

# **CCGS Earl Grey Vessel Life Extension**

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## **1.0 GENERAL NOTES**

### **1.1 Intent**

- 1.1.1 These project requirements are supplied to the Contractor outlining the objectives, performance, standards and engineering requirements for the Vessel Life Extension of the CCGS Earl Grey for the Canadian Coast Guard.
- 1.1.2 Notwithstanding any errors, omissions, discrepancies, duplication or lack of clarity in these project requirements, it must be the responsibility of the Contractor to ensure that:
  - 1) The execution of the work specified herein is to the satisfaction of the Inspection Authorities and Regulatory Bodies;
  - 2) All items and equipment supplied are deemed necessary for the safe and satisfactory operation and seaworthiness of the vessel, as required for a vessel of this class.
- 1.1.3 Sections 8 through to Sections 53 of this Specification define the individual work items that the Contractor must address during the CCGS Earl Grey's Vessel Life Extension Project.
- 1.1.4 The performance requirements specified in Sections 1 through to Sections 7 of these project specifications must be applicable to Sections 8 through to Sections 53 in all respects. The specification in Sections 8 to 53 may not specifically reference Sections 1 to 7; however, they must still apply.
- 1.1.5 A complete listing of drawings for the CCGS Earl Grey is attached in the Technical Data Package.
- 1.1.6 Abbreviations used in this Specification are provided in Appendix C .
- 1.1.7 The vessel will not be crewed during the contract except for the sea trail period.

## 1.2 General Particulars of Vessel

Name:	CCGS Earl Grey
Type:	Type 1050 Medium Endurance Multitasked Vessel,
Ice Classes	Lloyd's Register ✕100A1 Ice Class 1A Super ✕ LMC Arctic Shipping Pollution Prevention Regulations, Arctic Class 2
Year Built	1985
Voyage Class	Unlimited, beyond 200nm
Builder	Pictou Shipyards Ltd, Pictou, Nova Scotia

### Principal Dimensions:

Length	69.7 meters
Breadth, molded	13.7 meters
Draft	5.2 meters
Tonnage	1972 GRT, 653 NT

The CCGS Earl Grey is a four-engine twin-screw vessel, with two Deutz S/BV9M medium speed diesel engines driving each of two propulsion shafts via Valmet gearboxes. Each shaft drives a shrouded LIPS controllable pitch propeller. Each gearbox is fitted with two integral main input and two integral auxiliary power take off clutches. The power take off clutches drive a shaft generator. The shaft generators are primarily used to power the bow and stern thrusters, but are also used for ship's service. The existing bow thruster is a water jet type thruster. The stern thruster is a tunnel-type CPP stern thruster. The twin rudders are each fitted with independent electro-hydraulic steering gears.

### 1.3 Technical Data Package

1.3.1 The Contractor is provided with the following data packages to fully define the scope of work for the CCGS EARL GREY Vessel Life Extension Refit Project:

- Technical Specifications (This Specification Document and appendixes);
- Guidance Drawings – Electronic format;
- CCGS EARL GREY Drawings – Electronic format;
- CCGS Earl Grey Asbestos Re-Assessment Report 2014
- Applicable CCG Standards and Guidelines – Electronic format.

1.3.2 Supplementary Documentation (not provided by the CCG)

- ASTM F1321-92 (2004) – Standard Guide for Conducting a Stability Test (Lightweight Survey and Inclining Experiment) to determine the Light Ship Displacement and Centers of Gravity of a Vessel
- ASTM G82-95 (2003) – Standard Guide for Development and Use of a Galvanic Series for Predicting Galvanic Corrosion Performance
- CAN/CGSB-1.193-99 – Canadian General Standards Board for High-Build Epoxy Marine Coating
- CAN/CGSB 1.61-2004 – Canadian General Standards Board for Exterior Marine Alkyd Enamels
- CAN/CGSB 3-GP-11D – Naval Distillate Fuel, 2002-11-01
- CAN/CGSB 4.155-M88 – Canadian General Standards Board Flammability of Soft Floor Coverings – Sampling Plans
- CAN/CGSB 51.53-95 – Poly (vinyl chloride), Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- CAN/ULC-S102-03 – Surface Burning Characteristics of Building Materials and Assemblies
- CAN/ULC-S109-03 – Flame Tests of Flame-Resistant Fabrics and Films
- Canada Shipping Act Machinery and Hull regulations pertaining to a Research Vessel having general particulars as specified under Section 1.2
- CSA C22.1 SB-06 – Canadian Electrical Code Standard Part I Safety Standard for Electrical Installations
- CSA C22.2 – No. 0-M91 (R2006) – General Requirements – Canadian Electrical Code Part II
- CSA CAN3-Z299.3-85 (R2002) – Quality Assurance Program Category 3
- CSA W47.1 03 – Certification of Companies for fusion welding of steel
- CSA W47.2-M1987(R2003) – Certification of Companies for fusion welding of aluminum
- IEC 60092-504 ED 3.0 en:2001– Electrical Installations in Ships – Part 504: Special Features – Control and Instrumentation
- CAN/CSA-C22.2 No 60529-05 Degrees of protection provided by enclosures (IP Code)
- IEC 60533 Second Edition – Electrical and Electronic Installations in Ships – Electromagnetic Compatibility

- IEEE 45 STD -2002 – Recommended Practice for Electrical Installations Shipboard
- IEEE STD 315-1975 (Reaffirmed 1993) – Graphic Symbols for Electrical and Electronics Diagrams
- ISO 4406 – 1999 – Hydraulic fluid power -- Fluids -- Method for coding the level of contamination by solid particles
- ISO 18413:2002 – Hydraulic fluid power – Cleanliness of parts and components – Inspection document and principles related to containment collection, analysis, and data reporting
- ISO/TR 10949:2002 – Hydraulic fluid power – Component cleanliness – Guidelines for achieving and controlling cleanliness of components from manufacture to installation
- ISO/TS 16431:2002 – Hydraulic fluid power – Verification of cleanliness
- ISO 15748-1:2002 - Ships and marine technology - Potable water supply on ships and marine structures - Part 1: Planning and design
- ISO 15748-2:2002 - Ships and marine technology - Potable water supply on ships and marine structures - Part 2: Method of calculation
- ISO 2081 – 1986 – Metallic Coatings – Electroplated Coatings of Zinc on Iron or Steel;
- Lloyd’s Classification Society Rules for the Classification of Ships
- MOSH (SOR/87-183) – Marine Occupational Safety and Health Regulations
- PMBoK 3<sup>rd</sup> Edition – Project Management Institute guidelines to project management
- Provincial Department of Labour Industrial Health Regulations respecting removal of Asbestos
- S.N.A.M.E – Rules/Guidelines for Shop and Installation Trials – latest edition
- S.N.A.M.E.(3-47)\*1989 – Rules/Guidelines for Sea Trials – latest edition
- SOLAS recommendations
- TP 11469 E – Guide to Structural Fire Protection
- TP 127E (2002) – Ship Safety Electrical Standards
- TP 11469 – Guide to Structural Fire Protection 1993
- TP 1861E Standards for Navigation Lights, Shapes, Sound Signal Appliances and Radar Reflectors (1991)
- TP 2072E Deck Cargo Safety Code 1974
- TP 7301 Stability, Subdivision, and Load Line Standards 1975
- T.C.M.S. Ship Safety Bulletin 06/1989 Grounding Safety in Dry-dock
- UL 1309 – Standard for Safety for Marine Shipboard Cable

1.3.3 TP Publications are available at the following web site:

<http://www.tc.gc.ca/marinesafety/tp/menu.htm>

CGSB Standards and publications are available at the following web site:

<http://www.scc.ca>

ULC Standards and publications are available at the following web site:

<http://www.ulc.ca>

Canadian Standards Association Standards are available at the following web site:  
<http://www.csa.ca>

International Standards Organization (ISO) is available at the following web site:  
<http://www.iso.org>

IEEE Standards and publications are available at the following web site:  
<http://www.standards.ieee.org>

British Standards are available at following web site:  
<http://www.bsi-global.com>

ANSI Standards are available at the following web site:  
<http://www.ansi.org>

ASTM Standards are available at the following web site:  
<http://www.astm.org>

ASME Standards are available at the following web site:  
<http://www.asme.org>

S.N.A.M.E. Rules/Guidelines are available at the following web site:  
<http://www.sname.org>

Project Management Guidelines are available at the following web site  
<http://pmi.org>

#### **1.4 Office and Progress Meetings**

Contractor must provide an adequate boardroom for Progress Review Meetings (PRM)  
PRMs must be held monthly or more frequently as determined by the Contract Authority.

#### **1.5 Facilities for Government Personnel**

- 1.5.1 The Contractor must provide a minimum of 500 square feet of secure office space with the following requirements for CG personnel:
- 1) Two (2) lockable offices with a minimum of 200 square feet each;
  - 2) One (1) boardroom with furnishings to seat ten (10) people (arrangements must consist of one large boardroom table with seating for ten). The boardroom must also be furnished with a 4 foot by 6 foot whiteboard on one wall.
  - 3) Three (3) desks, full size with double pedestals containing drawers:
    - a) Desk drawers must be lockable;
    - b) One (1) desk must be an “L” shaped secretary style desk with side tables;
  - 4) One (1) desk size tables;

- 5) Ten (10) chairs, of which six (6) must be fully adjustable and fitted with a swivel base and casters (in addition to the boardroom furnishings);
- 6) Two (2) bookcases – 4 foot wide by 6 foot height;
- 7) Three (3) filing cabinets – four (4) drawers per cabinet. All cabinets are to be lockable;
- 8) Four (4) keys must be provided for each lockable door, desk and filing cabinet;
- 9) Three (3) direct telephones – one (1) of which must be in the boardroom;
- 10) Three (3) high speed internet connections;
- 11) One (1) office copier capable of handling 8.5 by 11 inch paper, 8.5 by 14 inch paper and 11 by 17 inch paper sizes. The copier must be equipped with an auto sheet feeder and serviceable within two (2) hours of any breakdowns.

- 1.5.2 The offices must be supplied with heating, ventilation/air conditioning, and lighting as per provincial health and occupancy regulations.
- 1.5.3 Washroom facilities must be located on site.
- 1.5.4 Three (4) parking spaces must be allocated within the confines of the shipyard for Government personnel. The spaces must be clearly marked and the required passes provided to Government personnel.
- 1.5.5 All of the above equipment and facilities must be clean and in good condition to the full satisfaction of Canada.

## **1.6 Storage Space**

- 1.6.1 The Contractor must provide 3000 square feet of secure, environmentally controlled storage space for the ship's equipment. The storage space environment must be maintained at 15 degrees Celsius and at a maximum relative humidity of 70 percent for the duration of the contract period.
- 1.6.2 The storage space must also contain 5000 square feet of standard seven (7) foot high storage shelving with 5 equally spaced shelves for 3000 square feet and shelving with 3 equally spaced shelves for 2000 square feet.
- 1.6.3 The Contractor must provide 150 new pallets for the storage of items.
- 1.6.4 All items must be stored in such a manner so as to be easily accessible for inspection. No items must be stored directly on floors.
- 1.6.5 The storage space must have one (1) desk with two (2) chairs.
- 1.6.6 The storage space must be on the premises of the Contractor's facility.

- 1.6.7 The Contractor must provide one (1) three (3) ton truck and driver for 3 days to de-store the accommodation areas of the vessel.
- 1.6.8 The Contractor must provide one (1) forklift and forklift driver for 3 days to de-store the vessel.
- 1.6.9 The Contractor must provide one (1) three (3) ton truck and driver for 3 days to re-storing the vessel.
- 1.6.10 The Contractor must provide one (1) forklift(s) and forklift driver(s) for 3 days to re-store the vessel.
- 1.6.11 The Contractor must provide storage for the remaining fuel on board for the duration of the contract. For the purposes of this specification the Contractor must quote for storage of 40 tonnes of diesel fuel. Any difference in the amount of fuel from 40 tonnes the price of storage must be adjusted up or down using the 1379 process.

## **1.7 Fees and Costs**

- 1.7.1 The Contractor must include in their bid for the following fees and costs:
  - 1) Services;
  - 2) Regulatory Bodies;
  - 3) Classification Society Inspections;
  - 4) Factory Service Representatives;
  - 5) Tests and Trials of equipment and vessel;
  - 6) Provision of safety services, e.g. gas freeing of tanks, fire protection, cocooning asbestos containing areas;
  - 7) Certification of lifting devices as required;
  - 8) Type approval of equipment to be installed if required.
- 1.7.2 The Contractor shall contact, coordinate and schedule all regulatory inspections and/or class surveys by the applicable authority: i.e. TCMS, HC, Environment Canada or others as required by the specification.

## **1.8 Quality Assurance**

Canada may audit the Quality Assurance program.

The Contractor must deliver, as part of its bid package, confirmation that its Quality Assurance program is in accordance with the above-mentioned standards.

## **1.9 “As Delivered” Inspection**

- 1.9.1 The Contractor must, with the Technical Authority and the Inspection Authority, carry out an operational inspection of the vessel. All parties must sign off on the operational

assessment of vessel's equipment and systems. This activity must be carried out before hand-over of the vessel to the Contractor. The Contractor must provide a photographic survey of the inspection to the Inspection Authority and the Technical Authority.

- 1.9.2 This inspection must meet the requirements of Section 6.6.1.1 of this Specification.



## **1.10 Property of Canada**

### **1.10.1 General**

- 1.10.1.1 All materials and equipment removed from the vessel by the Contractor, unless specifically identified within the project requirements for disposal as scrap, must remain the property of Canada.
- 1.10.1.2 All such equipment and materials must be held and retained in good condition by the Contractor pending instructions from the Contract Authority.
- 1.10.1.3 The Contractor must obtain agreement with the Contract Authority for the disposal of materials and equipment that will have no market value after removal from the vessel. Cost estimation must be supplied and environmental regulations may apply on some products.

### **1.10.2 Categorization**

- 1.10.2.1 Property of Canada that is to be either permanently or temporarily removed from the vessel must be identified as being in one of the following three (3) categories as determined by the Technical Authority and this Specification.:
- 1.10.2.2 **Category “A”**  
These items must be permanently removed from the vessel and must remain the property of Canada. The Contractor must store and protect these items from physical damage. The Contractor must store these items on pallets, skids, or in containers suitable for shipment until such a time as they have been inspected and accepted into the care and custody of Canada. The Contractor must provide storage to Canada, of these items for the contract period. Canada must be responsible for the removal of these items from the Contractor’s premises.
- 1.10.2.3 **Category “B”**  
These items must remain the property of Canada, and must be temporarily removed from their location on the vessel during the contract work. They must be returned to their original location on the vessel prior to the vessel leaving the Contractor’s facility. The Contractor must protect these items from weather or physical damage. These items must be stored to allow movement of the items to permit access for inspection, refurbishment and/or maintenance of these items as necessary. The Contractor must take care not to damage the equipment and material.
- 1.10.2.4 **Category “C”**  
Upon removal, these items must become the property of the Contractor and are to be disposed of in accordance with all applicable laws, rules and regulations.
- 1.10.2.5 Prior to removal of any items from the vessel, the items must be clearly identified with wire tags as falling into either Category “A”, “B”, or “C”.

- 1.10.2.6 This requirement must be in addition to any spare parts required for regulatory purposes. All such spare parts must be supplied packaged and individually identified with equipment description, model number and catalogue/part number.

## **1.11 Spare Parts**

- 1.11.1 All system spares must be provided in a spare parts list supplied by the Contractor in an electronic MS Excel spreadsheet format, listing individually the quantity recommended.
- 1.11.2 All new machinery and equipment procured by the Contractor for installation on the vessel must be supplied complete with sufficient manufacturer's recommended spare parts for six months or 2,000 hours of operation whichever is greater, or unless otherwise specified.
- 1.11.3 All system spares must be provided in a spare parts list supplied by the Contractor in an electronic format MS Excel spreadsheet format listing individually the quantity of installed base and unit price of each spare listed. This list must include the following fields:
- 1) Supplier;
  - 2) Manufacturer;
  - 3) Manufacturer's Part Number;
  - 4) Price per Unit;
  - 5) Unit definition (each, case, etc.);
  - 6) Recommended Quantity;
  - 7) Associated System/Equipment.
- 1.11.4 An electronic copy of the spares parts list must be supplied to the Inspection Authority and the Technical Authority.
- 1.11.5 The Contractor must notify the Inspection Authority and the Technical Authority when such spare parts have been received for visual inspection.
- 1.11.6 The Contractor must store the spare parts in accordance with manufacturer's requirements ensuring that the spares are protected from weather, physical damage, or complete loss.
- 1.11.7 The Contractor must deliver the spare parts to after inspection by TA:

**Canadian Coast Guard  
CCGS Earl Grey  
CCG Stores 05C, Warehouse Door #1  
13 Ackerley Blvd.  
Dartmouth, NS B3B 1J6**

## **1.12 Project Management**

### **1.12.1 Introduction**

1.12.1.1 Project management refers to system integration and technical control as well as business management of the CCGS Earl Grey Vessel Life Extension Refit Project.

1.12.1.2 NOTE: Items below marked with an asterisk \* must be delivered with the bidder's proposal, i.e. 1.13.2, 1.13.3, 1.13.4, 1.13.5, and 1.13.6.

### **1.12.2 Project Action Plan (PAP)\***

1.12.2.1 The Contractor must document the project management for the work in a Project Action Plan and must update this plan at monthly intervals or more frequently as required by the Contracting Authority.

1.12.2.2 The PAP must comprise organization structure charts, a master schedule, support schedules, sub-Contractor schedules and work, Government Furnished Equipment (GFE), and Contractor Furnished Equipment (CFE) delivery dates as a minimum.

1.12.2.3 The monthly updates to the PAP must comprise schedule updates, a progress report and review meetings. The components of the PAP and its updates are described in the following sub-sections.

### **1.12.3 Project Integration Management\***

The Contractor must provide an overall project organizational chart identifying all key personnel and sub-Contractors. Further, the Contractor must identify the contract-related work each sub-Contractor is responsible for.

### **1.12.4 Change Management Log\***

1.12.4.1 The Contractor must provide a Change Management Log that must be used for the duration of the project to manage project changes.

1.12.4.2 The Change Management Log must track project issues with the following criteria:

- 1) Individual tracking number;
- 2) Date issue was raised;
- 3) Expected resolution date;
- 4) Date issue was resolved;
- 5) Brief note of resolution on issue;
- 6) Individual who raised issue;
- 7) Individual assigned to resolve issue;
- 8) Risk Factor.

1.12.4.3 If issues require a change in the work they must be dealt by submitting a PWGSC 1379 Form.

**1.12.5 Risk Management\***

The Contractor must identify emergent risks and rank these risks by impact on the work. Mitigation strategies must be identified for all “High” risks. The “Risk Management Plan” must be updated at least weekly and provided to the Technical and Contracting Authorities. The “Risk Management Plan” must be included in the monthly progress meeting Record of Decisions.

**1.12.6 Scheduling\***

- 1.12.6.1 The Contractor must provide a schedule(s) that breaks the work down to the system and component level. The schedule must include sub-Contractor schedules to the same level. The Contractor must update the schedule(s) on a monthly basis and the updates must be provided to the Contract Authority, the Inspection Authority and the Technical Authority.
- 1.12.6.2 The schedule(s) must identify all work in the project. It must include long lead items, GFE, strip outs, production, assembly, installation, bench testing, system commissioning and tests and trials, as well as all scheduled and required resources.
- 1.12.6.3 The schedule(s) must identify the major milestones, critical path and all interrelationships between tasks. The schedule(s) must be baseline.
- 1.12.6.4 The initial schedule(s) must be delivered 21 calendar days after contract award.
- 1.12.6.5 A milestone schedule must be supplied with the bidder’s tender package.
- 1.12.6.6 The PMBoK 2000 must be used as the reference for scheduling.

**1.12.7 Project Reporting**

The Contractor must provide a monthly Progress Report describing the status of the project Time Line, Cost and Performance as an introduction. Time, Cost and Performance must then be addressed in detail. The report must identify significant risks to the program and the actions taken to resolve these risks. The risk analysis must identify any impact upon delivery and actions taken to recover any slippage that may affect the contract delivery date. The report, either in hard copy or in electronic format, must be delivered monthly, three (3) working days prior to the progress review meeting to the Contract Manager, the Inspection Authority and the Technical Authority. The progress report must include sub-Contractor and major component supplier activity.

## **2.0 GENERAL TECHNICAL**

### **2.1 Physical Operating Conditions for Equipment**

All new machinery and/or equipment that are to be supplied and installed must be designed for operation under the following conditions:

- 1) Outside air temperature:
- 2) -40 degree C winter;
- 3) +35 degree C summer;
- 4) Water temperature:
  - i. 0 degree C winter;
  - ii. +30 degree C summer;
- 5) Wind Velocity of 80 knots;
- 6) Sea State 6;
- 7) Ship inclination of up to 35 degrees roll on either side, with a cycle frequency of 10 seconds, and 10 degree pitch with a cycle frequency of 5 seconds and maximum linear acceleration of 1.0g;
- 8) Permanent list of 22.5 degrees port or starboard, and permanent trim of 10 degree fore and aft.

#### **2.1.1 Equipment below Decks**

All equipment must be capable of its intended operation at the ambient conditions of 95% relative humidity at temperatures to 50 degree Celsius.

#### **2.1.2 Equipment above Deck**

The equipment must be protected by means of an enclosure and must be capable of its intended operation in weather deck locations such that it is impervious to the effects of sea spray.

#### **2.1.3 Electronic Compartments**

Compartments containing electronic equipment must be provided with ship's services to maintain the following conditions:

Manned Compartments:

- 1) Room temperature: 20°C to 25°C;
- 2) Relative humidity: 5 to 70%;
- 3) Noise level: 65 dBA.

Unmanned Compartments:

- 1) Room Temperature: 20°C to 25°C;
- 2) Relative humidity: 40 to 70%;
- 3) Noise level: 80 dBA.

#### 2.1.4 **Vibration**

All shipboard equipment, racks, cables and other accessories must be mounted so as to be capable of performing their intended operation under the following conditions:

Shipboard Vibration:

- 1) Up to 13.2 Hz with displacement amplitude of +/- 1.0mm;
- 2) 13.2 to 80.0 Hz acceleration amplitude of +/- 0.7g with a maximum acceleration of 0.7g;
- 3) Natural frequencies at supports for equipment and parts of equipment must not be within the 0 to 80 Hz range, except where they cannot be kept outside this range by constructional design methods, the vibration must be damped so that undue amplification is avoided.

### 2.2 **Protection of Personnel**

#### 2.2.1 **General**

2.2.1.1 The Contractor must ensure the removal of all rough edges, points, sharp corners and protrusions created during the conduct of the work.

2.2.1.2 Smoking is not permitted aboard this vessel.

#### 2.2.2 **Hot Work**

2.2.2.1 The following precautions must be taken where hot work is to be conducted:

- 1) The compartment(s) affected must be certified gas free by a certified marine chemist. The Contractor must provide copies of all certificates to the Inspection Authority. Certificates must specify, "Safe for persons" and/or "safe for hot work" as appropriate. The Contractor must post a copy of all certificates at the entrance to the affected spaces;
- 2) Protective material must be used to prevent the spread of sparks, protecting electrical cables, machinery and other services;
- 3) Fire sentries must be provided in each space and in all adjacent spaces, if welding, grinding and burning is being carried out. Fire sentries must be provided with an appropriate fire extinguisher and must be trained in its use. The fire sentry must maintain a watch in his designated area for at least thirty (30) minutes after any hot work has been completed.

2.2.2.2 Any hot work carried out onboard the vessel during the contract period must be conducted in accordance with the Canadian Coast Guard Fleet Safety Management System (CCGFSM) procedures and individual shipboard work instructions. Copies of the manual and site-specific work instructions are available from the Technical Authority. The Contractor's Standard Operating Procedures (SOP's) may be substituted for this requirement based upon a review and acceptance of the Contractor's SOP's by the Contract Authority and the Technical Authority.

**2.2.3 Confined Space Entry**

2.2.3.1 The Contractor must supply a copy of a certified marine chemist or other qualified person's "Gas Free Certificate" to the Inspection Authority prior to commencing work. Certificates must specify, "Safe for persons" and/or "safe for hot work".

2.2.3.2 For all work requiring entering or working in confined spaces; contractor must note that Canadian Coast Guard ships are presently working under the ISM Code and that each ship has a Fleet Safety Manual onboard. This manual is also available in soft copy and can be distributed upon request. As a minimum the contractor must comply with the work requirements as outlined in the Fleet Safety Manual during the contracted work period. In accordance with the CCG Fleet Safety and Security manual, all work involving the entering of confined spaces must make use of a qualified rescue team. This team is to be used at all times when tanks or confined spaces are to be entered. The costs associated with all known work requiring the services of a confined space rescue team must be the responsibility of the contractor. Any entry into confined spaces during the contract period must be conducted in accordance with the Canadian Coast Guard Fleet Safety Management System procedures and individual shipboard work instructions. The Contractor's Standard Operating Procedures (SOP's) may be substituted for this requirement based upon a review and acceptance of the Contractor's SOP's by the Contract Authority and the Technical Authority.

**2.2.4 Rotating Machinery**

Newly installed machinery must be provided with shielding to prevent contact with rotating elements.

**2.2.5 Electrical Equipment**

2.2.5.1 When working on electrically operated equipment electrical lock-outs must be used to isolate the equipment and electrical caution tags posted at the main power and distribution panel on those switches supplying equipment under maintenance and verification made at the terminals to ensure power is not present.

2.2.5.2 Any lock-out requirements onboard the vessel during the contract period must be conducted in accordance with the Canadian Coast Guard Fleet Safety Management System procedures and individual shipboard work instructions. The Contractor's Standard Operating Procedures (SOP's) may be substituted for this requirement based upon a review and acceptance of the Contractor's SOP's by the Contract Authority and the Technical Authority.

**2.2.6 Work Aloft**

Any work aloft must be conducted in accordance with the Canadian Coast Guard Fleet Safety Management System procedures and individual shipboard work instructions. The Contractor's Standard Operating Procedures (SOP's) may be substituted for this

requirement based upon a review and acceptance of the Contractor's SOP's by the Contract Authority and the Technical Authority.

**2.2.7 Asbestos**

- 2.2.7.1 No material containing asbestos must be used. Any handling of material containing asbestos must be performed by personnel trained and certified in accordance with Provincial Labour Regulations. The Contractor must provide the certificates of certified personnel to the Inspection Authority prior to the commencement of any such work.
- 2.2.7.2 The Contractor must be responsible for the safe disposal of any asbestos containing material where such material is disposed of. The Contractor must provide the Inspection Authority with copies of certificates pertaining to the disposal of the asbestos containing material in accordance with Federal, Provincial and Municipal regulations.
- 2.2.7.3 **Note:** The latest survey done in May 2014 has determined that there are small quantities of non-friable ACMs (Asbestos Containing Materials) onboard the CCGS Earl Grey. The latest report is in PDF and attached in the Technical Data Package. Contractors must follow the vessel's Asbestos Management Plan when handling, disturbing, or working in the direct vicinity of these identified ACMs. Type 1 Work Procedures are necessary to work with these materials. Contractors must employ workers specifically trained and certified in dealing with ACMs or subcontract to parties that have personnel certified and trained to work with these materials. There is a comprehensive list onboard of spaces and materials regarding their ACM composition. Contractor must obtain specific job site information from TA to determine if these ACMs are present. All necessary documentation of compliance with these standards must be completed and given to TA prior to, during, and after completion of all work as applicable to the process. Air quality testing must be carried out prior to and after completion of work by certified personnel with the proper equipment. Copies of all air quality testing must be given to the TA.

**2.3 Workplace Hazardous Materials Information System (WHMIS)**

- 2.3.1 The Technical Authority will identify to the Contractor any hazardous materials that are onboard the vessel in accordance with the Workplace Hazardous Materials Information System (WHMIS).
- 2.3.2 WHMIS Material Safety Data Sheets for identified hazardous materials onboard the vessel will be provided to the Contractor by the Technical Authority.
- 2.3.3 The Contractor must be responsible for all Contractor supplied products and materials used aboard the vessel. These materials must be identified to the Technical Authority



and the Inspection Authority. Copies of the MSDS sheets must be provided to the Inspection Authority and the Technical Authority.

## **2.4 Protection of Equipment**

- 2.4.1 The Contractor must take measures to ensure that all surfaces and items of material or equipment installed on the vessel, finished surfaces, final color coats and other finished work must be protected against damage, soiling, and/or contamination.
- 2.4.2 All electrical and electronic equipment and components must be protected during the contract against damage by direct or indirect physical contact or by the effects of adverse temperatures or other environmental conditions.
- 2.4.3 Any damage to surfaces, equipment, furnishings or decor incurred prior to acceptance by Canada must be returned to “As Delivered” condition by the Contractor at no expense to Canada.
- 2.4.4 All openings in machinery and/or systems prior to connections being made must be kept covered by inserts or covers at all times.
- 2.4.5 The Contractor must obtain and follow instructions from its sub-Contractors for any special protection required for sub-Contractor furnished equipment during the project work. Such instructions must be made available to the Technical Authority and the Inspection Authority.
- 2.4.6 The Contractor must ensure that the ship's machinery, equipment and systems are protected from all hazards, including but not limited to damage from ongoing work, corrosion, sandblasting (directly or indirectly), paint over spray, hot work, adverse temperature or other environmental conditions and contaminants.

## **2.5 Access to Vessel and Equipment**

### **2.5.1 Installation and Removal Routes**

- 2.5.1.1 If the Contractor intends to disturb the physical structure of the vessel to facilitate removal or installations, approval of the Technical Authority and the Inspection Authority is required.
- 2.5.1.2 All interference items, protected, removed or disturbed during the course of overhaul, removal and installation, including lagging and/or insulation, must be renewed in good order to “As Delivered” condition on completion of work, unless otherwise specified.

## **2.5.2 Penetrations**

Sealing of redundant penetrations must be performed in a manner acceptable to TCMS. The Contractor must notify the Inspection Authority of any such penetrations that have been sealed and provide copies of all TCMS documentation.

## **2.5.3 Access for Maintenance**

The layout of the machinery and equipment must be designed and constructed to permit ready access for inspection, maintenance and repair without disturbance of other machinery, equipment or structures. Provisions must be made for the removal of machinery components.

## **2.6 Assembly of System Equipment and Components**

### **2.6.1 Securing Arrangements of System Equipment and Components**

2.6.1.1 All new and existing systems, equipment and components installed or disturbed as a result of the work, must be secured to prevent damage caused by the physical operating conditions of the vessel, as per Section 2.1 of this Specification.

2.6.1.2 The Contractor must follow manufacturers' recommendations for installation arrangements. In the event this information is not available, securing arrangements must be approved by the regulatory requirements prior to the Contractor commencing the securing activities.

2.6.1.3 The Contractor must follow torque specifications as provided by the manufacturer. Where manufacturer specific torque specifications are not provided, standard SAE nut and bolt torques must be used.

### **2.6.2 Cleaning**

The Contractor must ensure that after installation, parts and assembled equipment must be cleaned of smudges, spatter or excess solder, weld metal and metal chips or any other foreign material. This includes any particles that could loosen or become dislodged during the normal expected life of the equipment. All corrosive material must be removed. This cleaning must take place before final assembly of the equipment parts. Any disturbed paint is to be repaired prior to closing machinery.

### **2.6.3 Damaged Items**

Covers, cowlings, components and equipment damaged by the Contractor must be replaced at no expense to Canada.

## **2.7 Welding**

### **2.7.1 General**

- 2.7.1.1 For fusion welding for steel the Contractor must be certified in accordance with the Canadian Welding Bureau (CWB), CSA\ACNOR W47.1 1983, Division 2.1. The Contractor must supply proof of his accreditation to the Inspection Authority. All such welding must be to CSA Standard W59M "Welded Steel Construction (Metal Arc Welding) (Metric Version)".
- 2.7.1.2 All aluminum welding must conform to the requirements of CSA Standard W47.2-M1987 (R1998) "Certification of Companies for Fusion Welding of Aluminum" Division 2.1 and must be performed by persons currently certified by the Canadian Welding Bureau to CSA Standard W47.2-M1987 (R1988). Proof of certification must be provided to the Inspection Authority.
- 2.7.1.3 The Contractor must provide copies of all welding certificates at the start of the contract work.
- 2.7.1.4 The Contractor must submit CWB stamped welding specifications and weld procedure data sheets to TCMS where required. Weld procedures for joining pipe connections must be recorded and approved by CWB in accordance with ASME, Section IX.
- 2.7.1.5 All procedures pertaining to hot work as detailed in Section 2.2.2 must be adhered to.

### **2.7.2 Removal of Attachments**

Temporary cleats, lifting eyes and fastenings for servicing structures must be removed by burning or grinding, and any remaining irregularities must be ground flush with the surface of the parent plate. Any disturbed paint is to be repaired.

### **2.7.3 Weld Design Requirements**

The size, length and details of welds must be approved by TCMS.

## **2.8 Painting**

### **2.8.1 General**

- 2.8.1.1 The Contractor must prepare a paint schedule and submit the schedule to the Technical Authority and the Inspection Authority for review and acceptance. The paint schedule must list all areas and compartments on the vessel affected by the project work and indicate the proposed paint type, painting scheme, surface preparation, type of coating, number of coats, thickness and colors. All paint used must be compatible with the existing paint on the vessel.
- 2.8.1.2 All pipe markings must be in accordance with CGFM 308-00-03, Color Coding Standard for Piping Systems.
- 2.8.1.3 All new and disturbed steel and aluminum work must be painted in accordance with publication DFO 5847 and to the paint manufacturer's specifications.
- 2.8.1.4 All paint must be for marine application and must meet CAN/CGSB 1.61-99 for exterior marine alkyd enamels and CAN/CGSB 1.193-99 for marine epoxy paints. Paint, varnish and other finishes used on interior surfaces must be listed in TCMS's list of approved products, TP-438.
- 2.8.1.5 Each coat of paint must be of a different shade to indicate proper coverage, and thoroughly dry before application of subsequent coats. At minimum, the first primer coat must be applied by brush or airless spray.
- 2.8.1.6 The final topcoats must be protected from soiling or damage until the custody of the vessel is returned to Canada. Care must be taken in the application of paint to ensure that furnishings, and equipment liable to more serious damage due to excess spray, must be adequately protected.
- 2.8.1.7 The following must NOT be painted:
- 1) Screw threads;
  - 2) Grease fittings;
  - 3) Bronze pins;
  - 4) Door screens;
  - 5) Nameplates;
  - 6) Gaskets;
  - 7) Stainless steel or monel metal fittings;
  - 8) Machined surfaces;
  - 9) Instrumentation;
  - 10) Interior gratings;
  - 11) Electrical wires, insulation and fittings;
  - 12) Electrical panels;
  - 13) Rubber seals of watertight doors and hatches;
  - 14) Fire door seals, and;

15) In general, all working parts.

- 2.8.1.8 For the painting of the vessel's hull, or paint intended for application on the underwater hull surface, the product being applied must be registered and approved for use by Agriculture Canada. The Contractor must provide a copy of this approval to the Inspection Authority and the Technical Authority.

## 2.8.2 **Heavy Metal Based Coatings**

Paints containing lead, mercury or copper must not be used.

## 2.9 **Identification**

### 2.9.1 **Nameplates**

- 2.9.1.1 Nameplates must be fitted for all new equipment, new compartments, new doors and closures.
- 2.9.1.2 All nameplates must be in English, except where required in English and French by TCMS for reasons of emergency operation.
- 2.9.1.3 Lettering must be clear and concise with the minimum use of abbreviations. Primary information must be given in larger size lettering than secondary information.
- 2.9.1.4 The type of nameplates must suit the location in the vessel as specified below:
- 2.9.1.5 Plastic must be used in accommodation and navigation spaces where the nameplate is free of exposure to mechanical damage or covering over by ice, paint, oil, grease or dirt.
- 2.9.1.6 Plastic nameplates must be laminated phenolic rigid type with machine engraved lettering and secured with stainless steel or brass machine screws. Unless otherwise specified, nameplates must have white lettering on black for normal signs and white lettering on red background for warnings and emergency signs.
- 2.9.1.7 Laminated plastic nameplates, black with white core engraved through to the center core, must be provided for all devices located on the exterior surfaces of the switchboard.
- 2.9.1.8 Nameplates must be secured to the switchboard with machine screws. New nameplates to be fitted on the existing switchboard must be consistent in size and lettering with those already fitted. Nameplates for feeder circuits must identify each circuit by name and number and the fuse size and/or trip element rating.

- 2.9.1.9 Warning or caution nameplates must be laminated plastic, red with white core engraved through to the center core, and must identify circuit breakers with shunt trips requiring completion of remote circuits prior to being operated, and those having a potential power source connected to both sides, or to any other potentially hazardous condition.
- 2.9.1.10 Engraved Metal, stainless steel or brass nameplates must be used in machinery spaces and where exposed to the weather. Engraved metal nameplates must have lettering accentuated by means of black wax and secured with stainless steel or brass machine screws.
- 2.9.1.11 A complete drawing list of nameplates, detailing size of plate, size of lettering and inscription must be submitted to the Inspection Authority and the Technical Authority for review and acceptance prior to ordering and/or manufacturing.

## 2.9.2 **Key Tags**

- 2.9.2.1 Tags must be supplied for all new keys and must be of plastic composition. Tags must be marked to identify the space they serve. The description must be identical to that used for the space or equipment identification nameplate. A complete list of new keys and tags must be provided to the Inspection Authority and the Technical Authority.
- 2.9.2.2 All new keys and new key tags must be turned over to the Technical Authority as part of the acceptance of the vessel.

## 2.9.3 **Safety Related Signs**

- 2.9.3.1 All new signs must be in English except where required in English and French by TCMS for reasons of safety.
- 2.9.3.2 Painted signs for muster station directions, fire stations and emergency equipment, etc. must be supplied and located in accordance with TCMS approval.
- 2.9.3.3 The Contractor must prepare and submit a drawing indicating the location, type and size of lettering for all signs. This drawing must be submitted to TCMS for approval prior to construction or installation of the signs.

## 2.10 **Cleaning**

- 2.10.1 The Contractor must maintain the vessel in a clean condition. Debris and garbage must be removed from the vessel and disposed of at the end of each working day.

- 2.10.2 Attention must be given to hazardous materials such as flammable or toxic waste products. These must be disposed of in accordance with federal, provincial and municipal regulations.
- 2.10.3 Prior to any work commencing in the machinery spaces, the bilge in the machinery spaces must be cleaned. Cleaning must include pumping and disposal of all bilge water and washing of all bilges to remove all grease, oil and contaminants. Disposal of waste must be in accordance with all federal, provincial and municipal regulations. Disposal certificates must be provided to the Inspection Authority and the Technical Authority. The Contractor must bid on 5000 litres of bilge waste for disposal. PWGSC Form 1379 must be submitted to adjust the cost of bilge waste disposal up or down.
- 2.10.4 Vessel cleanliness must extend to the bilge areas which must be maintained free of oil, water, and debris for the duration of the project.
- 2.10.5 Prior to acceptance by the Coast Guard, the Contractor must thoroughly clean all spaces of the vessel including all bilge areas.

### **3.0 MECHANICAL**

#### **3.1 General**

- 3.1.1 The Contractor must supply all materials and/or equipment within the intent of these specification requirements.
- 3.1.2 All replacement machinery, equipment and fittings must be new and unused, manufactured by a recognized manufacturer, having established facilities and supply of parts and service in North America.
- 3.1.3 All machinery and equipment must be approved by a Classification Society for use onboard this class of ship and must meet all applicable TCMS regulations. The Contractor must provide copies of Classification Society approval certificates to the Inspection Authority and the Technical Authority. Approval certificates must be current and for the type and model of equipment being installed by the Contractor. The Contractor must make reference to Section 6.2.5 for complete documentation requirements.
- 3.1.4 All machinery must be capable of operating under the conditions set out in Section 2.1 of this Specification. All machinery must be installed to manufacturer's recommendations with particular attention to the reduction of vibration and noise transmission. All rotating machinery must be installed with axis fore and aft or vertical unless otherwise approved by TCMS. Location of all units must be with regard for accessibility for maintenance and repair.

#### **3.2 Piping**

##### **3.2.1 General Installation**

- 3.2.1.1 Piping must be installed so as not to interfere with:
- Passage through doors, hatches, scuttles, openings covered by portable plates or working areas. In frequently used walkways, the minimum overhead clearance of the piping must be 6 feet 6 inches.
  - Operation of machinery, equipment, controls, and with routine maintenance of machinery and the ship's structure;
  - Designated equipment removal routes or removable structural portions of the ship provided for equipment access, removal, and/or maintenance.
- 3.2.1.2 Piping must be located where it would not likely be subject to physical damage. Protection for piping must be provided wherever susceptibility to physical damage is unavoidable. Piping runs must be as direct as possible and utilize the minimum amount of fittings that would increase the frictional flow characteristics of the piping run. Piping must be portable in way of mechanical, electrical or hydraulic systems requiring periodic overhaul. Isolating valves must be provided in order to



facilitate piping portability in such a way as to minimize the effect on operation of the remainder of the system.

- 3.2.1.3 Where high and low points in piping are unavoidable, vent drains or other effective means must be installed to ensure proper system function. Pump suction piping must be as short as practical, and of sufficient diameter and arranged to rise without forming bends likely to cause air pockets. Tail pipe connections must be 0.5D above the bottom of the tank at the deepest point, D being the inside diameter of the suction pipe.
- 3.2.1.4 Bulkheads and decks must generally be pierced close to boundaries of compartments. Cutting bulkhead stiffeners, deck beams and plating butts and seams is not permitted without prior TCMS approval.
- 3.2.1.5 Piping must not be led through inner bottom tanks and voids except as necessary to serve the tanks themselves, or as necessary to avoid penetrations of fuel tanks, potable water tanks and ballast tanks by piping less desirable therein than in the inner bottom tanks and voids. Piping that operates under pressure must be kept out of voids, cofferdams and other normally non-vented spaces.
- 3.2.1.6 Deflections of bulkheads, decks and other structures due to working of the ship must be considered and the piping arranged for the necessary clearance and flexibility.
- 3.2.1.7 The amount of piping led through messing and living spaces must be minimized. Piping in such places must be symmetrically and neatly arranged for the necessary clearance and flexibility. Piping must be kept clear of the machinery control room.
- 3.2.1.8 Piping must not be led through the following spaces, except as necessary to serve the space:
  - Chain lockers;
  - Wiring trunks and enclosures.
- 3.2.1.9 When systems other than those serving a tank or similar tanks are permitted to pass through fuel oil or diesel oil tanks, the piping must be Schedule 80 thickness and must have welded joints.
- 3.2.1.10 Supports must be designed and located to safely support the weight of the piping, its operating or test fluid (whichever is heavier) and its insulation and lagging (where installed). The supports must also carry the loads imposed by expansion and contraction of the piping and working of the ship.
- 3.2.1.11 The number of supports installed, the type selected and their location must prevent excessive vibration of the piping under all system operating conditions. They must not constrain the piping for all operating conditions, so as to cause excessive

transfer of load from support to piping, from support to support or excessive stress from being transmitted by the piping to machinery, equipment or the ship's structure.

- 3.2.1.12 Rigid anchors must be designed so that noise and vibration from piping system components and excessive heat from high temperature systems are not transferred through the anchor into surrounding areas.
- 3.2.1.13 Changes in direction of piping must be made by pipe bends and offsets where space permits; otherwise, straight length of pipe and pipefittings specified for the system must be used. Miter joints must be permitted only in piping such as, air escape vents and overflows where their use would not cause unacceptable pressure drop or turbulence in the fluid flow. Branch connections must be located to minimize turbulent flow and the type used, (crosses, single and double-sweep tees, Y and lateral fittings), must be suitable for the required flow characteristics.
- 3.2.1.14 Direct reading thermometers, pressure, and/or compound gauges must be located in positions where they can be easily read and safe from damage. All pressure and compound gauges must be provided with an isolating cock.
- 3.2.1.15 Galvanic corrosion must be minimized in the sea water systems that couple dissimilar metals. Control of galvanic corrosion may be obtained by the coupling of a relatively small area of cathodic material to a large area of anodic material or the dissimilar metals may be separated with a short length of extra heavy galvanized steel pipe (waste piece). The permissible potential difference must be no greater than 0.4 volts. The latter must be fitted only when specified. The permissible potential difference must be no greater than 0.4 volts.
- 3.2.1.16 Raised face flanges must not be used against bronze or other relatively low strength composition valves, fittings or flanges.
- 3.2.1.17 Where pipes pass through holes in non-watertight structure, provision must be made to keep the pipes from bearing on the structure.
- 3.2.2 **Material Selection**
  - 3.2.2.1 Figure 3-1 specifies those materials that are acceptable for use in specific piping systems. Figures 3-2 to 3-8 specify materials for various piping systems and components.
  - 3.2.2.2 Piping systems and components must comply with this Specification except where the specified material is incompatible with materials remaining in the system. Alternate materials not listed must be employed only when approved or recommended by original equipment manufacturer and/or supplier of that

equipment/component. In such instances direction must be requested from the Technical Authority before proceeding further with the work.

- 3.2.2.3 Steel piping employed for raw water service must be hot dipped galvanized upon complete fabrication.

**Figure 3-1: Acceptable Materials for Specific Piping Systems**

<b>Item/System</b>	<b>Material Figure</b>
<b>Raw Water Systems</b>	<b>Reference</b>
Fire Main, Sanitary (Black Water), Sewage, Ballast, AFFF, Bilge Suction (Oil/Water Separation)	4t, 6b, 1a, 2a, 3a, 6a, 7a, 3fl, 4fl, 5fl, 11fl, 12fl, 1f, 2f, 3f, 4f, 19f, 20f, 21f, 1v, 2v, 3v, 5v, 6v, 7v, 8v, 22v, 5g (AFFF 11g only) (4b non-bilge areas).
Main and Auxiliary Circulating Systems	4t, 9v, 10v, 11v, 12v, 8f, 9f, 10f, 11f, 12f, 20f, 21f, 4fl, 5fl, 5g, 6g, 7g, 1b, 2b, 6b, 1a, 2a, 4a.
<b>Oil Fuel, Marine Diesel and Distillate</b>	<b>Reference</b>
Filling and Transfer	4t, 1b, 6b, 6g, 7g, 1a, 5a, 6a, 4fl, 5fl, 8f, 9f, 10f, 9v, 10v, 19v.
Inside Tanks	1b, 6b, 6g, 4fl, 8f, 9f.
<b>Fresh Water</b>	<b>Reference</b>
Potable (including vents, overflows, sounding tubes, inside tank suctions), Sanitary (Grey water)	3t, 5g, 4b, 1a, 2a, 3a, 6a, 1fl, 2fl, 1f, 3f, 4f, 5f, 3fl, 1v, 2v, 3v, 5v, 6v, 7v, 8v, (valve bodies may be used to ASTM B62, trim to ASTM B61)
Circulating (Engines)	5t, 5g, 2b, 6b, 1a, 2a, 3a, 6a, 3fl, 4fl, 5fl, 11fl, 12fl, 8f, 9f, 10f, 11f, 12f, 19f, 20f, 21f, 9v, 10v, 11v, 12v, 13v, 14v, 18v 19v, 20v.
<b>Lubricating Oil</b>	<b>Reference</b>
General Service (150 PSIG rating)	4t, 6g, 7g, 1b, 6b, 1a, 5a, 4fl, 12fl, 8f, 9f, 10f, 21f, 9v, 10v, 11v.
<b>Hydraulic Oil</b>	8t, 9t, 1b, 1g, 1a, 6fl, 12fl, 13f, 14f, 15f, 21f, 22f, 14v.
<b>Steam (150 psig)</b>	<b>Reference</b>
Feed water, Condensate	3t, 4t, 3g, 1b, 6b, 1a, 1fl, 2fl, 12fl, 1f, 2f, 4f, 5f, 21f, 1v, 2v, 3v, 4v, 6v, (valve bodies may be to B62 trim to ASTM B61)
<b>Compressed Air</b>	<b>Reference</b>
3000 PSIG 150° F	1t, 2g, 1a, 17f, 16f, 21v.
250 PSIG, 150° F	5t, 3g, 1b, 6b, 1a, 4fl, 5fl, 8fl, 12fl, 8f, 9f, 10f, 11f, 12f, 21f, 4v, 6v, 9v, 11v, 12v, 13v.
<b>Deck Drains and Scuppers</b>	<b>Reference</b>
All "As Fitted"	5t, 4b, 6b, 5g, 6g, 4fl, 8f, 9f.

**Figure 3-2: Material for Pipe and Tube**

	Description	Material	
1t	Tube – seamless (pipe for pressures exceeding 150 PSI)	ASTM B466-79	70-30 CU-NI
2t	Tube, seamless	ASTM B466-79, Alloy 706	90-10 CU-NI
3t	Tube, seamless	ANSI/ASTM B88-78	Copper
4t	Pipe, seamless	ANSI/ASTM A 53 GR A or B Schedule 40	Steel
5t	Pipe, seamless	ANSI/ASTM A53 GR A or B Schedule 40	Carbon Steel
6t	Tube	ANSI/ASTM A376-79B	Stainless Type 316L
7t	Tube	ASTM B59-78	Low Carbon Steel
8t	Tube, seamless	ASTM A179	Hydraulic Quality Carbon Steel
9t	Pipe, seamless	ANSI/AASME A376-79B AISI 316	Stainless

**Figure 3-3: Material for Valves**

	<b>Description</b>	<b>Material</b>
1v	Globe, angle	ANSI/ASTM B 61-76
2v	Pressure Regulating	ANSI/ASTM B 61-76
3v	Pressure Relief	ANSI/ASTM B 61-76
4v	Y Type Strainers	ANSI/ASTM B 61-76
5v	Diaphragm	ANSI/ASTM B 61-76
6v	SDNR and Lift Check	ANSI/ASTM B 61-76
7v	Butterfly	ANSI/ASTM B 61-76
8v	Gate, flanged	ANSI/ASTM B 61-76
9v	Globe, angle and check	Steel
10v	Gate	Steel
11v	Relief	Steel
12v	Pressure Regulating	Steel
13v	Globe, angle, relief, check, control bleeder, ball	Carbon Steel
14v	Globe, angle, gate ball (fire safe)	Stainless 316
18v	Angle, relief	Stainless 316
19v	Butterfly	Ductile iron or cast steel
20v	Assorted	AISI 304, 316/A51M, A 182 Teflon Packing
21v	Assorted	Alloy 642
22v	Sprinkler Control Valves	ASTM B61

**Figure 3-4: Material for Fittings**

	Description	Material
1f	Brazing	ANSI/ASTM B61 only (ASTM B 150 not to be used)
2f	Flanged	ANSI/ASTM B61 only
3f	Threaded	ANSI/ASTM B61 (125 psi rating)
4f	Unions	ANSI/ASTM B61 only
5f	Solder Joint	Wrought Copper ANSI B16.22
6f	Brazing Bosses	ANSI/ASTM B61 only
7f	Refrigeration	Wrought Copper ANSI B16.22
8f	Butt Welding	ANSI/ASTM A234-WPB
9f	Socket Welding	ANSI/ASTM A 105
10f	Welding Bosses	ANSI/ASTM A 105
11f	Threaded	ANSI/ASTM A 105
12f	Union	ANSI/ASTM A 105
13f	Socket Welding	AISI 316L
14f	Butt Welding	AISI 316L
15f	Flanges	AISI 316L
16f	Brazing	Bronze
17f	Union	Bronze
18f	Butt Welding	90-10 CU-NI
19f	Victaulic Type	Ductile iron for grooved end pipe
20f	Tube Fittings	Stainless steel (Swagelok)
21f	All types of Compression fittings	316L or carbon steel

**Figure 3-5: Material for Flanges**

	<b>Description</b>	<b>Material</b>
1fl	Brazing	ANSI/ASTM B61 only
2fl	Threaded	ANSI/ASTM B61 only
3fl	Composite	ANSI/ASTM B61 – Brazing Ring, Complete with slip-on flange to ANSI/ASTM A181-77 GR1 and ANSI/ASTM A181-GR1
4fl	Welding neck, Socket, Slip on	ANSI/ASTM A181-GR1
5fl	Extended Welding Neck	ANSI/ASTM A181-GR1
6fl	Welded	AISI 304L, 316L
8fl	Welding Neck Socket	ANSI/ASTM A105-GR-2
9fl	SAE 4 Bolt Split, Solid	Carbon steel
10fl	Composite	Inner flange 90-10 CU-NI Outer flange carbon steel
11fl	Victaulic	Ductile iron for grooved end pipe
12fl	Swagelok Flanges	316L or carbon steel



**Figure 3-6: Material for Gaskets**

	<b>Description</b>	<b>Material</b>
1g	O-Ring	Buna N
2g	O-Ring	Buna N
3g	Full Face	CAF Non graphite
4g	Full Face	CAF graphite
5g	Full Face	Synthetic rubber, max temp 180° F
6g	Full Face	Buna N
7g	Flat Ring	Teflon
8g	Spiral Wound	Teflon impregnated
11g	Sheet	Ethylene propylene terpolymer (EPT)

**Figure 3-7: Material for Bolts and Nuts**

	Description	Material
1b	Bolts	ANSI/ASTM A193-79A
	Continuous Thread	GR B16
	Stud or Hex Head	ANSI/ASTM A193-79A
	Tap End	GR B16
	Nuts: Hex, HSF	ANSI/ASTM A194-79A GR4
2b	Bolts	Phosphorous, Bronze ASTM
	Continuous Thread	ANSI/ASTM B139-79
	Stud or Hex Head	Alloy B1 or B2
	Tap End	
	Nuts: Hex, HSF	
4b	Bolts	Mild Steel
	Stud or Hex head	Hot dipped galvanized
	Nuts hex	
5b	Stud Bolts	
	Continuous thread	
	Tap End	
	Nuts: Hex, HSF	
6b	Bolts: Hex Head	ASTM A-307 Cadmium Plated
	Nuts: Hex Head	
7b	Bolts: Hex Head	ASTM A-320 Stainless Steel
	Nuts: Hex Head	

**Figure 3-8: Material for Assorted Components**

	Description	Material
1a	Pipe Clips	Steel
2a	Orifice Plates	Monel
3a	Strainers	
	Plate Type	ANSI/ASTM B 61-76
	Flat Plate	ANSI/ASTM B 61-76
	Y-Type	ANSI/ASTM B 61-76
	Basket Type	ANSI/ASTM B 61-76
4a	Strainers	Steel
	Y-Type	
	Basket Type	
5a	Strainers	304 Stainless
	Y- Type	
6a	Closure for Sounding Tube	Bronze
7a	Fire hose – Siamese Connection	Bronze

### 3.2.3 **Fire Fighting Systems**

Piping for FM200 firefighting systems must comply with the regulations of TCMS and system manufacturer's specifications.

### 3.2.4 **Exhaust Piping**

Exhaust piping must be fabricated from materials as specified on the guidance drawings. The flanges must be forged steel 1035 kPa Light Pattern ASTM A181-59T. Expansion pieces must be free flexing with flange joints, one fixed and one free floating flange, internal stainless steel sleeves (Senior Flexsonic™ or equivalent, suitable for exhaust duty at the systems operating temperature).

### 3.2.5 **Piping Fabrication**

Flange faces must be on a plane perpendicular to the longitudinal centerline of the pipe, tube or fitting to which they are attached. All components and assemblies of components must be thoroughly cleaned after fabrication and before installation in the ship. Foreign matter such as dirt, grit and shavings, must be removed by methods and materials compatible with the fluids employed in the service aboard ship.

### 3.2.6 **Bulkhead and Deck Pieces**

Bulkhead and deck pieces must be steel marine standard three-flange or other Class approved method, galvanized for seawater, black for oil. The penetration must be extra heavy pipe. Copper piping must be bronze type with nut on each side of the bulkhead or deck piece.

### 3.2.7 **Joints and Connections**

3.2.7.1 Braze joints in non-ferrous systems, welded joints in carbon steel and alloy systems must be used to the maximum extent practical. The number of joints must be minimized through the use of pipe bending. For bends 3D radius and below, prefabricated bends must be used. Prefabrication of piping system assemblies must be utilized to the greatest extent practical. Joints fabricated onboard ship must be located in areas that provide adequate clear space for welding and brazing. Takedown joints must be located to ensure sufficient clear space for proper assembly and maintenance. Joints located in areas inaccessible for maintenance must be welded or brazed. All flanged piping joints must be connected using jointing material suitable for the service intended and approved by TCMS.

3.2.7.2 Throttle valves and valves which operate automatically or semi-automatically such as safety, relief, regulating and governing valves, must be flanged unless of 19mm nominal bore or less in which case they may be of the screwed connection.

**3.2.8 Contact Strips**

All copper joints isolated by joining to other materials must have contact strips securely fitted from flange to flange to give a continuous circuit in the pipe lines.

**3.2.9 Hydraulic Piping**

Hydraulic piping must be phosphate pickled, neutralized, flushed with oil and blown dry prior to installation.

**3.2.10 Identification of Piping**

All piping systems must be identified in accordance with CCG Colour Coding Standard for Piping Systems in the Technical Data Package.

**3.3 Pumps**

**3.3.1 General**

- 3.3.1.1 Pumps, excluding engine driven type, must be supplied complete with electric motors suitable for the power supply specified on the single line diagram. Pump motors and starter characteristics must be as specified under Section 4 of this Specification.
- 3.3.1.2 Engine driven pumps must be engine manufacturer's standard supply. Allowance must be made for specific installation requirements when specifying pump performance parameters.
- 3.3.1.3 Pump performance characteristics must match the full range of the system(s) to which they are connected. Pumps must operate at or close to their design point. Pumps installed on resilient mounts must have flexible suction and discharge connections that will accept deflections arising from thrust and shock loading.
- 3.3.1.4 Radial and thrust bearings must either be of the sliding surface or rolling contact type. The selection of thrust bearings must take into consideration the rolling and pitching of the vessel that may impose axial thrust even where pumps are in hydraulic balance.
- 3.3.1.5 Wear rings must be fitted to the casings of all centrifugal pumps. Wear rings must be fitted to all impellers that are driven at a BHP of 10 or greater at rated output. Pump glands must incorporate mechanical seals. Pump casings must have a vent connection at each discharge stage and a casing drain connection.
- 3.3.1.6 Pumps operating in parallel must be capable of continuous steady operation.

- 3.3.1.7 The major rotating elements of all pumps complete with all connected appendages must be dynamically balanced. Documented proof of this must be supplied to the Inspection Authority.

### 3.3.2 **Centrifugal Pumps**

- 3.3.2.1 Centrifugal pumps, unless otherwise specified, must have the following characteristics:
- 1) Vertical in-line overhung;
  - 2) Radial split bronze casing;
  - 3) Stainless steel shaft;
  - 4) Mechanical shaft seal;
  - 5) Aluminum bronze impeller;
  - 6) Renewable wear rings;
  - 7) Removable shaft spacers;
  - 8) Bearings lubricated by the pumped fluid in plain bearing applications or grease packed roller bearings.
- 3.3.2.2 Pumps must be fitted with the following attachments:
- 1) Discharge pressure gauge, liquid filled, with isolating cock;
  - 2) Compound suction gauge, liquid filled, with isolating cock;
  - 3) Drip tray;
  - 4) All applicable guards.
- 3.3.2.3 The design of the pump must allow the complete rotating assembly to be withdrawn without disturbing the pipe work.
- 3.3.2.4 In cases where the pump discharge head can exceed the design pressure of any part of the connected piping system, pumps must be fitted with a relief valve.

### 3.3.3 **Positive Displacement Pumps**

- 3.3.3.1 Pumps, unless otherwise specified, must have the following characteristics:
- 1) Positive, constant displacement, rotary screw;
  - 2) Nodular iron casing, max 18% elongation;
  - 3) Steel power rotor;
  - 4) Integral relief valve, adjustable;
  - 5) Mechanical seal.
- 3.3.3.2 Pumps must be fitted with the following accessories:
- 1) Discharge pressure gauge, liquid filled, with isolating cock;
  - 2) Compound suction gauge, liquid filled, with isolating cock;
  - 3) Drip tray;
  - 4) All applicable guards.

### **3.4 Valves**

- 3.4.1 All valve bodies must have the pressure rating, size, manufacturer's name or trade mark cast or forged integral with the valve body or stamped in a non-stressed area. Valve hand-wheels must be located where they can be conveniently operated.
- 3.4.2 Where a system can be supplied by more than one pump, non-return valves must be fitted in the discharge side of each pump to prevent flow reversal.
- 3.4.3 Check valves and screw down non-return valves must be installed such that the disc will open with the flow and such that disc closure is possible using gravity or by means of springs. Check valves must be installed where reversal of flow would be detrimental to proper function of the system or where that reversal of flow could flood a space.
- 3.4.4 Globe and angle valves used for isolation must be fitted such that system pressure or vacuum is not exerted on the bonnet joint or stem packing with the valve closed.
- 3.4.5 Manifolds must be utilized wherever possible.
- 3.4.6 Safety and relief valves and their piping must be arranged such that their discharges do not damage or endanger machinery, equipment or personnel.
- 3.4.7 Valves in branch lines must be fitted adjacent to supply main to maintain system integrity in the event of branch line failure.
- 3.4.8 Butterfly or ball valves must not be used as sea isolation valves. Sea water isolation valves must be as specified under Section 3.6.5.
- 3.4.9 Position indicators are required on all valves having stem rotation of greater than 360 degrees. Exceptions are specific valves where position is obvious from operation of the system or position of the stem (unless required by TCMS).
- 3.4.10 Check valves must be installed wherever reversal of flow would be detrimental to proper function of the system or where a possibility exists, that reversal of flow could flood a space.
- 3.4.11 All automatic operating valves such must be sized to meet capacity requirements. They must have the control sensitivity and adjustment necessary for all operating conditions. Where extreme sensitivity is required, pilot actuated or air operated valves must be installed. Manually operated throttle valves and their operating mechanisms must have the necessary sensitivity of control.

- 3.4.12 Relief valves must be installed to protect pressure vessels, heat exchangers, piping systems, machinery and equipment from damage due to excessive pressure. Relief valves must have sufficient capacity to prevent a pressure increase of more than 10 per cent above maximum allowable operating pressure of the system.
- 3.4.13 A strainer must be installed in the inlet piping and a pressure gauge in the outlet piping from each pressure-reducing valve. A relief valve must be installed in the outlet piping, except where otherwise stated. The strainer must be upstream of the reducing valve and downstream of the by-pass isolating valve where fitted. The pressure gauge and the relief valve must be downstream of both the reducing valve and the bypass valve. Relief valves must be sized on the assumption that the reducing valve could stick wide open. The outlet piping must be increased in size to meet system flow characteristics. A straight piece of piping, of a length recommended by the manufacturer of the reducing valve, must be installed at the large end of a tapered fitting. A by-pass must be installed around each reducing valve, unless otherwise specified. The valve in the by-pass must be a manually operated throttle valve that must not permit a greater flow than the reducing valve's capacity.
- 3.4.14 Relief valves must not have a packed stem stuffing box. Relief valves discharging to pump suctions or vacuum piping must not be fitted with rubber or neoprene stem sealing sleeves. Enclosed spring design with tight covers must be used for the following services:
- 1) Discharge to a closed system or tank that subjects the valve outlet to a back pressure when the valve is closed;
  - 2) Discharge to a closed system or equipment that subjects the outlet to sub-atmospheric pressure when the valve is closed;
  - 3) Flammable or combustible liquids;
  - 4) Toxic and explosive gases.
- 3.4.15 All valves over 19mm must have flanged connections. All valves over 40mm diameter must have bolted bonnet, gland and screwed type renewable seats.
- 3.4.16 Nameplates identifying the service must be installed on all new or relocated valves as specified under Section 2.9. Valves installed under deck plates must be provided with hinged access covers. Nameplates must be fitted on the deck plate.

### **3.5 Machinery Insulation**

#### **3.5.1 General**

- 3.5.1.1 New, approved, non-asbestos containing insulation must be installed on all sections of piping, machinery and equipment where insulation was removed and all newly installed equipment requiring insulation. Valves and fittings must be insulated with material and thickness required for adjacent piping. The Contractor must submit a



complete lagging and insulation schedule to the Technical Authority and the Inspection Authority for review prior to ordering any material. All insulation and lagging must meet the applicable Regulatory Body requirements.

3.5.1.2 Piping and units of equipment with design internal temperatures of more than 150 degree C must be insulated from their supports or the supports insulated from the structures to which they are attached.

3.5.1.3 Piping hangers for piping with internal temperatures below 5 degree C must be insulated from the steel structure to which they are attached. Piping exposed to the weather must be effectively insulated against freezing. This requirement does not apply to systems in which a fluid is normally flowing or where the exposed portion of a respective system can be secured and drained to prevent freezing.

3.5.1.4 Where possible, insulation materials must be from one manufacturer.

### 3.5.2 **Lagging**

3.5.2.1 New, approved, non-asbestos containing lagging must be installed. Lagging (protective covering or coating over insulating materials) must be suitable for temperature and location and must be either of the following:

- 1) Fibrous glass cloth, tape and thread, Flextra™ or equivalent
- 2) Aluminum mechanical protective guards, plain or hammered, secured with quick release fasteners.

3.5.2.2 Piping and/or equipment insulation not exposed to weather must be covered with either a cloth or tape type lagging, when not of the pre-lagged type. Cloth type lagging must be secured by an adhesive or by sewing. Lagging in tape form must be applied spirally wound with not less than 10mm overlap and with ends fastened to the insulation and/or lagging by adhesive, stitching or stapling. Insulation and cements used for lagging purposes must comply with CGSB 51.9-92 and CAN/ULC-S102-M.

3.5.2.3 Insulation, insulation jackets, canvas, fiberglass mat and wrapping and adhesives must be fire retardant with a flame spread rating not greater than 25 and a smoke development rating not greater than 100 when tested in accordance with CAN/ULC S102-M.

3.5.2.4 Insulation on piping and/or equipment exposed to weather or excessive moisture must be protected by the application of 6mm thick, weather resistant type coating thereon and secured in place prior to application of its lagging. Cracks and/or openings in the continuity of the completed coating lagging, especially at valves, flanges and fittings, must be avoided to prevent entrance of moisture, spray and/or water. In way of deck penetrations, insulation must be protected by a 150mm high steel kick guard, welded to the deck and covered by the same insulation coating.

- 3.5.2.5 In locations where the completed insulation and lagging are liable to abuse, protective galvanized sheet metal lagging of No.2 USSG must be installed. Where protective metal lagging is subject to frequent removal when servicing machinery, it must be plain or hammered aluminum secured by quick release clips.

### 3.5.3 **Securing Arrangements**

- 3.5.3.1 All insulation materials must be secured to prevent settling and to permit ready removal for maintenance of equipment.
- 3.5.3.2 All high temperature piping systems must be insulated using reusable pre-made covers of the following materials, from pipe surface outwards:
- 1) Monel mesh;
  - 2) Fiberglass mat, approximately 9-lbs/cu.ft density and must contain no chemical binder and be resistant to service temperatures up to 450 degree C;
  - 3) Foil-lined silicone-coated fiberglass lagging secured to insulation by stapling: all edges are to be sealed.
- 3.5.3.3 Covers must have stainless or Monel clips, secured by through-hooks around which stainless steel lacing wire can be wound for mounting and securing.
- 3.5.3.4 The insulation, with all joints tightly butted, must be secured to the pipe at ends with not less than two metal bands per section, minimum 19mm wide, with quick release clips.
- 3.5.3.5 Where pipe insulation abuts flanges and fittings, the ends of the insulation must be tapered to permit removal of bolts.

### 3.5.4 **Insulation Thickness**

Surface temperature of insulation must not exceed 150 degrees F. The maximum temperatures must determine the thickness of insulation and must correspond to 10% overload of a respective machine or engine. Where the total required thickness of insulation is greater than 25mm, double layers must be used. These layers must be of equal thickness. All laps must be staggered and all end joints must be overlapped.

### 3.5.5 **Insulation, Anti-condensation**

- 3.5.5.1 Cold-water piping and equipment, including sewage pipes, must be insulated with anti-sweat type insulation. Anti-condensation insulation, other than elastomeric, foamed plastic type, must be covered with cloth lagging or tape lagging secured with adhesive to form a moisture proof finish. Anti-condensation insulation must be protected by lagging or protective screening as required where there is a potential for damage.

- 3.5.5.2 Where piping or tubing pass through the galley or other high humidity spaces, the insulation must be double layered and water proofed outside each layer.

**3.5.6 Insulation, removable/reusable covers or pads**

All flanges, flange fittings, flexible joints, expansion pieces or any components of machinery or piping susceptible to takedown for inspection and maintenance must be covered by removable, reusable cover or pad. They must be made of the same material as the main pipe insulation. Voids between pads and fitted insulation must be filled with pieces of applicable felted material, tight enough to prevent airflow.

**3.5.7 Ducting**

- 3.5.7.1 All ductwork must be insulated with minimum 50mm thick vapor seal duct insulation with factory applied vapor barrier (Manson AK Flex™ or equivalent). Vapor barrier dam must be Chil-Perm™ CP30 with fiberglass cloth reinforcing or equivalent. Two (2) layers of canvas mat wrap, 16 oz weight, must be applied with Bakor™ insulation cement or equivalent as a final finish for all ducting. Alternative products may be used with approval of the Technical Authority.

- 3.5.7.2 Air duct penetrations must be sealed with non-shrink/hardening silicone based caulking.

**3.6 Machinery Space Outfit**

**3.6.1 General**

Machinery spaces must be outfitted with ladders, gratings and floor plates, providing access at convenient levels to all items of machinery for routine operation and maintenance.

**3.6.2 Floor plates**

Floor plates must be of 20 lbs. multi-grip aluminum tread-plate, supported on steel bearers and secured by 13mm stainless steel counter-sunk screws at sides. Panels must not exceed 1220mm by 1830mm. Smaller portable plates must be provided wherever frequent access is required. Portable hinged openings must be arranged over valves, cocks, and strainers and identified with brass nameplates. Open boundaries must be bordered by upturned angle, except in way of low access openings in machinery. Bearers for floor plates must be painted. Bearers must be provided to allow for supporting machinery weights during refits (275 kg safe concentrated loads).

### 3.6.3 **Guards**

Guards must be provided over all rotating drives accessible to personnel. They must be light weight, and portable. Open guards must be of the rolled expanded metal, closed guards of steel or aluminum. The guards must allow visibility of drives and dissipation of heat. Access must be provided at the centers of shaft lines.

### 3.6.4 **Sea Suction and Overboard Discharges**

All new sea suctions and overboard discharges must be made of steel plate as used for the hull and protected by means of sacrificial anodes. All components must be given a full hull coating system.

### 3.6.5 **Sea Isolation Valves**

3.6.5.1 Each sea suction line must have a sea isolation valve fitted as near the sea inlet as practicable. Sea suction valves must be Classification Society approved, cast steel with stainless steel trim.

3.6.5.2 The valves must be attached by means of bolts to a steel pad with blind tapped bolt holes which has been welded directly to the ship's hull or sea chest. If it is not possible to attach the valve directly to the hull or sea chest, TCMS approved extension pieces must be installed between the valve and steel pad. The extension piece must be as short as possible and must have no joints other than to the valve and pad.

3.6.5.3 Sea isolation valves must be of the high lift globe type. High lift angle valves may be used if globe valves are impracticable. The minimum size of fasteners used for connections on the sea-side of isolations valves must be 19mm. The bolting material of fasteners must be phosphor bronze to ANSI/ASTM B139-79 alloy B1 or B2.

3.6.5.4 Where a pump or eductor, having direct sea suction, is located in a compartment remote from the sea isolating valve, an additional sea-isolating valve must be located within the pump compartment.

## 3.7 **Machinery Instrumentation**

### 3.7.1 **Pressure/Suction Gauges**

3.7.1.1 Unless otherwise specified, only 115mm diameter or bigger gauges must be used for instrumentation.

3.7.1.2 All gauges with pressure exceeding 1000 PSI (7000 kPa) or those used with compressible fluids must be safety gauges with back blow outs.

- 3.7.1.3 All gauge lines must have a capped test tee. All gauges must have needle type isolation valves. Pulsation dampers must be fitted to keep gauge pulsation below 5 % full scale. Gauge indication must be at  $\frac{1}{2}$  or  $\frac{2}{3}$  of its range respectively for fluctuating or steady state working pressure.
- 3.7.1.4 All pumps must be fitted with suction compound and discharge pressure gauges.
- 3.7.1.5 All refrigeration compressors must be fitted with suction and discharge pressure gauges and Schroeder valves must be fitted at the gauge lines for the connection of portable refrigeration gauge manifolds.
- 3.7.1.6 All new gauges must read in imperial (PSI) and metric units (kPa or Bar). The dial face must be white with black figures and the pointer must be of the micrometer adjustable type. Gauge movements must be stainless steel with stainless steel bushings and over-pressure and under-pressure stops. Bourdon tubes must be bronze or 316 stainless steel with brass or 316 stainless steel sockets. Gauge accuracy must be  $\pm 0.5\%$  of scale range, ASME B40.1 Grade 2A. Gauges must be filled with glycerin or silicone according to ambient temperature requirements or severity of vibration expected.
- 3.7.2 **Temperature Gauges**
  - 3.7.2.1 Unless otherwise specified all thermometers must be a standard 9 inch scale thermometer with a universal adjustable angle stem, cast aluminum case with cured polyester powder coating, clear window and brass separable thermo well. Thermometers must be fitted with an acrylic window to 300 degrees Fahrenheit and a double plated safety glass at temperature ranges above 300 degrees Fahrenheit.
  - 3.7.2.2 All thermometers must be housed in a 304 or 316 stainless steel thermo well to allow removal of the thermometer without disturbing the measured process. The thermometer and thermo well must extend at least  $\frac{1}{2}$  the pipe diameter into the measured process. Where thermometers are installed in pipes fitted with insulation, longer stem thermometers must be used with extension neck separable thermo wells. Extension necks must be at least 50mm long.
  - 3.7.2.3 Thermometers for measuring air temperatures must be fitted with a perforated guard stem and a mounting flange instead of a brass separable thermo well.
  - 3.7.2.4 All thermometers must contain red spirit fills. Range selection for thermometers must be so that the operating temperature of the measured process will fall approximately mid-scale. The scale face must be white with black figures and must contain dual reading scales, Fahrenheit and Celsius. Thermometer accuracy must be  $\pm 1$  scale division.

### **3.8 Equipment Foundations**

- 3.8.1 Steel and/or aluminum foundations must be fitted for all machinery, pumps, motors and all new and relocated equipment. Foundation scantlings must be of adequate strength and thickness and approved by TCMS where required. Additional stiffening must be fitted where required to distribute loads and reduce vibrations.
- 3.8.2 Save-alls must be fitted around any hydraulic system and pump installed during the vessel life extension.
- 3.8.3 Insulation must be provided between ferrous and non-ferrous materials and/or equipment.

### **3.9 Anti-Vibration Mounts for Equipment**

- 3.9.1 All main engines and ship service generator sets must be mounted on anti-vibration mounts. The Contractor must coordinate the mounting requirements of the equipment with the equipment supplier and/or manufacturer taking into consideration the following information:
  - 1) Weight of the combined equipment complete with sub-base;
  - 2) Center of gravity of the equipment;
  - 3) The requirement to limit vertical, longitudinal and lateral motion of the equipment to minimize impact on ancillary systems and services while maintaining the required isolation.
- 3.9.2 Anticipated motions of the vessel are defined in Section 2.1 of this Specification; Vibration mounts must provide between 75 to 85% isolation of all equipment generated vibration to the hull structure.
- 3.9.3 Vibration mounts must be fitted with a shock-proof device with resilient stop to withstand up to 5g of acceleration. Vibration mount metal parts must be corrosion protected with Fe/Zn 8C as per ISO 2081 for the marine environment. The resilient mounts must be protected with a cover to prevent contamination of the damping elements.

### **3.10 Hull – Structural**

- 3.10.1 Structural integrity must be preserved and any questions involving such integrity must be referred to TCMS for resolution.
- 3.10.2 All welding must be performed to the requirement of the CWB Welding Standard and/or the Classification Society Rules whichever is more stringent.

- 3.10.3 New structures and where permanent removal of fittings will result in the necessity of fitting insert plates in shell plating, watertight bulkheads and/or watertight decks, the following procedure must be adopted:
- 1) The Contractor must prepare and submit a CWB engineer approved welding schedule for approval by TCMS;
  - 2) All inserts on shell plating must be flush;
  - 3) All underwater inserts must be subject to 100% radiography on completion;
  - 4) New tanks and existing tanks and void spaces and where inserts have been fitted must be hydrostatically tested to a head of water of 2.5 meters. The tests must be recorded, witnessed by TCMS and the Inspection Authority;
  - 5) Location of any new insert plates must be noted on the vessel's Shell Expansion Drawing.

## **4.0 ELECTRICAL AND ELECTRONICS**

### **4.1 General**

- 4.1.1 The requirements specified in this section apply to all electrical work. The electrical modifications to the vessel must be in accordance with TP 127E and IEEE 45 STD - 2002 with approval by TCMS.
- 4.1.2 All electrical/electronic equipment, fittings and fixtures temporarily removed for access must be reinstalled and secured and the areas restored to the “As Delivered” condition as noted in Section 1.10.
- 4.1.3 The Contractor supplied equipment must conform to the requirements of IP56, IEC 60529 and Section 2.1 of this specification.
- 4.1.4 The Contractor must make reference to Section 6 for documentation requirements concerning the electrical system.
- 4.1.5 Electrical conducting surfaces, heat transfer surfaces and ventilation screens must not be painted. Such areas must be protected from dirt and debris including painting overspray during the contract.
- 4.1.6 The Contractor must remove all electronic equipment from compartments in which work such as cutting, welding grinding, etc. is being performed. The Contractor must obtain the Technical Authority’s approval for equipment that will remain in place and such approval must require the equipment to be protected from all possible hazards.

### **4.2 Load Analysis**

- 4.2.1 The Contractor must prepare a load analysis for the vessel, including the project work. The Contractor must update the load analysis bi-monthly and an electronic copy must be presented to the Inspection Authority and the Technical Authority at progress reviews or at each design change which has a significant impact on the electrical loads.
- 4.2.2 The final “As Fitted” load analysis must be TCMS approved. The load analysis must be configured to represent the Single Line Diagram for ease of equipment identification and direct derivation of data for bus bar, transformer, rectifier and cable sizing. All changes on the Single Line Diagram must be immediately reflected in the load analysis and vice versa.
- 4.2.3 The Contractor must provide documentation with regards to the “As Fitted” load analysis to the Technical Authority as detailed in Section 6.3.



#### **4.3 Electrical Single Line Diagram**

- 4.3.1 The Contractor must maintain an updated Single Line Diagram and an electronic copy must be provided to the Inspection Authority and the Technical Authority at monthly progress reviews or at each design change which has a significant impact on the electrical system.
- 4.3.2 The final “As Fitted” electrical single line diagram must be TCMS approved.

#### **4.4 Co-ordination Study of Main and Emergency Distribution Systems**

- 4.4.1 The Contractor must conduct a Co-ordination Study of Main and Emergency Distribution Systems and an electronic copy must be provided to the Inspection Authority and the Technical Authority at progress reviews or at each design change which has a significant impact on the electrical system.
- 4.4.2 The final “As Fitted” Co-ordination Study of Main and Emergency Distribution Systems must be TCMS approved.
- 4.4.3 The Contractor must provide the following documentation with regards to the “As Fitted” Co-ordination Study of Main and Emergency Distribution Systems to the Technical Authority:
  - a) Four (4) paper copies of the final TCMS approved Co-ordination Study of Main and Emergency Distribution Systems of the “As Fitted” electrical system;
  - b) Four (4) copies of the final TCMS approved Co-ordination Study of Main and Emergency Distribution Systems of the “As Fitted” electrical system in electronic format. The electronic files must be in Microsoft Office format and must be on individual CD-ROM media with a detailed listing of all files.

#### **4.5 Short Circuit Current Analysis**

- 4.5.1 The Contractor must conduct a short circuit current analysis and it must be maintained. The analysis calculation must be performed before switch gear selection and must represent the ship service voltage of 600 volts. The symmetrical short circuit current must be kept below 50 kA or, if this is not practicable, alternative mean must be identified, such as current limiting fuses, normally open disconnect links. The Contractor must update the short circuit analysis monthly and an electronic copy must be provided to the Inspection Authority and the Technical Authority at monthly progress reviews or at each design change which has a significant impact on the electrical system.
- 4.5.2 The final “As Fitted” short circuit current analysis calculations must be TCMS approved.

- 4.5.3 The Contractor must provide documentation with regards to the “As Fitted” short circuit current analysis to the Technical Authority as detailed in Section 6.3.

#### **4.6 New Rotating Machinery**

- 4.6.1 Motors must be commercial marine quality meeting all regulatory requirements. Motor enclosures for installations must conform to IEC 60529. Motors must be continuously rated except for deck machinery where one (1) full rated load, and continuous light running load are applicable.
- 4.6.2 All motors must have their windings covered with a class F insulating material, resistant to oil and water, and must operate in an ambient temperature of 50 Degree C when installed inside machinery spaces and 40 Degree C when installed on enclosed decks. For motors operating on the open deck, the low ambient temperature must be considered as - 40 degree C. Temperature rises, as measured by thermometer after an 8 hour heat run must not exceed those stated in TCMS, TP 127E Class B.
- 4.6.3 Rotating machinery with enclosed slip rings or commutators must not have any form of silicone-impregnated material incorporated into their windings, or introduced into the enclosure.
- 4.6.4 Any rotating equipment incorporating brushes must be fitted with inspection windows.
- 4.6.5 All A/C motors rated in excess of 0.37 kW (1/2 HP) must be of squirrel cage induction type, rated for continuous duty and capable of reaching design parameters at 600 Volts, 60 Hz, 3 phase, unless otherwise specified. Induction motors of 0.37 kW rating and less may be designed for operation on 120 Volts, 1 phase.
- 4.6.6 Particular care should be exercised in the selection of induction motors to ensure that each motor is not too large for the intended service and thus avoid the low power factor inherent in under-loaded induction motors.
- 4.6.7 Single speed induction motors must be of a 4-pole 1800-RPM, unless otherwise specified.
- 4.6.8 Motors of 0.18 kW (1/4 HP) and over must be equipped with anti-friction bearings designed to meet the imposed thrust and radial loads. Where motors are used with solid couplings a bearing to take thrust must be fixed to the shaft end housing, and shaft endplay limited to the clearance in the bearing. Tandem ball bearings must not be used for axial thrust loads.

- 4.6.9 Motors equipped with anti-friction bearings using pressure grease fittings must have positive means, either by relief plugs or fittings, or by a clearance differential relief system, to prevent grease from being forced out onto the motor windings.
- 4.6.10 Where anti-friction type bearings (ball bearings) are specified for rotating electrical machinery, they must:
- 1) Be rated and suitable for the type of drive;
  - 2) Be noise tested;
  - 3) Be of the deep groove type where the drive introduces end thrust;
  - 4) Be of the pre-lubricated type, unless otherwise specified.
- 4.6.11 Axial flow fan motors must be equipped with factory sealed pre-lubricated ball bearings or factory sealed pre-lubricated ball bearing housings. The bearing housing must not be drilled.
- 4.6.12 Motors for V-belt applications must have their bearings designed for this purpose.
- 4.6.13 Motors rated above 0.75 kW (HP) must have their rotor both statically and dynamically balanced. All windings must be vacuum pressure impregnated followed by oven curing. Attention must be paid to the elimination of dust and dirt traps within both windings and the motor enclosure. Records of the static and dynamic balancing must be submitted to the Inspection Authority and the Technical Authority.
- 4.6.14 Induction motors driving ventilation fans or pumps requiring both high and low operating speeds must be of the 2 speed 2 winding type with the top speed not greater than the 4 pole design, unless otherwise specified.
- 4.6.15 The Contractor must confirm all pertinent characteristics of replacement motors prior to procurement and to ensure compatibility with requirements of retained machinery.
- 4.6.16 Before placing any purchase orders, the Contractor must submit for review and approval to the Technical Authority a list of all electric motors to be installed. This list must detail the following:
- 1) Manufacturer's name;
  - 2) Duty/service factor;
  - 3) kW and full load speed;
  - 4) Enclosure type;
  - 5) Efficiency;
  - 6) PF for full,  $\frac{3}{4}$  and  $\frac{1}{2}$  load (A/C motors);
  - 7) Locked rotor torque and current;
  - 8) Weight;
  - 9) NEEMAC design characteristics;
  - 10) Insulation Class;
  - 11) Full Load Current;

- 12) Temperature rise class;
- 13) Voltage;
- 14) Frequency;
- 15) Frame size.

#### **4.7 Anti-Condensation Heaters**

- 4.7.1 Black heat, tubular or strip type space heaters must be fitted to all new motors and generators rated 15 kW or larger and to electric equipment installed in open decks or in damp or unheated spaces where specified. These space heaters must be arranged for operation from a separate supply. Heaters must be suitable for operation from 120/1/60 VAC.
- 4.7.2 A rated interlocking arrangement must be provided at the equipment control station to ensure that the heater is de-energized when the respective equipment comes into service.
- 4.7.3 Visual ON/OFF status indication must be provided at the equipment control station as detailed:
  - 1) For motors on their respective control station or local starting panel;
  - 2) For electrical control equipment on the relevant panel.
- 4.7.4 Isolation switches or control station disabling arrangements must be provided at equipment requiring local maintenance where the feeder breaker is not in sight. The isolating switch or lock-out station must be within sight from the protected equipment.

#### **4.8 Electrical Nameplates**

- 4.8.1 All electrical equipment must be fitted with nameplates. Each nameplate must identify the piece of equipment and in addition must include the manufacturer's name, type, serial number, model number, rating and date of manufacture.
- 4.8.2 Any special precautions, maintenance or operating instructions must be included on the nameplates or on a separate plate attached to the equipment.
- 4.8.3 All electrical equipment and compartments housing hazardous voltages must carry a warning notice indicating that a hazard exists and specify the maximum system voltage.
- 4.8.4 Switchboards must have nameplates listing:
  - 1) Name of switchboard;
  - 2) Manufacturer;
  - 3) Serial number, if applicable;
  - 4) Date of manufacture.

- 4.8.5 Each circuit breaker must have a nameplate showing the name and designation of the circuit and the setting of the breaker. Instruments, switches, etc., on the switchboard must be adequately marked with their function and designation as well as a red line at the full load or normal operating value.
- 4.8.6 Distribution panels must have nameplates showing:
  - 1) Space, service, apparatus or circuits controlled; feeder designation.
- 4.8.7 Internally, switchboards, distribution panels and motor controllers must have marking plates identifying bus bars and terminals. Bus bars must have phases identified by color- coding.
- 4.8.8 Electrical enclosures that house a multiple of electrical or electronic equipment and devices must have a unique identification code for each device and the device must be labeled as such. Mechanical layout drawings of the enclosures must clearly show the layout and identification code of the devices within the enclosure.
- 4.8.9 Terminal blocks and terminal wiring must be marked with the circuit designation and must be treated as devices within enclosures. Terminal blocks must be labeled consecutively and ascending from left to right and top to bottom.
- 4.8.10 Nameplate size and other characteristics must comply with Section 2.9.

#### **4.9 Cables**

- 4.9.1 All cables must meet TP127E requirements, be manufactured, tested and installed in accordance with the latest TCMS Publication, IEEE and Classification Society requirements.
- 4.9.2 The Contractor must develop a schedule of all new electrical cables to be installed and existing cables to be reused. The following must be listed for each cable:
  - 1) Conductor size;
  - 2) Current rating;
  - 3) Estimated length;
  - 4) Identification number and name of manufacturer;
  - 5) Approximate weight;
  - 6) Voltage drop;
  - 7) Insulation level (voltage);
  - 8) Insulation type designation and maximum allowable temperature.

- 4.9.3 This schedule must be submitted for review and approval to Technical Authority before any cables are installed and/or removed. The schedule may be submitted in sections as the detailed design develops.
- 4.9.4 New cables must not be spliced. Splicing in existing cables of 600VAC or less cable may be permitted with prior permission of TCMS providing splices are performed in accordance with TP 127E. Radio frequency co-axial cable must not be spliced. In-line connectors must not be used in such cables other than as required to terminate the cable. All wire and cable terminations must be accordance with TP127E.
- 4.9.5 Where cables enter drip proof or watertight cubicles, motors, or other equipment, TCMS approved glands and/or strain relief devices must be used. Cable entry into drip proof enclosures must be from the bottom or side of the enclosure. Where cables enter the side of an enclosure, they must run downward from the cabinet before running in an upward direction.
- 4.9.6 Where cables enter the side of an enclosure, they must run downward from the cabinet before running in an upward direction.
- 4.9.7 A minimum of 15% spare space must be provided on each new raceway and on all modified cable runs.
- 4.9.8 Cables must be concealed, except in machinery spaces, workshops, and storerooms. The location of cable runs, connection boxes, hangers, etc., concealed by paneling or linings must be clearly indicated on the “As Fitted” drawings. Concealed connection boxes must have the circuit designation stamped or painted on a part of the box not subject to being removed.
- 4.9.9 All permanently installed cables must be tagged with the circuit designation at all points of connection and on both sides of bulkheads and decks. Tags must be of metal compatible with the cable sheathing. Both ends of the tags must be strapped to the cable with metal strap after all painting has been completed. Straps must pass through holes in the tags so that tags are positively secured. Strap ends must be permanently folded and crimped.
- 4.9.10 Adhesive or permanently printed plastic identification tags for individual cables and conductors may be used inside equipment cubicles and equipment racks.
- 4.9.11 All conductor identification markings and cable tags must be reflected in the “As Fitted” system drawings and must be as follows:
- 1) Cable tags must be printed with indelible ink and must not be handwritten;
  - 2) Each cable must have an identifier unique to the installation;

- 3) Each cable tag must have the following information: unique cable name and location for each end, and;
  - 4) Conductor identification markings must be secured to the conductors to prevent them from becoming disassociated from the conductor when it is terminated to a device.
- 4.9.12 Spare conductors within a cable must not be stripped back or shortened and must be tied back and appropriately marked as spare. Control cables and cables for the alarm and monitoring system must contain a minimum of 10% spare conductors. Shielded control cable must have the shield bonded to ground at one end of the cable run only, preferably at the input signal end. The cable must not be grounded at both ends.
- 4.9.13 To avoid mutual interference, cables must be grouped and separated as specified per Figure 4-1. If the spacing is impractical, additional shielding must be provided as approved by TCMS.
- 4.9.14 Low loss co-axial cables of correct impedance must be used for co-axial cable antenna feeders.
- 4.9.15 Where foam core dielectric cables are used, crimp shield connectors must be fitted. The Contractor must not use solder type connectors.

#### **4.10 Separation of Cables**

- 4.10.1 The Contractor must refer to Figure 4-1 indicating the physical separation to be maintained between various categories of cables. The separations do not apply to cables crossing at, or close to, right angles. Cables of all types must be kept well separated from antennas, antenna couplers and feed wires. Deviations must be pre-approved by TCMS and the Technical Authority and Inspection Authority must be provided documentation of the approved deviations.
- 4.10.2 Cables may be bundled according to their categories in Figure 4-1 and the following guidelines:
- 1) Cables from group A to group E inclusive may be bundled with cables from the same group and share a common wire way with the remaining groups;
  - 2) Bundling of cables from Group F to Group K should be avoided and, if necessary, additional screening material should be provided;
  - 3) Cables in Group F to Group K should use separate wire ways wherever possible.

**Figure 4-1: Recommended Cable Separation (inches)**

Cable Group	Cable Group Classification	Recommended Inter-Cable Group Separation in inches									
		A	B	C	D	E	F	G	H	J	K
A	Ship's power and lighting	-	4	2	2	4	12	18	18	18	18
B	Receiving antenna cables	4	-	4	2	2	12	18	18	18	18
C	Electrical control cables	2	4	-	2	4	12	18	18	18	18
D	TV/VHF antenna distribution cables	2	2	2	-	2	12	18	18	18	18
E	Telephone/audio distribution cables	4	2	4	2	-	12	18	18	18	18
F	Echo sounder transducer	12	12	12	12	12	-	18	18	18	18
G	Transmitter/antenna coupler feed cables	18	18	18	18	18	18	-	18	18	18
H	Antenna coupler/antenna cables	18	18	18	18	18	18	18	-	18	18
J	VHF/UHF transceiver/antenna cables	18	18	18	18	18	18	18	18	-	18
K	Radar transceiver co-axial/wave guide	18	18	18	18	18	18	18	18	18	-

## 4.11 Circuit Breakers

- 4.11.1 Breakers must be equipped with individually insulated, braced and protected connectors. Tripped indication must be clearly shown by the handle at a position between ON and OFF and/or a visual trip indicator.
- 4.11.2 All breakers must be rated for the application with due consideration to voltage, amps, interrupting rating, number of poles, auxiliaries, etc, as determined by the final approved "Short Circuit Current Analysis" (4.4) and selected as per the co-ordination study.
- 4.11.3 Breakers must be calibrated at 50°C.
- 4.11.4 Breakers must be suitable for marine application;
- 1) Be the molded case type;
  - 2) Be rated for 600VAC, 240 VAC or 120VAC;
  - 3) Be the quick make/quick break type;
  - 4) Have inverse time over current characteristics;
  - 5) Have overload device in each phase.



## **4.12 Motor Controllers**

- 4.12.1 Motor controllers must be for marine duty. Motor controllers and contactors controlling machines which require continuous operation, must be fitted with low voltage release complete with timing circuitry, adjustable from 0.5 to 10 seconds, which must restart all running motors in case of a short duration power interruption.
- 4.12.2 Motors 30 kW and above must be equipped with solid-state reduced voltage starters (soft starts) to limit the inrush current.
- 4.12.3 Individual starters controlling 3-phase AC motors must conform to the latest edition of TP 127E and IEEE STD 45-2002 and must be:
- 1) Fitted with a means of locally isolating the motor where the starter is not located adjacent to the motor;
  - 2) Fitted with indicating lights at the starter to indicate the state of the isolating switch;
  - 3) Fitted with molded case type circuit breaker for each motor circuit to isolate the power supply and provide short circuit protection. The circuit breaker must have means to indicate its status locally and auxiliary contacts for remote monitoring;
  - 4) Fitted with two indicating lights: one to show when the associated motor is operating and one to show when it is stopped;
  - 5) Indicating lights must be LED type;
  - 6) Fitted with drip proof or watertight type START and STOP pushbutton;
  - 7) Fitted with one (1) externally operated, overload reset button mounted in the front, for all three overload relays;
  - 8) Fitted with auxiliary contact to operate anti-condensation heaters where required;
  - 9) Arranged for bottom cable entry through glands;
  - 10) Fitted with an ammeter with selector switch for individual phase amperage readings for motor ratings of 20 kW and over.
- 4.12.4 Where alarm indication lights are provided at the local control station, facilities must be provided for a lamp test.
- 4.12.5 Where alarm buzzers are provided at the local control stations, facilities must be provided for buzzer mute.
- 4.12.6 Starters controlling single phase motors less than 0.37 kW, unless they are for automatic duty, must be totally enclosed, double pole, manually operated, marine type switches, complete with overloads, provided the required protection is included within the switch enclosure.
- 4.12.7 All internal wiring must be permanently numbered. Numbering must be included in schematic and wiring diagrams to be supplied under the “As Fitted” requirement. Each

motor controller or starter must have a wiring diagram mounted on the inside of the door or cover.

- 4.12.8 A schematic diagram for each starter must be submitted. In the event that a number of motors have the same control schematic, the submission of one drawing must suffice providing that it is cross-referenced with a table listing the conductor identification for each circuit.
- 4.12.9 The Contractor must submit for review and approval to the Technical Authority, a list of all motor starters for motors to be fitted during the vessel life extension. This list must detail the following:
- 1) Manufacturer's name;
  - 2) Duty;
  - 3) Type of starter;
  - 4) Type of protection – over-current under voltage;
  - 5) Weight;
  - 6) Enclosure;
  - 7) Schematic wiring diagram;
  - 8) Starter size.

#### **4.13 Transformers**

- 4.13.1 Where a 3-phase bank of transformers is required, it must be made of three (3) 1-phase transformers connected delta/delta, except where specified otherwise. Transformers must be fitted with electrostatic shields.
- 4.13.2 In general, the following principles must apply to transformers:
- 1) Be of the single phase type (unless otherwise specified);
  - 2) Be suitable for 3-phase operation, delta/delta;
  - 3) Be suitable for bulkhead and/or deck mounting up to 50 kVA and platform or deck mounting above 50 kVA;
  - 4) Be of the air cooled type;
  - 5) Have a drip proof enclosure with louvers;
  - 6) Have a winding insulation of Class F or better;
  - 7) Have final operating temperature not exceeding Class B temperature rise;
  - 8) Have +/- 2 ½ % and +/- 5% taps on all primary windings (2 FCAN and 2 FCBN);
  - 9) Be supplied with copper windings;
  - 10) Be built in accordance with the latest edition of TP 127E and IEEE 45 STD - 2002;
  - 11) Sound levels must be at or below the latest CSA standards;
  - 12) Transformers must have nameplates consisting of the following:
    - a) Manufacturer's name;
    - b) Rating in kVA;
    - c) Rate full load temperature rise;

- d) Primary and secondary voltage ratings;
- e) Frequency in Hz;
- f) Rated impedance;
- g) Noise level.

- 4.13.3 Where a transformer may be de-energized for relatively long periods of time, the transformer enclosure must include a space heater as specified in Section 4.6. Space heaters must be capable of raising the internal temperature to, and maintaining it at 5 degree C above ambient. The Technical Authority may waive this requirement providing the transformer is located in a dry heated space.
- 4.13.4 The Contractor must supply to the Inspection Authority and the Technical Authority TCMS approval certificates for all transformers with a 15 kVA rating or greater. Certification documentation must be as per Section 6.2.5 of this Specification.

#### **4.14 Electronic Equipment Installation**

- 4.14.1 The Contractor must prepare layout drawings showing the location of electronic equipment at both rack/console as well as the compartment level. These must be prepared for all compartments containing electronic equipment. An Antenna Layout Diagram must also be prepared where necessary.
- 4.14.2 The Contractor must prepare drawings based upon the manufacturers' installation data showing the electrical details of the installation of each electronic system, e.g., cable details such as identifier number and type, connector detail, power supply detail. Point connection detail must be supplied separately but the drawing must reference the source.
- 4.14.3 The Contractor must provide a device list showing all device information and associated parts manufacturer data. Where devices are software and/or hardware configurable, such as DIP switches and device memory settings, the Contractor must record and provide all software and hardware configuration settings along with the device documentation to the Technical Authority and the Inspection Authority in an electronic format that is editable.
- 4.14.4 Each field device within each discrete field location must be uniquely identified. This identification must correspond to the identification for the field device used within all other documentation.
- 4.14.5 Field device identification labels must contain the following information:
- 1) Location of field device;
  - 2) Primary drawing associated with field device.

- 4.14.6 The intent of the field documentation is to provide a system by which all devices have a unique identifier thus allowing the cross referencing of all related OEM data, device specific configuration settings, schematic drawings, and electrical connections to a specific device within the system.

#### **4.15 Safety Switches**

- 4.15.1 Each piece of electronic equipment must be capable of being switched off locally. This may be achieved by means of a normally provided front panel switch. For equipment not provided with such a feature and which is remotely activated, a local ON/OFF safety switch must be provided.
- 4.15.2 Where any electronic unit or terminal box is obscured by ceiling tiles or liner board, access to the obscured equipment must be provided. The access panel must be clearly and permanently marked with the identity of the obscured equipment as detailed in Section 2.9.1.

#### **4.16 Rack/Console Mounting**

- 4.16.1 Rack and/or console mounting is the preferred method for the mounting of electronic equipment. The Contractor must supply racks and/or consoles required to mount the electronic equipment.
- 4.16.2 Racks and/or consoles must be all welded steel construction and must be well secured in a vertical position. The rack/console must be properly braced to meet the shock and vibration requirements of Section 2.1.
- 4.16.3 Racks and/or consoles must be designed for the retractable, slide mounting of standard 19 inches (483 mm) electronic equipment to an equipment depth of 24 inches (600 mm). Console height should be the maximum consistent with its purpose and surroundings.
- 4.16.4 The mounting slides must be of 2-piece construction with one piece attached to the rack, the other piece to the equipment. A means must be provided to prevent cable snags during slide insertion and/or withdrawal.
- 4.16.5 The racks must be designed with removable side panels. Racks must be arranged so that adjacent racks may be bolted together without interior side panels. Racks must be given to racks that are easily adapted for forced air ventilation.
- 4.16.6 The mounting of equipment must be by means of the retractable slides. Any equipment not mounted in this way must be supported from below. Equipment must be retained in the rack by front panel retaining screws. The retaining screws must be standardized for maintenance reasons.

- 4.16.7 Heavy equipment must be located at the bottom of the rack while lighter equipment without front panel controls, must be at the top. Equipment requiring frequent maintenance or control actions must be mounted in the center portion.

#### **4.17 Bulkhead/Tabletop Mounting**

- 4.17.1 Equipment mounted upon bulkheads must be secured, either directly or indirectly to the ship's structure. Under no circumstances must any equipment be supported on linerboard or ceiling panels.
- 4.17.2 Tabletop mounting of equipment is acceptable but the use of windowsills must be avoided unless approved by the Technical Authority. Maximum use must be made of the manufacturers' standard mounting accessories. All mounted equipment must be oriented to best serve the operator.
- 4.17.3 All bulkhead and tabletop mounted equipment must have its equipment cases bonded to the ship's metal structure.

#### **4.18 Overhead Mounting**

The overhead mounting of electronic equipment must be avoided and used only when alternative methods of mounting are impractical. The method must be by means of an overhead console, securely fixed to the ship's structure and designed to provide ease of maintenance access. The installation of any such overhead console must be such that there is no threat of personal injury. All equipment so mounted must be bonded to the ship's hull.

## **5.0 ELECTRO-MAGNETIC INTERFERENCE**

### **5.1 General**

- 5.1.1 The Contractor must identify sources of electromagnetic interference caused by the installation of equipment and for the subsequent suppression of the interference.
- 5.1.2 The following standards contain the acceptable limits for the specified frequencies of RF current and for radiated fields:
- IEC No. 60533 ed 2.0, en 1999; Electrical and electronic installations in ships - Electromagnetic compatibility
  - BS 5260:1975 Code of Practice for Radio Interference Suppression on Marine Installations, complete with the Code of Practice for Immunity;
  - Appendix 7 of IEEE 45 std-2002, Recommended Practice for Electrical Installations on Shipboard;
  - IACS Test Specification for Type Approval E10.

### **5.2 Limits of Interference**

Separate limits are defined for radiated interference, i.e., transmitted through the air; for conducted interference, i.e., transmitted by wire. Each type of interference has different levels allowed.

#### **5.2.1 Radiated Interference (above 150 kHz)**

The radiated interference limits must conform to the test parameters in IACS E10.

#### **5.2.2 Conducted Interference (30 Hz to 15 kHz)**

Measured at the incoming terminals of an electrical distribution panel, the level must not exceed 3% total distortion of the supply waveform. When measured at the electronic equipment terminals, it should not exceed 1% total distortion. Total distortion is defined as the ratio of the root sum square value of all interfering voltages to the root sum square value of the fundamental and all interfering voltages.

#### **5.2.3 Conducted Interference (above 15 kHz)**

- 5.2.3.1 Voltage interference levels measured at the terminals of any single piece of electrical equipment must not exceed the levels given in the Department of Communications Circular No. S11-10-47, Interference Suppression in Marine Craft.
- 5.2.3.2 Class 1 limits must apply where equipment or cables are poorly screened, such as:
- Above decks in general, unless proper screening has been used;
  - Where close coupling exists between the affected equipment and their associated cables.

- 5.2.3.3 Class 2 limits must apply in well-screened situations, such as:
- Within the metallic structure of the vessel;
  - Where screening has been specially provided.
- 5.2.3.4 Measurements must be made using instruments compliant to Canadian Standard C108.1.1. Measurements should be made under the worst-case conditions.

### **5.3 Interference Suppression**

Interference must be suppressed at its source or receiver using the following guidelines:

- 1) Any sensitive electronic equipment must be housed in a tested and certified enclosure which must provide at least 40 dBm of shielding for the onboard electromagnetic environment;
- 2) The minimal cable separations must be observed;
- 3) If capacitors are used, they should be on the equipment side of any isolating switch or the capacitor must be provided with an uninterruptible leakage path;
- 4) Capacitors must not be used to suppress arcs across electrical contacts;
- 5) Components in metal boxes must have the boxes bonded to the metal of the interfering source;
- 6) Electro statically shielded isolation transformers and/or suitable power line conditioners must be fitted in the power lines to electronic equipment, preferably at the equipment end of the feeder;
- 7) Double sided PCB's must be utilized wherever practicable.

### **5.4 Screening of Cables**

The screening of cables must satisfy the following ground rules:

- 1) Screens must have a shielding efficiency of at least 90%;
- 2) Low frequency cables should use a ferrous screen material, grounded at a single point, i.e. below 15 kHz;
- 3) High frequency cable should use bronze, copper, or aluminum material and should be grounded at intervals of less than 0.15 wavelengths at the highest frequency of interest, wherever practical;
- 4) Metallic trunking may provide effective screening provided it is bonded as it passes through any bulkhead and any seams and joints are continuously welded.

### **5.5 Grounding and Bonding**

Grounding and bonding must be in accordance with TP127E.

#### **5.5.1 Racks and Consoles**

The following applies to the grounding of equipment racks and consoles:

- 1) Racks and consoles must be of all welded construction with direct electrical connection of the rack or console to ship's metal. Where direct connection is not feasible, ground straps are required.

- 2) The use of non-welded racks and consoles is subject to the requirement that each individual member is properly grounded. Members may be either individually grounded or they may be bonded to each other by means of a strap. Electrically continuity between adjacent members must not be inferred from their proximity and mechanical connection.

#### 5.5.2 **Equipment Cases**

Equipment cases must have at least 40 dB attenuation capabilities. Sheet steel must be preferred. Individual equipment cases must be grounded as follows:

- 1) Cases must be connected to the ground rail or metal of the rack or console in which they are mounted;
- 2) Each case must be individually grounded, i.e. case-to-case connection is not allowed for grounding;
- 3) If practical, equipment within a single system must be located close together and connected to a single point ground;
- 4) The grounding of equipment cases must not rely upon their retaining hardware;
- 5) Access doors/covers must be bonded to the equipment case;
- 6) Slide mounted equipment must use straps which allow for the withdrawal of equipment;
- 7) On permanently mounted equipment, the ground strap must be as short as possible;
- 8) Flexible braid straps may be used only where movement of equipment or components so dictates.

#### 5.5.3 **Methods and Materials**

The following applies to materials and methods used in grounding and bonding:

- 1) All contact surfaces must be clean and free from paint, scale, rust or any material considered likely to impair the contact efficiency;
- 2) The contact surface area must be as large as practical;
- 3) Contact surfaces must be bonded using a method that will not impair contact efficiency, i.e., welding welded stud, etc.;
- 4) Straps must be of 2.5 cm (1 inch) solid copper, 0.6 mm (0.025 inch) thick and as short as possible while avoiding the creating of sharp bends and corners;
- 5) Ground straps and joints must be readily accessible for maintenance;
- 6) Other low resistance, chemically compatible, corrosion-resistant materials may be approved for use by TCMS;
- 7) All bonding hardware must be of low resistance, corrosion-resistant material, and preferably stainless steel. Upper deck hardware must be of stainless steel.

#### 5.5.4 **Additional Precautions**

- 5.5.4.1 Care must be taken in the grounding and bonding of metallic structures and of equipment in areas of high-level radio frequency energy, such as radio and electronic equipment rooms. Antennae, antenna tuners and radar transceivers are also critical regardless of where they are located. In these locations, all floating metallic structures such as conduit, air ducting, water pipes, box cable, cable



screens, and metal support frames for liner board or ceiling tiles must be grounded at intervals of less than 1m. The use of metal faced liner board and/or ceiling tiles must be avoided in these locations.

- 5.5.4.2 All metallic structures on the upper deck such as pipes, rails, stanchions, and casings must be bonded to ship's metal.

## **6.0 DOCUMENTATION**

All Contractor supplied documentation must become the property of Canada. This must include all electronic media. Electronic media must not be protected to prevent making additional copies for internal use.

### **6.1 Drawings**

#### **6.1.1 General**

- 6.1.1.1 All drawings supplied by the Contractor must be AutoCAD 2000 DWG format compatible. Electronic drawings must not be protected so as to be “Read-Only” files. Fonts for text must be AutoCAD 2000 standard. Blocks are not to be grouped. All text included in a block must be an attribute.
- 6.1.1.2 A complete list of layer names and brief description of each layer’s use must accompany all files. Layer names, layer color codes, and layer line types must be standardized across the drawings, or drawing types.
- 6.1.1.3 Electronic drawings must be provided to the Technical Authority on CD-ROM media. All disks must be clearly labeled with the project number, file names and drawing numbers. If a complete listing exceeds the label size, a “readme.txt” file in ASCII format must be provided with each disk. A printed copy of the “readme” file must accompany each disk. Disks must be labeled “As Fitted” drawings for those drawings that have been approved and finalized.
- 6.1.1.4 A complete list of symbol (block) names with a description of each symbol must be provided. One block per drawing must be provided in electronic format suitable for use with AutoCAD 2000. Drawing sheet sizes, including where possible vendor drawings, must be ANSI standards with standard border and title block in the layout section.
- 6.1.1.5 “As Fitted” prints/plots must not contain markings or corrections by hand, i.e. marker, pen, pencil.
- 6.1.1.6 The Contractor must provide the Inspection Authority and the Technical Authority with all drawings required by or generated by the sub-Contractors.
- 6.1.1.7 Schematic drawings of systems must include all pertinent system information, including sizes, dimensions, labeling, equipment locations, and all information relating to system fittings.
- 6.1.1.8 The Contractor must have in place a complete system of documenting and controlling all drawings and drawing revisions affected by the work. The Contractor must maintain an up-to-date list of drawings and revisions and must provide this list to the Inspection Authority and the Technical Authority at the monthly progress

meeting. This list must include a column of all drawings sent to TCMS for approval.

#### 6.1.2 **Guidance Drawings**

All technical guidance drawings are issued to the Contractor from the Canadian Coast Guard for guidance purposes only. The Contractor must develop working drawings and ensure that all drawings receive regulatory approval. The Contractor is to note that not all guidance drawings supplied are “As Fitted” drawings. The Contractor must physically verify all affected items and all dimensions necessary for the work.

#### 6.1.3 **Working Drawings**

6.1.3.1 The Contractor must develop detailed working drawings for all project work and regulatory body approval purposes. All variations must be incorporated into the working drawing revisions.

6.1.3.2 Working drawings must clearly indicate the materials and/or equipment being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each working drawing must have a unique identification number and blocks of numbers must be used to identify the various specification items. Where multiple working drawings are required each drawing must indicate the total number of sheets within the series.

6.1.3.3 Each working drawing for non-catalogue items must be prepared specifically for this project. Working drawings and brochures for catalogue items must be clearly marked to show the items being supplied.

6.1.3.4 The Contractor must sign off on all working drawings indicating:

- a) The drawing has been checked for conformance with all Specification requirements;
- b) The equipment has been coordinated with other equipment to which it is attached and/or connected;
- c) All dimensions have been verified to ensure the proper installation of equipment within the available space.

#### 6.1.4 **Working Drawings – Submission for Review by PWGSC and CCG**

6.1.4.1 The Contractor must submit to the Technical Authority two (2) copies of all working drawings, shop drawings and schedules required for the work. Drawings must be submitted to the Technical Authority and the Inspection Authority at least fourteen (14) days prior to commencement of work for the affected drawings. The Inspection Authority and the Technical Authority must review the drawings within five (5) working days. This review will consist of verification of adherence to the requirements of the specification. Where necessary the Technical Authority will return one (1) copy of the drawing to the Contractor with comments from the

Inspection Authority and the Technical Authority. The Contractor must make any required amendments and return two (2) copies of the revised drawing, with revision dates and revision numbers, to the Technical Authority.

- 6.1.4.2 Reviewed drawings must not be modified in any way without written approval of the Technical Authority. In the event of subsequent revisions to drawings already reviewed the entire drawing, i.e., all sheets, whether revised or not, must be resubmitted for review.
- 6.1.4.3 Space must be provided on the working drawings for review dates and signatures of the Inspection Authority and the Technical Authority.
- 6.1.4.4 Drawings submitted for review, unless otherwise specified, must be in the form of plotted originals. Manufacturer's printed data sheets for standard items are acceptable providing pertinent characteristics are identified and relate to specified items.
- 6.1.5 **Working Drawings – Submission for TCMS Approval**
  - 6.1.5.1 The Contractor must submit to TCMS copies, as necessary, of working drawings, ship drawings and/or layout drawings, schedules and calculation required for approval by TCMS.
  - 6.1.5.2 It must be the responsibility of the Contractor to ensure working drawings are TCMS approved prior to the start of work for any section of the specification where TCMS approval is required.
  - 6.1.5.3 Space must be provided on the working drawings for TCMS approval stamps. This space must be clear of all technical information and must not be on the back of any sheets
  - 6.1.5.4 The Contractor must contact the respective TCMS approvals office to determine the number and type of materials required for approval submissions.
  - 6.1.5.5 The Contractor must supply one (1) original stamped drawings and three (3) copies of all TCMS approved drawings to the Technical Authority.
  - 6.1.5.6 The Contractor must supply four (4) scanned copy, electronic TIF and PDF format, of all TCMS approved drawings on individual CD-ROM media to the Technical Authority.

**6.1.6 “As Fitted” Drawings**

- 6.1.6.1 Upon completion of the work, the Contractor must transfer all mark-ups from the working drawings to a final revision of all vessel drawings affected by the project work. These drawing must become the “As Fitted” drawings for the project work.
- 6.1.6.2 The Contractor must update all vessel drawings affected by the work.
- 6.1.6.3 Prior to completion of the contract, the Contractor must supply to the Technical Authority the following:
  - a) Four (4) plotted copies of the latest revision of each of the “As Fitted” drawings;
  - b) Four (4) electronic copies of the latest revision of each “As Fitted” drawing on individual CD-ROM media in AutoCAD 2000 DWG format. CD-ROM media must be supplied with detailed file lists for each CD-ROM;
  - c) All drawings must become the property of Canada;
  - d) Plotted drawings must be on standard ANSI paper sizes.
- 6.1.6.4 If no AutoCAD drawing files are produced then scanned files (raster format) must be supplied to the Technical Authority in a TIF format.
- 6.1.6.5 “As Fitted” drawings must be delivered within 15 days after completion of the sea trials.

**6.1.7 Framed Drawings**

The following drawings, modified to “As Fitted” status for the vessel must be printed, framed and mounted on board the vessel in locations to be designated by the Technical Authority:

- a) General Arrangement Drawings, Plan View of all Decks and Profile;
- b) Capacity Plan;
- c) Fire Fighting Systems and Life Saving Equipment.

**6.1.8 Working Drawing Updates – Technical Authority Review**

- 6.1.8.1 As drawings are developed during the performance of the Work, the Contractor must provide to the On Site Inspection Authority, one (1) hard copy of the latest revision of each drawing. Drawings must be provided in their native size.
- 6.1.8.2 The frequency of drawing updates must not be less than weekly.
- 6.1.8.3 An updated drawing index must be provided with each batch of updated drawings.

## **6.2 Manuals and Records**

### **6.2.1 General**

6.2.1.1 Instruction Manuals and Records must be individually bound in a hard cover 3 ring book formats with a page size of 8 1/2 inches x 11 inches. 3 Ring binders must be of the “D” type with positive locking mechanisms. Drawings and documents of a larger size must be concertina folded to suit. The covers must have the following information printed thereon:

- CCGS EARL GREY – Vessel Life Extension
- Equipment/System Identification;
- Equipment Manufacturer;
- Revision number and date.

6.2.1.2 Plastic tabbed indices must be provided for all sections of the manuals. Major equipment components must be subdivided into separate sections of the manuals.

6.2.1.3 A master index must be provided at the beginning of each binder indicating all items included in each section.

6.2.1.4 A list of names, addresses and telephone numbers of contacts associated with the equipment manufacturers must be provided that can be used after the project completion for maintenance and information data purposes.

6.2.1.5 A copy of the final reviewed and approved “As Fitted” drawing(s) must be provided within the maintenance manual.

6.2.1.6 The Contractor must supply four (4) paper copies of all manuals and data sheets in English for all Contractor Furnished Equipment items to the Technical Authority prior to the completion of the contract.

6.2.1.7 The Contractor must supply four (4) copies of each manual and all associated data sheets on individual CD-ROMs in electronic PDF file format to the Technical Authority prior to the completion of the contract.

### **6.2.2 Operation Manuals – “As Fitted”**

6.2.2.1 Operation manuals must include the following items:

- 1) General description of equipment operating sequence;
- 2) Step by step procedure to follow in commissioning the equipment;
- 3) Schematic wiring diagram for the fitted equipment;
- 4) All pertinent equipment performance criteria;
- 5) Where software/hardware systems are fitted, the operation manual must include the following:

- a) Full software documentation manual for the system and in a CD-ROM format such that Canada may revise programs without recourse to the Contractor.
- b) The minimum software documentation must include:
  - i. System level diagrams describing the overall scheme of the software/hardware system.
- 6) The functional specifications, which must describe in detail the functional capabilities of the system and each software components;
- 7) Project specific program listings including all comments describing the details of the code functions;
- 8) All listings, files, manuals and associated documentation materials must be delivered to and become the property of Canada.

6.2.2.2 The Contractor must supply the number of paper copies and electronic copies of the operations manuals as set out in Section 6.2.1.

### 6.2.3 **Maintenance Manuals – “As Fitted”**

6.2.3.1 Maintenance manuals are to include:

- 1) Manufacturer's maintenance instructions for each item of the equipment requiring maintenance activity;
- 2) Instructions are to include installation instructions, part numbers, part lists, master drawings and exploded views with part identification for all mechanical, electrical and electronic parts, name of suppliers;
- 3) Summary list of each item of the equipment requiring lubrication, indicating the name of the equipment item, location of all points of lubrication, type of lubricant recommended, and frequency of lubrication;
- 4) Troubleshooting sections must be included for all equipment in the maintenance manual under a separate heading.

6.2.3.2 The Contractor must supply the number of paper copies and electronic copies of the maintenance manuals as set out in Section 6.2.1.

### 6.2.4 **Tests / Trials and Inspection Records**

6.2.4.1 The Contractor must prepare a separate binder, arranged as per Section 6.2.1, for the documentation of all Test, Trials and Inspection Records. The binder must be indexed for each test, trial and inspection performed.

6.2.4.2 The Contractor must maintain a complete and accurate record of all tests, trials and inspections conducted during the execution of the work. This must include those tests, trials and inspections performed at sub-Contractors facilities. The records must include all relevant documentation, test procedures, associated test sheets, including shop test data, and test, trial and inspection data and observation results.

6.2.4.3 All originals of the test, trial and inspections records must be signed by TCMS, the Contractor and where necessary by the sub-Contractors and/or Field Service Representative (FSR) who witnessed the tests.

6.2.4.4 Tests and inspections carried out for the specific purpose of satisfying the TCMS requirements for the Ship Inspection Reporting System (SIRS) update of the vessel must be recorded and signed on documents meeting the requirements of TCMS to clearly indicate which piece of equipment or system with associated field number was tested and the results of the tests carried out. All copies of the documentation must be dated and signed by the attending TCMS surveyor and the Contractor.

### 6.2.5 **Certificate Records**

6.2.5.1 The Contractor must prepare a separate binder, arranged as per Section 6.2.1, for the documentation of all Certificate Records. The binder must be indexed for each item or piece of equipment for which Certificate Records are available.

6.2.5.2 The Contractor must maintain a complete and accurate record of all certificate records applicable to the work. Certificate records must be current and for the type of equipment being installed by the Contractor. The Contractor must ensure that where classification society approval certificates are required, as per Section 3.1, these certificates are provided within the Certificate Records binder. Where manufacturers have supplied certificates for equipment within operational manuals, copies of these certificates must be indexed within the Certificate Records binder. The Contractor must also obtain and index all certificates issued by its sub-Contractors.

6.2.5.3 The Contractor must supply the number of paper copies and electronic copies of the test, trials and inspection records as set out in Section 6.2.1.

6.2.5.4 NOTE: Where original certificates are provided, especially TCMS certificates, one of the three paper copies must be the original document.

## 6.3 **Electrical System Documentation**

- 6.3.1 The Contractor must provide the following documentation with regards to the “As Fitted” load analysis to the Technical Authority:
- 1) Four (4) paper copies of the final TCMS approved load analysis and calculations of the “As Fitted” electrical system. This must be provided as detailed in Section 6.2.1;
  - 2) Four (4) copies of the final TCMS approved load analysis and calculations of the “As Fitted” electrical system in electronic format. The electronic files must be in Microsoft Excel format and must be on individual CD-ROM media with a detailed listing of all files.



- 6.3.2 The Contractor must provide the following documentation with regards to the “As Fitted” short circuit current analysis to the Technical Authority:
- 1) Four (4) paper copies of the final approved short circuit current analysis and calculations of the “As Fitted” electrical system. This must be provided as detailed in Section 6.2.1;
  - 2) Four (4) copies of the final approved short circuit current analysis and calculations of the “As Fitted” electrical system in electronic format. The electronic files must be in Microsoft Excel format and must be on individual CD-ROM media with a detailed listing of all files.

#### **6.4 Inclining Experiment Documentation**

- 6.4.1 The Contractor must refer to Section 9.1 of this Specification for the details required for the Inclining Experiment.
- 6.4.2 The Contractor must prepare and supply four (4) stamped and TCMS approved paper copies of the CCGS Earl Grey Inclining Experiment Report, in imperial and metric units, for the modernized vessel. These reports must be delivered to the Technical Authority prior to the completion of the contract.
- 6.4.3 The Contractor must supply four (4) electronic copies of the Inclining Experiment Report to the Technical Authority on individual CD-ROM media in a PDF file format. This copy must be a scanned copy of the TCMS approved Inclining Experiment Report and must be delivered prior to the completion of the contract.

#### **6.5 Stability Booklet Documentation**

- 6.5.1 The Contractor must refer to Section 9.2 for the details required for the Trim and Stability Booklet.
- 6.5.2 The Contractor must prepare and supply four (4) stamped and TCMS approved paper copies of the CCGS Earl Grey Trim and Stability Booklet, in imperial and metric units, for the modernized vessel. The format must conform to the Transport Canada Ship Safety Branch publication TP 7301E, Stability Standard Stab. 1. The Contractor must deliver these copies to the Technical Authority prior to the completion of the contract.
- 6.5.3 The Contractor must also supply four (4) electronic copies of the Trim and Stability Booklet to the Technical Authority on individual CD-ROM media in a PDF file format. This copy must be a scanned copy of the TCMS approved Trim and Stability Booklet and must be delivered prior to the completion of the contract.

## **6.6 Photographs and Images – General**

### **6.6.1 “As Delivered” Photographs/Images**

- 6.6.1.1 The Contractor must supply a professional photographer to deliver 1000 high resolution (minimum 8 Mega Pixel) digital images in JPEG format. Images must be stored on CD-ROM media. The Inspection Authority and the Technical Authority must be in attendance for all images. The entire ship must be photographed with enough detail to point out specific parts and/or pieces. If Canada requests more images to be taken, the price must be prorated.
- 6.6.1.2 The Contractor must fulfill this requirement in conjunction with Section 1.9 of this Specification.
- 6.6.1.3 The Contractor must provide two (2) copies of all “As Delivered” digital images on individual CD-ROMs to the Inspection Authority and the Technical Authority at the first progress meeting after the delivery of the vessel to the Contractor’s facility.

### **6.6.2 Progress Photographs/Images**

- 6.6.2.1 The Contractor must provide high-resolution (minimum 8 Mega Pixel) JPEG digital images on CD-ROM media of the work in progress during each phase of the project. The photographs must commence when the work on the vessel begins and continue as long as work is in progress.
- 6.6.2.2 The Contractor must take sufficient exposures during the modernization project to ensure that an adequate record of work progress is captured. The date of exposure must be automatically recorded for all images.
- 6.6.2.3 The Contractor must provide two (2) copies of all progress photographs on individual CD-ROM media in JPEG format to the Inspection Authority and the Technical Authority at monthly progress meetings.

## **7.0 TESTS, DOCK TRIALS AND SEA TRIALS**

### **7.1 General Requirements**

- 7.1.1 The Contractor must demonstrate that the completed work and equipment is in compliance with the performance requirements of this Specification. The Contractor must develop test and trial procedures, and conduct all tests and trials required by this Specification and as may be required by the regulatory bodies in order to permit the issue of all appropriate certificates for the vessel. The Contractor must obtain all necessary certificates for the vessel to ensure that the vessel is fully certified and seaworthy for a vessel of its class prior to the completion of the contract.
- 7.1.2 The Contractor must prepare a trials schedule showing dates, sequence, procedures, and duration of each trial or set of trials. This agenda, including the proposed trial record sheets for all trials, must be submitted for review and comment to the Technical Authority and the Inspection Authority twenty (20) working days prior to the start of any tests and trials. The Contractor must coordinate the trials agenda with TCMS to ensure attendance where necessary. The Contractor must ensure a manufacturer's Field Service Representative (FSR) or written authorization from the manufacturer must be available prior to initial start-up of newly installed or modified equipment. All trials must be witnessed by the Inspection Authority and where necessary, by TCMS, FSR's and any sub-Contractors. All tests must be completed on individual components of a system and all defects corrected to the satisfaction of the Inspection Authority, TCMS and/or the attending FSR. Once defects are corrected, the test and trial must be repeated to the satisfaction of the Inspection Authority and where necessary TCMS.
- 7.1.3 Shop testing, dock and sea trials procedures must be to the standards required by TCMS. Where TCMS has no requirements for shop test procedures, the Contractor must adhere to the S.N.A.M.E. guidelines as referenced in Section 1.3 of this Specification. The minimum standard for all electrical dock and sea trials must be in accordance with TCMS, TP127E and IEEE Std 45-2002. All electronic equipment static tests must be completed prior to sea trials with only the operational tests to be carried out at sea.
- 7.1.4 Mechanical and piping systems must be tested in accordance with Section 7.2.
- 7.1.5 Hydrostatic testing of piping and components forming part of any system must be completed prior to any operational testing of the system. The Contractor must have on hand signed and witnessed test sheets showing the results of hydrostatic tests prior to the operational tests of the system. As a minimum the Inspection Authority must be notified when any components are being hydrostatically tested.

- 7.1.6 The Contractor must provide the Technical Authority with a complete list of disturbed services and ship's systems that require functional and operational tests prior to the completion of each specification requirement. The Contractor must develop specific test procedures to test the operational and functional condition of each of the disturbed services and/or ship's systems. The Contractor must submit the list of disturbed services and ship's systems and the associated specific test procedures for review to the Inspection Authority and the Technical Authority twenty (20) working days prior to the start of these system tests.
- 7.1.7 The Contractor must make reference to Section 6.2.4 with regard to the documentation requirements for the tests, trials and inspection records.

## **7.2 Mechanical and Piping Systems**

- 7.2.1 All sub-assemblies and piping systems fabricated by the Contractor must be hydrostatically tested to 1.5 times the system's working pressure and proven tight to the satisfaction of the Inspection Authority prior to installation on the vessel.
- 7.2.2 Machinery and equipment must not be subjected to pressures higher than their maximum allowable operating pressure during system pressure tests. Valves at the components may be closed, or the connection blanked off to protect such components from excessive pressure. If there are any flanged joints in the piping between a tank isolating valve and the open end of the tail pipe, or where a tank isolating valve has not been installed, the flanged joint next to the open end of the tailpipe must be temporarily blanked off so the system may be pressure tested up to that point. Instruments, pressure switches and other components that could be damaged by excessive pressure of system tests must be removed or otherwise protected during the tests.
- 7.2.3 For tests, calibrated pressure gauges must be installed at the connections provided in the gauge piping for this purpose. During tests, readings of installed gauges must be checked with the calibrated test gauges. Installed gauges must be adjusted where necessary to register pressure accurately. The Contractor must provide calibration certificates for all instrumentation used for the testing of systems to the Inspection Authority and the Technical Authority.
- 7.2.4 When the duration of a pressure test is not specified, the test pressure must be held a sufficient length of time to permit a thorough examination of the system for leaks to the satisfaction of the Inspection Authority.

- 7.2.5 Relief and safety valves and all other components installed to limit operating pressures must be removed, blanked or bypassed where necessary to build up to the pressure specified for the test. After a system has satisfactorily passed these tests, such components must be reinstalled and tested under pressure to assure they operate at approved set pressures. Set pressures indicated on identification plates of these valves must conform to the approved set pressures.
- 7.2.6 All components necessary for the safe operation of the system must be checked and adjusted during the operating tests to demonstrate compliance with the requirements specified and approved for the system. Operating tests must demonstrate that the piping design and installation adequately meet the service demands.
- 7.2.7 Components, such as spring hangers must be adjusted where necessary and flexible piping connections slip joints, expansion joints and noise isolation pipe fittings must be checked for satisfactory operation while the system in which they are installed is being operated.
- 7.2.8 Where pumps or ejectors have suctions from tanks or compartments, the operating test must demonstrate the ability of the system to remove the service liquid down to the level of the open end of the suction tail pipe.
- 7.2.9 Open systems such as air escapes, overflows and deck drains must be tested for unobstructed flow with compressed air or water at not more than 100 PSI. Systems for hand pumps, portable drainage facilities and similar miscellaneous systems must be given an operating test and the specified pressure test. Pressure tests must precede operating tests.
- 7.2.10 All systems must have a visual inspection and must be leak-free during the specified tests.
- 7.2.11 All of the system pressure and operating tests must be completed before the system trials.
- 7.2.12 Where tanks have been opened for the purpose of conducting work, all tanks are to be cleared, cleaned and submitted for inspection to the Inspection Authority prior to closing of the tank or space. Failure to notify the Inspection Authority does not absolve the Contractor of the responsibility of providing the opportunity to inspect any completed items. Inspection of any tanks or spaces by the Inspection Authority does not substitute for any required inspection by TCMS. At the completion of the inspection, all tank covers are to be fitted with new gasket material prior to the closing of the tanks.

- 7.2.13 Where work has been carried out in or on any structural part of a tank, that tank must be subjected to a hydrostatic pressure test of 8- foot (2.5m) head of water. The hydrostatic test must be witnessed by TCMS and the Inspection Authority. The hydrostatic tests must be documented as per Section 6.2.4 of this Specification.

### **7.3 Ship Performance Sea Trials**

In addition to dock trials and commissioning tests of individual ship systems specified within this Specification the Contractor must perform a full set of sea trials in accordance with the “Guide for Sea Trials” as published by S.N.A.M.E. (Section 1.3 of this specification). The Contractor must develop all sea trial procedures and data sheets. The sea trial procedures with attached data sheets must be submitted to the Inspection Authority and the Technical Authority for review and approval twenty (20) working days prior to the start of the Sea Trials.

## **8.0 BERTHING, MOORING, DOCKING/UNDOCKING, VESSEL SECURITY**

### **8.1 Berthing and Mooring**

- 8.1.1 The Contractor must provide all material and labor required to handle, dry-dock, and fit out a ship which has particulars set out in Section 1.2. Details of the Berthing and Mooring facilities are to be included in the bidder's proposal.
- 8.1.2 The Contractor must be responsible to berth and moor the vessel for the duration of the contract period. The Crown must have unrestricted access to the vessel at all times.
- 8.1.3 The vessel must be located at the Contractor's facility for the duration of the contract.
- 8.1.4 The depth of water must be sufficient to prevent the vessel touching bottom under any tidal or low water conditions. The Contractor must ensure that there is sufficient water under the keel to allow propulsion system testing during dock trials.
- 8.1.5 The Contractor must supply all mooring lines and labor required in berthing, mooring, dock trials and casting off for the vessel. The Contractor may use the vessel's lines to tie up the vessel on arrival but must immediately replace these and remove the vessel's lines to storage. The Contractor must supply all material and labor required to dock and undock the vessel including any vessel movements, provisions of tugs, and line handling personnel.

### **8.2 Services**

- 8.2.1 The Contractor must prevent rat and vermin harborage onboard the vessel for the duration of the contract. The Contractor must remove any rats or vermin from onboard the vessel if they do come onboard during the contract period.
- 8.2.2 Services must be connected upon arrival at the Contractor's facility and maintained for the duration of the refit. The cost of services must include any connections, disconnections, consumption, and any interim arrangements.
- 8.2.3 The Contractor must supply and erect one gangway complete with safety net in compliance with the Canada Labor Code while the vessel is secured alongside the Contractor's facility. The Contractor must be responsible for the safety of the gangway.
- 8.2.4 The Contractor must supply and erect gangways in compliance with the Canada Labour Code when the vessel is docked. There must be two separate and independent

means of accessing the vessel at all times. The Contractor must be responsible for the safety of the gangways.

- 8.2.5 The Bidder must submit a written price quote on a per cubic meter consumption of potable, non- potable, and sea water.
- 8.2.6 The Contractor must provide and install a calibrated flow meter for each domestic water supply connected to the vessel for the duration of the work period. Flow meters are to be sized for the service they are intended for. Calibration records for the flow meters must be presented to the Inspection Authority. All flow meters must be read by the Contractor at the beginning and end of the contract period, as well as before and after any vessel movement to or from the fit out wall or the dry dock, in the presence of the Inspection Authority. The following connections will be required to service the vessel:
- i. A pressure regulated water supply at 670 kPa must be connected to the vessel's fire main. The water supply must be connected immediately following the docking of the vessel. There must be no interruption of this supply until vessel delivery or acceptance. Consumption will be on an as-required basis for firefighting and cleaning purposes.
  - ii. A pressure regulated water supply at 670 kPa must be connected to the vessel's sanitary water supply system. The water supply must be connected immediately prior to the arrival of the crew for trials. There must be no interruption of this supply after connection. Consumption is estimated at 4000 liters of water per day when the vessel is crewed. The Contractor must quote on 14 day's supply of this service.
  - iii. A pressure regulated potable water supply at 670 kPa must be connected to the vessel's potable water supply system. The water supply must be connected immediately prior to the arrival of the crew for trials. There must be no interruption of this supply after connection. The vessel will be consuming an estimated 6,000 liters of potable water per day when crewed. The Contractor must quote on 14 day's supply of this service.
- 8.2.7 For all water lines connected and servicing the vessel, the Contractor must be responsible to take all necessary precautions to ensure that the water lines do not freeze during cold weather. Special attention must be given to the fire main supply line.
- 8.2.8 A garbage bin must be provided and located at the ship's gangway. Garbage must be collected from this bin daily while the vessel is crewed.



- 8.2.9 The Contractor must provide, install and remove 214m<sup>2</sup> (2300ft<sup>2</sup>) of protective floor covering consisting of 3mm Masonite. This floor covering must be fitted to all access alleyways throughout the vessel on the Main Deck, the Boat Deck and the Bridge Deck as well as in the Control Room in the Engine Room, the Mess and galley on the Main Deck. All edge joints must be taped to prevent the ingress of dirt. The Contractor must complete the installation of the protective floor covering within 48 hours of the vessels arrival at the Contractor's facility. The Contractor must remove the protective floor coverings no earlier than 24 hours before the vessels departure from the Contractor's facility
- 8.2.10 The Contractor must supply the services of a 20 ton crane and personnel to operate and direct the crane to load and unload supplies from the vessel.
- 8.2.11 The Contractor must provide a price quote per kW/Hr of electrical power at 600 VAC, 60 Hz, 3-phase. The quote must be based on 50A average current while the vessel is not crewed and 225A while the vessel is crewed. The Contractor must quote on 14 days crewed.
- 8.2.12 Electrical power requirements are 600 volts AC, 300 amps, 60 Hz, 4-wire, three-phase. The power supply must be connected before the vessel is docked and must remain connected for the duration of the contract. The shore power must be supplied through an independent kilowatt hour meter that is maintained by the Contractor. The Contractor must read the kilowatt hour meter in the presence of the Inspection Authority prior to power connection and disconnection to verify power consumption. Readings must be taken before and after any vessel movement to or from the fit out wall or the dry dock, and be read in the presence of the Inspection Authority.
- 8.2.13 The Contractor must ensure that environmental conditions are monitored aboard the vessel throughout the contract period to prevent damage from temperature variations. This must include protection from the freezing of any piping system with fluids within them and the overheating of any spaces in which electronic equipment could be detrimentally affected such as the electronics room, bridge or engine control room.

### **8.3 Docking**

- 8.3.1 The Contractor must supply all labor, materials and facilities to dock and undock the vessel to perform the work required by these specifications.
- 8.3.2 The vessel will be delivered to the ship yard entrance. The Contractor must provide for the handling of the vessel's mooring lines and tug assistance as required to perform the docking and undocking of the vessel and any other movements required during the contract period. The Contractor must be responsible for all associated fees.

- 8.3.3 The particulars of the vessel are as per Section 1.2 of this specification. The Contractor must provide proof with the bid documents that the docking facility is certified to dry dock a vessel with these particulars.
- 8.3.4 The stability books are included as part of the electronic materials on the CD-ROM provided to the bidders.
- 8.3.5 The Contractor must prepare blocks and necessary shoring to maintain the true alignment of the vessel's hull and machinery throughout the docking period.
- 8.3.6 The Contractor must be responsible for recording all tank soundings, draft, trim and list of the vessel, and performing the necessary stability calculations for the successful docking of the vessel. These calculations must be forwarded to the Technical Authority and the Inspection Authority for review 48 hours prior to docking the vessel.
- 8.3.7 The vessel must be docked so that all docking plugs, transducers, anodes and sea inlet grids are clear and accessible. A minimum clearance of 1.3 meters (4 feet) must be available below the keel. If any hull fittings are covered, the Contractor must be responsible for all labor and materials required for making alternative arrangements to drain tanks and/or move blocks to gain access to areas of specified work. The Contractor must refer to the Docking Plan on the CD-ROM.
- 8.3.8 The Contractor must fit drain fittings to the various deck scuppers or overboard drains as required if they interfere with the work in way. The Contractor must quote on fitting five (5) temporary drains for deck scuppers and overboard drains.
- 8.3.9 The Contractor must provide a vacuum truck to allow for the pump down and flushing of the vessel's sewage system. The Contractor must bid on removing 4 cubic meters of black water from the system, the amount to be adjusted through PWGSC 1379 Form and disposal certificate supplied to the TA to confirm the quantity removed.)
- 8.3.10 The Contractor must provide a ground cable between the vessel and the dock while the vessel is docked as per TCMS Ship Safety Bulletin 6/89.

#### **8.4 Undocking**

- 8.4.1 Before floating the vessel, the Contractor must ensure that all tanks are filled to obtain the same conditions as at docking. The Contractor must be responsible for the safe undocking of the vessel taking into consideration the stability changes resulting from the work of these specifications. The Contractor must perform the necessary stability

calculations for undocking of the vessel. These calculations must be forwarded to the Inspection Authority and the Technical Authority for review 48 hours prior to flooding the dry dock.

- 8.4.2 The Contractor must ensure that all shipside openings, including valves, drain and docking plugs are secure before flooding the dry dock.
- 8.4.3 The Contractor must supply and install and remove upon completion, any necessary fittings and lugs necessary to carry out the work in this specification. Where lugs and/or fittings are installed and removed, the welds must be ground flush with the hull. Any damaged and/or disturbed paint work must be treated in accordance with the paint manufacturer's requirements and painted according to the vessel's paint scheme.
- 8.4.4 The Contractor must supply all labour necessary to handle the ship's lines during the undocking process. The Contractor must be responsible to supply the services of tugs to ensure that the vessel is undocked in a safe manner and that no damage to the vessel will result during the undocking procedure.

## **8.5 Security**

- 8.5.1 The Contractor must ensure the security of the vessel while the vessel is in the Contractor's care, control and custody. This must include provisions to prevent damage to the vessel due to wind and wave action, tides, flooding, fire, and ambient temperature conditions.
- 8.5.2 The Contractor meet the above requirement, the Contractor must regularly monitor the mooring lines, and increase the frequency of the monitoring during adverse weather conditions.
- 8.5.3 The Contractor must provide security rounds of the vessel, at a minimum of every 4 hours, outside of the main working hours. These rounds must include a visual inspection of each compartment, and any adverse condition that could affect the vessel must be actioned immediately. Records of these rounds must be presented to the Inspection Authority upon request.
- 8.5.4 The Contractor must have a call out system in place to respond to any emergency, with personnel qualified to remedy the situation and prevent damage to the vessel.
- 8.5.5 Damage incurred to the vessel as a result of the Contractor's failure to meet these requirements will be repaired at the Contractor's expense.

## **9.0 INCLINING EXPERIMENT AND TRIM AND STABILITY BOOKLET**

### **9.1 Inclining Experiment**

- 9.1.1 The Contractor must report during the first technical progress meeting the method used to control the weight and centers movement on the vessel. The Contractor must record all weight movement within the vessel and all weight removed and added to the vessel as a result of the work.
- 9.1.2 The Contractor must perform an inclining experiment (in the presence of a TCMS Surveyor) upon completion of the work and prior to vessel delivery. The Contractor must produce an inclining experiment and must submit this for TCMS approval. The results from the inclining experiment must form the baseline for the Trim and Stability Booklet.
- 9.1.3 The Inclining experiment and lightship survey must be carried out in accordance with ASTM Standard F1321-92 and as directed by the attending TCMS Surveyor.
- 9.1.4 The Contractor must refer to Section 6.4 of this Specification with regards to the documentation requirements for the Inclining Experiment Report.

### **9.2 Inclining Experiment Documentation**

- 9.2.1 The Contractor must prepare and supply four (4) stamped and TCMS approved paper copies of the CCGS Earl Grey's Inclining Experiment Report, in imperial and metric units, for the modernized vessel. These reports must be delivered to the Technical Authority prior to the completion of the contract.
- 9.2.2 The Contractor must supply four (4) electronic copies of the Inclining Experiment Report to the Technical Authority on individual CD-ROM media in a PDF file format. This copy must be a scanned copy of the TCMS approved Inclining Experiment Report and must be delivered prior to the completion of the contract.

### **9.3 Trim and Stability Booklet**

- 9.3.1 The Contractor must prepare a Trim and Stability Booklet, in imperial and metric units, for the vessel in the condition at time of return of custody to Canada. The format must conform to TP7301E, Stability Standard Stab. 1, and must be TCMS approved.
- 9.3.2 The Contractor must refer to Section 6.5 of this Specification for the documentation requirements for the trim and Stability Booklet.

- 9.3.3 The baseline for the Stability Booklet must be the lightship centers of gravity determined from the inclining experiment as detailed in Section 9.1 of this Specification.
- 9.3.4 At completion of the work, the vessel must meet all requirements of TP7301E, Stability 6, in all operating conditions.
- 9.3.5 The following intact conditions must be prepared:
- A. Lightship condition:
    - Vessel complete with working level of fluids in machinery, sea bays flooded, and non-consumables onboard. The light ship must not include crew and effects, cargo, buoys or consumables. Fuel, fresh water and water ballast tanks must be empty.
  - B. Light Operating Conditions:
    - Lightship condition;
    - Crew and effects;
    - 100% consumables;
    - Full fuel;
    - Full fresh water;
    - Water ballast where required.
  - C. Departure Condition:
    - 1) Lightship condition;
    - 2) Crew and effects;
    - 3) 100% consumables;
    - 4) Deck cargo;
    - 5) Fuel and fresh water;
    - 6) Water ballast where required.
  - D. Arrival Condition:
    - 1) Lightship condition;
    - 2) Crew and effects;
    - 3) 10% consumables;
    - 4) Deck cargo;
    - 5) 10% fuel;
    - 6) 10% fresh water;
    - 7) Water ballast where required.
  - E. Arrival Condition with 30tonne (t) Accumulated Ice and 8 t Crane Lift:
    - 1) Lightship Condition;
    - 2) Crew and Effects;
    - 3) 10% Consumables;
    - 4) Deck Cargo;
    - 5) 30t Accumulated Ice;
    - 6) 8 t Crane Lift.

- F. Departure Condition with 30t Deck Cargo and 8 t Crane lift extended 8m:
    - 1) Lightship Condition;
    - 2) Crew and Effects;
    - 3) 100% Consumables;
    - 4) Deck Cargo;
    - 5) 8 t Crane lift at 8m extension.
  - G. Departure Condition with 30t Deck Cargo and 8 t Crane lift at full height:
    - 1) Lightship Condition;
    - 2) Crew and Effects;
    - 3) 100% Consumables;
    - 4) Deck Cargo;
    - 5) 8 t Crane lift at full height.
  - H. Arrival Condition with 30t Deck Cargo and 8 t Crane lift extended 8m:
    - 1) Lightship Condition;
    - 2) Crew and Effects;
    - 3) 10% Consumables;
    - 4) Deck Cargo;
    - 5) 8 t Crane lift at 8m extension.
  - I. Arrival Condition with 30t Deck Cargo and 8 t Crane lift at full height:
    - 1) Lightship Condition;
    - 2) Crew and Effects;
    - 3) 10% Consumables;
    - 4) Deck Cargo;
    - 5) 8 t Crane lift at full height.
  - J. Worst Operating Condition;
  - K. Any condition likely to be encountered by the vessel in operation in which the distribution and quantity of consumables, cargo, fuel, and water produce lower values of GZ and/or GM than conditions B to I listed above.
  - L. Hydrostatic Curves;
  - M. Cross Curves of Stability.
- 9.3.6 All conditions must include righting lever curves and areas under the curves. All data, whether measured or derived must be provided to the Technical Authority for future use for calculating the vessel's stability.

#### **9.4 Stability Book Documentation**

- 9.4.1 The Contractor must prepare and supply four (4) stamped and TCMS approved paper copies of the CCGS Earl Grey's Trim and Stability Booklet, in imperial and metric units, for the modernized vessel. The format must conform to Stability Standard Stab. 1. The Contractor must deliver these copies to the Technical Authority prior to the completion of the contract.
- 9.4.2 The Contractor must also supply four (4) electronic copies of the Trim and Stability Booklet to the Technical Authority on individual CD-ROM media in a PDF file format. This copy must be a scanned copy of the TCMS approved Trim and Stability Booklet and must be delivered prior to the completion of the contract.

## **10.0 FIELD SERVICE REPRESENTATIVE REQUIREMENTS**

### **10.1 Wartsila**

10.1.1 The Contractor must be responsible for obtaining the services of an accredited Wartsila Inc. Field Service Representative to confirm that the work undertaken in the following specification items:

- a) SECTION 13.0 PROPULSION ENGINE BLOCK REPLACEMENT
- b) SECTION 14.0 PROPULSION CONTROL SYSTEM;
- c) SECTION 17.0 STERN TUBE SEAL AND BEARING REPLACEMENT;
- d) SECTION 18.0 CPP SYSTEM OVERHAUL;
- e) SECTION 24.0 BOW THRUSTER REPLACEMENT

are completed in accordance with the applicable manufacturer's specifications, drawings, instructions, and these specifications. The Field Service Representative must be accredited by Wartsila Inc. as being a competent person to perform this work. The total cost of those services, including any travel related costs, must be included as separate line items in the Contractors financial proposal.

10.1.2 Accredited Wartsila Canada Field Service Representatives are available from:  
Wartsila Canada  
Unit 3, 90 Cutler Avenue  
Dartmouth, Nova Scotia B3B 0J6  
Tel: (902) 468-1264  
Fax: (902) 468-1265

### **10.2 Jastram Technologies**

10.2.1 The Contractor must be responsible for obtaining the services of an accredited Jastram Technologies Field Service Representative to confirm that the work undertaken in specification SECTION 15.0 STEERING GEAR CONTROL UPGRADE is completed in accordance with applicable manufacturer's specifications, drawings, instructions, and these specifications. The Field Service Representative must be accredited by Jastram Technologies as being a competent person to perform this work. The total cost of those services, including any travel related costs, must be included as separate line items in the Contractors financial proposal.

10.2.2 Accredited Jastram Technologies Field Service Representatives are available from:  
Jastram Technologies  
22 Trider Crescent  
Dartmouth, Nova Scotia  
Canada B3B 1R6  
Telephone: (902) 468-6450  
Fax: (902) 468-6901



### **10.3 Santasalo Moventas**

10.3.1 The Contractor must be responsible for obtaining the services of an accredited Moventas Ltd. Field Service Representative to confirm that the work undertaken in specification SECTION 16.0 GEARBOX OVERHAUL is completed in accordance with applicable manufacturer's specifications, drawings, instructions, and these specifications. The Field Service Representative must be accredited by Santasalo Moventas Ltd. as being a competent person to perform this work. The total cost of those services, including any travel related costs, must be included as separate line items in the Contractors financial proposal.

10.3.2 Accredited Santasalo Moventas's Field Services Representatives are available from:  
Santasalo Moventas  
C/O Moventas Ltd.  
P.O. Box 20100  
1615 Bishop Street North  
Cambridge, ON  
N1R 8C8  
Telephone: (519) 621-6390 x234  
Fax: (519) 621-7660

### **10.4 Liebherr Canada**

10.4.1 The Contractor must be responsible for obtaining the services of an accredited Liebherr Canada Field Service Representative to confirm that the work undertaken in specification SECTION 25 BUOY CRANE UPGRADE is completed in accordance with applicable manufacturer's specifications, drawings, instructions, and these specifications, and that the manufacturers' warranty is valid and applies to this installation . The Field Service Representative must be accredited by Liebherr Canada as being a competent person to perform this work. The total cost of those services, including any travel related costs, must be included as separate line items in the Contractor's financial proposal.

10.4.2 Accredited Liebherr Canada Field Service Representatives are available from  
Liebherr Canada  
51 Nantucket Blvd  
Toronto ON  
M1P 2N5  
Tel (416) 755-2221

### **10.5 Hose-McCann**

10.5.1 The Contractor must be responsible for obtaining the services of an accredited Hose-McCann Field Service Representative to confirm that the work undertaken in specification SECTION 26 ICS UPGRADE is completed in accordance with applicable manufacturer's specifications, drawings, instructions, and these

specifications, and that the manufacturers' warranty is valid and applies to this installation . The Field Service Representative must be accredited by Hose-McCann as being a competent person to perform this work. The total cost of those services, including any travel related costs, must be included as separate line items in the Contractor's financial proposal.

- 10.5.2 Accredited Hose-McCann Field Service Representatives are available from:  
United Marine Communications of Florida (a Subsidiary of Hose-McCann)  
1241 West Newport Center Drive  
Deerfield Beach,  
Florida, USA  
33442  
Tel (954) 429-2770

## **10.6 Palfinger**

- 10.6.1 The Contractor must be responsible for obtaining the services of an accredited Palfinger Field Service Representative to confirm that the work undertaken in specification SECTION 28 SHEPPARDING BOAT DAVIT INSTALLATION and SECTION 48 HIAB CRANE REPLACEMENT is completed in accordance with applicable manufacturer's specifications, drawings, instructions, and these specifications, and that the manufacturers' warranty is valid and applies to this installation. The Field Service Representative must be accredited by Palfinger as being a competent person to perform this work. The total cost of those services, including any travel related costs, must be included as separate line items in the Contractor's financial proposal.
- 10.6.2 Accredited Palfinger Field Service Representatives are available from:  
Pennecon Energy Hydraulic Systems  
2 Maverick Place  
Paradise, Newfoundland  
Canada,  
Telephone: (877) 926-3490  
Fax: (709) 726-3729

## **10.7 Rolls Royce**

- 10.7.1 The Contractor must be responsible for obtaining the services of an accredited Rolls Royce Field Service Representative to confirm that the work undertaken in specification SECTION 27 STERN THRUSTER UPGRADE is completed in accordance with applicable manufacturer's specifications, drawings, instructions, and these specifications, and that the manufacturers' warranty is valid and applies to this installation . The Field Service Representative must be accredited by Rolls Royce as being a competent person to perform this work. The total cost of those services,

including any travel related costs, must be included as separate line items in the Contractor's financial proposal.

- 10.7.2 Accredited Rolls Royce Field Service Representatives are available from:  
Rolls Royce Canada, Ltd.  
142 Glencoe Drive  
Mount Pearl, Newfoundland  
Canada  
A1N 4P7  
Tel (954) 429-2770

## **10.8 Volvo Penta**

- 10.8.1 The Contractor must be responsible for obtaining the services of an accredited Volvo Penta Field Service Representative to confirm that the work undertaken in specification SECTION 9A SHIP SERVICE GENERATOR AND DIESEL ENGINE OVERHAUL is completed in accordance with applicable manufacturer's specifications, drawings, instructions, and these specifications, and that the manufacturers' warranty is valid and applies to this installation. The Field Service Representative must be accredited by Volvo Penta as being a competent person to perform this work. The total cost of those services, including any travel related costs, must be included as separate line items in the Contractor's financial proposal.

### **10.8.2 Accredited Volvo Penta Field Service Representatives are available from:**

- 10.8.3 Wajax Power Systems  
10.8.4 70, Raddall Avenue  
10.8.5 Dartmouth, Nova Scotia  
10.8.6 B3B 1T7  
10.8.7 Tel: (902)-468-6200  
10.8.8 Fax: (902)-468-3325

## **10.9 FSR Scheduling**

The Contractor must ensure that FSRs are present on site to supervise their respective work.

## **11.0 VLE SUPPLEMENTAL REFIT SPECIFICATION (APPENDIX A)**

### **11.1 General**

The following sections are included in a VLE Supplemental Refit Specification as Appendix “A” and as such are priority items to be completed during the VLE. This Appendix forms part of the main CCGS EARL GREY VLE Specification and thus Sections 1.0 through Section 10.0 inclusive apply to Appendix “A”.

- 11.1.1 FM200 FIRE SYSTEM TCMSB INSPECTION**
- 11.1.2 FIRE DETECTION SYSTEM TCMSB SURVEY**
- 11.1.3 PORTABLE FIRE EXTINGUISHERS TCMSB SURVEY**
- 11.1.4 BALLAST TANKS TCMSB SURVEY**
- 11.1.5 FUEL TANKS TCMSB SURVEY**
- 11.1.6 LIFE RAFT ANNUAL INSPECTION AND CERTIFICATION**
- 11.1.7 AIR SAFETY VALVES**
- 11.1.8 ANNUAL MEGGER TESTING**
- 11.1.9 #1 S S GENERATOR/ DIESEL ENGINE OVERHAUL TCMSB SURVEY**
- 11.1.10 MIRANDA DAVIT 5 YEAR TCMSB SURVEY**
- 11.1.11 UNDERWATER HULL INSPECTIONS/ BUTTS & SEAMS**
- 11.1.12 HULL IDENTITY MARKINGS**
- 11.1.13 UNDERWATER HULL ANODES**
- 11.1.14 SEA BAYS**
- 11.1.15 C-2000 SYSTEM ANODES**
- 11.1.16 AQUAMATIC SYSTEM ANODES**
- 11.1.17 GALLEY EXHAUST DUCT CLEANING**
- 11.1.18 VENTILATION DUCT CLEANING**
- 11.1.19 WINTER VENTHEAD INSTALLATION**
- 11.1.20 EMERGENCY AIR COMPRESSOR INSTALLATION**
- 11.1.21 CRANE FALL ARREST**
- 11.1.22 UNDERWATER HULL CLEANING AND COATING**

## **12.0 VLE SUPPLEMENTAL ELECTRONIC EQUIPMENT SPECIFICATION (APPENDIX B)**

### **12.1 General**

The following sections are included in a VLE Supplemental Electronic Equipment Specification as Appendix “B” and as such are priority items to be completed during the VLE. This Annex forms part of the main CCGS EARL GREY VLE Specification and thus Sections 1.0 through Section 10.0 inclusive apply to Appendix “B”.

- 12.1.1 ELAC ES5100 ECHO SOUNDER INSTALLATION**
- 12.1.2 ICE HOUSING REPLACEMENT**
- 12.1.3 TV DISTRIBUTION BACKBONE SYSTEM UPGRADE**
- 12.1.4 DOPPLER SPEED LOG SYSTEM NAVIKNOT 450D INSTALLATION**
- 12.1.5 LOCAL AREA NETWORK (LAN) BACKBONE**
- 12.1.6 FLEET BROADBAND 500 (FBB500) INSTALLATION**
- 12.1.7 MASTERCLOCK REPLACEMENT**

### 13.0 PROPULSION ENGINE BLOCK REPLACEMENT (SURVEY ITEM)

#### 13.1 Identification

- 13.1.1 The Contractor must disassemble and remove the four (4) existing main propulsion diesel engine blocks. The installed blocks are damaged and must be removed and renewed. The Contractor is responsible for the removal and reinstallation of all piping, ventilation ducting, structural components, lighting, brackets, fire suppression systems and all other systems that are located in the removal and installation path of the engines. The Contractor must remove and dispose all redundant control systems and electrical cabling from the existing installation that will not be replaced during the Propulsion Control System Replacement.
- 13.1.2 The Contractor must install four (4) new Deutz S/BV9M propulsion diesel engines blocks, reassemble the engines, commission and test in accordance with the manufacturer's guidelines, instructions and recommendations. The Contractor must complete all to the satisfaction and approval of TCMS.

#### 13.2 Applicable Documents

The following documents are applicable to, or interface with the task requirements of this section:

- a) TP 127E;
- b) IEEE 45 STD -2002;
- c) C.S.A., Hull and Machinery Regulations;
- d) Deutz SBV9M 628 Operational Manual;
- e) Deutz SBV9M 628 Parts Manual;
- f) Drawing List below.

Drawing Number	Description
VNEA2_134-401	General Arrangement AS FITTED 2OF2
VNEA2_251-000	Main Engine Seats
VNEA2_315-003	Main Engine Cooling Water Diagram
VNEA2_315-006	Engine Cooling Arrangement 1 of 4
VNEA2_315-006	Engine Cooling Arrangement 2 of 4
VNEA2_315-006	Engine Cooling Arrangement 3 of 4
VNEA2_315-006	Engine Cooling Arrangement 4 of 4
VNEA2_331-004	Fuel Oil System Diagram
VNEA2_341-004	Lube Oil Filling and Service Diagram
VNEA2_342-004	Crankcase Breather Arrangement
VNEA2_362-004	Compressed Air Diagram
VNEA2_369-004	Main Engine Generator & Boiler Uptakes
VNEA2_369-005	Details of Uptake Supports
VNEA2_379-000	List of Insulation
VNEA2_381-003	Machinery Arrangement Elevations 2 OF 3

Drawing Number	Description
VNEA2_381-003	Machinery Arrangement Plan View 1 OF 3
VNEA2_381-003	Machinery Arrangement Sections 3 OF 3
VNEA2_381-004	Machinery Hold Down Bolts & Collision Chocks
VNEA2_381-005	Engine Room Wireways 1 of 2
VNEA2_381-023	Coupling Guards
VNEA2_SC-381-8	Engine Fastening

### 13.3 Technical

#### 13.3.1 General

- 13.3.1.1 The Contractor must ensure all surrounding areas not disturbed and protected from any damage. Any damage outside of the “as delivered” condition must be repaired at the Contractor’s expense.
- 13.3.1.2 The Contractor must be responsible for obtaining the services of a accredited Wartsila Field Service Representatives to provide guidance and assistance in performing the work undertaken in this specification section in accordance with the manufacturer’s specifications, drawings, instructions and these specifications. The FSR’s must be accredited by Wartsila Canada as being a person competent to perform this work. The FSR must be on site in person for all the work in this specification section. The total cost of those services must be included as a line item in the Contractor’s financial proposal.
- 13.3.1.3 The Contractor is responsible for all aspects of the removal and installation of the four (4) main engines including engine rebuild, commissioning and performance trials. All manufacturer’s recommendations and requirements must be followed for each stage of the removal and installation. All manufacturers’ documentation must be submitted to the TA prior to contract end.
- 13.3.1.4 Inspections must be completed by Transport Canada (TCMS), the TA and manufacturer’s representatives throughout the entire removal and installation process.
- 13.3.1.5 The propulsion diesel engine blocks remain the property of the Crown upon removal. All hazardous materials must be disposed of in accordance with all Federal, Provincial and Municipal regulations and certificates provided to the Inspection Authority.

#### 13.3.2 Component Certificates

- 13.3.2.1 The new engine blocks provided by the Crown are class approved and come with manufacturer’s warranty. This documentation can be provided to the Contractor upon request once engine has been delivered to Contractor’s facility.

- 13.3.2.2 Any parts required during the rebuild and installation of the new engine blocks outside the parts provided as GFM must be new, not reconditioned. These parts must be defined in a list and provided to TA for acceptance prior to rebuild. All parts must be purchased from the engine manufacturer. All new parts must carry manufacturer's warranties.

### 13.3.3 **Material Certificates**

- 13.3.3.1 The Contractor must provide all new material certificates to the TA prior to installation. Certificates must also be made available to all TCMS inspectors.

### 13.3.4 **Inspections, Reports and Certificates**

- 13.3.4.1 The Contractor must arrange for TCMS inspectors to inspect all work throughout the removal and replacement of the engine blocks, the rebuild of the main engines and the commissioning of the engines. The Contractor must deliver to the TA all original signed compliance reports provided by TCMS with regards to this work.
- 13.3.4.2 The Contractor must supply the TA with a schedule of work to be completed. The Contractor must also provide TA with a signed certificate from the engine manufacturer stating the engine has been rebuilt within manufacturer's tolerances, operation tolerances are verified and accepted, and all warranties are accepted by manufacturer.
- 13.3.4.3 The Contractor must supply the TA with a work report from Wartsila including a set of all measurements for any reused engine parts, clearances between any new and reused parts and any final assembly alignment and running clearance measurements.
- 13.3.4.4 All hazardous material removed during the engine work must be disposed of by Contractor according to all federal, provincial and municipal laws. Signed disposal certificates must be provided by the Contractor to the TA confirming all disposal regulations have been followed.

### 13.3.5 **Tools and Supplies**

- 13.3.5.1 It is the Contractor's responsibility to provide all tools and supplies to complete the work required. No tools or supplies must be used from the ships inventory.

### 13.3.6 **Cleanliness**

- 13.3.6.1 Care must be taken while installing and rebuilding the new engines that no debris enters the engines. This must include cleaning of crank case of all debris prior to installing on new engine block, covering and protecting top end of engine block during installation, welding and reinstallation of both piping, deck plate and lifting



beams. Any problems resulting from debris entering the new engine must be repaired at Contractor's expense.

### 13.3.7 **Temporary Storage**

- 13.3.7.1 Each engine will have many components that must be removed and reinstalled once the new engine block is in place. While these parts are removed the Contractor must store them in a secure, dry environment. The Contractor must ensure that sufficient storage space exists so that each engine's associated parts are located together in an identifiable area.
- 13.3.7.2 All parts removed must be tagged with the following information: the engine number for which they are associated with; the engine sub-system they are a part of; and if possible, a part number or part description.
- 13.3.7.3 Pipes that are removed must be temporarily capped to prevent debris entering the system once reinstalled.
- 13.3.7.4 Any damage to parts temporarily removed must be repaired or replaced at the Contractor's expense.

### 13.3.8 **Lifting Procedures**

- 13.3.8.1 The Contractor must develop a lifting plan for all main engines taking into account the requirements of the engine manufacturer and the intended removal and installation routes. The plan must take into account the removal of any systems, components, and structures and how their removal may affect other work items in this specification.
- 13.3.8.2 All lifting procedures must be carried out in accordance with all industrial regulations for the region. Lifting appliances must have safe working loads (SWL) above all intended lifts. Only certified lifting gear with SWL within lifting tolerances must be used. Any off-axis lifting must consider all vector loads and lifting appliances designed to withstand these loads.
- 13.3.8.3 The lifting plan must be provided to the TA prior to work being commenced. All temporary lifting lugs must be removed prior to contract end. All lifting lug designs and calculation must be provided to TA prior to install.
- 13.3.8.4 All loose or rotating parts within both new and existing engines must be secured prior to lifting.

**13.3.9 Piping, Connections and Hangers**

- 13.3.9.1 All pipes and piping systems broken during the engine block removal and install must be broken at the most convenient pipe joint unless defined within this document. Pipe system removal must be kept to a minimum while providing a safe, clear working space for removing and installing the engine block with minimal risk of damage to surrounding systems. All broken pipe systems must be capped at both ends to prevent debris from entering.
- 13.3.9.2 Pipes that are removed must be stored in a clean and dry environment protected from damage. Any pipes damaged during the removal, storing and reinstallation must be replaced with new at the Contractor's expense.
- 13.3.9.3 All pipes must be proven clean and clear of debris prior to reinstallation.
- 13.3.9.4 All removed pipe work must be reinstalled in the original configuration. Any flanges and connectors damaged during removal must be replaced with new materials by the Contractor at Contractor's expense. All gaskets must be replaced with new materials by the Contractor at Contractor's expense.
- 13.3.9.5 All pipe hangers removed during the engine work must be reinstalled in original position and provide adequate support and protection to piping system. The Contractor must replace any isolating rubber during the reinstallation of the hangers.

**13.3.10 Commissioning Systems**

- 13.3.10.1 The Contractor must commission all systems that are either temporarily removed or had components disturbed during this specification item, and the systems must be returned to operable condition. The Contractor must flush all system to avoid debris damaging the system. The Contractor must provide TCMS inspection certificates for all systems requiring periodic inspections.

**13.3.11 Paint Application**

- 13.3.11.1 All surfaces to be painted must be cleaned and degreased. All new structural parts must be shot blasted; the corners must be rounded by grinding and primed with preconstruction primer in accordance with paint supplier's recommendations.
- 13.3.11.2 All disturbed or exposed steel affected by this work must be painted. The Contractor must supply all paint. One (1) primer coat must be applied followed by two (2) top coats. One (1) stripe coat must be applied on all welds, edges, across holes etc. before the application of the primer coats well as before the application of the first finish coat.

- 13.3.11.3 All painting applications must be carried out in accordance with paint manufacturer's specifications.
- 13.3.11.4 The paints must be International Paints, Intershield 300 primer and Intergard 740 for topcoat in bilge areas and Interlac 665 for topcoat in engineering spaces above the bilges. Equivalents must be presented to the TA for consultation. All paints in engineering spaces must conform to the Fire Resistance – Surface Spread of Flame – IMO Fire Test Procedure (2010).

#### **13.4 Scope of Work**

- 13.4.1.1 The Contractor must use the engine manufacturer's Field Service Representatives (FSR) to oversee all aspects of the existing engine disassembly, the block and crankshaft removals, the lifting and installation of the new engine block assembly, as well as carry out the complete rebuild of main engines and commissioning.
- 13.4.1.2 Engine Manufacturer's Contact Information;  
Wartsila Canada  
Unit 3, 90 Cutler Avenue  
Dartmouth, Nova Scotia B3B 0J6  
Tel: (902) 468-1264  
Fax: (902) 468-1265
- 13.4.1.3 The Contractor must be responsible for all aspects of the engine removal and reinstallation including; old engine block removals, preparation of engine beds for new engine block, removal of all auxiliary systems in way of the removal/entry route, cutting of access hole in deck if required, installing of lifting lugs, develop lifting plan, installing new engine block assembly, fit existing flywheel, aligning engine to coupling, seating engine on engine beds, connect driveline, reinstalling auxiliary systems, commissioning auxiliary systems, repairing access hole in deck if required, complete engine build of new engines and initial operation and commissioning of engines.
- 13.4.2 **Deck Cutout**
  - 13.4.2.1 The Contractor, in consultation with the engine manufacturer, must determine the maximum dimensions of the engine blocks after they have been stripped to their lifting configuration. The Contractor must cut an access hole in the aft working deck that is larger than the existing soft patch to the engine room.
  - 13.4.2.2 The proposed deck cut out must be designed with the minimum number of structural members being cut, and with minimal piping and electrical wiring disruptions. The proposed cut out plan including the welding schedule for reconstruction must be approved by TCMS and the TA prior to work commencing.

- 13.4.2.3 Temporary barricades must be installed in way of the access hole. These barricades must be removed prior to end of contract.
- 13.4.2.4 If the section of deck plate removed contains pipe penetrations, then the pipes must be disconnected at the nearest possible pipe joint and removed with the deck plating to keep the water tight penetrations intact. The section of deck plate must be stored by Contractor in accordance with Section 13.3.7 and reused once engine work is complete. Contractor must arrange for TCMS inspection of work and witness a hose test to verify water tightness prior to painting welds. All tests and inspections of this repair must be defined by Contractor and submitted to TA for approval prior to completion. All painting to be done in accordance with Section 2.8.
- 13.4.2.5 Any temporary lifting lugs must be removed prior to contract end.
- 13.4.3 **Main Engine Work**
  - 13.4.3.1 The new Wartsila Deutz SBV9M628 short block assemblies for installation will be Government Furnished Equipment.
  - 13.4.3.2 For further technical information concerning the engine blocks and installation please contact Wartsila Canada. The Contractor must ensure proper engine lifting lugs are supplied by Wartsila with the new short block assembly for lifting. These lugs can be removed and installed on old block to help facilitate removal. All work with respect to the main engine removal, install, rebuild and commission must be done in the witness of or using Wartsila Canada certified FSR's. The Contractor must be responsible for returning the lifting lugs to Wartsila at the end of the work.
- 13.4.4 **Existing Main Engine Removals**
  - 13.4.4.1 The Contractor must drain the engines and associated piping of all jacket water and main engine oil and dispose of these fluids in accordance with all applicable federal and provincial regulations. Disposal certificates must be supplied to the TA.
  - 13.4.4.2 The Contractor must disconnect and partially disassemble the four (4) main engines to the state that the blocks can safely be lifted and removed from the vessel. The Contractor must install the Wartsila approved lifting lugs onto the existing blocks.
  - 13.4.4.3 It is expected that the engines will be stripped to the point of only the crankcase (block), crankshaft, connecting rods, pistons, liners, and drive gears will remain on the engine for the lift out of the ship. This will result in a lifting weight of approximately 6,600 kg.
  - 13.4.4.4 The Contractor must measure the existing alignment of the main engines to the gearbox pinion shafts prior to loosening the main engine hold down bolts. Current

engine position must be marked by the Contractor on the engine beds at all four corners prior to removal of the engine block. Any adjustment to the alignment of any main engine that requires engine seat preparation work will be dealt with as PWGSC 1379 action.

- 13.4.4.5 Existing engine blocks must be prepared by Contractor for shipping to Wartsila's facility for partial overhaul. This must include proper temporary shipping seating, all tie-downs to properly secure equipment and shrink wrapped to avoid water accessing engine parts. Any damage caused to engine and crankshaft due to improper shipping preparation must be repaired by OEM at Contractor's expense.
- 13.4.4.6 The Contractor must have Wartsila Canada complete the disassembly of the blocks and running gear, clean the engines, and reassemble the engines to maintain warranty.
- 13.4.4.7 At the completion of the Wartsila shop work, the Contractor must ship the engine blocks from Wartsila's facility to the vessel. The Contractor must be responsible for crating and shipping the blocks, and any subsequent damage due to improper shipping or shipping preparations must be repaired by the OEM at Contractor expense. If the Contractor is not immediately ready to install the engines, then the Contractor must store the engines as described in section 13.3.7.
- 13.4.5 **Cleaning of Area IWO Engine Block**
  - 13.4.5.1 Once the existing block is removed the crank case must be completely cleaned of all debris, oil and residue. The bilge beneath the crank case must also be cleaned and removed of all oily residue and debris prior to the new block being installed. The engine beds must be cleaned and all old chocking material and paint removed. Engine beds must be buffed down to bare metal in accordance with Chock Fast recommendation. Once bilge and engine beds are cleaned the Contractor must have the TA inspect the area and approve prior to repositioning the crank case and installing the new block. All removed material must be disposed of in accordance with all Federal, Provincial and Municipal regulations. Copies of all disposal certificates must be presented to the TA.
- 13.4.6 **Engine Beds**
  - 13.4.6.1 Alignment plates may require removal during the engine removal stage, and if so they must be welded to the engine beds using the marks provided prior to the engine removal as guidance. Once final alignment and engine fastening, any alignment plates interfering with engine assembly must be removed.
  - 13.4.6.2 To bed the engine the Contractor must use Chock Fast provided by Philadelphia Resins. The Contractor must provide an updated Chock Fast Pad dimensions drawing and Chock calculations. All chocking must be completed in accordance

with manufacturer's recommendations, TCMS and Wartsila requirements. The Contractor must supply 2 sample blocks per engine of the mix used for the mounts, and provide hardness test results for all blocks once cured.

**13.4.7 New Block Installation**

- 13.4.7.1 The new engine must be unpacked from its shipping crate and inspected by Wartsila prior to installation. Contractor must use Wartsila provided lifting lugs to lift the engine assembly. The Contractor must lower the new engine block assembly into the engine room space. For final manipulation into position the Contractor must use the installed lifting lugs and lifting tackle detailed in Section 13.3.8. All installation details must be in accordance with manufacturer's recommendations and under the supervision of a Wartsila FSR to ensure proper installation.

**13.4.8 Engine Alignment**

- 13.4.8.1 The engine must be aligned using the alignment plates and jacking screws installed on the engine. Alignment must be done under the supervision of Wartsila and witnessed by the TA in accordance with the requirements for the Vulkan Rato S Coupling. The existing Vulkan coupling and flywheel must remain and be used to connect the engine to the gearbox. All Alignment must be completed using laser measurement devices or other standard marine industry practices as approved by TA and TCMS. A report must be developed by the Contractor stating all tolerances have been met and must be submitted to TCMS for approval. Once approved the original signed report must be submitted to the TA prior to contract end.

**13.4.9 Engine bolting and Chocking**

- 13.4.9.1 The engine must be aligned to the engine beds using fitted bolts using chock fast using a Class approved method and in accordance with Wartsila requirements. Drawings of the fitted bolts must be submitted to the TA for acceptance.
- 13.4.9.2 Chock fast must be poured by a qualified technician and final torqueing of the bolts must be in accordance with Wartsila and Chock fast installation requirements. Any coffer dams or moulds used during the pouring of the Chock fast must be removed upon completion.

**13.4.10 New Engine Rebuild**

- 13.4.10.1 The Contractor must contract Wartsila Canada certified FSR's to complete the engine rebuild and connection of driveline. The Wartsila technicians must utilize all owner supplied equipment as defined in the GFM list (Table 13-1) to rebuild the engine. All GFM parts provided must be new or reconditioned and measured to be within manufacturer's tolerances for reuse until the next overhaul period.

13.4.10.2 Any additional parts required outside of the equipment provided by the owner must be defined in a list prior to the rebuild and submitted to the TA for approval. Purchase of any additional parts will be by submitting a PWGSC 1379 Form.

13.4.10.3 During the rebuild the Contractor must ensure access to the area for the TA to carry out inspections. All work carried out must be carried out in accordance with manufacturer's specifications as well as to the TA's satisfaction. Once engine rebuild is complete and all auxiliary's system are attached the Contractor must provide the TA with a signed reported from Wartsila Canada in accordance with Section 13.3.4.

#### 13.4.11 **Performance Trials**

13.4.11.1 The Contractor under the guidance of Wartsila Canada must perform a set of performance trials to ensure the engine is operating at optimum performance. A trial agenda must be submitted to the TA and TCMS for approval prior to the trials, in accordance with section 7.0. Any deficiencies noted during the trials must be rectified by the Contractor under the guidance of Wartsila prior to acceptance by the TA. Any additional work required to repair deficiencies must be completed at Contractor's expense.

#### 13.4.12 **Surrounding Systems**

##### 13.4.12.1 FM200 Fire Suppression System

13.4.12.1.1 The Contractor must hire a contractor certified to work on a Kidde Marine FM200 system to disconnect and remove any portion of FM200 suppression system in way of the engine removal/access path. During this time the Contractor must isolate this portion of the fire suppression system including all alarms, discharge pipes etc. Once engine work is completed the Contractor must reinstall the portion of the fire suppression system, reinstate all alarms, charge the system, prior to the completion of the annual inspection of the ship's fire suppression system.

##### 13.4.12.2 Lifting Beams

13.4.12.2.1 The lifting Rails located over the main engines may need to be removed. Care must be taken to maintain these rails especially to protect the running rails.

13.4.12.2.2 If these rails must be removed for the engine removal and install, it must be kept in mind that these rails are required to be in place for the dismantling and prior to the building of the main engines by Wartsila as they will require them to lift various components. Temporary storage of these items must be in accordance with Section 13.3.7.

13.4.12.2.3 When reinstalling the lifting beams the Contractor must ensure the beams are within a maximum deviation of <2 degrees from horizontal. Once lifting beams

are installed a static load test must be carried out in accordance with TCMS regulations and witnessed by TCMS inspectors to provide a safe working load. The lifting capacities for each beam must be maintained (SWL 3 ton).

#### 13.4.12.3 Electrical Trays

- 13.4.12.3.1 Any electrical wire trays running over the main engines are attached to the deck head and must remain intact throughout this work.

#### 13.4.12.4 Lighting

- 13.4.12.4.1 The Contractor must disconnect in accordance with Section 13.3.8 all permanent lighting in way of the engine removal/access route. These permanent lights must be removed and stored in a suitable location in accordance with Section 13.3.7. The Contractor must supply auxiliary lighting in the area surrounding the main engines for the duration of the removal/installation process. Once the new engine block is in place the ship's permanent lighting can be reinstalled and commissioned to be used during the engine rebuilding process.

### 13.5 Documentation

- 13.5.1.1 The Contractor must make reference to Section 6.2.4 for the documentation requirements for the main propulsion diesel engines block replacement.
- 13.5.1.2 The Contractor must consult with TCMS and define an inspection schedule. This schedule is to be provided to the TA for approval. The Contractor must deliver to the TA all original signed compliance reports provided by TCMS with regards to this work.
- 13.5.1.3 The Contractor must supply the TA with a schedule of work to be completed. The contractor must also provide TA with a signed certificate from the engine manufacturer stating the engine has been rebuilt within manufacturer's tolerances, operation tolerances are verified and accepted, and all warranties are accepted by manufacturer.
- 13.5.1.4 The Contractor must supply the system warranty information to the TA.

### 13.6 Inspections, Tests and Commissioning

#### 13.6.1 Inspections and Tests

- 13.6.1.1 The Contractor must arrange for TCMS inspectors to inspect all aspects of the engine overhauls.
- 13.6.1.2 During the main engine removals and installations, Wartsila Canada must be involved with the inspection of equipment, lifting plan, installation, alignment and



total overhaul of the engines. All documents and reports provided by Wartsila must be handed over to the TA at contract end.

13.6.1.3 The Contractor must schedule and conduct the commissioning, dock and sea trial testing of the propulsion systems. Commissioning of the propulsion systems must be done in accordance with the manufacturer's requirements and the dock and sea trials must be performed to the requirements of TCMS. The Contractor must prepare dock and sea trial test sheets according Section 7.0 of this Specification. The Contractor must seek TCMS approval of the dock and sea trial procedures prior to the commencement of the trial periods.

13.6.1.4 TA must inspect all aspects of the work being completed. All work completed must be to the TA's satisfaction.

#### 13.6.2 **Commissioning**

13.6.2.1 The Contractor must commission all systems affected by the engine overhauls. All pipe systems must be commissioned in accordance with Section 13.3.10. All main engine commissioning must be carried out by the Wartsila Canada FSR's.

13.6.2.2 Performance trials must be in accordance with Section 7.0.

13.6.2.3 Any part of the equipment that proves to be defective during any part of the tests must be replaced or repaired. Such occurrences may render the tests void or require further testing to be carried out to the satisfaction of TCMS and/or the Inspection Authority. New gaskets, seals, fuel oil, and lubricating oil filter elements must be installed after final testing and final inspection.

**Table 13-1: GFE Main Engine Spare Parts**

	<b>Part No.</b>	<b>Description</b>	<b>Qty.</b>
1	PAAS000557	SPARE PART SET LUBE OIL PUMP	4
2	PAAS004019	SPARE PART SET GASKET GEAR BOX	4
3	PAAS000563	SPARE PART SET OVERHAUL GEAR TRAIN	4
4	PAAS000249	EXPLOSION RELIEF VALVE	12
5	DZ02922181	GASKET SET	4
6	PAAS000558	SPARE PART SET GOVERNOR DRIVE GENERAL	4
7	PAAS000643	SPARE PART SET FOR GOVERNOR DRIVE	4
8	PAAS000566	SPARE PART SET MASTER START VALVE	4
9	PAAS003983	SPARE PART SET OVERHAUL FUEL INJECTOR	36
10	PAAS000555	SPARE PART SET LUBE OIL COOLER	4
11	PAAS003982	SPARE PART OVERHAUL SET CYLINDER HEAD	36
12	PAAS003984	SPARE PART SET OVERHAUL 4-RING PISTON	36
13	PAAS003986	GASKET SET CYLINDER LINER	36
14	PAAS003943	SPARE PART SET OVERHAUL CYLINDER HEAD	36
15	DZ04093413	MAIN BEARING	40
16	PAAE072373	CYLINDER LINER	9
17	DZ02071711	GASKET	4
18	DZ02071710	GASKET	4
19	DZ01168413	FELT ELEMENT	8
20	DZ01262535	SEALING RING	4
21	DZ12027411	SEALING RING	8
22	DZ12154599	SEALING RING	8
23	DZ02089104	CRANKCASE (BLOCK)	4
24	DZ04064043	SHIM	8
25	DZ01167374	O-SEAL	144
26	DZ04094270	PLAIN WASHER	144
27	DZ01167374	O-SEAL	128
28	DZ01153784	HEXAGON BOLT	12
29	PAAC000122	HEXAGON HEAD SCREW	48
30	PAAC000022	HEXAGON NUT	48
31	DZ01112633	HEXAGON BOLT	12
32	000000185 013	HEXAGONAL NUT M14	24
33	GRP99999	TC repair parts for qty 4 turbos	1
34	GRP99999	Rotor repair parts for qty 4 turbos	1
35	636306414DT920	COOLING WATER DE-AERATION DN80 55	4
36	PAAE144774	WARNING SYSTEM	4
37	PAAS000967	PRESSURE SWITCH	4
38	DZ04091662	BUSH	36
39	DZ04091884	BUSH	36
40	DZ03353136	PLAIN WASHER	36
41	DZ04062351	HEXAGON NUT	36
42	DZ01112852	HEXAGON NUT	36

43	DZ01120082	COMPRESSION RING	72
44	DZ01164748	O-SEAL	36
45	DZ01120065	COMPRESSION RING	72
46	000004496 101	LIQUID LOCKING MEDIUM 50CC	36
47	DZ04091673	VALVE	36
48	DZ04079617	COMPRESSION SPRING	36
49	DZ04091695	PISTON	36
50	DZ04091674	PISTON	36
51	DZ01138768	HEXAGON BOLT	400
52	DZ01138772	HEXAGON NUT	400
53	DZ01148594	HEXAGON BOLT	64
54	DZ01148597	HEXAGON NUT	64
55	DZ02929278	SEALING RING	136
56	DZ04055005	COMPENSATOR	32
57	DZ04055031	GASKET	8
58	DZ04055034	EXHAUST GAS BAND	8
59	DZ04055035	EXHAUST GAS BAND	8
60	DZ04055038	MULTI-PULSE CONVER	4
61	DZ04055040	COMPENSATOR	4
62	DZ04055050	EXHAUST GAS BAND	8
63	DZ04055051	EXHAUST GAS BAND	8
64	DZ04055061	EXHAUST PIPE	4
65	DZ04055062	EXHAUST PIPE	4
66	DZ04055063	EXHAUST PIPE	4
67	DZ04055064	EXHAUST PIPE	4
68	DZ04055065	EXHAUST PIPE	4
69	DZ04055118	CASING EXHAUST MANIFOLD	36
70	DZ04073025	HEXAGON BOLT	144
71	GRP99999	Special connection to VTR251	4
72	DZ04092288	FILLER	16
73	DZ04093410	GASKET	36
74	DZ01100120	HEXAGON BOLT	72
75	DZ01112636	HEXAGON BOLT	72
76	DZ12151279	LOCK WASHER	144

## **14.0 PROPULSION CONTROL SYSTEM REPLACEMENT (SURVEY ITEM)**

### **14.1 Identification**

14.1.1.1 The intent of this specification is for the Contractor to install a new GFE propulsion control system for the vessel complete with all sensors, displays, indicators, meters, alarms and other informational devices under the guidance and supervision of Wartsila approved FSR's.

14.1.1.2 The Contractor must also integrate and coordinate the PCS with the following specification items:

- Section 15.0 – Steering Gear Control Upgrade
- Section 24.0– Bow Thruster Replacement;
- Section 27.0 – Stern Thruster System Upgrades

### **14.2 Applicable Documents**

The following documents are applicable to or interface with the task requirements of this section:

- TP 127E;
- IEEE 45 STD -2002;
- Lloyd's Classification Society Rules;
- Canada Shipping Act 2001, Machinery Regulations;
- Wartsila PCS Installation Package;
- Drawing List below.

<b>Drawing Number</b>	<b>Description</b>
VNEA2 400-000	Misc. Outfitting Booklet 1 of 52
VNEA2 400-000	Misc. Outfitting Booklet 2 of 52
VNEA2 400-000	Misc. Outfitting Booklet 3 of 52
VNEA2 752-000	Machinery Control Room Seats and Floor Arrangement
VNEA2 752-002	Wheelhouse Arrangement 1 of 2
VNEA2 752-003	Electronics Room Battery Locker
VNEA2 E-2	Propulsion System Block & Connection Diagram 1 of 6
VNEA2 E-2	Propulsion System Block & Connection Diagram 2 of 6
VNEA2 E-2	Propulsion System Block & Connection Diagram 3 of 6
VNEA2 E-2	Propulsion System Block & Connection Diagram 4 of 6
VNEA2 E-2	Propulsion System Block & Connection Diagram 5 of 6
VNEA2 E-2	Propulsion System Block & Connection Diagram 6 of 6
VNEA2 E-45	Gyro Compass system
VNEA2 E-46	Autopilot Steering Control and Rudder Angle System
VNEA2 E-68	Vessel Positioning System
VNEA2 SC 382-25	Slip Supervision 2
VNEA2 SC 382-25	Slip Supervision

### 14.3 Scope of Work

14.3.1.1 The Contractor must retain the services of a Wartsila Canada FSR as the supplier of the new PCS to provide guidance and instruction on all aspects of this specification item. This is to ensure the correct components are removed or retained, and that the new system is installed in good order to preserve the warranty of the system.

14.3.1.2 All Category “A” material removed from the vessel are to be returned to the Technical Authority. All “B” material must be re-installed in accordance with Section 1.11.2. All “C” material removed must become the property of the Contractor and must be disposed of in accordance with all Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.

14.3.1.3 The following equipment has been categorized for handling as per Section 1.11.2:

<b>Equipment/Material</b>	<b>Category</b>
Existing Propulsion System Controls	A
Redundant Existing Propulsion System Sensors	A
Steering Control Devices	A
Scrap materials, wiring	C
Communication Devices - Radios	B
Communication Devices – Telephony System	B
Controllers – Window wiper, Horns/sirens	B
Indication Devices	B
Redundant Electric Cabling & Wiring	C
Redundant PCS components	C
Scrap steel	C

#### 14.3.2 Existing Propulsion Control System Removal

14.3.2.1 The Contractor must disconnect and remove the existing propulsion control system fitted in the ECR, Bridge Center Console and Bridge Wing Console and Bridge Aft Console. This must include all electrical controls, hardware, wiring and the operator interfaces as noted in the Wartsila PCS Installation Package included in the Technical Data Package.

14.3.2.2 The Contractor must decommission all services and systems of the consoles noted below and remove the following:

- a) Engine Control Room (ECR) main Console components only not including the physical console;
- b) Bridge Forward Console components only, not including the physical console;
- c) Bridge Wing Consoles (2) including the physical consoles.

This includes all gauges, control devices, lamps/LEDs, wiring, wiring system components, communication devices and all other redundant system components of these consoles, including those not associated with the Propulsion Control System (PCS).

- 14.3.2.3 The Contractor must also disconnect and remove and dispose all redundant electrical cabling associated with all respective services, communication devices, gauges, control devices, and indication devices associated with the equipment removal. Wiring that will remain to be reconnected to retained equipment must be properly labeled and protected.
- 14.3.2.4 The Contractor must disconnect and remove the following components, including all associated wiring, brackets, enclosures:
- a) FAMP-S: The FAMP-S system is located in the Engine Control Room (ECR) in two cabinets. Each cabinet supports the power supply requirements and main processors for the PCS on one side of the ship.
  - b) TESH-1: The Tesh-1 telegraph system functions as both a conventional telegraph system and as an input device for pitch and RPM commands to the FAMP-S system. Telegraph stations are located at the Bridge Forward, Port, and Starboard consoles, the ECR console, and at each gearbox.
  - c) NORIS SPEED MEASURING: There is one Noris Speed Measuring System panel mounted for each engine on the bulkhead above the propulsion gearboxes.
  - d) DEUTA WERKE: There is one Deuta Werke slip monitoring panel mounted for each gearbox. The system has three speed sensor inputs: one from each engine clutch pack and one from the main propeller shaft.
  - e) TORDUCTOR: There is one Torductor panel mounted for each shaft. The system uses a sensor assembly mounted around the propeller shaft just aft of the propulsion gearboxes.
  - f) WOODWARD 723 GOVERNORS: Each main engine is fitted with a Woodward 723 electronic governor. The governors are fitted in the ERC, with electro-hydraulic Woodward EG10PC rack actuators with PMC RVDT rack position transmitters fitted on each engine.
  - g) JOYSTICK CONTROL: An ASEA joystick control and vector computer are fitted at the Bridge aft console and bulkhead mounted.
  - h) C-CAN BATTERY CHARGING SYSTEM: Two sets of Battery Chargers/Rectifiers and gel cell battery banks provide 24VDC power for numerous control and monitoring systems. Removals include all breakers in the distribution system.

### 14.3.3 **Installation of New Propulsion System**

- 14.3.3.1 The Contractor must run new cabling, modify the existing consoles, fabricate and install new mounting arrangements for the following GFE components:

Qty	Description
2	LIPSTRONIC® CPP control cabinets
1	ECS Propulsion Control Section, integrated in ECS Control Panel
1	ECS Propulsion Indication Section, integrated in ECS Control Panel
1	BCS Propulsion Control Section, integrated in BCS Control Panel
1	BCS Propulsion Indication Section, integrated in BCS Control Panel
1	ACS Propulsion Control Section, integrated in ACS Control Panel (in 2 parts)
1	PWS Propulsion Control Sections, integrated in PWS Control Panel
1	SWS Propulsion Control Sections, integrated in SWS Control Panel
1	Telegraph System
1	LIPS-STICK® Control Cabinet
1	LIPS-STICK® Aft bridge Control Station (ACS-LS) Section, integrated in ACS Control Panel
1	MIMIC Touchscreen Display, integrated in ECS Control Panel
2	High speed Torque measurement systems
2	Slip detection systems
2	C-CAN Battery charging systems, with distribution breakers

- 14.3.3.2 For the purpose of this installation, the Contractor must be responsible for the running of new cabling, modifications to existing consoles, the fabrication and installation of new mounting arrangements for new components, and removal of surplus equipment including redundant mounting brackets and cabling. All activities will be as per the direction of the FSR.

- 14.3.3.3 The Contractor must ensure that all electrical supplies for the identified equipment have been isolated and are secured prior to work commencing.

### 14.3.4 **Connection of Field Devices to GFE Equipment**

- 14.3.4.1 To facilitate this installation, it is intended that all existing communication and electrical cabling will be reused ONLY if it meets the performance requirements as specified by the manufacturer. Prior to reuse, the Contractor must conduct continuity and insulation testing on the existing cabling and verify its suitability for reuse.

- 14.3.4.2 The Contractor must supply and install all necessary hardware to connect the individual field devices for the new PCS from the field devices or field device junction boxes to the Wartsila supplied equipment.
- 14.3.4.3 The Contractor, in conjunction with the Wartsila FSR, must coordinate the interface requirements of the individual field devices that will be used for the data collection for the PCS.
- 14.3.4.4 All instrumentation cabling used for the interconnection of the field devices to the PCS must meet TCMS approval requirements.
- 14.3.4.5 All instrumentation cabling must meet and follow the general cable requirements as identified in Sections 4 of this Specification.
- 14.3.5 **Installation of PCS in Engine Control Room**
  - 14.3.5.1 The new Wartsila supplied PCS cabinets must be mounted within the Engine Control Room in such a manner that it is accessible from the front, all modules and power supplies are removable, and there is ample access to all field wiring and terminals as recommended by the manufacturer.
  - 14.3.5.2 The Contractor must ensure space and ventilation requirements are in accordance with the manufacturer of the PCS cabinets. The Contractor must adhere to the requirements of Sections 4.0 and 5.0 of this Specification for the mounting and bonding requirements of electronic equipment. Care must be exercised in the installation of the PLC system to ensure minimum interference from other electrical A/C systems and following all recommendations of the system manufacturer with regards to component cooling requirements, spacing, and grounding.
- 14.3.6 **Installation of Operator Controls at the Operator Stations**
  - 14.3.6.1 The Contractor must be responsible for the installation of Wartsila supplied drop in control panels which include all required operator interfaces for the safe operation, control and monitoring of the Propulsion system from each of the four operation stations: ECR Console, Bridge Forward Console and Bridge Wing Consoles and Bridge Aft Console.
  - 14.3.6.2 Cut outs have been provided to reinstall the removed communication devices, controls for window wipers, horns/sirens and steering controls on the bridge consoles. Any cut outs not provided must be made by the Contractor with special care to be taken not to damage the new anodized surface coating of the Drop-in panel. This work must be done in coordination with Section 15.0 Steering Gear Controls, Section 24.0 Bow Thruster Replacement and Section 27.0 Stern Thruster System Upgrades.



- 14.3.6.3 The Contractor must modify the Bridge Center Console and ECR Consoles structures' as required for the installation the new Bridge Center and Bridge Wing Console Drop-in Panels and related panel devices. This must include additional reinforcing structure to prevent the Drop-in Panels from being unsupported over their length. The location of reinforcing structure must be determined in conjunction with the FSR and with actual measurements from the supplied Drop-in panels.
- 14.3.6.4 The Contractor must remove and modify the Bridge Wing Consoles structures' as required to accommodate the design change in the shape of the console. Each console must maintain the same footprint for mounting, however must have the outboard side flared out to provide an additional 6" width. The console must also be modified to allow for an angled surface facing aft as shown in the Wartsila Installation Package, and for the installation the new Bridge Wing Console Drop-in Panels and related panel devices. The Drop-in Panels must be mounted as far to the outboard edge as possible on the Wing Consoles. This must include additional reinforcing structure to prevent the Drop-in Panels from being unsupported over their length. The location of reinforcing structure must be determined in conjunction with the FSR and with actual measurements from the supplied Drop-in panels. Access panels must be installed on the forward and aft sides of the console to allow for full access to all wiring and components.
- 14.3.6.5 The Contractor must install, commission and test the new Drop-in Panels and all associated components.
- 14.3.6.6 All cables connecting to the Console Drop-in Panels must be on the underside of the panel from the interior of its respective Console.
- 14.3.6.7 The panels must have positive threaded securing arrangements with locking material used to prevent rattling.
- 14.3.6.8 All new ECR Console, Bridge and Bridge Wing Console Drop-in Panels and associated equipment/components are to be supplied with any specialty tools required for routine maintenance.
- 14.3.6.9 The Contractor must modify the MCR Consoles structure as required to accommodate the design changes in the layout of the console. The console must be modified to allow for the relocation of the EasyGen ship service generator panels, the installation of a two new drop in panels and related panel devices. This must include additional reinforcing structure to prevent the Drop-in Panels from being unsupported over their length. The location of reinforcing structure must be determined in conjunction with the Wartsila FSR and with actual measurements from the supplied Drop-in panels.
- 14.3.6.10 The MCR console section to the right of the Electrical Mimic Panel will receive a new drop in panel to accommodate new steering gear controls and start button

components. To accommodate this modification, the existing buttons must have all wiring disconnected, labeled and protected if they are to be reused. Lights and buttons that are being relocated to the new location below the MFR's will need wiring stripped back to the closest terminal block to accommodate longer wires being installed. Wiring that is redundant must be removed and disposed of as Category "C" property.

14.3.6.11 Upon installation of the new Emergency Fire pump and Air Compressor control buttons, the wiring must be reconnected and the button functions tested in the presence of the TA.

14.3.6.12 The MCR console section to the left of the Propulsion Control section will receive new MFR's, indication lights and start button components. To accommodate this modification, the new lights and buttons must have new wiring connected from the terminal blocks noted above to the new component contactor blocks. This work must be performed in conjunction with the work in Section 15.0 Steering Gear Control Upgrade and Section 22.0 Switchboard Upgrades.

14.3.6.13 Upon installation of the new Generator control buttons and lights, Engineer Call button, Stern Thruster servo pump controls, Bow and Stern Thruster indicating lights and VTS Alarm Silence button, the wiring must be reconnected and the button functions tested in the presence of the TA.

#### 14.3.7 **Interface to the Propulsion Diesels and Propulsion Drives**

14.3.7.1 The Contractor, in conjunction with the Wartsila FSR, must coordinate the control and feedback signal requirements necessary for the propulsion control system. This must include all signal and feedback requirements to meet the performance requirements of the propulsion control system.

14.3.7.2 The Contractor must supply, arrange, install test and commission all hardware, cabling, communication interfaces and field devices necessary for the propulsion control system.

#### 14.3.8 **System Power**

14.3.8.1 Power for the 110 VAC portion of the propulsion control system must be through the UPS supply as specified in the Wartsila Installation Package.

14.3.8.2 Power for the 24 VDC portion of the propulsion control system must be through the Wartsila supplied 24 VDC charging and distribution system supplied as part of the Wartsila Installation Package.

**14.3.9 Defects**

- 14.3.9.1 Any part of the equipment that proves to be defective during any part of the tests must be replaced or repaired. Such occurrences may render the tests void and require further testing to be carried out or a complete retest of the applicable device(s) or function(s) including other dependant systems, to the satisfaction of TCMS and/or the Inspection Authority.

**14.4 Proof of Performance**

**14.4.1 Testing and Commissioning**

- 14.4.1.1 On installation all of the system process variables (both derived and real) are to be verified through process function where possible or through closest to process simulation – i.e. physically lifting a level switch, and/or signal injection at the field device.
- 14.4.1.2 The Contractor must utilize the reporting functions of the AMS to provide test verification of all PCS monitored points for inclusion in the final test documentation package. The tests must be witnessed by the Inspection Authority.
- 14.4.1.3 Prior to connection to the system, the Contractor must measure all field cabling to ground with readings recorded to verify isolation. Any circuits that have a measurement under 100 MOhms must be identified and repaired before any devices are connected to the cables. Due care must be taken with the type of instrument that is used to take these measurements. Under no circumstances must a Megger Tester be used on a conductor that is connected to sensitive electronic devices. The Contractor must be responsible for any damage that occurs through incorrect facilitation of these tests.
- 14.4.1.4 The Contractor must provide the following test documentation to the Technical Authority (each test record must have a sign-off area for the Inspection Authority and the Contractor):
- a) Megger test sheets for each tested conductor (with readings);
  - b) Tests for each process variable and functionality of all hardware devices;
  - c) Installation inspection sign-off sheets for each hardware location;
  - d) Pull test for each termination.

**14.4.2 Onboard Tests and Commissioning**

- 14.4.3 The Contractor must provide the services of a FSR(s) onboard the vessel for the duration of the test periods for the support of the system. The personnel provided must be intimately familiar with the system specific configuration and must have the capability to support all elements of the Contractor's scope of supply. The Contractor must provide as many people as necessary to carry out the tests and support all parts of the system during commissioning, dock trials and sea trial periods.

- 14.4.4 Testing and demonstrations onboard must be conducted to demonstrate that all system aspects are in compliance with the regulatory requirements of TCMS, the relevant Classification Society and this Specification. A report on all testing and findings must be submitted to the TA and IA prior to the acceptance of this item.
- 14.4.5 Dock and sea trials must be conducted to verify the operation of all components fitted to the propulsion equipment in accordance with the Class Approved Trials Plan included in the Wartsila PCS Installation Package.

## **14.5 Deliverables**

### **14.5.1 Reports**

- 14.5.1.1 The Contractor must provide the TA with a typewritten report of the Contractors work in both electronic and hardcopy formats outlining the details of the inspection and any alterations / repairs made prior to the acceptance of this item.
- 14.5.1.2 The Contractor must provide a complete device list for all components and devices used in the PCS that were Contractor supplied. The device list must show the part numbers, manufacturers, the quantity installed and any replacement part numbers.
- 14.5.1.3 The Contractor must provide a complete list of all the final operating parameters and set points programmed into the PCS at the completion of all tests and trials.

### **14.5.2 Drawings**

- 14.5.2.1 The Contractor must generate new “As Fitted” drawings for the work in accordance with Section 6.1.6 of this Specification. The Contractor must ensure that all interconnection drawings are revised to capture any alterations to the working drawings.

## **14.6 Training**

### **14.6.1 General**

- 14.6.1.1 The Contractor must supply the services of a qualified trainer(s) familiar with the system specific installation to provide training to the ship’s crew in the proper operation and maintenance of the PCS and Control Power Systems.
- 14.6.1.2 This training must include:
- a) Familiarization with all major devices within the systems;
  - b) System specific training covering all functions of the systems, maintenance requirements and troubleshooting of the systems through practical exercises;
  - c) Training on use of the various software applications available to view the system and process variable statuses and to provide assistance in the isolation of field problems;

- d) Training on the interpretation of the programming style used within PLC and control system;
- e) Training and demonstration / labs on the complete recovery through procedures included in the documentation portion of the delivered system on the restoration of each of the complex devices with system specific configuration;
- f) System specific questions and exercises that promote and test an understanding of the plant configuration, the philosophy of operation and design and the mode of failure for all major system elements;
- g) Training on the integration of the PCS, and Control Power Systems to other systems within the vessel – i.e. the Propulsion Diesels, Thrusters, etc.;
- h) Instruction on the use of system documentation and schematics.

#### 14.6.2 **Course Design**

- 14.6.2.1 The Contractor must provide an outline of the course along with a course schedule 30 days prior to the delivery of the course. The Contractor must adjust the course content and schedule as required through consultation with the Technical Authority.

#### 14.6.3 **Delivery of Classroom Training Course**

- 14.6.3.1 The Contractor must provide a one week (7 day) classroom based course covering all areas as outlined above for 8 personnel.
- 14.6.3.2 The Contractor must provide all classroom and training support facilities.

#### 14.6.4 **Delivery of the Onboard Training Course**

- 14.6.4.1 In addition to the classroom portion of the training the Contractor must provide a practical systems training course on the vessel for 8 personnel.
- 14.6.4.2 This course may be provided after sea trial completion as part of a shake down of the vessel systems and a hands-on training opportunity.
- 14.6.4.3 The course must be held based on the vessel and prior to vessel acceptance.
- 14.6.4.4 This course must provide the participants with practical troubleshooting and procedural based training and exercises utilizing the vessel as a training laboratory.
- 14.6.4.5 The course must be designed to ensure the safety and security of the vessel and crew is never compromised.

14.6.5 **Course Content and Media**

- 14.6.5.1 The Contractor must provide all course material to each participant in electronic format and in paper based training manuals complete with all necessary drawings and schematics.
- 14.6.5.2 The course content, including training manuals, course syllabus, and course mock-ups will become the property of Canada upon completion of the work and delivery of the vessel.

## **15.0 STEERING GEAR CONTROL UPGRADE (SURVEY ITEM)**

### **15.1 Identification**

The intent of this specification is for the Contractor to install a GFE supplied steering gear control system under the guidance and supervision of the Jastram Technologies approved FSR's. Please refer to Table 15-1 for the GFE list of equipment for this specification item.

### **15.2 References**

#### **15.2.1 Installation Instructions**

Jastram Technologies Installation Package (Technical Data Package)

#### **15.2.2 Standards**

- a) Fleet Safety and Security Manual (DFO/5737)
- b) TP127 – Ship's Electrical Standard
- c) IEEE 45:2002 – Recommended Practice for Electrical Installation on Ships
- d) Society for Protective Coatings (SSPC) Standards

#### **15.2.3 Regulations**

- a) Canada Shipping Act 2001 – Marine Machinery Regulation

#### **15.2.4 Drawings**

<b>Drawing Number</b>	<b>Drawing Name</b>
VNEA2 291-005	Steering Gear Hydraulic Reserve Tank
VNEA2 451-004	Steering Gear Compartment
VNEA2 452-002	Steering Gear Hydraulic Piping
VNEA2 E-1	Electrical Power Single Line Diagram 1 of 2
VNEA2 E-1	Electrical Power Single Line Diagram 2 of 2
VNEA2 E-46	Autopilot Steering Control & Rudder Angle System
VNEA2	Wagner Steering Gear Cabling Diagram
VNEA2	Wagner Steering Gear Cabling Wiring Diagram
VNEA2	Wagner Steering Gear Cabling Wiring for RAI
VNEA2	Wagner Steering Gear Control Box
VNEA2	Wagner Steering Gear Hyd Schematic

## **15.3 Technical**

### **15.3.1 General**

- 15.3.1.1 Contractor must supply all equipment, enclosures, ventilation, staging, chain falls, crane, slings and shackles necessary to perform the work. All lifting equipment must be appropriate for the expected duties, and be accompanied by current

certification indicating, or be permanently marked as to being, of an adequate safe working load for the expected duties. Any brackets or other welded attachments required in the performance of this specification must be welded into place by CWB-certified welders certified to welding Std. W47.1, Div. 1 and 2.

- 15.3.1.2 The Contractor must arrange for a Jastram Technologies field service representative (FSR) to provide guidance, instruction and oversee the installation of the steering gear control system.
- 15.3.1.3 The Contractor must be responsible to arrange for TCMS attendance in order to obtain a survey credit when completing this specification item.
- 15.3.1.4 The Contractor must clean all exposed steel surfaces and must be prepared to SSPC-SP-3 standard. Contractor must supply all coating products, and all coatings must be Wasser Paints. All prepared areas of steel to have coating system applied, as follows, according to the coating manufacturer's instructions. See Technical Data Package for Wasser Product Data Sheets.
- 15.3.1.5 The Contractor must supply and apply one (1) coat of Wasser primer – MC MIOZINC (DFT 3mil) to be applied to all prepared steel followed by an intermediate coat of MC-Ferrox B (DFT 3mil). A topcoat of MC Luster Semi Gloss – White RAL 9003 (DFT 3mil) must be applied after sufficient curing time is allowed for the previous coats and following all manufacturer's recommendations.
- 15.3.1.6 The Contractor must ensure that all identified piping isolations for the steering system are closed and are secured using an established lock-out / tagout system.
- 15.3.1.7 The Contractor must ensure that all identified electrical supplies for the system have been isolated and secured using an established lock-out / tagout system.
- 15.3.1.8 The Contractor must be responsible to drain the necessary hydraulic oil from the system to permit the work to be carried out on the system as well as replenish the oil in the system that has been lost due to this work. Oil replenishment must be of the same type as that already in use and must be filtered through a portable filtration unit, 2 micron rating, prior to being admitted to the system.
- 15.3.1.9 The Contractor must work in conjunction with a Coast Guard Electronics Technician to oversee the installation of the new steering system to ensure compliance with the applicable Coast Guard standards. The Contractor must provide the TA with 4 days' notice prior to the technician being required.
- 15.3.1.10 The Contractor must remove all components deemed redundant by this installation and categorize them as Category "A" property. Redundant wiring must be categorized as Category "C" property.



**15.3.2 Steering Gear Hydraulics**

- 15.3.2.1 Installation of components for the steering gear must follow the Jastram installation and service manuals.
- 15.3.2.2 The Contractor must be responsible to supply all piping, tubing, fittings, and hoses required for the retrofit of the steering gear with the Owner supplied parts. Black iron pipe is not to be used.
- 15.3.2.3 The Contractor must replace the eight (8) shut off valves installed on the hydraulic cylinders as per the Jastram Installation Package.
- 15.3.2.4 The Contractor must replace the twelve (12) flex hoses connecting the hydraulic cylinders to the system as per the Jastram Installation Package.
- 15.3.2.5 The Contractor must replace the two (2) Double Acting Relief and Bypass (DARB) valves as per the Jastram Installation Package.
- 15.3.2.6 The Contractor must replace four (4) hydraulic power units and integrate with the existing reservoirs as per the Jastram Installation Package.
- 15.3.2.7 The Contractor must install four (4) hydraulic lock alarm manifolds, one on each of the pump sets, and two (2) dual processor units in the steering gear compartment.
- 15.3.2.8 The Contractor must remove the existing rudder angle feedback units and install two (2) RFU 2000 and two (2) RFU 300 rudder angle feedback units on each rudder assembly.
- 15.3.2.9 Upon completion of all work, the Contractor must bleed all air from the hydraulic system and components and ensure a solid column of fluid is present in all lines prior to energizing the pump sets.

**15.3.3 Steering Control and Instrumentation**

- 15.3.3.1 Installation of components for the steering control must follow the Jastram installation and service manuals.
- 15.3.3.2 The Contractor must be responsible to supply and install all necessary cabling and terminal blocks required for the installation of this equipment. All cabling used must be as identified in the Jastram Installation Package. Prior to using existing cabling, the Contractor must conduct testing of the cable to determine its suitability for future use.
- 15.3.3.3 All wiring must be labeled as per the Jastram Installation Package during this installation.

- 15.3.3.4 The Contractor must install Digital Steering Controllers, Mode Control Processors, one (1) unit selector junction box, one (1) digital wheel, and one (1) rudder order indicator in the central console of the wheelhouse. The Contractor must remove all items deemed redundant by this installation and categorize them as Category “A” property.
- 15.3.3.5 The Contractor must remove the existing helm console and modify the center console to allow for the installation of the new digital wheel and autopilot control head. This newly fabricated section must follow the profile of the existing console and must be matched for finish.
- 15.3.3.6 The Contractor must install two (2) new panoramic rudder angle indicators in the deck head of the wheelhouse in the position of the old units. The power supplies for these units must be installed in place of the old power supplies.
- 15.3.3.7 The Contractor must install jog switches and two (2) rudder angle indicators, complete with dimmer, in each of the two wings and forward console in the wheelhouse. On each wing console, the Contractor must also install one (1) take-over switch and one (1) non follow-up interface (CP-375 control panel).
- 15.3.3.8 The Contractor must install one (1) CP-600 control panel in the central console of the wheelhouse.
- 15.3.3.9 The Contractor must install (2) rudder feedback units in the steering gear compartment and connect to the tiller arm. The Contractor must be responsible for the fabrication of any required mounting arrangements.
- 15.3.3.10 The Contractor must install one (1) emergency steering junction box in the steering gear compartment. This must be mounted as near the manual helm pump as practical.
- 15.3.3.11 The Contractor must install one (1) NavPilot 4000 Autopilot system on the bridge centre console in accordance with the manufacturer’s installation instructions.
- 15.3.4 **Motor Starter and Alarms**
  - 15.3.4.1 Installation of components for the motor starters and alarms must follow section 8 of the Jastram installation and service manual.
  - 15.3.4.2 The Contractor must be responsible to supply and install all necessary cabling and terminal blocks required for the installation of this equipment. All cabling used must be as identified in the Jastram Installation Package. Prior to using existing

cabling, the Contractor must conduct testing of the cable to determine its suitability for future use.

- 15.3.4.3 The Contractor must install four (4) AP-600 motor starter and alarm panels in the central console of the wheelhouse for the operation and control of the steering motors.
- 15.3.4.4 The Contractor must install four (2) AP-375 alarm panels in the motor control room console in place of the existing annunciators.
- 15.3.4.5 The Contractor must remove the four (4) existing motor starter assemblies in the steering gear compartment and replace with the four (4) new Owner supplied units.
- 15.3.4.6 The Contractor must electrically isolate all push button controls on the MCR console next to the Electrical Mimic panel. All wiring must be disconnected, labelled and redundant wiring removed. Wiring to be reused must be protected until reconnected.
- 15.3.4.7 The Contractor must install the new motor starter and alarm panels in the control room in the location shown in the guidance drawing MCR Console Layout. The Contractor must use a new Contractor supplied drop in panel. The panel must be finished in the same colour as the propulsion control panel and the rest of the MCR console.
- 15.3.4.8 The Contractor must replace the Fire Pump and Air Compressor control buttons with Contractor supplied button and contactors. These buttons and contactors must be the same make and models as the existing Government supplied Propulsion Control System buttons and contactors.
- 15.3.4.9 The Contractor must modify the ECR Consoles structure as required for the installation the new Drop-in Panels and related panel devices. This must include additional reinforcing structure to prevent the Drop-in Panels from being unsupported over their length. The location of reinforcing structure must be determined in conjunction with the FSR and with actual measurements from the supplied Drop-in panels.
- 15.3.5 **Electrical Requirements / Cabling**
  - 15.3.5.1 The Contractor must be responsible to supply and install new cabling for the installation of the new steering control system as well as utilize existing cabling only where the existing cable meets all requirements for the new system.
  - 15.3.5.2 The Contractor must remove all redundant cables from steering control system.

- 15.3.5.3 The Contractor will be required to install cable runs between the port wing, starboard wing and after bridge consoles and the center console.
- 15.3.5.4 The Contractor must allow for the supply and install the follow cable lengths and types:
- a) 16/4 AWG shielded cable – 2 runs – total of 150 meters
  - b) 18/2 AWG shielded cable – 2 runs – total of 150 meters
  - c) 18/3 AWG shielded cable – 4 runs – total of 200 meters
  - d) 18/5 AWG shielded cable – 4 runs – total of 200 meters
  - e) 20/8 AWG shielded cable – 4 runs – total of 200 meters
- 15.3.5.5 In addition to those cables to be installed within the wheelhouse, the Contractor must be responsible for the installation of new cabling to be run from the wheelhouse to the electronics room and to the steering gear compartment. Existing cabling will be used for several of the connections but additional cables are required. Existing cables must be terminated at a terminal strip to permit the extension of the cables for the installation of new equipment.
- 15.3.5.6 The Contractor must allow for the supply and install the follow cable lengths and types:
- a) 20/15 AWG – 2 runs – total of 300 meters
  - b) 18 AWG / 2 pair shielded – 2 runs – total of 300 meters
  - c) 18/7 AWG – 2 runs – total of 300 meters
  - d) 16/4 AWG cable – 1 run – total of 200 meters
  - e) 14/2 AWG – 1 run – total of 200 meters
- 15.3.5.7 The Contractor must allow for the additional cable runs required for the connection of auxiliary equipment are as follows:
- a) 16/2 AWG shielded cable – 1 run – total of 150 meters
  - b) 16/2 AWG shielded cable – 2 runs – total of 250 meters
  - c) 20/15 AWG cable – 2 runs – total of 250 meters
- 15.3.5.8 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install for 10 meters of each of these types of cables listed in section 15.3.4 of the specification.
- 15.3.5.9 All cabling must follow existing cable trays throughout the vessel where fitted. Once installed, all cabling must be secured as per TP127. All cabling must be labelled as noted in Section 4.9 of this Specification.
- 15.3.6 **Locations**
- a) Wheelhouse
  - b) MCR

- c) Steering Gear Compartment
- d) Electronics Room

#### 15.3.7 **Interferences**

- 15.3.7.1 The Contractor must be responsible for the identification of interference items, their temporary removal, storage, and refitting to vessel.

### 15.4 **Proof of Performance**

#### 15.4.1 **Inspection**

- 15.4.1.1 All work must be subject to witness by the TA, IA and the attending TCMS surveyor in order to obtain a survey credit.

#### 15.4.2 **Testing**

- 15.4.2.1 The commissioning of the steering and control system must be done under the direction of the Jastram Technologies FSR and in accordance with the manufacturer's recommended practices.
- 15.4.2.2 Testing must be completed on the system to confirm that all system aspects are in compliance with the requirements of Transport Canada and the relevant Classification Society to ensure a Class approved installation. A report on all testing and findings must be submitted to the TA prior to the acceptance of this item.
- 15.4.2.3 Dock trials must be conducted to verify the operation of all new components in a variety of operational conditions including follow-up, non-follow-up, single pump operation, dual pump operation, and timed movements of the rudder in accordance with TCMS and Class Society requirements.
- 15.4.2.4 Sea trials must be conducted for a period of four (4) hours to verify the operation of the new components and the integration of the system with the Autopilot control.

#### 15.4.3 **Certification**

- 15.4.3.1 All original Class approval certificates for all system components must be submitted to the Owner prior to the acceptance of this item.

## **15.5 Deliverables**

### **15.5.1 Drawings/Reports**

- 15.5.1.1 The Contractor must provide the Chief Engineer with a typewritten report of the Contractor's work in both electronic and hardcopy formats outlining the details of the inspection and any alterations / repairs made prior to the acceptance of this item.
- 15.5.1.2 The Contractor must generate a new "As Fitted" drawing for the work. These drawings must be provided in both electronic and hardcopy format. Electronic copies must be supplied in AutoCAD format – latest edition.

### **15.5.2 Spares**

- 15.5.2.1 All spares which have been supplied with this item and have not been used in the installation must be returned to the Owner prior to the acceptance of this item.

### **15.5.3 Training**

- 15.5.3.1 The Contractor must provide one (1) training course of eight (8) hour duration to be held onboard after the final installation and commissioning of all new propulsion controls and governors. This training must be provided to 8 engineering and navigation staff and be provided by the manufacturer's technical representative (FSR). Training must encompass all items outlined in the operating and maintenance instructions as supplied by the manufacturer.

### **15.5.4 Manuals**

- 15.5.4.1 The Contractor must ensure that all operation, maintenance, and installation manuals supplied with the new equipment unit are submitted to the Owner prior to the acceptance of this item.

Table 13-1 **Steering Gear Control System: GFE**

Line	Qty	Description
1	8	Shut-off valve, 1" SAE, 4 bolt, 3 way
2	4	Flex hose, 1" nominal
3	8	Flex hose, 1" nominal
4	2	DARB (double acting relief and bypass) valve, 100 gpm capacity, protecting steering gear and rudder system from external shocks
5	4	HPU, 15 HP, Proportional w/ variable displacement pumps
6	4	HLA Hydraulic lock alarm manifold assembly
7	2	LAP-2 Hydraulic lock alarm processor w/ U1 and U2 processors
8	1	EW200-21 electric helm, c/w 2 pot
9	1	JO100-2 Jog switch
10	2	LC-2 Dual Lever Controller, c/w dual pot, FFY & NFU
11	1	ROI 280, rudder angle (order) indicator, 2.8 inch dial face, 24 VDC
12	8	RAI 380, rudder angle (order) indicator, 3.8 inch dial face, 24 VDC
13	2	18" Stainless Steel 5-spoke smooth rim dish type steering wheel (for EW200)
14	2	Digital Steering Controller, c/w 2 x MCP, 24 vdc
15	2	MCP100-10 Mode Control Processor, 2xDSC, for centre station inputs P&S
16	2	MCP100-12 Mode Control Processor, 2xDSC, for wing stations inputs P&S
17	1	CP-600 Control and mode selection panel, membrane style, digital, 3"x6", 7 buttons max
18	2	CP-375 control and mode selection panel membrane style, digital, 3"x3.75", 4 buttons max
19	2	RFU 2000 Rudder angle feedback unit w/ extra set of switches
20	2	RFU 300 rudder angle feedback unit
21	2	RAI 3300 Panoramic rudder angle indicator
22	2	RAI 3300 AC/DC power supply
23	1	ESJB-2 emergency steering junction box c/w 2 x RAI480, 2 x Jog (NFU)
24	4	Motor starter assembly, model MSA (10 – 20 HP @ 600 V), PLC
25	8	AP-600 Motor starter & Alarm panel, membrane style, c/w start/stop function, 3"x6"
26	4	AP-375 alarm panel, membrane style, 3" x 3.75"
27	1	Navpilot 4000 Autopilot System
28	4	Technical manual

## **16.0 GEARBOX OVERHAUL (SURVEY ITEM)**

### **16.1 Identification**

The Coast Guard has a requirement to have the two propulsion gearboxes surveyed and overhauled. The overhaul includes the replacement of the main rolling elements , replacement of the inboard quill shafts and pinion gears as well as the replacement of the PTO clutch packs for the shaft generators. Updated hydraulic tubing, needle valves and fittings will need to be installed as well as the development of a comprehensive test and trials program.

### **16.2 References**

#### **16.2.1 Manuals**

- Valmet Manual (Technical Data Package);
- List of Government Supplied Materials – Figure 16-1
- Gearboxes: Valmet model M2HC-1250+PC355+SC355 Serial No: 24196 and Model M2HC-1250+PC355+SC460 Serial No: 24195

#### **16.2.2 Drawings**

<b>Drawing Number</b>	<b>Description</b>
3K036-3199	Piping Drawing SB
5K036-3127	M2HC 1250 PC355 SC460 Starboard
5K036-3284	M2HC 1250 PC355 SC355 Port
5K036-3641	Instrumentation Scheme
8K036-3200	Piping Drawing BB
8K036-3639	Piping Drawing SB
8K036-3640	Piping Drawing BB
8K036-3649	Marine Gear Starboard
8K036-3650	Marine Gear Port

#### **16.2.3 Field Service Representatives**

Original Equipment Manufacturer's Field Services Representatives are available from:  
Santasalo Moventas  
C/O Moventas Ltd.  
P.O. Box 20100  
1615 Bishop Street North  
Cambridge, ON  
N1R 8C8  
Telephone: (519) 621-6390 x234  
Fax: (519) 621-7660



## **16.3 Technical**

### **16.3.1 General**

- 16.3.1.1 The Contractor must employ the services of Santasalo Moventas FSR's for the duration of the work in this Section. The materials listed in Figure 16-1 are supplied and stored for Canada by the OEM FSR. In order to maintain warranty on the gearbox components after commissioning, the work in this section must be supervised by the FSR's up to and including the sea trial requirements and any adjustments to the gearboxes during the trial process.
- 16.3.1.2 The Contractor must perform the work required to prepare the gearboxes, disassemble and overhaul, reassemble, test, and set to work. The Contractor must be responsible for the provision of all technicians, riggers/millwrights, rigging equipment, welders, crane and crane operator, hand, power, and specialty tools required to perform the work of this specification.
- 16.3.1.3 The Contractor must be responsible for arranging for the presence of TCMS as required by TCMS for inspection of the work. Inspection points and requirements of TCMS must be scheduled by the Contractor in consultation with TCMS, the Inspection Authority and the Technical Authority to ensure that the inspection requirements of TCMS during the work and testing of the work are met without causing delay to the work. The Contractor must convene a meeting of the FSR, the Technical Authority and Inspection Authority, the Contractor's Project Manager, and TCMS for the purpose of determining TCMS inspection requirements prior to submitting the production schedule.
- 16.3.1.4 The Contractor must be responsible for covering and protecting the exposed portions of the gearbox and gearbox bearings, gears, and oil piping from all contamination. The Contractor must exercise caution and diligence to prevent contamination from dust, dirt, debris, tools, and fluids. The Contractor must be responsible for cleaning and flushing all such contamination from the gearbox and oil systems.

### **16.3.2 Preparatory Work**

- 16.3.2.1 The Contractor must follow lock out and tag out procedures in order to isolate the propulsion gearbox systems in preparation for the overhaul. This must include all electrical power to motors and all field instrumentation wiring in the gearbox terminal boxes. The Contractor must loosen cables at supports and pull the terminal boxes or panels clear of the gearboxes to allow for removal of the gearbox components.
- 16.3.2.2 The Contractor must remove the brackets and disconnect the wiring from the junction boxes on the Oil Distribution boxes if the wiring would impede removal of

the gearbox components. The Contractor must disconnect and mark all field instrumentation wiring from field instruments to the terminal boxes.

- 16.3.2.3 The Contractor must isolate the sea water cooling system to the gearbox coolers, disconnect and remove the sea water piping. The sea water piping will be replaced with new piping as per Section 19.0 of this Specification.
- 16.3.2.4 The Contractor must remove stairs, railings, storage cabinets and any other secured fixtures that would impede the removal and installation route as determined by the Contractor in cooperation with the Moventas FSR.
- 16.3.2.5 The Contractor must remove and dispose of the gearbox oil in accordance with all Municipal, Provincial and Federal regulations.
- 16.3.2.6 Return junction boxes to position and reconnect wires after reassembly;
- 16.3.3 **Gearbox Dismantling**
  - 16.3.3.1 This Section must be completed with the guidance and assistance of the Moventas FSR's. The Contractor must disconnect and remove the gearbox hydraulic and lube oil piping and tubes, the field instrumentation, pumps, coolers, filters, and control valves to leave the upper gearbox casing bare for lifting.
  - 16.3.3.2 The Contractor must remove the turning gears, clutch covers, bearing covers, gear covers and gears. The Contractor must disconnect the driving and driven machinery at the flexible couplings to the gearbox.
  - 16.3.3.3 The Contractor must plan the lift and removal route of the upper gearbox casing, and provide, design and install temporary or permanent lifting points to accommodate the lift with sufficient safety factors. The Contractor must lift and remove the upper casings, approximate mass each is 1300 kg. The Contractor must store the upper casings in a protected location off the vessel.
  - 16.3.3.4 The Contractor must disassemble shafts, bearings, clutches, and drive connections in order to perform a full condition survey, and for the renewal of the bearings and input shafts.
  - 16.3.3.5 The Contractor must perform a full condition survey of the gearbox internals including, but not limited to, the gear teeth, thrust and journal bearings, thrust and journal bearing clearances, shafts, rolling element bearing fit surfaces in housings and on shafts, driven and driving machinery clutches, LO pump drives, and turning gear.

- 16.3.3.6 The Contractor must supply the bridge gauge for measuring journal bearing clearances, and supply the tool for the removing of the thrust pads.
- 16.3.3.7 The Contractor must clean the gearbox sump of all sludge and debris and dispose of in accordance with all Municipal, Provincial and Federal regulations.

**16.3.4 Gearbox Refurbishment**

- 16.3.4.1 This Section must be completed with the guidance and assistance of the Moventas FSR's. The Contractor must install new bearings, PTO clutch packs, input shafts and gears as supplied as GFE.
- 16.3.4.2 The Contractor must fabricate and install replacement hydraulic tube assemblies with fittings. The Contractor must bid on replacing 100% of the R10x1, R15x1.5, and the R35x3 tubing. The Contractor must supply the required Parker-EO metric tube fittings for the replacement of this tube as listed in the Valmet Bill of Material 0K036-3200.
- 16.3.4.3 With the replacement of the hydraulic tube the Contractor must install GSM supplied needle valves, manifold valves and test point quick connect fittings in place of the gauge cocks for items 200, 201, 205 to 219 inclusive drawing 8K036-3200/3639 Piping Drawing.
- 16.3.4.4 The Contractor must add jacking bolt threaded holes to the gearbox upper cover flanges in locations to be determined by the Moventas FSR's.
- 16.3.4.5 The Contractor must supply all materials such as sealants and gaskets, assembly lubricants, new locking wires and new locking plates required for the installation, and any hardware such as threaded rod, nuts and washers.
- 16.3.4.6 The Contractor must remove the oil coolers, oil pumps and motors from the ship and transport to their shore facility. All equipment associated with the coolers is to be tagged and locked out during this work.
- 16.3.4.7 Pumps are to be disassembled. Pump components are to be thoroughly cleaned. Measurements are to be taken and recorded of all internal components. The Contractor must arrange for the pumps to be inspected by TCMS. Upon completion of inspection pumps are to be reassembled with new Contractor supplied seals and joints.
- 16.3.4.8 The electric motors are to be send to an electrical shop of inspection and cleaning. A megger reading is to be taken before and after the cleaning. New bearings are to be fitted.

16.3.4.9 On completion of the work, a function test is to be carried out on the pumps. The current draw on the motor is to be recorded.

16.3.4.10 The gearbox oil coolers must be dismantled, cleaned and pressure tested to ensure there are no tubes leaking. Any tubes that fail the pressure test must be replaced according to the manufacturer's recommendations. After tube replacement, the cooler must be reassembled with new seals and pressure tested again. A report of the test results must be supplied to TCMS and the TA. The Contractor must arrange for the coolers to be inspected by TCMS.

**16.3.5 Reassemble and Set to Work**

16.3.5.1 This Section must be completed with the guidance and assistance of the Moventas FSR's. The Contractor must reassemble the gearboxes and all internal components.

16.3.5.2 The Contractor must supply and install new OEM locking plates for the threaded fasteners.

16.3.5.3 The Contractor must verify correct internal alignment. The Contractor must verify the correct alignment of engines and shaft generators to the gearboxes by precision methods to accuracy acceptable to the Inspection Authority, Technical Authority, and TCMS. A copy of all alignment readings must be provided to the Technical Authority prior to the completion of the contract.

16.3.5.4 The Contractor must reconnect the driving and driven machinery at the couplings including the reinstallation of all guards and shields.

16.3.5.5 The Contractor must install and reconnect all hydraulic and lube oil piping, pumps, coolers and filters. All lube oil and hydraulic lines must be flushed in accordance with Section 3.2.9. Once the system is assembled, the Contractor must fill the gearboxes with the correct amount of Contractor supplied oil which must be of the correct make and grade normally used in this machinery.

16.3.5.6 The Contractor must reconnect all field instrumentation, test and adjust all pressure switches to correct operation parameters with system oil at operating temperature. The Contractor must reconnect and secure all terminal and junction boxes.

16.3.5.7 The Contractor must supply new hydraulic control valves as per the OEM bill of materials for these gearboxes, positions 163, 166, 168, 180, 181, 183, 184, 187, 294, drawing 5K036-3641 Instrumentation Scheme. The Contractor must test and adjust the hydraulic control valves to correct operating pressures.

- 16.3.5.8 The Contractor must set the gearbox and clutch controls to correct operation.
- a) Check for and correct leaks in the oil systems;
  - b) Provide full set of measurements of gear backlash and alignment, bearing clearances, axial shaft movement;
  - c) Ensure correct and free operation of the turning gears.
- 16.3.5.9 The fabrication of replacement steel tube with fittings to be fabricated must be determined in the field and treated as work arising. The installation of the replacement steel tube must be considered as known work.

#### 16.3.6 **Government Furnished Materials**

- 16.3.6.1 Government furnished materials will be as listed in Figure 16-1.

### 16.4 **Inspections, Tests and Trials**

#### 16.4.1 **Inspections**

- 16.4.1.1 During disassembly and reassembly the Contractor must make written and photographic records of the conditions of the gearbox internals, including interior alignment, gear tooth meshing, gear tooth backlash, bearing clearances of rolling element and slide bearings, and rolling element bearing fits on shafts and housings.
- 16.4.1.2 The Contractor must provide sufficient notice to the attending TCMS surveyor such that the surveyor can witness all inspection points required by TCMS.

#### 16.4.2 **Tests and Trials**

- 16.4.2.1 During the setting to work and trials of the reassembled gearboxes the Contractor must demonstrate the correct functioning of the gearboxes, hydraulic and lubricating oil systems and running in of the gears to the requirements of the Marine Machinery Regulations under the Canada Shipping Act 2001 in the presence of the attending TCMS inspector, the Inspection Authority and Technical Authority.

### 16.5 **Documentation**

- 16.5.1.1 The Contractor must submit a final report of the work completed in the quantities and formats required in Section 6.2.4. The report must contain the information, certificates, and approval documents required in Section 6.2.4 and Section 6.2.5. The report must consist of narrative descriptions of the findings and work done supported by photographs, diagrams, and records of measurements taken.
- 16.5.1.2 The report must contain the following information at a minimum:
- a) Report of the as found and as completed conditions of the gearbox internals, including interior alignment, journal and thrust bearing clearances, tooth contact wear patterns, tooth condition, condition of

- rolling element bearing housings and bearing fits in housings and on shaft, and clutches;
- b) Detailed instruction on the disassembly and assembly procedures for the main and PTO clutches.

**Figure 16-1: Government Furnished Materials**

List #	Description	Dwg Number	Pos. No.	Comment
1	Shaft	8K036-3186	6	New solid input shaft
2	Pinion Gear Wheel	8K036-3186	7	New gear wheel, mates with bull gear
3	Seal Ring 370/315x8		10	Not the seal changed in 2009, that was Position 157
4	Outer Clutch Discs, Main Clutch A42 ZAN 14300	8K036-3186	35	Main clutch, not due for replacement
5	Inner Clutch Discs, Main Clutch 142 ZAN 14302	8K036-3186	36	Main clutch, not due for replacement
6	Rectangular Sealing Ring SL400/371.6x10 Main Clutch	8K036-3186	39	Piston ring, steel, one per main clutch
7	Rectangular Sealing Ring SL400/371.6x10 Main Clutch	8K036-3186	39	
8	Rectangular Sealing Ring SL280/259.2x6 Main Clutch	8K036-3186	40	Piston ring, steel, one per main clutch
9	Rectangular Sealing Ring SL280/259.2x6 Main Clutch	8K036-3186	40	Piston ring, steel, one per main clutch
10	Rectangular Sealing Ring SL280/259.2x6 Main Clutch	8K036-3186	40	
11	Pinion Gear Wheel	8K036-3186	59	New gear wheel, mates with PTO gear
12	Retaining Ring	8K036-3186	60	end cap for oil distribution sleeve
13	Oil Distribution Sleeve	8K036-3186	61	at aft end of new shaft, now for lubrication only
14	Oil Distribution Sleeve	8K036-3186	62	at fwd end of PTO shaft
15	Outer Clutch Discs, A30 ZAN 14301Gen clutch	8K036-3186	81	
16	Outer Clutch Discs, A30 ZAN 14301Gen clutch	8K036-3186	81	
17	Inner Clutch Discs, 130 ZAN 14302, Gen Clutch	8K036-3186	82	
18	Inner Clutch Discs, 130 ZAN 14302, Gen Clutch	8K036-3186	82	
19	Rectangular Sealing Ring SL280/259.2x6	8K036-3186	83	
20	Rectangular Sealing Ring SL180/165.8x5 for 1 gen clutch	8K036-3186	84	Piston ring, steel, one per generator clutch
21	Rectangular Sealing Ring SL180/165.8x5 for 1 gen clutch	8K036-3186	84	
22	Seal Ring 370/315x8	8K036-3186	121	inboard main clutch
23	Seal Ring 370/315x8	8K036-3186	121	
24	Key	8K036-3186	126	keys Pinion Gear Wheel Pos 7 to shaft
25	Key	8K036-3186	127	keys inboard main clutch to shaft
26	Journal Bearing BHW E-131.315 Lemon	8K036-3186	137	main journal bearings, for spare.
27	Bearing 24038 Spherical Roller Bearing	8K036-3186	138	supports inboard input shaft at the casing
28	Bearing 6030.C3	8K036-3186	139	aft end outboard main clutch
29	Bearing 6038	8K036-3186	140	aft end, inboard main clutch
30	Bearing 6020.C3	8K036-3186	141	fwd end gen clutch
31	Bearing NU214	8K036-3186	142	supports shaft 131/1 for fifi pump
32	Bearing NU1028	8K036-3186	143	fwd end outboard main clutch
33	Bearing NU1038	8K036-3186	144	fwd end inboard main clutch
34	Bearing NU1020	8K036-3186	145	aft end gen clutch

35	Bearing 22232	8K036-3186	146	supports outboard input shaft at the casing
36	Bearing 23220E.C3	8K036-3186	147	supports inboard input shaft either side of gear item 59
37	Bearing 23220E.C3	8K036-3186	147	
38	Bearing 22320E	8K036-3186	148	supports shaft at gen clutch
39	Bearing 30216	8K036-3186	149	supports shaft fifi pump input side of clutch
40	Bearing 6214	8K036-3186	150	fwd end fifi pump clutch
41	Bearing 6016	8K036-3186	151	fwd end gear stub shaft for LO pump drive
42	Bearing 6014	8K036-3186	152	aft end gear stub shaft for LO pump drive
43	Bearing 22216	8K036-3186	153	Not used on SR Gearbox, used on EG gearbox
44	Seal R-414.259.91T		157	these were the seals changed in 2009
45	O-ring 129.5x3 FKM,	8K036-3186	164	detail H
46	O-ring 169.3x5.7 FKM	8K036-3186	165	section LL
47	O-ring 59.2x5.7 FKM	8K036-3186	166	turning gear clutch
48	Shaft Seal A 100x80x10 FKM without spring	8K036-3186	167	fifi pump shaft seal
49	Shaft Seal A 52x40x7 FKM	8K036-3186	168	turning gear shaft
50	Shaft Nut	8K036-3186	175	aft end new pinion shaft
51	Lock Washer	8K036-3186	176	aft end new pinion shaft
52	Key	8K036-3186	129/2	key gen gear to shaft
53	DWG 8K036-3200 Position 241 Right Angle Connector W10PL	8K036-3200	241	Ermeto fitting
54	DWG 8K036-3200 Position 244 Right Angle Connector W22PL	8K036-3200	244	Ermeto fitting
55	DWG 8K036-3200 Position 275 Connector GE15PLR1/2	8K036-3200	275	Ermeto fitting
56	DWG 8K036-3200 Position 276 Connector AS15PL/ST	8K036-3200	276	Ermeto fitting
57	DWG 8K036-3200 Position 281 Connector GE35PLR11/4	8K036-3200	281	Ermeto fitting
58	Spacer Ring Du=115, Ds=100 L=25 C=3 A=1	2K053-1079	58	
59	Countersunk Slotted Screw DIN 963 M10 so		196	
60	Hexagon Screw DIN933 M10 20		212	



## **17.0 STERN TUBE SEAL AND BEARING REPLACEMENT (SURVEY ITEM)**

### **17.1 Identification**

- 17.1.1.1 The intent of this specification is for the Contractor to remove the existing stern tube seals and install a Wartsila system compatible with the use of a new lubricant. The Contractor must efficiently coordinate the work of this Specification item with all work in these Specifications, but especially with those items directly affecting the shafting, propeller, rudder and hull.

### **17.2 References Drawings**

<b>Document #</b>	<b>File Name</b>
VNEA2 271-002	Sterntube Bossing Arrangement
VNEA2 271-004	Sterntube Chocking Procedure
VNEA2 291-008	Sterntube LO tank – Lower
VNEA2 342-024	Sterntube LO Diagram (5 sheets)
VNEA2 342-026	Sterntube LO Arrangement
VNEA2 387-012	Shafting & Sterntube Arrangement
VNEA2 387-033	Shafting Alignment
VNEA2 W000931012	LIPS Arrangement Sterntube
VNEA2 W000100694	LIPS Arrangement of Shafting

### **17.3 Technical**

#### **17.3.1 General and Preparation**

- 17.3.1.1 The Contractor must coordinate the work in this section with the related work to the CPP system in Section 18.0 and the Rudders in Section 35.0 of this Specification.
- 17.3.1.2 The Contractor must contract a Wartsila FSR to provide guidance and instruction on the work in this section.
- 17.3.1.3 The stern tube lubricating oil header tanks are located in the crane base. The lubricating oil pumps, coolers, and seal header tanks are located in the port and starboard shaft tunnels. The Contractor must collect and dispose of the oil contained in the stern tubes and all associated tanks, pumps, coolers and piping. The Contractor must flush the stern tube oil system with new Contractor supplied lubricant.
- 17.3.1.4 The Contractor must ensure that all system components have had any sludge or residual oil removed, and new oil pumped through each component at least two times. The Contractor must have an oil sample tested from the system after all flushing operations to prove the purity of the new oil in the system and that no residual oil product or contaminants remain in any of the lubricating oil header

tanks, piping, coolers and pumps. The Contractor must supply the Technical Authority and TCMS with copies of the results of the oil tests.

- 17.3.1.5 The Contractor must collect and dispose of all oil drained from the stern tube systems in accordance with all Municipal, Provincial and Federal regulations and must provide copies of all disposal certificates to the Inspection Authority and Technical Authority
- 17.3.1.6 The Contractor must protect all equipment, stores, and machinery in the crane base and shaft tunnels from damage during the cleaning and flushing of the tanks, pipes and coolers.
- 17.3.1.7 The Contractor must remove the rope guards, the existing fore and aft shaft seals, with special care taken to avoid damage to the shaft seal surfaces. The tail shafts must be immediately removed to an indoor facility for additional work. The Contractor must remove the aft seal liners without damage.

#### 17.3.2 **Stern Tube Seal Service**

- 17.3.2.1 The Contractor must take and record the aft tail shaft bearing wear-down measurements for each the Port and Stbd shaft seals. Recorded readings must be provided to the Technical and Inspection Authorities. Measurement instruments will be provided by the Technical Authority for the Port and Stbd shafts.
- 17.3.2.2 The Contractor must disassemble the aft seals on both shaft lines. Seal parts are to be marked as to from which section they have been removed.
- 17.3.2.3 The Contractor must disassemble the forward seals on both shaft lines. Seal parts are to be marked as to orientation and from which section they have been removed.
- 17.3.2.4 Once the tail shaft has been inspected and has been re-installed, the Contractor must install new forward and aft stern tube seals. The Contractor must take another wear-down measurement to ensure that the new seals are located correctly. New seals will be Government Furnished Equipment.

#### 17.3.3 **SKF Coupling**

- 17.3.3.1 The Contractor must note the location of all SKF coupling parts on the intermediate and tail shafts.
- 17.3.3.2 The Contractor must release the SKF couplings on both shaft lines. This work item must be done in conjunction with Section 8 of this specification.

17.3.3.3 After completion of the tail shaft removals and inspections, the Contractor must re-assemble the two SKF couplings, ensuring that all parts are returned to their marked location on the tail shafts and the intermediate shafts.

17.3.3.4 Final tightening of the SKF coupling must be witnessed by the Technical and Inspection Authorities.

#### 17.3.4 **Tail Shaft Removal**

17.3.4.1 The Contractor must remove the tail shaft of the port and starboard shaft lines once the SKF coupling has been released and the seals have been dismantled. The removal of the tail shafts must be done in conjunction with Section 18.0 of this specification.

17.3.4.2 The Contractor must protect all bearing surfaces on the tail shafts to ensure that no damage is sustained to these.

17.3.4.3 The Contractor must wipe down and clean the port and starboard stern tubes, removing all traces of oil and any foreign debris and particles. All items must be disposed of by the Contractor.

17.3.4.4 The Contractor must take 3 sets of bearing measurements of each tail shaft bearing surface. The measurements must be equally spaced along the length of the bearing and must be in both the horizontal and vertical position. Readings must be recorded for the forward and aft bearing surface of each tail shaft. Readings must be provided to the Technical and PWGSC Inspection Authorities.

17.3.4.5 The Contractor must take 3 sets of bearing measurements of each stern tube bearing surface. The measurements must be equally spaced along the length of the bearing and must be in both the horizontal and vertical position. Readings must be recorded for the forward and aft bearing surface in each stern tube. Readings must be provided to the Technical and Inspection Authorities.

17.3.4.6 The Contractor must have the attending TCMS surveyor inspect the shafts and must obtain TCMS documentation to ensure the vessel receives credit for the inspection.

17.3.4.7 The Contractor must remove the Aft Seal Liner from each tail shaft. Seal liners are to be marked to identify from which shaft line they are removed. Extreme care must be exercised by the Contractor to avoid scoring the tail shaft bearings in the process of removing the aft seal liner.

17.3.4.8 The Contractor must verify that the aft seal liners are within tolerance of 5/100 mm of roundness and cylindricalness. Surface roughness must not exceed 1.5 micron. The Shaft Seal Liner diameters must be verified. Based on the above measurements

recorded, the Shaft Seal Liners may be machined to 1.5 mm undersize from a nominal diameter of 450 mm. If the shaft seal liners are found to be out of spec Contractor must submit a PWGSC Form 1379 to supply new liners.

17.3.4.9 Upon completion of the shaft seal liner inspections the Contractor must re-install the shaft seal liners with new GFE O-rings between the shaft seal liner and the flange of the propeller hub. Again extreme caution must be exercised by the Contractor when installing the shaft seal liner over the bearing surfaces of the tail shaft bearings.

17.3.4.10 All liner bolts must be torqued in accordance with the manufacturer's instructions and lock wired with stainless steel lock wire.

#### 17.3.5 **Composite Bearing Replacement and Alignment**

17.3.5.1 The Contractor must use laser alignment methods to determine the alignment of the existing shaft centerline at the stern tube bearings, tail shaft and intermediate shaft up to the output flange of the gearbox. Existing shaft centerline alignment must be determined prior to any bearing removals. The existing bearing carrier centerline alignment must be determined prior to removal of the bearings and bearing carriers. The Contractor must realign the stern tube bearings, tail shaft and intermediate shaft using laser alignment methods and without measurable misalignment up to the gearbox output flange. The Contractor must arrange for TCMS surveyor, Inspection Authority and Technical Authority to witness the measuring of existing alignments, and the re-alignment of the new tail shaft bearings and shafting.

17.3.5.2 The tail shaft bearing surfaces must be measured to determine bearing out of round, parallelism and surface tolerance. At a minimum, measurements must be taken in the vertical and horizontal directions at the bearing surface midpoint and ends. Any machining required will need to be authorized by submitting a PWGSC 1379 Form.

17.3.5.3 The Contractor must remove the existing bearings from the bearing carriers. Care must be taken to prevent damage to the RTD temperature probes. Caution must be used as the existing Railko WA80H bearings contain Chrysotile Asbestos, and proper asbestos removal procedures must be utilized. The stern tubes must be cleaned of all dirt, oil and residue prior to the installation of the new bearings.

17.3.5.4 The Contractor must finish machine the GFE semi-finished composite bearings to the tolerances and to provide the bearing clearances required by the measurements and any machining of the tail shaft bearing surfaces. The new bearings must be installed in accordance with the manufacturer's recommendations and instructions, and under the direction of the FSR.

17.3.5.5 The Contractor must provide records and readings of the initial and finished shaft alignment from the tail shaft to the gearbox output flange inclusive to the Technical

and Inspection Authorities and the attending TCMS inspector prior to the installation of the tail shafts.

**17.3.6 Intermediate Shaft Bearing Inspections**

- 17.3.6.1 The Contractor must drain and dispose of the oil from the sump of both intermediate shaft bearings. Sump capacity for each bearing is approximately 2 liters. The oil must be disposed of in accordance with all Federal, Provincial and Municipal regulations in effect. The Contractor must provide oil disposal certificates for the disposed oil.
- 17.3.6.2 The Contractor must ensure the shafting remains supported during all phases of shafting and propeller work Sections 17.0 and 18.0. The free shaft ends must not be allowed drop, raise or bend so as to interfere with bearing removal or cause damage to the shafting or bearing surfaces.
- 17.3.6.3 The Contractor must disassemble the port and starboard intermediate shaft bearings and remove the bearings from the pedestals for survey by TCMS. When removing the bearing shells particular attention must be given to the proper removal of all remote and local temperature sensors from the bearing shells.
- 17.3.6.4 The Contractor must have the bearings surveyed by the attending TCMS surveyor and must obtain TCMS documentation to ensure the vessel receives credit for the inspection of the two intermediate shaft bearings.
- 17.3.6.5 The Contractor must perform a hydrostatic pressure test on the cooling circuit of the intermediate shaft bearings. The test pressure must be a hydrostatic head of 2 meters. The pressure test must be witnessed as a minimum by the Technical and Inspection Authorities.
- 17.3.6.6 The Contractor must re-connect the cooling water piping flanges and must supply and install new Contractor supplied fiber re-enforced neoprene gaskets.
- 17.3.6.7 The oil sump, bearing shell support surfaces and housing components must all be cleaned and free of debris prior to re-installation.
- 17.3.6.8 The Contractor must reassemble and set-to-work the two shaft bearings. Care must be exercised in the assembly of the bearings to ensure that all parts removed during disassembly of the bearings are returned to their original location. The Contractor must verify the run-out on the oil slinger rings to ensure that they are set at 90 degrees and do not rub on any part of the bearing housing. The Contractor must ensure the proper location of rubber shaft lip seals.

- 17.3.6.9 The Contractor must fill the oil sumps of both intermediates shaft bearings to their working level with Contractor supplied oil.

**17.3.7 Assembly**

- 17.3.7.1 The Contractor must refill both shaft lines and header tanks to the high level marks in the header tanks with Coast Guard supplied oil. The Contractor must ensure that both the forward and aft intermediate seal cavities are filled with oil on both shaft lines.
- 17.3.7.2 Upon completion of the shaft seal installations the Contractor must fill the Port and Starboard stern tubes with oil and ensure all air is purged from the systems. The Contractor must follow the Wartsila FSR's instructions on filling and setting the forward and aft shaft seals to-work. This must include the filling of the rear seal cavity with oil and bleeding the air off the seals to ensure that these seals will be properly lubricated. Seal plugs must be lock wired with stainless steel locking wire.
- 17.3.7.3 The Contractor must test the shaft seals to ensure that there are no leaks in the shaft seals prior to re-floating the vessel. Header tank levels must be marked prior to re-floating to visually verify whether or not the seals are leaking water from outside when the vessel is re-floated. The Contractor must repair any oil and/or water leaks prior to the completion of the contract.
- 17.3.7.4 The Contractor must refit the rope guards and ensure that there is clearance to avoid contact between the rope guards and the propeller hubs. The Contractor must verify the propeller hub clearance through 1 full rotation of each of the shaft lines.
- 17.3.7.5 The Contractor must set to work the stern tube oil lubrication systems once the vessel has been undocked.

**17.4 Inspections, Tests and Trials**

**17.4.1 Inspections**

- 17.4.1.1 The Contractor must provide records and readings of the initial and finished shaft alignment from the tail shaft to the gearbox output flange inclusive.
- 17.4.1.2 The Contractor must provide the opportunity to the Inspection Authority and the Technical Authority to witness the measuring of the tail shaft bearing clearances.
- 17.4.1.3 The Contractor must have the shafting alignment witnessed by TCMS, Inspection Authority and the Technical Authority.

17.4.1.4 The Contractor must record the seal face, stern tube oil and intermediate shaft bearing oil temperatures for both shaft lines during the dock trials and sea trials for the vessel.

17.4.1.5 The Contractor must ensure that the intermediate shaft bearing oil supply rings and scrapers are working to supply oil to the top of the shaft bearings and that the shaft bearings are receiving proper lubrication.

#### 17.4.2 **Tests and Trials**

17.4.2.1 The Contractor must ensure the FSR is in attendance for the Tests and Trials.

17.4.2.2 Any leaks found during system testing must be remedied by the Contractor at the Contractor's expense.

17.4.2.3 The Contractor must turn the propellers through one full revolution at neutral, full ahead and full astern positions and record blade/nozzle clearances at each blade.

17.4.2.4 The Contractor must designate one propeller blade as the master blade and must verify and record the blade tip clearance of all propeller blades through one full revolution of the shaft in all three conditions of the blades mentioned above. Readings must be taken in 4 key positions around the circumference of the nozzle.

17.4.2.5 All recorded propeller tip clearances must be provided to the Inspection Authority and the Technical Authority.

#### 17.5 **Documentation**

17.5.1.1 The Contractor must supply certification from the Wartsila FSR engaged by the Contractor certifying that all instructions, specifications, procedures of Wartsila have been followed and that the stern tube seal system as installed is fully functional and fully warranted. The Contractor must deliver to Inspection Authority and the Technical Authority all certificates of material and regulatory approval received from Wartsila.

17.5.1.2 The Contractor must ensure TCMS documentation is provided showing that the Seals, Port and Starboard tail shaft bearings, and Port and Starboard Intermediate Shaft Bearings and alignment meet all requirements of TCMS.

17.5.1.3 The Contractor must supply a fully documented report of the installation complete with detailed descriptions of work performed, a photographic record of the work performed at each stage, tabulations of bearing clearances, and alignment data.

17.5.1.4 The Contractor must supply the following documentation for this specification section to the Technical and Inspection Authorities prior to the completion of the contract:

- a) Oil disposal certificates;
- b) SKF Coupling measurements and pressure used to set the SKF coupling;
- c) Tail shaft bearing readings for the forward and aft bearings on each shaft;
- d) Stern tube bearing readings for the forward and aft bearings on each stern tube;
- e) Temperature readings of the forward seal during dock and sea trials;
- f) Intermediate shaft bearing oil temperatures.



Table 15-1: **Stern Tube Seals and Bearings - GFE**

	<b>Quantity</b>	<b>Part Number</b>	<b>Description</b>
1	2 pc	AFT01-08	SR MK2/OLS3-P 0450 Bio FR Aft Kit
2	2 pc	AFT01-09	O-Ring 12.0-405(ID) NBR
3	2 pc	AFT01-10	Sheet Packing 450 No.4 Non-asbestos NR
4	2 pc	AFT01-11	Sheet Packing 450 No.8 Non-asbestos NR
5	6 pc	AFT01-20	Plug - PRL Hex Skt Head G 3/8 SUS316 W
6	6 pc	AFT01-21	Washer - Flat 25X18X1.5 G 3/8 C1100P-0
7	6 pc	AFT01-23	SW-Pack - Toothing:M8-20
8	12m	AFT01-25	SUS Wire (ø1.5 SUS304)
9	8 pc	AFT01-28A	Tongued Washer M16 SUS304
10	8 pc	AFT01-28B	Tongued Washer M18 SUS304
11	2 pc	FWD03-06	SR MK2/OLS2-P 0450 Bio FR Fwd Kit
12	2 pc	FWD03-07	Sheet Packing 450 No.8 Non-asbestos NR
13	2 pc	FWD03-08	O-Ring 8.4X0420 NBR
14	2 pc	FWD03-17A	SW-Pack - Toothing:M8-20
15	2 pc	FWD03-17B	SW-Pack - Toothing:M10-20
16	4 pc	FWD03-25A	Tongued Washer M16 SUS304
17	4 pc	FWD03-25B	Tongued Washer M18 SUS304
18	2 pc	FWD03-26	Sheet Packing 450 No.8 Non-asbestos NR
19	2 pc		Seal Assy 425 NA
20	2 pc		Aft composite bearing semi-finished 2 sections
21	2 pc		Forward composite bearing semi-finished

## 18.0 CPP SYSTEM OVERHAUL (SURVEY ITEM)

### 18.1 Identification

The Contractor must disassemble the controllable pitch propeller system in its entirety and submit all components for survey by the attending TCMS surveyor and then re-assemble the system. This must include the propeller hubs, oil distribution box, SKF coupling and all seals within the propeller shafting. The CPP system must then be reassembled tested and set to work. This work item must be done in conjunction with the Shaft Seal Replacement and the Stern Tube Survey Items.

### 18.2 References

#### HUB PARTICULARS:

Type	LIPS 4C11SW
Diameter	1100 mm
Mass	3900 kg

Document #	File Name
VNEA2 387-012	Shafting & Sterntube Arrangement
VNEA2 387-033	Shafting Alignment
VNEA2 388-004	Controllable Pitch Propeller Hydraulics
VNEA2 388-006	CPP Hydraulic System Arrangement
VNEA2 W000001195	Assembly of the Hub
VNEA2 W000100694	Arrangement of Shafting
VNEA2 W000400779	Assembly oil Distribution Box
VNEA2 W000461037	Pitch Transmitter Box
VNEA2 W000500171	Elec Hydraulic Control Unit
VNEA2 W000520623	Arrangement Oil Distribution
VNEA2 W000500006	Tools for Hoisting

The Contractor must make reference to the LIPS Instruction Manual for the Controllable Pitch Propeller Installation HO 2233/2234. This manual is available in the Technical Data Package.

### 18.3 Technical

#### 18.3.1 CPP Oil System

- 18.3.1.1 The Contractor must drain the CPP Oil from both the port and starboard systems and must dispose of the oil in accordance with all Federal, Provincial and Municipal regulations in effect. The Contractor must provide disposal manifests to the Technical and PWGSC Inspection Authorities.
- 18.3.1.2 The Contractor must dispose of approximately 1000 liters of oil from each of the Port and Starboard CPP systems for a total of 2000 liters of Tellus 46 oil.

- 18.3.1.3 The Contractor must install new isolation ball valves for the hydraulic suction port of each CPP pump set. These valves are located at the inlet connection for each suction line filter for each CPP pump set. Valves that are currently fitted are Apollo Style 600WOG, 3inch, FNPT both ends.
- 18.3.1.4 The Contractor must procure four (4) new isolation ball valves of the following recommended style for install (see Data sheet in Technical Data Package):  
Flow-Tek Model number: 7-1-10-3-R-R-L (3"NPT 1000WOG)  
Flow-Tek Series 7000, 3 piece ball valve, Stainless steel body 1000WOG  
316 Stainless steel ball and stem, RPTFE Seats, PTFE Body seals, Full port design, FNPT connections, 304 SST latch lock handle, Max temp: 230°C
- 18.3.1.5 The contractor must make adaptations for the threaded pipe connections in order to fit the new valves. Any pipe, flanges, gaskets or fasteners required must be Contractor supplied.
- 18.3.1.6 The Contractor must remove the common return pipe section for the port and starboard CPP pump set arrangements. The pipe to be removed for the Starboard side CPP pump set arrangement is labelled 12HP-1 and the pipe to be removed for the Port CPP pump set arrangement is labelled 6HP-1. These pipes are 2.5" diameter pipes, which reduce down to 1.5" at their lower ends and are provided with two 1.5" flanged connections.
- 18.3.1.7 The contractor must modify each pipe to allow fitting of a new 2.5" isolation ball valve. All pipe, flanges, gaskets and fasteners for this work to be CSM.
- 18.3.1.8 The contractor must procure two(2) of the following recommended flanged connection style ball valves:  
Manufacturer: M.A. Stewart & Sons Ltd.  
Body Size: 2.5" C/W Lockable handle  
Style: MAS F-150-CSF-SS-N
- 18.3.1.9 The contractor must properly mount all of the above mentioned valves such that handles are easily operated. Contractor must utilize thread sealant or gasket material that is rated for use with hydraulic fluid.
- 18.3.1.10 The Contractor must re-fill both the port and starboard CPP oil systems with Contractor supplied oil at the completion of all work in this Section and Section 17 of these specifications. The Contractor must provide a unit price with a quotation for 2000 litre of new oil for this specification item.
- 18.3.1.11 The new valves must be checked for leaks in the presence of the Technical Authority and any deficiencies must be corrected by Contractor at his expense.

**18.3.2 CPP Propeller Blades**

- 18.3.2.1 The Contractor must disassemble and remove four (4) Starboard propeller blades and four (4) Port propeller blades and associated blade seals under the supervision of a Wartsila FSR.
- 18.3.2.2 The Contractor must fit the propeller blades after the work on the propeller hubs has been completed. All propeller blade O-rings will be Coast Guard supplied.
- 18.3.2.3 The hardening-up of the propeller blade hold-down bolts must be witnessed by the attending TCMS surveyor, the Inspection Authority and the Technical Authority.
- 18.3.2.4 The Contractor must observe correct torque procedure in the instruction manual for the hardening-up of all propeller blade hold-down bolts. The Contractor must weld Coast Guard supplied stainless steel locking strip across the propeller blade hold-down bolts in the following manner:
  - a) Each stainless strip must span two bolt heads;
  - b) Each stainless strip must be welded to each bolt head in 3 places – the Contractor must ensure that the vent plugs within the heads of the bolts are not damaged;
  - c) On the three bolt side, a locking strip must be fitted from each outside bolt to the center bolt;
  - d) On the four bolt side, a locking strip must be fitted from the outermost bolts to the next bolt closest to the center. The strips must only span two bolts, with the two center bolts not being connected by a locking strip.

**18.3.3 CPP Propeller Hubs**

- 18.3.3.1 The Contractor must disassemble the port and starboard CPP propeller hubs under the supervision of a Wartsila FSR. The propeller hubs must be disassembled to that the satisfaction of the attending TCMS surveyor in order to ascertain the condition of the hub components and the Contractor must obtain a TCMS credit for the inspection of the propeller hubs and components.
- 18.3.3.2 All hub components must be inspected for wear and measurements must be taken and recorded as directed by the FSR in accordance with the service manual. The Contractor must replace worn parts with the Coast Guard supplied spare parts.
- 18.3.3.3 Once all items have been inspected and passed TCMS inspection the Contractor must re-assemble the hubs under the supervision of the Wartsila FSR.
- 18.3.3.4 The hubs must be re-installed on their respective propeller shafts and all hold down bolts must be torqued in accordance with the service manual in the presence of the PWGSC Inspection Authority and the Technical Authority. All propeller hub hold down bolts must be secured as originally fitted.

**18.3.4 Oil Distribution Boxes**

- 18.3.4.1 The Contractor must, under the supervision of the Wartsila FSR, remove and dismantle the port and starboard Oil Distribution (OD) boxes fitted at the front of the gearboxes in the engine room. The OD box casings will be replaced with new Coast Guard supplied OD box casings.
- 18.3.4.2 The Contractor must remove the existing torque stays and install new port and starboard Coast Guard supplied Torque Stays.
- 18.3.4.3 The Contractor must disassemble the OD boxes such that all parts can be inspected for wear and all components must be inspected by the attending TCMS surveyor and a TCMS survey credit must be obtained. The parts to be dismantled and inspected include all components interior to the OD box housing, all actuating lever assemblies on the outside of the OD box, and the solenoid valves mounted to the OD boxes.
- 18.3.4.4 The Contractor, under the direction of the LIPS FSR must take all necessary measurements to ascertain the serviceability of the internal OD box components and present them to the Technical and PWGSC Inspection Authorities.
- 18.3.4.5 The Contractor must re-assemble both OD boxes using new Coast Guard supplied casings and seal kits.
- 18.3.4.6 The Contractor must re-install each OD box on its respective shaft line and must ensure that all alignment measurements and precautions outlined in the service manual are followed. Final measurements and readings must be recorded and presented to the Technical and PWGSC Inspection Authorities.
- 18.3.4.7 The Contractor must set all pitch references with regards to the OD boxes, CPP systems and the CPP propellers.

**18.3.5 Propeller Shaft Internal Seals**

- 18.3.5.1 The Contractor, under the supervision and direction of the Wartsila FSR, must disconnect the port and starboard propeller shafts at each location in the shaft line that oil seals are present and replace the seals using new Coast Guard supplied seals.
- 18.3.5.2 The Contractor must ensure that for the duration of this part of the specification that the shafting is sufficiently supported to prevent damage during the seal replacement.
- 18.3.5.3 The Contractor must reconnect the propeller shaft sections under the supervision and direction of the Wartsila FSR.

**18.3.6 Inspection, Test and Trials**

- 18.3.6.1 The Contractor must develop a set-to-work trials procedure with the guidance of the Wartsila FSR to bring the CPP propeller system back to original operating parameters taking into account as a minimum the requirements outlined below.

**18.3.7 CPP Propeller Blades**

- 18.3.7.1 The Contractor must ensure that the propeller blades do not foul in the nozzles and must record blade tip to nozzle clearances in all three positions (full ahead, neutral and full astern pitch) for each of the blades within the nozzles. The Contractor must designate one propeller blade as the master blade and must verify and record the blade tip clearance of all propeller blades through one full revolution of the shaft in all three conditions of the blades mentioned above. Readings must be taken in 4 key positions around the circumference of the nozzle. All recorded propeller tip clearances must be provided to the Inspection Authority and the Technical Authority.

**18.3.8 CPP System Operational Tests**

- 18.3.8.1 The Contractor must test the Controllable Pitch Propeller systems as follows:
- Both the port and starboard CPP systems must be set to work;
  - All system pressures and temperatures must be recorded;
  - All propeller blades must be observed to be free from hydraulic oil leaks. Any leaks must be corrected by the Contractor.
  - The shaft line must be observed to be free from hydraulic oil leaks. Any leaks must be corrected by the Contractor.
  - The blades must be rotated from full astern to full ahead and the pitch readings observed on the remote indicators must match the actual pitch reading of the propeller blades. Where pitch readings do not reflect the actual readings the Contractor must make adjustments to ensure that all pitch readings are identical. This must be done for both the port and starboard systems.
  - The Contractor must ensure that the manual pitch control for each OD box is functional and that the pitch feedback system reads correctly.

**18.4 Deliverables**

- 18.4.1.1 The Contractor must provide the following documentation:
- Disposal certificates for the removed oil;
  - Measurements for the port and starboard Propeller Hub internal components;
  - Measurements for the port and starboard Oil Distribution Box internal components;
  - Measurements of the assembled OD boxes and adjustments to the shaft lines as well as internal oil tubes to the propeller hub;

- e) Blade Tip clearances for each propeller blade in the ahead, astern and neutral position through 1 shaft revolution, and;
- f) Temperatures and pressures of the CPP Systems.

18.4.1.2 Pitch feedback settings for actual pitch recorded on the blades, the OD box and the pitch readings in the control room and on the bridge readouts after reassembly.

Table 18-1: GFE for CPP Overhaul

	<b>Part Number</b>	<b>Description</b>	<b>QTY.</b>
1	W000001195001 W007130227	Blade bolt	8
2	W000001195002 PAAI065751	Sliding block (oversized)	4
3	W000001195011 W006915325	Strip	16
4	W000001195012 W007150033	Hub cover bolt	40
5	W000001195013 W007000805	Seamless O-Ring	40
6	W000001195014 W007000368	O-ring with vulcanized joint	2
7	W084825686	O-ring for blade foot	8
8	W000001195016 W006905378	Strip	32
9	W000001195017 W007130238	Blade bolt	48
10	W000001195018 M730000832	Seamless O-Ring	56
11	W000001195021 W004061700	Piston ring with clip	4
12	W000001195023 W004581600	Guiding ring	2
13	W007050001	Seamless O-Ring	2
14	W000001195029 M716600041	Dubo retaining ring	16
15	W000001195031 M713001634	Hexagon head screw M24X 50	16
16	W000001195033 M730000216	Seamless O-Ring	2
17	W000001195034 W006295000	Ball	2
18	W000001195035 W004010000	Compression spring	2
19	W000001195038 M712086274	Hex.socket set screw full dog point	2
20	W000001195040 M712040331	Hexagon socket head cap screw	24
21	W000001195041 W004725000	Split Ring	2
22	W000001195043 M716601041	Dubo retaining ring	4
23	W000001195044	Hexagon socket head cap screw (rm)	4



	M712041484		
24	W000001195046 M730000348	Seamless O-Ring	4
25	W000001195047 M730000452	Seamless O-Ring	4
26	W000001195048 W007141500	Flange bolt	24
27	W000001195049 M712084278	Hex.socket set screw cup point	24
28	W000001195050 W006572500	Plug	2
29	W000001195052 M730000333	Seamless O-Ring	2
30	W000001195053 M712046334	Hexagon socket head cap screw	16
31	W000001195056 W007355019	Hexagon plug for protection cover	2
32	W000001195057 M730000137	Seamless O-Ring	2
33	W000001195058 M730000130	Seamless O-Ring	2
34	W000001195059 W007355020	Hexagon plug for non return valve	2
35	W007030100	Seamless O-Ring	8
36	W000001195067 W006575026	Hexagon socket pipe plug	2
37	W000001195068 M718500426	Heavy Cylindrical Spring Dowel	2
38	W000001195069 W006575025	Hexagon socket pipe plug	56
39	W000001195070 W006711010	Non-Return Valve Assembly	16
40	W007087009	OK-sealing	2
41	W000100694013 M730000237	Seamless O-Ring	20
42	W084824912	Seamless O-Ring	2
43	W000100694016 W007015500	Seamless O-Ring	4
44	W000100694017 M713000380	Hexagon head screw	16
45	W000100694018 W007170210	Fitted bolt	4
46	W000100694020 M717710586	Split pin	20
47	W000100694021 M712045334	Hexagon socket head cap screw	8

48	W000100694022 M717501584	Hardened Cylindrical Pin	4
49	W000100694013 M730000237	Seamless O-Ring	4
50	W000400779002 W007023100	Seamless O-Ring	2
51	W000400779003 M713000586	Hexagon head screw	16
52	W000400779005 W007060200	Simmerring	2
53	W000400779008 W007017400	Seamless O-Ring	2
54	W000400779009 M701201051	Ball bearing deep groove	2
55	W000400779010 W004570061	Insert	2
56	W000400779011 M730000219	Seamless O-Ring	6
57	W000400779012 W004270009	Housing	2
58	W000400779014 M701201050	Ball bearing deep groove	2
59	W000400779016 W007024200	Seamless O-Ring	2
60	W000400779018 M713000532	Hexagon head screw	8
61	W000400779020 W007017100	Seamless O-Ring	2
62	W000400779021 W006230006	Taper roller bearing	4
63	W000400779023 W007250129	Locking Nut	2
64	W000400779027 W006840300	Thermometer	2
65	W000400779028 M735000026	Bonded seal	2
66	W000400779030 W006290100	Cam roller	4
67	W000400779031 W007206000	Hexagon nut thin	4
68	W000400779033 M713000426	Hexagon head screw	8
69	W000400779034 M735000030	Bonded seal	2
70	W000400779035 W007023200	Seamless O-Ring	4

71	W000400779036 W006575200	Hexagon socket pipe plug	2
72	W000400779037 W005055500	Torque stay	2
73	W000400779039 M718500276	Heavy cylindrical spring dowel	2
74	W000400779040 U000000068	Hexagon socket collar plug	2
75	W000400779042 M718500429	Heavy cylindrical spring dowel	4
76	W000400779043 M712045393	Hexagon socket head cap screw	16
77	W000400779044 W004780472	Locking washer	2
78	W000461037004 W006900000	Micro switch	6
79	W000461037028 W006912084	Potentiometer	2
80	W000461037029 W006910100	Synchro clamp	6
81	W000461037028 W006912084	Potentiometer	2
82	W000500171021 W007080300	Packing	2
83	W000500171024 W006200800	Ball bearing deep groove	4
84	W000500171027 M714050027	Hex. nut w. nylon locking ring	2
85	W000500171028 W007070000	Rod sealing	4
86	W000500171030 M730000224	Seamless O-Ring	2
87	W000500171032 M730000230	Seamless O-Ring	4
88	W000500171034 M731000160	Copper sealing ring	4
89	W000500171035 W007033200	Quadring	2
90	W000500171044 W006910100	Synchro clamp	6
91	W000400779034 M735000030	Bonded seal	12
92	W000520623007 M712040280	Hexagon socket head cap screw	24
93	W000520623008 M712045284	Hexagon socket head cap screw	24

94	W000520623009 W006600280	Hydraulic hose assembly	6
95	W006831200	Temperature switch	2
96	W000520623022 M735000022	Bonded seal	8
97	W000520623033 M716101031	Square spring lock washer	72
98	W000520623034 M714040031	Hexagon nut	24
99	W000530056001 M730000011	Seamless O-Ring	4
100	W000530056002 M712045237	Hexagon socket head cap screw	8
101	W000530056005 W084821122	Double speed regulating valve	2
102	W000530056006 W007280021	Hexagon socket head cap screw	8
103	W084841115	4/3-way valve	2
104	W001593184013 M714050029	Hex. Nut w. Nylon Locking Ring	2
105	W001593184016 W004010300	Compression spring	2
106	W001593184019 W004020000	Disc spring	8
107	W001593184027 M714050027	Hex. nut w. nylon locking ring	2
108	W001593184030 W004890600	Friction bush	4
109	W004605074002 W006800184	Pressure gauge	4
110	W004605074003 W006800200	Pressure gauge	2
111	W004605074004 W006830100	Pressure switch	2
112	W004605074009 W007385100	Copper sealing ring	6
113	W004605074011 M735000024	Bonded seal	10
114	W004605074012 M735000022	Bonded seal	4
115	W004605074009 W007385100	Copper sealing ring	32
116	W004620224004 W007080200	Packing	2
117	W004620224006 W006290100	Cam roller	4

118	W004620224009 W004502600	Bearing bush	4
119	W004620224010 W007033300	Quadrang	4
120	W004620224012 M712082170	Hex.socket set screw cone point	2
121	W004620224017 M712040383	Hexagon socket head cap screw	4
122	W004620224018 M712084118	Hex.socket set screw cup point	4
123	W004620224021 M730000212	Seamless O-Ring	2
124	W004620224022 M730000228	Seamless O-Ring	2
125	W004620224023 M730000223	Seamless O-Ring	4
126	W004620224024 M718701301	Retaining ring for bores	2
127	W006710094	Non-return valve assembly	16
128	W008450141001 M730000012	Seamless O-Ring	2
129	W008450141002 W006524300	Reducing nipple	2
130	W008450141003 M735000024	Bonded seal	2
131	W008450141004 W006480100	Self closing coupling	2
132	W008450141005 M710190085	Reducing socket nipple	2
133	W000001195011	Strip	16
134	W000001195056	Hexagon Plug for Protection cover	2
135	W000400779010	Insert	2
136	W000400779042	Heavy Cylindrical Spring Dowel	4
137	W000400779043	Hexagon socket head cap screw	16
138	W000520623009	Hydraulic Hose Assembly	6
139		Temperature Switch	2
140	W004620224009	Bearing Bush	4

## 19.0 SEA WATER PIPING SYSTEMS UPGRADE

### 19.1 Scope

- 19.1.1.1 The Contractor must remove, dispose and replace all sea water cooling piping arrangements throughout the vessel.
- 19.1.1.2 The Contractor must supply, install and commission new valves, fittings, piping and all other associated components to provide a fully functional and operational engine cooling water system.

### 19.2 Applicable Documents

The following documents are applicable to or interface with the task requirements of this section:

- C.S.A., Hull Construction Regulations, Marine Machinery Regulations;
- Drawing List.

Drawing Number	Description
VNEA2 315 003	Main Engine Cooling Water Diagram
VNEA2 315-006	Engine Cooling Arrangement (4 sheets)
VNEA2 315-007	Air Conditioning Sea Water Cooling System
VNEA2 315-008	Air Conditioning Sea Water Cooling Arrangement
VNEA2 315-010	Sea Chest Sea Bay Arrangement
VNEA2 317-006	Hot & Cold F W & Sanitary S W Arrangement (2 sheets)

### 19.3 Scope of Work

- 19.3.1.1 All material removed becomes property of the Contractor and is to be disposed of in accordance with Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.
- 19.3.1.2 The following equipment has been categorized for handling as per Section 1.11.2:

Equipment/Material	Category
Redundant Piping, Valves & Pumps,	C
Scrap steel	C

#### 19.3.2 Decommissioning of Sea Water Systems

- 19.3.2.1 The systems for replacement are:
- Main Engine, generator and auxiliary machinery cooling water system as noted on the Engine Cooling Arrangement drawings;
  - Air Conditioning System sea water as noted on the drawings.

19.3.2.2 The Contractor must decommission the sea water cooling systems onboard the vessel for the duration of the work period of this Specification. The sea water systems must be isolated with a lockout system to prevent ingress of any contaminants including water into the piping system while the work of this Section of the specification is carried out.

19.3.2.3 The Contractor must dispose of all water removed from the system in accordance with all Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.

### 19.3.3 **Engine Cooling Water System**

19.3.3.1 The Contractor must remove and dispose of the existing engine cooling water piping and valves in accordance with Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.

19.3.3.2 The Contractor must disconnect and remove all engine cooling water piping from the sea bay to the first flanges on the main and auxiliary engines and from the engines to any overboard connections suitable to allow the Contractor to perform the work of this Specification.

19.3.3.3 The Contractor must disconnect and remove all engine cooling water piping from the sea bay to the first flanges of all auxiliary coolers and from the coolers to any overboard connections suitable to allow the Contractor to perform the work of this Specification.

19.3.3.4 The Contractor must supply and install all piping, piping supports and hangers, flexible joints, gaskets, valves, gauges and instrumentation to provide a fully functional engine cooling water system as set out in the performance requirements this section of the Specification.

19.3.3.5 The components supplied for the engine cooling water system upgrade must meet the following approvals:

- a) Lloyds Register of Shipping Quality Assurance;
- b) Transport Canada Marine Safety;
- c) Canada Shipping Act, Marine Machinery Regulations.

19.3.3.6 The piping and piping installations must be in accordance with Section 3.2 of this Specification.

19.3.3.7 The Contractor must adhere to the requirements of Section 2.5.3 of this Specification with regards to equipment access for maintenance.

**19.3.4 Air Conditioning Sea Water System**

- 19.3.4.1 The Contractor must remove and dispose of the existing air conditioning cooling water piping, pumps, and valves in accordance with Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.
- 19.3.4.2 The Contractor must disconnect and remove all air conditioning piping from the sea bay to the first flanges on the circulation pumps and from the pumps to all HVAC units, then to overboard connections suitable to allow the Contractor to perform the work of this Specification.
- 19.3.4.3 The Contractor must supply and install two (2) new sea water pumps with the performance requirements stipulated on the Air Conditioning System drawing. The pumps must have the following characteristics:
- a) in current production;
  - b) supplied with a marine motor with TEFC frame;
  - c) mounted on a baseplate;
  - d) self-priming centrifugal;
  - e) pump casing and impeller made of bronze or stainless steel;
  - f) shaft must be stainless steel;
  - g) all other components designed for use in sea water.
- The Contractor must provide the proposed pump selection to the TA for review and consultation prior to purchasing.
- 19.3.4.4 The Contractor must be responsible for removing the existing mounts and installing new mounting arrangements for the new pumps. The Contractor must supply all new stainless steel hardware for securing the pumps.
- 19.3.4.5 The Contractor must supply, arrange and install all piping, valves, temperature regulating valves, expansion joints, flexible connections, unions, flanges, piping supports, hangers, gauges and instrumentation to provide a fully functional air conditioning cooling water system as set out in the performance requirements this section of the Specification.
- 19.3.4.6 The components supplied for the air conditioning cooling water system upgrade must meet the following approvals:
- a) Lloyds Register of Shipping Quality Assurance;
  - b) Transport Canada Marine Safety;
  - c) Canada Shipping Act, Marine Machinery Regulations.
- 19.3.4.7 The piping and piping installations must be in accordance with Section 3.2 of this Specification.



- 19.3.4.8 The Contractor must adhere to the requirements of Section 2.5.3 of this Specification with regards to equipment access for maintenance.

## **19.4 Testing and Commissioning**

### **19.4.1 Testing**

- 19.4.1.1 The Contractor must schedule and conduct the commissioning tests and dock trials of the sea water cooling water systems after final inspection.
- 19.4.1.2 The Contractor must develop specific procedural tests for the dock trials of the sea water cooling water systems to ensure that the system meets the performance requirements as set out in this Specification. The Inspection Authority must witness all commissioning and dock trials of the retrofitted engine cooling water system.
- 19.4.1.3 The Contractor must make reference to Section 7 for additional requirements.
- 19.4.1.4 The Contractor must ensure that the final installation is TCMS approved and inspected as such.

### **19.4.2 Defects and Re-Testing**

- 19.4.2.1 Any part of the sea water cooling water systems that prove to be defective during any part of the tests must be replaced or repaired to produce a fully operational and functional system. Such occurrences may render the tests void or require further testing to be carried out to the satisfaction of the Inspection Authority.

## **19.5 Documentation**

- 19.5.1.1 The Contractor must make reference to Section 6 for the documentation requirements for the retrofitted engine cooling water system.
- 19.5.1.2 The Contractor must update all “As Fitted” drawings affected by the work of this Specification.
- 19.5.1.3 The Contractor must provide the Technical Authority and Inspection Authority with copies of all TCMS documentation records for the retrofitted engine cooling water system as detailed in Section 6.2.4 of this Specification.

## **20.0 SANITARY WATER PIPING SYSTEMS UPGRADE**

### **20.1 Scope**

- 20.1.1.1 The Contractor must remove, dispose and replace all steel sanitary water piping arrangements throughout the vessel.
- 20.1.1.2 The Contractor must supply, install and commission new valves, fittings, piping and all other associated components to provide a fully functional and operational sanitary water system.

### **20.2 Applicable Documents**

The following documents are applicable to or interface with the task requirements of this section:

- Lloyd's Classification Society Rules;
- C.S.A., Hull Construction Regulations, Marine Machinery Regulations;
- Drawing List.

<b>Drawing Number</b>	<b>Description</b>
VNEA2 317 006	Hot and Cold FW & Sanitary SW Arrangement (2 sheets)

### **20.3 Scope of Work**

- 20.3.1.1 All material removed becomes property of the Contractor and is to be disposed of in accordance with Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.
- 20.3.1.2 The following equipment has been categorized for handling as per Section 1.11.2:

<b>Equipment/Material</b>	<b>Category</b>
Redundant Piping, Valves & Pumps,	C
Scrap steel	C

#### **20.3.2 Decommissioning of Sanitary Water System**

- 20.3.2.1 The Contractor must decommission the sanitary water system onboard the vessel for the duration of the work period of this Specification. The sanitary water system must be isolated with a lockout system to prevent ingress of any contaminants including water into the piping system while the work of this Section of the specification is carried out.
- 20.3.2.2 The Contractor must dispose of all sanitary water removed from the system in accordance with all Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.

### **20.3.3 Sea Water Piping**

- 20.3.3.1 The Contractor must remove and dispose of the existing sanitary water cooling piping, valves in accordance with Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.
- 20.3.3.2 The Contractor must disconnect and remove all sanitary water piping from the sea bay to the first flanges on the sanitary water pumps, and from the pumps to all sanitary fixtures or overboard connections suitable to allow the Contractor to perform the work of this Specification.
- 20.3.3.3 The Contractor must supply and install all piping, valves, temperature regulating valves, expansion joints, flexible connections, unions, flanges, piping supports, hangers, gauges and instrumentation to provide a fully functional sanitary water system as set out in the performance requirements of this section of the Specification.
- 20.3.3.4 The components supplied for the sanitary water system upgrade must meet the following approvals:
  - a) Lloyds Register of Shipping Quality Assurance;
  - b) Transport Canada Marine Safety;
  - c) Canada Shipping Act, Marine Machinery Regulations.
- 20.3.3.5 The piping and piping installations must be in accordance with Section 3.2 of this Specification.
- 20.3.3.6 The Contractor must adhere to the requirements of Section 2.5.3 of this Specification with regards to equipment access for maintenance.

## **20.4 Testing and Commissioning**

### **20.4.1 Testing**

- 20.4.1.1 The Contractor must schedule and conduct the commissioning tests and dock trials of the sanitary water system after final inspection.
- 20.4.1.2 The Contractor must develop specific procedural tests for the dock trials of the sanitary water system to ensure that the system meets the performance requirements as set out in this Specification. The Inspection Authority must witness all commissioning and dock trials of the retrofitted sanitary water system.
- 20.4.1.3 The Contractor must make reference to Section 7 for additional requirements.
- 20.4.1.4 The Contractor must ensure that the final installation is TCMS approved and inspected as such.

**20.4.2 Defects and Re-Testing**

- 20.4.2.1 Any part of the sanitary water system that prove to be defective during any part of the tests must be replaced or repaired to produce a fully operational and functional system. Such occurrences may render the tests void or require further testing to be carried out to the satisfaction of the Inspection Authority.

**20.5 Documentation**

- 20.5.1.1 The Contractor must make reference to Section 6 Documentation for the documentation requirements for the retrofitted sanitary water system.
- 20.5.1.2 The Contractor must update all “As Fitted” drawings affected by the work of this Specification.
- 20.5.1.3 The Contractor must provide the Technical Authority and Inspection Authority with copies of all TCMS documentation records for the retrofitted sanitary water system as detailed in Section 6.2.4 of this Specification.

## 21.0 SHIP'S SIDE VALVES AND SPOOL PIECES (SURVEY ITEM)

### 21.1 Identification

21.1.1 The Contractor must isolate, open and dismantle the valves identified in the reference table and submit these for inspection and approval by the attending TCMS surveyor. The Contractor must then reassemble the valves and test all valves once the vessel is undocked. The contractor must remove and replace all ship's side spool pieces (piping from the ship's side to the ship's side valve).

21.1.2 Where a ship's side valve as noted in the List of Sea Valves has been identified for removal, the Contractor must be responsible for removal of the valve and spool piece and blanking the ship's side.

### 21.2 Reference

#### 21.2.1 List of Sea Valves (Bays & Chests)

NO:	SPACE	VALVE	SIZE	TYPE	LOCATION /FRAME	IDENT. NUMBER
01	PORT SEA CHEST	Sea Chest Suction	16"	SDSL- Globe	Aft of 27	SC-25
02		Sea Chest Vent	4"	SDSL- Globe	Aft of 26	VS-32
03		F/W Maker Aux. Suction	3"	SDNR- Angle	Aft of 26	*
04		M/E Sea Water to Chest Recirculating	6"	SDSL- Globe	Aft of 26	SC-77
05		Grease Injection - remove	1/2"	SDSL- Globe	Aft of 27	*
06	STBD. SEA CHEST	Sea Chest Suction	16"	SDSL- Globe	Aft of 27	SC-26
07		Sea Chest Vent	4"	SDSL- Globe	Aft of 26	VS-33
08		M/E Sea Water to Chest Recirculating	6"	SDSL- Globe	Aft of 26	SC-76
09		Grease Injection - remove	1/2"	SDSL- Globe	Aft of 27	*
10		Port Sea Bay Flooding	16"	Butterfly	Aft of 27	SC-27
11		Stbd Sea Bay Flooding	16"	Butterfly	Aft of 27	SC-28
12		Emergency Fire Pump Suction	4"	Butterfly	Aft of 27	FF-1
13		General Service Pump Suction	4"	Butterfly	Aft of 27	BA-2
14		Bilge & Ballast Pump Suction	4"	Butterfly	Aft of 27	BA-1
15		Vent	4"	SDSL-Angle	Aft of 27	VS-34
16		Vent	4"	SDSL-Angle	Aft of 27	VS-35

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17	MAIN SEA BAY	Main Engine Sea Suction #1	5"	Butterfly	Aft of 26	SC-52
18		Main Engine Sea Suction #2	5"	Butterfly	Aft of 26	SC-50
19		Main Engine Sea Suction #3	5"	Butterfly	Aft of 26	SC-54
20		Main Engine Sea Suction #4	5"	Butterfly	Aft of 26	SC-56
21		Main Engine Sea Water Recirculating	6"	SDSL-Man.	Aft of 26	SC-31
22		Main Engine Sea Water Recirculating	6"	SDSL-Man.	Aft of 26	SC-32
23		Ballast Tank Recirc to Seabay	6"	SDNR	Aft of 26	SC-35
24		Ballast Tank Recirc to Seabay	6"	SDNR	Aft of 26	SC-36
25		Gear Box Sea Water Suction	4"	Butterfly	Aft of 26	SC-78
26		Ship Service Sea Suction	3"	Butterfly	Aft of 27	SC-59
27		Ship Service Sea Suction	3"	Butterfly	Aft of 27	SC-61
28		Ship Service Sea Water Recirculating	3"	SDNR-Angle	Aft of 26	SC-69
29		Ship Service Sea Water Recirculating	3"	SDNR-Angle	Aft of 27	SC-70
30		Air Cond. Pump Sea Water Suction	2"	Globe	Aft of 26	SC-1
31		Sanitary Pump Sea Water Suction	1 1/4"	SDSL-Globe	Aft of 26	SW-6
32		Sew. Sys. Backwash Suction (former) - unclear if this valve exists???	1"	SDSL-Globe	*	*
33	PORT	Fire Monitor Pump Suction -remove and blank	12"	SDSL-Angle	Aft of 17	FF-10
34	FIRE	Vent	4"	SDSL-Angle	Aft of 17	VS-36
35	MON.	Fresh Water Maker Suction	3"	SDSL-Angle	Aft of 18	PW-1
36	S/C	Grease Injection - remove	1/2"	SDSL- Globe	Aft of 17	*
37	STBD.	Fire Monitor Pump Suction -remove and blank	12"	SDSL-Angle	Aft of 17	FF-11
38	FIRE	Vent	4"	SDSL-Angle	Aft of 17	VS-37
39	S/C	Grease Injection - remove	1/2"	SDSL- Globe	Aft of 17	*
40	BOW	Emergency Fire Pump Suction - replacing this valve with a new GFM valve	4"	SDSL-Angle	Aft of 41	FF-9
41	THRUSTER	Vent	4"	SDSL-Angle	Aft of 40	VS-31
42	SEA BAY	Bow Thruster Gearbox Cooling Pump Disc. - blank	1"	SDSL-Globe	Aft of 40	*
43	HULL	Doppler Speed Log - moving this valve to better position or making better access.	3"	Gate	Fwd. of 41	*

44	B.T. TUBE	Bow Thruster Gearbox Cooling Pump Suct. - being removed with new thruster install	1/2"	SDNR-Globe	*	*
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#### LIST OF DE-ICING VALVES (BAYS & CHESTS)

01	MAIN STBD. S/C and PORT S/C	Compressed Air - Sea Chest - removed - must also remove the stub piece remaining on sea chest	1"	SDNR- Globe	Aft of 27	SA-23
02	SEW. RM.	Compressed Air - Sewage Overboard	1"	SDSL-Globe	Fwd of 35	SA-23
03	PORT S/C	Compressed Air - Fire Monitor Sea Chest - removed - must remove the stub piece remaining in the chest	1"	SDNR-Globe	Aft of 17	SA-23
04	STBD. S/C	Compressed Air - Fire Monitor Sea Chest - removed - must remove the stub piece remaining in the chest	1"	SDNR-Globe	Aft of 17	SA-23
05	B/T S/B	Compressed Air - Bow Thruster Suction - remove valve and stub piece connected to seabay	1"	SDNR-Globe	Aft of 41	SA-23

#### LIST OF OVERBOARD/DISCHARGE VALVES

NO:	SPACE	VALVE	SIZE	TYPE	LOCATION & FRAME	IDENT. NUMBER
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01	Port Side	Fresh Water Maker Brine Discharge, connect to reverse osmosis Ovbd	3"	SDNR-ANGLE	Aft of 25	PW-49
02		Air Conditioning Cooling Pump Discharge	2"	SDNR-ANGLE	Aft of 24	SC-6
03		Ship Service Generator Discharge	3"	SDNR-ANGLE	Aft of 25	SC-67
04		Ballast Discharge	4"	SDNR-ANGLE	Aft of 25	BA-21
05		Main Engines S/W Overboard	6"	SDNR-ANGLE	Aft of 24	SC-33
01						
02		Main Engines Salt Water Recirc. Seabay	6"	SDNR-MANIFOLD	Aft of 26	*
03		Main Engines Salt Water Recirc.Ballast Tk.	6"	SDNR-MANIFOLD	Aft of 26	*
04		Gear Box Cooling Pump Discharge	2 1/2"	SDNR-ANGLE	Aft of 24	SC-89

05		Fire Monitor Pump Discharge - remove and cap at hull	6"	SDNR-GLOBE	22	*
06	STBD.      SIDE	Oily Water Separator Discharge	1"	SDNR-GLOBE	Aft of 24	BL-20
07		Ship Service Generator Discharge	3"	SDNR-GLOBE	Aft of 24	SC-68
08		Ballast Discharge	4"	SDNR-ANGLE	Aft of 24	BA-22
09		Main Engine S/W Overboard	6"	SDNR-ANGLE	Aft of 24	SC-34
01						
02		Main Engine Salt Water Recirc. Seabay	6"	SDNR-MANIFOLD	Aft of 26	*
03		Main Engine Salt Water Recirc. Ballast Tk.	6"	SDNR-MANIFOLD	Aft of 26	*
04		Gear Box Cooling Pump Discharge	2 1/2"	SDNR-ANGLE	Aft of 24	SC-90
05		Fire Monitor Pump Discharge- remove and cap at hull	6"	SDNR-GLOBE	22	*
06	Gen. Stores	Chain Locker Bilge Pump	2 1/2"	SDNR-ANGLE	Fwd. of 46	BL-15
07	BT COMP.	Emergency Fire Pump ovbd	4"	SDNR-GLOBE	Fwd. of 40	BL-14

#### LIST OF STORM VALVES

01	PORT E/R	Winch Compartment Scupper	4"	SDNR-STORM	Fwd. of 22	DD-1
02	STBD. E/R	Winch Compartment Scupper	4"	SDNR-STORM	Fwd. of 22	DD-2
03	P STORE	Grey Water Discharge	4"	SDNR-STORM	Fwd. of 40	WC-34
04	S STORE	Grey Water Discharge	4"	SDNR-STORM	Fwd. of 40	WC-23
05	SEW. COM.	Sewage Emergency Discharge	6"	SDNR-STORM	Fwd. of 35	WC-22
06	SEW. COM.	Sewage System Discharge	1 1/2"	SDNR-STORM	Fwd. of 35	*

#### 21.2.2 Drawings

- a) SEABAY ARRANGEMENT DRAWING (with notes) VNEA2 315-010
- b) OVERBOARD DISCHARGERS ARRANGEMENT VNEA2 315-004
- c) COMPRESSED AIR DIAGRAM VNEA2 362-004
- d) COMPRESSED AIR ARRANGEMENT VNEA2 362-006



### 21.3 Technical

- 21.3.1.1 The Contractor must identify all valves and tag all valves and valve parts to ensure that items for a particular valve can be identified once the valve parts have been removed from the vessel.
- 21.3.1.2 The Contractor must disassemble and clean all valves and valve components identified in Section 21.2. The valves must be disassembled and laid out for inspection by the attending TCMS surveyor. TCMS approval must be obtained for all identified valves in Section 21.2.
- 21.3.1.3 The Contractor is to make special note of the Doppler Speed Log Transducer valve in the Bow Thruster Compartment. This valve is located between deep frames and is very difficult to reach. It is equipped with a remote operated hand wheel via chain link and sprocket. This operating gear will require removal for access. The speed log transducer must be withdrawn from the valve body and set aside. The valve will then to be entirely removed from the keel plate for maintenance purposes. Upon completion of overhaul a new joint of neoprene sheet suitable for sea water service must be installed under the valve and it must be secured to the hull using new stainless steel nuts and bolts, 4 each 5/8 x 11 UNC. The transducer and cap must then be reinstalled using a new neoprene sheet joint and stainless steel fasteners. All fasteners are to be coated with anti-seize compound prior to installation. The remote hand-wheel gear is to be reinstalled upon completion of the work and proven operational. The work in this section must be coordinated with the work in Section 24.0 of this Specification.
- 21.3.1.4 The Contractor must grind in all valve disc and valve seats after inspection. Final lapping must be done so as to ensure that the valve discs have full contact with the valve seat around the circumference of the valve seat and disc.
- 21.3.1.5 The Contractor must re-assemble and all internal surfaces of the valve bodies and bonnets must be given two (2) coats of cold water bitumastic coating such as Apexior #3. This coating must be cured prior to the valve being reassembled. Any substitutions are to be approved by the TA prior to use.
- 21.3.1.6 All valves are to be reassembled with new neoprene bonnet joints of required thickness. All spindle and fastener threads are to be coated with an anti-seize compound before installation. The valves are to be repacked using Garlock #5860 non-asbestos packing, or equivalent product, of appropriate size. TA will carry out a final inspection prior to closing up the valves. Where valves have required exterior wire brushing to remove accumulated rust, the exterior is to be coated with one coat of red primer.
- 21.3.1.7 The Contractor must reinstall all valves with new Contractor supplied asbestos free gaskets and packing. All valves must be installed and left in their closed position.

- 21.3.1.8 Where a valve is beyond serviceability, Contractor supplied replacement valves must be installed. The replacement valves must be Class approved, the same material, class of service and style as the condemned valve.
- 21.3.1.9 The Contractor must bid on the replacement, installation and disposal of 20% of each size the valves, and provide a unit price for each type of valve so that any adjustment in scope can be done by submitting a PWGSC Form 1379.
- 21.3.1.10 Contractor must remove the as fitted emergency fire pump suction valve, from the bow thruster sea bay, and fit with a new GFE supplied valve. The work in this section must be coordinated with the work in Section 24.0 of this Specification.
- 21.3.1.11 The Contractor must bid on providing 60 unit hours of machining for the various valve seats and valve discs and any adjustment in scope can be done by submitting a PWGSC Form 1379.
- 21.3.1.12 The Contractor must remove and machine new spool pieces as indicated in Section 21.2. The Contractor must bid on providing 200 unit hours of machining to produce these pieces and any adjustment in scope can be done by submitting a PWGSC Form 1379.
- 21.3.1.13 The Contractor must follow the original spool design except for the grease injection lines as this system is no longer in use. Spool pieces must be of solid construction.
- 21.3.1.14 The Contractor must reinstall all spool pieces with new Contractor supplied asbestos free gaskets suitable for sea water service.
- 21.3.1.15 Currently the reverse osmosis unit brine discharge is tied into the AC cooling water overboard discharge, using a pvc line.



Reverse osmosis unit pvc  
connection into AC cooling water  
discharge.

- 21.3.1.16 Contractor must remove this pvc line and fabricate a new section of pipe to replace this pipe section of the AC cooling water discharge. The discharge pipe for the air conditioning water is connected to the overboard valve by a 2-inch Victaulic coupling. The other end of this pipe section is also connected by a Victaulic coupling. The pipe section is about 7 feet long overall, with three 90-degree elbows. The work in this section must be coordinated with the work in Section 19.0 of this Specification.
- 21.3.1.17 Contractor must fabricate the new section of pipe to fit the same as the old. The TA will entertain an alternate route, if brought forward.
- 21.3.1.18 The old evaporator overboard valve has an eight foot length of pipe flanged to the valve, the other end of this pipe is blanked by a Victaulic coupling and end cap. This section of pipe must be removed and disposed of by the contractor.
- 21.3.1.19 Contractor must then hard pipe in the 1.5" brine discharge from the reverse osmosis unit to the existing evaporator brine discharge. Contractor must fabricate an adapter to allow connection of the 1.5" reverse osmosis discharge to the 3" evaporator brine discharge valve.



- 21.3.1.20 Contractor to note that the evaporator valve must be disassembled for TC inspection and the spool piece replaced, as per the intent of this specification item.
- 21.3.1.21 Contractor must remove the sea water suction valves and spool pieces from the fire pump suction, general service pump suction and the bilge and ballast pump suction lines off the engine room sea bay.
- 21.3.1.22 Contractor must install new 4" butterfly valves, complete with gearbox operation and removable hand wheels. These valves must be installed at the flange connection to the sea bay, to cut down on the long runs of pipe with no isolation.
- 21.3.1.23 Contractor must fabricate new pipe connections to run from the new butterfly valve locations to the existing seawater pipework.
- 21.3.1.24 Contractor must note that several sea valves are being replaced; main engine sea water suctions, ship service generator sea water suctions, ship service sea water recirculation, AC sea water suction, gearbox seawater suction, and sanitary sea water suction valves. These valves must require TCMS certification for this specification section. This Specification section may require coordination in conjunction with Specification Sections 19.0, 20.0 and 36.0 and 47.0.
- 21.3.1.25 The contractor must fabricate new spool pieces and pipe lengths for the replacement valves.
- 21.3.1.26 Contractor must remove both the port and stbd 12" fire monitor suction valves, and spool pieces, from the port and stbd fire monitor sea chests. The remaining fire monitor system has been removed. Contractor must fabricate new welded blanks to blank off the sea bay that will require TCMS approval.

- 21.3.1.27 Contractor must remove and blank the 1” bow thruster gearbox cooling water discharge line, into the bow thruster sea chest, if it is no longer needed. The work in this section must be coordinated with the work in Section 24.0 of this Specification, and requires TCMS approval.
- 21.3.1.28 Contractor must remove and dispose of all 1” compressed air lines, from the main port and stbd sea chests, the port and stbd fire monitor sea chest, and bow thruster sea chest. Contractor must note that the compressed air connection to the sewage discharge is still an operational requirement and must be reinstalled after work is complete on the sewage discharge overboard.
- 21.3.1.29 Contractor must remove both the port and stbd fire monitor discharge valves and spool pieces, at the ship’s hull. The ship’s side openings must be blanked.
- 21.3.1.30 Where permanent removal of fittings will result in the necessity of fitting insert plates in primary structures, shell plating, watertight bulkheads and watertight decks, the following procedure must be adopted:
- a) The Contractor must prepare and submit a planned method and CWB engineer approved welding schedule for approval by TCMS;
  - b) All plate material to be used as insert material must be the same Grade and thickness as the original plate material;
  - c) All inserts on shell plating must be flush;
  - d) All underwater inserts must be subject to 100% radiography on completion at the Contractor’s expense;
  - e) Tanks and void spaces where inserts have been fitted must be hydrostatically tested to a head of water of 2.5 meters. The tests must be witnessed by TCMS and the TA;
  - f) Location of any new insert plates must be noted on the vessel’s Shell Expansion Drawing.

## **21.4 Inspections, Tests and Trials**

- 21.4.1.1 The Contractor must obtain TCMS inspection and approval documentation is provided for all valves listed in Section 21.2.
- 21.4.1.2 The Contractor must identify all valves that are beyond their serviceability at the earliest possible time to the TA and IA to avoid a potential delay in the un-docking of the vessel.
- 21.4.1.3 The Contractor must coordinate attendance of TCMS, the TA and IA in order to examine all valves in their disassembled state.
- 21.4.1.4 The Contractor must have all valves closed and must have sufficient personnel on hand such that all valves listed in Section 21.2 can be inspected for leaks during the

undocking of the vessel. Once sufficient water depth has been obtained, all closed valves must be opened and verified that no bonnets or valve packing around the valve stems are leaking. Any leaks must be rectified by the Contractor prior to vessel acceptance. The TA and IA must be in attendance to verify that all valves are performing as designed.

## **21.5 Documentation**

- 21.5.1.1 The Contractor must supply valve certificates for all new valves.
- 21.5.1.2 The Contractor must supply the CGTA with confirmation that all valves have been surveyed and passed by the attending TCMS surveyor.
- 21.5.1.3 The Contractor must provide a detailed report with each valve identified separately of all work carried out to the valves. This must include details on the machining and repairs (if applicable) and on what valves it was performed on. The report must also include details of any obsolete valves that have been replaced and the new valve specifications.

## **22.0 SWITCHBOARD UPGRADES**

### **22.1 Identification**

- 22.1.1 The electrical distribution system on the CCGS Earl Grey requires upgrades to the existing original equipment. The Contractor must supply and install new electrical distribution equipment in the switchboards.

### **22.2 References**

#### **22.2.1 Drawings**

<b>Document #</b>	<b>File Name</b>
	Grey Switchboard Modifications
	MCR Console Layout
VNEA2 E-1	Electrical Power Single Line Diagram 1 of 2
VNEA2 E-1	Electrical Power Single Line Diagram 2 of 2

#### **22.2.2 Regulations and Standards**

- a) Canada Shipping Act 2001;
- b) Transport Canada TP 127E Ships Electrical Standards;
- c) IEEE 45 Recommended Practice for Electric Installations on Shipboard;
- d) DGTE-69 (70-000-000-EU-JA-001) Specification for the Installation of Shipboard Electronic Equipment;
- e) IEC 60533 – Electrical and Electronic Installations in Ships – Electromagnetic compatibility;

### **22.3 Technical**

All breakers and breaker accessories removed must be categorized as Category “A” property, all other redundant wiring, switches, lights must be categorized as Category “C” property and disposed of in accordance with all Federal, Provincial and Municipal regulations.

#### **22.3.1 120 Volt AC Distribution Breaker Replacement**

- 22.3.1.1 The contractor must be responsible to supply and replace new breakers for the 120VAC main distribution panel (1MO).
- 22.3.1.2 The replacement breakers must be I Line Products. The contractor will ensure that the new breaker’s, short circuit current rating will meet the requirements of the application and most recent regulatory standards.
- 22.3.1.3 The contractor must ensure that any required auxiliary contacts and shunt trips are duplicated in the replacement breakers. Spare breakers in the panel will be

identified and replaced as per the aforementioned specification and must have the same ampacity as that which is being replaced.

22.3.1.4 The panel has 11 breakers in total to be replaced:

- a) 1 x 30A Spare
- b) 1 x 40A
- c) 2 x 60A
- d) 2 x 90A
- e) 2 x 100A
- f) 1 x 125A
- g) 1 x 150A
- h) 1 x ?A Locked out

#### 22.3.2 **230 Volt AC Distribution Breaker Replacement**

22.3.2.1 The contractor must be responsible to purchase and replace new breakers for the 230VAC main distribution panel. (2MO ).

22.3.2.2 The replacement breakers must be I Line Products. The contractor will ensure that the new breaker's, short circuit KA current rating will meet the requirements of the application and most recent regulatory standards. Any required auxiliary contacts and shunt trips to be determined by the contractor.

22.3.2.3 Spare breakers in the panel will be identified and replaced as per the aforementioned specification and must have the same ampacity as that which is being replaced.

22.3.2.4 The panel has 15 breakers in total to be replaced. The incinerator breaker will become a spare as this power supply will be coming from an alternate source so the replacement breaker will become a spare and should be indicated as such on the panel Talley plate.

- a) 2 x 15A
- b) 5 x 20A
- c) 2 x 30A
- d) 1 x 50A
- e) 1 x 90A
- f) 1 x 100A
- g) 1 x 125A
- h) 1 x 200A
- i) 1 x ?A

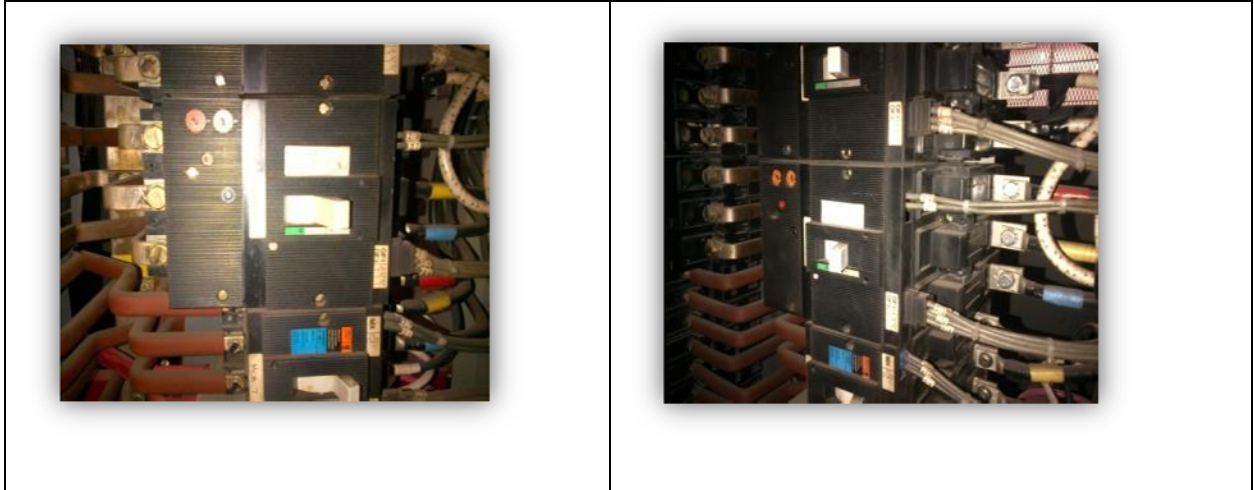


### 22.3.3 **600 Volt AC Distribution Breaker Replacement**

- 22.3.3.1 The contractor must be responsible to purchase and replace new breakers for the 600VAC main switchboard distribution panel.
- 22.3.3.2 The replacement breakers must be Merlin Gerin Products to maintain commonality with the vessel's electrical system.
- 22.3.3.3 The contractor will ensure that the new breaker's, short circuit KA rating will meet the requirements of the application and most recent regulatory standards. Any auxiliary contacts, shunt trips, and UV trips required for the replacement breakers will be identified by the contractor.
- 22.3.3.4 Spare breakers in the panel will be identified and replaced as per the aforementioned specification and must have the same ampacity as that which is being removed.
- 22.3.3.5 The panel has 13 breakers in total to be replaced. The "transformer breaker" "towing winch compartment" will be assigned M1 as an identifier and an appropriate lamonide should be made up with white lettering on a black background and attached (refer to Section 2.9 on labelling). This breaker (M1) will require testing but not replacement unless proven faulty during testing as this is a later model Circuit Breaker.

Table 20-1: 600 Volt Breaker List

M1	100A FRAME	100A TRIP
M2	250A FRAME	150A SHUNT TRIP
M3	250A FRAME	150A SHUNT TRIP
M4	250A FRAME	125A TRIP
M5	250A FRAME	225A SHUNT TRIP
M6	250A FRAME	200A TRIP
M7	250A FRAME	150A TRIP
M8	250A FRAME	125A SHUNT TRIP
M9	125A FRAME	500A INSTANTIOUS
M10	125A FRAME	500A INSTANTIOUS
M11	160A FRAME	UNKNOWN
M12	250A FRAME	200A SHUNT TRIP
M13	250A FRAME	250A TRIP
M14	250A FRAME	250A TRIP



**Above:** 2 pictures of 600VAC distribution breakers located in the main switchboard.

#### 22.3.4 **Generator Protective Relay Installation**

- 22.3.4.1 The contractor must purchase and install 4 SEL-700G Multi-Function Relays (MFR), 1 for each ships service generator and 1 for each Shaft generator.
- 22.3.4.2 The relays must have self-monitoring and communications capabilities. In the event of a relay failure the unit must have the ability to communicate this failure to the ships Alarm & monitoring system via a dry set of contacts.
- 22.3.4.3 The relay must also have communications capabilities to enable interaction between the new MFR and the vessels Alarm & Monitoring system (VTS).
- 22.3.4.4 The MFR package will include:
- a) 4 x SEL-700G MFR generator protection relays;
  - b) New protective class CT's for each SEL-700G relay;
  - c) Control Drawings;
  - d) Data and Alarm communications cables installed and terminated. Data protocol will be RS485 Modbus;
  - e) Provision for three timed preferential trips to be set at the appropriate load sheading percentage values;
  - f) Full software package provided to the TA. (2 user licence);
  - g) Backup copy of the relay settings for each relay;
  - h) Provide crew with required software training to maintain and upload/download the relay program in the event that a relay must be changed out at sea. Training will also include the proper approach to testing the preferential trips through the software.

- 22.3.4.5 The contractor will be responsible to run and terminate an alarm cable and a communications cable from each MFR relay to the VTS system.
- 22.3.4.6 The MFR FSR must be engaged by the contractor to configure, commission and confirm connections to the MFR. The SEL-700G relay FSR must determine the data required in setting the MFR relay parameters. The Contractor will provide the FSR with the trip and pre alarm parameters to complete the task.
- 22.3.4.7 Trihedral Engineering Ltd must be engaged by the contractor to reconfigure the VTS system and develop an appropriate electrical page on the VTS screen as directed by the Technical Authority. The MFR representative must provide Trihedral Engineering with all NEMA data registers that would have values available to the customer so that Trihedral can configure the dynamic points on the new A&M screen. (EG: amps/volts/ Kwatts/ power factor/frequency/Kvar etc.)
- 22.3.4.8 The MFR relays must be powered by a 24VDC battery backed up source to be identified by the TA.
- 22.3.4.9 The MFR representative must provide the contractor with the appropriate information to purchase and install Protective Class CT's for all 4 MFR relays.
- 22.3.4.10 The MFR relay must monitor all aspects of the generators operations as listed below. The MFR relays breaker tripping functionality will not include the breakers Long time, short time and instantaneous functions. This aspect of the generator protection will be left with the generator breaker Micrologic protective relay. The MFR relay must be a pre-alarm only for these functions, set at 5 % under the breaker protection curve.
- 22.3.4.11 The SEL-700G MFR protection must include but not be limited to: Reverse power, Preferential tripping, Under Voltage, Over Voltage, Under Frequency, Over Frequency, earth fault protection. The reverse power function must be configured such that it will become active @ 9% x Generator rated KW if in reverse power for 15 seconds.
- 22.3.4.12 The contractor will be responsible to remove all redundant wiring and relays. The old relays must be treated as Category "A" property.
- 22.3.4.13 The contractor will be responsible to update the vessel drawings to reflect the changes made to the switchboard.
- 22.3.4.14 The location of the new Shaft Generator MFR relays will be decided by the Technical Authority in conjunction with the contractor.

**22.3.5 MCR Switchboard and Console Modifications**

22.3.5.1 The Contractor must perform this work in conjunction with the following sections:

- a) 14.0 Propulsion Control System Replacement
- b) 15.0 Steering Gear Control Upgrade
- c) 40.0 MCC Upgrade

22.3.5.2 The new ship's service generator MFR's must be located on the renewed Machinery Control Room console, to the left of the Propulsion System controls as indicated in the guidance drawing MCR Console Layout in the Technical Data Package. The Contractor must use a new Contractor supplied drop in panel. The panel must be finished in the same colour as the propulsion control panel and the rest of the MCR console.

22.3.5.3 The Contractor must follow the MFR section 22.3.4 for the installation of these relays.

22.3.5.4 The Contractor must install new indication lights and control buttons below the MFR's with Contractor supplied lights, buttons and contactors. These lights, buttons and contactors must be the same make and models as the existing Government supplied Propulsion Control System buttons and contactors.

22.3.5.5 The Contractor must run new wires from the closest terminal block to the new indicating lights and button contactor blocks.

22.3.5.6 The Contractor must isolate, disconnect, label and remove all wiring from the ship's service generator EasyGen modules located in the desk of the MCR console. The Contractor must install a new terminal block inside the console to reconnect all the EasyGen wiring.

22.3.5.7 The Contractor must install the EasyGen modules (Port generator module on top, Starboard generator module below) in the Shore Power section of the main switchboard as shown in the guidance drawing Grey Switchboard Modifications.

22.3.5.8 The Contractor must run new wiring from the new terminal blocks to the EasyGen modules in the switchboard.

22.3.5.9 The Contractor must isolate and remove the existing Kilowatt hour meter from the Shore Power section of the main switchboard. The Contractor must isolate and remove all wiring back to the terminal blocks from the Shark 200 meter on the switchboard in the engine room on the auxiliary machinery flat. The Shark meter must be removed and a metal blank installed in the switchboard. The Shark meter must be installed in the Shore Power Section of the main Switchboard as shown in the guidance drawing Grey Switchboard Modifications in the Technical Data

Package, and wire connections made in accordance with the manufacturer's recommendations.

- 22.3.5.10 The Contractor must modify the MCR Consoles structure as required to accommodate the design changes in the layout of the console. The console must be modified to allow for the relocation of the EasyGen ship service generator panels, the installation of a two new drop in panels and related panel devices. This must include additional reinforcing structure to prevent the Drop-in Panels from being unsupported over their length. The location of reinforcing structure must be determined with actual measurements from the supplied Drop-in panels.
- 22.3.5.11 The MCR console section to the right of the Electrical Mimic Panel will receive a new drop in panel to accommodate new steering gear controls and start button components. To accommodate this modification, the existing buttons must have all wiring disconnected, labeled and protected if they are to be reused. Lights and buttons that are being relocated to the new location below the MFR's will need wiring stripped back to the closest terminal block to accommodate longer wires being installed. Wiring that is redundant must be removed and disposed of as Category "C" property.
- 22.3.5.12 Upon installation of the new Emergency Fire pump and Air Compressor control buttons, the wiring must be reconnected and the button functions tested in the presence of the TA.
- 22.3.5.13 The MCR console section to the left of the Propulsion Control section will receive new MFR's, indication lights and start button components. To accommodate this modification, the new lights and buttons must have new wiring connected from the terminal blocks noted above to the new component contactor blocks.
- 22.3.5.14 Upon installation of the new Generator control buttons and lights, Engineer Call button, Stern Thruster servo pump controls, Bow and Stern Thruster indicating lights and VTS Alarm Silence button, the wiring must be reconnected and the indicating light and button functions tested in the presence of the TA.
- 22.3.6       **Emergency Generator Switchboard Protective Relays**
- 22.3.6.1 The protective relays must be removed to a certified shop for inspection and calibration.
- 22.3.6.2 Any relays that no longer have manufacturer support must be replaced with the latest version.

- 22.3.6.3 A report must be generated by the contractor to reflect “as delivered”, “as repaired” information as well as the relays overall condition. This report must be presented to the Technical Authority and Inspection Authority.

**22.3.7 Main Switchboard & MCC Cleaning**

- 22.3.7.1 The main switchboard and associated MCC’s require extensive cleaning to remove accumulated dust and dirt which may become a fire hazard.
- 22.3.7.2 All bus work, insulators and installed equipment is to be wiped down and vacuumed. Low pressure air is to be utilized to remove dust from within ventilated equipment enclosures that are otherwise inaccessible.
- 22.3.7.3 Connections must be checked for tightness.
- 22.3.7.4 The contractor will report any anomalies found during the cleaning process to the Technical Authority.
- 22.3.7.5 Prior to commencement of work and upon completion of the task the contractor must perform a megger test on the main bus work and the results must be recorded and presented to the TA for future reference.

**22.3.8 Port & Starboard Shaft Generator Switchboard & MCC Cleaning**

- 22.3.8.1 The Shaft generator switchboards and associated MCC’s require extensive cleaning to remove accumulated dust and dirt which may become a fire hazard.
- 22.3.8.2 All bus work, insulators and installed equipment is to be wiped down and vacuumed. Low pressure air is to be utilized to remove dust from within ventilated equipment enclosures that are otherwise inaccessible.
- 22.3.8.3 Connections must be checked for tightness.
- 22.3.8.4 The contractor will report any anomalies found during the cleaning process to the Technical Authority.
- 22.3.8.5 Prior to commencement of work and upon completion of the task the contractor must perform a megger test on the main bus work and the results must be recorded and presented to the TA for future reference.

**22.3.9 Emergency Generator Switchboard & MCC Cleaning**

- 22.3.9.1 The Emergency generator switchboard and associated MCC’s require extensive cleaning to remove accumulated dust and dirt which may become a fire hazard.

22.3.9.2 All bus work, insulators and installed equipment is to be wiped down and vacuumed. Low pressure air is to be utilized to remove dust from within ventilated equipment enclosures that are otherwise inaccessible.

22.3.9.3 Connections must be checked for tightness.

22.3.9.4 The contractor will report any anomalies found during the cleaning process to the Technical Authority.

22.3.9.5 Prior to commencement of work and upon completion of the task the contractor must perform a megger test on the main bus work and the results must be recorded and presented to the TA for future reference.

#### **22.3.10 CB 8 Breaker Replacement**

22.3.10.1 Breaker CB8 is to be removed and replaced with a suitable alternative. The new units will be an Eaton product as Eaton is now the OEM for Klockner Moller. The contractor will be required to provide any bus work modifications necessary to complete the breaker connections to the system. The old breaker must be carefully removed and treated as Category “A” property.

22.3.10.2 It will be the contractor’s responsibility to ensure that the appropriate shunt and UV trips are identified and supplied with the new breaker.

22.3.10.3 Bus connections must be bolted with non-ferrous material or of steel rendered corrosion resistant bolts and conical spring washers. The new bus must be tin plated copper, the full length.

22.3.10.4 Upon completion of the installation the contractor must conduct testing in accordance with Section 29 of TP127E. All data must be recorder and verified.

22.3.10.5 Breaker contact resistance must be included in the breaker report documentation.

22.3.10.6 Located directly above the CB 8 breaker are control relays and fusing. These control relays are utilized to support the remote operation of CB 8. The contractor will inspect the 4 relays and one overload device and if found defective or marginalized by age, the contractor will submit a PWGSC Form 1379 to replace the units with equivalent Eaton’s products.

22.3.10.7 Upon completion of the breaker installation and control wiring the contractor must demonstrate the operation of the CB8 breaker to the satisfaction of the TA. Included in this trial will be the operation of the remote controls and indication.

22.3.10.8 All new product documentation, Breaker protection settings and test reports identifying the final breaker settings must be provided to the TA. If the control drawings had to be modified the contractor will provide a new/updated control drawing for the CB 8 breaker.

22.3.10.9 For safety reasons two new insulated barriers must be fabricated and installed around CB 8. These barriers will begin at the top and bottom of the breaker and extend to the extents of the cabinet to totally restrict access to the 600 volt connections. The present configuration has no barrier at the bottom and half a barrier at the top which leaves the bus work exposed.

22.3.10.10 New breaker installation must meet or exceed TP127E section 33.



## CB-8

NZM12-800  
ZM12A-800-NA  
Rated Current 800 Amps  
Instantaneous Trip Range 3000A-6000A

To the left is the CB-8 breaker control equipment. The fuses, terminals and PT are in good condition but the Contractor must inspect R1, R2, CRA and the OL unit located in the upper left of the corner. If these units are found to be in poor condition the contractor must replace them.





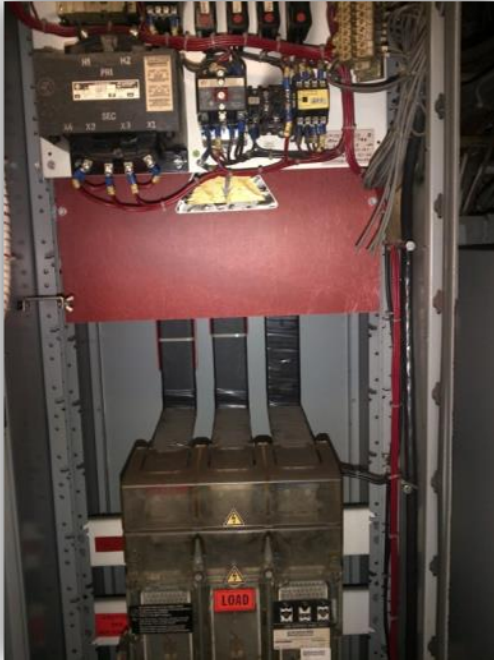


Figure 1: Top View of CB8



Figure 2: Bottom View Of CB8

The above pictures show breaker CB8 and the fact that the barrier required for the top and bottom of the breaker is inadequate and must be updated to meet the latest rule requirements.

#### 22.3.11 **SG14 Breaker Replacement**

22.3.11.1 Breaker SG14 is to be removed and replaced with a suitable alternative. The new unit will be an Eaton product as Eaton is now the OEM for Klockner Moller equipment. The contractor will be required to provide any bus work modifications necessary to complete the breaker connections to the system.

22.3.11.2 Bus connections must be bolted with non-ferrous material or of steel rendered corrosion resistant bolts and conical spring washers. The new bus must be tin plated copper.

22.3.11.3 Upon completion of the installation the contractor must measure, using a 1000 megger, the insulation resistance of the new circuit breaker from phase to phase and phase to ground for one minute each at a minimum test voltage of 1000VDC; minimum acceptable value for insulation resistance is 1 megohms. All data must be recorded and verified.

22.3.11.4 The contractor must demonstrate the operation of the breaker to the TA on completion of the work. Any auxiliaries connected to the breakers will also be demonstrated at the same time.

22.3.11.5 The contractor must provide the TA with all new product documentation.

22.3.11.6 New breaker installation must meet or exceed TP127E section 33.

22.3.11.7 Note: Main Switchboard Short Circuit Rating / Device Min. Isc Rating 42 kAIC at 600v AC.

#### **22.3.12 Switchboard Meter Calibration**

22.3.12.1 All Main switchboard, Emergency Switchboard, Port and Starboard shaft generator switchboard metering must be removed for inspection, calibration. These include meters for:

- a) Volts
- b) Amperes
- c) Kilowatts
- d) Power Factor
- e) Frequency
- f) Synchronizing Meter

22.3.12.2 The contractor will ensure that any metering devices that fail during testing and calibration must be replaced with a unit from the same manufacturer and of identical scaling and red line indication.

#### **22.4 Tests and Trials**

22.4.1 Upon completion of the MCC bucket upgrade and installation back into the MCC cabinet, the contractor must demonstrate proper operation of each unit and confirm rotation of motors controlled by the associated updated unit to the satisfaction of the Technical Authority.

#### **22.5 Deliverables**

##### **22.5.1 Documentation**

22.5.1.1 The Contractor must deliver all manuals, instruction sheets provided with the supplied equipment to the Technical Authority.

22.5.1.2 Documentation of all new parts including “part numbers” and “quantities” used must be provided to the Technical Authority.

22.5.1.3 The Contractor must provide a service report for each bucket, including test results, components changed, and the final settings for each breaker to the Technical and Inspection Authorities.

22.5.2 **Drawings**

22.5.2.1 The Contractor must revise all “As Fitted” drawings as required in Section 6.1.6 of this Specification.

## **23.0 SEWAGE SYSTEM REPLACEMENT (SURVEY ITEM)**

### **23.1 General**

- 23.1.1 The intent of this specification is for the Contractor to remove, dispose and replace the sewage treatment plant. Also, grey water drains will be rerouted from actual overboard discharge lines to flow directly to the new sewage treatment plant. This will insure that all black and grey water drains are treated by the new system.

### **23.2 References**

#### **23.2.1 Regulations**

- 23.2.1.1 The following documents must be used in carrying out this work:
- Lloyd's Register, Rules and Regulations for the Classification of Ships (July 2012), Part 5, Ch 12, Sec.1,2,6,7,8,10. Ch 13, Sec.1,2,12. Ch 14, Sec.1,2;
  - Transport Canada, SOR 2012-69, Vessel Pollution and Dangerous Chemicals Regulations. Division 4;
  - MARPOL, Annex IV, Regulation for Prevention of Pollution by Sewage from Ships;
  - Transport Canada, SOR 90-264 Marine Machinery Regulations, Schedule IX, Div.II
  - IACS No 47 Shipbuilding and Repair Quality Standard
  - TP 127E;
  - IEEE 45 STD -2002;
- Current edition of documents, at time of contract implementation, must be used.

#### **23.2.2 Drawings/Documents**

<b>Drawing/Document Number</b>	<b>Drawing/Document Name</b>
VNEA2 134-401	General Arrangement (Sh 2 of 2)
VNEA2 315-004	Overboard Discharge Arrangement rev C
VNEA2 316-008	Sewage and Grey Water Diagram (as fitted 1984)
VNEA2 316-010	Sewage and Grey Water Arrangement
C14-40-528-12	Sewage Treatment Plant installation
C14-40-528-13	Sewage & Grey Water Diagram
C14-40-528-14	Sewage Holding and Grey Water Tank Plan
C14-40-528-15	Grey Water Sump Tank Plan
01-000-00019-0-01000-B	Discharge Station HL-Cont PLUS
12-001-00002-0-01000-B	Grease Separator with heating GS 050
01-005-XXXXX-0-01000-0	HL-Cont Plus 05 Main Dimensions
01-005-00000-2-00000-0	HL-Cont Plus 05 Functional Diagram
VNEA2 E-1	Electrical Power Single Line Diagram 1 of 2
VNEA2 E-1	Electrical Power Single Line Diagram 2 of 2
	Installation Instruction HL-Cont PLUS 05
	General Information HL-Cont PLUS 05

**23.2.3 Nameplate Data**

**23.2.3.1 Removed Equipment**

23.2.3.1.1 Hamann Wassertechnik GMBH HL-Cont.

**23.2.3.2 Replacement Equipment (Supplied by Contractor)**

23.2.3.2.1 Hamann HL-Cont PLUS 05 Sewage Treatment Plant or equivalent.

**23.2.4 Owner Furnished Equipment**

23.2.4.1 The Contractor must supply all materials, equipment, and parts required to perform the specified work unless otherwise stated.

**23.3 Technical Description**

**23.3.1 Existing Configuration**

23.3.1.1 The actual sewage system, Hamann Wassertechnik GMBH HL-Cont is located in the sewage system room, between frames 32 and 37, port side.

23.3.1.2 The system is gravity fed, sea water flushed, and contains only black water refuse that enters the system directly.

23.3.1.3 The actual system does not meet the actual regulations on sewage discharge.

**23.3.2 Equipment to be removed**

23.3.2.1 All items removed from the vessel are to be disposed of in accordance with all Federal, Provincial and Municipal regulations with copies of disposal certificates provided to the Inspection Authority.

23.3.2.2 Equipment to be removed includes:

- a) Old sewage unit and skid;
- b) Electric control panel, on bulkhead;
- c) Valves & piping not used on 2 holding tanks fitted on vessel, as per drawing C14-40-528-12 Sewage Treatment Plant Installation;
- d) Shelving units, cabinets and workbench.

23.3.2.3 The following equipment has been categorized for handling as per Section 1.11.2:

<b>Equipment/Material</b>	<b>Category</b>
Cabinets, Shelves and Workbench	B
Sewage System	C
Redundant Electric Cabling & Wiring	C
Redundant Piping, Valves & Pumps, etc.	C

Equipment/Material	Category
Scrap steel	C
Electrical Equipment/Components	C

### 23.3.3 **Equipment to be purchased**

- 23.3.3.1 Hamann HL-Cont PLUS 05 sewage treatment plant (set), including electrical control panel.
- 23.3.3.2 250-liter grey water sump tank, c/w transfer pump, for starboard side grey water drains.
- 23.3.3.3 Hamann Grease Separator with heating – GS 050.
- 23.3.3.4 Discharge & sludge pump, c/w electric 3-way valve, HL-Cont PLUS 05/19/20/40, rotary lobe, 15 m<sup>3</sup>, cast iron coated.
- 23.3.3.5 Level sensors, for holding and sludge tanks (supplied as an option by Hamann).

### 23.3.4 **Scope of Work**

#### 23.3.4.1 **General**

- 23.3.4.1.1 The new system will be fed via a new sewage holding tank containing all black water refuse and all grey water drains, including all galley drains that will flow through a new grease separator, c/w heating element that would also be supplied through Hamann as part of the sewage treatment plant package. The grease separator is a new unit, as no grease interceptor is actually fitted on the vessel. Another new item will be a starboard side grey water drains tank and discharge pump set, which will be connected to new sewage holding tank. The sewage unit is of similar design as the present model and will fit into the same area on the vessel.

#### 23.3.4.2 **Old Unit Removal Preparation**

- 23.3.4.2.1 The Contractor must decommission the sewage system onboard the vessel for the duration of the work period of this Specification. The sewage system must be isolated with a lockout system to prevent ingress of any contaminants including water into the piping system and tank while the work of this Section of the specification is being carried out.
- 23.3.4.2.2 The Contractor must electrically lock out the Sewage Plant breaker 526-4, 15 amps, 600V, on panel MCC No.2.
- 23.3.4.2.3 The main cables must be disconnected, rolled up and protected for further use.

- 23.3.4.2.4 The Contractor must dispose of all raw sewage inside system tank, associated pumps and equipment before undertaking any dismantling. The Contractor must be prepared to remove 2 m<sup>3</sup> of raw sewage from the sewage storage tank. The Contractor must be responsible for disposal of all sewage removed from the system and tank in accordance with all Federal, Provincial and Municipal regulations and must provide disposal certificates to the IA.
- 23.3.4.2.5 The Contractor must disconnect all the sewage inlets and outlets to and from the unit and blank them off; major piping modifications will be necessary to reconnect these inlets & outlets to new equipment:
- a) Main unit inlet, 4-inch
  - b) Main unit outlet, 1½-inch
  - c) Unit vent line, 1-inch
  - d) Salt Water inlet to unit, 1-inch (from sanitary water system)
- 23.3.4.3 **Disassembly of old unit and associated equipment**
- 23.3.4.3.1 The Contractor must dismantle the transfer pump and the macerator from unit and remove them separately.
- 23.3.4.3.2 The Contractor must remove the chlorine dosing pump and the tank separately.
- 23.3.4.3.3 System tank will easily fit through proposed opening (approx. tank size 1000 X 1025 mm), without interference items.
- 23.3.4.4 **Removed Equipment Routing**
- 23.3.4.4.1 The Contractor must cut out access door frame (at frame 32) between sewage system room and main engine room to permit unit to be moved out in one piece. Cutout to be 1500 X 2000 mm approximately, contractor is responsible for accurate cutout size. See drawing C14-40-528-12 for details.
- 23.3.4.4.2 Contractor must supply handling and lifting equipment and manoeuvre unit and equipment through engine room up to engine room access opening, closed by a soft patch, approximately 2200 X 1900 mm clear opening (frame 18-20).
- 23.3.4.4.3 Port diesel ship service generator exhaust piping could hinder removal procedure. If a removal is required, Contractor to submit a PWGSC 1379 Form for approval.
- 23.3.4.4.4 Handrails on after flat, port side, will need to be removed.
- 23.3.4.4.5 Once up on deck, all equipment can be lifted ashore and disposed of.

**23.3.4.5 Structural Requirements**

- 23.3.4.5.1 The Contractor must complete structural modifications to suit footprint of new equipment following reference drawings:
- a) Details for the construction and the installation of the new holding/sludge tank are shown on drawing C14-40-528-14.
  - b) Discharge pump and grease separator are mounted on the holding/sludge tank as shown on drawing C14-40-528-14.
  - c) Details for the construction of the new Stbd grey water sump tank, 250 liters, is shown on drawing C14-40-528-15.
- 23.3.4.5.2 The Contractor must empty, de-gas and ventilate Ballast tank No.2P and F.O. tank No.1 in order to install the reinforcement for the installation of the new sewage system as shown on drawings C14-40-528-12 and C14-40-528-14.

**23.3.4.6 Equipment Insertion**

- 23.3.4.6.1 The Contractor must insert the new tanks, i.e. sewage holding tank, sludge tank & stbd grey water sump tank.
- 23.3.4.6.2 The Contractor must insert new sewage system & equipment into vessel following reverse order of removal.

**23.3.4.7 Piping**

- 23.3.4.7.1 Piping modifications, including interconnection with existing grey water mains piping and new grease trap.
- 23.3.4.7.2 Lead all black and grey water to new holding tank; it will also become necessary to route part of the grey water to an additional sump tank, stbd side, because of difficulty to drain grey water on stbd side of vessel. This tank and pump assembly will be situated in Domestic Machinery Space (fr.39 to 44). See drawing C14-40-528-12.
- 23.3.4.7.3 Removal or modification of all old piping to existing standby sewage holding tanks, as per drawing C14-40-528-12. These tanks were never used to hold sewage or grey water, and will never be used to contain sewage.
- 23.3.4.7.4 List of new connections for unit and new tanks:
- a) To ship's sludge tank, DN 40 connection;
  - b) To ship's sewage holding tank, 6-inch connection;
  - c) To overboard & shore discharge, DN 25 connection;
  - d) Seawater connection, DN 20 (from Sanitary S.W. System);
  - e) Control airline, ½-inch connection;
  - f) System vent line, 1-inch connection;
  - g) From ship's sludge tank, overboard & shore, DN 50 connection in & out of sewage & sludge discharge pump;



- h) From ship's sludge tank, vent line, 3-inch connection;
- i) From ship's sewage holding tank, DN 40 connection;
- j) From ship's sewage holding tank, vent line, 3-inch connection.

23.3.4.7.5 The Contractor must install spray head cleaning nozzles on sludge tank, holding tank and sump tank. Spray heads must be connected to the sea/domestic water system using 1" Schedule 80 pipes.

23.3.4.7.6 The Contractor must supply and install all piping, piping supports and hangers, flexible joints, valves, gauges and instrumentation to provide a fully functional sewage collection and storage system as set out in the performance requirements of Section 14.7 of this Specification.

23.3.4.7.7 The piping installations must be in accordance with Section 3.2 of this Specification.

#### 23.3.4.8 **Electrical & Electronic Connections & Modifications**

23.3.4.8.1 Actual power cable from 526-4, to be connected to new control cabinet (mounted on new unit).

23.3.4.8.2 New level switches from sludge tank and sewage holding tank to be wired to new control cabinet.

23.3.4.8.3 Final terminations from monitoring system to new equipment control cabinet to be completed.

23.3.4.8.4 The transfer sump pump (240V-60Hz) as to be connected to panel 230V Non-Essential (in E.C.R.) circuit 2M13 20A.

23.3.4.8.5 The Contractor must connect new Grease Separator to new control cabinet, as per 23.3.4.8.1.

### 23.4 **Proof of Performance**

#### 23.4.1 **Inspection**

23.4.1.1 All work must be witnessed by the Technical Authority and the attending TCMS surveyor.

#### 23.4.2 **Testing**

23.4.2.1 The Contractor must be responsible to have a technician qualified to work on this system on site to perform commissioning function tests of the new sewage treatment plant.

- 23.4.2.2 The Contractor must schedule and conduct the commissioning tests and dock trials of the sewage system after final installation.
- 23.4.2.3 The Contractor must develop specific procedural tests for the dock trials of the sewage system to ensure that it meets the performance requirements. The Inspection Authority must witness all commissioning and dock trials of the new sewage system.
- 23.4.2.4 The Contractor must make reference to Section 7.0 for these requirements.
- 23.4.2.5 The Contractor must ensure that the final installation is TCMS approved and inspected as such. The Contractor must provide the Technical Authority and Inspection Authority with copies of all TCMS documentation records for the new sewage system as detailed in Section 6 of this Specification.
- 23.4.2.6 The Contractor must ensure that TCMS and Inspection Authority witness the successful operational tests of the new sewage system so that TCMS documentation of satisfactory performance can be provided to the vessel.

## **23.5 Deliverables**

### **23.5.1 Training**

- 23.5.1.1 The Contractor must supply the services of a technician qualified to work on this system to provide 2 days' instruction to 6 ship's crew in the proper operation and maintenance of the new sewage system components. The training must consist of a familiarization package, maintenance requirements and operational training in the function of the new sewage system and monitoring system. The Contractor must coordinate training with other courses to be provided.

### **23.5.2 Documentation**

- 23.5.2.1 The Contractor must make reference to Section 6 for the documentation requirements for the sewage system operational and maintenance manual requirements.
- 23.5.2.2 The Contractor must supply the TA with all Class approval documentation.
- 23.5.2.3 The Contractor must ensure that TCMS documentation is provided to the TA and IA so that a survey credit can be provided to the vessel.
- 23.5.2.4 The Contractor must generate new "As Fitted" drawings for the work in accordance with Section 6.1.6 of this Specification. The Contractor must ensure that all

interconnection drawings are revised to capture any alterations to the working drawings.

**23.5.3 Special Tools**

23.5.3.1 All new components supplied by Contractor, must be supplied with all specialty tools if required to maintain, clean, inspect and repair the respective components.

**23.5.4 Spare parts**

23.5.4.1 Spare parts required for routine maintenance must be supplied for the first 500 running hours as detailed in the manufacturer's service literature.

23.5.4.2 The parts being supplied are to be listed and priced individually.

**23.6 Testing and Commissioning**

**23.6.1 General**

23.6.1.1 The Contractor must schedule and conduct the commissioning tests and dock trials of the sewage system after final installation.

23.6.1.2 The Contractor must develop specific procedural tests for the dock trials of the sewage system to ensure that it meets the performance requirements. The Inspection Authority must witness all commissioning and dock trials of the new sewage system.

23.6.1.3 The Contractor must make reference to Section 7 for these requirements.

23.6.1.4 The Contractor must ensure that the final installation is TCMS approved and inspected as such. The Contractor must provide the Technical Authority and Inspection Authority with copies of all TCMS documentation records for the new sewage system as detailed in Section 6 of this Specification.

**23.6.2 Defects and Re-Testing**

23.6.2.1 Any part of the new sewage system that proves to be defective during any part of the tests must be replaced or repaired to produce a fully operational and functional system. Such occurrences may render the tests void and/or require further testing to be carried out to the satisfaction of the Inspection Authority.

**23.7 Performance Requirements for New Sewage System**

23.7.1.1 The Contractor supply and install a new "Hamann AG, HL-Cont Plus 5" model sewage treatment system with new sludge and holding tanks. The recommended supplier of this system is:

Jastram Technologies  
22 Trider Crescent,  
Dartmouth, NS  
B3B 1R6

- 23.7.1.2 The Contractor must supply the make and model of the equipment identified above. An equivalent may be approved for use by the TA if the Contractor is able to confirm that all engineering aspects are equal to the recommended unit with regards to performance, physical size, orientation of components, and serviceability as considered in the attached Sewage System Report. The Contractor must be responsible for all engineering costs and effort required for the substituted system.

## **24.0 BOW THRUSTER REPLACEMENT**

### **24.1 General**

The intent of this specification is for the Contractor to install a Government supplied 600 kW, approximately 1.4m diameter tunnel type bow thruster on the CCGS Earl Grey. The Contractor must remove the existing thruster unit including the gearbox, motor, piping, hydraulic unit, motor starter unit and associated mounts. The thruster installation will consist of a typical controllable pitch tunnel type bow thruster with associated motor, starter unit and hydraulic power pack.

### **24.2 Applicable Documents**

#### **24.2.1 References**

- a) CSA W47.1-03, Certification of Companies for Fusion Welding of Steel
- b) CSA W59-03, Welded Steel Construction (Metal Arc Welding)
- c) CSA 17, Canada Shipping Act - Tackle Regulations
- d) CSA 28, Canada Shipping Act - Hull Construction Regulations
- e) CSA 33, Canada Shipping Act – Marine Machinery Regulations
- f) CSA 29, Canada Shipping Act - Hull Inspection Regulations
- g) CSA 57, Canada Shipping Act – Safe Working Practices Regulations
- h) MOSHR, Canada Labour Code – Marine Occupational Safety and Health Regulations
- i) TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- j) IEEE STD 45 – 1998 Recommended Practice for Shipboard Electrical Installations
- k) IACS No. 47 Shipbuilding and Repair Quality Standard (1996) Part B – Repair Quality Standard for Existing Ships
- a) Lloyd’s Classification Society Rules
- b) Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

#### **24.2.2 Documents**

The following documents are applicable or interface with the task requirements of this section:

- Transverse Thruster Installation Instructions in the Technical Data Package

#### **24.2.3 Drawings**

<b>Drawing Number</b>	<b>Description</b>
J14010-M02 Rev. A	Existing Bow Thruster Removal
J14010-S01 Rev. A	Bow Thruster Room Structural Strip-Out
J14010-S02 Rev. A	Bow Thruster Structural Installation
VNEA2 131-002	Lines Plan

VNEA2 131-201	Midship Section
VNEA2 131-202	Structural Profile and Deck Plans
VNEA2 131-203	Structural Sections
VNEA2 131-205	Shell Expansion & PL Line Body Plans
VNEA2 134-206	Welding Table
VNEA2 134-401	General Arrangement As Fitted 1 of 2
VNEA2 134-401	General Arrangement As Fitted 2 of 2
VNEA2 232-008	Inner Bottom Unit Frames 39 to 44
VNEA2 232-009	Inner Bow Unit Frames 44 to Stem
VNEA2 234-005	Side Shell Unit Frames 32 to 39
VNEA2 311-004	Bilge Ballast & Fire Piping Diagram
VNEA2 315-010	Sea Chest Sea Bay Arrangement
VNEA2 362-004	Compressed Air Diagram
VNEA2 362-006	Compressed Air Arrangement 1 of 2
VNEA2 364-005	Misc Compartment Ventilation
VNEA2 389-012	Bow Thruster Compartment Arrangement
VNEA2 389-013	Hydraulic Piping – Bow Thruster
VNEA2 393-004	Arrangement of Remote Operated Valves
VNEA2 442-001	Interior Ladders & Stairways 2 of 2
VNEA2 732-000	Steel Doors Hatches & Manholes
VNEA2 762-000	Natural Ventilation 1 of 3
VNEA2 762-000	Natural Ventilation 2 of 3
VNEA2 762-000	Natural Ventilation 3 of 3
VNEA2 E-1	Electrical Power Single Line Diagram 1 of 2
VNEA2 E-1	Electrical Power Single Line Diagram 2 of 2
VNEA2 E-16	Bow Thruster System
VNEA2 E-16	Bow Thruster General Configuration and Cabling 1 of 17
VNEA2 E-16	Bow Thruster Signal Junction Box 2 of 17
VNEA2 E-16	Bow Thruster Main Electronics Unit 3 of 17
VNEA2 E-16	Bow Thruster Prime Mover Control 4 of 17
VNEA2 E-16	Bow Thruster Schematic Hydraulic JB 5 of 17
VNEA2 E-16	Bow Thruster Model AY-06013 JB 6 of 17
VNEA2 E-16	Bow Thruster Outline Maneuvering JB 7 of 17
VNEA2 E-16	Bow Thruster Control Console 8 of 17
VNEA2 E-16	Bow Thruster Remote Operating Station 9 of 17
VNEA2 E-16	Bow Thruster Motor Starter Wiring Diagram 10 of 17
VNEA2 E-16	Bow Thruster Remote Control Drawing 11 of 17
VNEA2 E-16	Bow Thruster Motor Starter Schematic 12 of 17
VNEA2 E-16	Bow Thruster Electrical Control Hydraulic Motor 13 of 17

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VNEA2 E-16	Bow Thruster Master Control Console Wiring 14 of 17
VNEA2 E-16	Bow Thruster JB Wiring Diagram 15 of 17
VNEA2 E-16	Bow Thruster Autotransformer Starter Wiring 16 of 17
VNEA2 E-16	Bow Thruster Signal JB 17 of 17
VNEA2 E-34	Lighting Machinery Spaces & Thruster Compt.
VNEA2 E-40	Electric Heating Machinery Spaces & Thruster Compt.
VNEA2 E-52	Cable Routing Below Main Deck
VNEA2 E-61	150 Volt Electrical Distribution Panels 7 of 7
VNEA2 E-68	Vessel Positioning System
VNEA2_L1-6188701-01	FM 200 Piping Layouts 7 of 12

### 24.3 Technical

#### 24.3.1 General

- 24.3.1.1 This specification must be read in conjunction with the latest revision of the repair drawing, J13062-S01 Rev. 1 indicating the precise extent of the work and the use and location of specific materials.
- 24.3.1.2 The Contractor must isolate and remove all existing bow thruster components including the piping from the bow thruster sea bay, gearbox and motor seats and associated motor starter controls.
- 24.3.1.3 The Contractor must arrange for the detailed engineering, installation, testing and commissioning of the Government supplied controllable pitch tunnel type bow and the associated controls. The installation must meet all relevant TCMS rules and regulations and conform to the installation instructions supplied by the FSR. The Contractor must provide the Inspection Authority with a list of all interrupted services to complete the bow thruster installation.
- 24.3.1.4 Any piping, manholes, parts and/or equipment requiring removal to carry out specified work and/or to gain access must be refitted upon completion with new jointing, anti-seize compound, clamps and brackets as applicable (Contractor supply).
- 24.3.1.5 Temporary lighting and/or temporary ventilation required by the Contractor to carry out any item of this specification must be supplied, installed and maintained in safe working condition by the Contractor and removed on completion of the related work.

## 24.3.2 Removals

24.3.2.1 The Contractor must remove all existing bow thruster components. The following components have been categorized for disposal purposes:

Component	Category
Bow thruster motor	A
Bow thruster gearbox, gearbox cooler and couplings	A
Bow thruster hydraulic power pack	A
Bow thruster hydraulic power pack associated piping	C
Bow thruster “Y” piping, including impellor, diffuser ring, butterfly valves and actuators	A
Bow thruster inlet piping from sea bay and discharge piping to ship’s side	C
Cooling water piping	C
Motor, hydraulic power pack and gearbox seats	C
Bow thruster motor starter unit	A
Bow thruster controls on bridge consoles	A
All associated controls and sensors	A
All associated wiring and bulkhead transits.	C

24.3.2.2 All sections comprising the main OmniThruster unit are to be removed. See Drawing. J14010-M02-RA for guidance. These include, but are not limited to the following:

- a) Sea water inlet from sea chest to suction bowl
- b) Suction bowl
- c) Shaft bearings, stuffing box, drive shaft and impeller
- d) Discharge bowl
- e) Steering vane actuators
- f) Steering valve assembly
- g) All sections of the discharge nozzles (P&S)

24.3.2.3 Additional components/equipment for the OmniThruster unit to be removed includes, but not limited to the following:

- a) Thruster gearbox
- b) Thruster drive motor
- c) Sea water pump for gearbox oil cooler
- d) Hydraulic power unit

24.3.2.4 Piping to be removed includes, but must not be limited to:

- a) Sea water cooling piping between the sea water inlet, pump, and gearbox oil cooler
- b) Piping associated with the thruster gearbox



- c) Piping and hoses connecting the hydraulic power unit to the thruster vane actuators

24.3.2.5 Electrical equipment to be removed includes, but must not be limited to:

- a) Motor control cabinet
- b) Wheelhouse control panels and wiring
- c) All associated wiring between the MCC, the OmniThruster motor, hydraulic power unit, sea water pump, including power cables and sensor cables.
- d) All OmniThruster steering vane feedback wiring
- e) All associated junction boxes.

### 24.3.3 **Emergency Fire Pump Relocation**

24.3.3.1 The Contractor must isolate and remove the Emergency Fire pump from its mount and reserve it as Category B property.

24.3.3.2 The existing Fire pump seat must be removed and disposed of as Category C property.

24.3.3.3 The Contractor must remove all existing wiring to the pump back to the circuit breaker, if it is of insufficient length to run to the new pump location. The Contractor must supply and install new wiring to the pump, including all securing devices, wire trays, bulkhead transits and strain reliefs.

24.3.3.4 The Contractor must relocate the Emergency Fire pump to the port side of the Bow Thruster Compartment as indicated on Drawing J14010-S02 RA.

24.3.3.5 The Contractor must supply and install a new pump seat to accommodate the pump and piping in the new location, and remount the Emergency Fire pump.

24.3.3.6 The Contractor must re-route the suction piping to the pump from the existing Sea Suction valve, and the discharge piping to the existing fire main piping. All proposed routing must be approved by TCMS prior to installation.

24.3.3.7 The work in this section must be coordinated with the work in Section 21.0 Ship's Side Valves and Spool Pieces.

24.3.3.8 Upon completion of the dry dock portion of the VLE, the Emergency Fire pump must be tested in the presence of the attending TCMS inspector in order to gain survey credit for the pump.

#### 24.3.4 **Removal and Installation Routing**

- 24.3.4.1 Sections of side shell plating on the port side within Bow Thruster Compartment will be removed to aid in the removal of the existing OmniThruster and to facilitate installation of the new bow thruster unit. In addition, the side shell structure in these areas will be temporarily cut back. The locations for these removals at ships side are located between the aft bulkhead of the Bow Thruster Compartment (Fr.39) and Fr.41, from a distance between the top of the sea chest to the underside of the deck head structure. In addition, a small section of shell plating and side structure at the location of the OmniThruster discharge outlets (P&S) between Fr.42-43 will be cut back to allow removal. See Drawing J14010-S01-RA for guidance.
- 24.3.4.2 The Contractor must develop the route plan and present it for approval to the Technical Authority and the Inspection Authority prior to commencement of the structural work.
- 24.3.4.3 The Contractor must be responsible for isolating all equipment, piping systems, wiring, electrical fixtures, and fittings in way of the installation route and ensure the aforementioned are re-installed to original condition after the equipment is installed.
- 24.3.4.4 The Contractor must develop a welding schedule for the reinstallation of all cut steel, including the hull plate removed to facilitate removal and installation. The welding schedule must be approved by TCMS prior to commencement of the structural work.

#### 24.3.5 **Structural**

- 24.3.5.1 All steel is to be of shipbuilding quality and supplied with Lloyd's Class certification. All structural steel grades must be identical to those listed on the original CCGS Earl Grey Construction drawings. The shell side plating to the Upper Deck is Lloyd's grade "E". The thruster tunnel extensions must be Lloyd's grade "E" with identical scantlings as the shell side plating in the area where the tunnel is to be fitted.
- 24.3.5.2 The Contractor must develop the tunnel thruster structural requirements in accordance with the equipment manufacturer's installation instructions that will meet the performance requirements set out in these specifications.
- 24.3.5.3 The Contractor must develop certified (TCMS approved) installation drawings for the bow thruster system. This must include but not be limited to the following:
- a) Tunnel extension design including stiffening, the interconnection with the hull and surrounding framing, and integrating a tear drop shape on the trailing edge that serves to have the leading and trailing edges of the tunnel the same distance from the ship's centerline;
  - b) Structural stiffening required surrounding the new tunnel opening;
  - c) Structural stiffening required to cap the existing tunnel discharge holes;

- d) Structural stiffening required to cap the existing thruster inlet hole from the sea bay;
- e) Additional stiffening required in way of the web frames and the trailing edge configuration;
- f) The structural arrangement and stiffening required for the thruster;
- g) Welding schedule for deck and hull openings upon completion of the thruster installation;
- h) The seating arrangements required for the hydraulic units;
- i) Seating for the electrical panels;
- j) Structural support for the horizontally mounted thruster motor;
- k) Structural catwalk structure in the Thruster Compartment to provide access to the machinery.

24.3.5.4 TCMS approved drawings must be presented to the Technical Authority and the Inspection Authority prior to commencement of the structural work.

24.3.5.5 The Contractor must keep the extent of cuts in the ship's external shell structure to a minimum.

24.3.5.6 It must be the responsibility of the Contractor to develop an approved cutting and installation method for all openings cut into the ship's structure with regard to TCMS approval, scheduling and approval of weld sequences and inspections of finished welds.

24.3.5.7 The Contractor must be responsible for all temporary supports required to maintain the integrity and shape of the ship's structure during this phase of the project.

24.3.5.8 The full tunnel must be fitted to the hull as shown in Guidance Drawings "Tunnel Installation and Thruster Compartment Steelwork".

24.3.5.9 The propeller tip clearance must be checked and recorded by the Contractor before the start of installation. The Contractor must perform continuous tip clearance checks during welding. During and after welding, the propeller blade tip clearance must be checked and recorded by the Contractor. All measurements must be presented to the Technical Authority and the Inspection Authority at the completion of welding.

24.3.5.10 The Contractor must follow all applicable manufacturer's details and instructions when joining the tunnel extensions to the thruster tunnel. The Contractor must submit a welding schedule approved by the thruster manufacturer, TCMS and the Inspection Authority for this work. The Contractor must take all necessary precautions to prevent distortion of the tunnel during welding operations.

24.3.5.11 The Contractor must protect all parts and equipment from damage during welding.

- 24.3.5.12 The weld joints on the ‘wet’ side of the tunnel must be ground flush.
- 24.3.5.13 The openings in the side shell for the thruster discharges are to be sealed with insert plates. Related structure in this area where it has been interrupted by the discharge piping is to be modified in way of the new insert plates as required. See Drawing. J14010-S01-Rev A for guidance.
- 24.3.5.14 The ø890mm opening in the top plate of the sea chest is to be sealed with a new circular insert plate. The existing cut out in the centerline bulkhead at the underside of the tank top is to be sealed with an insert plate, and the cut outs in the two transverse floors at this location must be plated in with similar insert plates.
- 24.3.5.15 The Contractor must fabricate and install all insert plates, which must be of the same thickness as the floors and tank top in which they are to be fitted. See Drawing. J14010-S02 Rev. A for guidance.
- 24.3.5.16 New structural seats will be fabricated and installed by the Contractor to support the new drive motor, hydraulic pump, control cabinet, oil tank and the relocated emergency fire pump. Refer to Drawing. J14010-S02-Rev. A for further details on machinery seats.
- 24.3.5.17 Two new sections of thruster tunnel (approx. ø1.4m) are to be installed. Each section will be welded to one end of the main thruster unit and extend to the new opening in the ships side shell (Port and Starboard). Existing structure at side shell to be cut back to suit new tunnel installation and welded to new tunnel after fit up.
- 24.3.5.18 The Contractor must manufacture and install a grid designed by the thruster manufacturer to prevent the ingress of ice or other debris into the tunnel. The grid location must be located as determined by the manufacturer and the Inspection Authority.
- 24.3.6 Thruster Compartment**
- 24.3.6.1 The Contractor must provide and install certified lifting lugs to facilitate removal of the existing thruster components and installation of the new thruster tunnel, motor and other components. Lugs must have a minimum safety factor of 2.5 times the estimated highest component weight.
- 24.3.6.2 After all removals of the existing equipment, the Contractor must blast all areas of disturbed paint work in the Bow Thruster Compartment, in particular the bilge area under the existing OmniThruster unit to SSPC-SP6 standard. The Contractor must supply and apply one (1) coat of International Paint – Intershield 300 to be applied to all prepared steel. A topcoat of International Paint Intergard 740 must be applied after sufficient curing time is allowed for the previous coats and following all manufacturers’ recommendations.

- 24.3.6.3 The Contractor must cut a new access hatch and install a new coaming with hatch cover for access to the starboard side of the bow thruster sea bay. The new hatch coaming and cover will be identical in all dimensions to the existing coaming and hatch cover on the port side and subject to approval by TCMS. This new hatch will be required to allow access for welding to the underside of the new cover plate in way of the “Y” pipe for the existing thruster. The exact location will be dictated by the location of the new thruster tunnel and other machinery seats.
- 24.3.6.4 The Contractor must construct new cat walks and stairs throughout the bow thruster compartment to provide access to all thruster machinery, electrical panels, hydraulic power pack and to the access hatches for the bow thruster sea bay.
- 24.3.6.5 The existing steel ladder for access to the thruster compartment must be modified to integrate with the new catwalks surrounding the new thruster installation.

#### 24.3.7 **Piping**

- 24.3.7.1 The Contractor must not disturb the fire main piping in the thruster compartment other than the work for Section 22.3.3. To maintain fire protection of the vessel, the Contractor must temporarily cap the connections from the Emergency Fire pump. During this work, the Contractor must provide other means of fire protection and surveillance while the fire main is out of service. The Contractor must take all measures necessary to prevent damage to the remaining fire main piping during the thruster removal and installation processes. Any damage to the fire main piping must be repaired at Contractor expense.
- 24.3.7.2 The Contractor must retain the existing ballast piping in the thruster compartment, including piping passing through the bow thruster compartment to other spaces. Contractor may isolate and remove piping at his own expense during the removal and installation of the thruster tunnel to prevent damage or allow access for welding. Piping must be returned to its original position and condition prior to the completion of the contract at Contractor’s expense.
- 24.3.7.3 Hydraulic piping must be phosphate pickled, neutralized, flushed with oil and blown dry prior to installation.

#### 24.3.8 **Galvanic Protection**

- 24.3.8.1 The tunnel must be given adequate galvanic protection by a suitable number of zinc or aluminum anodes. The Contractor must follow the galvanic protection plan of the thruster manufacturer.

**24.3.9 Coatings**

- 24.3.9.1 Final treatment of thruster unit, tunnel and inboard equipment must be carried out by the Contractor in accordance with the manufacturer's recommendations.
- 24.3.9.2 After installation of tunnel, all welding seams and/or areas with corrosion attack(s) to be sandblasted to SA 2.5, cleaned and recoated with a layer of zinc epoxy primer.
- 24.3.9.3 Tunnel and thruster unit (except the rotating propeller) must be given minimum surface treatments according to manufacturer requirements.
- 24.3.9.4 First coat in the tunnel and tunnel extensions must be 1 coat of Amercoat 238 Black followed by 1 coat of Amercoat 238 Red, followed by a topcoat of Amercoat 339 CG Red. Application of the coatings must be as specified by the paint manufacturer. Care must be taken not to coat the anodes with paint.
- 24.3.9.5 All other inboard parts must be treated according to manufacturer's requirements and as follows:
  - a) Gravity Tank - Outside: Sandblasted to SA 2.5, cleaned and coated with primer, Interlac, and color according to vessel paint scheme;
  - b) Gravity Tank - Inside: Sandblasted to SA 2.5, cleaned and coated with epoxy top coat;
  - c) Hydraulic Servo Pump: Coated with primer, Interlac, and color according to vessel paint scheme;
  - d) Electric motor: Delivered according to the supplier's standard paint specification;
  - e) Other Electronic Equipment: Delivered according to the supplier's standard paint specifications
- 24.3.9.6 The Contractor must make reference to Section 2.8 of these project specifications with regards to the treatment of any other disturbed steel as a result of the work in this specification.

**24.3.10 Ventilation**

- 24.3.10.1 The Bow Thruster Compartment is ventilated using a natural supply and mechanical exhaust. The general layout for this system is shown in Drawing VNEA2 364-005 Misc Compartment Ventilation.
- 24.3.10.2 The return ducting must be removed by the Contractor to provide access to the work area and to prevent damage during the thruster installation. The ducting must be reinstalled and routed around the new machinery at the completion of the thruster installation by Contractor.
- 24.3.10.3 No air must be blown directly onto heat-emitting/electrical components sensitive to water.

**24.3.11 Electrical**

- 24.3.11.1 The Contractor must install, arrange, test and commission all electrical installations necessary to provide a fully functioning tunnel thruster system. This must include all cabling, cableways, safety interlocks, protection and the necessary deck and bulkhead penetrations for the cables.
- 24.3.11.2 All electrical equipment must be marine rated, comply with TP 127E, IEEE 45, and be current production makes and models with spare parts availability for the next ten (10) years.
- 24.3.11.3 The Contractor must develop certified (TCMS approved) drawings and calculations with regards to the following:
- a) Detailed calculations for the complete electrical installation of the bow thruster and auxiliary equipment required for a complete operational installation. These calculations must include but not be limited to the following requirements:
    - 1) All cable sizes required;
    - 2) Length and types of cables required;
    - 3) Compatibility with existing circuit breaker sizes and protection required;
    - 4) Interlock arrangements and preferential trip selections;
    - 5) Compliance with TP 127E and IEEE 45 requirements.
  - b) Detailed schematic layout and interconnection of all system components including controls.
  - c) Detailed cable diagrams showing the location and routing of all cables for the installation.
  - d) Detailed cable diagrams showing the location of all power supplies and circuit breakers for the installation.
- 24.3.11.4 Approved drawings must be presented to the Technical Authority and the Inspection Authority for review prior to commencement of the structural work.
- 24.3.11.5 Existing cable trays are to be utilized where possible. In locations where new (intermediate) trays are required, these must be supplied and mounted by the Contractor.
- 24.3.11.6 Cables that pass below the control room are to be run through the existing center cable trunk.
- 24.3.11.7 Cables for communication, monitoring and signal cables, are to be mounted a safe distance from power cables in order to prevent interference. Special attention in this respect must be given to the cable installation in the Engine Room, the

Wheelhouse and Thruster Compartment. The Contractor must refer to Section 5.0 concerning Electromagnetic Interference.

24.3.11.8 Cables in the accommodation block are to be concealed in the ceiling and behind bulkhead panels in wire ways.

24.3.11.9 All power circuits are to have over-current and short circuit protection as set out by TCMS. The protection must be of automatic circuit breaker type, and are to meet the short circuit level and the selectivity requirements at the location.

24.3.11.10 The Contractor must supply, arrange and install all necessary wiring, wire trays, terminals, junction boxes, and cable transits to provide the following alarms to the existing Alarm and Monitoring system:

- a) System failure;
- b) Pitch feedback failure;
- c) Low servo system pressure;
- d) Auto stop; overload of electric motor;
- e) Overload; high temperature electric motor – early warning;
- f) Low level in oil tank;
- g) Power alarm central.

24.3.11.11 The alarm points must be tied into the existing Alarm and Monitoring (A&M) system fitted in the control room. The Contractor must be responsible for updating and configuring the existing A&M software to incorporate the new alarm functions. These alarms must be blocked from alarming when the Thruster stop buttons have been pushed with the exception of the Low level in oil tank.

24.3.11.12 The Contractor must also make reference to Section 4 of these project specifications for other electrical requirements.

## 24.3.12 **Hydraulic**

24.3.12.1 The Contractor must supply, arrange and install all hydraulic piping and interconnections required between the hydraulic pumps, motors, reservoirs and controllers in accordance with the thruster manufacturer's requirements.

24.3.12.2 All hydraulic piping must be hydrostatically tested to 1.5 times the working pressure of the system prior to system operation.

24.3.12.3 Hydraulic piping must be phosphate pickled, neutralized, flushed with oil and blown dry prior to installation. The hydraulic piping system must be flushed with service fluid before being put into operation to ensure the system is clean and free of any debris. Filters must be changed after the flushing of the system.



24.3.12.4 The Contractor must supply and install all required hydraulic fluid in accordance with the thruster manufacturer's requirements.

**24.3.13 Fire Detection System and Fire Suppression System**

24.3.13.1 The Contractor must isolate and remove the fire detection system sensors in the bow thruster compartment for the duration of the work to prevent damage to the components.

24.3.13.2 Whenever any work is being carried out involving a ship's firefighting or fire detecting system, it must be done in such a way as to leave the vessel and any persons aboard with adequate protection against fire at all times.

24.3.13.3 The Contractor must reinstall the sensors after completion of the thruster installation. The final location for the sensors must not interfere with the operation of the thruster unit, and the sensors must be located so that they are accessible for maintenance and testing.

**24.3.14 Other Services**

24.3.14.1 The Contractor must be responsible for moving all services currently fitted in the thruster compartment such that sufficient space is available for the removal and installation of the electrical and hydraulic components of the bow thruster installation. Services must be relocated within limits of the existing wiring where possible. The services include but are not limited to the following:

- a) Internal Communication Junction Box and Telephone;
- b) Fluorescent lighting fixtures;
- c) 120 volt receptacles.

24.3.14.2 The Contractor must fit the seats for the electrical panels and hydraulic units in such a way that the panels and units remain accessible for all inspections, maintenance and service.

**24.4 Proof of Performance**

**24.4.1 Testing**

24.4.1.1 The Contractor must arrange and be responsible for the operational and load testing of the bow thruster after final installation. The operational and load tests must be performed in accordance with TCMS requirements.

24.4.1.2 TCMS and the Inspection Authority must witness the tests and the Contractor must prove that the bow thruster functions as per the performance requirements set out in these specifications.

24.4.1.3 The Contractor must provide for the services of a Factory Service Representative to be in attendance during the commissioning and testing of the bow thruster system.

24.4.1.4 The Contractor must make reference to Section 7 for additional requirements.

#### 24.4.2 **Dock Trials**

24.4.2.1 The Contractor must develop test procedures to prove that all aspects of the thruster installation and associated equipment are satisfactory. These test procedures must be submitted to the TA and the Inspection Authority prior to any system testing. Functional tests must include the operation of all control systems and safety devices. Tests must include but not be limited to the following:

- a) Interlocks for the proper shaft generator configuration prior to bow thruster start;
- b) Operational function of soft start and loading of ship's power supply;
- c) Operation of load limiting devices;
- d) Operation of all controls and interlocks associated with the bow thruster. This must include electrical, electronic, hydraulic and support equipment required for the safe operation of the bow thruster.

#### 24.4.3 **Sea Trials**

24.4.3.1 Thruster trials must include as a minimum the following:

24.4.3.2 With the vessel stopped in the water and heading into the wind, the bow thruster unit must be used to turn the vessel through 360 degrees both to port and to starboard. Weather and sea state conditions must be recorded.

24.4.3.3 As a minimum, the following data must be recorded during the trial:

- Time and date of the test and base heading;
- Time to rotate vessel through 360 degree (port and starboard);
- Compass headings to nearest degree every 10 seconds;
- Depth of water and sea conditions;
- Wind speed and direction;
- Trial draft;
- Amps and volts on bow thruster motor;
- Bow Thruster Compartment ambient temperature.

24.4.3.4 The bow thruster must also be demonstrated capable of maneuvering the vessel while underway.

24.4.3.5 Trial (1)

24.4.3.5.1 Vessel proceeding at speed of 3, 4, 5, and 6 knots and rudder midships, apply thruster to achieve course deviations to 20 degree to port and starboard.

24.4.3.6 Trial (2)

24.4.3.6.1 Vessel proceeding astern at a speed of 3 knots, apply the thruster to achieve course deviations as above.

24.4.3.6.2 The following data is to be recorded:

- Time to achieve course heading, degree of over swing.

## 24.5 Deliverables

### 24.5.1 Documentation

24.5.1.1 The Contractor must make reference to Section 6 of these specifications for the documentation requirements of the drawings.

24.5.1.2 The Contractor must update all “As Fitted” drawings affected by the installation of the bow thruster. Final versions of the drawings must be delivered to the TA and the Inspection Authority. Copies of all TCMS approved drawings must be delivered to the TA prior to completion of the contract.

24.5.1.3 The Contractor must prepare a file and include a good copy of all calculations performed pertaining to the installation of the bow thruster. A copy of this file must be given to the TA before the completion of the refit.

24.5.1.4 The Contractor must make reference to Section 6 with regard to the documentation required for the operation and maintenance manuals for the bow thruster installation.

### 24.5.2 Training

24.5.2.1 The Contractor must provide the services of a Factory Service Representative to provide 5 days’ instruction to 8 ship’s crew in the proper operation and maintenance of the thruster. The training must consist of a familiarization package, maintenance requirements and operational training in the function of the thruster and thruster components. The operator training may be deferred until the sea trial portion of the testing and commissioning of the CCGS Earl Grey, and must include both crews of the vessel.

## **25.0 BUOY CRANE UPGRADE (SURVEY ITEM)**

### **25.1 Identification**

The existing Liebherr main crane is original equipment that has electronic control systems that are no longer supported. The Contractor must remove and dispose of the obsolete equipment, including refurbishing the crane operator cabin, install and set to work the new Litronic Master 4 control systems. The Contractor must overhaul the main mechanical components, including the two aggregate motors and pump sets, the four slewing motors, the main hoist winch and the two whip hoist assemblies.

### **25.2 References**

#### **25.2.1 Manuals**

- Liebherr Instruction Manual;
- List of Government Supplied Materials – Figure 25-1
- Crane: Liebherr Model PBWS 15 (8.5)/ 8 (20) Serial No: 0160016

#### **25.2.2 Drawings**

<b>Drawing Number</b>	<b>Description</b>
VNEA2 415-004	Buoy Handling Crane
VNEA2 6787-970-002	General Hydraulic Diagram

#### **25.2.3 Field Service Representatives**

Original Equipment Manufacturer's Field Services Representatives are available from:  
Liebherr Canada  
49 Mews Place  
St. John's, NL  
A1B 4N2  
Telephone: (709) 748-7829

### **25.3 Technical**

The Contractor must employ the services of Liebherr Canada FSR's for the duration of the work in this Section. The materials listed in Figure 25-1 are supplied and stored for Canada by the OEM FSR. In order to maintain warranty on the crane components after commissioning, the work in this section must be supervised by the FSR's up to and including the sea trial requirements and any adjustments to the crane set up.

#### **25.3.1 Control System Removals**

- 25.3.1.1 The Contractor must isolate, lock out and tag out all electrical supply to the crane including both main and auxiliary circuits.

- 25.3.1.2 The Contractor must drain and dispose of all hydraulic fluid and gear oils from the crane in accordance with all Federal and Provincial regulations. The TA must be supplied with the disposal certificates.
  - 25.3.1.3 The Contractor, under the guidance and instruction from the Liebherr FSR, must dismantle the switch cabinet, cut all cable ties and cut and remove all cabling in pieces. The complete cabling of the crane will be removed from the slip ring unit and will be exchanged with new cables. The Contractor must dispose of the removed cabling as Category “C” property.
  - 25.3.1.4 The Contractor must supply all cranes and scaffolding required to complete this section of work. The Contractor must remove all sensors, and any solenoids as identified by the FSR, including hose connections. Redundant sensors and solenoids must be disposed of as Category “C” property.
  - 25.3.1.5 The Contractor must remove all lights, heating units, horn, and limit switches and dispose of as Category “C” property.
  - 25.3.1.6 The Contractor must remove all obsolete hoses associated with the Emergency Lowering System and dispose of as Category “C” property.
  - 25.3.1.7 The Contractor must remove the existing control cabin from the crane and transported to an indoor workshop in order to recondition the cabin and remove the old control stand including the chair, control consoles and cabling. The Contractor must be responsible for constructing suitable rigs to support the cabin during the removal and installation process.
  - 25.3.1.8 The Contractor must supply the labour, cranes, and consumable materials required to perform this work. These materials will include steel replacement for all brackets, replacement for all cable trays, welding materials, painting materials, grease, gear oil, hydraulic oil, hydraulic oil filter and replacement fittings such as bolts and screws. The Contractor must submit a PWGSC Form 1379 with these expenses itemized.
- 25.3.2      **Mechanical Removals**
- 25.3.2.1 The Contractor must use the guidance and instruction from the Liebherr FSR for all work in this section of the specification.
  - 25.3.2.2 The Contractor must be responsible for all cranes, scaffolding, rigging for this work.
  - 25.3.2.3 The Contractor must remove and dispose of all hoses from the two aggregate pump sets in the upper crane cab and caps or plugs placed on all exposed hydraulic fittings. The Contractor must supply new OEM hoses for the complete crane.

- 25.3.2.4 The Contractor must dismount the aggregate motor/pump assemblies and remove them from the crane to a workshop for overhaul.
- 25.3.2.5 All hoses must be removed from the hoist winches and slewing motors and caps or plugs placed on all remaining exposed hydraulic fittings.
- 25.3.2.6 The Contractor must remove the main hoist wire and dismount the main hoist winch from the top of the crane and transport it to a workshop for overhaul.
- 25.3.2.7 The Contractor must remove the two auxiliary hoist wires and dismount the two auxiliary hoist winches from above the crane cab and transport it to a workshop for overhaul.
- 25.3.2.8 The Contractor must remove all four slewing motors and gear case assemblies from the crane cab and transport them to a workshop for overhaul.
- 25.3.2.9 The Contractor must remove the two hydraulic cylinders from the crane and transport them to a workshop for overhaul. The Contractor must be responsible for constructing suitable rigs to accommodate the hydraulic rams needed to remove and insert the hydraulic cylinder pins. The Contractor must consult the FSR on this process.

### 25.3.3 **Mechanical Overhauls**

- 25.3.3.1 The Contractor must remove all pumps, motors, gear cases and winches using Contractor supplied OEM spare parts. Parts must be obtained from the OEM representative, as noted in section 25.2.3. The overhauls must be under the supervision of the Liebherr FSR.
- 25.3.3.2 All hydraulic and mechanical components must be disassembled and cleaned, inspected by the FSR and TA, and reassembled using new OEM components that are subject to wear or deterioration due to normal operations.
- 25.3.3.3 The Contractor must open the system oil tank and clean any residue in the tank. The tank must be inspected by the TA prior to being closed up.
- 25.3.3.4 The Contractor must supply and replace all system air, breather, precision and hydraulic filters with OEM components.
- 25.3.3.5 The Contractor must dispose of old and replace all gaskets, seals, o-rings, bearings, and grease nipples on the two main aggregate assemblies. This must include the shaft seals, main and auxiliary hoist pumps, slewing pumps, luffing pumps and distributor gear box of each unit. Any defects found with the aggregate assemblies

will be dealt by submitting a PWGSC Form 1379. The aggregates must be assembled according to the manufacturer's instructions and the FSR's guidance.

- 25.3.3.6 The Contractor must supply and install new bearings for the electric motors for the aggregates. The motors must be tested for insulation resistance, and the results provided to the TA. Any deficiency will be addressed using by submitting a PWGSC Form 1379. The electric motors must be assembled according to the manufacturer's instructions and the FSR's guidance.
- 25.3.3.7 The Contractor must replace all gaskets, seals, quad rings, felt strips, bearings, and grease nipples on the hydraulic winch motor assemblies. This must include the drum assembly, brake assembly, gear case of each unit. Any defects found with the winch motors will be dealt with by submitting a PWGSC Form 1379. The hydraulic winches must be assembled according to the manufacturer's instructions and the FSR's guidance.
- 25.3.3.8 The Contractor must replace all gaskets, seals, quad rings, nilos rings, bearings, air filters and grease nipples on the hydraulic slewing motor assemblies. This must include the shaft seals, brake assembly, gear case of each unit. Any defects found with the slewing motors will be dealt with by submitting a PWGSC Form 1379. The hydraulic motors must be assembled according to the manufacturer's instructions and the FSR's guidance.
- 25.3.3.9 The Contractor must replace all seals on the hydraulic cylinders. The hydraulic rams will have the surface inspected for wear and measurements must be presented to the TA to determine if additional work is required. Any defects found with the cylinders will be dealt with by submitting a PWGSC Form 1379.
- 25.3.4 **Interior Preparations**
  - 25.3.4.1 The Contractor must clean the crane interior of all debris, loose paint, dirt, grease and oily film prior to the installation of the new systems.
  - 25.3.4.2 The Contractor must mechanically remove and dispose of any rust or scale, and paint any exposed metal in accordance with the Liebherr Offshore Standard.
- 25.3.5 **Control System Installations**
  - 25.3.5.1 The Contractor must recondition the old crane cabin, and install the new control stand. The Contractor must reinstall the crane cabin to the crane body.
  - 25.3.5.2 The Contractor must install the new Emergency Lowering System (ELS) with new brackets welded to the crane to support new hydraulic components, and a new set of hoses. The materials required are GFM as listed in Figure 25-1, however the hoses

will be produced by the Contractor on site with the FSR's guidance once the hydraulic components are mounted.

- 25.3.5.3 The Contractor must install new GFM lights, heating units, horn, wind speed indicator and limit switches to the crane.
- 25.3.5.4 The Contractor must install new GFM sensors, and new solenoids including hose connections.
- 25.3.5.5 The Contractor must prepare and install new brackets in order to install the new control system and main drive control switch cabinets in the crane.
- 25.3.5.6 The Contractor must prepare and install new brackets, cable trays, new cables, cable ties, cable glands and electrical connection materials. The Contractor must complete all wiring connections to all components as directed by the FSR.
- 25.3.5.7 The Contractor must install new hydraulic components for the Automatic Overload Protections System (AOPS), the Manual Overload Protection System (MOPS), and the Constant Tension system (CT). The Contractor must supply and install new hoses for these components.

#### 25.3.6 **Mechanical Installation**

- 25.3.6.1 The Contractor must reinstall the two hydraulic cylinders on the crane. The Contractor must replace the grease fittings and grease hoses with Contractor supplied new components.
- 25.3.6.2 The Contractor must install all four slewing motors and gear case assemblies in the crane cab, and install all new Contractor supplied hoses. The Contractor must supply and fill the gear cases with FSR recommended quantities and grade of new gear oil.
- 25.3.6.3 The Contractor must install the two auxiliary hoist winches above the crane cab and install new Contractor supplied hoses. The Contractor must supply and fill the gear cases with FSR recommended quantities and grade of new gear oil. The Contractor must refit the hoist wires to the winches under the supervision of the FSR.
- 25.3.6.4 The Contractor must install the main hoist winch above the crane cab and install new Contractor supplied hoses. The Contractor must supply and fill the gear case with FSR recommended quantity and grade of new gear oil. The Contractor must refit the main hoist wire to the winch under the supervision of the FSR.
- 25.3.6.5 The Contractor must reinstall the two aggregate motor/pump assemblies into the crane. The Contractor must supply and fill the gear case with FSR recommended



quantity and grade of new gear oil. The Contractor must install new hoses for the pump sets and all other hydraulic components in the crane.

- 25.3.6.6 The Contractor must refill the crane hydraulic system with the FSR recommended quantity and grade of new hydraulic oil.

## **25.4 Tests, Trials and Commissioning**

- 25.4.1.1 The Contractor must bleed the hydraulic system to ensure smooth operation of all components.
- 25.4.1.2 The Contractor must set all limit switches with FSR guidance to ensure the luffing and hoist systems operate within parameters.
- 25.4.1.3 The Contractor, in consultation with the FSR, must provide a test and trial plan to TCMS and the TA for approval to ensure that all operations of the new systems function within the designed parameters.
- 25.4.1.4 The Contractor must perform the final tests and trials in the presence of TCMS and the TA.
- 25.4.1.5 Any part of the equipment that proves to be defective during any part of the tests must be replaced or repaired. Such occurrences may render the tests void or require further testing to be carried out to the satisfaction of TCMS and/or the Inspection Authority. New oil filter elements must be installed after final testing and final inspection.

## **25.5 Documentation**

- 25.5.1.1 The Contractor must make reference to Section 6.2 for the documentation requirements for the new control system.
- 25.5.1.2 The Contractor must coordinate with TCMS and define an inspection schedule. This schedule is to be provided to the TA for comment. The Contractor must deliver to the TA all original signed compliance reports provided by TCMS with regards to this work.
- 25.5.1.3 The Contractor must supply the TA with a schedule of work to be completed. The contractor must also provide TA with a signed certificate from the crane manufacturer stating the crane has been rebuilt following manufacturer's instructions, operational parameters are verified and accepted, and all warranties are accepted by manufacturer.

- 25.5.1.4 The Contractor must supply a Class approval certificate for the new control systems to TCMS, the TA and IA.

**Figure 25-1: Liebherr Crane GFM**

	<b>Quantity</b>	<b>Description</b>
1	1 pc	X1 Switch Cabinet (control system)
2	1 pc	X2 Switch Cabinet (motor control)
3	1 set	New cables
4	1 set	New sensors
5	1 set	New lights
6	1 set	New heaters
7	1 set	New limit switches
8	1 pc	AOPS including additional hydraulic hoses
9	1 pc	MOPS including additional hydraulic hoses
10	1 pc	CT including additional hydraulic hoses
11	1 pc	Control Stand
12	1 set	ELS hydraulic components
13	1 set	ELS required brackets
14	1 set	ELS required hose material

## **26.0 INTERNAL COMMUNICATIONS SYSTEM (SURVEY ITEM)**

### **26.1 Identification**

- 26.1.1.1 The intent of this specification is to update the existing ICS system and replace with a new Contractor supplied Hose McCann system or Vingtor equivalent.

### **26.2 References**

#### **26.2.1 Drawings and Documents in Technical Data Package**

General Arrangement drawings Dwg. MM678-001-GA

Existing ICS System drawings (Reference for Removal):

- Dwg. MM678-002-WD SHT 2/7
- Dwg. MM678-002-WD SHT 3/7
- Dwg. MM678-002-WD SHT 4/7
- Dwg. MM678-002-WD SHT 5/7
- Dwg. MM678-002-WD SHT 6/7
- Dwg. MM678-002-WD SHT 7/7
- Dwg. MM678-026-WD SHT 1/1
- Dwg. MM678-027-WD SHT 1/1
- Dwg. MM678-028-WD SHT 1/1
- Dwg. MM678-029-WD SHT 1/1
- Dwg. MM678-030-WD SHT 1/1
- Dwg. MM678-031-WD SHT 1/1

New ICS drawings (Reference for Installation):

ICP System Layout Dwg. 8010-100-CCGEG\_SHT 1/6 to 6/6

Multi-Port ICP Node Dwg. 8010-2014-CCG NODE-DS

Uninterruptible Power Supply Dwg. 8010-6700-122-DS

System Component Drawings

New ICS Drawing and Specification Package (United Marine- Hose McCann, Integrated Communication Platform)

CCGS Earl Grey – Phone Directory (E06CFGPHONEDIR0814.xls)

#### **26.2.2 Standards**

- a) Fleet Safety and Security Manual (DFO/5737)
- b) TP127 – Ship's Electrical Standards
- c) IEEE 45:2002 – Recommended Practice for Electrical Installation on Ships
- d) Specification for the Installation of Shipboard Electronic Equipment (70-000-000-EU-JA-001)
- e) Standard Technical Architecture for Shipboard Computer Installation (46-000-000-ES-TE-001)

#### **26.2.3 Regulations**

Canada Shipping Act, 2001

## **26.3 Technical Description**

### **26.3.1 Government Furnished Equipment**

The Contractor must supply all materials and equipment required to perform the specified work unless otherwise stated.

### **26.3.2 General**

26.3.2.1 The Contractor shall supply and install a Class Approved, as recognized by TCMS, Internet Protocol (IP) based End-to-End Digital, Integrated Internal Communications System consisting of Public Address (PA), PBX (VOIP) and audio Entertainment shall be provided.

26.3.2.2 The Supplier must be either Hose McCann or Vingtor. The system must be Class Approved and meet the requirements of TCMS. The system must satisfy all requirements that a Hose McCann ICP System provides. If an equivalent Vingtor system is to be supplied, it must conform to the Performance Requirements of this section, and the Contractor must submit design drawings and specifications to the Technical Authority prior to the purchase of any equipment. Contractor must allow in their Project Management schedule, a 5 day CCG review.

26.3.2.3 The Contractor must arrange for OEM authorized field service representatives (FSR) to conduct the set to work and commissioning of the ICS system.

26.3.2.4 Prior to any hot work taking place, the Contractor must ensure that the area of work and all equipment, wiring, transits, etc. have been sufficiently protected from any sparks or metal filings.

26.3.2.5 The Contractor must be responsible to ensure that all areas have been thoroughly cleaned and free of any debris resulting from the performance of this specification item.

26.3.2.6 In the case that if these specifications and the supplied drawings do not concur, the drawings will be taken as correct.

### **26.3.3 Integrated Internal Communication System Requirements**

26.3.3.1 The system must use only STP Cat5E copper and Multi-Mode fiber optic cabling. All end point equipment must be connected using RJ45 jacks wired in accordance with TIA/EIA 568B specifications regardless of equipment type. Exterior connections will have an environmental rating of IP66 or better.

26.3.3.2 All Systems must be IP based, (End-to-End Digital) and must operate on the same cable infrastructure. The systems must be designed so that the failure of one system does not affect operation of another system.

- 26.3.3.3 The main equipment rack(s) (Node) are to be shock mounted and contain thermostatically controlled cooling fans. The node must contain the Public Address (PA) system controller, the hot standby Public Address system controller (provided for redundant Public Address Control, VoIP PBX system controller and all equipment for endpoint (speaker, phone, etc.) connectivity eliminating the need for additional cross-connect or junction panel hardware.
- 26.3.3.4 The node(s) must receive power from an emergency 220VAC power source and include a UPS that will maintain system power for 30 minutes. Speakers, Horns and telephones must receive PoE (Power over Ethernet) from the node through the connected Cat5E cable.
- 26.3.4 **Public Address (PA) System**
  - 26.3.4.1 A marine grade Public Address System capable of multi-channel paging must be installed. The system will be designed in accordance with ABS/Lloyds Register requirements, and be Class approved.
  - 26.3.4.2 All speakers must be self-amplified and arranged such that announcements can be heard and understood over normal underway ambient noise. Interior speakers and horns are to be individually addressable and PoE powered. Loudhailers and beacons are to be individually addressable and supported by 120VAC external power. The failure of one IP speaker must not affect the operation of any other IP speaker in the system.
  - 26.3.4.3 Controlhead stations must be touch-screen units capable of making announcements, controlling signals and making/receiving phone calls via programmable menus/sub-menus. The Controlhead must be backlit and powered via PoE. The Controlheads must also monitor and report failure of any Public Address device (loudspeakers, IP relay boxes, Controlhead, etc.) including the PA system controller and hot standby PA system Controller. Users must be notified at the Controlhead of the exact PA device failure in the system. In the event that the Public Address System Controller and hot standby are lost, emergency all call activation must still be possible via the Controlhead.
  - 26.3.4.4 Talkback communication between the Controlhead(s) and outlying stations must be by the use of the Controlhead handset, integrated push to talk button and outlying station selection via Controlhead touch screen. Call in from outlying stations must be accomplished via “call in” push button at talkback speaker. The talkback speakers must also receive audio associated with activated alarms and normal group paging per system configuration without the use of any switching at the talkback speaker.

- 26.3.4.5 The system must have PA override capabilities based on priority settings. PA zones must be software configurable by Coast Guard personnel to accommodate future changes in configuration or operation without re-cabling.
- 26.3.4.6 The system must be capable of multiple configurations so that speakers can be placed into different paging zones, volume controls can be changed to support activities such as “at pier”, “underway”, etc. Multiple configurations must be pre-programmed and selectable at the Controlhead.
- 26.3.4.7 The ability to add future alarms and signals to be distributed to pre-programmed speakers must be possible via system software.
- 26.3.4.8 Speakers installed in staterooms and offices must be provided with the capability to connect an IP phone via Cat5E cable. This feature is included to reduce cabling and to provide volume/channel control for shipboard entertainment over the local loudspeaker.
- 26.3.4.9 IP (Internet Protocol) Equipment for Public Address must be provided with Ingress Protection (IPxx) indicated as follows:
- |    |  |        |
|----|--|--------|
| a) | IP Ceiling loudspeaker (bulkhead/flush mount), for cabins and common areas, (IP22) | 67 pcs |
| b) | IP Horn type loudspeaker for machinery spaces, (IP66)                              | 29 pcs |
| c) | IP Horn type loudspeaker (IP66) for outside spaces                                 | 2 pcs  |
| d) | IP Loudhailer for bridge top (IP66) 120V/60Hz supply                               | 3 pcs  |
| e) | IP Talkback for outside spaces (IP66)  | 9 pcs  |
| f) | IP Relay Box, for GA Bells Mute  | 1 pc   |
| g) | IP Talkback for inside spaces (IP66)   | 10 pcs |
| h) | IP EPIC Controlhead  | 3 pcs  |
- 26.3.5 **PBX (VoIP) System**
- 26.3.5.1 A marine grade VoIP system must be provided. The system must provide operator free dialling and communication for incoming and outgoing calls between all spaces identified.
- 26.3.5.2 System Features
- |    |   |
|----|---|
| a) | Self-contained unit   |
| b) | Programmable from Web Interface   |
| c) | Call Forwarding   |
| d) | Call Transfer   |
| e) | Voicemail   |
| f) | 3-way Conference  |
| g) | Exterior Communication Access – Programmable (Shoreline, Satellite, Cellular) |
| h) | Incoming Call Routing   |

- i) Public Address Interface
- j) Remote Diagnostics/Maintenance

26.3.5.3 All IP telephones must be able to dial all other telephones on board and access the shore trunks and other external communication systems if so programmed. IP telephones must be equipped with special marine handset retainers, suitable for bulkhead or desk mount and be either drip-proof or waterproof type, depending on location. In high noise areas, auxiliary visual signalling via rotating beacons must be supplied and installed to indicate an incoming call.

26.3.5.4 The VoIP system must be supplied with a 4 line shore line connection box (including a custom shoreline cable) and have the ability to access Satellite and Cellular lines as applicable. It must be capable of interfacing with a FAX machine on the vessel.

26.3.5.5 A Wake-Up System must be incorporated with the PBX allowing for individual operator programming and cancelling of Wake-Up calls.

26.3.5.6 Equipment for PBX (VoIP) System must be provided with Ingress Protection (IPxx) indicated as follows:

- |  |        |
|--|--------|
| a) IP telephone (wall or desk mount)   | 37 pcs |
| b) IP telephone (weatherproof), for exterior   | 2 pc   |
| c) IP Shore connection box (4 line with 150 ft. shoreline cable) 120VAC, 60Hz                | 1 pc   |
| d) IP telephone (rugged) with headset jack and beacon (machinery spaces) 120VAC, 60Hz beacon | 12 pcs |
| e) IP interface (for Iridium and Cell) 120VAC, 60Hz  | 1 pc   |
| f) IP interface (for FAX machine, Crane Analog Phone) 120VAC, 60Hz                           | 2 pc   |
| g) Headset (for engine room phone)   | 10 pcs |
| h) IP Beacon (for machinery spaces telephones)   | 10 pcs |
| i) Bridge IP DECT wireless base station  | 1 pc   |
| j) Bridge IP DECT portable handsets  | 3 pcs  |

## 26.3.6 **Ship's Recreational Entertainment System**

26.3.6.1 The IICS must be capable of accepting (4) line level audio inputs for Ship's Recreational Entertainment. Distribution of entertainment audio (i.e. music, recorded announcements, etc.) for cabins and offices must be programmable via system configuration software. Additional cabling and speakers for entertainment audio must not be required. Control of audio source and volume in spaces must be via local phone. Entertainment audio must be over-ridden and volume level selected for entertainment will be automatically bypassed in the event of PA announcement only.



26.3.6.2 A standard relay will be used to override entertainment in the event of General Alarm Bell activation.

26.3.6.3 Equipment for Entertainment System must be as follows:

- |    |   |      |
|----|---|------|
| a) | IP 4 Channel Interface 120VAC, 60Hz                 | 1 pc |
| b) | Standard relay (voltage to be provided by customer) | 1 pc |

#### 26.3.7 **OEM Equivalency**

26.3.7.1 One supplier which meets the above ICS system requirements is Hose McCann. Contractors that wish to supply and install an equivalent Vingtor system shall seek approval within the formal "Question and Answer" process, during the Solicitation. Additionally, Training and Spares Requirements for Equivalent systems shall be included within the know work scope, as detailed within the formal "Answer" for each proposed system.

#### 26.3.8 **Existing System Removals**

26.3.8.1 The Contractor must remove and dispose of all components and cabling from the original United Marine ICS system with the exception that the following components are to be stored and returned to the Canada as Category "A" property upon completion of Vessel Life Extension:

- a) Electronic Control Panel (Blue cabinet in Electronic Equip. Room);
- b) IDHC- 7200 Digital Control Head (x2 Bridge, x1 MCR);
- c) SX-50 Cabinet from Electronics Equipment Room;
- d) Loud Hailers (x2);
- e) Submerge Proof outside Speakers;
- f) Wall Mount DTMF Telephone;
- g) Blue Lights.

26.3.8.2 The Contractor must remove a total of 79 speakers (50 Deck head Flush Mount complete with backing boxes and volume control knobs (not all speakers have volume control knobs), 13 Submerge Proof outside speakers and associated talkback buttons, 2 loudhailers and associated talkback button, and 16 horn speakers from the locations on Wheelhouse Top, Bridge Deck, Crawl Space, Focsls Deck, Boat Deck, Main Deck, and Below Main Deck. Removals of these speakers must be complete with connecting cable back to originating locations as detailed in reference drawing MM678-002-WD Sheet 2/7. For any bulkhead mounted speaker the backing boxes are to remain for mounting the new speakers using adaptor plates.

26.3.8.3 The Contractor must remove 36 telephones complete with cable back to originating locations as detailed in reference drawings MM678-002-WD Sheet 2/7.

26.3.8.4 The Contractor must remove eight (8) existing Talkback Stations that include the following components:

- a) Relay Box
- b) Talkback Telephone (No dial)
- c) Talkback Speaker
- d) Rotating Blue Beacon

26.3.8.4.1 Removals of these Talkback Stations shall be complete with connecting cable back to originating locations as detailed in reference drawings MM678-002-WD Sheet 2/7. Retain the existing AC feeds for the installation of the new beacons with the exception of the Cables from the Crane Control Room. Retain the following cables for re-use in order to connect Analogue Talk Back Station in crane: IC-J8-8, IC-421, IC-221 and IC-121.

26.3.8.4.2 The Talkback Stations are located in the following spaces:

- a) Emergency Generator Room (LOC 189);
- b) Crane Control Room (LOC 157);
- c) Steering Gear Compartment at Frame 4.5 (LOC 193);
- d) Stern Thruster Compartment at Frame 7 (LOC 152);
- e) Engine Room Forward at Frame 27 (LOC 154);
- f) Engine Room Aft at Frame 18 (Auxiliary Flats) (LOC 153);
- g) Fuel valve Station at Frame 16 (on Aft Bulkhead under Auxiliary Flats) (LOC 156);
- h) Bow Thruster Compartment (LOC 155).

26.3.8.4.3 Electrical isolations for the beacons are as follows, all breakers are to be confirmed prior to isolations of circuits:

- a) Emergency Generator Room (IE5-1) – Panel IE5 Bkr #1
- b) Crane Control Room (Lighting Circuit inside crane)
- c) Steering Gear Compartment FR4.5 (IM7-4) – Panel IM7 Bkr #4
- d) Stern Thruster Compartment FR7 (IM7-2) – Panel IM7 Bkr #2
- e) Engine Room Forward FR27 (IE5-4) – Panel IE5 Bkr #4
- f) Engine Room Aft FR18 (Aux Flats) (IM7-4) – Panel IM7 Bkr #4
- g) Fuel valve Station FR16 (on Aft Bulkhead under Aux Flats) (IM7-2) – Panel IM7 Bkr #2
- h) Bow Thruster Compartment (IM7-16) – Panel IM7 Bkr #16

26.3.8.5 The Contractor must remove six (6) existing Blue Beacons complete with relay Box tied to MCR telephone in the following location:

- a) Sewage System Room
- b) Engineer's Workshop
- c) Engine Room Frame 29

- d) Engine Room Frame 26
- e) Engine Room Frame 22
- f) Cargo Hold.

26.3.8.5.1 Removals of these Blue Beacons must be complete with connecting cable back to originating locations, existing Relay Box, Junction Box, External Ringer and cable back to MCR console as detailed in reference drawings MM678-002-WD Sheet 2/7.

26.3.8.6 The Contractor must remove the three (3) existing IDCH-7200 control heads complete with cable from the Bridge Forward Console, Bridge Winch Console Aft, and Machinery Control Room as detailed in reference drawings.

26.3.8.7 The Contractor shall remove the following SRE equipment from the SRE Rack located in the Electronic Equipment Room, small black rack mounted on the STBD bulkhead:

- a) Remove INKEL Monitor Panel PM-9206
- b) Remove disable switches panel
- c) Remove DC Power Supply above Rack Power bar with associated cables.

26.3.8.8 The Contractor shall remove the Equipment Control Panel (ECP/Blue Rack), the SX50 Telephone Exchange (PBX) complete with UPS and Operator's Console with all associated cables (at the exception of cables GA.1, NERA PBX (connected to FT7- 5/30 for Voice and FT7- 7/32 for FAX in the SX-50 rack) and IE3-3, retain for use in new system) in the Electronic Equipment Room as shown in reference drawings MM678-002-WD sheet 2/7.

26.3.8.8.1 All associated Junction Boxes must be removed as follows:

- a) JB IC-1 (Remove cable back to Fire Alarm Panel);
- b) JB IC-2;
- c) JB IC-3;
- d) JB IC-4;
- e) JB IC-5 (Remove cable back to Port QM Station including outlet);
- f) JB IC-6 (Remove cable back to Starboard QM Station including outlet, Remove cable IC-473 back to existing Shore Box, retain existing Shore Box);
- g) JB IC-7 (Remove cables back to JB IC-7A and JB IC-7B);
- h) JB IC-7A;
- i) JB IC-7B;
- j) JB IC-8 (Remove cables back to IC-8A and two IC-8 Junction Boxes for the old Capstan Speakers);

- k) JB IC-8A;
- l) IC-8 Port Capstan;
- m) IC-8 Starboard Capstan
- n) JB IC-9;
- o) JB IC-10;
- p) JB IC-11(Remove cables back to Icevue Computer and Cordless Phone outlet on Bridge, remove outlets).

## 26.3.9 IIC System Installation

### 26.3.9.1 Speakers

26.3.9.1.1 The Contractor shall install 120 new speakers:

- |   |        |
|---|--------|
| a) IP Ceiling loudspeaker (bulkhead/flush mount), for cabins and common areas, (IP22) | 67 pcs |
| b) IP Horn type loudspeaker for machinery spaces, (IP66)                              | 29 pcs |
| c) IP Horn type loudspeaker (IP66) for outside spaces                                 | 2 pcs  |
| d) IP Loudhailer for bridge top (IP66) 120V/60Hz supply                               | 3 pcs  |
| e) IP Talkback for outside spaces (IP66)  | 10 pcs |
| f) IP Talkback for inside spaces (IP66)   | 9 pcs  |

26.3.9.1.2 The Contractor shall install 44 of the 67 flush mount speakers in the space vacated by the old speakers by flush mounting the new speakers using a 12-1/2" x 12-1/2" x 1/16" thick sheet metal adaptor plate with rounded edges. This speaker will now occupy the larger space left behind by the speakers that were removed. Twenty (20) Flush mount speakers of the 23 left shall be flush mounted in areas indicated in reference drawings by cutting the deck head panels to accommodate the extra speakers. The remaining 3 are supplied with surface mount boxes which will have to be mounted Crawl Space (2ea) below the Bridge Deck and one in the Engineer's Workshop.

### 26.3.9.1.3 Locations of Flush Mount Speakers:

Bridge Deck:

Install 4 new Speakers as per drawing # 8010-100-CCGEG. The Location of the removed speaker is to be repaired.

Crawl Space below Bridge Deck:

Install 2 new Speakers as per drawing # 8010-100-CCGEG

Forecastle Deck:

Install Flush Mount Speakers where existing speakers were removed:

- a) Captain's day Room;
- b) Chief Engineer's day Room;
- c) Chief Officer's Cabin;

- d) Senior Engineer's Cabin;
- e) Logistic Officer's Cabin;
- f) Passageway Forward;
- g) Passageway Aft;
- h) Stairway;
- i) Electronic Equipment Room.

Install New Flush Mount Speakers in:

- a) Captain's night Room;
- b) Chief Engineer's night Room.

Boat Deck:

Install Flush Mount Speakers where existing speakers were removed:

- a) Ship's Office;
- b) 2 Seaman;
- c) Winchman and Spare;
- d) 2 Quartermasters;
- e) Third Officer;
- f) Second Officer;
- g) Engineer's Office;
- h) 2 Seaman;
- i) Boatswain;
- j) Chief Cook;
- k) Second Engineer;
- l) Third Engineer;
- m) 2 Oilers;
- n) Port Passageway Forward;
- o) Port Passageway Aft;
- p) Starboard Passageway Forward;
- q) Starboard Passageway Aft;
- r) Stairway.

Install New Flush Mount Speakers as per drawing # 8010-100-CCGEG:

- a) Lavatory Port Inboard
- b) Stairway Starboard Inboard Frame 40/41
- c) Starboard Passageway Middle Frame 41

Main Deck:

Install Flush Mount Speakers where existing speakers were removed:

- a) 2 Cadets;

- b) Oiler & Spare;
- c) Crew's Mess Fwd;
- d) Crew's Mess Aft;
- e) Crew's Lounge;
- f) Galley;
- g) Steward & Spare;
- h) Steward & Spare;
- i) 2 Seaman;
- j) Starboard Passageway Forward;
- k) Port Passageway Forward approximately Frame 41;
- l) Port Passageway Aft approximately Frame 37;
- m) Aft Port Passageway Forward approximately Frame 32;
- n) Stairway;
- o) Laundry & Clean Up Room;
- p) Bosun's Workshop.

Install new Speakers as per drawing # 8010-100-CCGEG. The Location of the removed speaker is to be repaired.

- a) Officer's Mess and Lounge (Gym/ Recreation area) Aft Frame 33;
- b) Officer's Mess and Lounge (Gym/ Recreation area) Forward Frame 36;
- c) Prep Area.

Install New Flush Mount Speakers as per drawing # 8010-100-CCGEG in:

- a) Galley;
- b) Crew's Mess Frame 36;
- c) Aft Port Passageway Aft approximately Frame 28;
- d) Bosun's Store;
- e) Central Store;
- f) Stairway Starboard Inboard Frame 40/41;
- g) Lavatory Forward;

Below Main Deck:

Install Flush Mount Speakers where existing speakers were removed:

- a) MCR Aft

Install New Flush Mount Speakers as per drawing # 8010-100-CCGEG in:

- a) MCR Forward Frame 36;
- b) Engineer's Workshop.

26.3.9.1.4 The Contractor shall install 10 submerge proof speakers in the space vacated by the remove submerge proof speakers. This speaker design is of the same footprint as the existing speakers and shall utilize existing mounts if in good condition.

26.3.9.1.5 Locations of Submerge Proof Speakers:

Wheelhouse Top:

Install Submerge Proof Speakers where existing speakers were removed:

- a) Forward of Main Mast;
- b) Water Monitor Platform Forward Rail approximately Frame33.

Forecastle Deck:

Install Submerge Proof Speakers where existing speakers were removed:

- a) Foscle Forward Centre

Boat Deck:

Install Submerge Proof Speakers where existing speakers were removed:

- a) Port Lifeboat Station
- b) Starboard Lifeboat Station
- c) Port Tugger Winch Control Station
- d) Starboard Tugger Winch Control Station

Main Deck:

Install Submerge Proof Speakers where existing speakers were removed:

- a) Port Fueling Station
- b) Starboard Fueling Station
- c) Crane Base

26.3.9.1.6 The Contractor must install three (3) loudhailers in new locations as per drawing # 8010-100-CCGEG. The Contractor must be responsible for modifying the mounting as necessary to accommodate the new loudhailers. The Contractor must be aware that the new loudhailers are supplied with a driver box that must be mounted **above** and **near** the speaker for connection of an acoustic tube. The Contractor must be responsible for mounting these driver boxes.

26.3.9.1.7 Locations of Loud Hailer Speakers:

Wheelhouse Top:

Install new Loud Hailer Speakers as per drawing # 8010-100-CCGEG:

- a) Port Forward rail at a 45 degree angle facing outboard at approximately Frame 37;

- b) Starboard Forward rail at a 45 degree angle facing outboard approximately Frame 37;
- c) Outside Aft bulkhead of Air Conditioning Hut below Water Monitor Platform Aft Rail approximately Frame 30 (Speaker must be kept below aft looking radar and water cannons).

26.3.9.1.8 The Contractor shall install 30 PA Horn type speakers, 26 of type IP –HM-HSIS inside PA Horn and 4 of type IP-RG-HM1566 outside PA Horn Speakers. Some of these installs will be direct replacement of those removed and the remaining shall be installed as per the reference drawings.

26.3.9.1.9 Locations of PA Horn Speakers:

Forecastle Deck:

Install New PA Horn Speakers in:

- a) AC Equipment Room Frame 36;
- b) Outside Alleyway Port Frame 39;
- c) Outside Alleyway Starboard Frame 39.

Boat Deck:

Install PA Horn Speakers where existing speakers were removed:

- a) General Store Starboard

Install New PA Horn Speakers as per drawing # 8010-100-CCGEG:

- a) Engine Casing Frame 29
- b) Port Boat Deck Frame 26 (Bulkhead forward of inflatable Work Boat)

Main Deck:

Install PA Horn Speakers where existing speakers were removed:

- a) Winch Room.

Install New PA Horn Speakers as per drawing # 8010-100-CCGEG.

- a) Incinerator Room Frame 32
- b) Engine Casing Frame 29
- c) Aft Bulkhead outside Winch Room Frame 22

Below Main Deck:

Install PA Horn Speakers as per drawing # 8010-100-CCGEG:

- a) Domestic Machinery Space Starboard Frame 43
- b) Galley Dry Stores Port Frame 43
- c) Sewage System Room



- d) Engine Room Forward Starboard Frame 32
- e) Engine Room Forward Port Frame 32
- f) Engine Room Starboard Frame 27
- g) Engine Room Port Frame 27
- h) Engine Room Starboard Frame 24
- i) Engine Room Port Frame 24
- j) Engine Room Centre Frame 22
- k) Engine Room Starboard Frame 20
- l) Engine Room Port Frame 20
- m) Engine Room Centre Frame 20
- n) Engine Room Auxiliary Flats Starboard Frame 18
- o) Engine Room Port Auxiliary Flats Frame 18
- p) Engine Room under Auxiliary Flats Centre Frame 16
- q) Cargo Hold Port Frame 16
- r) Cargo Hold Starboard Frame 16
- s) Cargo Hold Port Frame 10
- t) Cargo Hold Starboard Frame 10

#### 26.3.9.2 Telephones

26.3.9.2.1 The Contractor shall install 37 IP bulkhead mount telephones, one (1) local Dect base station with three (3) IP Dect Portable VoIP Handsets with charger, two (2) Ruggedized telephone and one (1) IP bulkhead mount waterproof telephone as detailed in reference drawings.

26.3.9.2.2 The Contractor must be responsible to supply and install 37 bulkhead outlets complete with boxes and RJ45 jacks for the purpose of connecting the new telephones. The Waterproof and Ruggedized telephones do not require an outlet, wired directly through a waterproof connection.

#### 26.3.9.2.3 Locations of IP Telephones:

##### Bridge Deck:

- a) Install one (1) local Dect base station Frame 35 (Replace existing portable phone base), and 3 IP Dect Portable VoIP Handsets with charger as per drawing # 8010-100-CCGEG (LOC 120);
- b) Install one (1) IP Bulkhead Telephone FR35 where existing was removed (LOC 117).

##### Forecastle Deck:

Install IP Bulkhead Telephone where existing phones were removed:

- a) Captain's day Room (LOC 131)

- b) Captain's night Room (LOC 131)
- c) Chief Engineer's day Room (LOC 133)
- d) Chief Officer's Cabin (LOC 133)
- e) Senior Engineer's Cabin (LOC 134)
- f) Logistic Officer's Cabin (LOC 136)
- g) Electronic Equipment Room (LOC 122)

Install IP Bulkhead Telephone as per drawing # 8010-100-CGEG.

- a) Chief Engineer's night Room (LOC 133)

Boat Deck:

Install IP Bulkhead Telephones where existing Telephones were removed:

- a) Ship's Office (LOC 112)
- b) 2 Seaman (LOC 172)
- c) Winchman and Spare (LOC 163)
- d) 2 Quatermasters (LOC 173)
- e) Third Officer (LOC 140)
- f) Second Officer (LOC 145)
- g) Engineer's Office (LOC 113)
- h) 2 Seaman (LOC 175)
- i) Boatswain (LOC 135)
- j) Chief Cook (LOC 169)
- k) Second Engineer (LOC 141)
- l) Third Engineer (LOC 146)
- m) 2 Oilers (LOC 180)

Install IP Bulkhead Waterproof Telephone per drawing # 8010-100-CGEG.

- a) Port Bulkhead outside Frame 31 (LOC 123)

Main Deck:

Install IP Bulkhead Telephones where existing Telephones were removed:

- a) 2 Cadets (LOC 164)
- b) Oiler & Spare (LOC 181)
- c) Galley (LOC 168)
- d) Officer's Lounge (New Gym and Recreation area) FR35 inboard (LOC 178)
- e) Steward & Spare (LOC 170)
- f) Steward & Spare (LOC 183)
- g) 2 Seaman (LOC 174)

- h) Bosun's Stores (LOC 184)
- i) Bosun's Workshop (LOC 149)

Install IP Bulkhead telephones as per drawing # 8010-100-CGEG.

- a) Laundry and Cleanup Area (LOC 176)
- b) Winchroom FR28 (Ruggedized) (LOC 131)
- c) Canteen (LOC 177)
- d) Crew's Mess FR35 (LOC 115)
- e) Crew's Lounge FR32 (LOC 126)

Below Main Deck:

Install IP bulkhead Telephone where existing Telephone was removed:

- a) Engineer's Workshop (LOC 187)
- b) Cargo Hold (Ruggedized) (LOC 143)

Install New IP bulkhead Telephone as per drawing # 8010-100-CCGEG:

- a) MCR Frame 34 Starboard Bulkhead near door (LOC 116)

#### 26.3.9.3 Talkback Stations

26.3.9.3.1 The Contractor shall install 10 (10) new "Talkback Stations" in the space vacated by the old Talkback Stations and utilize the existing AC feed to each of the Beacon Interface Box. Nine (9) "IP Talkback Station" consists of the following equipment:

- a) IP-626GH70 Telephone
- b) Blue Beacon c/w interface box
- c) Headset c/w storage case
- d) Talkback Horn speaker and Call Button

26.3.9.3.2 One (1) "Analogue Talkback Station" for the crane control cab consists of the following equipment:

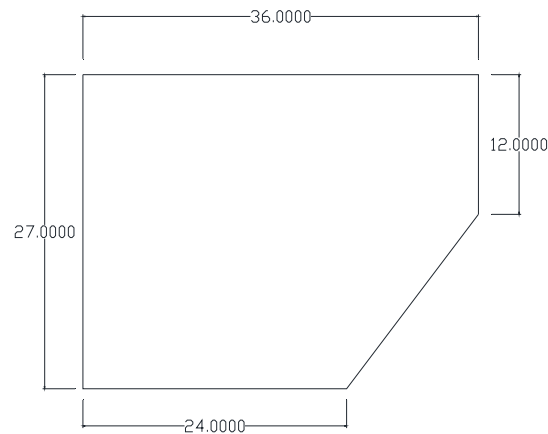
- a) 9491-J Telephone
- b) 910-14 Headset
- c) HM-ADRW-S-PBX relay
- d) HMC870-1206B Beacon
- e) HM-1566-TB Talk Back Speaker
- f) 2924.1 Headset Storage Box

Use the retained existing cables IC-121, IC-221 and IC-421 to interconnect the Analogue Talk Back Station components as per reference drawings.

- 26.3.9.3.3 Install two (2) new telephone stations for noisy area in the Domestic Machinery Space FR43 (LOC 158), replace existing telephone and Engine Room Center FR24 (LOC 159). Telephone station includes IP-626GH70 Telephone, Blue Beacon c/w interface box and Headset c/w storage case.
- 26.3.9.3.4 The Contractor must install six (6) new Blue Beacons where existing Beacons were removed to form a Beacon to Beacon Chained Network tied to the MCR Telephone. The Beacon relay box is to be connected to existing AC feed from IE5-4.
- 26.3.9.4 Control Heads
  - 26.3.9.4.1 The Contractor shall install three (3) new IP EPIC control heads complete with handsets in the space vacated by the old control heads noted above. The IP EPIC control heads for these locations shall be installed using adapter plates with the IP EPIC control heads and handsets fitted in the adapting plates. These plates shall be of suitable size to cover the existing hole. Plates shall be of the same paint scheme as the location they are being installed. The two IP EPICs in the Wheelhouse shall be LOC 117 FWD, LOC 118 Aft and the MCR IP EPIC shall be LOC 114.
- 26.3.9.5 The Contractor shall install the SRE interface (IP-SRE-4A) in the top space of the SRE Rack located in the Electronic Equipment Room where the INKEL Monitor Panel was removed, small black rack mounted on the Starboard bulkhead.
- 26.3.9.6 The Contractor must install one (1) GA IP Relay Box (IP-RG-605-108) in the Electronic Equipment Room for silencing of the general alarm during an announcement.
- 26.3.9.7 The Contractor shall install (1) Analog to IP Converters (IP-605-101CFX2S) in the Ship's Office on the Boat Deck near the FAX machine. Unit is to be connected to the nearest AC outlet available.
- 26.3.9.8 The Contractor must install one (1) Cell/Satcom Interface Unit (IP-605-118) in the Electronic Equipment Room near Cell phone.
- 26.3.9.9 The Contractor shall install one (1) Shore line Box (IP-865-4) in the Electronic Equipment Room. This shall be installed on the Aluminum plate where the SX-50 was removed. The old Shore Line Connection Box on the aft outside bulkhead shall be retained and the new shore line connection box is to be connected to existing Shore Line box using supplied shore cable (IP-865-24-CBL4).
- 26.3.9.10 The Contractor shall install (1) Phone/Speaker/TB Interface Box (IP-RG-605-121TBM) in the Steering Gear Compartment where Junction Box IC-8 was removed. Unit is to be connected to the existing Talk Back Station AC feed IM7-2

and IC-J8-8 which runs to the slip ring for the crane. A junction box will be required to split the existing AC feed to supply both the Talk Back Station and Interface Box.

- 26.3.9.11 The Contractor shall install Node #1 and the UPS in the space vacated by the old ECP Rack in the Electronic Equipment Room. Fabricate a 1/4" steel plate to be welded on existing bracket attached to bulkhead where the ECP rack was removed 73" H x 36" W. Fabricate a 1/4" steel bottom plate, the plate is to be fabricated as per drawing below with dimensions in inches. The plate is to be welded on the existing floor mount used to support the old ECP rack. All metal shall be primed and painted to match existing. Prior to installing the Node on the plate the following will have to be relocated, Air Conditioning Controller, Electric Heat Thermostat in the best feasible location, AC receptacle can be relocated to bulkhead between Node and UPS and move light switch closer to door facing STBD. Node#1 is to be mounted on the Bulkhead plate as close to the forward end of plate as possible to allow the split cabinet to open with the top of the Node at 72" from the deck. The UPS for Node#1 shall be mounted in the Electronic Equipment Room on the bottom plate beneath the Node.



- 26.3.9.12 The Contractor must install Node #2 in the Officer Lounge (Gym/Recreational Area) on the inboard bulkhead approximately Frame 34. The UPS for Node#2 must be mounted beneath Node in the same location. There is to be enough space to allow the Split Rack to be opened completely.
- 26.3.9.13 The Contractor must reuse all existing deck and bulkhead penetrations where possible. Any new penetrations required must follow the standards of 24.2.2.

26.3.9.14 The Contractor shall supply and install five (5) S 4x1 Roxtec primed frame complete with 36 RM20 Roxtec modules per Frame, one Wedge kit galvanized per frame.

26.3.9.15 For the purpose of adjustments, the Contractor shall include a unit cost for the supply and install for one (1) S 4x1 Roxtec primed frame complete with 36 RM20 Roxtec modules per Frame, one Wedge kit galvanized per frame.

26.3.9.16 The Contractor must reuse all existing cable trays and hangers. If new cable trays or hangers are required, they meet the standards of 24.2.2. and a PWGSC Form 1379 must be submitted for approval.

#### 26.3.9.17 Fibre Optic Cable

26.3.9.17.1 The contractor shall supply and install two Almond 3 Duplex Port fiber drop boxes complete with 3 LCD (Duplex) couplers to be mounted in the back of each Node.

26.3.9.17.2 The contractor shall supply and install 40m of Fibre Optic Cable run between the fiber drop boxes in Node #1 in the Electronic Equipment Room to Node #2 in the Officer Lounge (Gym / Recreation area). Use Belden B9C132 (POI 6 OM3-50. 10G 2 MM B) fiber cable.

26.3.9.17.3 For the purpose of adjustments, the Contractor shall include a unit cost per 1 meter for the supply and install for 10 meters of this cable type.

26.3.9.17.4 The contractor shall supply and install two (2) 1m LC to LC fiber patch cord between the fiber drop boxes and the nodes.

#### 26.3.9.18 AC Feeds

26.3.9.18.1 The Contractor shall supply and install a two circuit disconnect panel complete with two 15A circuit breakers. Install panel on existing aluminum plate where the SX-50 was removed. Remove the receptacle currently fed by cable IE3-15 and use cable IE3-15 as the main feed for the new two circuit panel.

26.3.9.18.2 The Contractor shall supply and install 85m of Marine AC 14/3 Shipboard cable with a junction box to provide one (1) 120VAC 15A Circuit to supply the three (3) Loudhailers located on Bridge Top. This feed will run from the new two circuit panel in the Electronic equipment Room to the deck head of the Wheelhouse and 3 runs out from the junction box to the three loudhailers.

26.3.9.18.3 The Contractor shall supply and install 10m of Marine AC 14/3 Shipboard cable to provide one (1) 120VAC 15A Circuit to supply the Shore Line Connection Box in the Electronic Equipment Room on Aluminum plate where the SX-50

was removed. Supply 120VAC to the new shore box from newly installed breaker panel.

- 26.3.9.18.4 For the purpose of adjustments, the Contractor shall include a unit cost per 1 meter for the supply and install for 10 meters of this cable type.
- 26.3.9.19 The Contractor shall supply and install a new 115 to 230 VAC Step-Up Transformer in the Electronics Equipment Room. The transformer must be rated to supply two 20A circuits for each UPS / Nodes. Supply for this transformer shall be from an existing circuit on the 115 VAC Emergency Bus, breaker IE3-3 (This circuit was originally supplying the old ECP rack).
- 26.3.9.20 The Contractor shall supply and install a new 230 VAC service panel, complete with main disconnect and two (2) 20 A supply breakers, in the Electronic Equipment Room on Aluminum plate (Port bulkhead) where SX-50 was removed.
- 26.3.9.21 The Contractor shall supply and install a new Automatic Changeover Switch (ACOS) in the area of the new 230 VAC panel. This switch shall be fed on one side from the new transformer and on the other side from a spare circuit in panel 2M5 in the bridge, breaker 17. The ACOS shall have indication for normal and emergency power operation. Primary supply will be from 2M5 breaker 17 and secondary supply from the new transformer. The Contractor shall supply and install 30 meters of 10/4 AWG marine shipboard cable for the connection of these components.
- 26.3.9.21.1 The Contractor shall supply and install 50 meters of 12/3 AWG marine shipboard cable for the connection of the UPS's to the new 230VAC panel in Electronic Equipment Room.
- 26.3.9.21.2 For the purpose of adjustments, the Contractor shall include a unit cost per 10 meters for the supply and install for 10 meters of these cable types.
- 26.3.9.22 Cat5e Cable
- 26.3.9.22.1 The Contractor shall supply and install 4000m of 1300SB Cat5e cable for the connection of speakers, phones, interface boxes, controllers and accessories as detailed in reference drawings.
- 26.3.9.22.2 For the purpose of adjustments, the Contractor shall include a unit cost per 10 meters for the supply and install for 10 meters of 1300SB Cat5e cable.
- 26.3.9.22.3 The Contractor shall run 143 homerun cables from all the peripheral devices to the Nodes. 67 homeruns will be to Node #1 in the Electronics Equipment Room from Water Monitor platform, Wheelhouse top, Bridge Deck and Forecastle Deck. 76 homeruns will be to Node #2 in the Officer's lounge

(Gym./Recreational Area) from the Main Deck, Below Main Deck, Below Aux Flats and Bow Thruster Compartment.

26.3.9.22.4 The contractor must run an additional 35 cables for the connection of the telephones chained to speakers.

26.3.9.22.5 The contractor must run an additional 3 cables for each talkback stations identified in section 26.3.8.4.2 for a total of 27 (x9 Talkback Station). One run will be from the telephone to headset junction box, one from the headset junction box to the Beacon junction box and the third one from the PA Horn to the call button box.

## **26.4 Customer Programming**

26.4.1 Programming of the system shall be carried out by FSR at time of installation.

26.4.2 The following are some of the required functionality from existing system:

- a) Local Telephone Numbers, Special Features and Access codes should be programmed as per reference document E06CFGPHONEDIR0814.xls where possible. The local telephone numbers are also included in this document which indicates the location of the phones on the vessel.
- b) Night Bells
- c) The following Talk Back Station should be able to contact both Bridge and MCR: Emergency Generator Room, Crane Control Cab Room, Steering Gear Compartment, Stern Thruster Compartment and Bow Thruster Compartment.
- d) The following Talk Back Speakers should be able to contact the Bridge: Water Monitor Platform, Focsle, Port & STBD Tugger Winch Stations, Port & STBD Lifeboat Stations and Crane Base.
- e) The following Talk Back Station/Speakers should be able to contact the MCR: Port & STBD Fueling Station, Engine Room Forward, Engine Room Aft and Fuel Valve Station.
- f) Direct Line between Engine Room and MCR.
- g) The SRE should be made available in the following areas: Laundry Room, Bosun's Workshop, Engineer's Workshop, MCR, Galley, Prep Area, Crews Lounge, Crews Mess, Officer's Lounge and Mess (GYM), Ships Office, Engineer's Office, Electronics Equipment Room and all Cabins. The telephone in each of those areas shall be programmed for volume controlled for the local speaker.
- h) When MCR Call Group LOC 121 is called it should activate all the blue light in the Engine Room (FWD, AFT and Fuel Valve Station), Stern Thruster Compartment and Steering Gear Compartment.



## **26.5 Proof of Performance**

### **26.5.1 Inspections**

- 26.5.1.1 All work must be subject to be witnessed by the IA or delegate and the attending TCMS surveyor.

### **26.5.2 Tests**

- 26.5.2.1 The programming and commissioning of the new ICS system shall be performed under the direction of approved FSR and in accordance with the manufacturer's approved procedures.
- 26.5.2.2 Testing shall be completed on the system to confirm that all system aspects are in compliance with the requirements of Transport Canada and the relevant Classification Society to ensure a class approved installation. A report on all testing and findings shall be submitted to the TA prior to the acceptance of this item.

## **26.6 Deliverables**

### **26.6.1 Documentation/Reports/Configuration**

- 26.6.1.1 All original Class approval certificates for all system components must be submitted to the TA and IA prior to the acceptance of this item.
- 26.6.1.2 The Contractor must provide the Technical Authority with a written report of the Contractors work in both electronic and hardcopy formats outlining the details of the inspection and any alterations / repairs made prior to the acceptance of this item.
- 26.6.1.3 The system supplier must provide an itemized list with details and serial numbers for all replaceable items used in this install to the Technical Authority. This is required for CCG to be able to enter all items in AMS (Asset Management System).
- 26.6.1.4 As-Built Programming/Configuration File (Flash Drive or CD) must be delivered to the TA prior to acceptance of this item.

### **26.6.2 Drawings**

- 26.6.2.1 The final "As-Fitted" drawing package must be provided. At minimum, this package must include separate drawings for:
  - a) Device Locations (overlaid on the vessel's General Arrangement, provided)
  - b) Cable Runs, Deck and Bulkhead Penetration Details overlaid on the vessel's General Arrangement, provided)
  - c) Block Diagram with Connection Details and

- d) Regulatory & Statutory Requirements. Three (3) paper copies ISO A2 size and one (1) electronic copy ACAD 2013.dwg format.

26.6.3      **Training**

26.6.3.1 The Contractor must provide one (1) training courses of eight (8) hours duration each to be held onboard after the final installation and commissioning of all new system components. This training must be provided to 8 ship's personnel involved in the operation of the system (both crews) and to 2 CCG Technicians responsible for the maintenance on the system. Contractor must coordinate with crew's availability and other courses and submit to TA.

26.6.3.2 The training must be provided by the manufacturer's technical representative (FSR). Training must encompass all items outlined in the operating and maintenance instructions as supplied by the manufacturer. (This may have to be provided on completion of Vessel Life Extension based on access to the vessel during VLE)

26.6.4      **Manuals**

26.6.4.1 The Contractor must ensure that all operation, maintenance, and installation manuals supplied with the new equipment unit are submitted to the Canadian Coast Guard prior to the acceptance of this item.

**Table 26-1: ICS GFE**

<b>Line</b>	<b>Item</b>	<b>Description</b>	<b>Quantity</b>
1	HMC-ICP-PGVE Series	Control Node, 92 Port Config	1
2	HMC-ICP-PGVE Series	Peripheral Node, 92 Port Config	1
3	IP-SRE-4A	IP-SRE Interface, 4 Channel	1
4	IP-RG-605-108	IP Relay Box (IP-RG-605-108MR)	1
5	IP-EPIC	EPIC – Mini Touchscreen Menu IP	3
6	IP-RG-HM387-20-UV-3	IP Loudhailer, 20" Projector	3
7	IP-RG-HSSR-TB-4X	IP PA / Talkback Speaker, NEMA 4X	10
8	IP-RG-HM1566-TB	IP PA Speaker Horn, IP66	8
9	IP-RG-HM1566	IP PA Speaker Horn, IP66, Corrosion Free	4
10	IP-HM-HSIS	IP PA Horn (Interior)	26
11	IP-HM305F	IP Loudspeaker, Flushmount	64
12	IP-HM305B	IP Loudspeaker, Bulkhead	3
13	IP-9315-MOH	IP Telephone	37
14	IP-RG-605-121TBM	IP/Analogue Dual Interface Box, Telephone and Speaker (TB), 120VAC	1
15	9491-J	Type "G" Phone, w/Jack, Wallmount	1
16	910-14	Headset with 20' cord	1
17	HMC870-1206B	Rotating Beacon, 120VAC, Blue Dome, Box mount	1
18	HM-ADRW-S-PBX	Single Aux Unit, 115V Trans. PBX Ring Voltage Relay Box	1
19	HM-1566-TB	Talkback Sta. Consisting of: 4W Speaker and Remote Push Button	1
20	IP-RG-626GH70	IP Ruggedized Telephone, IP44, Beacon & Headset Connection	11
21	910-18-10M	Headset w/ 10 m Cord	10
22	IP-RG-HMC870R-1206B	IP Rotating Beacon, Blue, 120VAC	10
23	2924.1	Sym#2924.1 Headset Stowage Box	10
24	IP-RG-9494H	IP Ruggedized "G" Phone w/ enclosure	1
25	IP-605-118	SAT / CELL Interface Box (FX80)	1
26	IP-605-101CFX2S	Analog to IP Converter, 2 Line, FXS	1
27	IP-RG-865-4	Shoreline Connection Box, 4 Line	1
28	IP-865-24-CBL4	50' Shoreline Cable (4 line)	1
29	IP-DECT-BS02	Local DECT Base Station, VoIP	1
30	IP-D9685	IP DECT Portable, Handset & Charger	3
31	Drawings – ICP	Layout, Hook-Up, Data Sheets	1
32	Manual, ICP-PGV	Hardcopy Original	1
33	Manual, LTD Copyright	Electronic PDF Manual	1

## **27.0 STERN THRUSTER SYSTEM UPGRADES**

### **27.1 Identification**

- 27.1.1.1 The Contractor must remove the existing Stern Thruster control system and main motor starter cabinet and install new GFE control system and motor starter cabinet.
- 27.1.1.2 The Contractors must drain and refill the stern thruster hub with oil, inspect the shaft seal exterior, and replace the tunnel sacrificial magnesium anodes.

### **27.2 References**

#### **27.2.1 Instructions**

Ulstein Maritime Instruction Manual  
Rolls Royce Installation Instruction Package

#### **27.2.2 Standards**

- a) Fleet Safety and Security Manual (DFO/5737)
- b) TP127 – Ship’s Electrical Standards
- c) IEEE 45:2002 – Recommended Practice for Electrical Installation on Ships

#### **27.2.3 Drawings**

<b>Drawings Number</b>	<b>Drawing Name</b>
VNEA2_381-003	Machinery Arrangement Elevations 2 OF 3
VNEA2_381-003	Machinery Arrangement Plan View 1 OF 3
VNEA2_381-003	Machinery Arrangement Sections 3 OF 3

### **27.3 Technical**

#### **27.3.1 General**

- 27.3.1.1 The Contractor must employ the services of a Rolls Royce Canada FSR for the duration of the work in this Section. In order to maintain warranty on the thruster components after commissioning, the work in this section must be supervised by the FSR’s up to and including the sea trial requirements and any adjustments to the thruster set up.
- 27.3.1.2 The Contractor must supply all external cabling and cable glands. The Contractor must supply all hardware, fasteners, brackets, hangers, cable straps, sacrificial magnesium anodes and wiring terminations.

- 27.3.1.3 Guidance is given in the manufacturer's instructions, diagrams and mounting instructions as to the cable type recommendations.

## 27.3.2 **Control System Replacement**

### 27.3.2.1 Removals

- 27.3.2.1.1 The Contractor must electrically isolate all power supplied to the Stern Thruster MAR-EL A/S control system.
- 27.3.2.1.2 All components of the control system must be removed and disposed of, including but not limited to, the thruster control stations on the bridge wing consoles, all wiring to redundant ASEA controls on the forward and aft bridge consoles to the thruster control system, the MAR-EL A/S electronic cabinet, system indicating lights in the machinery control room and all associated wiring between these components.
- 27.3.2.1.3 Wiring removals must also include all wiring from the control system to the Motor Starter unit, and up to the CPP pitch indication potentiometer on the maneuvering unit.
- 27.3.2.1.4 The Contractor must categorize all the control components as Category "A" property as per Section 1.11.2 and the wiring must be categorized as Category "C".
- 27.3.2.1.5 The Contractor must retain all other Stern Thruster system components in their present positions.

### 27.3.2.2 Installation

- 27.3.2.2.1 The Contractor must install the new GFE HCX1 Remote Control System in accordance with the manufacturer's instructions and under the guidance of the manufacturer's FSR. All wiring terminations must be supervised by the FSR.
- 27.3.2.2.2 The Contractor must install GFE control stations in the bridge wing consoles and the main bridge console. The Contractor must supply and install all wiring required to connect the components.
- 27.3.2.2.3 The Contractor must install the GFE Viewcon switch cabinet on the bridge and supply and install all wiring required to connect the bridge control panels to this unit.
- 27.3.2.2.4 The Contractor must install the GFE Electronic cabinet on the bridge in a location to be determined with the assistance of the TA, and supply and install all wiring to the external power supply, and all interconnected components.

- 27.3.2.2.5 The Contractor must install the GFE Distributed IO cabinet in the engine room, and supply and install all wiring required to connect to the external components to this unit including but not limited to the system indicating lights in the machinery control room. The Contractor must supply and install new LED indicating lights for MCR panel.

### 27.3.3 **Motor Starter Replacement**

#### 27.3.3.1 Removals

- 27.3.3.1.1 The Contractor must electrically isolate all power supplied to the Stern Thruster 400 HP Solid State Motor Starter system.
- 27.3.3.1.2 The Contractor must disconnect, label and protect all main power cables to the Motor Starter unit, and the power and heater cables to the Stern Thruster Motor. All power and heater cables must be megger tested and a copy of all reading delivered to the TA. Any cables with inadequate insulation readings must be replaced by submitting a PWGSC Form 1379 for approval.
- 27.3.3.1.3 The Contractor must disconnect, label and protect all remaining wiring to the Motor Starter unit and remove and dispose of any wiring not scheduled or able to be reused in accordance with the manufacturer's instructions for wiring for the new Motor Starter unit. The Contractor must remove the remote start and stop control switches and indication lights in the Machinery Control Room,
- 27.3.3.1.4 The Contractor must dismount and remove the Starter Cabinet with all components inside secured for transport. This equipment must be categorized as Category "A" property.

#### 27.3.3.2 Installation

- 27.3.3.2.1 The Contractor must modify the mounting arrangement for the new Motor Starter Cabinet in accordance with the installation instructions from the manufacturer, and mount the new cabinet.
- 27.3.3.2.2 The Contractor must install the new GFE Low Voltage Soft starter System in accordance with the manufacturer's instructions and under the guidance of the manufacturer's FSR. All wiring terminations must be supervised by the FSR.
- 27.3.3.2.3 The Contractor must reinstall the power supply cables and power and heater cables to the Stern Thruster Motor. The Contractor must supply and install all other wiring required for the starter unit, including but not limited to all remote start and stop buttons for the thruster motor. The Contractor must install new LED start and stop buttons in the main console of the Machinery Control Room.

**27.3.4 Stern Thruster Hub Maintenance**

- 27.3.4.1 This work must be done under the supervision of an accredited Rolls Royce FSR. All Rolls Royce spare parts will be Coast Guard supplied.
- 27.3.4.2 The Contractor must bid for 40 hours of machine shop time to make any adjustments to the mounting flange bolt patterns and hydraulic piping holes as required. Adjustments up or down in the hours will be by submitting a PWGSC Form 1379 for approval.
- 27.3.4.3 The contractor must remove and salvage the grids for the stern thruster tunnel.
- 27.3.4.4 The Contractor must remove and dispose of approximately 150 liters of waste oil from the thruster. The Contractor must remove and dispose of one (1) oil filter from the stern thruster piping in the stern thruster compartment. Disposal must be in accordance with all Federal, Provincial and Municipal regulations. Disposal certificates must be delivered to the TA.
- 27.3.4.5 Access to the thruster compartment is restricted and contractor responsible to determine removal path and all associated Work. Removal path can be facilitated by removing soft patch in deck head of compartment for this purpose. Removal, re-installation and sealing of the soft patch will be the contractor's responsibility.
- 27.3.4.6 Care is to be taken to prevent damage to all wiring, piping, paint and ventilation trunking in way of stern thruster compartment. Any damage to be repaired by contractor at Contractor's expense.
- 27.3.4.7 Components of stern thruster are of significant weight. Contractor is to supply personnel and lifting arrangements, as necessary, for support and removal of components
- 27.3.4.8 The Contractor must remove the complete underwater stern thruster unit and replace it with GFE supplied Model # 90TV-A unit and seals. Manufacturer's drawing and instructions are available for reference purposes. Specific procedures for disassembly will be left to the Contractor's discretion with the FSR's guidance however all relative positions of all components are to be maintained and special note is to be made of all shims and adjustment points with intent to maintain adjustment as per original.
- 27.3.4.9 Scope of work herein will also include, but is not be limited to the removal and re-attachment of the main drive motor, electrical connections and control devices such as thruster maneuvering unit, the valve block and the valve block. All hold down bolts, associated driveshaft couplings arrangements, maneuvering unit connections, oil pump, oil pipes, pitch control lever and welded beveled struts.

- 27.3.4.10 The Contractor must install the new Coast Guard supplied thruster maneuvering unit, valve block and pump unit. This will also include all high pressure piping and piping modifications, mounting plates, bed plates as required and all vibration isolating securing devices required to install the new thruster unit.
- 27.3.4.11 Alignment of the stern thruster will also be required. The final measurements must be witnessed by the Coast Guard representative for final approval and acceptance. A written report must be submitted recording the axial and radial alignment measurements of the driveshaft connecting the stern thruster and the drive motor.
- 27.3.4.12 The Contractor must commission the new unit completely as recommended by the manufacturer representative including supply and filling the unit with Omala 150 oil. The Contractor must install one (1) new Contractor supplied oil filter for the stern thruster. The installation of the drain plug and gasket must be witnessed by the Inspection Authority. The drain plug areas and the shaft seals must be surveyed for oil leaks after the unit has been refilled with new oil. The Contractor must install the rope guards.
- 27.3.4.13 The thruster installation and commissioning operation is to be tested to the satisfaction of the Technical Authority. Any leaks or other defects are to be corrected by the Contractor at the Contractor's expense.
- 27.3.4.14 For reference, the Contractor must record the blade tunnel clearances throughout one full revolution at the neutral, full port and full starboard positions. This test must be done without the thruster running.
- 27.3.4.15 The Contractor must remove the sacrificial anodes, supply and install same size replacement magnesium anodes in the stern thruster tunnel, and must touch up any damaged paint in this area with the hull coatings system paints
- 27.3.4.16 Once the vessel has been re-floated a full functional test of the thruster is to be undertaken to the satisfaction of the TA. Pitch response is to be timed and compared to those values recorded prior to docking as is motor current draw.

## **27.4 Inspections, Tests and Trials**

- 27.4.1 The Contractor must inspect the propeller tip clearances as noted in 27.3.4.14.
- 27.4.2 The Contractor must perform tests and trial of the control system as recommended by the FSR in order to prove the operation of all components and the system as a whole.



- 27.4.3 The Contractor must develop a set of sea trials for the stern thruster following the recommendations of the FSR.
- 27.4.4 All recorded propeller tip clearances must be provided to the Inspection Authority and the Technical Authority in an MS-Excel spreadsheet format, 2 paper copies and 1 electronic copy in PDF format on CD media.

## **27.5 Deliverables**

- 27.5.1 The Contractor must supply the TA with a copy of all Class approval documents for the components supplied for this work.
- 27.5.2 The Contractor must supply the TA with final “As-Fitted” drawings of all wiring systems in accordance with Section 6.1.6 of this Specification.
- 27.5.3 The Contractor must supply the TA and IA with final installation reports from the FSR including any issues, repairs or modifications that occurred during the installation.
- 27.5.4 The Contractor must supply the TA with oil disposal certificates.
- 27.5.5 The Contractor must supply the TA and IA with copies of the results of all tests and sea trials.

## **28.0 SHEPARDING BOAT DAVIT INSTALLATION (SURVEY ITEM)**

### **28.1 Identification**

- 28.1.1.1 The Contractor must supply and install a Palfinger PRHE 35H davit on the starboard boat deck of the CCGS Earl Grey.

### **28.2 References:**

#### **28.2.1 Davit Installation Instruction Package**

See Technical Data Package

#### **28.2.2 Documents**

- a) Canada Shipping Act, 2001 and all associated Regulations
- b) TP 7321-Transport Canada – Standards for Life Rafts & Inflatable Rescue Platforms
- c) TP 7323E-Transport Canada – Standard for Launching & Embarkation Appliances
- d) IEEE Std 45-1998-Recommended Practice for Electrical Installation on Shipboard
- e) Palfinger Installation Instructions

### **28.3 Technical**

#### **28.3.1 General**

- 28.3.1.1 The Contractor must supply a Palfinger model “PRHE 35H” davit system rigged to secure, launch and recover a GFE Zodiac Hurricane 749 fitted with a Coast Guard standard lifting arrangement.
- 28.3.1.2 The Contractor must not substitute the model of davit with any other prior to approval from the TA and IA. Any substitute must Class approved and the Contractor must be responsible for all engineering required to install the substitute to the satisfaction of TCMS.

#### **28.3.2 Removals**

- 28.3.2.1 The existing life raft cradle situated on the starboard Boat Deck is to be removed to storage as category “A” property, and the Boat Deck plating is to be ground smooth and restored to the same condition as the surrounding structure. For location of the new davit, see the guidance drawing in the Technical Package.
- 28.3.2.2 The existing ship's fenders in way of the Sheparding boat launching area at the Boat Deck and the Main Deck levels are to be removed to ensure smooth deployment and recovery of the boat. The steel flat bars supporting the fenders are to be cut back clear of the affected area, and the rubber fenders are to be cut to suit the revised arrangement.

28.3.2.3 Store room gear, ventilation, ducting, insulation, piping, outfitting removals and reinstallation are the responsibility of the Contractor.

28.3.2.4 The main crane crutch must be removed and the Boat Deck plating is to be ground smooth and restored to the same condition as the surrounding structure

### 28.3.3 **Structural Installations**

28.3.3.1 New 12mm insert plates must be installed under the new Palfinger davit feet as shown on the installation drawings. In conjunction with these new insert plates, additional stiffeners of 125x75x8mm are to be fitted under the deck to align with the davit feet once the davit has been installed, properly aligned and tack welded in place to ensure correct alignment. A transverse stiffener is also to be fitted at the underside of the deck to align with the ends of the hydraulic pump seats on the deck above, the exact location of this to be determined once the location of the pumps is finalized.

28.3.3.2 The Palfinger davit is to be installed as per the installation drawings. Care must be taken to ensure proper alignment with new and existing deck structure, and to ensure that the installation is level with the ship's baseline (keel). All items provided by Palfinger are to be installed by the Contractor and include, but must not be limited to: davit structure, pump units, rigging components, and control stand. The davit is to be aligned longitudinally with the side shell, as per the guidance drawings.

28.3.3.3 Installation is to be in accordance with manufacturer's recommendations in the reference manuals and drawings.

28.3.3.4 At the ends of the modified fenders, at the Boat Deck and Main Deck levels, steel cap plates are to be fabricated and welded to the side shell plating, in accordance with the detail on the guidance drawings including steel grade and thickness.

28.3.3.5 The one 'tween deck sidelights in way of the boat launching area is to be fitted with protection bars to prevent damage from the boat or the boat lifting gear. The existing coaming at the sidelights is to be cut more or less flush with the shell plating, and 19mm diameter round bars are to be welded across the spigot of the sidelights to afford some protection to the glass. The work is to be generally in accordance with the detail shown on the guidance drawings.

28.3.3.6 The existing handrails at the Boat deck in way of the new davit must be modified to tie in to the new equipment arrangement. The handrails will also require modification in way of the stripped out life raft station at the same location. Replacement handrails are to be similar in diameter and thickness to the existing arrangement.

28.3.3.7 The existing life raft cradle must be reinstalled on the starboard Boat Deck as far aft as practicable. The Boat Deck plating is to be ground smooth prior to the welding of the cradle pads. All bare metal must be coated as per 28.3.4.4.

28.3.3.8 The main crane crutch is to be relocated to a position and orientation to allow the crane to rest at the same height above the base line as it is presently. The crutch must be shortened and located between the two mushroom vents, on the centerline of the vessel. Additional stiffening must be included in accordance with the detail shown on the guidance drawings.

#### 28.3.4 **Davit Installation Instructions and Recommendations**

28.3.4.1 The installation will require temporary removal of ceilings and deck head linings in way of the affected areas of the Mess. The Contractor must remove ventilation ductwork if it is obstructing areas where work needs to be carried out. Any interrupted ductwork will need to be replaced once the work associated with the davit installation is completed, and the systems will need to be tested to ensure there are no leaks or deficiencies which will need to be addressed.

28.3.4.2 All temporary removed insulation, linings, ceilings, sheathings and coatings must be restored to as found condition. All new installations must be finished to the same standard as similar existing installations.

28.3.4.3 New and disturbed work must be painted in accordance with the existing paint scheme. Preparation and application of coatings must be in accordance with the manufacturer's instructions. On completion of work, all debris, foreign materials, and protective coverings must be removed. The ship, in way of any affected spaces, must be delivered in a clean condition to at least the same standard as when delivered to the Contractor.

28.3.4.4 The Contractor must supply and apply one (1) coat of Wasser primer – MC MIOZINC (DFT 3mil) to be applied to all prepared steel followed by an intermediate coat of MC-Ferrox B (DFT 3mil) to all external areas. The Boat Deck must receive a topcoat of MC TRUGRIP 100 Deck Grey RAL 7042 (DFT 25mil).

28.3.4.5 All new pipe brackets, penetrations and fittings must be at least equivalent to the existing shipboard installation.

28.3.4.6 All work must follow the instructions given in the Palfinger installation manual. Under the direction of the Palfinger FSR, the Contractor must make all the connections between the hydraulics reservoir and the davit pumps. Also, the connection between control stand and the hydraulic motors and the hydraulic pumps, and the connection between the hydraulic pumps and the winch.

- 28.3.4.7 The Contractor must be responsible for the installation of Palfinger supplied hydraulic piping and hoses as required by the reference hydraulic schematics and arrangements. Contractor to supply hydraulic oil, grade and type as per Palfinger recommendations.
- 28.3.4.8 All applicable recommendations and instructions in the Palfinger Davit Installation Manual must be observed by the Contractor during the davit installation.
- 28.3.4.9 The Contractor must also install all rigging components in accordance with the manufacturer's instructions.

#### 28.3.5 **Electrical Installation**

- 28.3.5.1 The Contractor must supply and install new power cables from the ship's 600 volt supply MCC to the Palfinger supplied motor starter cabinet, and to the davit motor(s).
- 28.3.5.2 All new cables to be supplied and installed by the Contractor must be of an approved marine type which is listed by Transport Canada Marine Safety Directorate. All cables must be copper.
- 28.3.5.3 Cables are to be generally installed on existing wire ways. If new cable hangers are required they will be supplied and installed by the Contractor and will be of non-corrosive marine type. Power cables will be restricted to no greater than double banking of cables. Cables are to be secured to the wire ways at intervals as required by TCMS. Contractor is responsible to meet physical separation standards of non-shielded electronic cables from the power, control and lighting cables. Contractor to submit a PWGSC Form 1379 for all new work approval.
- 28.3.5.4 Miscellaneous cable runs will be secured with approved clips and studs (Nelson or equal).
- 28.3.5.5 In exposed areas and any location where cables may be subject to mechanical damage, they will be protected in accordance with section 12 of TP 127E.
- 28.3.5.6 Wire ways will be routed to avoid areas of high fire risk, (such as over exhaust pipes), except as required in such areas to provide service. If it is necessary to route cables in proximity to such areas, then suitable heat shields to be provided by the Contractor.
- 28.3.5.7 Transition pieces through water tight, gas tight and fire proof bulkheads and decks will be in accordance with the requirements of TP 127E.

- 28.3.5.8 All cables to be secured using approved fastening methods. Cable terminations in enclosures will have fittings approved for the applicable environment, and will be connected via terminal blocks where practicable.
- 28.3.5.9 All cables must be tagged with circuit identification at all points of connection and on both sides of bulkheads, decks and barriers. The tags will be metal, compatible with the cable sheath and must have the circuit designation embossed thereon. Both ends of the tags must be taped to the cable with metal tape or ty-raps.
- 28.3.5.10 The electric motor starter for the new davit installation is Palfinger supply, and is to be installed by the Contractor in accordance with the manufacturer's instructions. The electric motor starter location must be determined by the Contractor and approved by the TA and IA.

## **28.4 Inspections, Tests and Trials**

### **28.4.1 Inspections**

- 28.4.1.1 A physical inspection of all structural welds, including temporary structural installations, must be conducted by the Contractor to ensure the welds are satisfactory and contain no visible deficiencies.
- 28.4.1.2 The Contractor must conduct physical inspections of all structural welds to ensure the welds are satisfactory and contain no visible deficiencies. Plating insert welds must be inspected using Magnetic Particle inspection on the comers and cruciforms. The Contractor must also perform Magnetic Particle Inspection on the welds of any lifting lugs where applicable. All weld deficiencies must be repaired and re-inspected by the Contractor.
- 28.4.1.3 Inspections of all new installations must be in accordance with the procedures provided by the manufacturer where applicable.
- 28.4.1.4 The work must also be carefully inspected by the Contractor to ensure the methods of installation and workmanship conform to the drawings and specifications. Inspections of the work must also be conducted by TCMS, the TA and IA.

### **28.4.2 Tests**

- 28.4.2.1 Megger tests must be conducted in accordance with the requirements of TP127. The insulation resistance must be measured by self-contained instruments such as a direct reading ohmmeter of the generator type, applying a voltage of at least 500 volts. When an insulation test is made on a circuit incorporating capacitors of a total capacitance exceeding 2 microfarads, an insulation tester of the constant- voltage type should be used.

- 28.4.2.2 The Palfinger Davit and all of the associated electrical and control systems must be functionally tested by the Contractor in accordance with the manufacturer's instructions. All tests must be conducted under the direction and supervision of the Palfinger FSR.
  - 28.4.2.3 Testing of any new or modified installations must be in accordance with the procedures provided by the manufacturer.
  - 28.4.2.4 All tests must be witnessed by the TA, IA and the Palfinger FSR.
  - 28.4.2.5 All new piping components must be hydrostatically tested to 1.5 times the system working pressure. Air must be eliminated from the tested piping prior to demonstration of the test (this must be verified by releasing a small amount of the test fluid and observing an immediate drop in pressure). The test pressure must be held for a minimum of 10 minutes or the duration of the piping components inspection, whichever is greater.
  - 28.4.2.6 All modified or disturbed piping components must be functionally tested to the system working pressure.
- 28.4.3       **Trials**
- 28.4.3.1 The new Palfinger davit and all of the associated systems and components must be functionally tested by the Contractor in accordance with the manufacturer's instructions. All tests must be conducted under the direction and supervision of the Palfinger FSR.
  - 28.4.3.2 The Contractor must trial the new davit system in the presence of the TCMS inspectors in order to approval documentation for the Sheparding boat davit. The Contractor must supply all weights and equipment required to perform the load tests for TCMS.

## **29.0 CCTV SYSTEM INSTALLATION**

### **29.1 Identification**

- 29.1.1 The intent of this specification is to replace the existing CCTV System with a new Contractor supplied IP CCTV System to provide better coverage.

### **29.2 References**

#### **29.2.1 Drawings and Documents**

- 29.2.1.1 Existing CCTV System drawing (Reference for Removal):

1. Dwg. MM678-044-WD (CCTV Camera System)

- 29.2.1.2 New CCTV CAMERA System drawing (Reference for Installation):

- a) Dwg. MM678-068-BD
- b) Dwg. MM678-047-RL

#### **29.2.2 Standards**

- a) Fleet Safety and Security Manual (DFO/5737)
- b) TP127 – Ship’s Electrical Standards
- c) IEEE 45:2002 – Recommended Practice for Electrical Installation on Ships
- d) Specification for the Installation of Shipboard Electronic Equipment (70-000-000-EU-JA-001)
- e) Standard Technical Architecture for Shipboard Computer Systems (46-000-000-ES-TE-001)

#### **29.2.3 Regulations**

- a) Canada Shipping Act, 2001

## **29.3 Technical**

### **29.3.1 Removal of existing CCTV System**

- 29.3.1.1 **Remove all components and cabling from the original CCTV CAMERA System as per drawing MM678-044-WD at the exception of the Insignia TV Monitors located in the MCR Port side of console and on the Bridge Starboard Wing Console as they will be re-used with the new CCTV Camera System. Dispose of all cablings as Category “C” property. All equipment (see list below) is Category “A” property:**

- a) Pelco VS 5108 Desktop Switcher (MCR);
- b) Coaxitron Controller Switcher part# MPT9008CZ (STBD Wing Console);
- c) Pelco CC370UH Colour Camera (Fwd Steering Console);
- d) Pelco CC3610UH-7 Colour Camera (Steering Flats);
- e) Pelco CC3610UH-7 Colour Camera (Bow Thruster Compartment);
- f) Dome Camera DD53C22 (Buoy Deck);



g) 115V to 24V Transformer (Inside Port Buoy Deck Door).

**29.3.2 Disposal and Care / Custody of removed equipment**

**29.3.2.1 The equipment noted above is to be stored and returned to CCG upon completion of Vessel Life Extension as Category “A” property. All removed cables are to be properly disposed of as Category “C” property.**

**29.3.3 Installation of New CCTV Camera System**

**29.3.3.1 The contractor must supply and install the CCTV system using the following components:**

**Cameras and Mounts:**

Water Monitor Platform Port & STBD:

AXIS Q6044-E Network Camera – Color, Monochrome – 30x Optical – CCD  
Mfg# 0572-004(x2)

AXIS T91B61 Wall Mount for Surveillance Camera Mfg#5504-621(x2)

Buoy Deck Forward:

AXIS Q6044-E Network Camera – Color, Monochrome – 30x Optical – CCD  
Mfg# 0572-004 (x1)

AXIS T91B61 Wall Mount for Surveillance Camera Mfg#5504-621 (x1)

Wheelhouse Forward:

AXIS Q1755 Network Camera – Color, Black & white – CMOS Mfg#0304-001  
(x1)

AXIS T91A21 Wall Mount for Surveillance Camera Mfg#5022-211(x1)

Boat Deck Port & Starboard (Gangway Location):

AXIS Q1755-E Network camera with zoom and autofocus Mfg#0348-001 (x2)

AXIS VT Wall Mount Bracket WBOVA1 T92E Mfg#0217-031 (x2)

Bow Thruster Compartment:

AXIS Q1755 Network Camera – Color, Black & white – CMOS Mfg#0304-001  
(x1)

AXIS VT Column Mount Ball Joint WFWCA Mfg#0217-071 (x1)

Steering Gear Compartment:

AXIS Q1755 Network Camera – Color, Black & white – CMOS Mfg#0304-001  
(x1)

AXIS VT Wall Mount Bracket with Ball Joint Mfg#0217-021(x1)



**Accessories:**

Wheelhouse:

Mini PC – Intel NUC Kit DC3217IYE (x1)  
AXIS T8311 Joystick Mfg# 5020-101(x1)  
HDMI (x2) (1 x 2m, 1 x 15m)  
APC 700VA Smart UPS X93 Marine Rated (x1)  
Insignia 19” TV Display Part# NS-19E310A13 (x1)

Electronic Equipment Room:

POE injectors (Supplied with AXIS Q6044-E Cameras) (x3)  
TE - 5-569550-3 – Metal RJ-45 Connector (x12)  
TE – 9-336513-7 - black boot (x12)  
TE - 3-231652-0 Hand tool and dye set. White dot for specified connector (x1)  
Note: The connectors above are used to connect to the POE injector's and cameras located STBD and Port side Boat Deck, Steering Console Wheelhouse, Bow Thruster Compartment and Steering Gear Compartment.  
Transtector Power bar Model SL5 (x1)  
HP 2920-24G-POE+ Switch (J9727A) (x1)  
Exacqvision Web Server ISP04-2000LC (x1)  
Extra Camera Licenses (x4)  
TE Connectivity Patch Panel 1U 24 Port – part# TE1933307-1 (x1)  
(<http://www.te.com/catalog/pn/en/1933307-1?RQPN=1933307-1>)  
TE Connectivity CAT5E cable mounted Jacks – Part# TE1375189-1 (x15)  
(<http://www.te.com/catalog/products/en?q=1375189-1>)  
TE Connectivity Crimp Tool – Part# 1725150-1 (x1)  
(<http://www.te.com/catalog/pn/en/1725150-1?RQPN=1725150-1>)

Note: Crimping tool to be returned to CCG upon completion of VLE

MCR:

Mini PC – Intel NUC Kit DC3217IYE (x1)  
Transtector Power bar Model SL5 (x1)  
HDMI cables (1 x 5m)  
Fiber to UTP converter Planet Ethernet Bridge Model GT-802(v3) (x1)  
Fiber Patch cord 1m SC to LC connectors 50 micron 2m (x1)  
Cat5e Patch Cord 2m (x1)

- 29.3.3.2     **The Contractor must weld four camera mounting bracket on the Water monitor Platform PORT and STBD side and Port and STBD boat Deck as per photos below. The brackets must be 50mm from main structure and the dimension will have to be able to accommodate the mount for each of the cameras. Bulkhead tubes c/w cable glands will have to be welded in the bulkhead near each camera locations; cable support must be welded at each 300mm in order to support the cable from camera to gland.**





- 29.3.3.3      **The Contractor must install the Axis Q6044-E c/w bracket on Port and STBD side of water monitor platform. Connect Camera to 1300SB cable.**
- 29.3.3.4      **The Contractor must install the Axis Q1755-E c/w bracket on Port and STBD side of Boat Deck. Connect Camera to 1300SB cable.**
- 29.3.3.5      **The Contractor must install the Axis Q6044-E c/w bracket on existing bracket where Buoy Deck camera was removed. The existing camera mount bracket may need to be modified to ensure that the camera remains within the protection pipe and the lens extends below the pipe. Connect Camera to 1300SB cable. See photo below.**



- 29.3.3.6      **The Contractor must install the Axis 1755 c/w Axis T92A10 outdoor housing and Axis VT Column Mount on the existing bracket in the Bow Thruster Compartment. Connect Camera to 1300SB cable. See photo below.**



- 29.3.3.7      **The Contractor must install the Axis 1755 c/w Axis T92A10 outdoor housing and Axis VT Wall Mount on the existing bracket in the Steering Gear Compartment. Connect Camera to 1300SB cable. See photo below.**



- 29.3.3.8      **The Contractor must install the Axis 1755 c/w Axis T91A21 Metal Stand black on the Steering console in the Wheelhouse where existing was removed. Connect Camera to 1300SB cable. See Photo below.**



- 29.3.3.9      **The Contractor must install three ganged POE injectors in the Electronic Equipment Room Port Bulkhead where the SX50 rack was removed. Mount a power bar near POEs and plug power bar into APC Smart UPS 1500 (left from original phone system).**
- 29.3.3.10     **The contractor must remove the drawer unit from the LAN Rack and install the HP2920-24G-POE+ Switch and the 1RU Patch Panel with connectors in the same location.**
- 29.3.3.11     **The Contractor must install the Exacqvision Web Server in the LAN rack located in the Electronic Equipment Room. The exact location must be**



determined by the CCG Technical representative. See Dwg#MM678-047-RL for reference.

- 29.3.3.12 The contractor must install a new monitor on the Port Wing Console in similar position as the STBD Wing Console monitor. The Monitor can be plugged into the outlet inside the console.
- 29.3.3.13 The Contractor must install the camera control computer c/w APC Smart UPS 700 in the STBD wing console, the UPS plugged into the local AC outlet IM10-9 and the Computer plugged into the UPS. A mounting plate may be required to mount and secure the UPS in the bottom of the STBD Wing Console. See pictures below for reference.



- 29.3.3.14 The contractor must install the Axis TA311 Joystick on the STBD Wing Console; the exact location must be determined by the CCG Technical representative.



- 29.3.3.15 **The contractor must install two duplex AC receptacles beneath the desk port bulkhead near existing computer in the MCR as per picture below.**



- 29.3.3.16 **The Contractor must install the camera control computer and a fiber to UTP converter under desk in the MCR as per picture above. Remove extension cord and plug existing UPS into the outlet fed from IE5-9, install the Power bar in the same area and plug bar into UPS. The computer and converter must be plugged into the Power bar.**

#### 29.3.4 Cable Installation

- 29.3.4.1 **Install, label, and terminate the following cables as per MM678-068-BD:**

CABLE LABEL	CABLE TYPE	FROM	TO
CCTV-1	1300SB CAT5e	24 Port Patch Panel Port 1 in LAN Rack in the Electronic Equipment Room	Exacqvision Web Server in LAN Rack Electronic Equipment Room
CCTV-2	1300SB CAT5e	24 Port Patch Panel Port 3 in LAN Rack in the Electronic Equipment Room	POE Injector in the Electronic Equipment Room Port bulkhead
CCTV-3	1300SB CAT5e	POE Injector in the Electronic Equipment Room Port bulkhead	Axis Q6044-E PTZ Dome Camera on STBD side base of Water Monitor Platform
CCTV-4	1300SB CAT5e	24 Port Patch Panel Port 5 in LAN Rack in the Electronic	POE Injector in the Electronic Equipment Room

		Equipment Room	Port bulkhead
CCTV-5	1300SB CAT5e	POE Injector in the Electronic Equipment Room Port bulkhead	Axis Q6044-E PTZ Dome Camera on Port side base of Water Monitor Platform
CCTV-6	1300SB CAT5e	24 Port Patch Panel Port 6 in LAN Rack in the Electronic Equipment Room	POE Injector in the Electronic Equipment Room Port bulkhead
CCTV-7	1300SB CAT5e	POE Injector in the Electronic Equipment Room Port bulkhead	Axis Q6044-E PTZ Dome Camera on Buoy Deck
CCTV-8	1300SB CAT5e	24 Port Patch Panel Port 4 in LAN Rack in the Electronic Equipment Room	Axis Q1755-E STBD side Boat Deck
CCTV-9	1300SB CAT5e	24 Port Patch Panel Port 8 in LAN Rack in the Electronic Equipment Room	Axis Q1755 Steering Console on Bridge
CCTV-10	1300SB CAT5e	24 Port Patch Panel Port 9 in LAN Rack in the Electronic Equipment Room	Axis Q1755 in Bow Thruster Compartment
CCTV-11	1300SB CAT5e	24 Port Patch Panel Port 7 in LAN Rack in the Electronic Equipment Room	Axis Q1755-E Port side Boat Deck
CCTV-12	1300SB CAT5e	Bridge Network Switch Port #3 on the Port Fwd side of Nav Console	Camera Control Computer located in STBD Wing Console
CCTV-13	HDMI 2m	Camera Control Computer located in STBD Wing Console	Monitor / TV located on STBD Wing Console
CCTV-14	HDMI 15m	Camera Control Computer located in STBD Wing Console	Monitor / TV located on Port Wing Console
CCTV-15	1300SB CAT5e	24 Port Patch Panel Port 2 in LAN Rack in the Electronic Equipment Room	Axis Q1755 Steering Gear Compartment
CCTV-16	Cat5e Patch	Camera Control Computer	Fiber to UTP Converter

	Cord 2m	located in MCR Console	located in the MCR Console
CCTV-17	HDMI 5m	Camera Control Computer located in MCR Console	Monitor / TV located on MCR Console Port Side
CCTV-18	50 micron SC to LC fiber patch cord	Fiber to UTP Converter located in the MCR Console	LAN-17 Fiber Drop fiber 5/6 in MCR
IE5-9-1	14/3 Marine AC	Existing AC outlet inside MCR Console Port Side forward fed from IE5-9	New Outlet below desk in MCR Port side, label outlet IE5-9
IE5-10-1	14/3 Marine AC	Existing AC outlet inside MCR Console Port Side forward fed from IE5-10	New Outlet below desk in MCR Port side, label outlet IE5-10

**29.3.5 Government Furnished Equipment**

29.3.5.1 Nil.

**29.3.6 Material to be supplied by Contractor**

29.3.6.1 **The Contractor must supply and install all equipment identified in section 29.3.3. In order to maintain Fleet wide standard equipment, no substitutions will be considered.**

29.3.6.2 **The Contractor must supply and install 500 meters of 1300SB CAT5e cable.**

29.3.6.3 **For the purpose of adjustments, the Contractor must include a unit cost for the installation for 10 meters for this cable type.**

29.3.6.4 **The Contractor must supply AC outlets with dual receptacles (x2).**

29.3.6.5 **The Contractor must supply and install 10 meters of Marine 14/3 AC cable.**

29.3.6.6 **For the purpose of adjustments, the Contractor must include a unit cost for the installation of 1 meter for this cable type.**

29.3.6.7      **All materials required to complete statement of work. All cables are to be properly secured in existing cable trays. In locations where trays do not exist, appropriate hangers are to be installed.**

29.3.7          **Set to Work / Commissioning**

29.3.7.1      **The CCTV camera System will be configured and set to work by CCG Technical representative.**

#### **29.4 Deliverables**

29.4.1.1      The Contractor must supply the TA with all manuals for the installation, operation and maintenance manuals for each component of the CCTV system.

29.4.1.2      The Contractor must supply new “As Fitted” drawings in accordance with Section 6.1.6 of this Specification.

### 30.0 WHEELHOUSE TOP STEEL REPAIRS

#### 30.1 Identification

- 30.1.1 The intent of this specification is for the Contractor to cut out and replace the steel surrounding the exhaust piping in the stacks at the wheelhouse top level. The Contractor must cut out and replace the steel deck and mounting arrangement under the wheelhouse air conditioning units.

#### 30.2 References

##### 30.2.1 Drawings

Drawing Number	Description
VNEA2 134 206	Welding Table
VNEA2 246 001	Wheelhouse 1 of 2
VNEA2 246 001	Wheelhouse 2 of 2
VNEA2 247 000	Funnels
VNEA2 313 000	Outside Scuppers & Drains
VNEA2 369 004	Main Engine Generator & Boiler Uptakes
VNEA2 369 005	Details of Uptake Supports
VNEA2 379 000	List of Insulation
VNEA2 400 000	Misc Outfitting Booklet 18 of 52 (WH AC unit seat)
VNEA2 721 000	Insulation Plan
VNEA2 ESK 009	Funnel Composite
VNEA2 ESK 12	Flanges for Main & Aux Uptakes

##### 30.2.2 Standards

- a) Fleet Safety and Security Manual (DFO/5737);
- b) CSA W47.1 09 – Canadian Welding Bureau Standards for the fusion welding of steel;
- c) CSA W59-08(R2008) – Welded Steel Construction
- d) IACS No. 47 – Shipbuilding and Repair Quality Standard
- e) Society for Protective Coatings (SSPC) Standards

##### 30.2.3 Regulations

- a) Canada Shipping Act 2001 – Hull Construction Regulations

### **30.3 Technical**

#### **30.3.1 General**

- 30.3.1.1 The work in this specification must be completed in conjunction with the work in Section 36 HVAC UPGRADE.
- 30.3.1.2 The steel must be of the same grade and thickness as shown on the drawings included in the Technical Data Package. Welding must be full penetration fillet welds and must be welded from both sides of the deck plate, in accordance with the original Welding Table in the Technical Data Package.
- 30.3.1.3 All welding repairs must follow the International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.
- 30.3.1.4 The Contractor must ensure that all steel plate and sections are clean and free of scale. All surfaces must be coated with a weldable primer prior to fabrication. Material certificates for all steel must be provided.
- 30.3.1.5 The Contractor's welding inspector will complete a visual inspection of all welds prior to arranging inspection by the attending TCMS surveyor, the TA and IA.
- 30.3.1.6 Full penetration welds to be subject to 100% ultrasonic thickness testing. Technician to be certified to a minimum of Level II under CAN/CGSB 48.9712 – latest edition.
- 30.3.1.7 The Contractor must confirm with the TA all sizes of plating inserts and stiffeners prior to work commencement.
- 30.3.1.8 The Contractor must remove weld splatter, smooth weld seams and sharp edges, and remove grease, smoke, and soot marks as per SSPC-SP1. All welds must be power tool cleaned to SSPC-SP3.
- 30.3.1.9 The Contractor must supply and apply one (1) coat of Wasser primer – MC MIOZINC (DFT 3mil) to be applied to all prepared steel followed by an intermediate coat of MC-Ferrox B (DFT 3mil) to all external areas and the areas in the funnel compartment. The internal bridge deck head must be coated with 2 coats of Wasser MC-Miozinc 100 primer.
- 30.3.1.10 A topcoat of MC Luster 100 – Black RAL 9004(DFT 3mil) must be applied in the internal areas of the funnel after sufficient curing time is allowed for the previous coats. A topcoat of MC Luster Semi Gloss – White RAL 9003 (DFT 3mil) must be applied to the external sides of the funnel after sufficient curing time is allowed for the previous coats and following all manufacturer's recommendations. The

wheelhouse deck and air conditioning mounts must receive a topcoat of MC TRUGRIP 100 Deck Grey RAL 7042 (DFT 25mil).

### 30.3.2 **Removals**

- 30.3.2.1 The Contractor must remove the bridge deck head and deck head insulation in way of the bridge top air conditioning units between the stacks. All deck head panels must be identified as to their location and in the order in which they were removed.
- 30.3.2.2 The Contractor must ensure all bridge equipment, bulkheads, fixtures and fittings are protected in accordance with Section 2.4 of this Specification.
- 30.3.2.3 The Contractor must cut an opening into the wheelhouse top in the way of the air conditioning units so that new steel can be inserted. The Contractor must protect this opening from the ingress of water into the ship during inclement weather conditions. The opening into the deck must be cut to comply with TCMS requirements with regards to proper radii on the corners of the opening. The area to be cut out is approximately 7m<sup>2</sup>.
- 30.3.2.4 The Contractor must disconnect the resilient vibration mounts for the exhaust piping in the stack and remove the exhaust outlet piping for the main engines, generators, thermal fluid heater and incinerator. This piping can be disconnected at the flanges just above the wheelhouse top level. These items are Category “B” property and must be handled as per Section 1.11.
- 30.3.2.5 The Contractor must remove the vent piping for the sewage plant (80mm), vent piping for the sewage drains (50mm) and scupper drain pipes.
- 30.3.2.6 The Contractor must support the exhaust piping below the wheelhouse top level during the course of the work in this specification. Piping removal will require the removal of the rain hat on each exhaust pipe. The rain hats must be reinstalled, however any damage will have to be repaired or replaced at contractor’s expenses.
- 30.3.2.7 The Contractor must cut away and dispose of the existing Wheelhouse deck plating in way of the penetrations for the exhaust piping in each funnel, including stiffeners if required. All steel must be removed to parent material that is of adequate thickness (in accordance with Lloyd’s register Thickness Measurement and Close-Up Survey Guidance) to allow welding of the new insert plates. The total area to be cut out is approximately 8m<sup>2</sup>.
- 30.3.2.8 The Contractor must remove and dispose of a band of steel on the forward and inboard sides of both funnels, from the level of the wheelhouse top deck to a line 8” above the wheelhouse top deck. The Contractor must maintain the structural

integrity of the funnel while the replacement steelwork is done, and submit a work plan to the TA for comments.

### 30.3.3 **Steel Installation**

- 30.3.3.1 The Contractor must supply and install new steel deck plate in way of the wheelhouse air conditioning units. The steel must be of the same grade and thickness as shown on the drawings included in the Technical Data Package.
- 30.3.3.2 The Contractor must supply and install new steel plate in way of the exhaust piping penetrations, including new coamings to accommodate the existing sliding supports as shown in the Funnel Composite drawing. The steel must be of the same grade and thickness as shown on the drawings included in the Technical Data Package.
- 30.3.3.3 The Contractor must supply and install new steel plate to replace the 8” band of steel around the inboard and forward sides of each funnel. The steel must be of the same grade and thickness as shown on the drawings included in the Technical Data Package.
- 30.3.3.4 The Contractor must ensure that all steel plate and sections are clean and free of scale. All surfaces must be coated with a weldable primer prior to fabrication. Material certificates for all steel must be provided.
- 30.3.3.5 The Contractor must install new steel seats for the wheelhouse air conditioning units with the guidance of the mounting arrangement as detailed in the drawing VNEA2\_400-000 of the Technical Data Package, and modified as required to fit the units proposed in Section 36 of this Specification.
- 30.3.3.6 The Contractor’s welding inspector will complete a visual inspection of all welds prior to arranging inspection by the attending TCMS surveyor, the TA and IA.
- 30.3.3.7 Full penetration welds to be subject to 100% ultrasonic thickness testing. Technician to be certified to a minimum of Level II under CAN/CGSB 48.9712 – latest edition.
- 30.3.3.8 Upon completion and TCMS approval of all testing, the Contractor must coat all surfaces as noted in Section 30.3.1.

### 30.3.4 **Re-installations**

- 30.3.4.1 The Contractor must install the removed insulation from the deck head. The Contractor must install the deck head paneling that was previously removed.
- 30.3.4.2 The Contractor must reinstall all exhaust piping, scuppers and vent pipes. The exhaust piping must be installed with new Contractor supplied gasket material of



the same grade as specified on the supplied drawings, and new securing hardware. Rain hats must be installed on all exhaust pipes in the configuration noted on the Funnel Composite drawing.

- 30.3.4.3 The Contractor must reinstall the resilient vibration mounts for the exhaust piping in the stack.

### **30.4 Tests and Trials**

- 30.4.1 The Contractor must have the attending TCMS surveyor witness a hose test on the welded portion of the wheelhouse top deck plate after all welding has been completed and prior to any insulation being replaced below deck.
- 30.4.2 All welds must be subject to visual and Ultrasonic Testing (UT). All full penetration welds must be subject to UT, and the technician must be certified to a minimum of Level II under CAN/CGSB 48.9712 – latest edition. The UT test report must be submitted to the TA and the attending TCMS inspector.
- 30.4.3 All testing to be witnessed by the attending TCMS inspector, the Technical Authority and Inspection Authority.
- 30.4.4 Upon the completion of all mechanical work on the main engines and thermal fluid heater, the Contractor must ensure each piece of machinery with an exhaust pipe is run up to ensure the vibration supports are functioning properly. This testing must be witnessed by the TA and IA.

### **30.5 Documentation**

- 30.5.1 The Contractor must supply the TA with all the following documents in the final report for this specification item:
- a) Material Certificates for Plates and Sections
  - b) CWB Certificates for Welders
  - c) CWB Certificates for Welding Supervisors
  - d) CWB Weld Procedures
  - e) CWB Weld Data Sheets
  - f) UTM Testing Documentation
- 30.5.2 The Contractor must supply new “As Fitted” drawings in accordance with Section 6.1.6 of this Specification.

## **31.0 CARGO HATCH REPLACEMENT**

### **31.1 Identification**

The intent of this specification is for the Contractor to supply and install a replacement cargo hatch. The cargo hatch and coaming must be Class and TCMS Approved.

### **31.2 References**

#### **31.2.1 Documents**

<b>Document Number</b>	<b>File Name</b>
C14-40-169-02 R1	Conceptual Flush Mount Cargo Hatch Arrangement

#### **31.2.2 Regulations and Standards**

1. Lloyd's Class Notification 100A1 Ice Class 1A Super LMC Arctic Class 2 vessel operating on Unlimited, beyond 200nm voyages
2. Fleet Safety and Security Manual (DFO/5737)
3. Canada Shipping Act of 2001
4. International Load Line Convention of 1966, position #1
5. CSA W59-08(R2008) –Welded Steel Construction
6. CSZ W47.1-09–Certification of Companies for Fusion Welding of Steel

#### **31.2.3 Government Furnished Equipment**

- 31.2.3.1 The contractor must supply all documents, materials, equipment, and parts required to perform the specified work unless otherwise stated.

## **31.3 Technical**

### **31.3.1 General**

- 31.3.1.1 The hatch is located 1000mm forward of frame 14 and 890mm port of centerline. It gives access to cargo hold.
- 31.3.1.2 The contractor must replace the old 1500mmx1500mm hatch by a new 1500mmx1700mm hatch including its coaming.
- 31.3.1.3 The old watertight flush mount cargo hatch has been resized to facilitate its installation.
- 31.3.1.4 Contractor is responsible to have a new custom hatch designed as per reference drawing C14-40-169-02 R1, constructed with Lloyd's Grade A steel structure and a Lloyds Grade E cover plate. New custom hatch fabrication drawing must be approved by a Classification Society and Transport Canada prior to its fabrication.

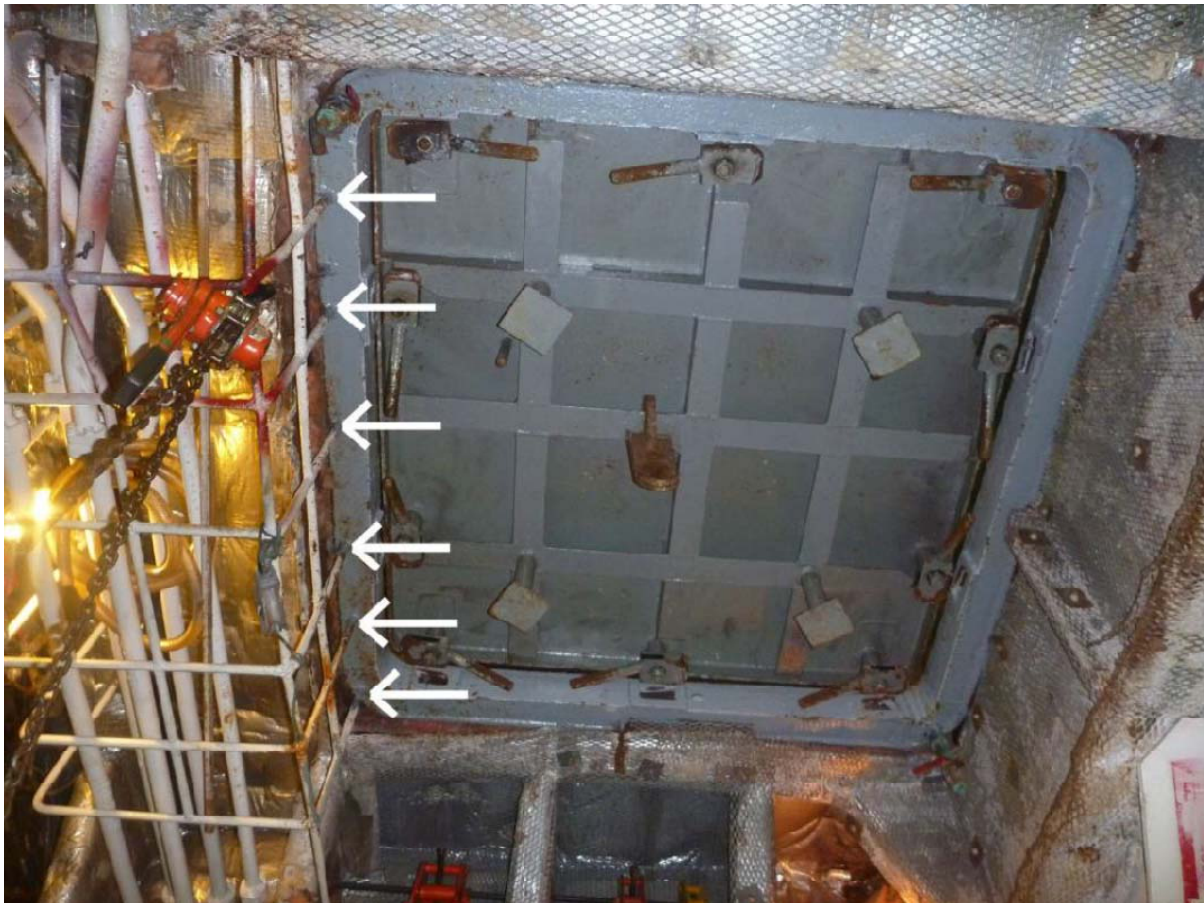
31.3.1.5 Stiffeners modification arrangement shown surrounding the coaming on drawing C14-40-169-02 R1 must be respected. Their position and missing dimensions need to be confirmed on the hatch fabrication drawing.

31.3.1.6 The position and the dimension of the clear opening indicated on the drawing C14-40-169-02 R1 must be respected, but the cut-out may change following the elaboration of the fabrication drawing.

### 31.3.2 **Scope of Work**

#### 31.3.2.1 Old Hatch Removal

31.3.2.1.1 The contractor must remove the section of the pipe's protection cage welded on the old hatch coaming, located port of the hatch and retain for reinstallation as Category "B" property.



#### 31.3.2.1.1.1 Pipes protection cage

31.3.2.1.2 The Contractor must remove the protection mesh and insulation from the following locations:

- a) On bulkhead 16;
- b) On frame 14;
- c) On center girder;



d) Under main deck, through 250mm port of hatch frame and dispose of these materials as Category “C” property.



31.3.2.1.2.1 Bulkhead 16 insulation



31.3.2.1.2.2 Frame 14 insulation





31.3.2.1.2.3 Center girder insulation



31.3.2.1.2.4 Under main deck insulation

- 31.3.2.1.3 The contractor must remove the dunnage wood surrounding the hatch. The hatch cover is to be removed and disposed of as Category "C" property.
- 31.3.2.1.4 The Contractor must remove the hatch frame by cutting the main deck around the frame and disposed of as Category "C" property.





#### 31.3.2.1.3.1 Dunnage wood

#### 31.3.2.2 Steel Replacement

31.3.2.2.1 Corroded steel that still meets Class requirements must be properly buffed.

31.3.2.2.2 The contractor must replace or modify the deck plating and its stiffeners to meet the new equipment footprint, including the surrounding angle bar for dunnage wood fastening.

#### 31.3.2.3 Hatch Installation

31.3.2.3.1 It is the responsibility of the Contractor to provide a TCMS approved welding procedure to avoid any deformation on the hatch frame.

31.3.2.3.2 The coaming drains must be directed to the closest bilge well through a 40mm diameter galvanized Schedule 40 pipe arrangement with an isolation ball valve.

31.3.2.3.3 The Contractor must install new dunnage wood on the hatch cover and secure it in place with fastening rods according to reference drawing. Wood will be 80mm thick x 250mm wide hemlock.

- 31.3.2.3.4 The hatch cover must be lifted into place. Water tightness must be tested and demonstrated to Transport Canada inspector before new insulation is installed.
- 31.3.2.3.5 Hatch, coaming, and structure need must be prepared to SSPC-SP-3 and SSPC-SP2 standard. Contractor must supply all coating products. All prepared areas of steel to have coating system applied, as follows, according to the coating manufacturer's instructions. See Technical Data Package for Wasser Product Data Sheets.
- 31.3.2.3.6 All coatings must be Wasser Paints. One (1) coat of Wasser primer – MC MIOZINC (DFT 3mil) to be applied to all prepared steel followed by an intermediate coat of MC-Ferrox B (DFT 3mil). Topcoat of MC Luster Semi Gloss – Grey to match the surrounding area (DFT 3mil) must be applied after sufficient curing time is allowed for the previous coats.
- 31.3.2.3.7 Any area that is normally under dunnage must be prepared with 2 full primer coats of MC MIO ZINC (3mils DFT per coat) and be allowed to cure. The prepared areas must receive a first intermediate coat of MC TAR BLACK (6mils DFT), then a second intermediate coat of MC TAR RED (6mils DFT). The area must now receive a topcoat of RUBBER GUARD by Aqualoc, to be applied to the horizontal deck surface only (20mil DFT). Roller application is acceptable. See Technical Data Package for Aqualoc Product Data Sheet.
- 31.3.2.3.8 Deck plating, bulkhead and frames under main deck must be insulated according to reference drawing.
- 31.3.2.3.9 New dunnage wood must be secured on deck.

## **31.4 Proof of Performance**

### **31.4.1 Inspection**

- 31.4.1.1 All work must be witnessed by the Technical Authority, Inspection Authority and the attending TCMS surveyor.
- 31.4.1.2 The Contractor must demonstrate to the Inspection Authority and the Technical Authority that the new hatch cover locking system works as designed and as intended.
- 31.4.1.3 The Contractor must ensure the drain pipe is attached to the new coaming, and that the entire run of pipe is free from debris before water testing the hatch seal.

**31.4.2 Testing**

- 31.4.2.1 A hose test to prove the hatch water tightness must be demonstrated to the attending TCMS surveyor, Technical Authority and Inspection Authority.
- 31.4.2.2 All welding in way of the new hatch must be subject to a dye penetrant test.
- 31.4.2.3 The drain must be tested to ensure proper function of the valves and to ensure the piping is clear.

**31.5 Deliverables**

**31.5.1 Drawings/Reports**

- 31.5.1.1 The Contractor must provide the TA with a report of the results of the dye penetrant testing performed on the welds.
- 31.5.1.2 The Contractor must provide the TA with the final “As Fitted” plan of the hatch approved by a Classification Society and Transport Canada.
- 31.5.1.3 The Contractor must ensure that the TCMS and Inspection Authority witnesses the hose test of the hatch cover as part of the vessel's Annual Load Line Inspection, and documentation from TCMS is provided to the TA as proof of successful inspection of the new installation..



## **32.0 STAIR TOWER STEEL DECK REPAIRS**

### **32.1 Identification**

- 32.1.1 The Coast Guard has performed a condition survey (included in the Technical Data Package) of the CCGS Earl Grey and found that the steel deck in the stair tower at the foscle deck is in need of repair.
- 32.1.2 The Contractor must replace the corroded steel deck at the port and starboard side entrance ways to the stairwell at the Foscle deck and renew the deck covering materials.

### **32.2 References**

#### **32.2.1 Drawings**

<b>Document Number</b>	<b>Description</b>
VNEA2 134-401	General Arrangement as fitted (2 sheets)
VNEA2 242-006	Foscle Deck and Bulkheads Under
VNEA2 379-000	List of Insulation
VNEA2 651-000	Interior Painting
VNEA2 711-000	Joiner Bulkheads & Doors 1 of 4
VNEA2 711-000	Joiner Bulkheads & Doors 2 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 3 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 4 of 4
VNEA2 721-000	Insulation Plan
VNEA2 771-000	Deck Coverings

#### **32.2.2 Regulations and Standards**

- Canada Shipping Act 2001;
- TP 11469E Guide to Structural Fire Protection;
- CSA W59-13 – Welded Steel Construction
- CSA W47.1-09 – Certification of companies for fusion welding of steel;
- International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.

### **32.3 Technical**

- 32.3.1 All decks, deck heads, and bulkheads must be suitably protected with temporary coverings during the course of this work. All items must be reinstalled upon completion of all work and returned to the “as delivered” condition.
- 32.3.2 Contractor must remove any interference items as necessary to carry out this work. (Aluminum steps and stainless kick plates on the Foscle deck level) Interference items to be refitted upon completion of work.

- 32.3.3 Contractor must remove and reinstall the Isolamin panels around the existing doors to allow access to steel bulkhead. Isolamin panels to be re-installed after new door installation complete.
- 32.3.4 Contractor to remove approximately one (1) square metre of decking material from the deck inboard of the port and starboard side stairwell door on the Foscle deck to allow access to steel deck. The Contractor must remove all existing floor coverings as well as associated trim, as detailed in drawing VNEA2 771-000. The floating sub-floor metal panels must be removed. All associated fasteners, hardware, etc. must be ground smooth to the steel deck. All floating floor panel studs are to be ground off flush. Any insulation removal required for hot work on the underside of the steel deck at this location must be removed and re-installed by contractor.
- 32.3.5 The Contractor must replace the area of corroded steel in its entirety. The Contractor must develop a TCMS approved welding schedule for installation of the new steel, a copy of which must be delivered to the TA.
- 32.3.6 Contractor is to supply and install 50mm by 3mm steel 90 degree angle to the remaining floating floor perimeter to prevent it from collapsing. Contractor is to stitch weld the steel angle to the floating floor top and to the steel deck.
- 32.3.7 Contractor must install a Dexotex or equivalent A60 deck in all the areas of sub-floor removal. Contractor to ensure uniform height of flooring.
- 32.3.8 The Contractor must allow TCMS, the TA and IA to inspect the installation of the A-60 deck material prior to the installation of floor coverings.
- 32.3.9 The top floor covering must be Vinyl flooring tiles that match existing. Existing tiles are Armstrong Standard Excelon Imperial Texture, pattern 51911, Classic White (300mmx300mmx3mm). Contractor to bid on sufficient tiles to cover area of stairwell deck, taking into account any cut tiles as required.
- 32.3.10 Upon completion of tile installation, tiles to be cleaned. Following cleaning, three (3) coats of approved sealer to be applied as per manufacturer's instructions. After sealer, three (3) coats of approved wax to be applied to tiles as per manufacturer's instructions.

#### **32.4 Deliverables**

- 32.4.1 The Contractor must provide TCMS, the TA and IA with documentation of the A-60 flooring product.

- 32.4.2 The Contractor must provide a work report detailing the exact measurements and location of the steel replaced, the materials used in the deck covering repair.
- 32.4.3 The Contractor must provide the TA with the final “As Fitted” drawings affected by this work.

### 33.0 MAIN ACCOMMODATION DECK COVERING RENEWAL

#### 33.1 Identification

The intent of this specification is for the Contractor to remove all deck flooring material in the designated areas on the three accommodation decks of the vessel. It has been identified there is a moisture problem within the mineral fiber insulation on the existing floating floor material and thus needs to be removed and replaced.

#### 33.2 References

##### 33.2.1 Regulations and Standards

The following regulations and standards are applicable to this section:

- a) Canada Shipping Act 2001;
- b) TP 11469E Guide to Structural Fire Protection;
- c) CSA W59-13 – Welded Steel Construction
- d) CSA W47.1-09 – Certification of companies for fusion welding of steel;
- e) International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.

##### 33.2.2 Drawings

Document Number	Description
	Common Mess Conversion Guidance Drawing
VNEA2 134-401	General Arrangement as fitted (2 sheets)
VNEA2 134-701	Accommodation Layouts
VNEA2 236-001	Main Deck Unit Frames 32-39 Centre
VNEA2 236-003	Main Deck Unit Frames 32-39 P&S
VNEA2 241-008	Boat Deck and Bulkheads Under
VNEA2 317-008	Sewage and Grey Water Diagram
VNEA2 317-008	Sewage and Grey Water Arrangement
VNEA2 317-008	Arrangement of Sanitary Fixtures 1 to 27
VNEA2 379-000	List of Insulation
VNEA2 400-000	Misc Outfitting Booklet 30 of 52 (Pantry crew mess)
VNEA2 400-000	Misc Outfitting Booklet 31 of 52 (Pantry officer mess)
VNEA2 651-000	Interior Painting
VNEA2 711-000	Joiner Bulkheads & Doors 1 of 4
VNEA2 711-000	Joiner Bulkheads & Doors 2 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 3 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 4 of 4
VNEA2 721-000	Insulation Plan
VNEA2 751-000	Furniture List
VNEA2 751-000	Furniture Sketches Booklet 1 to 33
VNEA2 753-002	Galley and Mess Arrangement
VNEA2 771-000	Deck Coverings

### **33.3 Technical**

#### **33.3.1 General**

- 33.3.1.1 The Contractor must ensure all surrounding areas are not disturbed in this specification are protected from any damage. Any damage from the “as delivered” condition of the vessel must be repaired at the Contractor’s expense.
- 33.3.1.2 The Contractor must remove all existing flooring coverings, cement and floating floor deck covering from the steel deck plating beneath and dispose of in accordance with all Federal, Provincial and Municipal regulations and provide copies of the disposal certificates to the Inspection Authority.
- 33.3.1.3 Contractor must monitor the air quality of the spaces affected and ventilate to the exterior of the ship if required. Contractor is responsible to provide all additional ventilation equipment required to maintain a suitable work space in accordance with local laws.
- 33.3.1.4 All measurements provided are for guidance only and should be confirmed by Contractor during the vessel site visit.

#### **33.3.2 Certifications**

- 33.3.2.1 All deck coverings to replace existing must provide an A-60 fire barrier. All materials used must have either Class or TCMS type approval and suitable for marine use. All material certificates must be submitted to the TA prior to installation.
- 33.3.2.2 Personnel responsible for taking Ultrasonic readings must provide certificates to the TA and TCMS Inspectors they are certified to a minimum of Level II of Can/CGSB 48.9712-2000.

#### **33.3.3 Electrical & Plumbing Isolation**

- 33.3.3.1 The Contractor must use common ship building and repair practices when removing deck covering material. This includes proper lockout and tag out of all associated electrical connections as well as the disconnection of all associated plumbing interfaces. Both electrical and plumbing connections affected during the removal of the floor must be reconnected and demonstrated as operable to the TA prior to the contract end.

#### **33.3.4 Fuel Tanks**

- 33.3.4.1 There must be welding in way of the fuel oil tanks located between frames 37 and 39. Due to the welding of wall panel support brackets and HVAC unit seats onto

the main steel deck these fuel tanks are required to be emptied and gas free prior to this work commencing.

33.3.4.2 The Contractor must arrange with the ship's crew to transfer all fuel in these tanks to other onboard fuel tanks. The Contractor must ask crew to leave the final 10% (volume) in each fuel tank (approximately 3000 litres in each tank). The Contractor must remove the remaining fuel from the tanks and dispose of it using proper disposal methods in accordance with Federal, Provincial and Municipal regulations and provide copies of the disposal certificates to the Inspection Authority.

33.3.4.3 The Contractor must clean and gas free each fuel tank and provide certificates to the TA from a certified marine chemist prior to any welding on the tank top.

### 33.3.5 Other Tanks

33.3.5.1 There are several other tanks located below the main deck as shown on the General Arrangement. Tanks located between frames 29 and 46 could be affected by welding on the main steel deck. The Contractor must ensure all tanks in way of welding on the main deck are properly prepared for hot by removing any liquid inside the tank, gas freeing the tank and repairing the coating that could be affected by the hot work on the main deck.

33.3.5.2 These tanks include fresh water tank (frame 27-32, port side), Stand-by Sewage Tanks (frame 37-39, port & starboard), Sanitary Water Tank (frame 27-32, starboard side) and water ballast tanks (frame 32-37, port & starboard). All repairs must be in accordance with TCMS regulations and inspected by TCMS inspectors and the TA prior to closing.

33.3.5.3 All gas freeing certificates must be presented to the TA and completed by a certified marine chemist.

## 33.4 Scope of Removals and Repairs

The Contractor must provide a unit rate price for the removal & installation of the decking materials based on measurements provided.

### 33.4.1 Main Deck

33.4.1.1 The approximate areas of deck covering to be removed and replaced are as follows:

Location	Area (m <sup>2</sup> )
a) Passageways (port, starboard and forward)	55
b) Crew Lounge	19
c) Crew Mess	34
d) Canteen	6
e) Oiler and Spare (starboard)	12
f) Cadets (starboard)	12

g) Steward and Spare (2 of)(port)	23
h) Seaman (port)	12
i) Officer's Mess and Lounge	31
j) Galley	30
k) Locker (2 of)	1

33.4.1.2 The Main Deck has had previous repairs performed to the deck coverings. The port passageway from the stair tower (Frame 35) forward to the forward edge of the air conditioning unit (Frame 38), from the passageway outboard to half way into the Officer's Mess and Lounge has had steel deck replacement, subfloor and deck materials replaced. The Contractor must remove the deck coverings up to this area to allow for careful inspection to determine if the repaired area will need to have the coverings replaced or if the new coverings can allow for a seamless transition to the repaired area. The Contractor must consult with the TA and TCMS to determine the course of action.

33.4.1.3 The Main Deck passageway forward of the repair above, from Frame 38 forward to Frame 43 athwart ships to the starboard passageway and aft to the crew's mess entrance has had the subfloor and decking material replaced. The Contractor must allow for careful inspection to determine if the repaired area will need to have the coverings replaced or if the new coverings can allow for a seamless transition to the repaired area. The Contractor must consult with the TA and TCMS to determine the course of action.

#### 33.4.2 **Removal, Storage and Installation of Cabin Joinery, Mess Equipment**

33.4.2.1 The Contractor must remove all cabin joinery and mess equipment that prevents the removal and replacement of the existing flooring, and these items must be handled as Category "B" property. This procedure also applies to any other items that require removal to access, remove and replace the floor covering. All items must be reinstalled prior to vessel acceptance. Any items that require plumbing or electrical disconnection and reconnection must do so in accordance with Section 33.3.3. Any damage to equipment must be repaired or replaced at the Contractor's expense.

33.4.2.2 All exposed service connections resulting from the removal of furnishings must be identified and tagged with their service and purpose. These temporary tags must be affixed to the services in such a way that they will remain attached to identify the services throughout the work of this Section of the specification.

33.4.2.3 The Contractor must remove the mess tables in the Officer's mess and dispose of as Category "C" property. These will not be reinstalled at the completion of the flooring project. The Contractor must remove the mess tables in the Crew's mess and retain them as Category "B" property.

33.4.2.4 The Contractor must remove the bulkhead panels from the after and angled walls of the canteen and replace them after the flooring is complete in the configuration shown in the Common Mess Conversion Guidance Drawing. The Contractor must supply and install any bulkhead panel corner pieces required to make the modification to the canteen bulkheads.

33.4.2.5 The Contractor must supply and install a new table with the approximate size and location as indicated in the Common Mess Conversion Guidance Drawing.

### 33.4.3 **Existing Ship's Side Insulation Renewal**

33.4.3.1 The Contractor must remove every second interior outboard bulkhead panel on the starboard side of the Main Deck from frame 29 forward to frame 46. The Contractor must remove every second interior outboard bulkhead panel on the port side of the Main Deck starting from the after bulkhead of the Officer's Mess at frame 32, forward to frame 46.

33.4.3.2 Where there is conflict with electrical outlets the Contractor may choose to leave the bulkhead in place provided that access to the area requiring additional attention can be fully accessed. If access will not be suitable the Contractor must isolate, lock out power and disconnect the outlets prior to removing the bulkhead section.

33.4.3.3 All bulkhead panels removed must be labeled as to their location and orientation and retained for re-installation following completion of the work as Category "B" property. Any damaged panels must be replaced at contractor's expense.

33.4.3.4 The Contractor must take care to avoid damaging the surface of the panels. The Contractor must remove any surface mounted items carefully and note the location of the items for re-installation.

33.4.3.5 To facilitate the bulkhead removal the Contractor must remove deck head panels as required to access retaining screws. The deck head panels must be labeled and protected from damage for installation following the repair work required as Category "B" property. Any damaged panels must be replaced at contractor's expense. Removal of deck head panels may require the removal of lighting fixtures. The Contractor must coordinate this work in conjunction with Section 45.0 Accommodation Lighting Upgrade.

33.4.3.6 Contractor must remove the structural insulation attached to the ship's side to a height of 300 mm above the current A-60 decking structure. This bottom section of insulation must be removed along the full length of the hull or deckhouse that has been opened as described in 33.4.6.1 through 33.4.6.3.

33.4.3.7 Following the work to install the new floor as described in this Section of the specification and at such a time that the floor has cured to an acceptable level (Dex-



O-Tex FSR agreement) the Contractor must install new foil backed insulation (minimum R40) from the cut insulation line to the new floor surface. The insulation must be packed snugly to the existing cut line, the outer hull or deckhouse plate, support structure and new flooring. Contractor must use reference document TP11469 E Guide to Structural Fire Protection to ensure proper re-insulation of hull and deckhouse plating. The insulation must be secured in place by existing insulation pins (if any) and industrial reinforced foil backed tape specific for insulation.

33.4.3.8 The Contractor must seal all insulation joints and carefully wrap steel support structure to ensure that no cold joints are exposed.

33.4.3.9 Upon completion of the insulation the Contractor must re-install the bulkhead panels, ceiling panels and any items removed during this work. The Contractor must supply new bulkhead panel securing strips that colour match the original bulkhead panels.

#### 33.4.4 **Existing Flooring Removal**

33.4.4.1 The Contractor must remove all existing Isolamin floating floor, vinyl floor tiles, baseboards, carpet and leveling cement and epoxy one piece flooring located in the areas noted in Section 33.4.2 through 33.4.4. Disposal of these materials will be as Category “C” property. All traces of the existing decking material must be removed to expose the main deck steel deck plating.

#### 33.4.5 **Deck Plate Inspection and Repairs**

33.4.5.1 Once all remaining fire insulation and flooring materials are removed, the Contractor must remove all rust and loose paint. The Contractor must prepare deck plate for paint by blasting to SSPC-SP6 or power tooling to a minimum of SSPC-SP3. The Contractor must take care not to contaminate surrounding area due to power tooling action.

33.4.5.2 Once deck plate is cleaned and prepped the Contractor must provide the TA the opportunity to inspect the condition of the deck plating. During this time 60 ultrasonic readings must be taken. The locations for the Ultrasonic readings must be determined under consultation with the TA and TCMS inspectors. Contractor must supply a report to the TA on the Ultrasonic readings along with a detailed drawing showing each measurement location. This report must be supplied within 24 hours of completing the measurements.

33.4.5.3 The Contractor must perform an extensive survey of all exposed steel deck/bulkhead boundaries to ensure there are no perforations that compromise the fire integrity and water tightness of the decks. The Contractor must provide a report detailing any defects found and proposed repair procedures to the TA with 48 hours of the survey. Should there be issues with the underlying deck plate, the Contractor

must produce a repair plan for the deck plate and submit this to the TA and the TCMS inspector prior to commencing further repair work. Any additional work determined by the Contractor and in agreement by the TA must be submitted for approval using a PWGSC Form 1379.

- 33.4.5.4 All replacement steel must be of the same grade and thickness as shown on the drawings included in the Technical Data Package. Welding must be full penetration fillet welds and must be welded from both sides of the deck plate, in accordance with the original Welding Table in the Technical Data Package.
- 33.4.5.5 All welding repairs must follow the International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.
- 33.4.5.6 The Contractor must ensure that all steel plate and sections are clean and free of scale. All surfaces must be coated with a weldable primer prior to fabrication. Material certificates for all steel must be provided to the TA.
- 33.4.5.7 The Contractor's welding inspector will complete a visual inspection of all welds prior to arranging inspection by the attending TCMS surveyor.
- 33.4.5.8 Full penetration welds to be subject to 100% ultrasonic thickness testing. Technician to be certified to a minimum of Level II under CAN/CGSB 48.9712 – latest edition.
- 33.4.5.9 The Contractor must confirm all sizes of plating inserts and stiffeners prior to work commencement.
- 33.4.6 **Underlying Deck Plate Painting**
  - 33.4.6.1 The underlying deck plate must be painted with rust inhibiting epoxy primer similar to International Paint's Intershield 300. The application of this paint must be done in accordance with manufacturers recommendations. Data including film thickness for each coat, number of coats, dew point, temperature and relative humidity must all be given to the TA for their records.
  - 33.4.6.2 This paint must be suitable for use with the replacement flooring noted in Section 33.5. The paint must be suitable for marine use and certification must be given to the TA.
- 33.4.7 **Bulkhead Support**
  - 33.4.7.1 During the floor removal phase the Contractor must support the Isolamin Panel bulkheads with temporary means in order to preserve the original spacing and panel

gaps as well as prevent collapse of the panel system. The Contractor must be responsible for any damage to the bulkhead system as a result of a lack of support.

33.4.7.2 Contractor must fit the new bulkhead supports and tack weld in place ensuring that the Isolamin bulkhead remains true and at the original spacing from the inner steel bulkhead. Bulkhead supports must be fitted at each joint channel such that the required fastening specification is maintained. The Contractor must include and fit supports at any free end of the bulkhead panel and at any point where additional support is required. Please refer to sections 33.3.4 and 33.3.5 prior to welding over tanks.

#### 33.4.8 **HVAC Unit Seats**

33.4.8.1 The Contractor must install a seamless epoxy floor under the HVAC unit located on main deck. This epoxy floor must be sloped toward a new deck drain installed during this refit (please refer to Section 33.5.2). Due to the new sloped floor the Contractor is required to install fixed steel seats for the HVAC unit to sit on providing a level base.

33.4.8.2 The Contractor must ensure the new seats are welded to the main steel deck in accordance with TCMS regulations. Rubber isolation must be installed between the steel seats and the HVAC unit. This rubber isolation must be in the form of 3mm-6mm thick industrial rubber matting cut to match the units footing layout. The new seats must be painted using the same epoxy primer used on the main deck, see Section 33.4.8. The Contractor must perform this work in conjunction with Section 36.0 HVAC Upgrade.

#### 33.4.9 **Shower Stalls**

33.4.9.1 The Contractor must refurbish all shower stalls aboard the vessel as listed below:

- a) Main Deck washroom (1 of)
- b) Main Deck forward washroom (2 of)

33.4.9.2 All fixtures including hand rails, curtain rods, soap dishes, piping brackets, showerheads and control valves shall be removed and retained for reuse. Where fitted, shower stall doors and hardware shall be removed and retained for reuse.

33.4.9.3 The Contractor must remove the deck material within each shower stall to the steel deck. The steel deck must be inspected and prepared in accordance with the instructions in Section 33.4.7 and 33.4.8.

33.4.9.4 The Contractor must remove shower drains and replace them in accordance with Section 33.5.2.

- 33.4.9.5 The Contractor must install new subfloor and top coat. These must be Dex-O-Tex coatings as follows:
- a) Dex-O-Tex – A70 Latex Concrete
  - b) Dex-O-Tex Terrazzo “M” (Fine)
- The coatings are to be installed as per the manufacturer’s instructions and top coat colour must be confirmed in consultation with the TA.
- 33.4.9.6 Final floor coating shall be applied in such manner as to be a generous radius in all corners and extend up the 150mm flat bar to the base of the Isolamin wall panels. The top edge shall be slightly sloped away from the wall panels and approximately 13mm thick. Reference must be made to drawing VNEA2 771-000 Deck Coverings.
- 33.4.9.7 Shower stalls shall be fitted with a front sill that is 100mm above the finished floor surface of the shower stall.
- 33.4.9.8 Shower stall pans shall be fitted to prevent water seepage. Shower tile water proof membrane shall be installed behind all wall tiles in way of the shower stalls. Membrane shall extend over the shower pan edges to ensure water proof integrity. Deck drains shall be slopped to ensure proper operation.
- 33.4.9.9 Shower bulkheads shall be finished with tile in colour and size as chosen by the Technical authority.
- 33.4.9.10 All caulking used shall be mold and mildew resistant and colour matched to surfaces requiring application.
- 33.4.9.11 The Contractor must reinstall all hardware mounted to the bulkheads including hand rails, soap dishes and piping brackets.

### **33.5 Deck Plate Fire Insulation, Sound Insulation and Flooring Installation**

- 33.5.1.1 The Contractor must replace the existing floating floor with a trowelled on composite flooring like Dex-O-Tex or similar. The composite flooring must have an A-60 fire rating. The new flooring must extend to the outboard deck / hull intersection and to any deck / interior steel bulkhead intersection thus providing a complete fire barrier within each area the flooring is replaced.
- 33.5.1.2 The Contractor must ensure the A-60 flooring is suitable for marine use with either Class or TCMS approval. Certificates for the material must be provided to both the TA and TCMS inspector. Contractor must ensure the new flooring is installed as per the manufacturer’s recommendations and that the weight of the material is kept to a minimum within these recommendations.
- 33.5.1.3 The general layup to be used (for guidance only);
- a) Steel main deck plate

- b) Epoxy Primer (rust inhibitor) International Paint-Intershield 300
- c) Bonder
- d) Acoustic damping underlayment
- e) A-60 Fire Insulation
- f) Top Coat

33.5.1.4 The top coat will consist of three alternative finishes according to the application. For dry spaces defined as: the Officer's Mess, Crew Lounge, Passageways, all Cabins, Canteen and Crew Mess the top coat must consist of 3mm Vinyl flooring. The Vinyl flooring must be roll type with welded seams. The colours must be confirmed with samples provided to the TA for approval prior to installation. The Vinyl must be suitable for marine use with Class or TCMS approval and installed as per manufacturers recommendations. The Contractor must supply any sealant or protective coatings recommended by the manufacturer of the Vinyl flooring, and apply it in accordance with the manufacturer's recommendations.

33.5.1.5 The top coat for wet spaces defined as: Lavatories and the area below the HVAC units the flooring must consist of a seamless epoxy top coat similar to Terrazzo M supplied by Dex-O-Tex. This epoxy top coat must be similar in colour to the existing flooring. Colour flake and an anti-slip agent must be added to improve the appearance and traction of the product within these wet spaces. The seamless floor must extend up the walls in accordance with the Deck Covering drawing and the finish level must be above the bottom of the side bulkhead. This is necessary to provide additional wall support and seal the bulkhead panels.

33.5.1.6 The Galley flooring top coat must consist of quarry tile. The tiles must be similar in colour to the existing Terra-Cotta colour and be installed in accordance with the manufacturer's recommendations and following the guidance given in the Deck Covering drawing. The Contractor must supply any sealant or protective coatings recommended by the manufacturer of the quarry tile flooring, and apply it in accordance with the manufacturer's recommendations.

33.5.1.7 The Contractor must ensure all floor coatings are installed by or under consultation with a certified service representative to ensure product cures properly and the application will meet an A-60 fire rating. Contractor must involve TCMS inspectors during this process to ensure regulatory compliance.

33.5.1.8 Contractor must carefully remove residual contact cement from the baseboard area of the bulkheads and supply and install new flexible PVC baseboard skirting in all dry areas.

### 33.5.2 **Floor and Grey Water Drains**

33.5.2.1 The work in this Section should be done in conjunction with the work in Section 34.3.8 Galley Refit/Grey Water System.

- 33.5.2.2 In the wet areas located under each deck's HVAC unit and within the galley the seamless epoxy flooring must be graded towards the deck drains to be installed in accordance with manufacturer's recommendations. All pipe penetrations must be fully welded, ground and coated with rust inhibitive paint in accordance with Section 33.4.9 prior to installing new flooring.
- 33.5.2.3 All Grey water drains in the mess areas exposed by the decking removals in this Section shall be removed and replaced with new material. The Contractor shall supply new stainless steel deck drains to be used for all deck drains. New drains shall be welded to the steel deck prior to the new flooring being installed.
- 33.5.2.4 Sink drains shall be removed and disposed of and renewed during the floor renewal stage of this refit as noted on drawing VNEA2 317-008. Sink drains shall be renewed up to the P-traps for each sink above the deck. Drains shall be re-plumbed into existing piping.
- 33.5.2.5 TCMS inspectors shall inspect these penetrations prior to covering and contractor shall be responsible for full compliance with all TCMS regulations. Contractor shall take care to install proper galvanic isolation.
- 33.5.2.6 All drain piping shall consist of galvanized schedule 80 seamless pipe. All piping shall be welded using proper CWB and TCMS regulations as well as proper ship building practices.

### **33.6 Deliverables**

#### **33.6.1 Certificates**

- 33.6.1.1 The Contractor must provide the TA with all required certificates for the persons responsible for taking the Ultrasonic readings.
- 33.6.1.2 Copies of all disposal certificates must be provided to the TA.
- 33.6.1.3 The Contractor must provide to the TA the original written acceptance report from TCMS regarding the A-60 fire insulation boundary for the main deck.
- 33.6.1.4 The contractor shall provide all documentation to the TA showing all products used are suitable for the marine industry and the intended application.

**33.6.2 Reports**

- 33.6.2.1 The Contractor must supply a technical report for the ultrasonic thickness measurements. Reports must be presented to the TA in the allotted time frame and provided in both hard copy and PDF electronic copy.
- 33.6.2.2 A detailed drawing must be provided with the ultrasonic testing report showing the exact locations of each test point taken. This drawing must be plotted on an ISO size A1 paper and provided to the TA in both hard copy and PDF electronic copy. Along with this drawing must be an MS-Excel spreadsheet table identifying the test points by position on the drawing, steel thickness found, original thickness and percent wastage for each point.

**33.6.3 Drawings**

- 33.6.3.1 The Contractor must be responsible for updating all “As Fitted” drawings in accordance with Section 6.1.6 of this Specification.

**33.6.4 Manuals**

- 33.6.4.1 The Contractor must supply three sets of product literature for the new deck flooring that includes detailed data on the following:
- a) Cleaning;
  - b) Maintenance;
  - c) Repair;
  - d) Specifications;
  - e) Cautions and Limitations;
  - f) WHMIS.
- 33.6.4.2 The maintenance and repair literature is to be that which the O.E.M. distributes to the authorized service centers for use by their technicians.
- 33.6.4.3 The Contractor must also supply product literature on the epoxy primer used on the steel decking.

## **34.0 GALLEY REFIT**

### **34.1 Identification**

- 34.1.1 The intent of this specification is for the Contractor to remove and replace all listed galley equipment.

### **34.2 References**

#### **34.2.1 Guidance Drawings/Nameplate Data**

- a) C14-40-601-02-R0 Galley Modification
- b) C14-40-512-01-04 HVAC General Arrangement Main Deck and Galley Details
- c) VNEA2\_732-000\_STEEL DOORS HATCHES & MANHOLES
- d) VNEA2\_711-000\_JOINER BULKHEADS & DOORS
- e) VNEA2\_711-000\_JOINER BULKHEADS & LININGS

#### **34.2.2 Standards and Regulations**

- a) Lloyd's Class Notification 100A1 Ice Class 1A Super LMC Arctic Class 2 vessel
- b) Fleet Safety and Security Manual (DFO/5737)
- c) CSA W59-08(R2008) –Welded Steel Construction
- d) CSZ W47.1-09–Certification of Companies for Fusion Welding of Steel
- e) TP 11469 - Guide to Structural Fire Protection
- f) TP 127 – Ships Electrical Standards
- g) Canada Labour Code – Maritime Occupational Health and Safety Regulations
- h) Nova Scotia Health Protection Act – Food Safety Regulations

#### **34.2.3 Government Furnished Equipment**

- 34.2.3.1 The contractor must supply all materials, equipment, and parts required to perform the specified work unless otherwise stated.

## **34.3 Technical**

### **34.3.1 General**

- 34.3.1.1 The contractor must electrically isolate the equipment by performing a lock out of the IM9 115V distribution panel and the #200 230V distribution panel.
- 34.3.1.2 The Contractor must maintain lighting system and fire detection system.
- 34.3.1.3 All removed equipment is categorized as Category “A” as per section 1.11.2.
- 34.3.1.4 Upon completion of all hot work, any coating that has been disturbed by hot work or new steel must be prepared to SSPC-SP3 standard and then given 2 coats of Contractor supplied Wasser MC-Miozinc 100 primer. Contractor must apply a



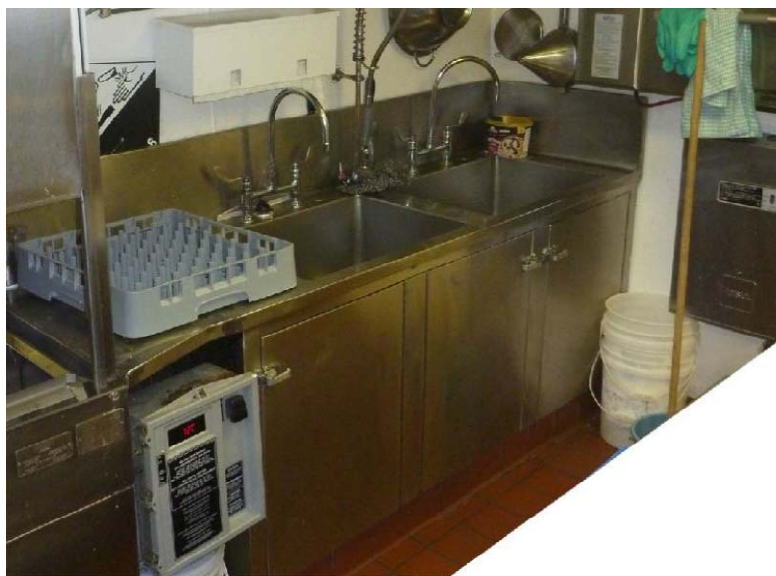
topcoat of paint to colour match the existing colour scheme of the work area, and conform to the vessel's Paint Schedule.

### 34.3.2 **Removals**

#### 34.3.2.1 Equipment to be removed from the galley:

- a) Clean dish table, with sinks, faucets and pre-rinse unit, right of dishwasher
- b) Soiled dish table with dish rack shelves, left of dishwasher
- c) Dishwasher
- d) Booster tank
- e) Hot food table
- f) Refrigerated countertop display case
- g) 1150mm work table
- h) 1500mm work table (must be kept onboard)
- i) Fryer
- j) Range
- k) Grill
- l) Grill cabinet
- m) Work table, right of grill
- n) Exhaust hood
- o) Exhaust hood control cabinet
- p) Fire suppression system
- q) Refrigerator
- r) Freezer
- s) Laminate wood cabinet over sink
- t) Laminate wood cabinet over counter
- u) Laminate wood closet

#### 34.3.2.2 Equipment pictures:



#### 34.3.2.2.1 Clean dish table



34.3.2.2.2 Soiled dish table



34.3.2.2.3 Dishwasher and Booster tank



34.3.2.2.4 Hot food table



34.3.2.2.5 Refrigerated counter top display case





34.3.2.2.6 1150mm Work table



34.3.2.2.7 1500mm Work table



34.3.2.2.8 Fryer



34.3.2.2.9 Range





34.3.2.2.10 Grill, grill cabinet and work table



34.3.2.2.11 Exhaust hood



34.3.2.2.12 Exhaust hood control cabinet and fire suppression system



34.3.2.2.13 Refrigerator and Freezer



34.3.2.2.14 Laminate wood closet



34.3.2.2.15 Laminate wood cabinet





34.3.2.2.16 Laminate wood cabinet

### 34.3.3 Removal Route #1

#### 34.3.3.1 General

34.3.3.1.1 Small equipment must transit via route #1. Equipment exits the galley via the starboard side mess door. It enters the stair well to go up one deck. Equipment is then taken out onto boat deck via the starboard side stair well door.

34.3.3.1.2 No lining or doors are to be removed for this route.

34.3.3.1.3 Equipment has been treated as crated boxes for the routing. Width, length and height do not refer to the actual shape or footprint of the equipment.

#### 34.3.3.2 Equipment to be removed via Route #1:

- |                                     |                             |
|-------------------------------------|-----------------------------|
| a) Fryer                            | 457 x 876 x 1111mm          |
| b) Refrigerated display case        | 584 x 775 x 1219mm          |
| c) Soiled dish table                | 455 x 650 x 910mm (approx.) |
| d) Grill                            | 572 x 610 x 610mm (approx.) |
| e) Grill cabinet                    | 572 x 610 x 610mm (approx.) |
| f) Work table                       | 400 x 610 x 910mm (approx.) |
| g) Exhaust hood control cabinet     | 178 x 762 x 813mm           |
| h) Chemical fire suppression system | 190 x 420 x 597mm           |
| i) Laminate wood closet & cabinets  | misc.                       |

#### 34.3.4 **Removal Route #2**

##### 34.3.4.1 **General**

- 34.3.4.1.1 Larger equipment must transit via route #2. Equipment exits the galley via the forward galley door leading to the domestic machinery room stairs. It goes down the machinery room stairs and enters the escape trunk. The equipment must be hoisted up the escape trunk through the stores hatch located on the forecastle deck.

##### 34.3.4.2 **Galley Forward Door Modification**

- 34.3.4.2.1 The galley front door must be removed.
- 34.3.4.2.2 The magnetic catch must be removed.
- 34.3.4.2.3 Cold room indicator lights located above front door must be dismantled.
- 34.3.4.2.4 Forward galley door clear opening must be cut to 1000mm x 2025mm.

##### 34.3.4.3 **Trunk Access Modification**

- 34.3.4.3.1 Domestic machinery space trunk access must be cut to 2025mm high.
- 34.3.4.3.2 Trunk cutout must be painted following painting procedure in 34.3.1.4.

##### 34.3.4.4 **Escape Trunk Modification**

- 34.3.4.4.1 Escape trunk ladder must be removed.
- 34.3.4.4.2 Ladder brackets must be cut.
- 34.3.4.4.3 Ballast tank valve must be locked and tagged out.
- 34.3.4.4.4 Ballast tank stiffener located in the truck access must be removed.
- 34.3.4.4.5 The plate surrounding the stores hatch coaming on top of the access trunk has to be cut to create a clear opening of 1040 x 1150. This operation is needed for the routing of the main deck HVAC unit.

##### 34.3.4.5 **Equipment to be removed via Route #2:**

- |                      |                     |
|----------------------|---------------------|
| a) Dishwasher        | 743 x 889 x 1753mm  |
| b) Clean dish table* | 610 x 910 x 2300mm  |
| c) Hot food table    | 710 x 915 x 1500mm  |
| d) Range*            | 807 x 870 x 1524mm  |
| e) Exhaust hood*     | 711 x 1334 x 2769mm |

- |                  |                     |
|------------------|---------------------|
| f) Refrigerator* | 762 x 1295 x 1828mm |
| g) Freezer*      | 762 x 1295 x 1828mm |
| h) Work table    | 710 x 914 x 1150mm  |
- Equipment with a \* are to be dismantled in order to fit in the route. Procedure is detailed below.

#### 34.3.5 Removal Procedure

##### 34.3.5.1 Counter Equipment

- 34.3.5.1.1 Counter and wall equipment like toaster, electric slicer, mixers, french fry cutter, etc., must be removed and stored properly until their re-installation.

##### 34.3.5.2 Fryer

- 34.3.5.2.1 Frying pan must be emptied and cooking grease disposed of in accordance with all provincial and municipal regulations. A copy of the disposal certificate must be submitted to the TA.

- 34.3.5.2.2 Fryer must be cleaned to avoid any oil spill during transport.

- 34.3.5.2.3 Electrical wire must be properly secured.

##### 34.3.5.3 Refrigerated countertop display case

- 34.3.5.3.1 Glass doors, shelves and electrical wire must be secured for transport.

- 34.3.5.3.2 Containing refrigerant fluid, the Contractor must reclaim the refrigerant from the display case and supply the TA with all halocarbon disposal records.

##### 34.3.5.4 Grill

- 34.3.5.4.1 Electrical cable must be disconnected.

- 34.3.5.4.2 The grill must be properly cleaned to avoid any grease spill during transport.

- 34.3.5.4.3 Cooking grate, cover plates and electrical wire should be properly secured.

##### 34.3.5.5 Grill Cabinet

- 34.3.5.5.1 Grill cabinet's drawer must be secured for its carriage.

##### 34.3.5.6 400mm Worktable

- 34.3.5.6.1 The worktable beside the grill must have its door and shelves secured for its transport.

34.3.5.7 1150mm Worktable

- 34.3.5.7.1 The small worktable on starboard side must have its door and shelves secured for its transport.

34.3.5.8 1500mm Worktable

- 34.3.5.8.1 The large worktable on starboard side must be removed and properly stored in the crew mess until its re-installation.

34.3.5.9 Chemical Fire Suppression System

- 34.3.5.9.1 The chemical fire suppression system must be dismantled by a qualified technician.
- 34.3.5.9.2 As it contains chemicals, the fire suppression system must be properly recycled and the Contractor must supply the TA with copies of the disposal certificates.

34.3.5.10 Dishwasher

- 34.3.5.10.1 Water supply, drain and electrical wire must be disconnected.
- 34.3.5.10.2 The dishwasher must be cleaned to avoid any water or detergent spill during transport.
- 34.3.5.10.3 Door and electrical wire must be properly secured for transport.

34.3.5.11 Clean Dish Table

- 34.3.5.11.1 Water supplies and drains must be disconnected.
- 34.3.5.11.2 Faucets and pre-rinse must be removed.
- 34.3.5.11.3 Front wall and cabinet doors must be separated from counter top for transport.

34.3.5.12 Hot Food Table

- 34.3.5.12.1 Hot food table must be emptied to avoid any water spill.
- 34.3.5.12.2 Electrical wire must be disconnected.
- 34.3.5.12.3 Sneeze guard, pans and wells must be removed.
- 34.3.5.12.4 Electrical wire and doors must be properly secured for transport.

34.3.5.13 Range

34.3.5.13.1 The range must be cleaned to avoid any grease spill.

34.3.5.13.2 Electrical wire must be disconnected.

34.3.5.13.3 Legs and back guard must be removed in order to fit in the route. Parts must be marked and attached to the range for transport.

34.3.5.13.4 Cooking grates, electrical wire and oven doors must be properly secured for transport.

34.3.5.14 Exhaust Hood Control Cabinet

34.3.5.14.1 The auto clean system pipes and controls for the exhaust hood must be dismantled.

34.3.5.14.2 Water supply and electrical cable must be disconnected.

34.3.5.14.3 Control cabinet must be cleaned to avoid any water or soap spill.

34.3.5.14.4 Door and electrical wire must be properly secured for transport.

34.3.5.15 Exhaust Hood

34.3.5.15.1 Cleaning water pipes, drain and electrical wire must be disconnected.

34.3.5.15.2 Fire extinguishing nozzles must be dismantled by a qualified technician.

34.3.5.15.3 The exhaust hood must be cut in two 1500mm sections in order to fit in the route.

34.3.5.16 Refrigerator

34.3.5.16.1 Refrigerant gas must be removed and properly disposed of by a qualified technician. Refrigerant disposal certificates and documentation must be provided to the TA.

34.3.5.16.2 The refrigerator must be cut in two or more sections in order to fit in the route.

34.3.5.17 Freezer

34.3.5.17.1 Refrigerant gas must be removed and properly disposed of by a qualified technician. Refrigerant disposal certificates and documentation must be provided to the TA.

34.3.5.17.2 The freezer must be cut in two sections in order to fit in the route.

#### 34.3.5.18 Laminate Wood Cabinets

34.3.5.18.1 Cabinets must be taken off the bulkheads.

34.3.5.18.2 Cabinets can be dismantled for their carriage.

### 34.3.6 HVAC Routing

#### 34.3.6.1 General

34.3.6.1.1 Before bringing any new galley equipment in place, the main deck HVAC unit must be routed through the emptied galley. See HVAC report for detailed information, and Specification Section 36.

34.3.6.1.2 Portside galley door steel cutout must be removed and cutout modified as per description below.

34.3.6.1.3 Once HVAC unit is onboard and positioned, the opening will be completely closed.

#### 34.3.6.2 Portside Galley Door

34.3.6.2.1 The portside galley door must be removed.

34.3.6.2.2 The magnetic catch must be removed and reprogrammed on its control panel.

34.3.6.2.3 Exhaust hood auto-clean control cabinet must be removed.

34.3.6.2.4 The wet chemical fire system control cabinet must be removed.

34.3.6.2.5 Galley door clear opening width must be cut to 900mm.

#### 34.3.6.3 Galley Door Closing

34.3.6.3.1 IMPORTANT: Main deck HVAC unit has to be brought in place before performing these operations.

34.3.6.3.2 New plate and stiffeners must be welded in place following C14-40-601-02-R0 to completely close the portside galley door.

34.3.6.3.3 New bulkhead must be painted on both sides following painting procedure in section 34.3.1.4.

34.3.6.3.4 The bulkhead lining will be completed after galley drains modification as per drawing VNEA2\_711-000\_JOINER BULKHEADS & LININGS.

34.3.7 **Electrical system,**

34.3.7.1 Galley's electrical panel and wire must be reconfigured to meet the new equipment requirements.

34.3.7.2 All electrical works must be done following C14-40-306-01 R0 Load Analysis.

34.3.7.3 Panel #200, 230V

34.3.7.3.1 Circuit 201 - Range

- a) Breaker must be raised to 150 amps.
- b) Wire must be changed for 3C 2/0.

34.3.7.3.2 Circuit 202 – Convection/steamer oven

- a) Breaker must be raised to 80 amps.
- b) Wire must be changed for 3C5.

34.3.7.3.3 Circuit 203 - Fryer

- a) Breaker must be raised to 80 amps.
- b) Wire must be changed for 3C5.

34.3.7.3.4 Circuit 204 – Food waste disposer

- a) New 3C14 wire must be installed leading to food waste disposer location for future installation.

34.3.7.3.5 Circuit 208 – Dishwasher booster tank

- a) Breaker must be raised to 50 amps.
- b) Wire must be verified and need to be replaced if smaller than 3C6.

34.3.7.3.6 Circuit 209 – Toaster, aft plug

- a) Breaker must be raised to 30 amps.
- b) Wire must be changed for 2C10.

34.3.7.3.7 Circuit 210 – Toaster, fwd plug

- a) Breaker must be raised to 30 amps.
- b) Wire must be changed for 2C10.

34.3.7.3.8 Circuit 211 – Hot food table

- a) Breaker must be raised to 40 amps.
- b) Wire must be changed for 3C10.

34.3.7.3.9 Circuit 213 - Dishwasher

- a) Breaker must be verified and need to be replaced if not 50 amp capacity.
- b) Wire must be verified and need to be replaced if smaller than 3C6.

34.3.7.4 Panel IM9, 115V

34.3.7.4.1 Circuit IM9-12 – Microwave oven

- a) Breaker must be raised to 40 amps.
- b) Wire must be changed for 2C10.

34.3.8 **Grey Water System**

34.3.8.1 General

- 34.3.8.1.1 The grey water system of the galley must be modified to match the new equipment requirements. Reference drawing: C14-40-601-02.

34.3.8.2 Convection Oven, Exhaust Hood and Sink Drains

- 34.3.8.2.1 Passageway lining must be removed.

- 34.3.8.2.2 Diameter of spool 2-WC-24 must be changed to 50mm.

- 34.3.8.2.3 Diameter of spool 2-WC-23 must be changed to 50mm.

- 34.3.8.2.4 New 50mm diameter spools are to be added:

- a) 2-WC-23B
- b) 2-WC-23C
- c) 2-WC-23D
- d) 36-WC-5

- 34.3.8.2.5 Spool 2-WC-23B must pass through passageway bulkhead.

- 34.3.8.2.6 Spool 2-WC-23D must pass through deck.

- 34.3.8.2.7 Welding on bulkhead and deck must be painted on both sides following the painting procedure in section 32.3.1.4.

- 34.3.8.2.8 Connect original 2-WC-23A sink drain to new 2-WC-23C.

- 34.3.8.2.9 Spool 36-WC-5 must be connected to 36-WC-4.

- 34.3.8.2.10 Lining panels must be reinstalled.

34.3.8.3 Dish Table Drains

- 34.3.8.3.1 Dishwasher and clean dish table drains must be reconfigured as per drawing.



34.3.8.3.2 New spool 2-WC-21A must be connected to original 2-WC-21.

34.3.8.4 Hot Food Table Drain.

34.3.8.4.1 The hot food table needs a drain connected to the sewage system. Its position must be verified on the equipment specification document.

34.3.8.4.2 Mess lining panels must be removed.

34.3.8.4.3 Spool 1-WC-22B must pass through mess bulkhead.

34.3.8.4.4 Spool 1-WC 22A must pass through deck.

34.3.8.4.5 Spool 1-WC 22A must be connected to 1 WC-22.

34.3.8.4.6 Welding on bulkhead and deck must be painted on both sides following painting procedure in section 34.3.1.4.

34.3.8.4.7 Lining panels must be reinstalled.

### 34.3.9 **Hot and Cold Water Supply**

34.3.9.1 General

34.3.9.1.1 Hot and cold water supply system must be refitted as per drawing C14-40- 601-02.

34.3.9.2 Clean Dish Table

34.3.9.2.1 Faucets must be supplied with hot and cold water.

34.3.9.2.2 Pre-rinse unit must be supplied with hot and cold water.

34.3.9.3 Dishwasher

34.3.9.3.1 Equipment must be supplied with hot and cold water.

34.3.9.4 Soiled Dishtable

34.3.9.4.1 Pre-rinse unit must be supplied with hot and cold water.

34.3.9.4.2 Additional cold water connection must be installed under the table for food waste disposer re-installation.

34.3.9.5 Hot Food Table

34.3.9.5.1 Equipment must be supplied with cold water.

34.3.9.6 Convection/Steamer Oven

34.3.9.6.1 Equipment must be supplied with cold water.

34.3.9.7 Exhaust Hood Control Cabinet

34.3.9.7.1 Auto-clean system and fire system must be supplied with hot water.

34.3.10 **List of new galley equipment**

- a) Clean dish table, sinks, faucets, pre-rinse unit and cabinet doors right of dishwasher
- b) Soiled dish table, mounted with food waste disposer sink, pre-rinse, dish rack shelf and cabinet door, left of dishwasher.
- c) Dishwasher
- d) Anti-splash wall
- e) Refrigerated countertop display case
- f) 1660mm work table
- g) 1500mm work table (old one to be re-installed)
- h) Fryer
- i) Range
- j) Convection/steamer oven
- k) Stationary oven stand
- l) Hot food table
- m) Exhaust hood and fire suppression system
- n) Make-up air plenum
- o) Exhaust hood control and wash down cabinet
- p) Refrigerators (2)
- q) Freezer
- r) Stainless steel shelf
- s) Microwave oven shelf
- t) Closet cabinet
- u) Wall mounted storage cabinet
- v) Wall mounted cookie sheets cabinet
- w) Drawers cabinet

34.3.11 **New Equipment Routing**

34.3.11.1 General

34.3.11.1.1 Main deck HVAC unit has to be routed in place before any galley equipment routing.

34.3.11.1.2 All stainless steel equipment, cabinet and shelves must be measured in place before ordering.

34.3.11.1.3 Equipment has been treated as boxes for the routing. Width, length and height do not refer to the actual shape and footprint of the equipment.

34.3.11.2 Equipment brought in via route #1

a) Fryer	457 x 876 x 1111mm
b) Refrigerated countertop display case	584 x 775 x 1219mm
c) 1660mm worktable	610 x 915 x 1016mm
d) Stationary oven stand	483 x 781 x 838mm
e) Exhaust hood control cabinet	178 x 762 x 813mm
f) Chemical fire suppression system	190 x 420 x 597mm
g) Closet cabinet	350 x 750 x 1750mm
h) Microwave oven shelf	75 x 540 x 650mm
i) Stainless steel shelf	75 x 307 x 1200mm
j) Wall mounted storage cabinet	300 x 600 x 675mm
k) Wall mounted cookie sheets cabinet	375 x 675 x 700mm
l) Drawers cabinet	915 x 700 x 375mm

34.3.11.3 Equipment brought in via route #2

a) Dishwasher	743 x 889 x 1753mm
b) Range	807 x 870 x 1524mm
c) Convection/steamer over	781 x 838 x 845mm
d) Soiled dish table	762 x 914 x 1143mm
e) Clean dish table	762 x 914 x 1600mm
f) Hot food table	610 x 914 x 1524mm
g) Exhaust hood (2 section)	914 x 991 x 1500mm
h) Refrigerator (2)	687 x 749 x 1991mm
i) Freezers (2)	687 x 749 x 1991mm

34.3.11.4 The range's back guard and legs must be removed in order to fit in the route.

### 34.3.12 After Routing Rebuild

#### 34.3.12.1 Forward Galley Door

34.3.12.1.1 Steel cutout must be brought back to original dimension following VNEA2 732-000 Steel doors, Hatches & Manholes plan.

34.3.12.1.2 New steel must be painted on both sides following painting procedure in section 34.3.1.4.

34.3.12.1.3 New door must be installed as per VNEA2\_711-000\_JOINER BULKHEADS & LININGS.

34.3.12.1.4 Cold room indicator lights must be reinstalled.

34.3.12.1.5 Door's magnetic catch must be reinstalled.

34.3.12.2 Escape Trunk

34.3.12.2.1 Ballast tank stiffener must be welded back in place.

34.3.12.2.2 Ballast tank stiffener must be painted in the escape trunk and inside the ballast tank. The paint inside the ballast tank must follow the coatings in Section 41 of this Specification.

34.3.12.2.3 Ballast tank valve must be unlocked.

34.3.12.2.4 Ladder brackets have to be welded back in place.

34.3.12.2.5 All exposed metal after welding are to be painted following painting procedure in section 34.3.1.4.

34.3.12.2.6 Ladder must be reinstalled.

34.3.12.2.7 Stores hatch must be reinstalled.

34.3.13 **New Equipment Installation Details**

34.3.13.1 All galley equipment must be tested and demonstrated to TA or IA.

34.3.13.2 **Dishwasher**

34.3.13.2.1 Located on aft galley bulkhead.

34.3.13.2.2 Electrical power, hot and cold supply water must be properly connected to the dishwasher following the equipment specification document.

34.3.13.2.3 Height must be adjusted to match soiled and clean dish tables.

34.3.13.2.4 Legs must be secured to the floor.

34.3.13.2.5 Water hammer arrestor meeting ASSE-1010 standard or equivalent must be supplied by the contractor, in common water supply line at service connection.

34.3.13.2.6 For convenience when cleaning, water tap must be installed near machine with heavy duty hose and squeeze valve.

34.3.13.2.7 This is a pumped rinse machine. Pressure regulating valve is not necessary on hot or cold lines.

**34.3.13.3 Clean Dish table**

- 34.3.13.3.1 Located to the right of the dishwasher on aft galley bulkhead.
- 34.3.13.3.2 Final measurements must be taken in place before ordering.
- 34.3.13.3.3 Faucets, pre-rinse and drains must be properly connected to respective circuits.
- 34.3.13.3.4 Height must be adjusted to match soiled dish table and dishwasher.
- 34.3.13.3.5 The dish table must be correctly secured to bulkhead and floor.
- 34.3.13.3.6 Cabinet doors must be installed, adjusted and tested for suitable operation.

**34.3.13.4 Soiled Dish table**

- 34.3.13.4.1 Located left of the dishwasher on aft galley bulkhead.
- 34.3.13.4.2 Final measurements must be verified in place for approval before ordering.
- 34.3.13.4.3 Pre-rinse must be properly connected to hot and cold supply.
- 34.3.13.4.4 Height must be adjusted to match dishwasher and clean dish table.
- 34.3.13.4.5 The dish table must be correctly secured to bulkhead and floor.
- 34.3.13.4.6 Cabinet door must be installed, adjusted and tested for suitable operation.
- 34.3.13.4.7 The sink must be selected to be able to install a of food waste disposer in the future. Fittings will be necessary to match the 7" drain opening of the drain pipe.

**34.3.13.5 Anti-Spray Wall**

- 34.3.13.5.1 A 13mm thick Plexiglas wall must be installed between the soiled dish table and the electrical panels to prevent any water splatter.

**34.3.13.6 Exhaust Hood and Fire Suppression System**

- 34.3.13.6.1 Located aft of the center galley wall.
- 34.3.13.6.2 The hood must be recessed 150mm in the ceiling.
- 34.3.13.6.3 The hood must be correctly mounted as per manufacturer recommendations, including:
  - a) Two low proximity sloped back shelf hood.

- b) Backsplash
- c) Side splash
- d) Stand-off
- e) Quarter-end panels
- f) Wall mounted utility cabinet
- g) CORE fire protection systems

34.3.13.6.4 Exhaust hood must be properly installed following supplier documentation ASIZE-Master-CanadianCoastGuardShip-R4 (1).pdf.

34.3.13.6.5 Exhaust hood has to be connected to HVAC system as per drawing C14-40-512-01-04 HVAC General Arrangement Main Deck and Galley Details.

**34.3.13.7 Exhaust Hood Control and Wash-down Cabinet**

34.3.13.7.1 Located on the portside galley bulkhead, in front of the clean dish table.

34.3.13.7.2 Cabinet must be correctly fixed to bulkhead.

34.3.13.7.3 Chemical fire suppression system must be properly installed following supplier documentation ASIZE-Master-CanadianCoastGuardShip-R4 (1).pdf.

34.3.13.7.4 Duct must be connected to air extraction system.

34.3.13.7.5 Electrical power and water supply must be connected to control cabinet.

34.3.13.7.6 Cleaning water and fire protection system must be connected to hood.

34.3.13.7.7 Drain must be properly connected.

**34.3.13.8 Make-up Air Plenum**

34.3.13.8.1 Located in front of the exhaust hood.

34.3.13.8.2 Plenum must be installed flush to the ceiling.

34.3.13.8.3 Make-up air plenum has to be properly installed following supplier documentation ASIZE-Master-CanadianCoastGuardShip-R4 (1).pdf.

34.3.13.8.4 Make-up air plenum has to be connected to HVAC system as per drawing C14-40-512-01-04 HVAC General Arrangement Main Deck and Galley Details.

**34.3.13.9 Fryer**

34.3.13.9.1 Located on portside, aft of the center galley wall.

34.3.13.9.2 Electrical power must be properly connected following the equipment specification document.

34.3.13.9.3 The fryer must be secured to the floor.

**34.3.13.10 Range**

34.3.13.10.1 Located right of the fryer, aft of the center galley wall.

34.3.13.10.2 Back guard and legs must be re-assembled.

34.3.13.10.3 Electrical power must be properly connected following the equipment specification document.

34.3.13.10.4 The range must be secured to the floor.

**34.3.13.11 Stationary Oven Stand**

34.3.13.11.1 Located right of the oven, aft of the center galley wall.

34.3.13.11.2 The stationary oven stand must be secured to the floor.

**34.3.13.12 Convection/Steamer Oven**

34.3.13.12.1 Installed on the stationary oven stand, aft of the center galley wall.

34.3.13.12.2 Electrical power, water and drain are to be properly connected following the equipment specification document.

34.3.13.12.3 Equipment must be secured to its stand.

**34.3.13.13 Freezer**

34.3.13.13.1 Located on the starboard side galley bulkhead, sided to aft galley bulkhead.

34.3.13.13.2 Old toe plate must be completely removed.

34.3.13.13.3 A new base must be built to raise the equipment as high as possible.

34.3.13.13.4 Electrical power must be properly connected following the equipment specification document.

34.3.13.13.5 The freezers are to be secured to the bulkhead and/or the floor.

**34.3.13.14 Refrigerator**

34.3.13.14.1 Located on the fore galley bulkhead, sided to portside galley bulkhead.

34.3.13.14.2 Old toe plate must be completely removed.

34.3.13.14.3 A new base must be built to raise the equipment as high as possible.

34.3.13.14.4 Electrical power must be properly connected following the equipment specification document.

34.3.13.14.5 The refrigerators must be secured to the bulkhead and/or the floor.

**34.3.13.15 1660mm Worktable**

34.3.13.15.1 Located on the starboard side galley bulkhead, right of the freezer.

34.3.13.15.2 Final measurements must be taken in place before ordering.

34.3.13.15.3 The final length of this work table must be taken in place considering refrigerators, 1500mm work table and hot food table in place before ordering.

34.3.13.15.4 Height must be adjusted to match the 1500mm worktable.

34.3.13.15.5 The table must be correctly fixed to bulkhead and floor.

34.3.13.15.6 Cabinet doors and drawers must be installed, adjusted and tested for suitable operation.

**34.3.13.16 1500mm Worktable**

34.3.13.16.1 Located right of the 1660mm worktable on starboard side galley bulkhead.

34.3.13.16.2 This worktable is the old one that has been removed and stored.

34.3.13.16.3 The worktable must be correctly secured to bulkhead and floor.

34.3.13.16.4 Cabinet doors and drawers must be adjusted and tested for suitable operation.



**34.3.13.17 Refrigerated Countertop Display**

- 34.3.13.17.1 Counter mounted on the 1500mm worktable.
- 34.3.13.17.2 The refrigerated countertop display must be installed on the 1500mm worktable.
- 34.3.13.17.3 The right side of the display must be aligned with the right end of the table.
- 34.3.13.17.4 Electrical power must be properly connected following the equipment specification document.
- 34.3.13.17.5 Legs must be secured to the worktable.

**34.3.13.18 Hot Food Table**

- 34.3.13.18.1 Located on the starboard side galley bulkhead, left of the crew mess door.
- 34.3.13.18.2 The hot food table must be correctly secured to bulkhead and floor.
- 34.3.13.18.3 Electrical power, supply water and drain must be properly connected following the equipment specification document.
- 34.3.13.18.4 Cabinet sliding doors must be installed, adjusted and tested for suitable operation.

**34.3.13.19 Stainless Steel Shelve**

- 34.3.13.19.1 Mounted on forward side of the center galley wall, on portside, over the sink.
- 34.3.13.19.2 Final measurements must be taken in place before ordering.
- 34.3.13.19.3 The shelf must be properly mounted to the wall.

**34.3.13.20 Microwave Oven Shelve**

- 34.3.13.20.1 Located on the starboard side galley bulkhead, sided to the freezer.
- 34.3.13.20.2 Final measurement must be taken on the microwave oven before ordering.
- 34.3.13.20.3 The shelf must be properly mounted to the bulkhead.

**34.3.13.21 Closet Cabinet**

- 34.3.13.21.1 Located on the forward galley bulkhead, right of the refrigerators.

34.3.13.21.2 Final measurements must be taken in place before ordering.

34.3.13.21.3 The cabinet must be properly secured to the floor and the bulkhead.

34.3.13.21.4 Closet hinged doors must be installed, adjusted and tested for suitable operation.

**34.3.13.22 Wall Mounted Storage Cabinet**

34.3.13.22.1 Located on the starboard side galley bulkhead, sided to the microwave oven shelf.

34.3.13.22.2 The cabinet must be properly fixed to the bulkhead.

**34.3.13.23 Drawers cabinet**

34.3.13.23.1 Located on the portside galley bulkhead, centered between the clean dish table and the fryer.

34.3.13.23.2 The cabinet must be properly secured to floor and bulkhead.

34.3.13.23.3 Cabinet hinged doors must be installed, adjusted and tested for suitable operation.

**34.3.13.24 Wall Mounted Cookie Sheets Cabinet**

34.3.13.24.1 Located on the portside galley bulkhead, over the drawers cabinet.

34.3.13.24.2 The cabinet must be properly mounted to bulkhead.

34.3.13.24.3 Cabinet sliding doors must be installed, adjusted and tested for suitable operation.

**34.3.13.25 Toe Plates**

34.3.13.25.1 If necessary, all ceramic covered toe plates must be adjusted or re-built to match new equipment.

34.3.13.25.2 Measurements must be taken on site.

**34.4 Proof of Performance**

**34.4.1 Inspection**

34.4.1.1 All work must be witnessed by the TA and IA and the attending TCMS surveyor.

34.4.1.2 The contractor must give access to a Captive Aire technician for the inspection of the exhaust hood system.

34.4.1.3 Items to be verified by operation or commissioning by certified technicians:

- a) CORE fire system
- b) Energy management system
- c) Exhaust fan
- d) Hood
- e) Self-cleaning system

#### 34.4.2 **Testing**

34.4.2.1 The Contractor must perform functional tests of the new galley equipment as per the manufacturer's recommendations for commissioning.

#### 34.4.3 **Certification**

34.4.3.1 Equipment and component certificates including all test reports and CSA and / or ULC certificates of compliance must be supplied to the TA and TCMS.

34.4.3.2 The Contractor must provide the services of a certified fire protection service company to obtain certificates for the CORE firefighting system.

#### 34.5 **Deliverables**

34.5.1 All documentation supplied with the galley equipment must be delivered to the TA.

#### 34.6 **Training**

34.6.1 The Contractor must be responsible to give 2 ship's staff any necessary training to operate all new galley equipment.

34.6.2 The Contractor must give access to a Rational technician for the start-up training of the convection/steamer oven. The contractor must be responsible for the arrangements between the supplier and the ship's staff.

### **35.0 RUDDERS (SURVEY ITEM)**

#### **35.1 Identification**

The Contractor must remove the rudders, prepare them for TCMS survey and then re-install the rudders and set them to work.

#### **35.2 References**

##### **35.2.1 Equipment Data**

Wagner Steering Gear:

Model LA216-35-C1B2 Electro Hydraulic Full follow up power steering details in Technical data Package

##### **35.2.2 Drawings and Documents**

<b>Drawing</b>	<b>Drawing Name</b>
VNEA2 241-004	Nozzle Arrangement and Details
VNEA2 254-000	Steering Gear Seats
VNEA2 271-000	Rudder and Rudder Stocks
VNEA2 451-004	Steering Gear Compartment Arrangement
VNEA2 452-002	Steering Gear Hydraulic Piping
VNEA2 D-2249	Carrier Radial Bearing

#### **35.3 Technical**

##### **35.3.1 General**

35.3.1.1 The Contractor must unship the port and starboard rudders and rudder stocks for inspection by the attending TCMS surveyor for survey credit.

35.3.1.2 The Contractor must include the following in the bid price as a specific line item:

- 1) Cost of the removal of the existing gudgeons and pintle sleeves;
- 2) Machining of Contractor supplied gudgeon and pintle sleeve material;
- 3) Machining of Contractor supplied gudgeon and pintle Thordon XL bearing material, and;
- 4) Cost of installing gudgeon and pintle sleeves and bearings.

35.3.1.3 The Contractor must determine the dimensions of the material to be supplied in order to minimize the amount of machining required to the components.

**35.3.2 Rudders**

- 35.3.2.1 Unshipping of the rudder stocks must include the removal of the rudder follow-up assemblies, disconnecting of the actuating rams from the rudder tiller arms, the rudder stock nuts and locking bars, jumping collars and tiller heads. Any damage to the threads of the rudder stocks during the removal of the nuts, removal, storage or refitting of the rudders and rudder nuts must be corrected by the Contractor to TCMS approval.
- 35.3.2.2 The Contractor must take and record the port and starboard gudgeon to pintle clearances and the port and starboard rudder stock lower end carrier bearing clearances. Copies of the readings must be provided to the TA within 24 hours of the rudders being removed from the vessel.
- 35.3.2.3 Readings taken by the Contractor must be used to determine if new pintle and gudgeon bearing sleeves need to be machined and installed and if the work of section 35.3.3 will be completed.
- 35.3.2.4 The Contractor must remove and dispose of all packing from the rudder stock glands. The Contractor must supply and install new Teflon impregnated flax type packing (19mm).
- 35.3.2.5 The Contractor must remove the drain and vent plugs from each rudder and subject the forward and after sections of both rudders to an air pressure test not in excess of 0.1 bar (1.5 psig). This test must be witnessed and approved by a TCMS surveyor and the TA.
- 35.3.2.6 After testing, the Contractor must float coat the interior sections of both rudders with Contractor supplied "VapCor SeaGuard A". Upon completion of float coating the rudders must be drained and all plugs must be reinstalled.
- 35.3.2.7 The Contractor must supply and install new 316 Stainless Steel Hex- Socket plugs on both rudders as shown on drawing VNEA2 271-000 . This work must be done prior to the installation of the rudders. All Plugs must have Loctite® PTFE applied to the threads prior to installation.
- 35.3.2.8 The Contractor must perform MPI examinations of the rudder stock keyways and rudder stock threads.
- 35.3.2.9 The Contractor must supply all material and labour to repair and replace any missing fairing compound on the rudders, specifically the slot welds and the transition from the forward and aft section of the rudder.

**35.3.3 Sleeve and Bearing Replacement**

- 35.3.3.1 The Contractor must break out the component of Section 35.3.3 as a separate line item in the bid submission.
- 35.3.3.2 The Contractor must provide the services of a Thordon FSR or other certified Thordon service representative to oversee the work of this Section.
- 35.3.3.3 Pintle to gudgeon clearance specifications must be determined by the Thordon FSR. Documentation with the final measured clearance for both port and starboard rudder bearings with reference to the Thordon specified clearance must be provided to the TA and to TCMS for approval.
- 35.3.3.4 The machining and fitting of the Thordon material must comply with the specific material application guidelines. The Contractor must supply a Thordon FSR to witness and approve the machining and installation process.
- 35.3.3.5 The Contractor must supply all materials necessary to machine and fit the stainless steel sleeves and the Thordon bearing material.
- 35.3.3.6 Final measurements of the pintle outside diameter and gudgeon inside diameter must be taken and recorded in three places along the length of the bearing (Top, Center and Bottom) in both the Port/Starboard and Fore/Aft directions.

**35.3.4 Hydraulic Cylinder Overhaul**

- 35.3.4.1 The Contractor must remove and dismantle the steering gear hydraulic cylinders.
- 35.3.4.2 The Contractor must supply and install new bearings and pins for the cylinder connection to the tiller arms and new bearings and pins for the fixed end of the cylinders. These components must be machined and heat treated in accordance with the original Wagner specifications, and can be obtained from Jastram Engineering.
- 35.3.4.3 The Contractor must re-chrome and machine the cylinder rams to bring the rams to original specification for surface roughness. The Contractor must take and record the port and starboard ram diameters after machining and copies of the readings must be provided to the TA.
- 35.3.4.4 The Contractor must supply and install new oil seals for the hydraulic cylinders. The Contractor must reassemble the hydraulic cylinders and reinstall them in same positions from which they were removed. All hydraulic connections must be tested for leaks, and any leaks must be repaired at Contractor expense.

**35.3.5 Installation and Set to Work**

- 35.3.5.1 The Contractor must verify the initial fit of the taper connection between each rudder stock and the associated tiller head. Verification of initial fit must be by machinist bluing process. The acceptable minimum contact area of 80% is to be achieved between the rudder stock taper and tiller head and this is to be evenly distributed. Final fit of the flanges and tapers must be witnessed by the attending TCMS surveyor and the TA.
- 35.3.5.2 The Contractor must re-install the rudders, rudder tiller arms, rudder stock bolts and nuts, locking bars, hydraulic rams and rudder follow-up assemblies and set the rudders and steering gear to work.
- 35.3.5.3 The Contractor must supply and install 16 new 316 stainless steel bolts on the jumping collars as shown on drawing VNEA2 271-000. All holes must be tapped prior to bolt installation and installed with Loctite 242 prior to final securing of the bolts.
- 35.3.5.4 The Contractor must take and record the fitted clearance between the fitted keys and keyways of the rudder stocks and tiller heads for both the port and starboard rudders.
- 35.3.5.5 The Contractor must touch up any damaged hull paint in this area.

**35.4 Proof of Performance**

**35.4.1 Inspections**

- 35.4.1.1 The Contractor must have each rudder inspected by the attending TCMS surveyor and provide the TA with proof of inspection.
- 35.4.1.2 The Contractor must provide a Quality Assurance report indicating that all parts of the rudder assembly have been inspected by the Contractor's Q.A. department for correct installation and fit.
- 35.4.1.3 The Contractor must ensure that the rudders are installed in good order and that the tiller nuts, rudder coupling bolts, lower gudgeon bolts, nuts and the jumping collars screws are locked and to the satisfaction of the attending TCMS surveyor.

**35.4.2 Testing/Trials**

- 35.4.2.1 Upon completion of the inspection and final installation of the rudders and rudder stock, the Contractor must perform operational tests on the rudders to ensure that the steering system performs as required. All operational tests must be witnessed by

the TA. The Contractor must test and verify the following items with regards to the steering system:

- 1) The Contractor must verify the proper operation and indication of each rudder's angle indicator system. The Contractor must verify that all local and remote rudder angle indicators indicate the true deflection of the rudder as witnessed in the steering gear compartment. Where necessary, the Contractor must adjust the system to provide correct indication.
- 2) The Contractor must verify the hydraulic operation of each steering gear pump and that each rudder's hydraulic system operates in a smooth manner. Where air is entrapped in the system, the Contractor must bleed the hydraulic system until all entrapped air has been removed.
- 3) The Contractor must verify that each rudder has full travel from hard over to hard over when being steered by the hydraulic systems. The Contractor must adjust the hydraulic systems to prevent the rudders from contacting the mechanical stops on either side and to ensure that travel in both directions is equal.
- 4) The Contractor must verify that both rudders operate and respond to all local and remote steering station inputs.

### **35.5 Deliverables**

- 35.5.1 The Contractor must provide a report of the findings, work and final condition for the work of Section 6.2.4 in accordance with the Inspection, Test and Trials Plan.
- 35.5.2 The Contractor must provide waste and oily-waste disposal certificates to the TA prior to the close of the contract.
- 35.5.3 The Contractor must provide the TCMS survey documentation to the TA prior to vessel acceptance.



## **36.0 HVAC UPGRADE**

### **36.1 Identification**

The intent of this specification is for the Contractor to replace the Accommodation HVAC equipment that has outlived their lifespan. Furthermore, new equipment will be installed in order to correct HVAC deficiencies on the Main Deck, Boat Deck, Forecastle Deck and Wheelhouse.

### **36.2 References**

#### **36.2.1 Drawing & documents supplied in Technical Data Package**

- a) HVAC Report – P201404001-A1
- b) Humidification Report – P201404001-A2
- c) VNEA2 761-014 HVAC System – Focsle Dk, Bridge Dk and WH: Sheet 1 of 2
- d) VNEA2 761-014 HVAC System – Main deck and Boat deck: Sheet 2 of 2
- e) VNEA2 761-015 A/C Equipment Room
- f) C14-40-512-00 HVAC Bill of Material
- g) C14-40-512-01 HVAC General Arrangement
- h) C14-40-512-02 HVAC Elevations and details – Boat and Main decks
- i) C14-40-512-03 Wheelhouse Rooftop units
- j) C14-40-512-04 Self-Contained units – Forecastle and Boat decks
- k) C14-40-512-05 Self-Contained unit – Main deck
- l) C14-40-512-06 Thermal Fluid Heating coils and valves
- m) C14-40-512-07 Humidifiers
- n) C14-40-512-08 Forecastle deck Fan – Fresh air
- o) C14-40-512-09 Boat deck Fan – Fresh air
- p) C14-40-512-10 Main deck Fan – Fresh air
- q) C14-40-512-11 Galley hood Exhaust Fan
- r) C14-40-512-12 Galley make-up Supply Fan
- s) C14-40-512-13 Lavatory Exhaust Fan
- t) C14-40-512-14 Laundry Exhaust Fan
- u) C14-40-512-15 Round closeable hatch
- v) C14-40-512-16 Spot air diffuser

#### **36.2.2 Standards and Regulations**

- a) Federal Halocarbon Regulations, 2003
- b) TP 11469E – Guide to Structural Fire Protection
- c) International Maritime Organization – SOLAS
- d) IEEE 45 – Recommended Practice for Electrical Installations on Shipboard
- e) SNAME Technical and Research Bulletin No. 4-7
- f) SNAME Technical and Research Bulletin No. 4-16
- g) SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) – HVAC Duct Construction Standards, Metal and Flexible (2005)
- h) ANSI/ASHRAE Standard 151:2010 - Practices For Measuring, Testing, Adjusting, And Balancing Shipboard HVAC&R Systems

### 36.2.3 **Owner Furnished Equipment**

- 36.2.3.1 The contractor must supply all materials, equipment, and parts required to perform the specified work unless otherwise stated.

## 36.3 **Technical**

### 36.3.1 **General**

- 36.3.1.1 Before proceeding with any dismantling work, the contractor must lock out and tag out the respective electric distribution panels serving the HVAC equipment listed in the following section.
- 36.3.1.2 Equipment has been treated as crated boxes for routing purposes. Width, length and height do not refer to the actual shape or footprint of the equipment.
- 36.3.1.3 The TA must be provided with copies of Halocarbon recovery and disposal records for all equipment removed from service. The TA must also be provided copies of Halocarbon service records for all new equipment installed aboard the vessel.
- 36.3.1.4 Upon completion of all hot work, any coating that has been disturbed by hot work, disturbed steel work or new steel must be prepared to SSPC-SP3 standard and then given 2 coats of Contractor supplied Wasser MC-Miozinc 100 primer. Contractor must apply a topcoat of paint to colour match the existing colour scheme of the work area, and conform to the vessel's Paint Schedule.

### 36.3.2 **List of HVAC equipment to be removed**

- a) Two (2) Carrier 50TJ-004 single-package rooftop units (Wheelhouse) including associated thermostats and control wiring.
- b) Two (2) Carrier 90MA006 self-contained cooling units (Forecastle and Boat Decks), including associated thermostats, sensors and control wiring.
- c) One (1) Carrier 90MA008 self-contained cooling unit (Main Deck) including associated thermostats, sensors and control wiring.
- d) One (1) Forecastle Deck tube axial supply fan.
- e) One (1) Boat Deck tube axial supply fan.
- f) One (1) Main Deck tube axial supply fan.
- g) One (1) Lavatory exhaust fan.
- h) One (1) Galley exhaust fan.
- i) One (1) Laundry exhaust fan,
- j) Three (3) Thermal fluid heating coils including pneumatic control valves and accessories (Forecastle, Boat and Main Decks).
- k) Specific ducting and duct accessories as identified on drawings.

**36.3.3 Removed equipment routing**

36.3.3.1 All the equipment except those specified below must transit via the stair well and taken out on boat deck via the starboard side stair well door.

36.3.3.2 The Carrier 90MA008 Self-contained unit located on main deck will have to be completely dismantled in order to be carried out by the same route.

**36.3.4 Removal Procedure**

**36.3.4.1 Carrier 50TJ-004 rooftop units (wheelhouse)**

36.3.4.1.1 Refrigerant (R22, 1.4 kg) in each unit must be recovered using the appropriate pressure-rated recovery cylinder relative to the refrigerant in the system. This task must be performed by a certified refrigeration technician.

36.3.4.1.2 Condensate line must be disconnected from units, see C14-40-512-03 Wheelhouse Rooftop units.

36.3.4.1.3 All electrical cables must be disconnected from the units and the wiring for power must be removed to the nearest disconnect box. If low voltage wiring for thermostatic control is deemed to be in satisfactory condition, they may be reused. See drawing VNEA2 E-1 Electrical Power Single Line.

36.3.4.1.4 Remove and dispose of all thermostats related to the units.

36.3.4.1.5 Supply and return duct collars to be disconnected from the units in order to remove unit without damaging the existing duct. The ducting in the wheelhouse must remain in place.

36.3.4.1.6 Dismantle and dispose of units in a proper manner as Category “C” property.

**36.3.4.2 Carrier 90MA006 Self-contained units (Forecastle and Boat decks)**

36.3.4.2.1 Refrigerant (R22, 4.54 kg) in each unit must be recovered using the appropriate pressure-rated recovery cylinder relative to the refrigerant in the system. This task must be performed by a certified refrigeration technician.

36.3.4.2.2 All electrical cables to be disconnected from the units and the wiring for power must be removed to the nearest disconnect box. Remove all low voltage wiring associated with the thermostat. See drawing VNEA2 E-1 Electrical Power Single Line.

36.3.4.2.3 Damper control switches (3 of, refer to Image 36.1) mounted on the Forecastle unit to be removed and secured for future use.

- 36.3.4.2.4 Remove and dispose of all sensors and thermostats related to the units.
- 36.3.4.2.5 All water piping must be isolated using existing valves and disconnected from the units. This piping must be replaced as part of Section 19.0 Sea Water Piping Systems Upgrade.
- 36.3.4.2.6 Condensate line must be disconnected from units.
- 36.3.4.2.7 Remove and dispose of the water regulating valves.
- 36.3.4.2.8 Fresh air and supply ducts must be dismantled where required as per drawing C14-40-512-01. The ducting in the wheelhouse must remain in place.
- 36.3.4.2.9 Dismantle and dispose of units in a proper manner as Category “C” property.



Image 36.1 – Damper Control Switches

**36.3.4.3 Carrier 90MA008 Self-contained unit (Main deck)**

- 36.3.4.3.1 Refrigerant (R22, 4.54 kg) in the unit must be recovered using the appropriate pressure-rated recovery cylinder relative to the refrigerant in the system. This task must be performed by a certified refrigeration technician.
- 36.3.4.3.2 All electrical cables to be disconnected from the units and the wiring for power must be removed to the nearest disconnect box. Remove all low voltage wiring associated with the thermostat.
- 36.3.4.3.3 Remove and dispose of all sensors and thermostats related to the unit.
- 36.3.4.3.4 All water piping must be isolated using existing valves and disconnected from the unit. This piping must be replaced as part of Section 19.0 Sea Water Piping Systems Upgrade.
- 36.3.4.3.5 Condensate line must be disconnected from units.
- 36.3.4.3.6 Remove and dispose of the water regulating valve.
- 36.3.4.3.7 Fresh air and supply ducts must be dismantled where required as per drawing C14-40-512-01.
- 36.3.4.3.8 Dismantle and dispose of units in a proper manner. Recycle items whenever possible. These items are classed as Category “C” property.

**36.3.4.4 Fans**

- 36.3.4.4.1 All electrical cables to be disconnected from the units and the wiring for power must be removed to the nearest disconnect box.
- 36.3.4.4.2 For fans installed outside on mushroom vents, the top part of mushroom vent must be dismantled and stored in a protected area prior to fan removal.
- 36.3.4.4.3 If bolt pattern of new fans do not match with existing bolt pattern, cut existing coaming flanges.
- 36.3.4.4.4 Dismantle and dispose of fans in a proper manner. These items are classed as Category “C” property.

**36.3.4.5 Thermal Fluid Heating Coils**

- 36.3.4.5.1 Isolate thermal oil heating coils by closing supply and return isolation valves.

- 36.3.4.5.2 Empty the thermal oil heating coil and recover the oil for reuse. This should be done in conjunction with Section 39.0 Thermal Fluid Heater Upgrade.
- 36.3.4.5.3 Disconnect piping from the coil making sure the pipes are isolated.
- 36.3.4.5.4 Cap all pipes until installation of new coil.
- 36.3.4.5.5 Remove and dispose of all sensors and pneumatic valve control stations.
- 36.3.4.5.6 Dismantle heating coil as well as pneumatic control valve (Leslie) by removing bolts and dispose in a proper manner. These items are classed as Category “C” property.

### 36.3.5 **New HVAC Equipment**

#### 36.3.5.1 **General**

- 36.3.5.1.1 The Contractor must supply the make and model of the equipment identified below. Equivalents may be approved for use if the Contractor is able to confirm that all engineering aspects are equal to the recommended unit with regards to performance, physical size, orientation of components, and serviceability as considered in the attached HVAC Report. The Contractor must be responsible for all engineering costs and effort required for any substituted components.
- 36.3.5.1.2 Refer to drawing C14-40-512-00 for the new equipment list.

#### 36.3.5.2 **Single-Package rooftop units**

- 36.3.5.2.1 Galvanized steel unit cabinet coated with a pre-painted baked enamel finish on all externally exposed surfaces.
- 36.3.5.2.2 Aluminum fin – Copper tube Condenser and Evaporator coils to be uniformly coated with a flexible epoxy polymer (E-coated or equivalent). The coating process must ensure complete coil encapsulation of tubes, fins and headers.
- 36.3.5.2.3 Unit must use one fully hermetic, scroll type compressor for each independent refrigeration circuit.
- 36.3.5.2.4 The new selected single-packaged rooftop unit must have the same footprint as the existing unit.
- 36.3.5.2.5 Puron (R-410A) HFC refrigerant must be used.
- 36.3.5.2.6 Power: 208/230V-3ph-60Hz.

36.3.5.2.7 For cooling and heating capacities, refer to drawing C14-40-512-03.

36.3.5.2.8 Model must be Carrier 50TC-A04A2C5-0A0A0 or approved equivalent.

**36.3.5.3 Self-Contained units**

36.3.5.3.1 The frame, panels, removable access panels, and top panel must be constructed of heavy gauge steel. The base panel must be constructed of heavy gauge steel with welded steel channel supports for maximum rigidity.

36.3.5.3.2 Removable panels must allow easy access to internal parts within each section. When possible, all access panels for maintenance must be positioned on the unit for easy access from the corridor.

36.3.5.3.3 Unit must be painted with a white colour (preferred) powder coat with high impact finish.

36.3.5.3.4 Unit must be insulated to prevent sweating and to reduce noise level.

36.3.5.3.5 The condenser (coaxial) must be tube-in-tube type water-cooled. Seawater tubes must be seamless cupronickel with no interior joints. Threaded pipe connections must be provided for water supply and return lines.

36.3.5.3.6 The evaporator coils must be of nonferrous construction with die-formed, collared, self-spacing aluminum plate fins mechanically bonded to seamless copper tubing and must be fed by a thermostatic expansion valve.

36.3.5.3.7 The evaporator coil must be coated with a Heresite protective finish.

36.3.5.3.8 The compressor must be high efficiency, suction cooled hermetic type mounted outside the air stream in an insulated compartment to reduce noise level (acousticap option). The compressor must be equipped with internal spring and internal solation to provide vibration-free operation.

36.3.5.3.9 Nominal 5 ton units must come with a single compressor. Nominal 10 ton units must be designed with twin compressors providing single or dual stage cooling.

36.3.5.3.10 Puron (R-410A) HFC refrigerant must be used.

36.3.5.3.11 Power: 575V-3ph-60Hz.

36.3.5.3.12 For cooling capacities, refer to drawings C14-40-512-04 sheet 1 and C14-40-512-05.

- 36.3.5.3.13 Model must be Thermoplus KACE-072V (Forecastle and Boat decks) or approved equivalent.
- 36.3.5.3.14 Model must be Thermoplus KACE-144V (Main deck) or approved equivalent.
- 36.3.5.3.15 For control equipment and installation required to operate the system, refer to drawings C14-40-512-04 and C14-40-512-05.
- 36.3.5.4 **Fans**
  - 36.3.5.4.1 Fan casing must be hot dipped galvanized with steel or aluminum blades.
  - 36.3.5.4.2 All hardware must be 316 Stainless steel.
  - 36.3.5.4.3 Fan motor must meet IEEE-45 requirements.
  - 36.3.5.4.4 Galley exhaust fan must be explosion proof type.
  - 36.3.5.4.5 All other fans must come with TEFC or TEAO motors.
  - 36.3.5.4.6 Power: 575V-3ph-60Hz, 120V-1ph-60Hz (Laundry exhaust fan).
  - 36.3.5.4.7 For airflows, external static pressure drop and type of fan, refer to drawings C14-40-512-08 to C14-40-512-14.
  - 36.3.5.4.8 Model must be American Fan, Hartzell or approved equivalent.
- 36.3.5.5 **Thermal fluid heating coils**
  - 36.3.5.5.1 Casing material and construction must be suitable for thermal fluid type and temperature.
  - 36.3.5.5.2 Headers, coils tubes and fins must be suitable for thermal fluid type and temperature.
  - 36.3.5.5.3 Flange type must be ANSI Class 300 rated to match existing.
  - 36.3.5.5.4 Thermal oil used must be Shell Heat Transfer Oil S2 X.
  - 36.3.5.5.5 The entering and leaving temperature of the fluid is 220°C and 180°C.
  - 36.3.5.5.6 For heating capacities and dimensions, refer to drawing C14-40-512-06. Dimensions must match existing coils.



- 36.3.5.5.7 Model must be Enerfin WGC or approved equivalent.
- 36.3.5.5.8 Fluid control valve must be installed in the same location, connected to the existing flanged piping. The valve must be sized and selected to operate with the thermal fluid type and temperature. The replacement valves must have 24V electric actuators for modulation, refer to control drawing C14-40-512-06. Model must be Leslie or Spirax-Sarco or approved equal.
- 36.3.5.6 **Humidifiers**
  - 36.3.5.6.1 Humidifier must be electrode steam type.
  - 36.3.5.6.2 Humidifier must come with its own integrated controller.
  - 36.3.5.6.3 A stainless steel atmospheric steam distributor must be supplied for duct mounting.
  - 36.3.5.6.4 Steam and condensate hoses must be supplied with the humidifier.
  - 36.3.5.6.5 Power: 575V-3ph-60Hz.
  - 36.3.5.6.6 For humidifier capacities, refer to drawings C14-40-512-07.
  - 36.3.5.6.7 Model must be Nortec NHTC series or approved equivalent.
- 36.3.5.7 **Ducting and Insulation (specification)**
  - 36.3.5.7.1 Ducting must be fabricated from galvanized steel in accordance with SMACNA standards. Duct thickness must not be less than 22 gauge.
  - 36.3.5.7.2 Ducting in mechanical rooms and ducting passing through A-class boundaries must be heavy gauged (minimum 3 mm).
  - 36.3.5.7.3 All duct joint and seals must be taped with Foil-Grip duct sealant or with Hardcast mastic joint sealant.
  - 36.3.5.7.4 Supply and fresh air ducts must have 25 mm insulation.
  - 36.3.5.7.5 Rectangular duct must be supplied with a minimum 48 kg/m<sup>3</sup> density fiberglass insulation board, 25 mm thick with a factory-applied aluminum foil vapor barrier, minimum thickness 0.05 mm.
  - 36.3.5.7.6 All joints in the vapor barrier must be overlapped a minimum of 50 mm and coated with an approved vapor sealing compound.

- 36.3.5.7.7 Round ducts must be insulated in the same manner using foil faced blanket insulation 25 mm thick with a minimum density of 24 kg/m<sup>3</sup>.
- 36.3.5.7.8 Insulation must be secured to the duct with an approved adhesive. On rectangular ducts over 600 mm wide, insulation must be further secured with metal clips, pins or studs.
- 36.3.5.7.9 For spot diffusers and round closeable hatch, refer to drawings C14-40-512-16 and C14-40-512-15 respectively.
- 36.3.5.7.10 For installation notes, refer to section 36.3.7.7.

### 36.3.6 New equipment routing

#### 36.3.6.1 Routing

- 36.3.6.1.1 All the equipment, except the main deck self-contained unit, will enter ship via the starboard side stair well door.
- 36.3.6.1.2 Equipment located on the forecastle deck A/C Equipment Room will be taken up one floor.
- 36.3.6.1.3 Equipment located on the boat deck will pass through the passageway door.
- 36.3.6.1.4 Equipment located on main deck will be taken down one floor and pass through the portside passageway door.
- 36.3.6.1.5 Refer to Section 34.3.4.4 Escape Trunk Modification and 34.3.6 HVAC Routing for the complete information about the main deck self-contained unit routing. Contractor must coordinate this work with Section 34.0.

#### 36.3.6.2 Equipment size

- 36.3.6.2.1 As the self-contained units on boat deck and forecastle deck are 663mm wide and the door's clear opening is 660mm, three (3) door frames will have to be removed to permit equipment routing.

#### 36.3.6.3 Doors to be modified

- a) Starboard side stairwell door on boat deck.
- b) Starboard side passageway stairwell door on boat deck.
- c) A/C Equipment Room door on forecastle deck.

**36.3.6.4 Door modifications**

- 36.3.6.4.1 Doors must be removed and protected for reinstallation later as Category “B” property.
- 36.3.6.4.2 Only the vertical frame opposite to the hinge side needs to be removed.
- 36.3.6.4.3 Lining and ceiling panels that could be damaged must be removed.
- 36.3.6.4.4 Door frames, lining and ceiling panels are to be reinstalled when routing is completed.
- 36.3.6.4.5 If welding was necessary, frames and surrounding bulkhead are to be properly painted in accordance with 36.3.1.4.

**36.3.7 New equipment installation details**

**36.3.7.1 General Notes**

- 36.3.7.1.1 All equipment must be lifted according to Manufacturer’s instructions with slings or other suitable and secure means. The Contractor must be responsible for all handling and any damage incurred must be rectified at Contractor expense.
- 36.3.7.1.2 Openings on the different pieces of equipment must be covered during storage, handling and installation in order to eliminate the risk of foreign body contamination.
- 36.3.7.1.3 The Contractor must be responsible to readjust ceiling panels and finishing tiles around the Boat deck and Main deck self-contained units in order to provide a clean finish. Damaged panels must be replaced by the Contractor.
- 36.3.7.1.4 The Contractor must be responsible to remove ceiling panels as well as to replace any ceiling panels damaged during the contract.

**36.3.7.2 Single-Package rooftop units (wheelhouse)**

- 36.3.7.2.1 Prior to the installation of the new single-package rooftop units, the Contractor must ensure the work in Section 30.0 Wheelhouse Top Steel Repairs is completed including the installation of the required seating arrangements.
- 36.3.7.2.2 All surfaces must be cleaned prior to installation of the new unit.

- 36.3.7.2.3 The single packaged rooftop units must be mounted in place and secured as indicated on installation drawing C14-40-512-03.
- 36.3.7.2.4 Electrical power must be connected to the unit following drawing C14-40-512-03 in conjunction with the manufacturer's installation manual.
- 36.3.7.2.5 Existing supply and return collars must be connected to the unit using proper mounting accessories.
- 36.3.7.2.6 Thermostat must be installed at location indicated on the general arrangement drawing C14-40-512-01.
- 36.3.7.2.7 Thermostat must be wired to unit following drawing C14-40-512-03 in accordance with the manufacturer's installation manual.
- 36.3.7.3 **Self-contained units (Forecastle, Boat, Main decks)**
  - 36.3.7.3.1 Prior to the installation of the new self-contained units, the Contractor must complete the work detailed in Specification 33.4.10 – HVAC Unit Seats.
  - 36.3.7.3.2 All surfaces must be cleaned prior to the installation of the new unit.
  - 36.3.7.3.3 The self-contained units must be mounted in place and secured as indicated on the installation drawings.
  - 36.3.7.3.4 Existing water pipes must be modified as indicated on the installation drawings in order to adapt to the new units.
  - 36.3.7.3.5 Electrical power must be connected to the unit following drawings C14-40-512-04 and C14-40-512-05 in conjunction with the manufacturer's installation manual.
  - 36.3.7.3.6 Temperature controller and sensors must be installed at the location indicated on the drawings C14-40-512-01 and C14-40-512-02 and must be wired to units following drawings C14-40-512-04 and C14-40-512-05 in conjunction with the manufacturer's installation manual.
  - 36.3.7.3.7 Existing supply duct must be modified as indicated on the installation drawings in order to connect to the unit supply opening.
  - 36.3.7.3.8 Existing fresh air duct must be modified as indicated on the installation drawings.

**36.3.7.4 Fans**

- 36.3.7.4.1 Prior to the installation of the new fans, the Contractor must verify the condition of the coaming flanges. If required, the flanges must be sandblasted, primed and painted in accordance with Section 36.3.1.4.
- 36.3.7.4.2 If bolt pattern of new fans do not match with existing bolt pattern, a new steel mating flange must be welded to coaming, primed and painted in accordance with Section 36.3.1.4.
- 36.3.7.4.3 All surfaces must be cleaned prior to the installation of the new fans.
- 36.3.7.4.4 The fans must be mounted in place making sure that their orientation is correct. They must be secured in place as indicated on installation drawings C14-40-512-08 to C14-40-512-14.
- 36.3.7.4.5 Electrical power must be connected to the unit following the electrical drawings in conjunction with the manufacturer's installation manual.

**36.3.7.5 Thermal fluid heating coils**

- 36.3.7.5.1 Thermal fluid heating coils must be mounted to duct and secured using bolts, nuts and lock washers as indicated on installation drawing C14-40-512-06.
- 36.3.7.5.2 Duct sealant must be applied at flanged joints before securing with fasteners.
- 36.3.7.5.3 Supply and return piping must be connected to the new coils.
- 36.3.7.5.4 Electric control valve must be mounted and secured on piping as indicated on installation drawing C14-40-512-06.
- 36.3.7.5.5 Electrical power must be connected to the control valve following drawing C14-40-512-06 in conjunction with the manufacturer's installation manual.
- 36.3.7.5.6 Temperature sensors must be installed at location indicated on the general arrangement drawings C14-40-512-02.
- 36.3.7.5.7 Temperature sensors and control valves must be wired to their respective heating thermostats following drawings C14-40-512-06 in conjunction with the manufacturer's installation manual.

**36.3.7.6 Humidifiers (Forecastle, Boat, Main decks)**

- 36.3.7.6.1 Humidifiers must be wall-mounted at the locations indicated on drawing C14-40-512-01 respecting the minimum clearances as indicated in the manufacturer's installation manual.

- 36.3.7.6.2 Electrical power must be connected to the units following drawings C14-40-512-07 in conjunction with the manufacturer's installation manual.
- 36.3.7.6.3 Humidifiers must be wired to the respective deck thermostat as per drawings C14-40-512-04 and C14-40-512-05.
- 36.3.7.6.4 The steam distributor must be mounted on the supply duct and connected to the humidifier, with the condensate return.
- 36.3.7.6.5 Cold potable water lines must be connected to each humidifier.
- 36.3.7.6.6 Drain lines must connect the units to the ship's drainage system as per drawing VNEA2 316-008 Sewage and Grey Water Diagram.
- 36.3.7.6.7 Ensure manufacturer's recommendations are followed.
- 36.3.7.7 **Ducting and Insulation (Installation)**
  - 36.3.7.7.1 For the following ducting installation, refer to drawing C14-40-512-01.
  - 36.3.7.7.2 Return plenums complete with return grilles must be installed on the Forecastle, Boat and Main decks self-contained units.
  - 36.3.7.7.3 Duct transitions to the new equipment (fans, heating coils, cooling units, etc.) must be provided and installed when required.
  - 36.3.7.7.4 A new exhaust duct must connect the new Galley hood to the existing exhaust run.
  - 36.3.7.7.5 A new insulated air conditioned supply air duct complete with spot diffusers must be installed in the Galley. This supply duct must connect to the existing duct outside the Galley.
  - 36.3.7.7.6 A new insulated Galley make-up supply duct must be connected from the existing make-up supply run to the new Galley hood.
  - 36.3.7.7.7 Transfer ducts complete with grilles must be installed between the Laundry room and General Store as well as between the Crew mess and the corridor on the Main deck.
  - 36.3.7.7.8 An exhaust duct must connect the Forecastle deck lavatory/laundry room to the exterior in order to properly exhaust the dryer.

**36.3.7.8 Cleaning**

- 36.3.7.8.1 All ductwork interiors, heating coils, fans, and cooling units must be cleaned after installation and prior to delivery to owner.
- 36.3.7.8.2 All surfaces around the units must be cleaned after installation and prior to delivery to the owner.
- 36.3.7.8.3 After all work, cleaning and testing is completed, and just prior to delivery, provide new filters for all systems.

**36.4 Acceptance Test Procedure**

**36.4.1 Purpose and scope**

- 36.4.1.1 The HVAC system acceptance test procedure must be performed once the HVAC equipment has been installed, connected and started on the vessel and is ready to be operated under normal conditions.
- 36.4.1.2 This procedure verifies the functional operation of the HVAC equipment and controls system supplied by the vendor.

**36.4.2 Acceptance criteria**

- 36.4.2.1 The equipment under test must meet all requirements of the test procedure in order to be deemed to be operating as per the required design parameters.
- 36.4.2.2 The Contractor must provide a written test procedure for each of the following systems. These procedures will be reviewed and approved by the TA prior to conducting the test.
- 36.4.2.3 Once approved, any deviation from this procedure is considered to be in non-conformance and must be reviewed by the TA in order to be accepted.
- 36.4.2.4 Acceptance test procedures to be provided include:
  - a) Air conditioning unit and controls test procedure for the RTUs and SCUs.
  - b) Thermal fluid heater capacity and control valve test procedure.
  - c) Fan capacity and pressure test procedure.
  - d) Humidifier operation and capacity test procedure.

**36.4.3 Test procedure and documentation**

- 36.4.3.1 The test record sheet must be completed as the test is being performed. A copy must be provided to the TA and IA within 10 days of completing the test. It must be signed by the tester or a designated authority.

36.4.3.2 The TA must be advised prior to test to ensure that power and water services are available and to allow the TA and IA to witness the tests.

36.4.3.3 Prior to conducting the tests, ensure that all test equipment and tools are properly calibrated and have valid certificates where applicable. Include the list of test equipment and tools used on the test record sheet.

36.4.3.4 ONLY QUALIFIED AND/OR CERTIFIED PERSONEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE OR SERVICE THE HVAC EQUIPMENT.

#### 36.4.4 **Air balance and report**

36.4.4.1 Upon successful start up and operation of the HVAC equipment, the Contractor must perform an air balance for the accommodation decks (Main deck, Boat deck and Foscle deck). The air balance must be performed for all rooms that are served by the HVAC equipment as identified on the ducting arrangement drawings C14-40-512-01 and C14-40-512-02.

36.4.4.2 Airflow in each room must be within +/- 10% of the design parameters identified on the drawings C14-40-512-01 and C14-40-512-02. Total airflow per system (each RTU or SCU) must be within +/-5% of the design parameters.

36.4.4.3 The air balance must be performed by a NEBB certified technician. A tabulated air balance report must be provided within 10 days of completing the field measurements. The report must comply with NEBB standards and be delivered to the TA and IA.

#### 36.4.5 **Inspection**

36.4.5.1 All work must be subject to witness by the TA and the attending TCMS surveyor.

### 36.5 **Deliverables**

#### 36.5.1 **General**

36.5.1.1 All documentation supplied with the HVAC equipment must be handed to the Technical Authority.

36.5.1.2 The TA must be provided with copies of Halocarbon recovery and disposal records for all equipment removed from service. The TA must also be provided copies of Halocarbon service records for all new equipment installed aboard the vessel



**36.5.2 Instruction manuals**

- 36.5.2.1 The contractor must provide the instruction manuals for all supplied equipment together with parts lists necessary to maintain provided equipment and accessories in accordance with Section 6.2 of this specification.

**36.5.3 Spare parts**

- 36.5.3.1 The contractor must provide a list of recommended spare parts and special tools for the supplied HVAC equipment.

**36.5.4 Certification**

- 36.5.4.1 The contractor must provide equipment and component certificates including all test reports and CSA and / or ULC certificates of compliance.

**36.5.5 Air balancing and commissioning**

- 36.5.5.1 A tabulated air balance report which complies with NEBB standards must be provided to the TA.

**36.5.6 Warranty**

- 36.5.6.1 All supplied equipment must be under warranty for a minimum period of 24 months after owner acceptance. Warranty information must be provided to the TA and IA.

## **37.0 REFRIGERATION SPACE REFURBISHMENT**

### **37.1 Identification**

The Contractor must remove the existing provision refrigeration space insulation panels and wiring. The Contractor must repair any corrosion damage in the space. The refrigeration space must be recoated prior to the installation of new provision space insulation panels, sensors and wiring.

### **37.2 References**

#### **37.2.1 Standards and Regulations**

- a) TP 11469E – Guide to Structural Fire Protection
- b) International Maritime Organization – SOLAS
- c) IEEE 45 – Recommended Practice for Electrical Installations on Shipboard
- d) Fleet Safety and Security Manual

#### **37.2.2 Drawings**

<b>Document Number</b>	<b>Document Name</b>
VNEA2 131-401	General Arrangement 2 of 2
VNEA2 781-000	Refrigerated Spaces Arrangement
VNEA2 5407-C-1	Freezer & Cooler Door Details
VNEA2 5407-D	Combination Walk In Cooler & Freezer
VNEA2 E-9	Domestic Refrigeration System

### **37.3 Technical**

37.3.1 All work performed in this Section must comply with the Federal Halocarbon Regulations latest edition. The Contractor must comply with the provisions of the Fleet Safety and Security Manual Section 7.E.8, "Use of Halocarbons".

37.3.2 All work in this section must conform to CFIA regulations for food storage. The work in this section must be done in conjunction with Section 18.

#### **37.3.3 Removals**

37.3.3.1 The Contractor must use a certified refrigeration technician to reclaim all existing refrigerant from the cooler and freezer units, and safely dispose of the refrigerant in accordance with all applicable Federal and Provincial regulations. The Contractor must electrically isolate the existing controls, compressors and alarm wiring in accordance with the vessel's Safety Management System.

- 37.3.3.2 The Contractor must electrically isolate the refrigerator and freezer spaces, disconnect all lighting and alarm and monitoring system wiring and mark the wires for reuse.
- 37.3.3.3 The Contractor must remove the existing cool and cold room evaporators and all associated piping, wiring, vibration isolators, piping support brackets and insulation required. The refrigerant piping must be removed to a point that the retained piping is clear of the work area. The piping ends must be capped to prevent the ingress of dirt or debris. These materials are Category “B” property.
- 37.3.3.4 Any areas that require cutting and grinding to bare metal must be coated with one coat of primer, and one coat of top coat paint to match the surrounding area.
- 37.3.3.5 The Contractor must dismantle and remove the refrigerator and freezer room doors, interior gratings and shelving units, light switches and light fixtures. All wiring must be retained for reuse, and pulled back so as to not interfere with the work area.
- 37.3.3.6 The Contractor must disconnect, remove and dispose of all insulating panels for the cool and cold rooms.
- 37.3.3.7 The Contractor must clean the area enclosing the refrigeration units and remove any debris, rust or scale so the interior of the space can be inspected.
- 37.3.3.8 The Contractor must allow the TA to inspect the refrigeration spaces including the condition of the 10mm latex cement on the deck of the space.
- 37.3.4 **Repairs to Steelwork**
  - 37.3.4.1 The Contractor must clean all exposed steel surfaces must be prepared to SSPC-SP-3 standard. Contractor must supply all coating products, and all coatings must be Wasser Paints. All prepared areas of steel to have coating system applied, as follows, according to the coating manufacturer’s instructions. See Technical Data Package for Wasser Product Data Sheets. and ensure the area is clean and dry prior to application.
  - 37.3.4.2 The Contractor must supply and apply one (1) coat of Wasser primer – MC MIOZINC (DFT 3mil) to be applied to all prepared steel followed by an intermediate coat of MC-Ferrox B (DFT 3mil). A topcoat of MC Luster Semi Gloss – White RAL 9003 (DFT 3mil) must be applied after sufficient curing time is allowed for the previous coats and following all manufacturer’s recommendations.

**37.3.5 Installations**

- 37.3.5.1 The Contractor must supply and install a new walk in cooler, approximately 19.06 m<sup>2</sup> at +2°C and a new walk in freezer approximately 13.27 m<sup>2</sup> at -17°C including all insulated walls, ceilings, floors, doors and hardware in the same size and configuration as the existing units.
- 37.3.5.2 The Contractor must use a refrigeration supplier with a minimum of 10 years of documented experience and be an established organization and production facility specializing in this type of equipment. The documentation must be delivered to the TA for approval.
- 37.3.5.3 The Contractor must replace the existing plywood ceiling stiffeners and modify them to the design of the prefabricated panels. The Contractor must supply and install all new mounting hardware for the ceiling stiffeners as on drawing VNEA2 781-000.
- 37.3.5.4 The walk in cooler and walk in freezer must be provided complete by one manufacturer, and must be fabricated to the National Sanitation Foundation (NSF) Standard No. 7. The units must be clearly labeled with the NSF label, and the panels and doors must be UL and CSA/ETL Listed and be HACCP compliant. The units must be prefabricated modular design and construction and have been designed in the year 2011 or later.
- 37.3.5.5 The units must be constructed with modular panels possessing cam-lock closers, for secure and tight fit between joints. All panels must be interchangeable and have a non-silicone rubber gasket seal to ensure air tight and vapour proof seals at the joints without the use of applied silicone.
- 37.3.5.6 The Contractor must ensure panels are a minimum 4" (102mm) thick with a core made from CFC free and HCFC free material and permanently affixed to the interior and exterior metal panels.
- 37.3.5.7 The units including doors must have a minimum R-value of R27 for the cooler and R-32 for the freezer and retaining 75% of its R-value after 5 years.
- 37.3.5.8 The units' interior metal finishes must be a minimum 26 gauge, corrosion, dent and scratch resistant stainless steel and exterior finished in 26 gauge stucco embossed aluminum. Floors must be 16 gauge stainless steel and reinforced for a uniformly distributed load of 750 pounds per square foot. The exposed front exterior wall must be a minimum 20 gauge stainless steel.
- 37.3.5.9 The Contractor must ensure the panels have sufficient structural backing in way of the deck head mounted cooler units (evaporators) and in way of all shelving wall brackets. The Contractor must reuse the existing shelving units.

- 37.3.5.10 The Contractor must ensure the refrigerated space is boxed-in in way of the girder end brackets of the vessel.
- 37.3.5.11 The Contractor must make any service penetrations to and from the walk in units, and ensure proper sealing of the service penetrations on both sides of the penetrations once the services are installed.
- 37.3.5.12 The Contractor must supply approximately 34" wide x 70" in fitting, self-closing and flush mounted doors, with the same door opening orientation as presently exist. The doors must be finished in stainless steel, and both sides and the top of door must be equipped with a magnetic gasket to form an airtight seal. The bottom edge of the door is equipped with an adjustable double sweep gasket. All door gaskets must be replaceable design. Door hinges must be polished chrome, strap type, cam-lift hinges. Door latch must be polished chrome with provisions for locking and a safety release to prevent entrapment of personnel within walk in units.
- 37.3.5.13 The Contractor must ensure the door section is provided with a light switch with LED light indicating the interior lights are on and a 4" thermometer (reading the interior temperature in Centigrade). The threshold plate must be made of materials that will withstand heavy traffic, and the door jamb must be rigid frame designed for easy cleaning and maintenance.
- 37.3.5.14 The Contractor must include built-in thermostatically controlled heater cables inside perimeter of door and beneath sill plate and jambs of door opening. Heater wire must be provided in an electrically safe housing and be easily replaceable without the need for clips or special tools. All conduits for the inner-wiring of the door panel must be totally concealed in the panel. The Contractor must reuse the existing 120 volt supply for this seal.
- 37.3.5.15 The Contractor must supply and install new drain lines from the cool and cold room evaporators to the existing floor drains. The cold room drain must be copper tubing and be heated and insulated to prevent freeze-up. The piping must be suitably supported to withstand vibration.
- 37.3.5.16 The Contractor must supply and install new low temperature resistant, vapour proof lighting fixtures to provide sufficient lighting within the spaces utilizing the existing power supplies. The Contractor must install all new control and monitoring system temperature sensors utilizing the existing wiring.
- 37.3.5.17 The Contractor must reinstall the evaporators and all associated wiring, vibration insulators, piping support and brackets into the cool and cold rooms.
- 37.3.5.18 The Contractor must supply and install new refrigeration lines from the cool and cold room evaporators to the capped lines on the condensing units. All lines must be insulated using Armaflex or equivalent insulation. All lines must be secured with

vibration isolators to prevent fractures of the lines due to vibration and movement of the ship to the satisfaction of the TA. The Contractor must provide and install new filter-driers with replaceable cores and isolation valves to facilitate core exchange, moisture indicators, liquid solenoid valves, and thermostatic expansion valves to be fitted into the refrigeration lines. The cool and cold rooms must be fitted with new space temperature sensors.

- 37.3.5.19 The Contractor must clean the interior of the refrigeration spaces prior to reinstalling the interior grating and shelving units. The units must be inspected by the TA and IA prior to the installation of the interior fittings.

#### **37.4 Inspections, Tests and Trials**

- 37.4.1 The Contractor must perform a pressure test on all refrigeration systems upon completion of the installation of all components. A 400 micron vacuum test must also be performed on the systems prior to charging the systems with refrigerant.
- 37.4.2 The Contractor must charge the system with the correct amount of refrigerant. The Contractor must commission the systems, ensuring correct operation of all units.
- 37.4.3 The Contractor must supply the TA and IA with copies of all refrigerant Notices as required under the Federal Halocarbon Regulations. This must include a Dismantling, Disposal or Decommissioning Notice for a System; a Leak Test Notice for a Refrigeration System; a System Service Log, and an Inventory upon commissioning of the systems.
- 37.4.4 The Contractor must supply the Inspection Authority and the Technical Authority with copies of the readings of each unit, and must include at a minimum the suction and discharge pressures for each compressor and the Cool and Cold Room temperatures when they have reached steady operating temperatures.

#### **37.5 Documentation**

- 37.5.1 The Contractor must supply three (3) copies each of the Manufacturer's Installation, Operation, Maintenance and Service Manuals, and the Manufacturer's Parts List.
- 37.5.2 The Contractor must supply three (3) copies of an "As Fitted" system drawing for both the Cool Room and Cold Room.
- 37.5.3 The Contractor must supply electronic copies all documentation and drawings in PDF file format on a CD media.

## **38.0 ACCOMODATION FURNISHING RENEWAL**

### **38.1 Identification**

The purpose of this specification item is for the Contractor to renew the cabinetry and space heaters on each of the accommodation decks with new Contractor supplied units.

### **38.2 References**

#### **38.2.1 Drawings**

<b>Drawing Number</b>	<b>Drawing Name</b>
VNEA2 134-401	General Arrangement As Fitted 1 of 2
VNEA2 134-401	General Arrangement As Fitted 2 of 2
VNEA2 751-000	Furniture List
VNEA2 751-000	Furniture Sketches Booklet 1 to 33
VNEA2 E-1	Electrical Power Single Line Diagram 1 of 2
VNEA2 E-1	Electrical Power Single Line Diagram 2 of 2
VNEA2 E-38	Electric Heating Wheelhouse Foscle Deck
VNEA2 E-39	Electric Heating Main & Boat Deck

### **38.3 Technical**

#### **38.3.1 General**

38.3.1.1 The Contractor must supply and install new furnishings as listed for each of the spaces below. The furnishings being replaced in Sections 38.3.3 to 38.3.7 must be disposed of as Category “A” property. The recommended supplier of the furnishings is:

Joiner Systems International  
1925 – 52 Avenue  
Lachine, Quebec  
H8T 3C3  
Tel: 514-636-5555  
Fax: 514-636-5410

38.3.1.2 The furnishings supplied must be metal furniture, with the desk tops being metal with a plastic laminate top.

38.3.1.3 Furnishings other than those noted in 38.3.1.1 are to be retained as Category “B” property. In conjunction with Sections 33.0, 54.0 and 55.0 of this Specification, any

cabinetry, furniture or appliance in the affected spaces that are damaged during the removal process must be identified to the TA, and replaced at Contractor expense.

38.3.1.4 Any cabinetry, furniture or appliance in the affected spaces that are found to be unsuitable for reinstallation during removal must be identified immediately to the TA and IA, and replacement will be actioned by submitting a PWGSC Form 1379.

38.3.1.5 In all cabins fitted with bunk beds, the Contractor must remove and modify the beds to allow more headroom between the top bunk and the deck head. This must be accomplished by removing the drawers below the bottom bunk, and lowering both bunks a suitable amount to provide the additional headroom. The final dimensions must be presented to the TA for comment prior to the modifications being performed.

### 38.3.2 **Heaters**

38.3.2.1 The Contractor must supply and install new space heaters for all cabins, common rooms and office spaces and exclude areas outside the accommodation area. The Contractor must confirm the ratings for the heater units. The heaters are listed on drawings VNEA2 E-38 and VNEA2 E-39:

- a) 0.3 kW 1;
- b) 0.5 kW 9;
- c) 0.75 kW 13;
- d) 1.0 kW 10;
- e) 1.5 kW 9;
- f) 2.0 kW 2;
- g) 3.0 kW 1;

38.3.2.2 The new heaters must be of similar heating capacity and with the same electrical ratings as the existing heaters. The new heaters must be capable of being mounted in the same locations as the existing heaters.

38.3.2.3 The Contractor must present to TA the purchase order of proposed new heaters being purchased.

### 38.3.3 **Captain's Cabin**

38.3.3.1 The Contractor must supply and install the following furnishings:

- a) Desk top 67-3/4" x 20-1/2";
- b) 3 Drawers Cabinet 10" Wide;
- c) File cabinet 18-1/2" Wide;
- d) Computer cabinet 8" Wide;
- e) Book shelf, double 67-3/4" Wide.



**38.3.4 Chief Officer's Cabin**

38.3.4.1 The Contractor must supply and install the following furnishings:

- |                      |                  |
|----------------------|------------------|
| a) Desk top          | 68" x 28";       |
| b) 3 Drawers Cabinet | 16" Wide;        |
| c) Computer cabinet  | 16" Wide;        |
| d) Book shelf double | 44" Wide;        |
| e) Bureau 4 Drawers  | 29" x 22" x 38". |

**38.3.5 Chief Engineer's Cabin**

38.3.5.1 The Contractor must supply and install the following furnishings:

- |                      |                    |
|----------------------|--------------------|
| a) Desk top          | 93-1/4" x 29-1/2"; |
| b) 3 Drawers Cabinet | 16" Wide;          |
| c) Computer cabinet  | 23-1/2" Wide;      |
| d) 5 Drawers Cabinet | 23" Wide;          |
| e) Bureau 4 Drawers  | 29" x 22" x 38";   |
| f) Book shelf double | 68" Wide.          |

**38.3.6 Ship's Office**

38.3.6.1 The Contractor must supply and install the following furnishings:

- |                      |                |
|----------------------|----------------|
| a) Desk top          | 93-1/4" x 32"; |
| b) File cabinet      | 18-1/2" Wide;  |
| c) File cabinet      | 18-1/2" Wide;  |
| d) Computer cabinet  | 16" Wide;      |
| e) Book shelf double | 76" Wide;      |
| f) Book shelf single | 40" Wide;      |
| g) Book shelf single | 40" Wide.      |

**38.3.7 Logistic Office**

38.3.7.1 The Contractor must supply and install the following furnishings:

- |                     |                        |
|---------------------|------------------------|
| a) Desk top L Shape | 84" x 24" & 30" x 36"; |
| b) File cabinet     | 18-1/2" Wide.          |

**38.4 Documentation**

38.4.1.1 The Contractor must deliver all manufacturers' information delivered with the furnishings to the TA.

38.4.1.2 The Contractor must deliver all manuals and installation information delivered with the electric space heaters to the TA.

## **39.0 THERMAL FLUID HEATER UPGRADE (SURVEY ITEM)**

### **39.1 Identification**

The intent of this specification item is for the Contractor to replace all listed changeable parts of the thermal fluid heater with new Contractor supplied components.

### **39.2 References**

#### **39.2.1 Nameplate Data**

Make: THERMOPAC  
Model: 1000B  
Heat Output: 1160 kW  
Serial No: 99565  
Order: 5104.91187  
Coil MFG No: 20575-6  
Minimum Pressure Drop in Boiler: 8.6 m.L.C.  
Year Built: 1985  
Fuel: 35/45 RI Fuel oil  
575V, 60Hz, 3 Ph.  
Max Power : 19 kW

#### **39.2.2 Regulations**

- a) Canada Shipping Act 2001 Vessel Pollution and Dangerous Chemicals Regulations
- b) Canada Shipping Act 2001 Marine Machinery Regulations
- c) Lloyd's Class Notification 100A1 Ice Class 1A Super LMC Arctic Class 2 vessel operating on Unlimited, beyond 200nm voyages

#### **39.2.3 Drawings and Documents**

- a) VNEA2\_345-002\_THERMAL FLUID SYS ARRGT TANK HEATING COIL
- b) VNEA2\_345-002\_THERMAL FLUID SYS ARRGT
- c) VNEA2\_345-002\_THERMAL FLUID SYS ARRGT SECTS & ELEVS
- d) VNEA2\_345-000\_THERMAL FLUID SYS DIAGRAM AS FITTED

#### **39.2.4 Owner Furnished Equipment**

39.2.4.1 The Contractor must supply all materials, OEM equipment, and OEM parts required to perform the specified work unless otherwise stated.

39.2.4.2 The Contractor must retain the services of an OEM approved supplier that will supply, pre-mount and calibrate the replacement components on a test unit at their facilities. This supplier should be able to offer the service of a qualified technician

that will assist the Contractor during the mounting, calibration and start-up of the renewed thermal fluid heater.

### **39.3 Technical**

#### **39.3.1 System Components Location**

- 39.3.1.1 The thermal fluid heater is located in the engine room between frame 29 and 30, port of the portside ship's service generator.
- 39.3.1.2 Circulating pumps are located in the engine room at frame 30, port of the thermal fluid heater.
- 39.3.1.3 Other components to be replaced are mounted on the thermal fluid heater.

#### **39.3.2 Equipment to be replaced**

- a) Complete burner unit
- b) Complete electrical panel
- c) Fan and motor
- d) Controls and safeties
- e) Rods and brackets to connect all those items together
- f) Two circulating pumps

#### **39.3.3 Scope of Work**

##### **39.3.3.1 Removal Preparation**

- 39.3.3.1.1 The Contractor must electrically lock out opened breaker 526-14-1 and 526-14-2 on panel MCC No.2 and breaker IM11-13 on 115V E/R Power Panel No.2.
- 39.3.3.1.2 The cables must be disconnected and properly stored for their further reconnection.
- 39.3.3.1.3 The Contractor must dispose of all thermal oil inside tank and associated pumps, tanks, piping and equipment before undertaking any dismantling. The Contractor must dispose of the thermal oil in accordance with all Federal, Provincial and Municipal regulations and supply the TA with a copy of the disposal certificates.
- 39.3.3.1.4 The Contractor must disconnect all thermal oil inlets and outlets to and from the unit and blank them off for their further reconnection.
- 39.3.3.1.5 The Contractor must disconnect fuel oil inlet and outlet and blank them off for their further reconnection.

**39.3.3.2 System Components Removal**

- 39.3.3.2.1 All work on the thermal fluid heater must be done in accordance with the manufacturer's instructions and recommendations.
- 39.3.3.2.2 The Contractor must remove the burner.
- 39.3.3.2.3 The Contractor must disconnect and remove the electrical box.
- 39.3.3.2.4 The Contractor must disconnect and remove the fan and motor.
- 39.3.3.2.5 The Contractor must disconnect and remove all controls and safeties.
- 39.3.3.2.6 The Contractor must disconnect and blank off the circulation pipes for their further reconnection.
- 39.3.3.2.7 The Contractor must disconnect the power cables, un-mount and remove the two circulation pumps.
- 39.3.3.2.8 The Contractor must remove and dispose of valves TF-28 and TF-32, and all piping, pipe insulation, brackets and hangers between those valves as indicated on the VNEA2 345-300 Thermal Fluid System Diagram up to the internal heating coil flanges outside each fuel tanks ( #1-TF through #7-TF inclusive). The pipe flanges at TF-28 and TF-32, as well as the internal heating coil flanges must have new blank flanges installed with new gaskets.
- 39.3.3.2.9 The Contractor must remove and dispose of all piping, pipe insulation, brackets and hangers from the internal heating coil flanges for the Forward D.B F.O tank (#14-TF) as shown on the VNEA2 345-300 Thermal Fluid System Diagram up to the first isolation valves possible and install new blank plates with new gaskets at each flange.

**39.3.3.3 New Components**

- 39.3.3.3.1 The Contractor will modify the circulation pumps seats to match with the new pumps footprint.
- 39.3.3.3.2 The circulation pipes and power cables will be reconnected to the circulation pumps. The Contractor will manage the modifications of the pipes to fit the new pump configurations.
- 39.3.3.3.3 New burner must be mounted on unit. Fuel lines, power and control cables must be reconnected.

- 39.3.3.3.4 New fan must be mounted on unit. Control and power cables must be reconnected.
- 39.3.3.3.5 New electrical box must be mounted on unit. Control and power cables must be reconnected.
- 39.3.3.3.6 New controls and safeties must be mounted on unit and reconnected.
- 39.3.3.3.7 System must be filled with new Contractor supplied heat transfer oil Shell Heat Transfer Oil S2 X (formerly Shell Thermia Oil “C”).

#### **39.4 Proof of Performance**

##### **39.4.1 Inspection**

- 39.4.1.1 All work must be subject to witness by the TA or IA and the attending TCMS surveyor.

##### **39.4.2 Testing**

- 39.4.2.1 The Contractor must perform functions tests of the overhauled thermal fluid heater as per the manufacturer’s recommendations for commissioning.
- 39.4.2.2 The Contractor must allow for testing as required by the attending TCMS inspector in order to obtain a survey credit for this specification item.

#### **39.5 Deliverables**

##### **39.5.1 Documentation**

- 39.5.2 All documentation supplied with the new equipment must be delivered to the TA.
- 39.5.3 The Contractor must ensure documentation is received from TCMS proving satisfactory performance of this equipment.

#### **39.6 Training**

- 39.6.1 The Contractor must provide the 2 ship’s crew with training for 1 day to operate the revamped thermal fluid heater.

## **40.0 MCC UPGRADE**

### **40.1 Identification**

The purpose of this specification item is for the Contractor to remove the identified components on the ship's MCC's and replace with new Contractor supplied units.

### **40.2 References**

#### **40.2.1 Drawings**

<b>Document #</b>	<b>File Name</b>
VNEA2 E-1	Electrical Power Single Line Diagram 1 of 2
VNEA2 E-1	Electrical Power Single Line Diagram 2 of 2

### **40.3 Technical**

#### **40.3.1 General**

- 40.3.1.1 The following list of MCC's units must be removed from the vessel to the contractors shop for upgrading (40.3.2 to 40.3.10 inclusive).
- 40.3.1.2 The upgrade must consist of OEM components supplied by Eaton. Components to be replaced will be the main contactor/contactors, Overloads, all operational buttons including contact blocks, toggle switches including contact blocks and illuminated indication, such as start/stop/standby.
- 40.3.1.3 The contractor must clean all buckets on each of the listed MCC's prior to commencement of work. The Contractor must visually inspect all bucket components and should components other than those listed in this document show signs of fatigue or failure condition a list must be generated and submitted to the Technical Authority for review. Additional components requiring replacement will be actioned by submitting a PWGSC Form 1379.
- 40.3.1.4 Incandescent luminaries must be replaced with LED technology.
- 40.3.1.5 The circuit breaker in all buckets on each of the listed MCC's must be inspected and tested. Should the breaker fail a new Eaton equivalent will be installed and tested, with the additional components requiring replacement being actioned by submitting a PWGSC Form 1379.
- 40.3.1.6 Prior to removal from the vessel the contractor must test each MCC bucket identified below in this specification to:
  - a) Ensure proper operation of the control unit; note any operational anomalies prior to removal.

- b) Identify and note the direction of rotation of those motors related to the appropriate MCC.

40.3.2

**No. 1 Essential MCC**

CPP Hydraulic Pump Port	515-3
No 1 Main Engine Prelube Pump	515-6
Stern Tube L/O Pump No 1 Port	515-4
Gearbox Cooling Water Pump (Aft)	516-7
Port Gearbox Stby L/O Pump	515-12

40.3.3

**No. 2 Essential MCC**

CPP Hydraulic Pump Starboard	516-1
No 2 Main Engine PreLube Pump	516-3
Stern Tube Lube Oil Pump #2	516-5
Gearbox Cooling Water Pump (Fwd)	515-5
Starboard Gearbox Stby L/O Pump	516-13

40.3.4

**No. 1 Non-Essential MCC**

#1 Main Engine Preheat & Circ Pump	517-4
#2 Main Engine Preheat & Circ Pump	517-6

40.3.5

**No. 2 Non-Essential MCC**

#3 Main Engine Preheat & Circ Pump	526-2
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40.3.6

**No. 3 Non-Essential MCC**

#4 Main Engine Preheat & Circ Pump	527-2
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40.3.7

**No. 1 Semi-Essential MCC**

#3 Main Engine Prelube Pump	522-1
CPP Hyd Pump Port Stby	522-11

40.3.8

**No. 2 Semi-Essential MCC**

#4 Main Engine Prelube Pump	523-1
CPP Hyd Pump Stbd Stby	523-8

40.3.9

**Auxiliary Landing**

Port Mooring Winch/Windless Hyd Pump #1	5S1
Stbd Mooring Winch/Windless Hyd Pump #2	5S2

**40.3.10 Emergency Generator Room**

Emergency Fire Pump	5E2-4
No. 1 Air Compressor	5E2-6

**40.4 Tests and Trials**

- 40.4.1 Upon completion of the MCC bucket upgrade and installation back into the MCC cabinet, the contractor must demonstrate proper operation of each unit and confirm rotation of motors controlled by the associated updated unit to the satisfaction of the Technical Authority and TCMS.

**40.5 Deliverables**

**40.5.1 Documentation**

- 40.5.1.1 The Contractor must deliver all manuals, instruction sheets provided with the supplied equipment to the Technical Authority.
- 40.5.1.2 Documentation of all new parts including “part numbers” and “quantities” used must be provided to the Technical Authority.
- 40.5.1.3 The Contractor must provide a service report for each bucket, including test results in accordance with testing procedures in TP127E, components changed, and the final settings for each breaker to the Technical and Inspection Authorities.

**40.5.2 Drawings**

- 40.5.2.1 The Contractor must revise all “As Fitted” drawings as required in Section 6.1.6 of this Specification.



## **41.0 AFTER PEAK VOID TANK COATING (SURVEY ITEM)**

### **41.1 Identification**

The purpose of this specification item is for the Contractor to open up, clean, inspect and test for TCMS Inspection and survey. The Contractor must arrange with TCMS for the witnessing of hydrostatic test and inspections. The Contractor must quote on removing up to 200 liters of solid debris from the void space.

### **41.2 Reference**

<b>Drawing Number</b>	<b>Drawing Name</b>
VNEA2 131-202	Structural Profile & Deck Plans
VNEA2 134-401	General Arrangement (sheet 2)
VNEA2 225-008	Stern Unit Frames 5 to Aft

#### **Description**

Aft Peak Void tank

#### **Location**

Aft Peak Frame 0-1

### **41.3 Technical**

- 41.3.1 The Aft Peak tank has never been properly coated since the vessel's commissioning. This space is difficult to access and due to the stern roller configuration, manoeuvrability inside the tank is limited.
- 41.3.2 Tank must be filled with fresh water by the Contractor and then subjected to a hydrostatic test to TCMSB requirements. Any removal of vents that is required to carry out this hydrostatic test must be contractor responsibility. Following the completion of the hydrostatic test, Contractor must be responsible to dispose of tank contents in accordance with all Federal, Provincial and Municipal regulations.
- 41.3.3 Prior to entry, the tank is to have its cover removed and is to have suction ventilation applied from as low a point in the tank as is practical. Prior to any entry, tanks are to be certified "Safe for Workers" or "Safe for Hot Work". Copies of gas-free certificates are to be posted at each tank entrance, the access gangway, and one copy to be provided to TA.
- 41.3.4 The Contractor must clean the interior of the tank to bare steel by blasting to a near white standard, SSPC-SP-10. The tank is then to be thoroughly cleaned and wiped down to remove any and all grit, dirt, debris, or liquid contamination that may be present, prior to coating application. All sludge and debris from the tanks must be disposed of ashore in accordance with all Federal, Provincial and Municipal regulations in effect. The Contractor must provide proof of disposal for this waste to the Inspection Authority and the Technical Authority.

- 41.3.5 The Contractor must submit the tank for inspection by the attending TCMS surveyor, the Technical and Inspection Authorities.
- 41.3.6 The Contractor must supply all coating products. All prepared areas of steel to have coating system applied, as follows, according to the coating manufacturer's instructions:
- a) Prime of all prepared steel areas with WASSER MC-Miozinc 100, 3mil DFT
  - b) Intermediate coat of WASSER MC-Tar 100 Black, 6mil DFT
  - c) Topcoat of WASSER MC-Tar 100 Red, 6mil DFT
  - d) See Technical Data Package for product data sheets.
- 41.3.7 Upon completion and curing of the coating system, and final inspection by the TA, the tanks are to be sealed using new ¼" neoprene manhole gaskets with center removed (contractor supply) and marine grade anti-seize compound applied to all fasteners. *No use of power tools must be permitted to tighten the fasteners.*

#### **41.4 Inspections, Test and Trials**

- 41.4.1 The Contractor must inspect the sounding pipe and remove any foreign materials from the sounding pipe.
- 41.4.2 Upon completion of the cleaning the Contractor must have these tanks and void spaces inspected by the attending TCMS surveyor. The Contractor must obtain a credit for these survey items. A copy of this survey credit must be provided to the Inspection Authority and the Technical Authority before the end of the contract.
- 41.4.3 The Contractor must perform the hydrostatic test under Section 41.3.2 in accordance with TCMS requirements. All hydrostatic tests must be witnessed by the attending TCMS surveyor and the Inspection Authority. The Contractor must ensure that signed documentation from the TCMS surveyor attesting that the pressure test on the tanks has been performed and the tanks passed the test.

#### **41.5 Deliverables**

- 41.5.1 The Contractor must provide the TCMS survey credits for the internal tank inspections and the hydrostatic pressure tests of each tank.
- 41.5.2 All documentation must be provided to the Inspection Authority and the Technical Authority prior to vessel acceptance.

## **42.0 POTABLE WATER TANK INSPECTIONS (SURVEY ITEM)**

### **42.1 Identification**

The Contractor must open, clean and prepare the identified potable water tanks for TCMS inspection and survey. The tanks must be cleaned, visually inspected and must then be subjected to a pressure test. Upon completion of the work, the tanks must be returned to a state of operational readiness.

### **42.2 References**

#### **42.2.1 Drawings**

<b>Drawing Number</b>	<b>Drawing Title</b>
VNEA2 134-401	General Arrangement as fitted (sheet 2)
VNEA2 291-004	Potable Water Service Tank

#### **42.2.2 Tanks**

<b>Tank</b>	<b>Frames</b>	<b>Volume</b>
Port Fresh Water	27 – 32	44.4 cubic meters
Starboard Fresh Water	27 – 32	44.4 cubic meters
Daily Service	28 – 30	4.0 cubic meters

### **42.3 Technical**

#### **42.3.1 Cleaning and Inspection**

- 42.3.1.1 The manhole covers are to be removed from each tank by the Contractor. The Contractor must provide each tank with a mechanical ventilation/extraction system, vented to the outside of the ship. Good ventilation must be provided and any blowers/extractors must ensure good air movement and solvent vapour removal from the lowest point in the tanks. Vapours, dust, dirt, etc. must not be allowed to enter the ship and must be directed by flexible ducting to the outside of the vessel.
- 42.3.1.2 Contractor must supply and maintain good ventilation during all stages of this work in compliance with the coating manufacturer's requirements.
- 42.3.1.3 Tanks must be certified safe for personnel to enter prior to any work being carried out internally. The Contractor must arrange for a certified Marine Chemist to visit the ship, test the tanks, and certify that the tanks are safe for personnel to enter. Copies of certificates must be given to the TA and posted outside each manhole cover in a conspicuous location, the access gangway, and one copy to be provided to the TA. Tanks must be tested daily.

- 42.3.1.4 All contractor personnel must be outfitted with appropriate disposable work clothing and protective safety boot covers (contractor supplied) to be worn at all times within these tanks. The admission of contaminants to the tank internals must be minimized in this fashion due to worker activity within these tanks.
- 42.3.1.5 The Contractor must remove any water remaining in tanks following discharge of the contents by vessel crew. The amount is estimated to be approx. 2 cubic meters per tank. Contractor is to quote a cost per 100 liters of waste fluid removal for adjustment purposes by submitting a PWGSC Form 1379.
- 42.3.1.6 Contractor to note these tanks are fitted with PSM tank level sensors and must suitably protect the transducers when carrying out this work. Functioning condition of these sensors to be appraised before and after completion of work. Any damages to be repaired or unit replaced at contractor's cost.
- 42.3.1.7 The Contractor must supply and install a new PSM tank level sensor in the port Fresh Water Tank. The Contractor must ensure the sensor is electrically isolated prior to the removal of the old and installation of the new sensor. The sensor function must be proven after completion of the work in this section.
- 42.3.1.8 All internal surfaces are to be washed down and the tank surfaces must be cleaned of all dirt, debris and sludge. All debris and sludge must be disposed of ashore by the Contractor. The tank must be ventilated until dry.
- 42.3.1.9 Each tank is to be inspected by TA after cleaning, prior to and after any coating application. Contractor is to ensure that all sounding and suction pipes are free and clear as well as all limber holes in the floors, stringers and webs so as to allow for proper drainage.
- 42.3.1.10 After cleaning the tanks must be inspected by the TA and the attending TCMS surveyor. The Contractor must obtain TCMS documentation confirming inspection of the tanks. A copy of this must be provided to the Inspection Authority and the Technical Authority before vessel acceptance.
- 42.3.2 **Coating Application**
  - 42.3.2.1 Each tank is to be inspected by the TA after cleaning, prior to and after any coating application. Contractor is to ensure that all sounding and suction pipes are free and clear as well as all limber holes in the floors, stringers and webs so as to allow for proper drainage.
  - 42.3.2.2 The Contractor must take precautions to ensure that no damage, unnecessary cleaning, or repairs must accrue from hydro blasting and/or the application of coatings. The Contractor must ensure that every opening in the tanks where paint

chips and debris from hydro-blasting can gain entry is suitably covered. Measures are to be taken to ensure that surfaces and equipment other than those specified are not coated and that any inlets or discharges will not be blocked by the coating or grit.

- 42.3.2.3 All areas of coating loss, breakdown, or blistering, as identified by the TA and contractor, are to be scaled and mechanically cleaned to SSPC-SP3 standard. All areas so prepared are to extend out to sound, intact coating, tightly adhered to steelwork. Intact coating around perimeter edges of prepared areas is to be generously feathered. Tanks are then to be thoroughly cleaned and wiped down to remove any and all grit, dirt, debris, and any other solid or liquid contamination that may be present, prior to coating application. The TA must perform an additional inspection of affected tanks prior to application of repair coatings. The Contractor must be responsible for disposing of all removed paintwork, scale, dirt, etc. in an environmentally safe manner.
- 42.3.2.4 Contractor must apply Royal Coatings “Easy Prep” (see Technical Data Package for product data sheet) by airless sprayer to all internal surfaces of the tanks and let stand 20 to 30 minutes. Apply 2000-3000 psi water blasting to all internal surfaces then remove wash down liquid and debris and ventilate tanks until dry.
- 42.3.2.5 Upon completion of blasting, all residue and debris are then to be cleaned and removed from the tanks. Contractor is to ensure that all sounding and suction pipes are free and clear as well as all limber holes in the floors, stringers and webs so as to allow for proper drainage. Each tank is to be inspected by the TA after cleaning, prior to and after any coating application.
- 42.3.2.6 The Contractor is to bid on price to re-coat 35m<sup>2</sup> of total tank surface. Contractor must provide a unit price per square meter to re-coat tank surfaces for adjustment purposes by submitting a PWGSC Form 1379. All equipment, surface cleaners and coatings must be contractor supplied.
- 42.3.2.7 Suggested supplier of Royal Coatings - EasyPrep, EasyPrime and EasyFlex is:  
Barry Schnare  
Manager, Marine and Industrial Coatings  
K&D Pratt  
55 Akerley Blvd|Dartmouth, NS|B3B 1M3  
DL: 902-480-3011|C:902-456-9238  
barry.schnare@kdpratt.com|www.kdpratt.com
- 42.3.2.8 Before application, the coatings (EasyPrime and EasyFlex) must be above 22° C prior to mixing. See Technical Data Package for EasyPrime and EasyFlex product data sheets.

42.3.2.9 Contractor must note that the application conditions must provide a substrate temperature greater than 3°C and rising while air temperature must be greater than 4°C. Relative humidity must be lower than 90% during application. Contractor must be responsible to supply and maintain heating/dehumidifying equipment required to ensure proper environment.

42.3.2.10 All disturbed areas must be coated with one coat to 3-4mils of Royal's EasyPrime to all prepared steel. Any sharp edges within the prepared areas must be stripe coated with EasyFlex. Apply one top coat of EasyFlex to all primed areas to a wet film thickness of 12-14mils. Runs and sags in the applied coating should be left alone. Allow the coating to cure for 48hours @ 20°C or above. At lower temperatures let cure for 72 hours.

42.3.2.11 When coating is thoroughly cured, tank to be inspected by the TA and local accredited health inspector. Coating adhesion and condition must be acceptable to the TA and local accredited health inspector. Contractor must obtain verbal approval from the TA prior to closing these tanks.

#### **42.4 Inspections, Tests and Trials**

42.4.1 The Contractor must close all tank access covers after final inspection by the attending TCMS surveyor, Inspection Authority and the Technical Authority. The Contractor must replace all tank access cover gaskets with new ¼" thick fiber-reinforced neoprene gaskets suitable for potable water service, cut from sheet to match shape of manhole with center removed. Anti-seize compound must be applied to the fasteners of the manhole covers. No use of power tools must be permitted to tighten the fasteners.

42.4.2 The Contractor must hydrostatically test all tanks to TCMS requirements. All hydrostatic tests must be witnessed by the attending TCMS surveyor and the Inspection Authority. The Contractor must ensure that documentation is obtained from the TCMS surveyor attesting that the pressure test on the tanks has been performed and the tanks passed the test.

42.4.3 The Contractor must disinfect all potable water tanks after the successful completion of the hydrostatic pressure tests. Tanks are to be filled with fresh water and the calculated amount of Sodium hypochlorite 5% solution to attain 50mg/L of free chlorine for the purpose of super-chlorination of the tanks. Contractor must supply enough 5%~sodium hypochlorite solution to provide a mixing ratio of 1liter solution/ 1 m3 water within each tank. Tanks must rest in this condition for a period of 24hrs. The solution must be circulated by ship's personnel as required.

42.4.4 The Contractor must provide certification to the Inspection Authority that the water used for the disinfection meets the above requirements. If the Contractor wishes to use

calcium hypochlorite to produce the hyper-chlorinated potable water, the water must be filtered to remove all calcium before it is introduced into the potable water tanks.

- 42.4.5 Upon completion of the super-chlorination process, the tank solutions are to be neutralised in each tank using 35% hydrogen peroxide, Contractor supply. The contents of the tank water must be tested to determine that the chlorine has been neutralised. Once this has been achieved the Contractor will dispose of the water in accordance with the Provincial Regulations. The Contractor must submit a report to the TA showing the results of the various tests during the super-chlorinated /de-chlorination process. The Contractor must provide a proof of disposal certificate to the Inspection Authority.
- 42.4.6 All tanks must receive one complete fill and flush operation with fresh water. All water used in the flushing process must be disposed of by the Contractor.
- 42.4.7 The Contractor must fill the tanks with potable water. The Contractor must dose and test the tank contents until a free chlorine maintenance level of 0.2- 0.5 mg/l of free chlorine has been attained.
- 42.4.8 Tanks are to be refilled and a sample taken after water has rested in the tanks for a period of 24hrs. Contractor must retain the services of a provincially accredited Potable water sampling company. Samples are to be collected in approved containers by a representative of the accredited company and then tested at their laboratory facility. The water is to be certified acceptable as a potable source. The TA is to receive a report and final analysis of the potable water samples for posting onboard of the vessel.

## **42.5 Deliverables**

- 42.5.1 The Contractor must provide the TCMS survey credits for the internal tank inspections and the hydrostatic pressure tests of each tank.
- 42.5.2 The Contractor must provide certification to the Inspection Authority that the water used for the disinfection meets the requirements of this specification.
- 42.5.3 The Contractor must provide the TA with the disposal certificates for the neutralized water.
- 42.5.4 The Contractor must provide the TA with the Potable Water laboratory testing results.
- 42.5.5 All documentation must be provided to the Inspection Authority and the Technical Authority prior to the completion of the contract.

## **43.0 TOW PIN SYSTEM OVERHAUL**

### **43.1 Identification**

The purpose of this specification item is for the Contractor to overhaul the identified components on the ship's tow pin system located in the Steering Gear Compartment.

### **43.2 References**

#### **43.2.1 Drawings**

<b>Drawing Number</b>	<b>File Name</b>
VNEA2_134-401	General Arrangement as fitted (sheet 2)
VNEA2 451-004	Steering Gear Compartment
VNEA2 852-1	Western Machine Tow Pins Installation
VNEA2 E-41	Tow Pin & Hold Down Block Electrical

### **43.3 Technical**

#### **43.3.1 General**

- 43.3.1.1 The Contractor must electrically isolate and lock out the Tow Pin control system to complete the work in this section.
- 43.3.1.2 Contractor is responsible for removal of any interference items such as piping or electrical connections required to gain access to the tow pin unit components and remove them from the vessel. All items removed must be re-installed in good order by the contractor and verified by the TA. Any disturbed insulation must be re-applied with matching material and sealed to match the existing arrangement of the steering gear compartment.
- 43.3.1.3 The Contractor must drain the hydraulic reservoir and all lines, disposing of approximately 150 litres of oil in accordance with all Federal, Provincial and Municipal regulations. The Contractor must supply the TA with a copy of the disposal certificates.
- 43.3.1.4 The Contractor is to record locations of existing hoses prior to disassembly and removal. Hoses must be tagged as to their relative positions prior to removal. All hydraulic pipes and hoses are then to be disconnected and the oil drained and collected. Pipes must be considered Category "B" property, and the hoses considered Category "C" property.
- 43.3.1.5 Following opening of any fitting, it is to be plugged or capped to prevent ingress of contamination and is to be kept as such until reassembly occurs.



- 43.3.1.6 Hose and piping assemblies must be flushed clean prior to installation, and the Contractor must reference Section 3.2.9 for additional instructions.
- 43.3.1.7 All materials and parts are to be Contractor supplied unless otherwise identified.
- 43.3.1.8 Tow Pin Unit parts may be obtained from the original manufacturer:  
Western Machine Works  
1870 Harbour Road,  
North Vancouver, BC  
V7H 1A1  
Phone: (604) 929-7901  
Fax: (604) 929-7951
- 43.3.1.9 Upon completion of all work described below, the system must be refilled to its working level with new hydraulic oil, and all components suitable greased in accordance with the manufacturer's instructions and the system set to work.

#### 43.3.2 **Tow Pin Enclosure**

- 43.3.2.1 The tow pin enclosure must be drained and all water, oil, grease, dirt and debris cleaned from the interior.
- 43.3.2.2 The tow pin enclosure requires repair to restore the linkage for the hydraulic cylinder position.
- 43.3.2.3 The enclosure hatches must be resealed with new neoprene gaskets on manhole covers and anti-seize compound on all fasteners.

#### 43.3.3 **Tow Pins**

- 43.3.3.1 The Contractor must remove the three tow pins from the tow pin module. The tow pins cylinders must be cleaned of debris and grease. The Contractor must verify the outer cylinder depth and the tow pin heights correspond to allow the tow pins to sit flush with the deck.
- 43.3.3.2 The Contractor must remove all dirt and grease from the tow pin cylinder which is preventing the tow pin from lowering completely.
- 43.3.3.3 The Contractor must disassemble the tow pin manganese steel rollers, tow pin pistons, and tow pin top plate, clean and examine the components. The TA must be afforded the opportunity to inspect the disassembled components.

- 43.3.3.4 Manganese rollers from this age of tow pin were designed to turn on stainless steel needle bearings, the Contractor must remove the needle bearings and install the manganese rollers with new OEM bronze bushings.
- 43.3.3.5 The Contractor must inspect the 1" diameter cross pin holes in the outer cylinders and report the condition to the TA for his consideration.
- 43.3.3.6 The Contractor must disassemble, inspect, and overhaul the four hydraulic cylinders. The 1" diameter holes in the hydraulic cylinder lugs must be checked for excessive clearance and repaired as necessary. The TA must be afforded the opportunity to inspect the disassembled components. The hydraulic cylinders must be inspected and reported to the TA for his consideration.
- 43.3.3.7 The Contractor must reassemble the four hydraulic cylinders with new OEM seals and o-rings. Test and install the four hydraulic cylinders.
- 43.3.3.8 The Contractor must bid on 20 hours of machining time to complete the repairs in to the tow pin units. Adjustments will be made by submitting a PWGSC Form1379.
- 43.3.4 **Hold-Down Block**
  - 43.3.4.1 The Contractor must replace the hold-down block linkage arms and pins with new OEM components.
  - 43.3.4.2 The Contractor must disassemble the hold-down block system and perform the following inspections:
    - a) measure and confirm the axle and bracket clearance;
    - b) renew the axle and brackets to restore shaft clearance;
    - c) check the bore of the lugs on the hold-down block in way of the axle;
    - d) machine and fit the bushings to restore the shaft clearance. The new axle will be the current pattern with locking tabs to secure the axle in position.
  - 43.3.4.3 The Contractor must assemble the hold-down block system at the vessel, align and set the linkage to ensure the linkages toggle into the over center position when the hold-down block is up.
- 43.3.5 **Hydraulic Pump Set and Valves**
  - 43.3.5.1 The Contractor must overhaul the pump motor with new OEM bearings.
  - 43.3.5.2 The Contractor must disassemble and clean the Sperry Vickers solenoid valves.
  - 43.3.5.3 The Contractor must install a new hydraulic filter.

43.3.5.4 The Contractor must reassemble, reinstall all components and set them to work.

**43.3.6 Hydraulic Controls**

43.3.6.1 The Allen Bradley 3-position spring-to-center NWT control switches as noted on drawing VNEA2 852-1 are obsolete. The Contractor must replace these controls with current production equivalent Eaton-Moeller push-button control switches. The Contractor must make all modifications required to mount the new switches on the control pedestal.

**43.3.7 Hoses**

43.3.7.1 All of the hydraulic hoses, grease hoses, and grease nipples must be replaced with new.

43.3.7.2 All hydraulic hoses must be rated in excess of the system pressures and conditions.

**43.4 Inspections, Tests and Trials**

**43.4.1 Inspections**

43.4.1.1 The Contractor must coordinate all component inspections at different work stages with the TA.

43.4.1.2 The TA must be provided with all measurements taken of the removed components, and a new set of measurements taken with the renewed components.

**43.4.2 Tests and Trials**

43.4.2.1 On completion of all overhaul work, the Contractor must demonstrate to the TA and IA the correct operation of the system, and all its components. Any deficiencies must be corrected by the Contractor at his expense.

**43.5 Deliverables**

**43.5.1 Report**

43.5.1.1 The Contractor must supply a report detailing the as found condition of all components noted in this section, and a table of as found measurements and new measurements with the renewed components. The report must also consist of a list of all spare part names, part numbers and quantities used in this specification.

## **44.0 RUBBER FENDERING REPAIR**

### **44.1 Identification**

The intent of this specification is for the Contractor to replace a section of rubber hull fendering on the starboard side of the vessel.

### **44.2 References**

#### **44.2.1 Documents**

<b>Document Number</b>	<b>File Name</b>
VNEA2_282-000	Fenders

#### **44.2.2 Regulations and Standards**

- a) Canada Shipping Act of 2001 and associated Regulations
- b) International Load Line Convention of 1966, position #1
- c) CSA W59-08(R2008) –Welded Steel Construction
- d) CSZ W47.1-09–Certification of Companies for Fusion Welding of Steel

#### **44.2.3 Government Furnished Equipment**

- 44.2.3.1 The Contractor must supply all documents, materials, equipment, and parts required to perform the specified work unless otherwise stated in Section 44.3.2.4.

## **44.3 Technical**

### **44.3.1 Removals**

- 44.3.1.1 A section of rubber fendering, located on the starboard side forward at main deck level (fr.26-24), must have its locking pins removed. Contractor must remove the locking pins by grinding 12 cap welds from the 6 pins present in the repair area. Welds are positioned at pin ends above and below fender channel exterior surface. When welds are re-moved, pins are to be pushed out. Rubber fender must be pulled out of the channel and the damaged section (2.0 m in length) must be cut out of the fender section that must remain.
- 44.3.1.2 The fender section that remains attached must have its forward end cut at a 45 degree angle as per the repair joint on the same fender section just forward of current repair area. The 2.0 m long insert fender section must have its aft face cut to 45 degree angle to complete the lap joint. The forward end of the repair section must form a butt joint with the fender material just forward of the repair section. The damaged section must be disposed of as Category “C” material.

### **44.3.2 Repairs**

- 44.3.2.1 After damaged fender section is removed, all cap welds must be ground flush. Fendering channel is to be prepared to SSPC-SP3 and SSPC-SP2 and then sprayed

with Holdtight 102 at a mixture ratio of 50:1 by means of water blast with 3000psi. Complete repair area to be cleaned to remove all slag dirt and debris. See Technical Data Package for Holdtight product datasheet.

- 44.3.2.2 All coatings must be Wasser Paints. The Contractor must follow all application instructions of the paint manufacturer. One (1) coat of Wasser primer – MC MIOZINC (DFT 3mil) to be applied to all prepared steel followed by an intermediate coat MC-Ferrox B (DFT 3mil). Topcoat of MC Luster Semi Gloss / Safety Red F1350 (DFT 3mil) must be applied after sufficient curing time is allowed for the previous coats. Channel must be inspected by TA before replacement of rubber fendering begins.
- 44.3.2.3 Six (6) new steel pins must be fabricated and used to secure the fendering. Pins are to be cut at a length suitable for proper cap welding when installed in fendering channel. Approximately 2.0 meters of 25mm steel rod will be required. Pins are to be cleaned of all oil and grease and given a solvent swipe with Wasser MC-thinner. Next the pins must be given one (1) coat of MC MIOZINC primer (DFT 3mil) followed by one coat of MC-Ferrox B (DFT 3mil). Topcoat of MC Luster Semi Gloss / Safety Red F1350 (DFT 3mil) must be applied after sufficient curing time is allowed for the previous coats prior to installation. See Technical Data Package for Wasser Product data sheets.
- 44.3.2.4 The vessel will supply the new rubber fendering. Rubber fendering must be pressed back into channel. Care is to be taken to ensure that the rubber fender has been fully seated into the channel. Fender to be cut to a sufficient length so that no more than a 1/4 of an inch gap exists between the butt ends of the fendering. Contractor is to note that some grinding and cutting of the fendering may be necessary in order to permit installation in the channel.
- 44.3.2.5 Holes are to be drilled in the fender material in order to allow installation of the steel locking pins. New pins must be installed and twelve (12) cap welds are to be applied to hold pins in place, as per existing retention end cap structure for the pins on this particular fender section.
- 44.3.2.6 All heat/grinding affected steel work must be prepared to SSPC-SP3 and SSPC-SP2 and then given a solvent swipe with Wasser MC-Thinner. Next the prepared area must be given one (1) coat of MC MIOZINC primer (DFT 3mil) followed by one coat of MC-Ferrox B (DFT 3mil). A topcoat MC Luster Semi Gloss / Canadian Coast Guard Red (DFT 3mil) to match the Amercoat 339 C.G. Red of the Hull coat must be the last coating to be applied to the repair area.

#### **44.4 Inspections**

The Contractor must allow the TA and IA the opportunity to inspect the exposed channel of the fendering once the rubber has been removed.

## **45.0 ACCOMODATION LIGHTING UPGRADE**

### **45.1 Identification**

The purpose of this specification item is for the Contractor to remove the existing fluorescent lighting units on each of the three accommodation decks and replace with new Contractor supplied units.

### **45.2 References**

#### **45.2.1 Drawings**

<b>Drawing Number</b>	<b>Name</b>
VNEA2 E-1	Electrical Pwr Single Line Diagram Emerg, Shaft Gen, Essential
VNEA2 E-1	Electrical Pwr Single Line Diagram Semi & Non-Essential
VNEA2 E-32	Lighting Fire Mon. Platform, WH, WH Bridge, Foscle Deck
VNEA2 E-33	Lighting Main and Boat Decks
VNEA2 E-61	115 Volt Electrical Distribution Panel 1 of 7
VNEA2 E-61	115 Volt Electrical Distribution Panel 2 of 7
VNEA2 E-61	115 Volt Electrical Distribution Panel 4 of 7
VNEA2 E-61	115 Volt Electrical Distribution Panel 5 of 7
VNEA2 E-61	115 Volt Electrical Distribution Panel 6 of 7

#### **45.2.2 Regulations and Standards**

- a) Canada Shipping Act, 2001, Crew Accommodation Regulations
- b) TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- c) IEEE STD 45 – 1998 Recommended Practice for Shipboard Electrical Installations

### **45.3 Technical**

#### **45.3.1 General**

- 45.3.1.1 The Main, Boat and Foscle Deck accommodation areas are currently fitted with 4' T-12 fluorescent lighting fixtures. All T-12 Fluorescent fixtures must be replaced with current production LED lamp fixtures. The exact number of fixtures must be confirmed by the Contractor during the site visit. Current production refers to fixtures currently being manufactured with all individual parts being new and easily obtainable commercially.
- 45.3.1.2 The Main, Boat and Foscle Deck accommodation corridors are currently fitted with Corner incandescent lighting fixtures (Fixtures labelled as "CI" on the VNEA2 E-32 and VNEA2 E-33 drawings). All Corner fixtures must be replaced with current production LED lamp fixtures.

- 45.3.1.3 The Main, Boat and Foscle Deck common areas are currently fitted with fluorescent lighting fixtures (Fixtures labelled as “E”, “M1” and “M3” on the VNEA2 E-32 and VNEA2 E-33 drawings). All fluorescent fixtures must be replaced with current production LED lamp fixtures.
- 45.3.1.4 All 4’ fixtures must fit in the same dimensional footprint and location as the existing fixtures, and be lower profile fixtures than the existing. The deck heads may require modification to accommodate the new fixtures.
- 45.3.1.5 All Corner fixtures must fit in the same dimensional footprint and location as the existing fixtures.
- 45.3.1.6 All existing fixtures must be electrically isolated, dismantled and the existing wiring protected in place for reuse with the new fixtures.
- 45.3.1.7 All new fixtures must be capable of producing similar lumen rating as the existing fixtures, and be capable of operating on the existing lighting voltage and amperage rated circuits. The illumination must meet the requirements of the Crew Accommodation Regulations of the CSA, 2001.

The Contractor must dispose of all removed fixtures as Category “C” property. All ballasts must be properly disposed of in the case of those that may contain PCB’s, and fluorescent bulbs with mercury content. Disposal certificates for these ballasts and bulbs must be provided to the TA.

- 45.3.1.8 The Contractor must install new hangers or support arrangements for the new lighting fixtures. All fixtures must be installed and secured in accordance with the manufacturer’s recommendations and in accordance with the Regulations and Standards noted in Section 45.2.2.

#### 45.3.2 **Foscle Deck Replacements**

- 45.3.2.1 The Contractor must supply and install fourteen (14) new 4’ lighting fixtures indicated as “A” fixtures on drawing VNEA2 E-32 for the following areas:

a) Chief Engineer	3
b) Commanding Officer	3
c) Senior Engineer	2
d) Chief Officer	2
e) Logistics Officer	2
f) Electronics Room	2

- 45.3.2.2 The Contractor must supply and install eight (8) new Corner lighting fixtures indicated as “CI” fixtures on drawing VNEA2 E-32 for the following areas:

a) Foscle Deck Corridor	4
-------------------------	---

- b) Foscle Deck Stair Tower 4

**45.3.3 Boat Deck Replacements**

45.3.3.1 The Contractor must supply and install sixteen (16) new 4' lighting fixtures indicated as "A" fixtures on drawing VNEA2 E-33 for the following areas:

- |                       |   |
|-----------------------|---|
| a) Second Officer     | 1 |
| b) Third Officer      | 1 |
| c) Quartermasters     | 1 |
| d) Winchman/Spare     | 1 |
| e) Seaman (2)         | 1 |
| f) Ship's Office      | 2 |
| g) Bosun              | 1 |
| h) Chief Cook         | 1 |
| i) Second Engineer    | 1 |
| j) Third Engineer     | 1 |
| k) Oilers (2)         | 1 |
| l) Engineers Office   | 2 |
| m) Seaman (2) inboard | 2 |

45.3.3.2 The Contractor must supply and install one (1) new lighting fixtures indicated as "E" fixtures on drawing VNEA2 E-33 for the following area:

- |             |   |
|-------------|---|
| a) Lavatory | 1 |
|-------------|---|

45.3.3.3 The Contractor must supply and install fourteen (14) new Corner lighting fixtures equipped with LED lamps for following areas as "CI" fixtures on drawing VNEA2 E-33:

- |                           |    |
|---------------------------|----|
| a) Boat Deck Corridor     | 10 |
| b) Boat Deck Stair Towers | 4  |

**45.3.4 Main Deck Replacements**

45.3.4.1 The Contractor must supply and install sixteen (16) new 4' lighting fixtures indicated as "A" fixtures on drawing VNEA2 E-33 for the following areas:

- |                                 |   |
|---------------------------------|---|
| a) Officers Mess and Lounge     | 5 |
| b) Steward + Spare              | 1 |
| c) 2 <sup>nd</sup> Cook + Clerk | 1 |
| d) Seaman (2)                   | 1 |
| e) Cadets (2)                   | 1 |
| f) Oiler + Spare                | 1 |
| g) Canteen                      | 1 |



h) Mess + Lounge 5

45.3.4.2 The Contractor must supply and install six (6) new lighting fixtures indicated as “E” fixtures on drawing VNEA2 E-33 for the following areas:

- a) Galley 4
- b) Central Store 1
- c) Lavatory 1

45.3.4.3 The Contractor must supply and install one (1) new Corner lighting fixtures indicated as “M1” fixtures on drawing VNEA2 E-33 for the following areas:

- a) Lavatory 1

45.3.4.4 The Contractor must supply and install one (1) new Corner lighting fixtures indicated as “M3” fixtures on drawing VNEA2 E-33 for the following areas:

- a) Lavatory 1

45.3.4.5 The Contractor must supply and install fourteen (14) new lighting fixtures indicated as “CI” fixtures on drawing VNEA2 E-33 for the following areas:

- a) Aft Corridor 3
- b) Stair Towers 4
- c) Forward Corridor 7

#### **45.4 Inspections and Tests**

45.4.1 The Contractor must allow the Technical Authority and Inspection Authority the opportunity to inspect the securing arrangements of the new recessed fixtures prior to the final deck head installation.

45.4.2 The Contractor must demonstrate to the TA the proper operation of all newly installed lighting fixtures as well as all other receptacles and lights on the lighting circuits to ensure proper operation.

#### **45.5 Deliverables**

45.5.1 The Contractor must deliver all operating, maintenance, instruction or spare parts manuals supplied with the new lighting fixtures to the TA.

## **46.0 OILY WATER SEPARATOR REPLACEMENT**

### **46.1 Identification**

- 46.1.1 The intent of this specification is for the Contractor to remove and replace the Oily Water Separator.

### **46.2 References**

#### **46.2.1 Guidance Drawings/Reports**

- a) C14-40-538-01 Oily Water Separator Selection Report
- b) 514-10-000 RWO Oily Water Separator SKIT/S DEB 2012
- c) 114-DEBC15-0001 RWO Dimensional Drawing SKIT/S DEB 1.5 m<sup>3</sup>/h
- d) Installation, operating and maintenance manual SKIT/S- DEB
- e) C14-40-538-02 Oily Water Separator Installation

#### **46.2.2 Regulations**

- 46.2.2.1 The following regulations must be used in carrying out this work. Current edition of documents, at time of contract implementation, must be used.
- a) Canada Shipping Act, 2001 – Marine Machinery Regulation
  - b) Transport Canada, TP 127, Part 1, Section 1.8
  - c) IMO MARPOL resolution MEPC.107 (49).
  - d) SOR-2012-69 Vessel pollution and Dangerous chemical regulation.
  - e) Transport Canada, C.R.C., c. 353, Arctic shipping Pollution Prevention Regulation.
  - f) IACS No 47 Shipbuilding and Repair Quality Standard

#### **46.2.3 Nameplate Data**

##### **46.2.3.1 Removed Equipment**

- 46.2.3.1.1 Oily Water Separator unit, RWO Abwassertechnik SKIT/S 1E, 1.5 m<sup>3</sup>/hour.

##### **46.2.3.2 Replacement Equipment (Supplied by Contractor)**

- 46.2.3.2.1 Veolia RWO SKIT/S DEB 1.5 separator unit (or equivalent)

#### **46.2.4 Owner Furnished Equipment**

- 46.2.4.1 The Contractor must supply all materials, equipment, and parts required to perform the specified work unless otherwise stated.

## **46.3 Technical**

### **46.3.1 General**

- 46.3.1.1 The unit is situated in main engine room, starboard side forward, between frames 28-29.
- 46.3.1.2 The Contractor must supply the make and model of the equipment identified above. An equivalent may be approved for use if the Contractor is able to confirm that all engineering aspects are equal to the recommended unit with regards to performance, physical size, orientation of components, and serviceability as considered in the attached Oily Water Separator Report.

### **46.3.2 Removal Preparation Work**

- 46.3.2.1 The Contractor must lock out the breaker #517-2, 15 amps, 600 Volts on electrical panel MCC No.1 before any dismantling work.
- 46.3.2.2 The Contractor must disconnect, roll up and protect the electrical power cable for further re-installation.
- 46.3.2.3 The Contractor must properly dispose of all oily water & oil inside the unit and associated pumps (approx. 50 liters) before undertaking any dismantling. Disposal must be in accordance with all Federal, Provincial and Municipal regulations and disposal certificates must be provided to the TA.
- 46.3.2.4 All the piping to and from the unit must be disconnected up to the closest isolating point, cleaned, reinstalled and blanked off for their further re-connection.

### **46.3.3 Equipment Removal**

- 46.3.3.1 Mono pump & associated piping can be dismantled from unit and removed separately.
- 46.3.3.2 Electric control panel & alarm monitor can be dismantled and removed separately.
- 46.3.3.3 Entire unit (approx. 1500 X 800 mm) to be unbolted from ships structure & will easily be maneuvered through engine room up to engine room access opening, closed by a soft patch, approximately 2200 X 1900 mm clear opening (frame 18-20).
- 46.3.3.4 Contractor responsible to determine if handrails and part of mezzanine on aft flat needs to be removed. If so, the Contractor must reinstall to "as delivered" condition under section 1.10.

- 46.3.3.5 Once up on deck, all equipment can be lifted ashore and disposed of as Category “A” property.

#### 46.3.4 **Equipment Footprint**

- 46.3.4.1 The Contractor must modify the actual seat to meet the structural requirements of the new equipment as per drawing C14-40-538-02.
- 46.3.4.2 The Veolia SKIT/S separator has to be mounted on skid, as per drawing C14-40-538-02.

#### 46.3.5 **Equipment Routing**

- 46.3.5.1 Equipment has to be brought in place following reverse order of the removal.

#### 46.3.6 **Services Re-connection**

- 46.3.6.1 New unit must be purchased with a loose control cabinet or will need to be properly dismantled by the contractor.
- 46.3.6.2 New unit must be connected as per manufacturer instruction and drawing C14-40-538-02.
- 46.3.6.3 The Contractor must install a new line from the OWS to the oily water tank as per drawing C14-40-538-02.
- 46.3.6.4 The contractor must install the control cabinet as per drawing C14-40-538-02.
- 46.3.6.5 Monitoring system and control cabinet must be linked as per equipment requirements.

#### 46.3.7 **Electrical Power**

- 46.3.7.1 The original cable #517-2 must be re-connected to breaker panel and control cabinet.
- 46.3.7.2 The lock on breaker #517-2 must be removed.

### 46.4 **Proof of Performance**

#### 46.4.1 **Inspection**

- 46.4.1.1 All work must be subject to be witnessed by the TA and the attending TCMS surveyor.

**46.4.2 Testing**

- 46.4.2.1 The Contractor must be responsible to have a manufacturer FSR on site to perform commissioning function tests of the new OWS.

**46.5 Deliverables**

**46.5.1 Documentation**

- 46.5.2 The Contractor must supply the TA with the Class Approval certificates for the new oily water separator.

- 46.5.3 The Contractor must make reference to Section 6 for the documentation requirements for the OWS maintenance and operation manual requirements and for the OWS installation drawings.

**46.5.4 Training**

- 46.5.4.1 The Contractor is responsible to give all necessary training to 3 crew to permit them to properly operate the new Oily Water Separator, in coordination with other courses provided.

## **47.0 BILGE, GREY & BLACK WATER, FIRE MAIN PIPING UPGRADE**

### **47.1 General**

The intent of this specification is for the Contractor to remove and replace pipe spools of specific systems that are identified under Article 47.3.2.3.5.

### **47.2 References**

#### **47.2.1 Guidance Drawings and Documents**

- a) VNEA2 311-006 BILGE BALLAST & FIRE PIPING ARRGT
- b) VNEA2 316-010 SEWAGE & GREY WATER ARRANGEMENT
- c) VNEA2 389-012 BOW THRUSTER COMPT ARRGT
- d) C14-40-528-12 Sewage Treatment Plan Installation
- e) C14-40-078-01 Table of Material / Piping Replacement

#### **47.2.2 Regulations**

47.2.2.1 The following regulations must be used in carrying out this work:

- a) Lloyd's Register, Rules And Regulations for the Classification of Ships (2012), Part 5, Ch 12, Sec.1,2,8,11. Ch 13, Sec.1,2,3,7.
- b) IACS No 47 Shipbuilding and Repair Quality Standard.
- c) Canada Shipping Act, Marine Machinery Regulations.

47.2.2.2 Current edition of documents, at time of contract implementation, must be used.

### **47.3 Technical Description**

#### **47.3.1 Pipe Spools to be replaced**

##### **47.3.1.1 Sewage and Grey Water System**

- a) 1-WC-3, Domestic Machinery Space
- b) 16-WC-1, Dry Provisions Store
- c) 16-WC-4, Dry Provisions Store
- d) 16-WC-5, Dry Provisions Store
- e) 17-WC-34, Sewage System Room
- f) 23WC-6, Dry Provisions Store

##### **47.3.1.2 Bilge System**

- a) 14-BL-6, Pipe Tunnel
- b) 15-BL-6, Pipe Tunnel

##### **47.3.1.3 Firefighting System**

- a) 23-FF-3, Bow Thruster Compartment

**47.3.2 Scope of Work**

**47.3.2.1 General**

- 47.3.2.1.1 Prior to all work in this section, the individual systems must be isolated, drained and the contents disposed of in accordance with all Federal, Provincial and Municipal regulations.
- 47.3.2.1.2 The spools to be replaced must be disconnected, removed, duplicated and reinstalled as per drawing C14-40-078-01 Table of Material / Piping Replacement.
- 47.3.2.1.3 All material removed becomes property of the Contractor and is to be disposed of in accordance with all Federal, Provincial and Municipal regulations and copies of disposal certificates provided to the Inspection Authority.

**47.3.2.2 Surrounding preparation and protection**

- 47.3.2.2.1 Prior to replace spool 23-FF-3, the Contractor must ventilate the old Standby Sewage Tank, now void space, portside, Fr. 37-39.
- 47.3.2.2.2 The Contractor must shut off and secure all equipment connected to the concerned lines.
- 47.3.2.2.3 All surrounding equipment or goods subject to damage must be protected in place or moved to a secure location for their afterwards reinstallation.
- 47.3.2.2.4 The Contractor must remove all insulation, cladding, lining, ceiling and flooring subject to damage and move them to a secure location for their afterwards reinstallation.

**47.3.2.3 Disassembly of Old Spools**

- 47.3.2.3.1 The Contractor must dismantle the concerned spools.
- 47.3.2.3.2 The Contractor must blank the opened lines to avoid spills.
- 47.3.2.3.3 The Contractor must move the dismantled spools to their facilities with all necessary attention to avoid damage on the ship during the removal.
- 47.3.2.3.4 Removed Spool Duplication
- 47.3.2.3.5 The Contractor must duplicate the following spools.

SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
1-WC-3	Grey Water	218-316-010 DET.'13-M'	ASTM A53 A/B SCH 40, Galv.	1 1/4"	3000# F.S. UNION



SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
16-WC-2	Grey Water	218-316-010 DET.'13-B'	ASTM A53 A/B SCH 40, Galv.	2"	1: FLG, 150# 2: Victaulic Style 07





SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
16-WC-4	Grey Water	218-316-010 DET.'13-B'	ASTM A53 A/B SCH 40, Galv.	2"	FLG, 150#



SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
16-WC-6	Grey Water	218-316-010 Plan. '9-B'	ASTM A53 A/B SCH 40, Galv.	2"	Victaulic Style 07 3000# F.S. UNION

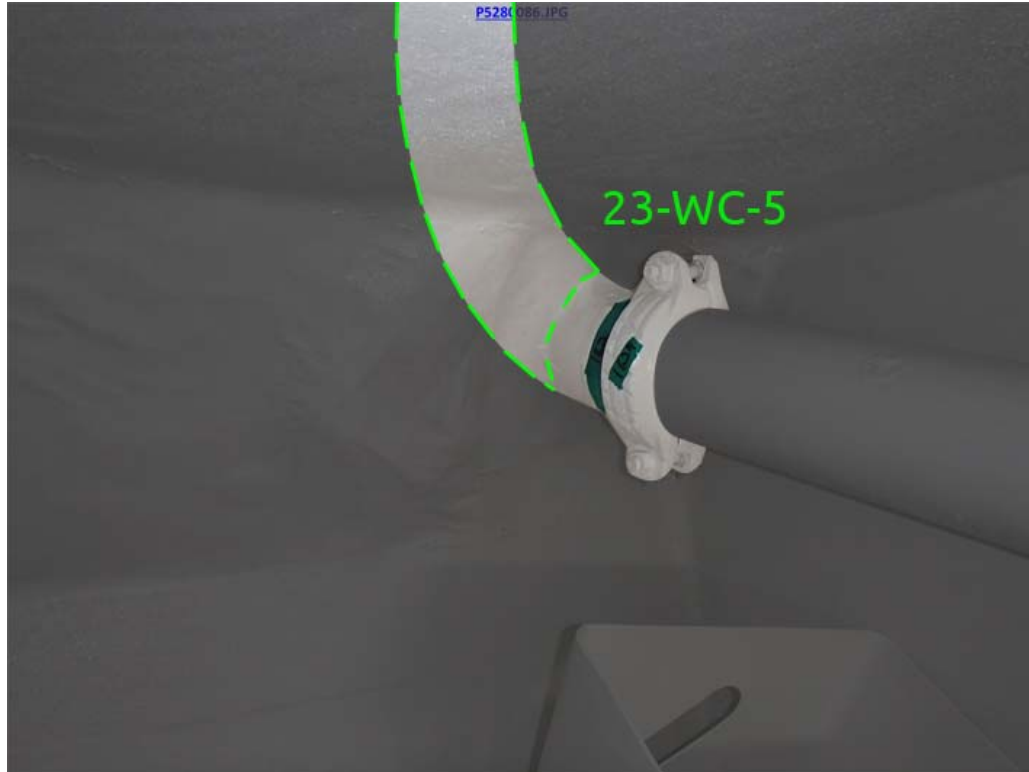




SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
17-WC-34	Black Water	218-316-010 DET.'12-B'	ASTM A53 A/B SCH 80, Galv.	6"	Victaulic Style 07



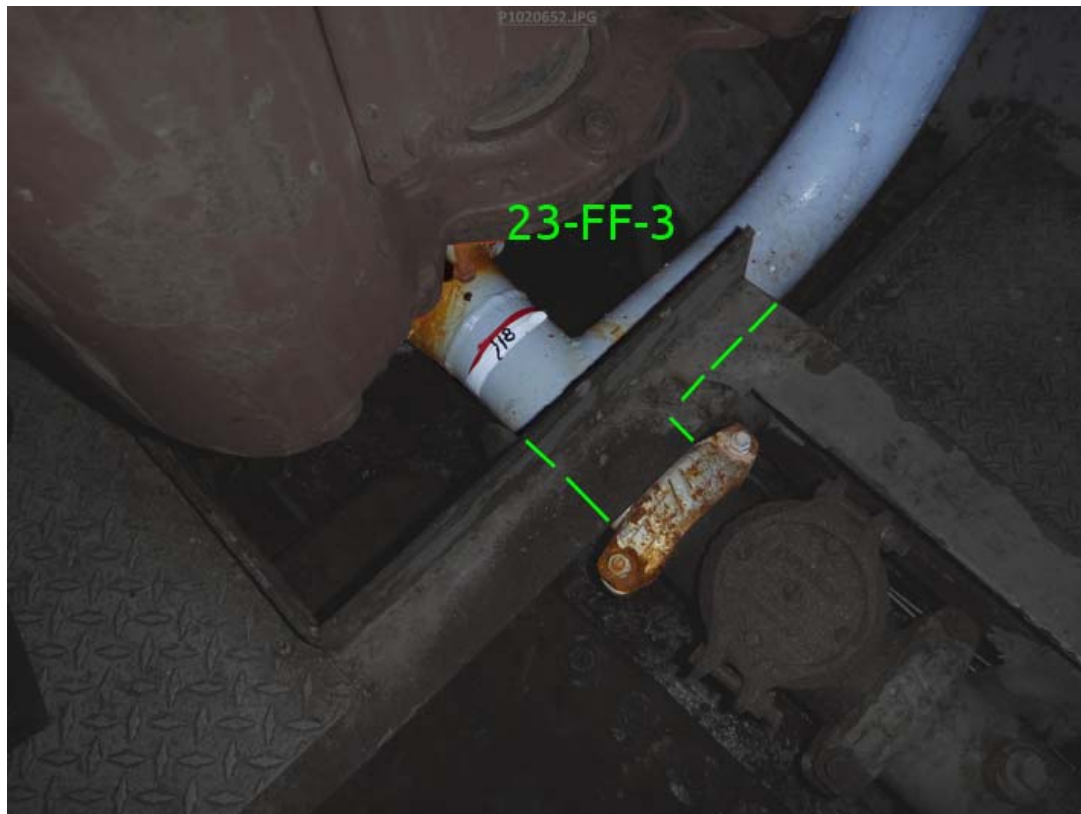
SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
23-WC-5	Black Water	218-316-010 DET.'12-c'	ASTM A53 A/B SCH 80, Galv.	4"	Victaulic Style 07



SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
14-BL-6	Bilge	218-311-006 DET.'3-A'	ASTM A53 A/B SCH 40, Galv.	2"	Victaulic Style 07
15-BL-6	Bilge	218-311-006 DET.'3-A'	ASTM A53 A/B SCH 40, Galv.	2"	Victaulic Style 07



SPOOL	SYSTEM	DRAWING	MATERIAL	DIA.	CONNECTION
23-FF-3	Firefighting	218-389-12 DET.'5-A'	ASTM A53 A/B SCH 40, Galv.	4"	Victaulic Style 07



The spools must be hot dip galvanized after fabrication then painted as per CCG standard.

47.3.2.3.6 Spools to be tested prior to their galvanization & installation.

#### 47.3.2.4 **New Spools Installation**

47.3.2.4.1 The Contractor must install the new spools using only new nuts, bolts and gaskets. All unions or Victaulic must be inspected by the TA for deterioration.

47.3.2.4.2 The Contractor must renew/repair with new and equivalent material all removed insulation, cladding, lining, ceiling and flooring.

47.3.2.4.3 The Contractor must reinstall all removed insulation, cladding, lining, ceiling and flooring.

47.3.2.4.4 The Contractor must reinstall all equipment or goods previously removed.

#### **47.4 Proof of Performance**

##### **47.4.1 Inspection**

- 47.4.1.1 All work must be witnessed by the Technical Authority and the attending TCMS surveyor.

##### **47.4.2 Testing**

- 47.4.2.1 The Contractor must be responsible to perform commissioning function tests of the systems containing the replaced spools.
- 47.4.2.2 The Contractor must make reference to Section 7.0 for additional testing requirements.
- 47.4.2.3 Any part of the upgrades performed that prove to be defective during any part of the tests must be replaced or repaired to produce a fully operational and functional system. Such occurrences may render the tests void or require further testing to be carried out to the satisfaction of the Inspection Authority.

#### **47.5 Deliverables**

##### **47.5.1 Documentation**

- 47.5.1.1 The Contractor must supply the Technical Authority with the following documentation:
  - a) CWB Certificates for Welders
  - b) CWB Certificates for Welding Supervisors
  - c) CWB Weld Procedures
  - d) CWB Weld Data Sheets



## **48.0 HIAB CRANE REPLACEMENT**

### **48.1 Identification**

- 48.1.1 The Contractor must remove the existing HIAB stores crane and supply and install a new GFE Class approved crane.

### **48.2 References**

#### **48.2.1 Documents**

- a) Palfinger PK23500MC Information
- b) Palfinger Remote Control Instructions

#### **48.2.2 Drawings**

<b>Drawing Number</b>	<b>Description</b>
VNEA2 412-003	Stores Crane Arrangement
VNEA2 435-004	Hydraulic Piping Deck Machinery
VNEA2 DA 1159	Forward System Power Pack
VNEA2 DS 1020	Hydraulic Schematic for Forward System
VNEA2 DS 1048	Electric Schematic Fwd Mooring Winches, Windlass 1 of 2
VNEA2 DS 1051	Forward System Wiring Diagram 2A of 2
VNEA2 DS 1051	Forward System Wiring Diagram 2B of 2
VNEA2 DS 1051	Wiring Diagram Fwd Winch System 1 of 2
VNEA2 E-18	Windlass Mooring Winches & Utility Crane Fwd 1 of 4

#### **48.2.3 Regulations and Standards**

- 48.2.3.1 The following regulations must be used in carrying out this work. Current edition of documents, at time of contract implementation, must be used.
- a) Canada Shipping Act, 2001 – Cargo, Fumigation, and Tackle Regulations
  - b) Transport Canada, TP 127, Part 1, Section 1.8
  - c) Fleet Safety and Security Manual (DFO/5737)
  - d) TP127 – Ship's Electrical Standard
  - e) IEEE 45:2002 – Recommended Practice for Electrical Installation on Ships
  - f) CSA W59-08(R2008) – Welded Steel Construction
  - g) CSA W47.1-09 – Certification of Companies for Fusion Welding of Steel
  - h) CSA Z150.3-11 – Safety Code on Articulating Boom Cranes
  - i) Society for Protective Coatings (SSPC) Standards

#### **48.2.4 Nameplate Data**

- 48.2.4.1 Removed Equipment
- 48.2.4.1.1 HIAB 180 Sea Crane

48.2.4.2 Replacement Equipment (GFE)

48.2.4.2.1 Palfinger Model PK23500MC with radio remote control

**48.3 Technical Description**

**48.3.1 General**

48.3.1.1 Contractor must supply all equipment, enclosures, ventilation, staging, chain falls, craneage, slings and shackles necessary to perform the work. All lifting equipment must be appropriate for the expected duties, and be accompanied by current certification indicating, or be permanently marked as to being, of an adequate safe working load for the expected duties. Any brackets or other welded attachments required in the performance of this specification must be welded into place by CWB-certified welders certified to welding Std. W47.1, Div. 1 and 2.

48.3.1.2 The Contractor must be responsible to arrange for TCMS survey when completing this specification item.

48.3.1.3 Prior to any hot work taking place, the Contractor must ensure that the area of work and any adjacent space is certified as gas free and suitable for hot work as per the preamble.

48.3.1.4 The Contractor must be responsible to protect the interior of the vessel from physical damage and contamination by generated smoke. This must include the provision of suitable extraction fans as well as suitable coverings for decks, decking, deck heads, bulkheads, and outfit as required to limit additional damages.

**48.3.2 Removals**

48.3.2.1 The Contractor must include for all temporary and permanent removals for the completion of this specification item. All permanent removals are to be disposed of as Category "C" property.

48.3.2.2 The Contractor must ensure that all electrical supplies for the identified pumps have been isolated and are secured using an established lock-out / tag out procedure.

48.3.2.3 The Contractor must collapse the crane into a stowed position prior to isolation. Once locked out, the Contractor must drain all oil from the crane and hydraulic power unit. Disposal of all oils must be in accordance with all Provincial and Municipal regulations. The Contractor must deliver the disposal certificates to the Technical Authority.

- 48.3.2.4 The Contractor must retain the forward hydraulic power unit from the general forward stores space. The hydraulic lines on the foscle deck must be removed and temporarily capped to prevent contamination in the lines.
- 48.3.2.5 The Contractor must dismount the crane from the existing pedestal and remove ashore. Disposal of these cranes and associated hydraulic power units must be the responsibility of the Contractor.
- 48.3.2.6 The Contractor must remove and dispose of the existing crane pedestal arrangement for the crane. All points of attachment must be ground flush to the existing deck with all exposed and heat affected steel being recoated as per Section 48.3.4.
- 48.3.2.7 The Contractor must remove and dispose of the existing control pedestal for the crane. All points of attachment must be ground flush to the existing pedestal with all exposed and heat affected steel being recoated as per Section 48.3.4.
- 48.3.3 **Welding**
  - 48.3.3.1 The Contractor must design and obtain TCMS approval for a new pedestal and structural supports under the foscle deck to allow the crane to be mounted approximately 150mm aft of the present location. The Contractor must develop a welding schedule approved by TCMS for the pedestal and any welding structural reinforcements to the existing ship's structure required.
  - 48.3.3.2 The Contractor must design and fabricate a new control pedestal for the crane to accommodate the new crane controls and the existing pump start and stop buttons. The new pedestal must not exceed the present pedestal's footprint without approval of the Technical Authority.
  - 48.3.3.3 The Contractor must ensure that only CWB certified welders are used to complete the welding.
  - 48.3.3.4 The Contractor must use new Grade 44W steel or better all for plating and sections. Any proposal for material substitution must be made in writing and must be approved by the Technical Authority prior to fabrication. All materials used must be in accordance with TCMS or equivalent Classification Society.
  - 48.3.3.5 The Contractor must ensure that all steel plate and sections are clean and free of scale. All surfaces must be coated with a weldable primer prior to fabrication. Material certificates for all steel must be provided.
  - 48.3.3.6 The Contractor's welding inspector will complete a visual inspection of all welds prior to arranging inspection by the attending TCMS surveyor.

- 48.3.3.7 The Contractor must remove weld splatter, smooth weld seams and sharp edges, and remove grease, smoke, and soot marks as per SSPC-SP1. All welds must be power tool cleaned to SSPC-SP3.

**48.3.4 Coatings and Paint Work**

- 48.3.4.1 The Contractor must clean all exposed steel surfaces to SSPC-SP-3 standard. Contractor must supply and apply all coating products according to the coating manufacturer's instructions. See Technical Data Package for Wasser Product Data Sheets.

- 48.3.4.2 The Contractor apply the coatings as follows:

- a) One (1) coat of Wasser primer – MC MIOZINC (DFT 3mil).
- b) One (1) intermediate coat of MC-Ferrox B (DFT 3mil).
- c) A topcoat of MC Luster 100 – Buff RAL Design 070 7040 (DFT 3mil) must be applied to the adapter plate for the crane and control pedestals.
- d) A topcoat of MC Luster 100 – Deck Grey RAL 7042 (DFT 3mil) must be applied to the deck areas affected.

**48.3.5 Installation**

- 48.3.5.1 The Contractor must install the new support structures to accommodate the installation of the new crane pedestal as per the TCMS approved design.

- 48.3.5.2 Once all deck modifications have been completed, the Contractor must install the new crane pedestal on the ship's structure. All welding must be subject to visual and magnetic particle inspection as per Section 48.4.1.2.

- 48.3.5.3 The Contractor must install the crane on the new pedestal and attach using new Contractor supplied hardware of the appropriate size. All mounting hardware must be of the Grade and sizing as suggested by the manufacturer.

- 48.3.5.4 The Contractor must install the new crane control pedestal. The Contractor must mount the new crane control unit and make all hydraulic connections between the crane and control unit as directed by the FSR. The Contractor must make all electrical connections required to the control pedestal to accommodate the new wireless remote control unit.

- 48.3.5.5 The Contractor must hydraulically and electrically connect the crane and controls to the existing hydraulic power unit as per the manufacturer's installation instructions. The Contractor must utilize existing hydraulic piping runs as much as possible.

- 48.3.5.6 The Contractor must allow for the provision of services of the crane manufacturer's authorized Field Service Representative (FSR) to oversee the final installation as well as schedule and conduct the commissioning and trials of the new cranes.
- 48.3.5.7 All exposed hydraulic fittings must be covered with a layer of Denso-Tape to protect the fittings from corrosion. The Denso-Tape must be installed only after all hydraulic testing has been completed

#### **48.4 Proof of Performance**

##### **48.4.1 Inspection**

- 48.4.1.1 All work must be subject to witness by the Technical Authority and the attending TCMS surveyor.
- 48.4.1.2 All welds must be subject to visual and Magnetic Particle Inspection (MPI). All full penetration welds must be subject to MPI. A minimum of 50% inspection of all remaining welds will be surveyed via MPI. Technician to be certified to a minimum of Level II under CAN/CGSB 48.9712 – latest edition.
- 48.4.1.3 The FSR must provide a final installation and inspection report indicating all crane commissioning has been conducted in accordance with the manufacturer's recommendations.

##### **48.4.2 Testing**

- 48.4.2.1 The Contractor must complete performance testing on the new cranes and hydraulic power units as directed by the attending TCMS surveyor and in accordance with the manufacturer's recommended instructions. Testing will include, but not be limited to:
  - a) Verification of running direction (phasing)
  - b) Pressure testing of all piping, hoses, and connections
  - c) Electrical current readings taken at condition of zero load and full load
  - d) Testing of system relief valves
  - e) Loading as per the Cargo, Fumigation, and Tackle Regulations.

#### **48.5 Deliverables**

##### **48.5.1 Documentation**

- 48.5.1.1 The Contractor must provide the Technical and Inspection Authorities with a typewritten report of the Contractors work in accordance with Section 6.2.4 of this Specification – Tests/Trials and Inspection Records.

48.5.1.2 The Contractor must ensure that the following documents are included in the final report for this specification item:

- a) Material Certificates for Plates and Sections
- b) CWB Certificates for Welders
- c) CWB Certificates for Welding Supervisors
- d) CWB Weld Procedures
- e) CWB Weld Data Sheets
- f) MPI Testing Documentation

48.5.1.3 The Contractor must update all affected “As Fitted” drawings affected by this work. These drawings must be provided in both electronic and hardcopy format. The Contractor must refer to Section 6.1 of this Specification.

48.5.1.4 The Contractor must ensure that all operation, maintenance, and installation manuals supplied with the cranes are submitted to the TA prior to the acceptance of this item.

#### 48.5.2 **Spare Parts**

48.5.2.1 All spare parts which have been supplied with this crane system and have not been used in the installation must be returned to the TA prior to the acceptance of this item.

#### 48.5.3 **Training**

48.5.3.1 The Contractor must supply the services of the manufacturer’s FSR to provide instructions to ship’s personnel in the correct operation and maintenance procedures of the new marine cranes. The training must consist of a system familiarization package, maintenance requirements, and operational training for the new crane.

48.5.3.2 The training must incorporate one eight (8) hour day following the commissioning and testing of the systems for a total of five (5) ship’s personnel.

## **49.0 MAIN BUOY DECK CLEANING AND COATINGS**

### **49.1 Identification**

- 49.1.1 The purpose of this specification is for the Contractor to grit blast and recoat to the paint manufacturer's requirements the entire main buoy deck including areas under the existing dunnage.

### **49.2 References**

<b>Document Number</b>	<b>File Name</b>
VNEA2_134-401	General Arrangement as fitted (sheet 2)

### **49.3 Technical**

#### **49.3.1 General**

- 49.3.1.1 The entire main buoy deck surface, which includes all areas covered by wooden dunnage and all traffic areas from frame 22 extending aft to frame 0 for the entire beam of the vessel must be reconditioned by painting, replacement of corroded steel and replacement of all wooden dunnage. This specification of repair must be scheduled when painting conditions are optimal and the vast majority of heavy work in the area of the main deck has been completed. (ie. Crane modifications, passage of components through deck soft patch).
- 49.3.1.2 Sections 2.2 – Protection of Personnel, Section 2.7 – Welding, and Section 2.8 – Painting must be referred to in conjunction with the work described in this specification item. No hot work may be undertaken in the areas of any fuel tank tops (#4 P&S, #3P&S) prior to these tanks being emptied of fuel and being declared safe for hot work by a certified Marine Chemist.
- 49.3.1.3 This work item must be done in conjunction with the following Specification items:
- a) Section 13.0 Propulsion Engine Block Replacement;
  - b) Section 16.0 Gearbox Overhaul;
  - c) Section 25.0 Buoy Crane Upgrade
  - d) Section 31.0 Cargo Hatch Replacement
  - e) All other specification items that require the main deck as a transit route for the removal and installation of equipment.
- 49.3.1.4 A condition survey of the main deck steel has been conducted and the results show no diminution that would result in the need to replace steel deck plate. After the removal of the dunnage and cleaning of the deck steel, the Contractor, together with the Technical and Inspection Authorities must inspect the cleaned steel deck and any areas of concern will be identified. Any UT investigation and subsequent steel insert repair will be addressed by submitting a PWGSC Form 1379.

**49.3.2 Dunnage removal and Steel repair**

49.3.2.1 Contractor is to commence with the removal of all enclosing plates for the deck tie-down channel system (7 channels total). All plates must have welds released so that the plates in best condition may be re-used (must mark location prior to releasing). Contractor to bid on supply of 100ft of ¼" x 10" mild steel flat bar (ASTM A-36) to replace enclosing plates deemed unsuitable for re-use by Technical Authority. Adjustments will be made by submitting a PWGSC Form 1379.

49.3.2.2 All wooden dunnage from each of the 8 sections of the main deck must be released from its retention angle bar arrangement and disposed of by contractor except the lumber for Section #1. Approximate square footage of each section as detailed in the following list must be re-covered with 3" x 10" Hemlock, rough-cut boards. Custom cutting of boards must be required to fill each section in terms of length and locking tongue ends.

- |                                |  |
|--------------------------------|--|
| a) Section 1: Fr 1 to Fr3      | All lumber to be Category "B" property |
| b) Section 2: Fr 3 to Fr6      | 315 sq ft approx                       |
| c) Section 3: Fr6 to Fr8       | 335 sq ft approx.                      |
| d) Section 4: Fr8.5 to Fr10.5  | 270 sq ft approx                       |
| e) Section 5: Fr11 to Fr13     | 220 sq ft approx                       |
| f) Section 6: Fr13.5 to Fr15.5 | 335 sq ft approx                       |
| g) Section 7: Fr 16 to Fr 18   | 370 sq ft approx                       |
| h) Section 8: Fr18 to Fr20     | 370 sq ft approx                       |

49.3.2.3 All retention angle bar to be inspected by Contractor. This includes angle bar used to frame around all of the D-ring hold-down pockets of the main deck area. Any sections requiring replacement must be marked and indicated to TA prior to removal of any angle bar from the main deck. Once agreement of corroded segments to be removed has been reached, contractor to cut out affected lengths of angle bar and prepare surface for re-welding of new material. Contractor must include the supply of 400 feet of 2.5 x 2.5 x 5/16" mild steel angle within the bid price of this contract. Adjustments will be made by submitting a PWGSC Form 1379.

49.3.2.4 New sections of retention angle bar must be welded into previously prepared areas. Intermittent filet welding of all angle bar is to be employed for connection of angle to the steel deck. (4" weld x 12" space) Angle bar is to be installed in the same arrangement as original.

49.3.2.5 Wooden bumpers installed as protection around each mast base on the Port side of the main deck (one located forward of aft-most Bollard frame 6.5, one located by #5 Port Ballast tank vent frame 13) must be removed for surface preparation of the main deck. The retaining studs of these wooden bumpers to be protected from damage to enable re-install.



- 49.3.2.6 The triangular machinery mounting plate welded into the raised coaming (forward of #5 P Ballast tank vent frame14,) must have its welds released and the steel under to be inspected as in Section 49.3.1.4.
- 49.3.2.7 The coaming of this machinery mounting plate to be given drainage holes as indicated by TA prior to the mounting plate being re-welded into position after all painting in the area of the coaming has been completed.
- 49.3.2.8 Both bolted feet connections of the Stbd side bulwark (Frame 20 and Frame18) must be cropped out and disposed of. The forward stay plate to be cut at a level, which is 2 inches above a developed stress fracture, suitable for blending in steel flat bar for attachment of the stay direct to the deck. The steel deck in way of these bolted connections to be inspected as in Section 49.3.1.4.
- 49.3.2.9 The base of each bulwark stay plate must now be repaired with the use of 3/8" x 5" mild steel flat bar (ASTM A-36) such that the connection to the steel deck is similar to all other stays for the bulwark system on the stbd side of the main deck. Full penetration fillet welding all around must be used for the connection to the deck of each extended stay plate.
- 49.3.2.10 The bulwark on the stbd side of the main deck connects to an angled plate at its very most forward end termination. This connection at Frame 21.5 was a bolted interface in original condition. The bulwark has since been welded but the bolted attachment point has remained.
- 49.3.2.11 Contractor must remove the entire bolted connection channel bar and 1 inch thick bolt connection plate at the forward end of the stbd side bulwark. Steel to be disposed of by contractor.
- 49.3.2.12 The starboard side bulwark angled connection plate must become exposed and must be repaired by steel insert plate method (approximately 3 square feet of ½ inch mild steel plate ASTM-A36). Full penetration fillet welding to be employed to re-attach the insert plate to the deck, ship's side plating and support stiffener. Contractor to provide a drainage hole at the interface of connection between the deck plating and the hull plating.
- 49.3.2.13 The upper and lower pipe rails of Stbd bulwark to be extended with schedule 80 pipe of appropriate diameter to the angled connection plate to form a welded termination. Insert plate must be fitted to the bulwark between the upper and lower pipe rails to be welded to the angled connection plate. Contractor to weld insert plate into position to match the same appearance as the forward end of the Port side bulwark at Frame 22 of the main deck. All steel in this area must now be fully exposed for coating maintenance.

49.3.2.14 The spare anchor at the base of the crane must be released and removed from the vessel so that the deck plating area beneath the anchor and within the mounting base can be properly prepared for coating application.

49.3.2.15 The large deck equipment container must be released from its position at Frame 22, centerline of vessel and removed from the vessel so that the area directly under this container can be properly prepared for coating application.

#### 49.3.3 **Surface Preparation**

49.3.3.1 All commercial equipment, coatings, chemicals and other materials required for proper application of paint system must be Contractor supplied. As a guide, all areas currently coated on the main deck horizontal surface with International Paint product Interlac 665 Red (product code CLL274) and the area under any deck dunnage must be prepared to accept coating products.

49.3.3.2 All horizontal traffic deck areas with minimal interference items and horizontal areas within the dunnage sections of the main deck surface must be prepared by BLAST TRACK method to bare steel SSPC-SP5 standard.

49.3.3.3 All inaccessible and internal areas as well as the surface area extending beneath the bulwarks to the sheer stake of the hull must be prepared by GEO-BLAST equipment to SSPC-SP 10 standard. Holdtight 102® must be added at a mixture ratio of 50:1 for all water utilized with the GEO-BLAST method. This will serve to minimize particulate ingress to other work areas and prevent flash rusting. See Technical Data Package for information on GEO-BLAST equipment.

49.3.3.4 All Deck rings and deck lugs and areas of steel repair on the main deck area to be prepared with GEO-BLAST equipment as per Section 49.3.3.3.

49.3.3.5 Any new or re-used enclosing plates for the tie-down channels must be prepared by GEO-BLAST method.

49.3.3.6 Contractor must exercise caution when preparing the surfaces in way of the Western Machine Works Tow pin system. The hydraulic rams and tow hook must be protected from debris ingress. Exterior surfaces of tow pin and tow hook must receive paint but paint must be kept from creeping into open seams.

49.3.3.7 Contractor must also prepare the deck contained within the save-all coaming provided for the Oily Waste Water discharge connection. Frame 22, inboard of the Stbd Hydraulic Tugger winch. GEO-BLAST method to be employed.

- 49.3.3.8 The Contractor must supplement both commercial processes with SSPC –SP2 and SP3 Hand and power tool cleaning for any remaining areas of rust, scale and loose paint in the work area. Contractor to ensure that any retained coatings have an adhesion testing of minimum 250psi.
- 49.3.3.9 Prior to application of any coatings all areas of the main buoy deck that have been prepared by commercial or hand tool method must be de-salinated with HOLDTIGHT 102® water mixture to remove chlorides and to prevent flash rusting. Mixture ratio of 100:1 and applied at 3000psi pressure. See Technical Data Package for information on Holdtight 102.
- 49.3.3.10 Prior to any commencement of coating application, the fully prepared area must be displayed for inspection by the TA. Contractor must correct any deficiencies noted by TA prior to commencing product application.

49.3.4 **Product Application**

- 49.3.4.1 The following is a list of products to be utilized for the application covering of the main deck. Product manufactures are Wasser High-Tech Coatings and Aqualoc.

- a) Stripe coat: MC MIO ZINC
- b) Full Primer: MC MIO ZINC
- c) Intermediate Coat: MC TAR Black
- d) 2<sup>nd</sup> Intermediate Coat: MC TAR Red
- e) Top Coat for Bulwark steel area: MC LUSTER 100 – CG Red RAL 3000
- f) Anti- slip coating: MC TRUGRIP 100 Red Brown RAL 3011
- g) Dunnage section topcoat: RUBBER GUARD by Aqualoc

Please see Technical Data Package for product information of all above listed coatings.

- 49.3.4.2 Recommended Distributor for all above products

K&D Pratt Limited

55 Akerley Blvd

Dartmouth NS B3B 1M3

Ph: (902)468-1955

Product representative: Barry Schnare (902) 456-9238cell

Email: [barry.schnare@kdpratt.com](mailto:barry.schnare@kdpratt.com)

- 49.3.4.3 Contractor must protect the grease fittings and each tow pin or tow hook device for the Western Machine Works tow pin system – located just forward of the stern roller. The exterior surface of the pins, hook and grease nipples must receive 2 primer coats and 1 coat of MC TAR BLACK, but no other products to be applied to

these operating pieces of equipment. Care to be taken to eliminate paint creeping into seams for this system that would restrict movement.

- 49.3.4.4 Contractor must provide protection to all sounding tube caps within the main deck area to prevent them from being painted shut.
  - 49.3.4.5 Entire main deck prepared areas must first be given a Stripe coat of MC MIO ZINC (3mils DFT) to all edges, crevices, nuts, bolts, back-to-back angle and weld seams.
  - 49.3.4.6 Entire main deck prepared areas to now receive 2 full primer coats of MC MIO ZINC (3mils DFT per coat) and be allowed to cure.
  - 49.3.4.7 Entire main deck prepared areas to now receive first intermediate coat of MC TAR BLACK (6mils DFT)
  - 49.3.4.8 Entire main deck prepared areas to now receive second intermediate coat of MC TAR RED (6mils DFT).
  - 49.3.4.9 Line items 49.3.4.6 to 49.3.4.8 must be applied to all main deck tie-down channel enclosing plates and the machinery mounting plate prior to their re-installation.
  - 49.3.4.10 All dunnage sections of the deck must now receive a topcoat of RUBBER GUARD, to be applied to the horizontal deck surface only (20mil DFT). Roller application is acceptable. This product must not be applied to the fasteners or deck surface of the main engine room soft patch.
  - 49.3.4.11 TRUGRIP anti-slip coating must be applied to an area consisting of the perimeter of the dunnage sections excluding some of the deck fixtures and the tie-down channels to 25mil DFT(mixed to CG Red Brown, RAL3011 colour specification). This area to be coated will be confirmed with the TA with contractor in attendance.
- 49.3.5        **Reassembly of Main Deck**
- 49.3.5.1 After all coatings have been allowed to fully cure, contractor must prepare CSM Hemlock lumber to fit into the 8 sections of the deck. Contractor must note the contact information of a supplier with known inventory of the product (3" x 10" rough cut stock) to be re-installed:

Hefler Forest Products Ltd.  
230 Lucasville Rd  
Middle Sackville, NS  
Phone: 902-865-1158

- 49.3.5.2 Contractor must exercise caution and make use of welding blankets to protect new coatings from weld spatter. The use of MIG welding machines to limit spatter and weld debris is preferred.
- 49.3.5.3 Contractor must apply Denso paste to all surfaces that have been previously coated with Rubber Guard, this will provide easement for positioning of deck dunnage.
- 49.3.5.4 After all Hemlock dunnage has been re-installed, contractor must weld into place the final segments of 2.5 x 2.5 x 5/16 angle to lock each dunnage section and prevent dunnage movement at sea. Final segments to be assembled according to original arrangement (4" weld x 12" space).
- 49.3.5.5 All enclosing plates must be re-welded into position according to original arrangement (ensure opening of 10 inches at each deck tie-down ring).
- 49.3.5.6 Once all welding is completed, all weld areas to be cleaned to SSPC-SP2 and SP3 for application of two coats of MC MIO ZINC primer (3mil DFT per coat) followed by one top coat of MC TAR RED (3mil DFT).
- 49.3.5.7 The steel work area of the Bulwark connection (item 49.3.2.12) on the Stbd side must receive topcoat of MC-Luster 100 CG RED, RAL 3000 (3mil DFT)
- 49.3.5.8 Wooden bumpers for the mast post locations on the Port side of the main deck to be re-secured with stainless fasteners.
- 49.3.5.9 Ship's spare anchor to be lifted onto vessel and re-secured into original position.
- 49.3.5.10 Deck Gear container to be lifted onboard vessel and secured to deck by welding in its original position. Same coating application as section 49.3.5.6 to be utilized for coating repair to the weld areas required to re-secure the Deck Gear container.
- 49.3.5.11 Triangular mounting plate for the Port side machinery mounting location must be re-welded within its coaming as per original. Drainage holes for the coaming to have been previously cut in the steel at section 49.3.2.7.

#### **49.4 Inspections**

- 49.4.1 The Contractor must submit the completed After Deck for inspection by the Inspection Authority to ensure that all work as per the specification has been completed.

- 49.4.2 Upon completion of all coating applications the Contractor must take no less than 5 dry film spot thickness readings of the coating in each 10 m<sup>2</sup>. The dry film thickness measurements of must meet the numerical requirements of the SSPC PA 2 Appendix 1. Readings must be recorded and be contained in the final report.

## **49.5 Deliverables**

### **49.5.1 Report**

- 49.5.2 The Contractor must provide a coating application report to the Inspection Authority and the Technical Authority that details all of the particulars of the coating application process as completed by the Contractor. The report must include environmental conditions such as dry and wet bulb temperatures, relative humidity, and dew point at the time any coatings are applied and at which areas on the After Deck the coating was applied. The locations of the readings must be marked on a plan drawing of the Main Buoy Deck. Also to be included in the report must be the temperature of the product at application time as well as wet and dry film thickness gauge readings.

## 50.0 SEARCHLIGHT REPLACEMENT

### 50.1 Identification

- 50.1.1 The Contractor must remove the three existing Carlisle & Finch Searchlights including starter panels (3 of), controls, and associated wiring. Contractor will install three new Owner supplied ColorLight CL-35 Searchlights, controls and associated wiring.
- 50.1.2 Overview of the work required is as follows. Contractor must remove existing searchlight starter panels from present location in the Electronics Room. The 600 V feeds to each of the old starter panels will be run to 600V / 120V transformers, which the Contractor will install in the crawl space below the bridge. The Contractor must run new cable from these transformers to new E-boxes, which the Contractor will install in the bridge crawl space. Contractor must run Cat5 cable from each of the E-boxes to an Ethernet switch located on the bridge. Four remote control panels will be installed on the bridge, and connected to the Ethernet switch by Cat5 cables. Antennas for wireless remote controls for each of the three search lights will be installed on the bridge.

### 50.2 References

#### 50.2.1 Drawings and Documents

Document Number	File Name
	Colorlight Manual_CL20, CL25, CL35_Eng
	Installation Manual CL25, CL35 Ver.F1.6 ENG
	CL OP3G New Remote CadDWG
	CL35 Dimensions
	Power Cable Tec Spec
	Communication Cable Spec
	Hammond Titan Single Phase Data Sheet
VNEA2_134-401	General Arrangement as fitted
VNEA2 E-1	Electrical Power Single Line Diagram 1 of 2
VNEA2 E-1	Electrical Power Single Line Diagram 2 of 2
VNEA2 E-27	Searchlights Block & Connection Diagram
VNEA2 E-61	115 Volt Electrical Distribution Panels 3 of 7

#### 50.2.2 References

- 50.2.2.1 **The following regulations must be used in carrying out this work. Current edition of documents, at time of contract implementation, must be used.**
- Canada Shipping Act, 2001
  - Transport Canada, TP 127, Part 1, Section 1.8
  - Fleet Safety and Security Manual (DFO/5737)
  - TP127 – Ship's Electrical Standard

- e) IEEE 45:2002 – Recommended Practice for Electrical Installation on Ships
- f) CSA W59-08(R2008) – Welded Steel Construction
- g) CSA W47.1-09 – Certification of Companies for Fusion Welding of Steel
- h) Society for Protective Coatings (SSPC) Standards

### **50.3 Technical**

#### **50.3.1 General**

**50.3.1.1 The three searchlights are located above the wheelhouse, with two mounted on the extreme outboard edges of the wheelhouse top facing forward, and one mounted on the centreline of the fire monitor platform at the after edge.**

**50.3.1.2 There are controllers for all three of the searchlights on the forward and after bridge consoles, and each wing console has one controller each for the light above that bridge wing.**

**50.3.1.3 The searchlight starter cabinets, and control assembly junction boxes are located in the electronics room on the foscle deck.**

**50.3.1.4 Contractor must isolate and lockout/tag out the affected circuits for all three searchlights. This includes the 115 volt anti-condensation heater circuits as indicated on drawing VNEA2 E-61. The following circuits are affected:**

- a) Emergency Switchboard 600 Volt supply Breaker 5E2-10 Port Search light
- b) Emergency Switchboard 600 Volt supply Breaker 5E2-11 for the Starboard search light
- c) Emergency Switchboard 600 Volt supply Breaker 526-8 for the after search light
- d) Base Heater 120 Volt, for Stbd search light: 1M3-1 , Located in Wheelhouse.
- e) Base Heater 120 Volt, for Port search light: 1M3-3, Located in Wheelhouse.

**50.3.1.5 Contractor will be required to removed deck head panels and bulkhead panels to facilitate the removal and installation of the searchlights and associated components. All panels must be reinstalled at the end of the searchlight installation in ‘as delivered’ condition.**

**50.3.1.6 The Contractor must refer to the Color Light CL35 Searchlight System User’s Manual.**

**50.3.1.7 Contractors must supply all materials necessary to perform the work in this specification unless otherwise specified.**



50.3.2 **Coatings and Paint Work**

50.3.2.1 **The Contractor must clean all exposed steel surfaces to SSPC-SP-3 standard. Contractor must supply and apply all coating products according to the coating manufacturer's instructions. See Technical Data Package for Wasser Product Data Sheets.**

50.3.2.2 **The Contractor must apply the coatings on the outside areas as follows:**

- a) One (1) coat of Wasser primer – MC MIOZINC (DFT 3mil).
- b) One (1) intermediate coat of MC-Ferrox B (DFT 3mil).
- c) A topcoat of MC Luster 100 – White: RAL9003 (DFT 3mil) must be applied to the searchlight mounting bases and railings.
- d) A topcoat of MC Luster 100 – Deck Grey RAL 7042 (DFT 3mil) must be applied to the deck areas affected.

50.3.2.3 **The Contractor must apply the coatings on the interior areas as follows:**

- a) One (1) coat of Wasser primer – MC MIOZINC (DFT 3mil).
- b) One (1) intermediate coat of MC-Ferrox B (DFT 3mil).
- c) A topcoat of MC Luster 100 – White: RAL9003 (DFT 3mil) must be applied to the searchlight mounting bases and railings.

50.3.3 **Removals**

50.3.3.1 **Contractor must disconnect and dismount the existing Carlisle and Finch Searchlights complete with their bases from their mounted positions on the wheelhouse top and the fire monitor platform. These redundant searchlights must be transported ashore and retained as Category “A” property. The shock absorbing bases are to be altered and used for the installation of new ColorLight searchlights.**

50.3.3.2 **The Loud hailer on the port and starboard search lights is to be mechanically detached from the search light and be electrically isolated. The loud hailer is to be considered Category “B” until they are re-installed by the Contractor. The electric cable for the loud hailer is to be withdrawn into the deck head of the bridge, to permit removal of its kick pipe.**

- 50.3.3.3 **Contractor must disconnect and dismount the three redundant Carlisle and Finch searchlight starters located in the Electronics Room on the foscle deck. These panels must be transported ashore and retained as Category “A” property. Contractor must remove all wiring and controls associated with the Carlisle and Finch Searchlights between the searchlight starter panels and the search lights, and also remove the cable for the search light heaters (120 V). Contractor to note that, in addition to the starter panels located in the electronics room, the aft searchlight has a control box located in the bridge crawl space, see photo 50.1.**



Photo 50.1 Aft Searchlight Control Panel in Bridge Crawl Space

- 50.3.3.4 **The Contractor must megger all power cables between the 600 V breaker panels located in the Emergency Generator Compartment and the search light starters in the Electronics Room to ensure they are in condition to be reused and present the results to the TA for evaluation as to whether the cables may be reused for the new searchlights. New cables required as a result of poor megger results will be addressed by submitting a PWGSC Form 1379.**
- 50.3.3.5 **The Contractor must remove the transformer for the after search light located in the Electronics Room below its starter box. Contractor is to note that the power and control cables for the after search light currently pass on the underside of the Fire Monitor Platform through steel conduits. These pipes are to be cropped out and disposed of as Category “C” property.**
- 50.3.3.6 **Contractor is to remove all kick tubes at the base of each search light to the deck level. The steel deck must be cut to remove the electrical wire kick-tubes and to allow fitting of a square stand tube approximately 350mm in height.**

**Contractor must note that the location of the kick tubes for the after search light is located just forward of the starboard stack.**

**50.3.4 Installation**

**50.3.4.1 Contractor must fabricate a foundation arrangement for each new searchlight that corresponds to the dimensions of the Foundation Plate illustrated on page 10 of the ColorLight User's Manual. Each foundation plate is to be welded to the circular plate on top of each of the three search light supports. The Contractor is to ensure that the 20 mm diameter holes on the foundation plate are unobstructed to permit the installation of the anti-vibration mounts.**

**50.3.4.2 Contractor must install new Owner supplied searchlights to the new foundation plates, using anti-vibration mounts as per page 7 of the ColorLight User's Manual. The three search lights must be installed in such a way that the power cable for each faces aft. Note: The power cable and the signal cable for each search light must remain attached to the search light at all times. Should the cables need to be made shorter, the cable must be cut at the free end, not at the search light.**

**50.3.4.3 Contractor must install new schedule 40 electrical conduit in the same configuration as the original conduit for the Aft searchlight under the fire monitor platform.**

**50.3.4.4 For the Aft Searchlight, Contractor must fabricate a 300mm x 300mm square base plate of 10mm thick steel plate and weld it to the deck of the former fire monitor platform, approximately 0.5 meters to starboard of the present location of the after search light. Continuous, full penetration fillet welds are to be employed. The contractor will crop the existing support stanchion for the after search light and weld it to the new base plate using full penetration fillet welds, so as to permit 360 degree rotation of the new searchlight. The former location of the support stanchion must be mechanically ground flush with the surrounding deck. If a deck penetration is found to exist upon removal of the search light stanchion, the hole is to be repaired using a steel insert plate of the same thickness as the existing deck. Insert plate is to be welded with full penetration fillet welds.**

**50.3.4.5 The Contractor must cut the steel decks to allow fitting of a square kick stand tubes approximately 350mm in height. These stand tubes must be fitted with a "Roxtec" transit block with a stainless steel wedge kit. Size of Roxtec transit block to be decided by TA prior to procurement by contractor. The transit block must have capacity for future runs of wire. The stand tube to be welded to the deck with full penetration fillet welding from above and below deck. Contractor is responsible to remove any insulation and interference**

**items for the removal of kick-tubes and the cutting/fitting of new stand tube for the transit block.**

- 50.3.4.6 **Once the stand tubes are erected they must be fitted with Roxtec transit and sealed with plugs to allow a hose test of the welded joints. The hose test must be witnessed by the TA.**
- 50.3.4.7 **Contractor must run the control cable and the signal cable from each search light to the corresponding E-panels in the bridge crawl space via the appropriate Roxtec transit. These cables must be run from each search light, through the transit, then along existing cable trays above the Wheelhouse deckhead panels, pass through the existing wire transits in the deckhead of the bridge crawl space, to the appropriate E-box. Cable length from E-panels to each searchlight is approximately 25 meters.**
- 50.3.4.8 **Contractor must install new, CFM, 600V/120V transformers for the port, starboard, and after search lights in the crawl space below the bridge. Suggested transformers are:**  
HSP Titan  
Model: Q003PEKF  
3000VA  
600Volt Pri  
120/240Sec  
1 Ph  
NEMA 3R

**Note:** Equivalent transformers will be considered and must be agreed upon by the TA.

- 50.3.4.9 **Contractor must construct a base of ASTM A36 mild steel angle bar 50x50x6mm for each transformer. These bases must be secured to the deck of the crawl space using small angle iron feet, to ensure they are lifted up a minimum of 50mm from the deck. Continuous welds to be used. The base must be sized so as to support each transformer. Contractor must weld two lengths of ASTM A36 mild steel flat bar 50 x 6mm between adjacent angle bar supports for the bridge deck, at a height such that the securing lugs on the top of each transformer can be bolted to the flat bar. Location within the crawl space to be determined in consultation with the TA. See photo 50-2.**



Photo 50-2 Suggested location of transformer bases and horizontal support bracket in the crawl space under the bridge deck. View is looking to starboard, aft to forward.

- 50.3.4.10 **Contractor must install three E-boxes for each of the new search lights, in the bridge crawl space, port side looking aft, in the location of the removed aft searchlight control panel, see photo 50.3. Final location of the E-boxes must be determined by the TA.**



Photo 50.3 Suggested location of the new starter panels.

- 50.3.4.11 **Contractor must modify the existing location to accommodate the E-boxes. Contractor must remove the insulation from the frames, to allow 40mm angle brackets to be welded in place, full penetration welding to be used. Contractor must secure starter boxes to these brackets. Insulation must be re-installed/repared after welding and mounting complete.**
- 50.3.4.12 **Contractor must run marine grade cable from each transformer, to the corresponding E-box, via existing cable trays and conduit.**
- 50.3.4.13 **Contractor must install 600V junction boxes in the electronics room, connected to the original 600V feed for the originally fitted searchlights. Contractor must install marine grade cable from each junction box to the new transformer located in the bridge crawl space, through existing cable ways, see photo 50.4.**



Photo 50.4 Existing cable way between the electronics room and the Bridge crawl space.

- 50.3.4.14 **Contractor must mount the Ethernet switch on the bridge, beneath a control console, at a location to be determined by the TA. The Contractor must fabricate suitable brackets for this device.**
- 50.3.4.15 **Contractor must install one Controller panel at each of the following locations: the forward bridge console, the port wing console, the starboard wing console, and the aft bridge console. These consoles will have been modified to accept the Controller panels.**
- 50.3.4.16 **Contractor must run one 24V DC control cable from the Controller Panel on the Port bridge wing console to the E-box for the port search light. Contractor must run a second 24V DC control cable from the Controller Panel on the Starboard bridge wing to the E-box for the Starboard search light. Contractor will run two 24V DC control cables from the E-box for the Aft search light, one to the Controller Panel on the Forward Bridge console, and the other cable to the Controller Panel on the Aft console.**
- 50.3.4.17 **The three remote control unit antennas must be installed on brackets next to the windows on the port and starboard wings, and on the after wing of the bridge. Location to be determined by the TA. Contractor must modify the wood trim so that the antennas will mount flush with the Isolamin panel between the windows. The RS485 cables are to run from each E-box in the Electronics Equipment room, to the deck head of the Bridge, above the deck head panels, and then down to each antenna. Where cable trays are not available above the deck head panels, Contractor must weld stainless steel clips to the underside of the Wheelhouse top, in order to properly and securely support the RS485 cables.**



- 50.3.4.18 **Each E-box must be connected to the Ethernet switch using Ethernet cable, as per the manufacturer's drawings. Ethernet cable to be suitably secured with hardware supplied by the Contractor.**
- 50.3.4.19 **Each of the four search light control stations on the bridge must have Ethernet cable connected to it and run to terminals on the Ethernet switch located on the bridge.**
- 50.3.4.20 **Contractor must connect all wiring as per manufactures diagrams and instructions, and all instructions in this Specification.**
- 50.3.4.21 **Contractor must fit all associated cables with metal cable identification tags at each end and on each side of all bulkhead and deck head penetrations. Cable identification numbers to be approved by the TA before tags are installed.**
- 50.3.4.22 **Contractor is to reconnect the loud hailer electrically and re-locate the loud hailer as directed by the TA.**

#### **50.4 Tests and Trials**

- 50.4.1 The Contractor must perform a functionality test on all three searchlights in the presence of the TA in all modes of operation as detailed in the operator's manual. Any deficiencies in operation are to be corrected by the Contractor.
- 50.4.2 Contractor must provide onsite training of the new searchlight system to all identified vessel staff that would normally operate the system.

#### **50.5 Deliverables**

- 50.5.1 All system/component manuals for the newly installed system must be provided to TA in two (2) paper copies and one (1) electronic copy on CD ROM or USB format. Preferred electronic format is PDF.
- 50.5.2 Contractor must provide a revised "As Fitted" drawing of the system line drawings, system interconnection drawings and integration drawings with all newly fitted /arranged components. Section 6.1.6 of this Specification must apply to the drawings.



## **51.0 AFT CAPSTAN CONTROL STATION – WIRELESS CONVERSION**

### **51.1 Identification**

- 51.1.1 Currently Main deck capstan control stations for the Port and Starboard Capstans are a source of electrical faults for the WESTEC Aft Hydraulic System. The intent of this specification is to have fitted remote controls for the Port and Starboard capstans.
- 51.1.2 The forward control station must be completely rebuilt using the existing enclosure with all new components.

### **51.2 References**

- 51.2.1 Contractor must ensure that welding is performed by a welder certified by the Canadian Welding Bureau (CWB)
- 51.2.2 Contractor must adhere to the following codes and standards for all work involved with this contract specification:
- a) CSA C22.1 – 98 Canadian Electrical Code Standard Part I Safety Standard for Electrical Installations
  - b) CSA C22.2 – No. 0-10 General Requirements – Canadian Electrical Code Part II
  - c) DFO 5781 (18-080-000-SG-001) Welding of Ferrous Materials
  - d) TP 127E Ships Electrical Standards;
  - e) IEEE 45 Recommended Practice for Electric Installations on Shipboard
  - f) CSA W47.1 1983 – Canadian Welding Bureau Standards for the fusion welding of steel (**Minimum division level 2.0**)
  - g) ISO 9001:2000, Quality Management Systems – Requirements
  - h) MOSH
- 51.2.1 Reference drawings and Information for this specification include:
- a) SYSTEM Manual – Westec Equipment Ltd. – Aft Hydraulic System and Deck Machinery -1050 Navigation Aids Vessel
  - b) DWG 218-E-52 Cable routing below Main deck
  - c) DWG 218 – E-51 Cable routing Main & Boat deck
  - d) DWG – Westec – DS1049-Sh 1 of 2
  - e) DWG – Westec - DS1049 Sh 2 of 2
  - f) DWG – Westec - DS1054 – Sh 1A
  - g) DWG – Westec - DS1054 –Sh 1B
  - h) DWG - Westec - DS1054 – Sh 3B
  - i) DWG – Westec - DS1054 – Sh 3B of 4
  - j) DWG – Westec – DA 1300 – Capstan control console
  - k) GSM = Government Supplied Material List
  - l) Wireless Control Bill of Materials – P14-2203-WC
  - m) Wireless Capstan Control Drawing Package – Section WC

### **51.3 Technical**

#### **51.3.1 Main Buoy Deck - Removal of Control Console Heads**

- 51.3.1.1 Current location of fitted control consoles for the aft capstans is outboard of each hydraulic operated capstan head on the after section of the main deck level. Approximately at frame location 2.5. Work in this Section must be coordinated with the work in Section 49.0.
- 51.3.1.2 Contractor must ensure a gas free environment that is safe for hot work in the Steering gear void spaces (aft section). These voids are open to atmosphere at all times – no manholes are involved with entry to these spaces. NOTE: Contractor to assess the space for Tank Entry team requirement – the vessel does not consider these open voids as confined spaces.
- 51.3.1.3 All fitted cables that are currently connected to the aft capstan control stations must be removed in their entirety to the Cargo hold control cabinet. Contractor must be responsible for removing any interference items or opening of transit blocks to allow wire removal. Note that wires extend from the main HPU control cabinet then through the Steering gear passageway into the steering gear compartment before branching to each control console within the Port and stbd steering gear open void spaces.
- 51.3.1.4 Any disturbed vessel wiring that must be released to remove unnecessary control console cables must be re-secured with contractor supplied nylon cable ties.
- 51.3.1.5 The currently mounted Talk-back speaker box for each capstan head must be removed along with its communication wiring. Contractor must consult with CG Technical Solutions Center to determine the desired approach for removing the communication cables and terminating the cables within a CSM supplied junction box within the deck head area of the cargo hold. The Technical Solution Centre can be contacted at the following phone number: 1-902-407-7521
- 51.3.1.6 Contractor must deliver the talk-back boxes to TA as Category “B” property.
- 51.3.1.7 Each control console head must be removed flush to the main deck location and given to TA for stripping of useful components for spare inventory as Category “A” property.
- 51.3.1.8 The holes in the main deck that will be created must be sealed with welding of insert plate to regain watertight integrity of the deck. Contractor must prepare the holes for insert plate welding process from the upper and lower surfaces.

- 51.3.1.9 Contractor must supply required 12.5mm insert plate of Lloyds Register Grade E or equivalent. One copy of the Mill Certificate of new steel utilized must be provided to TA prior to use of the plate; in paper and electronic format (PDF is preferred).
- 51.3.1.10 All weld joints must be continuous and seal welded. Once all welding is complete, the areas must be tested for watertight integrity in the presence of TCMS and TA. Contractor to provide TA with scheduled timeframe of TCMS involvement, a minimum of 4 hours notice, prior to hose test commencement is requested.
- 51.3.1.11 Testing for water tight integrity must be completed by using a fire hose connected to a dock hydrant. The ship's crew will provide the materials and labour to conduct the hose test. This test must be witnessed by TA and TCMS Surveyor. Any deficiencies noted must be corrected by contractor and then the welds retested at contractor expense.
- 51.3.1.12 All new and disturbed steel surfaces above and below the insert repair area must be power-tool-cleaned to SSPC-SP-3 standard, primed two coats (3mil DFT) with Wasser Mio-zinc Primer and allowed to cure.

#### 51.3.2 **Installation of Wireless Remote System**

- 51.3.2.1 Contractor is to note that the flow output of the AA4V Rexroth pumps is infinitely variable from 0 to 100% and directly proportional to an electrical current applied, in the range of 200 to 600 milliamps at 24VDC.
- 51.3.2.2 All present functions of the Stbd and Port capstan control consoles must be retained by the wireless system. The handheld operator interface module (bellypack remote) must provide indication and give control for the following items:
- a) Port or Stbd capstan "In Control" indication, green LED lamps
  - b) Ability to select which capstan must be controlled, use black push buttons
  - c) Ability to stop the port or stbd hydraulic pumpset, use red push buttons
  - d) Ability to indicate the port and stbd pumpset "Running" condition, White LED lamps
  - e) Each capstan must retain the ability to be operated in a directly proportional fashion. A single lever must be used by the operator for each capstan that must allow directional as well as control of the speed of rotation. When the lever is released, the capstan head must stop all rotation and be held in the "zero" or neutral position.
  - f) Two levers must be fitted – one dedicated for Port control and the other dedicated for Stbd control
  - g) Contractor must retain the use of the Rexroth VT-3000 amplifier and design the wireless control system to input the required variable current signal necessary for OEM control characteristics of pump stroking and hydraulic valve operation.

- 51.3.2.3 Location and wiring details for the receiver component must be surveyed and agreed upon by contractor and TA. Suggested location for receiver is the external top deck area of the Tow Winch compartment – protection provided to the unit antenna by the ventilation intake plenums for the Main engine room.
- 51.3.2.4 Contractor must attempt to utilize the main control cabinet in the Cargo Hold for the mounting of additional electronic components. If space is insufficient, the contractor must be extended the option to supply and mount an additional NEMA 4 enclosure to an agreed upon location by TA and Contractor for the installation of required components for the remote system circuitry.
- 51.3.2.5 Contractor must be responsible to run all communication wiring from the designated receiver location to the control cabinet in the cargo hold. Contractor must install a new wire kick-tube and seal this kick tube with a non-metallic, threaded strain relief fitting for the placement of wire through the tow winch deck head to connect with the newly installed receiver.
- 51.3.2.6 Welding of the kick-tube to the tow winch deck head must be full penetration file welding. A ½ hose supplied with 60psi water pressure must be supplied by vessel staff to ensure watertight integrity of welding for kick-tube. Any defects to be corrected by contractor. All fasteners used to secure any wireless component to the vessel structure must be stainless steel, provided by contractor.
- 51.3.2.7 All new and disturbed steel surfaces for kick-tube installation must be power-tool-cleaned to SSPC-SP-3 standard, primed two coats (3mil DFT) with Wasser Mio-zinc Primer and allowed to cure
- 51.3.2.8 Contractor must supply all components required to allow the signal produced by the Hetronics remote control to be properly communicated to the VT-3000 amplifier for each hydraulic pumpset of the Aft Hydraulic System.
- 51.3.2.9 Contractor must provide one spare bellypack remote unit complete with charging station for both remotes. Vessel staff will secure the charging station in an appropriate location.
- 51.3.2.10 Any interference items that were removed by the contractor for the purposes of this work item must be re-installed to original condition and subject to TA inspection. Any defects found with re-install of interference items must be corrected by the contractor at contractor expense.

#### **51.4 Tests and Trials**

- 51.4.1 Contractor must test each remote control unit and each individual function of the wireless communication. Tests to be completed in the presence of TA with assistance of vessel operators. Any defects to be corrected by contractor at contractor expense.
- 51.4.2 Contractor must provide onsite training of the new Wireless remote control system to 4 vessel staff for 1 day that would normally operate the capstan system. This training must be coordinated with the other training provided.

#### **51.5 Deliverables**

- 51.5.1 All system/component manuals for the newly installed system must be provided to TA in two (2) paper copies and one (1) electronic copy on CD ROM or USB format. Preferred electronic format is PDF.
- 51.5.2 Contractor must provide a revised “As Fitted” drawing of the system line drawings, system interconnection drawings and integration drawings with all newly fitted /arranged components. Section 6.1.6 of this Specification must apply to the drawings.
- 51.5.3 A clearly identified Bill of Materials for all components added (location, manufacturer, model and serial number) to be created and included as a reference sheet to the provided “As Fitted” drawings of new wireless radio remote control.

Table 51-1: **Government Furnished Equipment**

Line	Part Number	Description	Qty
1	3031241	Rail Mount TB, Spring Cage, ST 2.5-TWIN	44
2		Rail Mount TB, Spring Cage, ST 2.5-TWIN-PE	2
3	3030488	End Cover D-ST 2.5-TWIN	3
4	3022218	Rail Mount End Block CLIPFIX 35	5
5	0800886	Rail Mount End Block E/NS 35 N	1
6	C10-A10X/120VAC	Relay SPDT, 120v AC, LED x 1 Rect. S10 Series	4
7	S10	Relay base SPDT, S-10 Series	4
8	C9-A41X/120VAC	Relay 4PDT, 24v DC x LED x FWD. S9 Series	2
9	S9-M	Relay base 4PDT, S-9 Series	2
10	SHG14000	Encloser heater, 15W, 120Vac	1
11	SKH600NCC	Thermostat 120V 2A	1
13	CSD24248	Mild steel enclosure 24x24x8 type 4	1
14	CP2424	back plate 24x24	1
15	MC 3-5 Terminal	Remote location Control System	1
16	MC-IRX Base Unit	Remote Receiver	1
17	Aircell5	Airecell5 Antena Cable	1
18	Receiver Panel	Mount Receiver Panel	1

## 52.0 SUPERSTRUCTURE COATINGS

### 52.1 Identification

- 52.1.1 The purpose of this specification is for the Contractor to grit blast and recoat the superstructure area of the vessel.

### 52.2 References

#### 52.2.1 Drawings

Document Number	File Name
VNEA2_134-401	General Arrangement as fitted (2 sheets)

### 52.3 Technical

- 52.3.1 The Contractor must bid on the blasting and coating of the entire superstructure of the vessel, including, but not limited to, the following areas:

- Tow Winch Enclosure;
- Stacks;
- Fire Monitor Platform;
- Foscle Deck Superstructure;
- Wheelhouse Superstructure;
- Exterior decks above the Main Deck level;
- Main Mast;
- Associated railings, ladders, stairs and bulwarks.

- 52.3.1.1 This work item must be done in conjunction with the following Specification items:

- Section 28.0 Sheparding Boat Davit Installation;
- Section 29.0 CCTV System Installation;
- Section 30.0 Wheelhouse Top Steel Repairs
- Section 31.0 Cargo Hatch Replacement
- Section 50 Searchlight Installation
- Section 53 Hull Above Waterline Coating
- All other specification items that require access around the superstructure as a transit route for the removal and installation of equipment.

#### 52.3.2

#### 52.3.3 Superstructure Cleaning and Inspection

- 52.3.3.1 The Contractor must ensure that all items not being blasted or being painted are protected during the execution of this specification item. In particular, care must be taken to protect all deck machinery, cables, antenna, light fixtures, etc. These must be identified and clearly marked and covered to protect them from the blasting process. All equipment protection must be removed at the completion of this specification item. Where blasting material and/or paint overspray damages

equipment and/or other paint coatings, these defects must be rectified by the Contractor at the Contractor's expense prior to the completion of the contract.

- 52.3.3.2 The Contractor must ensure no ingress of blasting material and/or overspray into the accommodation area of the vessel. All openings must be sealed or closed off to prevent the ingress of blasting material and/or overspray. The Contractor must be responsible for the cleanup of all blasting material, debris and overspray from the vessel's interior and exterior decks.
- 52.3.3.3 All deck machinery, all sidelights, scuttles, windows, must be protected from blasting material and the superstructure coating.
- 52.3.3.4 The Contractor must blast the superstructure areas identified in Section 52.3.1 of this specification. The blasting must use GeoBlast technology with Holdtight in the slurry mix to achieve SSPC-SP6 surface conditions.
- 52.3.3.5 The Contractor must apply the following coating system to the blasted areas of the superstructure in accordance with the coating manufacturer's requirements:
  - a) One (1) coat of Wasser primer – MC MIOZINC (DFT 3mil)
  - b) An intermediate coat of MC-Ferrox B (DFT 3mil)
  - c) A topcoat of MC Luster 100 –RAL 9003 White (DFT 3mil) for all superstructure sides normally painted white.
  - d) A topcoat of MC Luster 100 –RAL 9004 Black (DFT 3mil) for the stack areas that are normally painted black.
  - e) A topcoat of Wasser MC Luster 100, RAL 070-7040 Buff, (DFT 3mil) for the main mast and other deck fittings that are normally painted buff.
  - f) A topcoat of Wasser MC Luster 100, RAL 7042 Deck Grey, (DFT 3mil) for the deck areas that are normally painted deck grey.
- 52.3.3.6 The Contractor must refer to the technical data sheets for this product included in the Technical Data Package for application and curing instructions of the coating system. The Contractor must supply all materials for the superstructure coating.
- 52.3.3.7 The Contractor must adhere to all coating system requirements for the application of the coating system. Where ambient air temperatures or humidity may become a problem, the Contractor must take steps to ensure that the painting and complete curing of the coating system will be completed before the completion date of the contract.

## **52.4 Inspections and Tests**

- 52.4.1 The Contractor must submit the completed superstructure for inspection by the Inspection Authority to ensure that all work as per the specification has been completed.



- 52.4.2 Upon completion of all coating applications the Contractor must take no less than 5 dry film spot thickness readings of the coating in each 10 m<sup>2</sup>. The dry film thickness measurements of must meet the numerical requirements of the SSPC PA 2 Appendix 1. Readings must be recorded and be contained in the final report.

## **52.5 Deliverables**

### **52.5.1 Report**

- 52.5.2 The Contractor must provide a coating application report to the Inspection Authority and the Technical Authority that details all of the particulars of the coating application process as completed by the Contractor. The report must include environmental conditions such as dry and wet bulb temperatures, relative humidity, and dew point at the time any coatings are applied and at which areas on the superstructure the coating was applied. Also to be included in the report must be the temperature of the product at application time as well as wet and dry film thickness gauge readings.

## **53.0 HULL ABOVE WATERLINE COATINGS**

### **53.1 Identification**

- 53.1.1 The purpose of this specification is for the Contractor to blast and recoat the hull above the ice belt (ice breaking coating) with a new paint system according to this specification.

### **53.2 References**

#### **53.2.1 Drawings**

<b>Document Number</b>	<b>File Name</b>
VNEA2 131-205	Shell Expansion & PL Line Body Plans
VNEA2 134-401	General Arrangement as fitted (2 sheets)
VNEA2 282-000	Bulwarks
VNEA2 282-010	Bulwarks
VNEA2 315-004	Overboard Dischargers Arrangement

### **53.3 Technical**

- 53.3.1 The Contractor must bid on the blasting and coating of the entire hull exterior of the vessel, including, but not limited to, the following areas:
- Hull above the Ice Breaking Coating;
  - Forward Bulwarks (inboard and outboard side);
  - Aft bulwarks (outboard side).

- 53.3.2 The Total area of hull above the water line including the bulwarks is approximately 675 m<sup>2</sup>.

#### **53.3.3 Above Water Hull Coating Renewal**

- 53.3.3.1 This portion of the Contract must take place in conjunction with Sections 52.0 and Appendix "A" Specification Item 22 – Underwater Hull Cleaning and Coating of this Specification.
- 53.3.3.2 The Contractor must supply all material for the above water hull preparation and coating. Stickers are not to be included.
- 53.3.3.3 The Contractor must ensure that all items not being blasted or being painted are protected during the execution of this specification item. All equipment protection must be removed at the completion of this specification item. Where blasting material and/or paint overspray damages equipment and/or other paint coatings, these defects must be rectified by the Contractor at the Contractor's expense prior to the completion of the contract.

- 53.3.3.4 The Contractor must ensure no ingress of blasting material and/or overspray into the accommodation area of the vessel. All openings must be sealed or closed off to prevent the ingress of blasting material and/or overspray. The Contractor must be responsible for the cleanup of all blasting material, debris and overspray from the vessel's interior and exterior decks.
- 53.3.3.5 All overboard discharges must be plugged and protected from blasting material and hull coating.
- 53.3.3.6 All fendering must be protected from grit blasting and hull coating. The Contractor must ensure that no coating is removed from between the Fendering and the steel retention system.
- 53.3.3.7 All port holes and windows must be protected from blasting grit and paint/hull coating
- 53.3.3.8 All deck machinery must be protected from blasting grit and the paint/hull coating.
- 53.3.3.9 Prior to blasting the area where the WHITE STRIPE and adjacent BLACK STRIPES are located must be marked for the purpose of re-application.
- 53.3.3.10 The Contractor must blast the hull and bulwark areas identified in Section 53.3.1 of this specification. The blasting must use GeoBlast technology with Holdtight in the slurry mix to achieve SSPC-SP6 surface conditions.
- 53.3.3.11 The Contractor must apply the following coating system to the blasted areas of the superstructure in accordance with the coating manufacturer's requirements:
- a) One (1) coat of Wasser primer – MC MIOZINC (DFT 3mil)
  - b) An intermediate coat of Wasser MC-Ferrox B (DFT 3mil)
  - c) A topcoat of Wasser MC Luster Gloss –RAL 3000 CCG Red (DFT 3mil) for all hull exterior and bulwards normally painted red.
  - d) Two topcoats of Wasser MC Luster Gloss –RAL 9003 White (DFT 3mil) for the hull stripe, thruster symbols and lettering that is normally painted white.
  - e) A topcoat of Wasser MC Luster Gloss, RAL 9004 Black, (DFT 3mil) for the hull white stripe outline, bulwark top rails and fairlead port areas that are normally painted black.
  - f) A topcoat of Wasser MC Luster 100, RAL 7042 Deck Grey, (DFT 3mil) for the bulwark areas that are normally painted deck grey.
- 53.3.3.12 The areas where the previous below waterline coating remains must be feathered to provide a smooth and efficient bond with the new coating.

53.3.3.13 The Contractor must refer to the technical data sheets for this product included in the Technical Data Package for application and curing instructions of the coating system. The Contractor must supply all materials for the superstructure coating.

53.3.3.14 The Contractor must adhere to all coating system requirements for the application of the coating system. Where ambient air temperatures or humidity may become a problem, the Contractor must take steps to ensure that the painting and complete curing of the coating system will be completed before the completion date of the contract.

#### **53.4 Inspections and Tests**

53.4.1 Prior to coating, the Contractor must submit the blasted above water hull for inspection by the Inspection Authority and TCMS. The Inspection Authority must verify that the hull has been blasted to the required standard in any bare areas as well that the all hard edges to the existing hull coating have been feathered as required in the paint manufacturer's recommendations.

53.4.2 Upon completion of all coating applications the Contractor must take no less than 5 dry film spot thickness readings of the coating in each 10 m<sup>2</sup>. The dry film thickness measurements of must meet the numerical requirements of the SSPC PA 2 Appendix 1. Readings must be recorded and be contained in the final report.

#### **53.5 Deliverables**

##### **53.5.1 Report**

53.5.2 The Contractor must provide a coating application report to the Inspection Authority and the Technical Authority that details all of the particulars of the coating application process as completed by the Contractor. The report must include environmental conditions such as dry and wet bulb temperatures, relative humidity, and dew point at the time any coatings are applied and at which areas on the superstructure the coating was applied. Also to be included in the report must be the temperature of the product at application time as well as wet and dry film thickness gauge readings.

## 54.0 FOSCLE DECK COVERING RENEWAL

### 54.1 Identification

The intent of this specification is for the Contractor to remove all deck flooring material in the designated areas on the Foscle deck of the vessel. It has been identified there is a moisture problem within the mineral fiber insulation on the existing floating floor material and thus needs to be removed and replaced. Steel deck replacement is also required below the windows on this deck.

### 54.2 References

#### 54.2.1 Regulations and Standards

The following regulations and standards are applicable to this section:

- f) Canada Shipping Act 2001;
- g) TP 11469E Guide to Structural Fire Protection;
- h) CSA W59-13 – Welded Steel Construction
- i) CSA W47.1-09 – Certification of companies for fusion welding of steel;
- j) International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.

#### 54.2.2 Drawings

Document Number	Description
	Common Mess Conversion Guidance Drawing
VNEA2 134-401	General Arrangement as fitted (2 sheets)
VNEA2 134-701	Accommodation Layouts
VNEA2 236-001	Main Deck Unit Frames 32-39 Centre
VNEA2 236-003	Main Deck Unit Frames 32-39 P&S
VNEA2 242-006	Foscle Deck and Bulkheads Under
VNEA2 317-008	Sewage and Grey Water Diagram
VNEA2 317-008	Sewage and Grey Water Arrangement
VNEA2 317-008	Arrangement of Sanitary Fixtures 1 to 27
VNEA2 379-000	List of Insulation
VNEA2 400-000	Misc Outfitting Booklet 30 of 52 (Pantry crew mess)
VNEA2 400-000	Misc Outfitting Booklet 31 of 52 (Pantry officer mess)
VNEA2 651-000	Interior Painting
VNEA2 711-000	Joiner Bulkheads & Doors 1 of 4
VNEA2 711-000	Joiner Bulkheads & Doors 2 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 3 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 4 of 4
VNEA2 721-000	Insulation Plan
VNEA2 751-000	Furniture List
VNEA2 751-000	Furniture Sketches Booklet 1 to 33
VNEA2 771-000	Deck Coverings

### **54.3 Technical**

#### **54.3.1 General**

- 54.3.1.1 The Contractor must ensure all surrounding areas are not disturbed in this specification are protected from any damage. Any damage from the “as delivered” condition of the vessel must be repaired at the Contractor’s expense.
- 54.3.1.2 The Contractor must remove all existing flooring coverings, cement and floating floor deck covering from the steel deck plating beneath and dispose of in accordance with all Federal, Provincial and Municipal regulations and provide copies of the disposal certificates to the Inspection Authority.
- 54.3.1.3 Contractor must monitor the air quality of the spaces affected and ventilate to the exterior of the ship if required. Contractor is responsible to provide all additional ventilation equipment required to maintain a suitable work space in accordance with local laws.
- 54.3.1.4 All measurements provided are for guidance only and should be confirmed by Contractor during the vessel site visit.

#### **54.3.2 Certifications**

- 54.3.2.1 All deck coverings to replace existing must provide an A-60 fire barrier. All materials used must have either Class or TCMS type approval and suitable for marine use. All material certificates must be submitted to the TA prior to installation.
- 54.3.2.2 Personnel responsible for taking Ultrasonic readings must provide certificates to the TA and TCMS Inspectors they are certified to a minimum of Level II of Can/CGSB 48.9712-2000.

#### **54.3.3 Electrical & Plumbing Isolation**

- 54.3.3.1 The Contractor must use common ship building and repair practices when removing deck covering material. This includes proper lockout and tag out of all associated electrical connections as well as the disconnection of all associated plumbing interfaces. Both electrical and plumbing connections affected during the removal of the floor must be reconnected and demonstrated as operable to the TA prior to the contract end.

### **54.4 Scope of Removals and Repairs**

The Contractor must provide a unit rate price for the removal & installation of the decking materials based on measurements provided.

**54.4.1 Foscle Deck**

54.4.1.1 The approximate areas of deck covering to be removed and replaced are as follows:

<b>Location</b>	<b>Area (m<sup>2</sup>)</b>
a) Passageways	24
b) Commanding Officer	21
c) Chief engineer	21
d) Chief Officer	17
e) Senior Engineer	12
f) Logistics Officer	11

**54.4.2 Removal, Storage and Installation of Cabin Joinery**

54.4.2.1 The Contractor must remove all cabin joinery that prevents the removal and replacement of the existing flooring, and these items must be handled as Category “B” property. This procedure also applies to any other items that require removal to access, remove and replace the floor covering. All items must be reinstalled prior to vessel acceptance. Any items that require plumbing or electrical disconnection and reconnection must do so in accordance with Section 54.3.3. Any damage to equipment must be repaired or replaced at the Contractor’s expense.

54.4.2.2 All exposed service connections resulting from the removal of furnishings must be identified and tagged with their service and purpose. These temporary tags must be affixed to the services in such a way that they will remain attached to identify the services throughout the work of this Section of the specification.

**54.4.3 Existing Ship’s Side Insulation Renewal**

54.4.3.1 The Contractor must remove all interior outboard bulkhead panels on the starboard side of the Foscle Deck from frame 34 forward to frame 42-1/2. The Contractor must remove all interior outboard bulkhead panels on the port side of the Foscle Deck starting from the frame 37, forward to frame 42-1/2.

54.4.3.2 Where there is conflict with electrical outlets the Contractor may choose to leave the bulkhead in place provided that access to the area requiring additional attention can be fully accessed. If access will not be suitable the Contractor must isolate, lock out power and disconnect the outlets prior to removing the bulkhead section.

54.4.3.3 All bulkhead panels removed must be labeled as to their location and orientation and retained for re-installation following completion of the work as Category “B” property. Any damaged panels must be replaced at contractor’s expense.

54.4.3.4 The Contractor must take care to avoid damaging the surface of the panels. The Contractor must remove any surface mounted items carefully and note the location of the items for re-installation.

- 54.4.3.5 To facilitate the bulkhead removal the Contractor must remove deck head panels as required to access retaining screws. The deck head panels must be labeled and protected from damage for installation following the repair work required as Category “B” property. Any damaged panels must be replaced at contractor’s expense. Removal of deck head panels may require the removal of lighting fixtures. The Contractor must coordinate this work in conjunction with Section 45.0 Accommodation Lighting Upgrade.
- 54.4.3.6 Contractor must remove the structural insulation attached to the ship’s side to a height of 300 mm above the current A-60 decking structure. This bottom section of insulation must be removed along the full length of the deckhouse that has been opened as described in 54.4.3.1.
- 54.4.3.7 Following the work to install the new floor as described in this Section of the specification and at such a time that the floor has cured to an acceptable level (Dex-O-Tex FSR agreement) the Contractor must install new foil backed insulation (minimum R40) from the cut insulation line to the new floor surface. The insulation must be packed snugly to the existing cut line, the outer hull or deckhouse plate, support structure and new flooring. Contractor must use reference document TP11469 E Guide to Structural Fire Protection to ensure proper re-insulation of hull and deckhouse plating. The insulation must be secured in place by existing insulation pins (if any) and industrial reinforced foil backed tape specific for insulation.
- 54.4.3.8 The Contractor must seal all insulation joints and carefully wrap steel support structure to ensure that no cold joints are exposed.
- 54.4.3.9 Upon completion of the insulation the Contractor must re-install the bulkhead panels, ceiling panels and any items removed during this work. The Contractor must supply new bulkhead panel securing strips that colour match the original bulkhead panels.
- 54.4.4       **Existing Flooring Removal**
- 54.4.4.1 The Contractor must remove all existing Isolamin floating floor, vinyl floor tiles, baseboards, carpet and leveling cement and epoxy one piece flooring located in the areas noted in Section 54.4.1. Disposal of these materials will be as Category “C” property. All traces of the existing decking material must be removed to expose the main deck steel deck plating.
- 54.4.5       **Deck Plate Inspection and Repairs**
- 54.4.5.1 Once all remaining fire insulation and flooring materials are removed, the Contractor must remove all rust and loose paint. The Contractor must prepare deck plate for paint by blasting to SSPC-SP6 or power tooling to a minimum of SSPC-



SP3. The Contractor must take care not to contaminate surrounding area due to power tooling action.

54.4.5.2 Once deck plate is cleaned and prepped the Contractor must provide the TA the opportunity to inspect the condition of the deck plating. During this time 60 ultrasonic readings must be taken. The locations for the Ultrasonic readings must be determined under consultation with the TA and TCMS inspectors. Contractor must supply a report to the TA on the Ultrasonic readings along with a detailed drawing showing each measurement location. This report must be supplied within 24 hours of completing the measurements.

54.4.5.3 The foscle deck has known corrosion of the deck plating due to leakage of the window drains for each cabin. The Contractor must include in the bid a quotation for the replacement of a 300mm wide strip under the superstructure bulkhead as follows:

- a) Port side from Frame 37 to 42.5;
- b) Starboard side from Frame 34 to 42.5

The Contractor must also include a band of superstructure plating from the deck level to a height of 150mm from the deck in way of the two areas above.

54.4.5.4 The Contractor must perform an extensive survey of all exposed steel deck/bulkhead boundaries to ensure there are no perforations that compromise the fire integrity and water tightness of the decks. The Contractor must provide a report detailing any defects found and proposed repair procedures to the TA with 48 hours of the survey. Should there be issues with the underlying deck plate, the Contractor must produce a repair plan for the deck plate and submit this to the TA and the TCMS inspector prior to commencing further repair work. Any additional work determined by the Contractor and in agreement by the TA must be submitted for approval using a PWGSC Form 1379.

54.4.5.5 All replacement steel must be of the same grade and thickness as shown on the drawings included in the Technical Data Package. Welding must be full penetration fillet welds and must be welded from both sides of the deck plate, in accordance with the original Welding Table in the Technical Data Package.

54.4.5.6 All welding repairs must follow the International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.

54.4.5.7 The Contractor must ensure that all steel plate and sections are clean and free of scale. All surfaces must be coated with a weldable primer prior to fabrication. Material certificates for all steel must be provided to the TA.

54.4.5.8 The Contractor's welding inspector will complete a visual inspection of all welds prior to arranging inspection by the attending TCMS surveyor.

54.4.5.9 Full penetration welds to be subject to 100% ultrasonic thickness testing. Technician to be certified to a minimum of Level II under CAN/CGSB 48.9712 – latest edition.

54.4.5.10 The Contractor must confirm all sizes of plating inserts and stiffeners prior to work commencement.

#### 54.4.6 **Underlying Deck Plate Painting**

54.4.6.1 The underlying deck plate must be painted with rust inhibiting epoxy primer similar to International Paint's Intershield 300. The application of this paint must be done in accordance with manufacturers recommendations. Data including film thickness for each coat, number of coats, dew point, temperature and relative humidity must all be given to the TA for their records.

54.4.6.2 This paint must be suitable for use with the replacement flooring noted in Section 54.5. The paint must be suitable for marine use and certification must be given to the TA.

#### 54.4.7 **Bulkhead Support**

54.4.7.1 During the floor removal phase the Contractor must support the Isolamin Panel bulkheads with temporary means in order to preserve the original spacing and panel gaps as well as prevent collapse of the panel system. The Contractor must be responsible for any damage to the bulkhead system as a result of a lack of support.

54.4.7.2 Contractor must fit the new bulkhead supports and tack weld in place ensuring that the Isolamin bulkhead remains true and at the original spacing from the inner steel bulkhead. Bulkhead supports must be fitted at each joint channel such that the required fastening specification is maintained. The Contractor must include and fit supports at any free end of the bulkhead panel and at any point where additional support is required.

#### 54.4.8 **HVAC Unit Seats**

54.4.8.1 The Contractor must install a seamless epoxy floor under the HVAC unit located on main and boat decks. This epoxy floor must be sloped toward a new deck drain installed during this refit (please refer to Section 54.5.2). Due to the new sloped floor the Contractor is required to install fixed steel seats for the HVAC unit to sit on providing a level base.

54.4.8.2 The Contractor must ensure the new seats are welded to the main steel deck in accordance with TCMS regulations. Rubber isolation must be installed between the

steel seats and the HVAC unit. This rubber isolation must be in the form of 3mm-6mm thick industrial rubber matting cut to match the units footing layout. The new seats must be painted using the same epoxy primer used on the main deck, see Section 54.4.6. The Contractor must perform this work in conjunction with Section 36.0 HVAC Upgrade.

#### 54.4.9 **Shower Stalls**

54.4.9.1 The Contractor must refurbish the shower stalls aboard the vessel as listed below:

- a) Commanding Officer's cabin
- b) Chief Engineer cabin
- c) Chief Officer cabin
- d) Senior Engineer cabin
- e) Logistic Officer cabin

54.4.9.2 All fixtures including hand rails, curtain rods, soap dishes, piping brackets, showerheads and control valves shall be removed and retained for reuse. Where fitted, shower stall doors and hardware shall be removed and retained for reuse.

54.4.9.3 The Contractor must remove the deck material within each shower stall to the steel deck. The steel deck must be inspected and prepared in accordance with the instructions in Section 54.4.5 and 54.4.6.

54.4.9.4 The Contractor must remove shower drains and replace them in accordance with Section 54.4.11.

54.4.9.5 The Contractor must install new subfloor and top coat. These must be Dex-O-Tex coatings as follows:

- a) Dex-O-Tex – A70 Latex Concrete
- b) Dex-O-Tex Terrazzo “M” (Fine)

The coatings are to be installed as per the manufacturer's instructions and top coat colour must be confirmed in consultation with the TA.

54.4.9.6 Final floor coating shall be applied in such manner as to be a generous radius in all corners and extend up the 150mm flat bar to the base of the Isolamin wall panels. The top edge shall be slightly sloped away from the wall panels and approximately 13mm thick. Reference must be made to drawing VNEA2 771-000 Deck Coverings.

54.4.9.7 Shower stalls shall be fitted with a front sill that is 100mm above the finished floor surface of the shower stall.

54.4.9.8 Shower stall pans shall be fitted to prevent water seepage. Shower tile water proof membrane shall be installed behind all wall tiles in way of the shower stalls. Membrane shall extend over the shower pan edges to ensure water proof integrity. Deck drains shall be slopped to ensure proper operation.

54.4.9.9 Shower bulkheads shall be finished with tile in colour and size as chosen by the Technical Authority.

54.4.9.10 All caulking used shall be mold and mildew resistant and colour matched to surfaces requiring application.

54.4.9.11 The Contractor must reinstall all hardware mounted to the bulkheads including hand rails, soap dishes and piping brackets.

#### **54.4.10 Deck Plate Fire Insulation, Sound Insulation and Flooring Installation**

54.4.10.1 The Contractor must replace the existing floating floor with a trowelled on composite flooring like Dex-O-Tex or similar. The composite flooring must have an A-60 fire rating. The new flooring must extend to the outboard deck / hull intersection and to any deck / interior steel bulkhead intersection thus providing a complete fire barrier within each area the flooring is replaced.

54.4.10.2 The Contractor must ensure the A-60 flooring is suitable for marine use with either Class or TCMS approval. Certificates for the material must be provided to both the TA and TCMS inspector. Contractor must ensure the new flooring is installed as per the manufacturer's recommendations and that the weight of the material is kept to a minimum within these recommendations.

54.4.10.3 The general layout to be used (for guidance only);

- g) Steel main deck plate
- h) Epoxy Primer (rust inhibitor) International Paint-Intershield 300
- i) Bonder
- j) Acoustic damping underlayment
- k) A-60 Fire Insulation
- l) Top Coat

54.4.10.4 The top coat will consist of three alternative finishes according to the application. For dry spaces defined as: the Passageways and all Cabins, the top coat must consist of 3mm Vinyl flooring. The Vinyl flooring must be roll type with welded seams. The colours must be confirmed with samples provided to the TA for approval prior to installation. The Vinyl must be suitable for marine use with Class or TCMS approval and installed as per manufacturers recommendations. The Contractor must supply any sealant or protective coatings recommended by the manufacturer of the Vinyl flooring, and apply it in accordance with the manufacturer's recommendations.

54.4.10.5 The top coat for wet spaces defined as: Lavatories the flooring must consist of a seamless epoxy top coat similar to Terrazzo M supplied by Dex-O-Tex. This epoxy top coat must be similar in colour to the existing flooring. Colour flake and an anti-

slip agent must be added to improve the appearance and traction of the product within these wet spaces. The seamless floor must extend up the walls in accordance with the Deck Covering drawing and the finish level must be above the bottom of the side bulkhead. This is necessary to provide additional wall support and seal the bulkhead panels.

54.4.10.6 The Contractor must ensure all floor coatings are installed by or under consultation with a certified service representative to ensure product cures properly and the application will meet an A-60 fire rating. Contractor must involve TCMS inspectors during this process to ensure regulatory compliance.

54.4.10.7 Contractor must carefully remove residual contact cement from the baseboard area of the bulkheads and supply and install new flexible PVC baseboard skirting in all dry areas.

#### **54.4.11 Floor and Grey Water Drains**

54.4.11.1 All pipe penetrations must be fully welded, ground and coated with rust inhibitive paint in accordance with Section 54.4.6 prior to installing new flooring.

54.4.11.2 All Grey water drains exposed by the decking removals in this Section shall be removed and replaced with new material. The Contractor shall supply new stainless steel deck drains to be used for all deck drains. New drains shall be welded to the steel deck prior to the new flooring being installed.

54.4.11.3 Sink drains shall be removed and disposed of and renewed during the floor renewal stage of this refit as noted on drawing VNEA2 317-008. Sink drains shall be renewed up to the P-traps for each sink above the deck. Drains shall be re-plumbed into existing piping.

54.4.11.4 TCMS inspectors shall inspect these penetrations prior to covering and contractor shall be responsible for full compliance with all TCMS regulations. Contractor shall take care to install proper galvanic isolation.

54.4.11.5 All drain piping shall consist of galvanized schedule 80 seamless pipe. All piping shall be welded using proper CWB and TCMS regulations as well as proper ship building practices.

### **54.5 Deliverables**

#### **54.5.1 Certificates**

54.5.1.1 The Contractor must provide the TA with all required certificates for the persons responsible for taking the Ultrasonic readings.

54.5.1.2 Copies of all disposal certificates must be provided to the TA.

54.5.1.3 The Contractor must provide to the TA the original written acceptance report from TCMS regarding the A-60 fire insulation boundary for the main deck.

54.5.1.4 The contractor shall provide all documentation to the TA showing all products used are suitable for the marine industry and the intended application.

#### 54.5.2 **Reports**

54.5.2.1 The Contractor must supply a technical report for the ultrasonic thickness measurements. Reports must be presented to the TA in the allotted time frame and provided in both hard copy and PDF electronic copy.

54.5.2.2 A detailed drawing must be provided with the ultrasonic testing report showing the exact locations of each test point taken. This drawing must be plotted on an ISO size A1 paper and provided to the TA in both hard copy and PDF electronic copy. Along with this drawing must be an MS-Excel spreadsheet table identifying the test points by position on the drawing, steel thickness found, original thickness and percent wastage for each point.

#### 54.5.3 **Drawings**

54.5.3.1 The Contractor must be responsible for updating all “As Fitted” drawings in accordance with Section 6.1.6 of this Specification.

#### 54.5.4 **Manuals**

54.5.4.1 The Contractor must supply three sets of product literature for the new deck flooring that includes detailed data on the following:

- g) Cleaning;
- h) Maintenance;
- i) Repair;
- j) Specifications;
- k) Cautions and Limitations;
- l) WHMIS.

54.5.4.2 The maintenance and repair literature is to be that which the O.E.M. distributes to the authorized service centers for use by their technicians.

54.5.4.3 The Contractor must also supply product literature on the epoxy primer used on the steel decking.

## **55.0 BOAT DECK COVERING RENEWAL**

### **55.1 Identification**

The intent of this specification is for the Contractor to remove all deck flooring material in the designated areas on the Boat deck of the vessel. It has been identified there is a moisture problem within the mineral fiber insulation on the existing floating floor material and thus needs to be removed and replaced.

### **55.2 References**

#### **55.2.1 Regulations and Standards**

The following regulations and standards are applicable to this section:

- k) Canada Shipping Act 2001;
- l) TP 11469E Guide to Structural Fire Protection;
- m) CSA W59-13 – Welded Steel Construction
- n) CSA W47.1-09 – Certification of companies for fusion welding of steel;
- o) International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.

#### **55.2.2 Drawings**

<b>Document Number</b>	<b>Description</b>
VNEA2 134-401	General Arrangement as fitted (2 sheets)
VNEA2 134-701	Accommodation Layouts
VNEA2 241-008	Boat Deck and Bulkheads Under
VNEA2 317-008	Sewage and Grey Water Diagram
VNEA2 317-008	Sewage and Grey Water Arrangement
VNEA2 317-008	Arrangement of Sanitary Fixtures 1 to 27
VNEA2 379-000	List of Insulation
VNEA2 651-000	Interior Painting
VNEA2 711-000	Joiner Bulkheads & Doors 1 of 4
VNEA2 711-000	Joiner Bulkheads & Doors 2 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 3 of 4
VNEA2 711-000	Joiner Bulkheads & Linings 4 of 4
VNEA2 721-000	Insulation Plan
VNEA2 751-000	Furniture List
VNEA2 751-000	Furniture Sketches Booklet 1 to 33
VNEA2 771-000	Deck Coverings

### **55.3 Technical**

#### **55.3.1 General**

- 55.3.1.1 The Contractor must ensure all surrounding areas are not disturbed in this specification are protected from any damage. Any damage from the “as delivered” condition of the vessel must be repaired at the Contractor’s expense.

- 55.3.1.2 The Contractor must remove all existing flooring coverings, cement and floating floor deck covering from the steel deck plating beneath and dispose of in accordance with all Federal, Provincial and Municipal regulations and provide copies of the disposal certificates to the Inspection Authority.
- 55.3.1.3 Contractor must monitor the air quality of the spaces affected and ventilate to the exterior of the ship if required. Contractor is responsible to provide all additional ventilation equipment required to maintain a suitable work space in accordance with local laws.
- 55.3.1.4 All measurements provided are for guidance only and should be confirmed by Contractor during the vessel site visit.

#### 55.3.2 **Certifications**

- 55.3.2.1 All deck coverings to replace existing must provide an A-60 fire barrier. All materials used must have either Class or TCMS type approval and suitable for marine use. All material certificates must be submitted to the TA prior to installation.
- 55.3.2.2 Personnel responsible for taking Ultrasonic readings must provide certificates to the TA and TCMS Inspectors they are certified to a minimum of Level II of Can/CGSB 48.9712-2000.

#### 55.3.3 **Electrical & Plumbing Isolation**

- 55.3.3.1 The Contractor must use common ship building and repair practices when removing deck covering material. This includes proper lockout and tag out of all associated electrical connections as well as the disconnection of all associated plumbing interfaces. Both electrical and plumbing connections affected during the removal of the floor must be reconnected and demonstrated as operable to the TA prior to the contract end.

### 55.4 **Scope of Removals and Repairs**

The Contractor must provide a unit rate price for the removal & installation of the decking materials based on measurements provided.

#### 55.4.1 **Boat Deck**

- 55.4.1.1 The approximate areas of deck covering to be removed and replaced are as follows:

<b>Location</b>	<b>Area (m<sup>2</sup>)</b>
a) Passageways (port, starboard and forward)	52
b) Boatswain	12



c) Chief Cook	12
d) 2 <sup>nd</sup> Engineer	12
e) 3 <sup>rd</sup> Engineer	11
f) Oilers	11
g) Ships Office	16
h) Seaman (port)	9
i) Winchman/Spare	13
j) Quartermasters	13
k) 3 <sup>rd</sup> Officer	12
l) 2 <sup>nd</sup> Officer	12
m) Seaman (centre)	8
n) Engineers Office	8
o) Steward's Locker	3
p) Lockers (3 of)	3

#### 55.4.2 **Removal, Storage and Installation of Cabin Joinery, Mess Equipment**

55.4.2.1 The Contractor must remove all cabin joinery that prevents the removal and replacement of the existing flooring, and these items must be handled as Category "B" property. This procedure also applies to any other items that require removal to access, remove and replace the floor covering. All items must be reinstalled prior to vessel acceptance. Any items that require plumbing or electrical disconnection and reconnection must do so in accordance with Section 55.3.3. Any damage to equipment must be repaired or replaced at the Contractor's expense.

55.4.2.2 All exposed service connections resulting from the removal of furnishings must be identified and tagged with their service and purpose. These temporary tags must be affixed to the services in such a way that they will remain attached to identify the services throughout the work of this Section of the specification.

#### 55.4.3 **Existing Ship's Side Insulation Renewal**

55.4.3.1 The Contractor must remove every second interior outboard bulkhead panel on both sides of the Boat Deck from frame 34 forward to frame 46.

55.4.3.2 Where there is conflict with electrical outlets the Contractor may choose to leave the bulkhead in place provided that access to the area requiring additional attention can be fully accessed. If access will not be suitable the Contractor must isolate, lock out power and disconnect the outlets prior to removing the bulkhead section.

55.4.3.3 All bulkhead panels removed must be labeled as to their location and orientation and retained for re-installation following completion of the work as Category "B" property. Any damaged panels must be replaced at contractor's expense.

- 55.4.3.4 The Contractor must take care to avoid damaging the surface of the panels. The Contractor must remove any surface mounted items carefully and note the location of the items for re-installation.
- 55.4.3.5 To facilitate the bulkhead removal the Contractor must remove deck head panels as required to access retaining screws. The deck head panels must be labeled and protected from damage for installation following the repair work required as Category “B” property. Any damaged panels must be replaced at contractor’s expense. Removal of deck head panels may require the removal of lighting fixtures. The Contractor must coordinate this work in conjunction with Section 45.0 Accommodation Lighting Upgrade.
- 55.4.3.6 Contractor must remove the structural insulation attached to the ship’s side to a height of 300 mm above the current A-60 decking structure. This bottom section of insulation must be removed along the full length of the hull that has been opened as described in 55.4.1.
- 55.4.3.7 Following the work to install the new floor as described in this Section of the specification and at such a time that the floor has cured to an acceptable level (Dex-O-Tex FSR agreement) the Contractor must install new foil backed insulation (minimum R40) from the cut insulation line to the new floor surface. The insulation must be packed snugly to the existing cut line, the outer hull or deckhouse plate, support structure and new flooring. Contractor must use reference document TP11469 E Guide to Structural Fire Protection to ensure proper re-insulation of hull and deckhouse plating. The insulation must be secured in place by existing insulation pins (if any) and industrial reinforced foil backed tape specific for insulation.
- 55.4.3.8 The Contractor must seal all insulation joints and carefully wrap steel support structure to ensure that no cold joints are exposed.
- 55.4.3.9 Upon completion of the insulation the Contractor must re-install the bulkhead panels, ceiling panels and any items removed during this work. The Contractor must supply new bulkhead panel securing strips that colour match the original bulkhead panels.
- 55.4.4 **Existing Flooring Removal**
- 55.4.4.1 The Contractor must remove all existing Isolamin floating floor, vinyl floor tiles, baseboards, carpet and leveling cement and epoxy one piece flooring located in the areas noted in Section 55.4.1. Disposal of these materials will be as Category “C” property. All traces of the existing decking material must be removed to expose the main deck steel deck plating.

**55.4.5 Deck Plate Inspection and Repairs**

- 55.4.5.1 Once all remaining fire insulation and flooring materials are removed, the Contractor must remove all rust and loose paint. The Contractor must prepare deck plate for paint by blasting to SSPC-SP6 or power tooling to a minimum of SSPC-SP3. The Contractor must take care not to contaminate surrounding area due to power tooling action.
- 55.4.5.2 Once deck plate is cleaned and prepped the Contractor must provide the TA the opportunity to inspect the condition of the deck plating. During this time 60 ultrasonic readings must be taken. The locations for the Ultrasonic readings must be determined under consultation with the TA and TCMS inspectors. Contractor must supply a report to the TA on the Ultrasonic readings along with a detailed drawing showing each measurement location. This report must be supplied within 24 hours of completing the measurements.
- 55.4.5.3 The Contractor must perform an extensive survey of all exposed steel deck/bulkhead boundaries to ensure there are no perforations that compromise the fire integrity and water tightness of the decks. The Contractor must provide a report detailing any defects found and proposed repair procedures to the TA with 48 hours of the survey. Should there be issues with the underlying deck plate, the Contractor must produce a repair plan for the deck plate and submit this to the TA and the TCMS inspector prior to commencing further repair work. Any additional work determined by the Contractor and in agreement by the TA must be submitted for approval using a PWGSC Form 1379.
- 55.4.5.4 All replacement steel must be of the same grade and thickness as shown on the drawings included in the Technical Data Package. Welding must be full penetration fillet welds and must be welded from both sides of the deck plate, in accordance with the original Welding Table in the Technical Data Package.
- 55.4.5.5 All welding repairs must follow the International Association of Classification Societies (IACS) No. 47 – Shipbuilding and Repair Quality Standard.
- 55.4.5.6 The Contractor must ensure that all steel plate and sections are clean and free of scale. All surfaces must be coated with a weldable primer prior to fabrication. Material certificates for all steel must be provided to the TA.
- 55.4.5.7 The Contractor's welding inspector will complete a visual inspection of all welds prior to arranging inspection by the attending TCMS surveyor.
- 55.4.5.8 Full penetration welds to be subject to 100% ultrasonic thickness testing. Technician to be certified to a minimum of Level II under CAN/CGSB 48.9712 – latest edition.

55.4.5.9 The Contractor must confirm all sizes of plating inserts and stiffeners prior to work commencement.

**55.4.6 Underlying Deck Plate Painting**

55.4.6.1 The underlying deck plate must be painted with rust inhibiting epoxy primer similar to International Paint's Intershield 300. The application of this paint must be done in accordance with manufacturers recommendations. Data including film thickness for each coat, number of coats, dew point, temperature and relative humidity must all be given to the TA for their records.

55.4.6.2 This paint must be suitable for use with the replacement flooring noted in Section 55.5. The paint must be suitable for marine use and certification must be given to the TA.

**55.4.7 Bulkhead Support**

55.4.7.1 During the floor removal phase the Contractor must support the Isolamin Panel bulkheads with temporary means in order to preserve the original spacing and panel gaps as well as prevent collapse of the panel system. The Contractor must be responsible for any damage to the bulkhead system as a result of a lack of support.

55.4.7.2 Contractor must fit the new bulkhead supports and tack weld in place ensuring that the Isolamin bulkhead remains true and at the original spacing from the inner steel bulkhead. Bulkhead supports must be fitted at each joint channel such that the required fastening specification is maintained. The Contractor must include and fit supports at any free end of the bulkhead panel and at any point where additional support is required.

**55.4.8 HVAC Unit Seats**

55.4.8.1 The Contractor must install a seamless epoxy floor under the HVAC unit located on main and boat decks. This epoxy floor must be sloped toward a new deck drain installed during this refit (please refer to Section 55.4.10). Due to the new sloped floor the Contractor is required to install fixed steel seats for the HVAC unit to sit on providing a level base.

55.4.8.2 The Contractor must ensure the new seats are welded to the main steel deck in accordance with TCMS regulations. Rubber isolation must be installed between the steel seats and the HVAC unit. This rubber isolation must be in the form of 3mm-6mm thick industrial rubber matting cut to match the units footing layout. The new seats must be painted using the same epoxy primer used on the main deck, see Section 55.4.6. The Contractor must perform this work in conjunction with Section 36.0 HVAC Upgrade.

**55.4.9 Shower Stalls**

- 55.4.9.1 The Contractor must refurbish the shower stalls aboard the vessel as listed below:
- a) 2<sup>nd</sup>/3<sup>rd</sup> Engineer
  - b) 2<sup>nd</sup>/3<sup>rd</sup> Officer
  - c) Bosun/Chief Cook
  - d) Boat Deck washroom
- 55.4.9.2 All fixtures including hand rails, curtain rods, soap dishes, piping brackets, showerheads and control valves shall be removed and retained for reuse. Where fitted, shower stall doors and hardware shall be removed and retained for reuse.
- 55.4.9.3 The Contractor must remove the deck material within each shower stall to the steel deck. The steel deck must be inspected and prepared in accordance with the instructions in Section 55.4.5 and 55.4.6.
- 55.4.9.4 The Contractor must remove shower drains and replace them in accordance with Section 55.4.11.
- 55.4.9.5 The Contractor must install new subfloor and top coat. These must be Dex-O-Tex coatings as follows:
- c) Dex-O-Tex – A70 Latex Concrete
  - d) Dex-O-Tex Terrazzo “M” (Fine)
- The coatings are to be installed as per the manufacturer’s instructions and top coat colour must be confirmed in consultation with the TA.
- 55.4.9.6 Final floor coating shall be applied in such manner as to be a generous radius in all corners and extend up the 150mm flat bar to the base of the Isolamin wall panels. The top edge shall be slightly sloped away from the wall panels and approximately 13mm thick. Reference must be made to drawing VNEA2 771-000 Deck Coverings.
- 55.4.9.7 Shower stalls shall be fitted with a front sill that is 100mm above the finished floor surface of the shower stall.
- 55.4.9.8 Shower stall pans shall be fitted to prevent water seepage. Shower tile water proof membrane shall be installed behind all wall tiles in way of the shower stalls. Membrane shall extend over the shower pan edges to ensure water proof integrity. Deck drains shall be slopped to ensure proper operation.
- 55.4.9.9 Shower bulkheads shall be finished with tile in colour and size as chosen by the Technical authority.
- 55.4.9.10 All caulking used shall be mold and mildew resistant and colour matched to surfaces requiring application.

55.4.9.11 The Contractor must reinstall all hardware mounted to the bulkheads including hand rails, soap dishes and piping brackets.

**55.4.10 Deck Plate Fire Insulation, Sound Insulation and Flooring Installation**

55.4.10.1 The Contractor must replace the existing floating floor with a trowelled on composite flooring like Dex-O-Tex or similar. The composite flooring must have an A-60 fire rating. The new flooring must extend to the outboard deck / hull intersection and to any deck / interior steel bulkhead intersection thus providing a complete fire barrier within each area the flooring is replaced.

55.4.10.2 The Contractor must ensure the A-60 flooring is suitable for marine use with either Class or TCMS approval. Certificates for the material must be provided to both the TA and TCMS inspector. Contractor must ensure the new flooring is installed as per the manufacturer's recommendations and that the weight of the material is kept to a minimum within these recommendations.

55.4.10.3 The general layup to be used (for guidance only);

- m) Steel main deck plate
- n) Epoxy Primer (rust inhibitor) International Paint-Intershield 300
- o) Bondar
- p) Acoustic damping underlayment
- q) A-60 Fire Insulation
- r) Top Coat

55.4.10.4 The top coat will consist of three alternative finishes according to the application. For dry spaces defined as: Passageways, all Cabins, Engineering and Ship's Offices, the top coat must consist of 3mm Vinyl flooring. The Vinyl flooring must be roll type with welded seams. The colours must be confirmed with samples provided to the TA for approval prior to installation. The Vinyl must be suitable for marine use with Class or TCMS approval and installed as per manufacturers recommendations. The Contractor must supply any sealant or protective coatings recommended by the manufacturer of the Vinyl flooring, and apply it in accordance with the manufacturer's recommendations.

55.4.10.5 The top coat for wet spaces defined as: Lavatories and the area below the HVAC units the flooring must consist of a seamless epoxy top coat similar to Terrazzo M supplied by Dex-O-Tex. This epoxy top coat must be similar in colour to the existing flooring. Colour flake and an anti-slip agent must be added to improve the appearance and traction of the product within these wet spaces. The seamless floor must extend up the walls in accordance with the Deck Covering drawing and the finish level must be above the bottom of the side bulkhead. This is necessary to provide additional wall support and seal the bulkhead panels.

55.4.10.6 The Contractor must ensure all floor coatings are installed by or under consultation with a certified service representative to ensure product cures properly and the application will meet an A-60 fire rating. Contractor must involve TCMS inspectors during this process to ensure regulatory compliance.

55.4.10.7 Contractor must carefully remove residual contact cement from the baseboard area of the bulkheads and supply and install new flexible PVC baseboard skirting in all dry areas.

#### **55.4.11 Floor and Grey Water Drains**

55.4.11.1 In the wet areas located under each deck's HVAC unit the seamless epoxy flooring must be graded towards the deck drain to be installed in accordance with manufacturer's recommendations. All pipe penetrations must be fully welded, ground and coated with rust inhibitive paint in accordance with Section 55.4.6 prior to installing new flooring.

55.4.11.2 The Contractor shall supply new stainless steel deck drains to be used for all deck drains. New drains shall be welded to the steel deck prior to the new flooring being installed.

55.4.11.3 Sink drains shall be removed and disposed of and renewed during the floor renewal stage of this refit as noted on drawing VNEA2 317-008. Sink drains shall be renewed up to the P-traps for each sink above the deck. Drains shall be re-plumbed into existing piping.

55.4.11.4 TCMS inspectors shall inspect these penetrations prior to covering and contractor shall be responsible for full compliance with all TCMS regulations. Contractor shall take care to install proper galvanic isolation.

55.4.11.5 All drain piping shall consist of galvanized schedule 80 seamless pipe. All piping shall be welded using proper CWB and TCMS regulations as well as proper ship building practices.

### **55.5 Deliverables**

#### **55.5.1 Certificates**

55.5.1.1 The Contractor must provide the TA with all required certificates for the persons responsible for taking the Ultrasonic readings.

55.5.1.2 Copies of all disposal certificates must be provided to the TA.

55.5.1.3 The Contractor must provide to the TA the original written acceptance report from TCMS regarding the A-60 fire insulation boundary for the main deck.

- 55.5.1.4 The contractor shall provide all documentation to the TA showing all products used are suitable for the marine industry and the intended application.

**55.5.2 Reports**

- 55.5.2.1 The Contractor must supply a technical report for the ultrasonic thickness measurements. Reports must be presented to the TA in the allotted time frame and provided in both hard copy and PDF electronic copy.
- 55.5.2.2 A detailed drawing must be provided with the ultrasonic testing report showing the exact locations of each test point taken. This drawing must be plotted on an ISO size A1 paper and provided to the TA in both hard copy and PDF electronic copy. Along with this drawing must be an MS-Excel spreadsheet table identifying the test points by position on the drawing, steel thickness found, original thickness and percent wastage for each point.

**55.5.3 Drawings**

- 55.5.3.1 The Contractor must be responsible for updating all “As Fitted” drawings in accordance with Section 6.1.6 of this Specification.

**55.5.4 Manuals**

- 55.5.4.1 The Contractor must supply three sets of product literature for the new deck flooring that includes detailed data on the following:
- m) Cleaning;
  - n) Maintenance;
  - o) Repair;
  - p) Specifications;
  - q) Cautions and Limitations;
  - r) WHMIS.
- 55.5.4.2 The maintenance and repair literature is to be that which the O.E.M. distributes to the authorized service centers for use by their technicians.
- 55.5.4.3 The Contractor must also supply product literature on the epoxy primer used on the steel decking.



## **APPENDIX C**

## **55.6 Definitions and Abbreviations**

For the purpose of these Specifications, the following definitions and abbreviations must apply:

### **ABT**

Automatic Bus Transfer

### **A/C or A.C.**

Alternating Current

### **AFFF**

Aqueous Film Forming Foam

### **AMS**

Alarm and Monitoring System

### **ANSI**

American National Standards Institute

### **Approved**

Approved means Inspected and Stamped Approved from TCMS

### **As Fitted Drawings**

A final drawing showing the “As fitted” condition of all equipment and system fittings. The “As Fitted” drawings must be the final revision of the drawing documenting the mark-up of the working drawings during installation.

### **A.S.M.E.**

American Society of Mechanical Engineers

### **ASTM**

American Society for Testing of Materials

### **Assistant Project Manager (APM)**

The authorized representative of the Project Manager who will be the on-site contact for all technical related matters.

### **BHP**

Brake Horsepower

### **Bi-Weekly**

Where the words "bi-weekly" are used in these project Specifications, they must be understood to mean once every two (2) weeks.

### **B.S.I.**

British Standard Institute

### **Btu/hr**

British thermal unit per hour

**CAD**

Computer Aided Drafting

**Calibrate**

The word “calibrate” means that an instrument or piece of equipment must be mechanically, electrically disconnected and removed to a clean work place. The Contractor must clean and inspect all internal instrument movements. Calibration must be done using an instrument that is a calibration standard that has been certified by a recognized testing laboratory within a twelve month period of the date the test is carried out. Readings must be taken at six (6) equidistant points on the scale including zero and end of scale readings. Calibration seals and stickers must be affixed to instruments upon completion of calibration. Instruments are to be reinstalled and tested onboard ship. The Contractor must produce test sheets and when completed must be delivered to the Project Manager.

**Canada**

The Government of Canada as represented by the Canadian Coast Guard  
Fisheries & Oceans Canada  
50 Discovery Drive,  
Dartmouth, NS.

**CCGS**

Canadian Coast Guard Ship

**CD-ROM**

Compact Disk – Read Only Memory

**C.E.M.A.**

Canadian Electric Manufacturer’s Association

**CGSB**

Canadian General Specifications Board

**C.I.**

Cast Iron

**Classification Society**

Lloyd’s Register of Shipping, its representatives and published Rules for the Construction and Classification of Steel Ships.

**Contract Authority (CA)**

An officer of the Public Works and Government Services Canada responsible for the management and administration of the Contract on behalf of Canada and the only person with authority to negotiate or effect amendments or any other variation to any provisions of the Contract.

**Contractor**

The shipbuilder and/or ship repairer

**Contractor Furnished Material (CFM)**

Equipment and material furnished by the Contractor or the Sub-Contractor(s).

**CP**

Controllable Pitch

**CPU**

Central Processing Unit

**CSA**

Canadian Standards Association

**C.S.A.**

Canadian Shipping Act

**cw or c/w**

Complete with, or comes with – as in “c/w backslash”

**CWB**

Canadian Welding Bureau

**Day(s)**

A working day(s) unless stated otherwise herein.

**Db**

Dry Bulb

**dB**

Decibels

**dBA**

A weighted system that assigns a weight related to how sensitive the human ear is to each sound frequency. The adjusted sounds are called A-weighted levels (dBA.)

**dBm**

Power measurement in the unit of decibels for use in telecommunications systems. The reference point, 0 dBm, is defined as 1 milliwatt of electrical power dissipated by a 600  $\Omega$  load.

**deg. C (°C)**

Degree Celsius

**deg. F (°F)**

Degree Fahrenheit

**Dia, D or d**

Diameter

**Disassemble**

The Contractor must provide all labour and materials to take apart, piece by piece, the equipment, machinery or system to be examined or overhauled.

**Disconnect**

The Contractor must provide all labour and materials to mechanically and electrically disconnect the piece of equipment from all piping, wiring, seats and other attachments with the purpose of permitting removal of the unit.

**DFO**

Department of Fisheries and Oceans Canada

**Dock Trials**

Consist of alongside acceptance trials of machinery systems and sub-systems prior to sea trials. These trials must be carried out only after all testing is complete.

**DOL**

Direct On Line

**DVD**

Digital Video Disk

**ECR**

Engine Control Room

**EEMAC**

Electrical and Electronic Manufacturer's Association of Canada.

**EMI**

Electromagnetic interference

**Environmentally Controlled**

This must be taken to mean heated, ventilated, cooled and lighted to the level required by the particular compartment. As a supplementary requirement, humidity control must also be included in cases where equipment which is sensitive to humidity must be stored.

**FAT**

Factory Acceptance Test

**Field Service Representative (FSR)**

A representative of either the Contractor or Sub-Contractor competent to supervise the installation and commissioning of machinery and equipment and to ensure satisfactory performance at all times during the specified warranty period.

**FI-FO**

First In – First Out

**FMEA**

Failure Mode Effect Analysis

**fpm**

Feet Per Minute

**fps**

Feet Per Second

**FSM**

Canadian Coast Guard Fleet Safety Manual

**ft**

Foot or Feet

**g**

Force exerted by gravity

**GM (relating to ship stability)**

Vertical distance between the Center of Gravity and the Metacentre.

**GZ (relating to ship stability)**

Perpendicular distance between the lines of action of the force of buoyancy and the weight of the vessel.

**Government Furnished Equipment (GFE)**

Equipment and material furnished by the Government and delivered to the Contractor's premises for installation or use onboard the vessel.

**Guidance Drawings**

Guidance drawings are provided strictly for guidance purposes only. The Contractor must physically verify all project requirements and must then develop working drawings for approval.

**HMI**

Human Machine Interface

**Health Canada**

Health Canada

**HOT**

Hand Held Operator Terminal

**HP**

Horsepower

**Hz**  
Hertz

**Inspection Authority**

The Director, Inspection and Technical Services Public Works and Government Services Canada, is responsible for the inspection of the work and acceptance of the finished work under the Contract. The Inspection Authority will be represented on-site by an assigned Inspector.

**Install**

the word “install” means that the Contractor must provide all labour and provide the equipment to be installed, connect it mechanically, electrically, hydraulically and provide any other connections necessary to complete the installation.

**Integrate**

The Contractor must provide all labour and material necessary to combine systems and their features into a complete functional unit or system.

**IPS**

Iron pipe size

**ID**

Identification, as in number

**IEEE**

The Institute of Electrical and Electronics Engineers

**IMO**

International Maritime Organization

**in**

Inches

**IO**

Input/Output, as in device or list

**IPS**

Iron Pipe Size

**JB**

Junction Box

**JPEG**

Joint Photographic Experts Group

**Lab**

Laboratory

**LAN**

Local Area Network

**lbs/hr**

Pounds Per Hour

**LED**

Light Emitting Diode

**M.B.H.**

1000 British Thermal Units Per Hour

**MCT's**

Multiple Cable Transits

**Megger Tester**

The trade name for an instrument used for electrical circuitry insulation testing

**MOSH**

Marine Occupational Safety and Health Regulations as per Canada Shipping Act

**Motor Repair/Rewind Service Center**

Electrical motor repair/rewind service center with relevant experience dealing with large rotating marine electrical equipment.

**m/s**

Meters per second

**MSDS**

Material Safety Data Sheet

**Mtg or mtg**

Mounting – as in flush mounting

**mV**

Milli-volts

**N.B.S.**

National Bureau of Standards

**N.C.**

Noise Criteria

**N.E.M.A.**

National Electric Manufacturer's Association



**N.F.P.A.**

National Fire Protection Association

**NFU**

Non-follow-up, as in alarm

**No.**

Number

**npt or NPT**

National Pipe Thread

**ODBC**

Open Database Connectivity

**OEM**

Original Equipment Manufacturer

**O.I.C**

Officer In-Charge

**On-Site**

Within the confines of the Contractor's facility or where the repair of the vessel is to be conducted

**Or Equivalent**

The term “or equivalent” (also “or equal”) means a substitute which has equal or better characteristics than that specified. Where the Contractor selects an “or equivalent” it must be subject to review by the Technical Authority. A comparison of the general Specifications sufficient to prove equivalency must be provided to the Technical Authority for the equipment specified and the “or equivalent”.

**Overhaul**

The term “overhaul” as applied to any mechanical equipment, structure or system means the Contractor must incorporate into the work requirement as a minimum the following:

- Disassembly into component parts;
- Cleaning;
- Inspection of parts for defects;
- Gauging of parts for wear;
- Renewal or repair of parts worn beyond Specification limits or otherwise defective;
- Reassembly;
- Adjustment to Specification;
- Tests and functional trials.

**Owner**

Her Majesty, The Queen in Right of Canada as represented by the Minister of Fisheries and Oceans.

**Owner Sea Trials**

Additional sea trials conducted subsequent to the trials specified above the intention of which is to demonstrate the correct operation and performance of the vessel and its equipment to the owner.

**O.S&Y.**

Outside Screw and Yoke

**PDF Format**

Portable Document File format.

**PAP**

Project Action Plan

**PC**

Personal Computer

**PCS**

Propulsion Control System

**PID**

Proportional, Integral, Derivative control loop

**PIT**

Portable Interface Terminal

**PLC**

Programmable Logic Controller

**PM**

Preventative Maintenance

**PMBok**

Project Management Body of Knowledge

**PMI**

Project Management Institute

**PSI**

Pounds per Square Inch

**PSIA**

Pounds per Square Inch Absolute

**PSIG**

Pounds per Square Inch Gauge

**PWGSC**

Department of Public Works and Government Services Canada

**RCS**

Remote Control System

**Reassemble**

The Contractor must provide all labour to put together, piece by piece, the equipment, machinery or system on completion of examination or overhaul.

**Refurbish**

The Contractor must provide all labour and materials to effect minor repairs, clean and refinish to like new condition.

**Reinstall**

The word “reinstall” means a piece of equipment the Contractor has removed that must be installed in its original location unless stated to relocate. The Contractor must provide all materials and labour to complete the installation.

**Relocate**

The Contractor must provide all labour and materials to remove the unit, piece of equipment or system and install the same unit, piece of equipment or system in a new location.

**Remove**

The Contractor must provide all labour and materials to remove the unit, equipment, materials or systems in its entirety. Part of the removal process must include the termination of any connected system which must remain on the vessel. As part of the removal process the Contractor must restore all disturbed surfaces such as insulation, linings, deck covering and paint coatings to their original condition.

**Replace**

The Contractor must provide all labour and materials to disconnect and remove existing equipment and material and supply and install new equipment and material to the extent specified in the Project Task Requirements.

**RFI**

Radio Frequency Interference

**RIO**

Remote Input/Output

**RPM or rpm**

Revolutions per Minute

**RPU**

Remote Processing Unit

**RPU-TU**

Remote Processing Unit for Terminal Units

**SAE**

Standards of Automotive Engineers

**SCADA**

Supervisory Control and Data Acquisition

**SCR**

Silicone Controlled Rectifier

**Sea Trials**

Consist of a full trial of all equipment and systems under operational conditions at sea. These trials must be carried out only after all dock trials are complete.

**SHP or S.H.P.**

Shaft Horsepower

**Shop Test**

Tests performed in a controlled environment ensure that the machinery has been built to Specification and is approved by TCMS before delivery.

**S.N.A.M.E.**

Society of Naval Architects and Marine Engineers

**SOLAS**

Safety of Life at Sea Convention as per IMO

**SOP**

Standard Operating Procedure

**SP. In. WG.**

Static Pressure, Inches Water Gauge

**SS**

Stainless Steel

**Sub-Contractor**

A competent service facility or service provider under contract to the Contractor

**T or t**

Thickness, as in plate thickness

**TCMS**

Transport Canada Marine Safety is the final authority in the interpretation of the applicable Ship Safety Branch Standards.

**Technical Authority (TA or CCG PM)**

The Technical Authority must be responsible for all technical and operational aspects of the project requirements.

**Tests**

A test must be the verification of a component or part of a system. The test must ensure compliance with the Specification and demonstrate quality of workmanship.

**TIF**

Tagged Image File

**TP**

Transport Canada Publications

**Trial**

A trial must be carried out only on systems that are complete in all respects. The documentation must be complete and verified by the Technical Authority. The system must be fully marked and tagged. The trial must demonstrate the required performance of the system under all operating conditions. A trial must be carried out using normal system operating fluids.

**U.L.**

Underwriter's Laboratories

**U.L.C.**

Underwriter's Laboratories of Canada

**UPS**

Uninterrupted Power Supply

**US gph**

United States Gallon per Hour

**US gpm**

United States Gallon per Minute

**USSG**

United States Steel Gage

**VAC (V A/C) or VAC**

Voltage Alternating Current

**VDC (V D/C) or VDC**

Voltage Direct Current

**TLE**

Transitional Life Extension

**VPI**

Vacuum Pressure Impregnated

**W**

Watt

**wb**

Wet Bulb

**WHMIS**

Workplace Hazardous Material Information System

**WSP**

Working Steam Pressure

**WOG**

Water, Oil, Gas

**Working Drawings**

Detailed engineering drawings produced by the Contractor or sub-Contractors from the guidance drawings. The working drawings must be submitted for approval by TCMS where required. Working drawings must be used for field installations and must be marked-up with any corrections during field installations.

**120/1/60**

120VAC, Single Phase, 60 Hz

**240/3/60**

240VAC, 3 Phase, 60 Hz

**600/3/60**

600VAC, 3 Phase, 60 Hz

,

Denotes measurement in feet

”

Denotes measurement in inches

