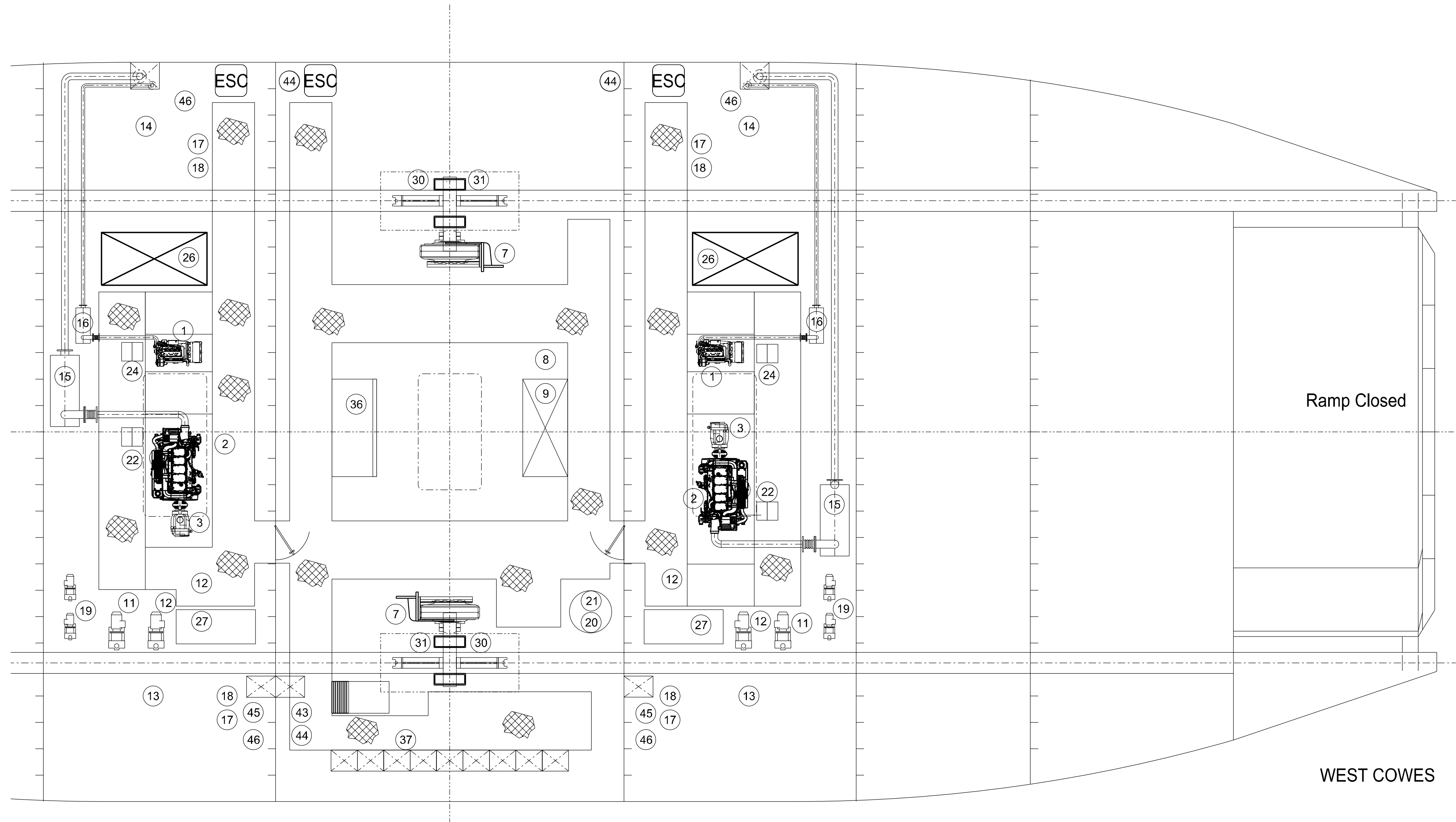
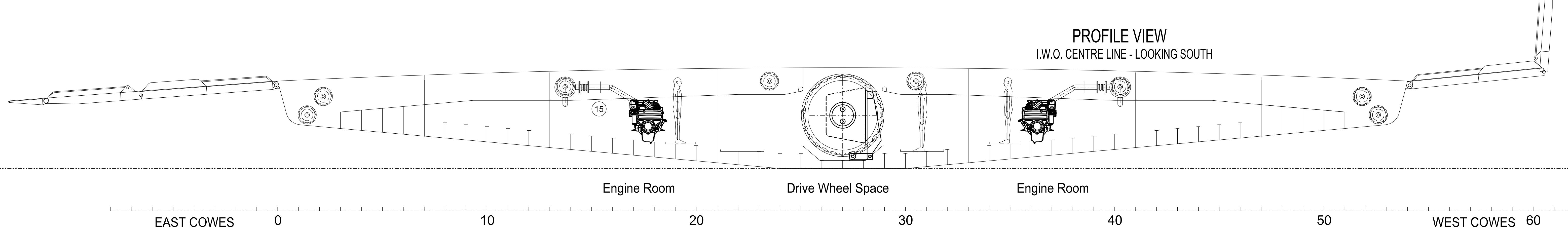
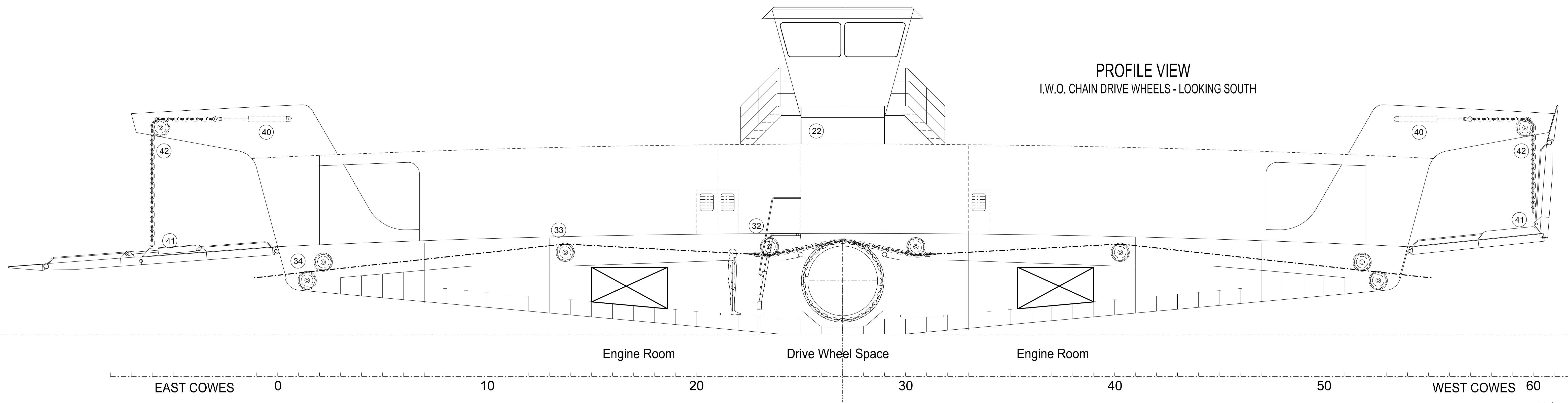
PRINCIPAL PARTICULARS

Length Ramps Raised	37.40m
Length Hull Overall	29.70m
Breadth Moulded	14.00m
Depth to Vehicle Deck	2.65m
Scantling Draft	1.40m
Parabolic Inverse Sheer	350mm in 14.85m
Carriageway Width	10.45m
4 Car Lanes	2 x 2.5m x 29.7m 2 x 2.5m x 22.0m
Average Slipway Inclination	1 : 8 East Cowes 1 : 10 West Cowes
Chain Spacing	8.75m
Frame Spacing	550mm

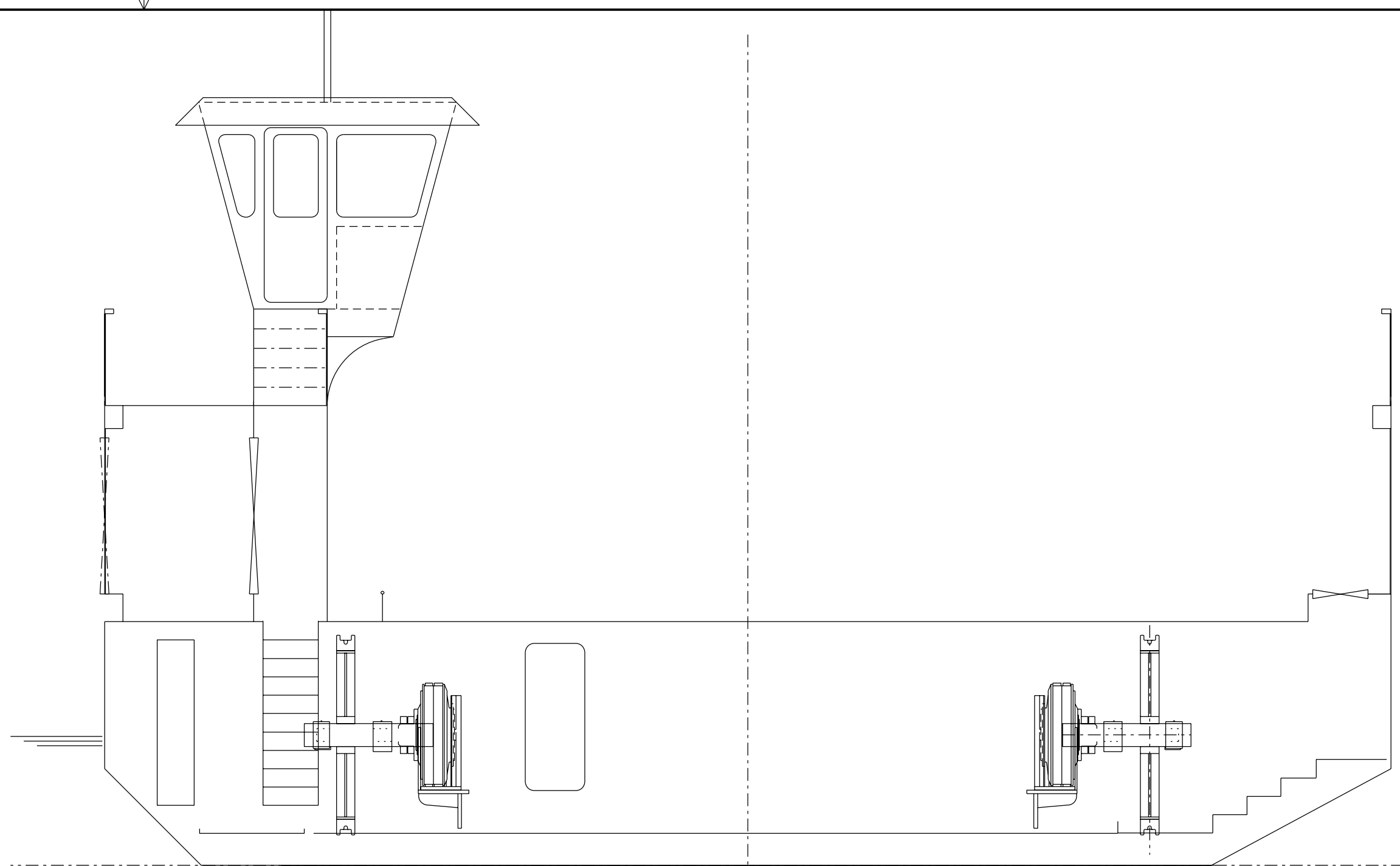
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Appendix 2 MACHINERY ARRANGEMENT PLAN

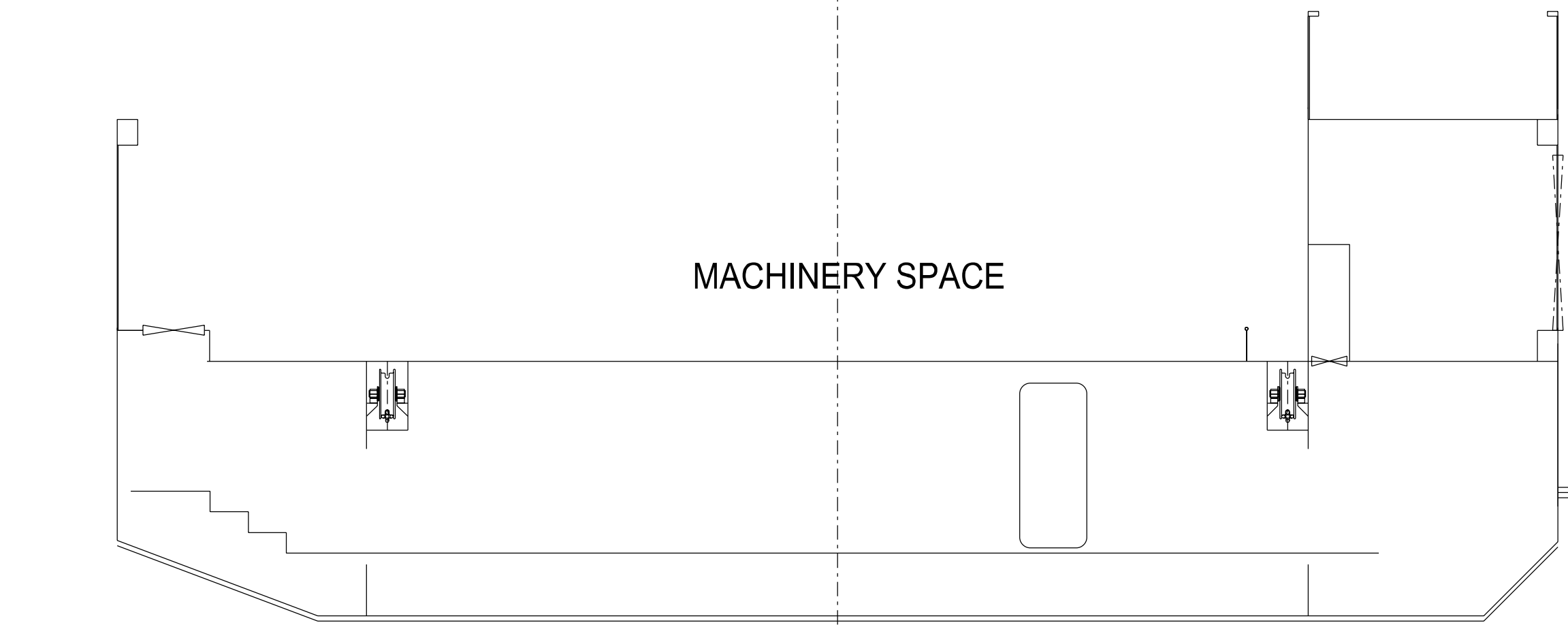
Drawing No. J10384/02/200 Rev 0



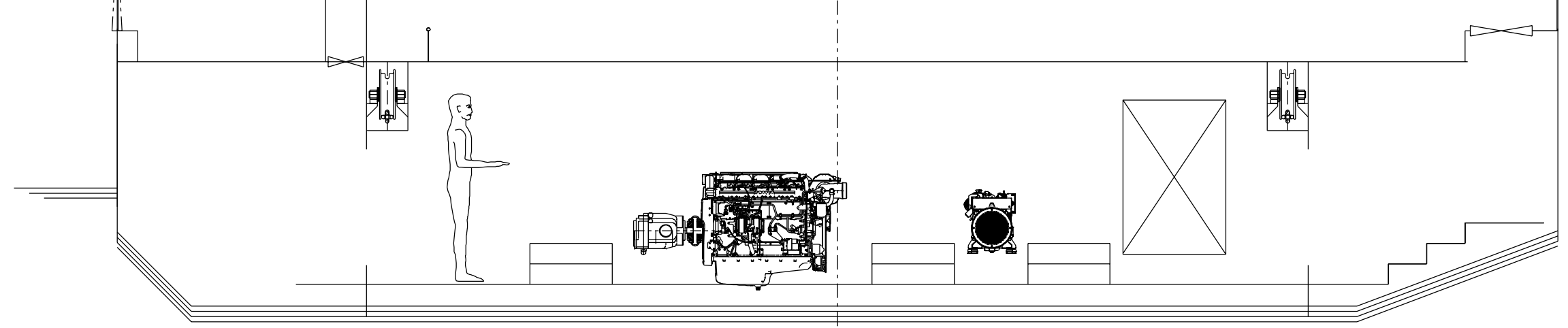
Item No.	No. Off.	General Description	Specification	Remarks
			Supplier Type No.	
1	2	Auxiliary Harbour/Night Generator Set	- 230V / 1 Ph / 50Hz.	1500 Rpm
2	2	Chain Drive Diesel Engine	- Max 1800 Rpm	-
3	2	Chain Drive Hydraulic Pump	-	Pressure Sensing, Swash Plate Type
4	-	-	-	-
5	-	-	-	-
6	-	-	-	-
7	2	Chain Drive Hydraulic Motor	-	-
8	1	Drive Hydraulics - Directional Control Valves	-	-
9	1	Hydraulic Oil Reservoir	-	-
10	2	Ramp Hydraulics - Control Valve Manifold	-	-
11	2	Bilge/Fire Pump Ac Driven	-	-
12	2	Fire/Bilge Pump Ac Driven	-	-
13	2	M.E. Keel Coolers	-	-
14	2	Aux Engine Keel Coolers	-	-
15	2	M.E. Dry Exhaust Silencer	-	-
16	2	Aux Engine, Dry Exhaust Silencer	-	-
17	4	Sea Inlet Valve	-	-
18	4	Sea Inlet Strainer	-	-
19	4	High Pressure Jet Pump, Chain Washing	-	-
20	1	Heating Circuit Accumulator	-	Heat Recovery From Both Main Engines
21	1	Heating Circuit, Circulating Pump	-	-
22	2	M.E. Start Batteries (24 Volt)	-	-
23	2	Service Battery Sets	-	-
24	2	Aux Engine Start Batteries (24 Volt)	-	-
25	2	Battery Charger / Inverter Units	-	-
26	2	Fuel Bunker Tanks	-	-
27	2	Main Switchboards	-	-
28	X	X	-	-
29	X	X	-	-
30	2	Chain Drive 'Gypsy' Wheels	-	-
31	4	Chain Drive Shaft Bearings	-	-
32	4	Chain 'Pressure' Wheels	-	-
33	4	Chain Trough Guide Wheels	-	-
34	8	Chain Entry Guide Wheels	-	-
35	X	X	-	-
36	1	Workbench, Vice And Tool Stowage	-	-
37	A/R	Crew Lockers	-	-
38	X	X	-	-
39	X	X	-	-
40	A/R	Ramp Hoist Rams - Inner Ramp	-	-
41	A/R	Ramp Hoist Rams - Outer Ramp	-	-
42	A/R	Ramp Locking Pin Rams	-	-
43	1	Propulsion Space - Inlet Ventilation Fans	-	-
44	3	Propulsion Space - Fire Flaps	-	-
45	2	Engine Space - Inlet Ventilation Fans	-	-
46	4	Engine Space - Fire Flaps	-	-



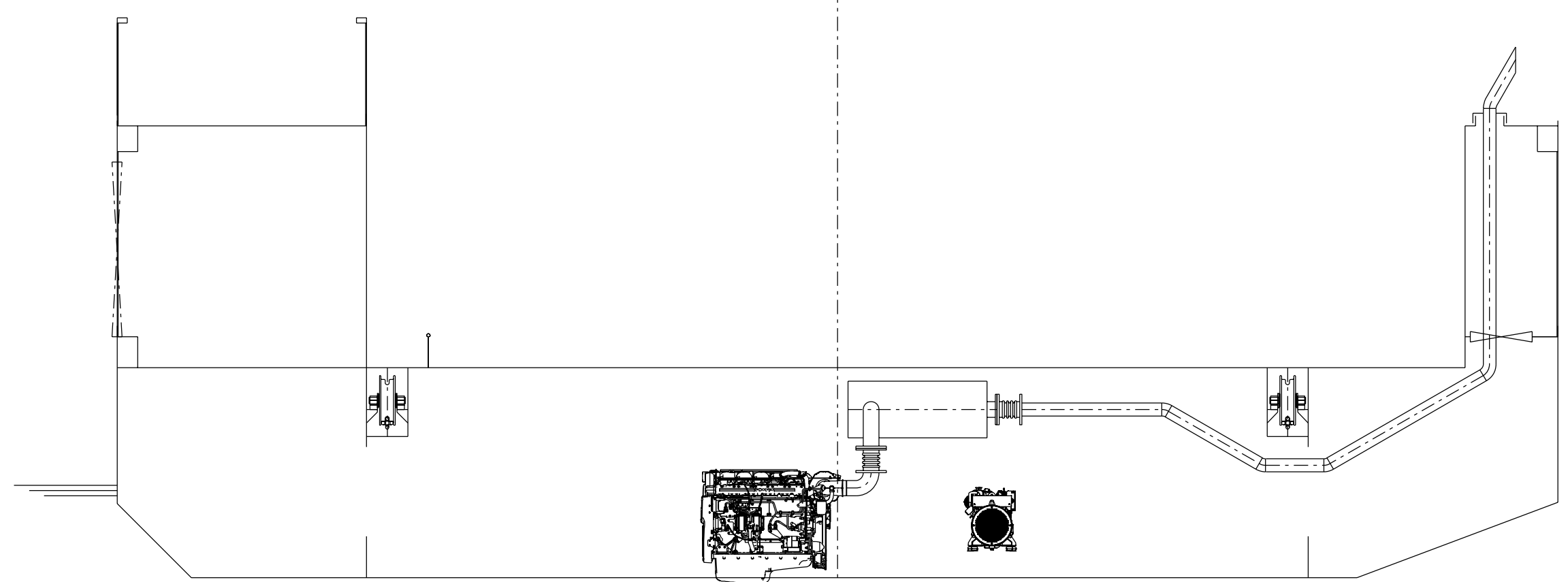
SECTION AT
FRAME 27 - LOOKING EAST - MIDSHIPS



SECTION AT
FRAME 21 - LOOKING WEST
FRAME 33 - LOOKING EAST - OPPOSITE HAND



SECTION AT
FRAME 20 - LOOKING EAST
FRAME 34 - LOOKING WEST - OPPOSITE HAND



SECTION AT
FRAME 14 - LOOKING EAST
FRAME 40 - LOOKING WEST - OPPOSITE HAND

PRINCIPAL PARTICULARS

Length Ramps Raised	37.40m
Length Hull Overall	29.70m
Breadth Moulded	14.00m
Depth to Vehicle Deck	2.65m
Loaded Draft	1.40m
Scantling Draft	1.50m
Span between Chains	8.75m

0	05/10/15	DAW	First Issue, with ITT	JW	JW
REV.	DATE	BY	DESCRIPTION	CHKD.	APPD.
PROJECT			TITLE		
COWES FLOATING BRIDGE REPLACEMENT VESSEL			MAIN MACHINERY PRELIMINARY ARRANGEMENT		
REF. No.	DRAWING No.	SHEET No.	REV.	SCALE	DRAWN
BCP/J10384/02	J10384/02/200	1 of 1	0	1:50 @ A0 Size	CHECKED
				APPROVED	JW
					JW
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Appendix 3 CHAIN DRIVE ITEMS

Drawing No. J10384/02/201 Rev 0, Sheet 1 – Chain Drive Wheel Segments

Drawing No. J10384/02/201 Rev 0, Sheet 2 – Chain Guide Wheels

7 CHAIN POCKET SEGMENTS

9/16" -

1831.975 mm
6FT 1/8inch

6 CHAIN POCKET SEGMENTS

This technical drawing shows a circular structure composed of chain pocket segments. The structure is divided into two main sections: the upper section, labeled '7 CHAIN POCKET SEGMENTS', and the lower section, labeled '6 CHAIN POCKET SEGMENTS'. The total diameter of the structure is indicated as 1831.975 mm, which is equivalent to 6 feet and 1/8 inch. A dimension of 9/16 inch is shown at the top right, likely representing the thickness of a segment. The drawing includes a center point and radial lines to define the geometry of the segments.

171.45mm
6.75in

2171.70 mm
7FT 1-1/2inch

0	06/10/15	DAW	FIRST ISSUE FOR ITT	JW	JW
REV.	DATE	BY	DESCRIPTION	CHKD.	APP'D



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Burness Corlett T

Burness Corlett Three Quays

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www.bctq.com

PROJECT				TITLE			
REPLACEMENT COWES CHAIN FERRY				OWNERS SUPPLY CHAIN DRIVE ITEMS - DRIVE WHEEL			
REF. No.	DRAWING No.	SHEET No.	REV	SCALE	DRAWN	DAW	06/10/15
BCP/J/10384/02	BCP/J/10384/02/01	1 of 2	0	1:10 @ A2	CHECKED	JW	06/10/15
					APPROVED	JW	06/10/15
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Technical drawing of a circular part. The drawing shows concentric circles. A dimension line indicates a diameter of 482.6mm. Another dimension line indicates a diameter of 19in. A small circle is shown on the outer edge, with a leader line pointing to it.

438.4mm
17.2598in

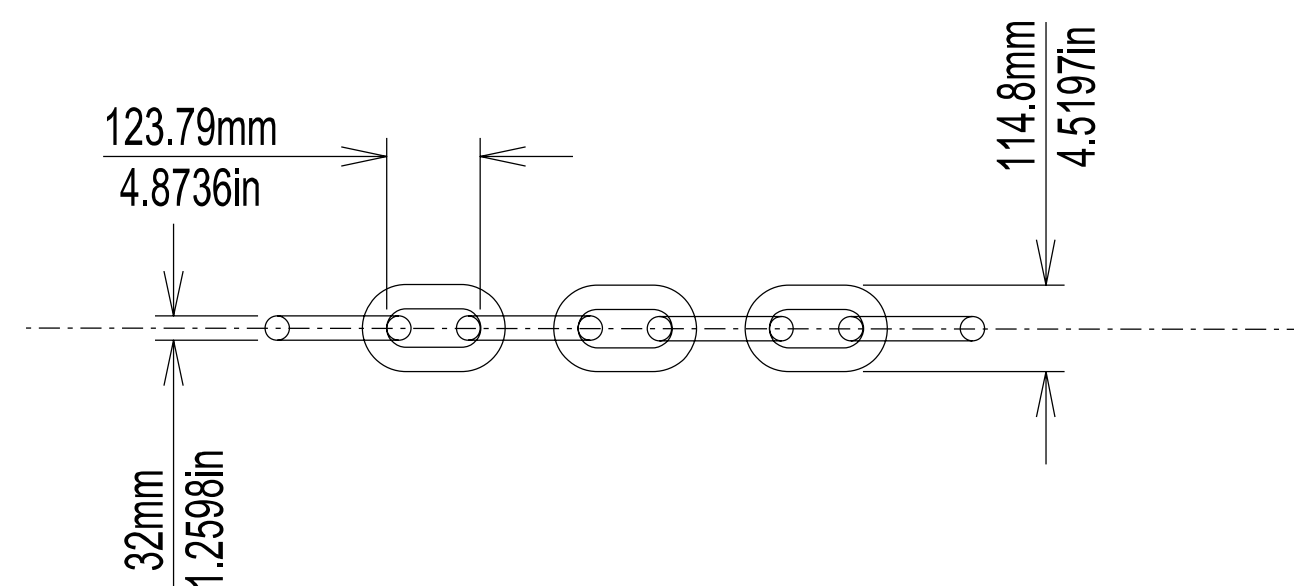
Technical drawing of a mechanical assembly, likely a shaft-hub connection. The drawing shows a shaft with a keyway and a hub with a keyway. Dimensions are provided in millimeters (mm) and inches (in).

- Overall length of the shaft: 349.25 mm (13.75 in)
- Distance from the left end of the shaft to the center of the hub: 152.4 mm (6 in)
- Distance from the center of the hub to the right end of the shaft: 127 mm (5 in)
- Distance from the center of the hub to the right end of the shaft (including the hub length): 63.5 mm (2.5 in)

400mm
15.748in

$$\frac{650\text{mm}}{25.5906\text{in}}$$

TYPICAL ARRANGEMENT OF GUIDE WHEELS IN TROUGH
16 GUIDE WHEELS C/W, BEARING BLOCKS , TO BE SUPPLIED BY THE OWNER.
BEARING BLOCK DETAILS TO FOLLOW ON DRAWING J10384/02/203



SECURING / DRIVE CHAIN DIMENSIONS
INFORMATION ONLY, NO SUPPLY TO THE CONSTRUCTION YARD

0	06/10/15	DAW	FIRST ISSUE FOR ITT	JW	JW
REV.	DATE	BY	DESCRIPTION	CHKD.	APP'D



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PROJECT				TITLE			
REPLACEMENT COWES CHAIN FERRY				OWNERS SUPPLY CHAIN DRIVE ITEMS - GUIDE WHEELS			
REF. No.	DRAWING No.	SHEET No.	REV	SCALE	DRAWN	DAW	06/10/15
BCP/J/10384/02	BCP/J/10384/02/01	2 of 2	0	1:10 @ A2	CHECKED	JW	06/10/15
					APPROVED	JW	06/10/15
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