

CCGS *Martha L. Black* **Drydock Refit**

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Prepared by
Vessel Life Extension Program
And
Marine engineering

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1.0 GENERAL NOTES

1.1 Intent

- 1.1.1 The CCGS Martha L. Black is currently a fully operational vessel with all valid ABS navigation certificates.
- 1.1.2 These project requirements are supplied to the Contractor outlining the objectives, performance, standards and engineering requirements for the Vessel Life Extension (VLE) and maintenance of the CCGS Martha L. Black.
- 1.1.3 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:
 - 1.1.3.1 The execution of the work specified herein is to the satisfaction of the Inspection Authorities and Regulatory Bodies, delegated by Transport Canada TC/MS to American Bureau of Shipping ABS;
 - 1.1.3.2 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.
- 1.1.4 Sections 8 and beyond of this Specification define the individual work items that the Contractor must address during the CCGS Martha L. Black's Vessel Life Extension Project.
- 1.1.5 The performance requirements specified in Sections 1 through to Sections 7 of these project specifications must be applicable to Sections 8 and beyond in all respects. The specification in Sections 8 and beyond may not specifically reference Sections 1 to 7; however, they must still apply.
- 1.1.6 A complete listing of drawings for the CCGS Martha L. Black is in the Technical Data Package available on Buy and Sell.
- 1.1.7 Abbreviations used in this Specification are provided in Appendix A of this Statement of Work.
- 1.1.8 The vessel will have a reduced crew for the first part of the contract. The full crew will be mobilized for the final weeks of the project to conduct maintenance, recertification and sea trials. The crew will not be accommodated on board during the period when the shipyard is in charge of the vessel.

1.2 General Particulars of Vessel

Name:	CCGS <i>Martha L. Black</i>
Type:	Type 1100 High Endurance Multi-tasked Vessel (HEMV)
Ice Classes	Lloyd's Register ✱100A1 Ice Class 1A Super LMC With Descriptive Notation: Navais Tender / Light Ice Breaker
Year Built	1986
Voyage Class	Unlimited, beyond 200nm
Builder	Burrard DryDock, Vancouver

Principal Dimensions:

Length Overall	83.0 meters
Length BP	75.0 meters
Breadth, molded	16.2 meters
Depth Molded	7.75 meters
Draft	6.20 meters
Tonnage	3853 GRT, 1528 NT
Displacement, Full Load	4967.87 tonnes
Lightship Weight	3323.45 tonnes

The CCGS *Martha L. Black* is a three-engine twin-screw vessel, with three Alco 251F medium speed, 900 RPM, diesel engines propulsion generators that provide power to two propulsion motors and shafts. Each shaft drives a fixed pitch propeller. The existing bow thruster is a Wartsila fitted in 2018. The single rudder is fitted with an independent electro-hydraulic steering gear.

1.3 Technical Data Package

The Contractor is provided with the following data packages to fully define the scope of work for the CCGS *Martha L. Black* Vessel Life Extension Refit Project:

- Technical Specifications (this Specification document and appendixes);
- Guidance Drawings – Electronic format;
- CCGS *Martha L. Black* Drawings – Electronic format;
- CCGS *Martha L. Black* Asbestos Materials Re-Assessment updated Report
- Applicable CCG Standards and Guidelines – Electronic format.

Supplementary Documentation (not provided by the CCG)

- ASTM F1321-14 – 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 G82-98 (2014) – Standard Guide for Development and Use of a Galvanic Series for Predicting Galvanic Corrosion Performance
- CAN/CGSB 3.11-2010 – Naval Distillate Fuel
- CAN/CGSB 4.155-M88 (R2013) – 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 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- CAN/ULC-S102.2-10 – Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies
- CAN/ULC-S109-14 – Standard Method for Flame Tests of Flame-Resistant Fabrics and Films
- CAP437 – Standards for Offshore Helicopter Landing Areas
- Canada Shipping Act, Machinery and Hull regulations pertaining to a Vessel having general particulars as specified under Section 1.2
- CSA C22.1-15 – Canadian Electrical Code Part I Safety Standard for Electrical Installations
- CSA C22.2 – No. 0-10 (2014) – General Requirements – Canadian Electrical Code Part II
- CSA W47.1-09 (2014)– Certification of Companies for fusion welding of steel
- CSA W47.2-11 – Certification of Companies for fusion welding of aluminum
- IEC 60092-504 ED 3.0 CORR1:2001– Electrical Installations in Ships – Part 504: Special Features – Control and Instrumentation
- CAN/CSA-C22.2 No. 60529-05 (R2010) 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 3rd 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 (1993)
- TP 127E (2002) – Ship Safety Electrical Standards
- TP 1861E Standards for Navigation Lights, Shapes, Sound Signal Appliances and Radar Reflectors (1991)
- TP 2072E Deck Cargo Safety Code 1974
- TP 4414E – Guidelines Respecting Helicopter Facilities on Ships
- 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

TP Publications are available at the following web site:

<http://www.tc.gc.ca/eng/marinesafety/tp-menu-515.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.bsigroup.com/en-GB/>

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

- 1.4.1 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 50 square meters of secure office space with the following requirements for CG personnel:
 - 1.5.1.1 Two (2) lockable offices with a minimum of 20 square meters each;
 - 1.5.1.2 Three (3) high speed internet connections;
 - 1.5.1.3 One (1) office copier capable of handling 216 by 279 mm paper, 216 by 356 mm paper and 279 by 432 mm 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 Six (6) 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 200 square meters 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 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.
- 1.6.3 The storage space must be on the premises of the Contractor's facility.
- 1.6.4 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 100 cubic meters of diesel fuel. Any difference in the amount of fuel from 100 cubic meters the

price of storage must be adjusted up or down, at the volume prorate, 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:
 - 1.7.1.1 Services;
 - 1.7.1.2 Regulatory Bodies;
 - 1.7.1.3 Classification Society Inspections;
 - 1.7.1.4 Factory Service Representatives;
 - 1.7.1.5 Tests and Trials of equipment and vessel;
 - 1.7.1.6 Provision of safety services, e.g. gas freeing of tanks, fire protection, cocooning asbestos containing areas;
 - 1.7.1.7 Certification of lifting devices as required;
 - 1.7.1.8 Type approval of equipment to be installed if required.
- 1.7.2 The Contractor must contact, coordinate and schedule all regulatory inspections and/or class surveys by the applicable authority: i.e. ABS (TCMS), HC, Environment Canada or others as required by the specification.

1.8 “As Delivered” Inspection

- 1.8.1 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 Property of Canada

General

- 1.9.1 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.
- 1.9.2 All such equipment and materials must be held and retained in good condition by the Contractor pending instructions from the Contract Authority.
- 1.9.3 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.

Categorization

1.9.4 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:

1.9.5 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.

1.9.6 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.

1.9.7 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.

1.9.8 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”.

1.9.9 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.

1.10 Spare Parts

1.10.1 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.

1.10.2 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.

- 1.10.3 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 of installed base and unit price of each spare listed. This list must include the following fields:
 - 1.10.3.1 Supplier;
 - 1.10.3.2 Manufacturer;
 - 1.10.3.3 Manufacturer's Part Number;
 - 1.10.3.4 Price per Unit;
 - 1.10.3.5 Unit definition (each, case, etc.);
 - 1.10.3.6 Recommended Quantity;
 - 1.10.3.7 Associated System/Equipment.
- 1.10.4 An electronic copy of the spares parts list must be supplied to the Inspection Authority and the Technical Authority.
- 1.10.5 The Contractor must notify the Inspection Authority and the Technical Authority when such spare parts have been received for visual inspection.
- 1.10.6 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.
- 1.10.7 The Contractor must deliver the spare parts to after inspection by TA:
**Canadian Coast Guard
CCGS Martha L. Black
101 Boul. Champlain,
Québec City, Québec,
G1K 7Y7**

1.11 Project Management

Introduction

- 1.11.1 Project management refers to system integration and technical control as well as business management of the *CCGS Martha L. Black* Vessel Life Extension Refit Project.
- 1.11.2 NOTE: Examples of the items below marked with an asterisk * should be delivered with the bidder's proposal.

Project Action Plan (PAP)*

- 1.11.3 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.
- 1.11.4 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.
- 1.11.5 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.

Project Integration Management*

- 1.11.6 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.

Change Management Log*

- 1.11.7 The Contractor must provide a Change Management Log that must be used for the duration of the project to manage project changes.
- 1.11.8 The Change Management Log must track project issues with the following criteria:
 - a) Individual tracking number;
 - b) Date issue was raised;
 - c) Expected resolution date;
 - d) Date issue was resolved;
 - e) Brief note of resolution on issue;
 - f) Individual who raised issue;
 - g) Individual assigned to resolve issue;
 - h) Risk Factor.
- 1.11.9 If issues require a change in the work they must be dealt by submitting a PSPC 1379 Form.

Risk Management*

- 1.11.10 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.

Scheduling*

- 1.11.11 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.
- 1.11.12 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.
- 1.11.13 The schedule(s) must identify the major milestones, critical path and all interrelationships between tasks.
- 1.11.14 The schedule(s) must be delivered 14 calendar days after contract award.
- 1.11.15 A milestone schedule must be supplied with the bidder’s tender package.
- 1.11.16 The PMBoK 2000 must be used as the reference for scheduling.

Project Reporting

- 1.11.17 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

- 2.1.1 All new machinery and/or equipment that are to be supplied and installed must be designed for operation under the following conditions:
- a) Outside air temperature:
 - b) -40 degree C winter;
 - c) +35 degree C summer;
 - d) Water temperature:
 - i. 0 degree C winter;
 - ii. +30 degree C summer;
 - e) Wind Velocity of 80 knots;
 - f) Sea State 6;
 - g) 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;
 - h) Permanent list of 22.5 degrees port or starboard, and permanent trim of 10 degree fore and aft.

Equipment below Decks

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

Equipment above Deck

- 2.1.3 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.

Electronic Compartments

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

Manned Compartments:

- a) Room temperature: 20°C to 25°C;
- b) Relative humidity: 5 to 70%;
- c) Noise level: 65 dBA.

Unmanned Compartments:

- a) Room Temperature: 20°C to 25°C;
- b) Relative humidity: 40 to 70%;
- c) Noise level: 80 dBA.

Vibration

- 2.1.5 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:

- a) Up to 13.2 Hz with displacement amplitude of +/- 1.0mm;
- b) 13.2 to 100.0 Hz acceleration of +/- 0.7g with a maximum acceleration of 0.7g;
- c) Natural frequencies at supports for equipment and parts of equipment must not be within the 0 to 100 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

General

- 2.2.1 The Contractor must ensure the removal of all rough edges, points, sharp corners and protrusions created during the conduct of the work.
- 2.2.2 Smoking is not permitted aboard this vessel.

Hot Work

- 2.2.3 The following precautions must be taken where hot work is to be conducted:
- a) 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;
 - b) Protective material must be used to prevent the spread of sparks, protecting electrical cables, machinery and other services;
 - c) 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.
- 2.2.4 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.

Confined Space Entry

- 2.2.5 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".
- 2.2.6 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.

Rotating Machinery

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

Electrical Equipment

- 2.2.8 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.
- 2.2.9 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.

Work Aloft

- 2.2.10 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.

Hazardous material

- 2.2.11 Reference documentation:
- 2.2.11.1 171-09529-47_NGCC_MarthaL-Black_HazMat_20190808_signe
- 2.2.11.2 TB-BT-2020-03
- 2.2.12 Reference Document *171-09529-47_NGCC_MarthaL-Black_HazMat_20190808_signe* contains the inventory of hazardous materials on board the vessel. The contractor must be aware of the hazardous materials when planning the work in order to implement the appropriate health and safety measures in accordance with the regulations in force.
- 2.2.13 TB-BT-2020-03 outlines the risk control measures and actions required for work with lead- and mercury-containing coatings. The contractor must follow the control and mitigation measures outlined in the document for all painting jobs. The contractor must assume that old or existing coatings on CCG vessels contain lead and, until proven otherwise, appropriate measures and precautions must be taken for any work that may alter these coatings.
- 2.2.14 The Contractor shall provide a 500-hour allowance for the containment and decontamination of painting areas. Disposal of hazardous materials shall be processed on a Form 1379. The Contractor shall provide a certificate or proof of hazardous material disposal.
- 2.2.15 No material containing asbestos is permitted to 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.
- 2.2.16 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.

- 2.2.17 Note: The latest survey done has determined that there are small quantities of non-friable ACMs (Asbestos Containing Materials) onboard the CCGS Martha L. Black. 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 in the survey 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 the machinery and/or systems prior to connections being made must be kept covered by inserts or covers at all times. All openings into the superstructure or hull must be kept covered to prevent water or contaminant ingress into the vessel.
- 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

Installation and Removal Routes

- 2.5.1 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.
- 2.5.2 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.

Penetrations

- 2.5.3 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.

Access for Maintenance

- 2.5.4 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

Securing Arrangements of System Equipment and Components

- 2.6.1 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.
- 2.6.2 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.
- 2.6.3 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.

Cleaning

- 2.6.4 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.

Damaged Items

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

2.7 Welding

General

- 2.7.1 For fusion welding for steel the Contractor must be certified in accordance with the Canadian Welding Bureau (CWB), CSA\ACNOR W47.1-09 (R2014), Division 2.1. The Contractor must supply proof of his accreditation to the Inspection Authority. All such welding must be to CSA Standard W59:2013 - Welded Steel Construction (Metal Arc Welding).
- 2.7.2 All aluminum welding must conform to the requirements of CSA Standard W47.2-11 "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 W47.2-11. Proof of certification must be provided to the Inspection Authority.

- 2.7.3 The Contractor must provide copies of all welding certificates at the start of the contract work.
- 2.7.4 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 Boiler and Pressure Vessel Code, Section IX.

Removal of Attachments

- 2.7.5 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.

Weld Design Requirements

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

2.8 Painting

General

- 2.8.1 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.
- 2.8.2 All pipe markings must be in accordance with the Canadian Coast Guard Color Coding Standard for Piping Systems.
- 2.8.3 All new and disturbed steel and aluminum work must be painted in accordance with publication Canadian Coast Guard Paints and Coatings Standard and to the paint manufacturer's specifications.
- 2.8.4 Paint, varnish and other finishes used on interior surfaces must have Classification Society Type Approval certificate from a Transport Canada authorized Registered Organization.
- 2.8.5 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.
- 2.8.6 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.

2.8.7 The following must NOT be painted:

- a) Screw threads;
- b) Grease fittings;
- c) Bronze pins;
- d) Door screens;
- e) Nameplates;
- f) Gaskets;
- g) Stainless steel or monel metal fittings;
- h) Machined surfaces;
- i) Instrumentation;
- j) Interior gratings;
- k) Electrical wires, insulation and fittings;
- l) Electrical panels;
- m) Rubber seals of watertight doors and hatches;
- n) Fire door seals, and;
- o) In general, all working parts.

2.8.8 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.

2.8.9 The Contractor must ensure the ambient environmental conditions are within the acceptable parameters for the application of any hull coatings. The Contractor is responsible for hoarding the vessel to ensure the ambient conditions during the dry dock permit the application of the hull coatings.

Heavy Metal Based Coatings

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

2.9 Identification

Nameplates

- 2.9.1 Nameplates must be fitted for all new equipment, new compartments, new doors and closures.
- 2.9.2 All nameplates must be in English and French for safety of operation.
- 2.9.3 Lettering must be clear and concise with the minimum use of abbreviations. Primary information must be given in larger size lettering than secondary information.
- 2.9.4 The type of nameplates must suit the location in the vessel as specified below:
- 2.9.5 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.
- 2.9.6 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.
- 2.9.7 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.
- 2.9.8 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.
- 2.9.9 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.
- 2.9.10 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.
- 2.9.11 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.

Key Tags

- 2.9.12 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.
- 2.9.13 All new keys and new key tags must be turned over to the Technical Authority as part of the acceptance of the vessel.

Safety Related Signs

- 2.9.14 All new signs must be in English and French for safety of operation.
- 2.9.15 Painted signs for muster station directions, fire stations and emergency equipment, etc. must be supplied and located in accordance with TCMS approval.
- 2.9.16 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. PSPC Form 1379 must be submitted to adjust the cost of bilge waste disposal up or down, at the volume prorated.
- 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 engine room bilge areas and pump with disposal of accumulation of any solids and liquids.

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.
- 3.1.4 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

General Installation

- 3.2.1 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.
- 3.2.2 Piping must be located where it would not likely be subject to physical damage.
- 3.2.3 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.

- 3.2.4 Where high and low points in piping are unavoidable, vents, 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.
- 3.2.5 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.
- 3.2.6 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.
- 3.2.7 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.
- 3.2.8 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.
- 3.2.9 Piping must not be led through the following spaces, except as necessary to serve the space:
 - Chain lockers;
 - Wiring trunks and enclosures.
- 3.2.10 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.
- 3.2.11 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.
- 3.2.12 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.

- 3.2.13 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.
- 3.2.14 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.
- 3.2.15 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.
- 3.2.16 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 latter must be fitted only when specified. The permissible potential difference must be no greater than 0.4 volts.
- 3.2.17 Raised face flanges must not be used against bronze or other relatively low strength composition valves, fittings or flanges.
- 3.2.18 Where pipes pass through holes in non-watertight structure, provision must be made to keep the pipes from bearing on the structure.

Material Selection

- 3.2.19 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.
- 3.2.20 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.

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

Figure 3-1: Acceptable Materials for Specific Piping Systems

Item/System	Material Figure
Raw Water Systems	Reference
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, 19f, 20f, 21f, 4fl, 5fl, 11fl, 5g, 6g, 7g, 1b, 2b, 6b, 1a, 2a, 4a.
Oil Fuel, Marine Diesel and Distillate	Reference
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.
Fresh Water	Reference
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.
Lubricating Oil	Reference
General Service (150 PSIG rating)	4t, 6g, 7g, 1b, 6b, 1a, 5a, 4fl, 12fl, 8f, 9f, 10f, 21f, 9v, 10v, 11v.
Hydraulic Oil	8t, 9t, 1b, 1g, 1a, 6fl, 12fl, 13f, 14f, 15f, 21f, 22f, 14v.
Steam (150 psig)	Reference
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)
Compressed Air	Reference
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.
Deck Drains and Scuppers	Reference
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/AASTM A376-79B AISI 316	Stainless

Figure 3-3: Material for Valves

	Description	Material
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

	Description	Material
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

	Description	Material
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

Fire Fighting Systems

- 3.2.22 Piping for CO₂ and FM200 firefighting systems must comply with the regulations of TCMS and system manufacturer's specifications.

Exhaust Piping

- 3.2.23 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).

Piping Fabrication

- 3.2.24 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.

Bulkhead and Deck Pieces

- 3.2.25 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.

Joints and Connections

- 3.2.26 Brazed 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.
- 3.2.27 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.

Contact Strips

- 3.2.28 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.

Hydraulic Piping

- 3.2.29 Hydraulic piping must be phosphate pickled, neutralized, flushed with oil and blown dry prior to installation. The cleanliness of the flushing fluid must be to ISO 4406 class 18/16/13, and be determined on the basis of a fluid sample.

Identification of Piping

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

3.3 Pumps

General

- 3.3.1 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.
- 3.3.2 Engine driven pumps must be engine manufacturer's standard supply. Allowance must be made for specific installation requirements when specifying pump performance parameters.
- 3.3.3 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.
- 3.3.4 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.
- 3.3.5 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.

3.3.6 Pumps operating in parallel must be capable of continuous steady operation.

3.3.7 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.

Centrifugal Pumps

3.3.8 Centrifugal pumps, unless otherwise specified, must have the following characteristics:

- a) Vertical in-line overhung;
- b) Radial split bronze casing;
- c) Stainless steel shaft;
- d) Mechanical shaft seal;
- e) Aluminum bronze impeller;
- f) Renewable wear rings;
- g) Removable shaft spacers;
- h) Bearings lubricated by the pumped fluid in plain bearing applications or grease packed roller bearings.

3.3.9 Pumps must be fitted with the following attachments:

- a) Discharge pressure gauge, liquid filled, with isolating cock;
- b) Compound suction gauge, liquid filled, with isolating cock;
- c) Drip tray;
- d) All applicable guards.

3.3.10 The design of the pump must allow the complete rotating assembly to be withdrawn without disturbing the pipe work.

3.3.11 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.

Positive Displacement Pumps

3.3.12 Pumps, unless otherwise specified, must have the following characteristics:

- a) Positive, constant displacement, rotary screw;
- b) Nodular iron casing, max 18% elongation;
- c) Steel power rotor;
- d) Integral relief valve, adjustable;
- e) Mechanical seal.

3.3.13 Pumps must be fitted with the following accessories:

- a) Discharge pressure gauge, liquid filled, with isolating cock;
- b) Compound suction gauge, liquid filled, with isolating cock;
- c) Drip tray;

- d) 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:
- a) Discharge to a closed system or tank that subjects the valve outlet to a back pressure when the valve is closed;
 - b) Discharge to a closed system or equipment that subjects the outlet to sub-atmospheric pressure when the valve is closed;
 - c) Flammable or combustible liquids;
 - d) 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

General

- 3.5.1 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.

- 3.5.2 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
- 3.5.3 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.
- 3.5.4 Where possible, insulation materials must be from one manufacturer.

Lagging

- 3.5.5 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:
 - a) Fibrous glass cloth, tape and thread, Flextra™ or equivalent
 - b) Aluminum mechanical protective guards, plain or hammered, secured with quick release fasteners.
- 3.5.6 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
- 3.5.7 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.
- 3.5.8 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.

- 3.5.9 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.

Securing Arrangements

- 3.5.10 All insulation materials must be secured to prevent settling and to permit ready removal for maintenance of equipment.
- 3.5.11 All high temperature piping systems must be insulated using reusable pre-made covers of the following materials, from pipe surface outwards:
- a) Monel mesh;
 - b) 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;
 - c) Foil-lined silicone-coated fiberglass lagging secured to insulation by stapling: all edges are to be sealed.
- 3.5.12 Covers must have stainless or Monel clips, secured by through-hooks around which stainless steel lacing wire can be wound for mounting and securing.
- 3.5.13 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.
- 3.5.14 Where pipe insulation abuts flanges and fittings, the ends of the insulation must be tapered to permit removal of bolts.

Insulation Thickness

- 3.5.15 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.

Insulation, Anti-condensation

- 3.5.16 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.

3.5.17

3.5.18 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.

Insulation, removable/reusable covers or pads

3.5.19 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.

Ducting

3.5.20 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.

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

3.6 Machinery Space Outfit

General

3.6.1 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.

Floor plates

3.6.2 Floor plates must be of 10 kg. 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).

Guards

- 3.6.3 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.

Sea Suction and Overboard Discharges

- 3.6.4 All new sea suction 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.

Sea Isolation Valves

- 3.6.5 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.
- 3.6.6 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.
- 3.6.7 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.
- 3.6.8 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

Pressure/Suction Gauges

- 3.7.1 Unless otherwise specified, only 115mm diameter or bigger gauges must be used for instrumentation.
- 3.7.2 All gauges with pressure exceeding 1000 PSI (7000 kPa) or those used with compressible fluids must be safety gauges with back blow outs.
- 3.7.3 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.

- 3.7.4 All pumps must be fitted with suction compound and discharge pressure gauges.
- 3.7.5 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.
- 3.7.6 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.

Temperature Gauges

- 3.7.7 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.
- 3.7.8 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.
- 3.7.9 Thermometers for measuring air temperatures must be fitted with a perforated guard stem and a mounting flange instead of a brass separable thermo well.
- 3.7.10 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 ± 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:
 - a) Weight of the combined equipment complete with sub-base;
 - b) Center of gravity of the equipment;
 - c) 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:
 - a) The Contractor must prepare and submit a CWB engineer approved welding schedule for approval by TCMS;

- b) All inserts on shell plating must be flush;
- c) All underwater inserts must be subject to 100% radiography on completion;
- d) 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;
- e) 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 New Rotating Machinery

- 4.2.1 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.
- 4.2.2 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.

- 4.2.3 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.
- 4.2.4 Any rotating equipment incorporating brushes must be fitted with inspection windows.
- 4.2.5 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.
- 4.2.6 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.
- 4.2.7 Single speed induction motors must be of a 4-pole 1800-RPM, unless otherwise specified.
- 4.2.8 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.
- 4.2.9 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.
- 4.2.10 Where anti-friction type bearings (ball bearings) are specified for rotating electrical machinery, they must:
 - a) Be rated and suitable for the type of drive;
 - b) Be noise tested;
 - c) Be of the deep groove type where the drive introduces end thrust;
 - d) Be of the pre-lubricated type, unless otherwise specified.
- 4.2.11 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.
- 4.2.12 Motors for V-belt applications must have their bearings designed for this purpose.
- 4.2.13 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.

- 4.2.14 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.
- 4.2.15 The Contractor must confirm all pertinent characteristics of replacement motors prior to procurement and to ensure compatibility with requirements of retained machinery.
- 4.2.16 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:
 - a) Manufacturer's name;
 - b) Duty/service factor;
 - c) kW and full load speed;
 - d) Enclosure type;
 - e) Efficiency;
 - f) PF for full, $\frac{3}{4}$ and $\frac{1}{2}$ load (A/C motors);
 - g) Locked rotor torque and current;
 - h) Weight;
 - i) NEEMAC design characteristics;
 - j) Insulation Class;
 - k) Full Load Current;
 - l) Temperature rise class;
 - m) Voltage;
 - n) Frequency;
 - o) Frame size.

4.3 Anti-Condensation Heaters

- 4.3.1 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.
- 4.3.2 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.
- 4.3.3 Visual ON/OFF status indication must be provided at the equipment control station as detailed:
 - a) For motors on their respective control station or local starting panel;
 - b) For electrical control equipment on the relevant panel.
- 4.3.4 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.

4.4 Electrical Nameplates

- 4.4.1 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.
- 4.4.2 Any special precautions, maintenance or operating instructions must be included on the nameplates or on a separate plate attached to the equipment.
- 4.4.3 All electrical equipment and compartments housing hazardous voltages must carry a warning notice indicating that a hazard exists and specify the maximum system voltage.
- 4.4.4 Switchboards must have nameplates listing:
 - a) Name of switchboard;
 - b) Manufacturer;
 - c) Serial number, if applicable;
 - d) Date of manufacture.
- 4.4.5 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.
- 4.4.6 Distribution panels must have nameplates showing:
 - a) Space, service, apparatus or circuits controlled; feeder designation.
- 4.4.7 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.
- 4.4.8 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.
- 4.4.9 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.

4.5 Cables

- 4.5.1 All cables must meet TP127E requirements, be manufactured, tested and installed in accordance with the latest TCMS Publication, IEEE and Classification Society requirements.
- 4.5.2 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:
 - a) Conductor size;
 - b) Current rating;
 - c) Estimated length;
 - d) Identification number and name of manufacturer;
 - e) Approximate weight;
 - f) Voltage drop;
 - g) Insulation level (voltage);
 - h) Insulation type designation and maximum allowable temperature.
- 4.5.3 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.
- 4.5.4 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.
- 4.5.5 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.
- 4.5.6 Where cables enter the side of an enclosure, they must run downward from the cabinet before running in an upward direction.
- 4.5.7 A minimum of 15% spare space must be provided on each new raceway and on all modified cable runs.
- 4.5.8 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.

- 4.5.9 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.
- 4.5.10 Adhesive or permanently printed plastic identification tags for individual cables and conductors may be used inside equipment cubicles and equipment racks.
- 4.5.11 All conductor identification markings and cable tags must be reflected in the “As Fitted” system drawings and must be as follows:
- a) Cable tags must be printed with indelible ink and must not be handwritten;
 - b) Each cable must have an identifier unique to the installation;
 - c) Each cable tag must have the following information: unique cable name and location for each end, and;
 - d) 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.
- 4.5.12 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.
- 4.5.13 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.
- 4.5.14 Low loss co-axial cables of correct impedance must be used for co-axial cable antenna feeders.
- 4.5.15 Where foam core dielectric cables are used, crimp shield connectors must be fitted. The Contractor must not use solder type connectors.
- 4.5.16 The routing of new generator cables must be as direct as possible and such cables must be run on the wire ways carrying existing generator cables or if this is impractical, then on wire ways specifically designed for this purpose. When taking generator cables to their respective machines, provision must be made for sufficient slack to permit the machine to be subsequently disconnected and reconnected without damaging the cable.

4.6 Separation of Cables

4.6.1 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.

4.6.2 Cables may be bundled according to their categories in Figure 4-1 and the following guidelines:

- a) 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;
- b) Bundling of cables from Group F to Group K should be avoided and, if necessary, additional screening material should be provided;
- c) 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	-

4.7 Circuit Breakers

- 4.7.1 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.
- 4.7.2 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.
- 4.7.3 Breakers must be calibrated at 50°C.
- 4.7.4 Breakers must be suitable for marine application;
- Be the molded case type;
 - Be rated for 600VAC, 240 VAC or 120VAC;
 - Be the quick make/quick break type;
 - Have inverse time over current characteristics;
 - Have overload device in each phase.

4.8 Motor Controllers Center MCC

- 4.8.1 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.
- 4.8.2 Motors 30 kW and above must be equipped with solid-state reduced voltage starters (soft starts) to limit the inrush current.
- 4.8.3 Individual starters controlling 3-phase AC motors must conform to the latest edition of TP 127E and IEEE STD 45-2002 and must be:
- a) Fitted with a means of locally isolating the motor where the starter is not located adjacent to the motor;
 - b) Fitted with indicating lights at the starter to indicate the state of the isolating switch;
 - c) 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;
 - d) Fitted with two indicating lights: one to show when the associated motor is operating and one to show when it is stopped;
 - e) Indicating lights must be LED type;
 - f) Fitted with drip proof or watertight type START and STOP pushbutton;
 - g) Fitted with one (1) externally operated, overload reset button mounted in the front, for all three overload relays;
 - h) Fitted with auxiliary contact to operate anti-condensation heaters where required;
 - i) Arranged for bottom cable entry through glands;
 - j) Fitted with an ammeter with selector switch for individual phase amperage readings for motor ratings of 20 kW and over.
- 4.8.4 Where alarm indication lights are provided at the local control station, facilities must be provided for a lamp test.
- 4.8.5 Where alarm buzzers are provided at the local control stations, facilities must be provided for buzzer mute.
- 4.8.6 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.
- 4.8.7 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.
- 4.8.8 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.

4.8.9 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:

- a) Manufacturer's name;
- b) Duty;
- c) Type of starter;
- d) Type of protection – over-current under voltage;
- e) Weight;
- f) Enclosure;
- g) Schematic wiring diagram;
- h) Starter size.

4.9 Transformers

4.9.1 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.

4.9.2 In general, the following principles must apply to transformers:

- a) Be of the single phase type (unless otherwise specified);
- b) Be suitable for 3-phase operation, delta/delta;
- c) Be suitable for bulkhead and/or deck mounting up to 50 kVA and platform or deck mounting above 50 kVA;
- d) Be of the air cooled type;
- e) Have a drip proof enclosure with louvers;
- f) Have a winding insulation of Class F or better;
- g) Have final operating temperature not exceeding Class B temperature rise;
- h) Have +/- 2 ½ % and +/- 5% taps on all primary windings (2 FCAN and 2 FCBN);
- i) Be supplied with copper windings;
- j) Be built in accordance with the latest edition of TP 127E and IEEE 45 STD - 2002;
- k) Sound levels must be at or below the latest CSA standards;
- l) Transformers must have nameplates consisting of the following:
 - i. Manufacturer's name;
 - ii. Rating in kVA;
 - iii. Rate full load temperature rise;
 - iv. Primary and secondary voltage ratings;
 - v. Frequency in Hz;
 - vi. Rated impedance;
 - vii. Noise level.

- 4.9.3 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.
- 4.9.4 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.

4.10 Electronic Equipment Installation

- 4.10.1 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.
- 4.10.2 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.
- 4.10.3 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.
- 4.10.4 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.
- 4.10.5 Field device identification labels must contain the following information:
- a) Location of field device;
 - b) Primary drawing associated with field device.
- 4.10.6 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.

4.11 Safety Switches

- 4.11.1 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.
- 4.11.2 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.

4.12 Rack/Console Mounting

- 4.12.1 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.
- 4.12.2 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.
- 4.12.3 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.
- 4.12.4 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.
- 4.12.5 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.
- 4.12.6 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.
- 4.12.7 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.

4.13 Bulkhead/Tabletop Mounting

- 4.13.1 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.
- 4.13.2 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.
- 4.13.3 All bulkhead and tabletop mounted equipment must have its equipment cases bonded to the ship's metal structure.

4.14 Overhead Mounting

- 4.14.1 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
 - 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

- 5.2.1 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.

Radiated Interference (above 150 kHz)

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

Conducted Interference (30 Hz to 15 kHz)

- 5.2.3 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.

Conducted Interference (above 15 kHz)

- 5.2.4 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.
- 5.2.5 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.
- 5.2.6 Class 2 limits must apply in well-screened situations, such as:
- Within the metallic structure of the vessel;
 - Where screening has been specially provided.
- 5.2.7 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

- 5.3.1 Interference must be suppressed at its source or receiver using the following guidelines:
- a) 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;
 - b) The minimal cable separations must be observed;
 - c) 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;
 - d) Capacitors must not be used to suppress arcs across electrical contacts;
 - e) Components in metal boxes must have the boxes bonded to the metal of the interfering source;
 - f) 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;
 - g) Double sided PCB's must be utilized wherever practicable.

5.4 Screening of Cables

5.4.1 The screening of cables must satisfy the following ground rules:

- a) Screens must have a shielding efficiency of at least 90%;
- b) Low frequency cables should use a ferrous screen material, grounded at a single point, i.e. below 15 kHz;
- c) 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;
- d) 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

5.5.1 Grounding and bonding must be in accordance with TP127E.

5.6 Racks and Consoles

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

- a) 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.
- b) 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.

Equipment Cases

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

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

Methods and Materials

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

- a) All contact surfaces must be clean and free from paint, scale, rust or any material considered likely to impair the contact efficiency;
- b) The contact surface area must be as large as practical;
- c) Contact surfaces must be bonded using a method that will not impair contact efficiency, i.e., welding welded stud, etc.;
- d) 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;
- e) Ground straps and joints must be readily accessible for maintenance;
- f) Other low resistance, chemically compatible, corrosion-resistant materials may be approved for use by TCMS;
- g) All bonding hardware must be of low resistance, corrosion-resistant material, and preferably stainless steel. Upper deck hardware must be of stainless steel.

5.7 Additional Precautions

- 5.7.1 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.
- 5.7.2 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

General

- 6.1.1 All drawings supplied by the Contractor must be AutoCAD 2013 DWG format compatible. Electronic drawings must not be protected so as to be "Read-Only" files. Fonts for text must be AutoCAD 2013 standard. Blocks are not to be grouped. All text included in a block must be an attribute.
- 6.1.2 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.

- 6.1.3 Electronic drawings must be provided to the Technical Authority via email, FTP server or USB device. All files must be clearly labeled with the project number, file names and drawing numbers. Files must be labeled “As Fitted” drawings for those drawings that have been approved and finalized.
- 6.1.4 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 2013. Drawing sheet sizes, including where possible vendor drawings, must be ANSI standards with standard border and title block in the layout section.
- 6.1.5 “As Fitted” prints/plots must not contain markings or corrections by hand, i.e. marker, pen, pencil.
- 6.1.6 The Contractor must provide the Inspection Authority and the Technical Authority with all drawings required by or generated by the sub-Contractors.
- 6.1.7 Schematic drawings of systems must include all pertinent system information, including sizes, dimensions, labeling, equipment locations, and all information relating to system fittings.
- 6.1.8 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.

Guidance Drawings

- 6.1.9 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.

Working Drawings

- 6.1.10 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.
- 6.1.11 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.

- 6.1.12 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.
- 6.1.13 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.

Working Drawings – Submission for Review by CCG

- 6.1.14 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.
- 6.1.15 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.
- 6.1.16 Space must be provided on the working drawings for review dates and signatures of the Inspection Authority and the Technical Authority.
- 6.1.17 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.

Working Drawings – Submission for TCMS Approval

- 6.1.18 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.
- 6.1.19 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.
- 6.1.20 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
- 6.1.21 The Contractor must contact the respective TCMS approvals office to determine the number and type of materials required for approval submissions.
- 6.1.22 The Contractor must supply one (1) original stamped drawings and one (1) copy of all TCMS approved drawings to the Technical Authority.
- 6.1.23 The Contractor must supply four (4) scanned copy, electronic TIF and PDF format, of all TCMS approved drawings via email, FTP server or USB device to the Technical Authority.

“As Fitted” Drawings

- 6.1.24 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.
- 6.1.25 The Contractor must update all vessel drawings affected by the work.
- 6.1.26 Prior to completion of the contract, the Contractor must supply to the Technical Authority the following:
 - a) Two (2) 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 via email, FTP server or USB device in AutoCAD 2013 DWG or later format.;
 - c) All drawings must become the property of Canada;
 - d) Plotted drawings must be on standard ANSI paper sizes.

- 6.1.27 If no AutoCAD drawing files are produced then scanned files (raster format) must be supplied to the Technical Authority in a TIF format.
- 6.1.28 “As Fitted” drawings must be delivered within 15 days after completion of the sea trials.

Framed Drawings

- 6.1.29 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.

Working Drawing Updates – Technical Authority Review

- 6.1.30 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.
- 6.1.31 The frequency of drawing updates must not be less than weekly.
- 6.1.32 An updated drawing index must be provided with each batch of updated drawings.

6.2 Manuals and Records

General

- 6.2.1 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 Martha L. Black – Vessel Life Extension
 - Equipment/System Identification;
 - Equipment Manufacturer;
 - Revision number and date.
- 6.2.2 Plastic tabbed indices must be provided for all sections of the manuals. Major equipment components must be subdivided into separate sections of the manuals.
- 6.2.3 A master index must be provided at the beginning of each binder indicating all items included in each section.
- 6.2.4 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.

- 6.2.5 A copy of the final reviewed and approved “As Fitted” drawing(s) must be provided within the maintenance manual.
- 6.2.6 The Contractor must supply four (4) paper copies of all manuals and data sheets in French for all Contractor Furnished Equipment items to the Technical Authority prior to the completion of the contract.
- 6.2.7 The Contractor must supply four (4) copies of each manual and all associated data sheets via email, FTP server or USB device in electronic PDF file format to the Technical Authority prior to the completion of the contract.

Operation Manuals – “As Fitted”

- 6.2.8 Operation manuals must include the following items:
 - a) General description of equipment operating sequence;
 - b) Step by step procedure to follow in commissioning the equipment;
 - c) Schematic wiring diagram for the fitted equipment;
 - d) All pertinent equipment performance criteria;
 - e) Where software/hardware systems are fitted, the operation manual must include the following:
 - i. Full software documentation manual for the system and via email, FTP server or USB device such that Canada may revise programs without recourse to the Contractor.
 - ii. The minimum software documentation must include system level diagrams describing the overall scheme of the software/hardware system.
 - f) The functional specifications, which must describe in detail the functional capabilities of the system and each software components;
 - g) Project specific program listings including all comments describing the details of the code functions;
 - h) All listings, files, manuals and associated documentation materials must be delivered to and become the property of Canada.
- 6.2.9 The Contractor must supply the number of paper copies and electronic copies of the operations manuals as set out in Section 6.2.1.

Maintenance Manuals – “As Fitted”

- 6.2.10 Maintenance manuals are to include:
 - a) Manufacturer's maintenance instructions for each item of the equipment requiring maintenance activity;
 - b) 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;
 - c) 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;

d) Troubleshooting sections must be included for all equipment in the maintenance manual under a separate heading.

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

Tests / Trials and Inspection Records

6.2.12 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.

6.2.13 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.

6.2.14 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.

6.2.15 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.

Certificate Records

6.2.16 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.

6.2.17 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.

6.2.18 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.

6.2.19 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:

- a) Two (2) 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;
- b) 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 via email, FTP server or USB device 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:

- a) Two (2) 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;
- b) 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 via email, FTP server or USB device with a detailed listing of all files.

6.4 Photographs and Images – General

“As Delivered” Photographs/Images

6.4.1 The Contractor must supply a professional photographer to deliver 1000 high resolution (minimum 12 Mega Pixel) digital images in JPEG format. Images must be delivered via email, FTP server or USB device 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.

6.4.2 The Contractor must provide two (2) copies of all “As Delivered” digital images via email, FTP server or USB device to the Inspection

Authority and the Technical Authority at the first progress meeting after the delivery of the vessel to the Contractor's facility.

Progress Photographs/Images

- 6.4.3 The Contractor must provide high-resolution (minimum 12 Mega Pixel) JPEG digital images delivered via email, FTP server or USB device 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.
- 6.4.4 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.
- 6.4.5 The Contractor must provide two (2) copies of all progress photographs delivered via email, FTP server or USB device 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 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.
- 7.1.5 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.

7.2 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 ABS. 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 2.5m head of water. The hydrostatic test must be witnessed by ABS 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

- 7.3.1 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, SECURITY

8.1 Reference documents

8.1.1	60-90-23
8.1.2	67-30-02_01
8.1.3	67-30-02_02
8.1.4	108-H-0001
8.1.5	Bilge block
8.1.6	CCGS Martha L. Black Blocking plan 2018
8.1.7	H-0002
8.1.8	H-0022
8.1.9	H-2740
8.1.10	MB-97-13
8.1.11	MB-97-14
8.1.12	MB-98-03
8.1.13	MB-98-04

8.2 Berthing and Mooring

- | | |
|-------|--|
| 8.2.1 | The Contractor must include in their bid provision of all material and labor required to handle, dock, undock, moor, and fit out a ship which has particulars set out in Section 1.2. for the duration of the working period at the shipyard. Details of the Mooring facilities are to be included in the bidder's proposal. The Contractor must note that the CCGS Martha L. Black will be available to dock as soon as it arrives the contractor facilities, crew members will be leaving shortly after arrival. |
| 8.2.2 | 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. The Contractor must include in their bid the cost for five (5) keel block moves, and five (5) bilge block moves while the vessel is in dry dock. |
| 8.2.3 | The vessel must remain at the contractor facilities during the whole contract period, The vessel must remain at the Contractor's facility location for the duration of the contract, in dry dock or at berth. Only one dry docking is provided for the contract, and no additional delay is granted for successive floats, the contractor will have to bear the costs and delays inherent in this situation. |
| 8.2.4 | 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.

- 8.2.5 The Contractor must supply all mooring lines and labor required in 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 move the vessel including any vessel movements, provisions of tugs, and line handling personnel.

8.3 Services

- 8.3.1 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.
- 8.3.2 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.
- 8.3.3 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.
- 8.3.4 The Contractor must provide and install gangways that comply with the Canada Labor Code as long as the vessel is docked. The vessel must have two separate and independent access at all times. Contractor is responsible for gangway security.
- 8.3.5 The Bidder must submit a written price quote on a per cubic meter consumption of potable, non- potable, and sea water.
- 8.3.6 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 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 380 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 10 000 liters of water per day. The Contractor must quote on 91 day's supply of this service.
 - iii. A pressure regulated potable water supply at 380 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 3,000 liters of potable water per day. The Contractor must quote on 91 day's supply of this service.
- 8.3.7 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. Shore Steam Supply (Port or Stbd Boat Deck Inlets) and supplementary electric heat to a number of outside spaces must be supplied during cold weather.
- 8.3.8 A 16 cubic yard or 2.5 TM yard waste bin must be provided and must be located near the ship's gangway. The bin will be emptied every 7 days for a period of 13 weeks. The use of the bin will be for CCG personnel only.
- 8.3.9 The Contractor must provide, install and remove 250m² of protective floor covering consisting of 3mm Masonite. This floor covering must be fitted to all access alleyways throughout the vessel in areas to be used by the Contractor for access to required work areas. All edge joints must be taped to prevent the ingress of dirt and prevent migration of the applied sections. 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
- 8.3.10 The Contractor must supply the services of a 20 tons crane and personnel to operate and direct the crane to load and unload supplies from the vessel.
- 8.3.11 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 150A average current while the vessel is not crewed and 225 As. The Contractor must quote on 91 days crewed.
- 8.3.12 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 and be read in the presence of the Inspection Authority.

- 8.3.13 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.

8.4 Docking

- 8.4.1 The Contractor must supply all labor, materials and facilities to dock and undock the vessel to perform the work required by these specifications.
- 8.4.2 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.
- 8.4.3 The stability books are included as part of the electronic materials provided to the bidders.
- 8.4.4 The Contractor must prepare blocks and necessary shoring to maintain the true alignment of the vessel's hull and machinery throughout the docking period.
- 8.4.5 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.
- 8.4.6 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.
- 8.4.7 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.

8.4.8 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 PSPC 1379 Form and disposal certificate supplied to the TA to confirm the quantity removed. The Contractor will supply and connect an untreated waste water container to contain the gray and black water flow while performing the sewage treatment upgrade. A quantity of 2 cubic meter per 7 days is required for disposal by contractor.

8.4.9 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.

8.5 Undocking

8.5.1 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.

8.5.2 The Contractor must ensure that all shipside openings, including valves, drain and docking plugs are secure before flooding the dry dock.

8.5.3 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.

8.5.4 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.

8.6 Security

8.6.1 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.

- 8.6.2 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.
- 8.6.3 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.
- 8.6.4 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.
- 8.6.5 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 HULL CLEANING AND COATING

9.1 Scope

9.1.1 The Coast Guard has a requirement to clean the entire hull of the vessel by high pressure water washing to remove marine growth, grit blast the hull surface, apply Inerta hull coating below the water line, and apply a compatible coating above the water line.

9.1.2 This work must be carried out in conjunction with the following specification items:

- a) Propellers
- b) Tailshaft(s) and Sterntube(s) Inspections and Thordon Bearing(s) Installation
- c) Seabay, Sea chests and Strainers

9.2 References

Drawings

- 9.2.1 108-H-00SP
- 9.2.2 Coating surface
- 9.2.3 07352-SF
- 9.2.4 CCGS Martha L Black blocking plan 2018

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Note: Underwater hull surface is 1950 m², detailed as such: underwater shell: 1288 m², ice belt: 618 m² and approximately 50 m² for the drift well. It includes all underwater from the keel up to the 7 meters load line including; rudder, ship's bow covering anchor pockets (a train-gle leading to the aft upper edge of each pocket from frame 164) , rudder trunk, drift well and bossing are also included in the total surface area. It also includes the sea chests grates, the bow thruster tunnel and grates.

Part of the hull must be painted red (from the 7m load line to 4m load line. This area covers the complete perimeter of the vessel), while the remaining hull, including the hawseholes, the rudder and the rudder trunk, must be painted in black (only on bare metal).

9.3 Technical

Docking and Cleaning

- 9.3.1 The Contractor must dock the vessel in accordance with the vessel's docking plan.
- 9.3.2 The Contractor must supply all materials, equipment, and parts required to perform the specified work unless otherwise stated.
- 9.3.3 Contractor must protect all anodes and transducers from high pressure water washing, abrasion and coating. Protection to be removed before undocking. Transducers are located as follows:
 - a) Speed Log Transducer Frame 161-162 port
 - b) Echo Sounder Transducer Frame 127 port and stbd
- 9.3.4 The Contractor must hydro blast the entire hull area within four hours of docking including up the top of all bulwarks. High pressure fresh water washing (5000 PSI minimum) to remove all marine growth and allow inspection by Vessels Designate. This must include rudder, drift & well, propellers and the thruster tube. All marine growth must be removed.

Preparations

- 9.3.5 All staging, cranes, screens, heaters and other environmental control equipment, lighting and any other support services, equipment and material necessary to perform the tasks set out in this specification must be supplied by the Contractor. Contractor must supply and install a temporary shelter covering the ship's hull entire area that is to be painted with black and red Inerta160. This shelter is to be ventilated and heated. No combustion gasses exhausted from the heaters are allowed in the shelter. The shelter must be dismantled only after the paint work is completed, and after the recommended drying time is reached per manufacturer guidelines and NACE confirmation.
- 9.3.6 Suitable storage facilities for the materials and equipment must be provided close to the work site. These facilities must be maintained at a temperature recommended by the paint manufacturer as necessary to ensure ease of preparation and application of the paint.
- 9.3.7 The underwater hull area is 2000 m² (1288 m² below the ice belt and 617 m² for the ice belt) and the above water is 722 m². The drift well and the drift must be included in the cleaning, preparation and paint work, surface is 72m². It includes all underwater from the keel up to the 7 meters load line including; rudder, ship's bow covering anchor pockets (a triangle leading to the aft upper edge of each pocket from frame 164) , rudder trunk, drift well and bossing are also included in

the total surface area. It also includes the sea chests grates, the bow thruster tunnel and grates.

- 9.3.8 Contractor must provide a manlift for inspection of hull by ABS and the TA or designate and include this price in the bid.
- 9.3.9 A 40% of the underwater surface (515 m²) and ice belt (247 m²) must be grit sandblast to the SSPC-SP-10 standard (very near white) and feathered transition with existing paint. If oxidation occurs between blasting and application of the coating, the surface must be re-blasted to the specified surface preparation standard.
- 9.3.10 Contractor must cover all deck machinery, and equipment including all Speedcrane blocks, cables and fittings and openings into the ship to prevent ingress of grit from blasting. The Contractor must remove any and all coverings after the coating operations are complete.
- 9.3.11 The Contractor must plug deck scuppers and discharges as well as taking other measures necessary to prevent any liquids from contaminating areas being prepared or coated. The plugs must be hollow and contain extension tubes to allow precipitation run-off to run clear of the hull. The Contractor must also take measures to ensure that no damage, unnecessary cleaning or any repairs result from either the hull preparation process or coating application. Grit for blast cleaning is not permitted to enter any part of the ship. The Contractor must ensure that every opening into the vessel where grit can gain entry is suitably covered. Measures are also to be taken to ensure that surfaces and equipment other than those specified are not coated and that any inlets or discharges in the shell will not be blocked by the coating. The Contractor is responsible for removing any over spray on the vessel as a result of this work. The Contractor must remove all coverings and plugs after the coating operations are complete and sufficiently cured.
- 9.3.12 The contractor must retain the services of an independent NACE consultant to verify that the surface preparation and coating, storage, preparation and application as per the manufacturer's specification minimum. The Nace expert must have a minimum of 3 years experience in the inspection of ship hull paint. The Nace inspector shall provide five hull paint inspection reports to demonstrate experience.
- 9.3.13 The Contractor must allow safe access to areas where work is being performed under this specification including storage and mixing areas as the consultant deems necessary for the purpose of verifying that the

surface preparation, coating, storage, preparation and application are as per the specification.

9.3.14 The Contractor must supply all coatings and paints for the underwater and above water areas of the hull.

9.3.15 All traces of grit used for blast cleaning must be removed by the Contractor. Contractor must be responsible and liable for ensuring that the hull is clear and clean prior to, during and immediately after the coating application.

Underwater Hull Coating (1288 m² below the ice belt and 617 m² for the ice belt)

9.3.16 A 40% surface bare steel (515 m²) of complete underwater area of hull must be coated with one coat of Intershield 163 Inerta 160 Black (or equivalent), 20 mils DFT.

9.3.17 The 40% surface bare steel (247 m²) of complete ice belt area of hull must be coated with one coat of Intershield 163 Inerta 160 Red (or equivalent), 20 mils DFT.

9.3.18 The coating to be applied to the hull of a polar icebreaker must meet the following criteria:

9.3.18.1 The product must have been proven for at least 3 years on the hull of a polar icebreaker;

9.3.18.2 Must be recognized by Lloyd's Register as a coating with a high resistance to abrasion;

9.3.18.3 Must be effective at temperatures as low as -50°C;

9.3.18.4 Anticorrosive epoxy coating with minimum 90% solids;

9.3.18.5 It must be possible to paint the hull in a single application, with a thickness of at least 30 mils dry;

9.3.18.6 Taber abrasion resistance (ASTM D40601, 1 kg, CS-17 wheel): maximum weight loss 50 mg;

9.3.18.7 Elcometer adhesion value (ASTM D45412): 1,000 psi min;

9.3.18.8 Kinetic coefficient of friction against ice of less than 0.03 at a velocity between 10 and 25 cm/s

9.3.19 The 100% surface (617 m²) of complete ice belt area of hull must be coated with one coat of Intershield 163 Inerta 160 Red (or equivalent), 10 mils DFT.

9.3.20 On all bare metal surfaces of the transformer trunk and , approximately 20% or 14.5 m² of all surfaces (72.3 m²), the contractor is to remove all oxidation traces using mechanical tools or sandblasting before applying the following paint system:

9.3.20.1 -supply and apply two (2) coats of INTERSHIELD 300 paint from International Paint. Each coat is to be 0.006" thick, dry. The first coat is to

cover all bare metal surfaces, and the second coat to cover all internal surfaces of the transducer trunk.

- 9.3.20.2 -supply and apply two (2) coat of anti-fouling INTERSPEEDBRA 640 paint from International. Each coat is to be 0.005" thick, dry. The first coat is to cover all bare metal surfaces, and the second coat to cover all surfaces of the centerboard.
- 9.3.21 Contractor must apply the coating to fair straight line along waterline, see reference note above. In addition, the superstructure coatings should be applied to the ice reinforcement area down to where the waterline meets a visible line of demarcation. In order to ensure proper adhesion between the Intershield 163 / Inerta 160 and the surface layer, an Intergard 264 Coating Coating layer should be applied with a roller and paintbrush to the coating of the anti-ice reinforcement area as long as it can be printed with a thumbprint. The Contractor should contact the Coatings Manufacturer's Technical Service Representative for information regarding the appropriate time.
- 9.3.22 The contractor must take dry paint thickness between coats. C/E must witness the measurements.
- 9.3.23 Sea bay grids must be protected during application of coating and orifice diameters must be verified by the Contractor as original and readings delivered to the TA before undocking (i.e. not blocked or reduced).
- 9.3.24 The Contractor must paint the draft marks, load lines, thruster symbols, and all government symbols and icons white using Intersheen White 579. The Contractor must apply two coats at 2 mils DFT per coat. Stencils for the Federal Identity Program Markings will be owner supplied.
- 9.3.25 The Contractor shall ensure that the drydock 2018 block locations are all painted during this refit.

Above Water Hull Area (722 m² approx.)

- 9.3.26 The Contractor must remove the port and stbd gangways from the vessel before blasting begins. The gangways must be reinstalled following all work. This is to allow bulwark preparation and painting in way of gangway stowage area.
- 9.3.27 All bare and rusted areas must be abrasive blasted to SSPC-SP-10 Near White finish. Edges of existing coatings must be "feathered back" using blasting or suitable mechanical means to allow a sound surface to accept the new coating. The Contractor must estimate 35%

bare for quotation purposes. Difference will be adjusted by 1379 action.

- 9.3.28 The Contractor and TA or designate will inspect the surface preparation before any coating is applied and mark up areas for further preparation.
- 9.3.29 Any marked up areas must be re-inspected by the Contractor and the TA or designate before any coating is applied.
- 9.3.30 The entire hull area from the water line to the top of the bulwarks must be sand swept in preparation for application of coatings as follows:
- a) Two coats of Interguard 264 –Primer (Red Oxide) to all bare areas. Apply at 3 mils DFT per coat.
 - b) Two complete coats of Interthane 990 RAL3000 Marine Enamel (CG Red 509102). Apply at 2 mils DFT per coat.
- 9.3.31 The Contractor and TA or designate must inspect the previous coat and mark areas for further surface preparation between coats. Any marked up areas must be re-inspected by the Contractor and TA or designate before any additional coating is applied.

9.4 Inspections, Tests and Trials

Inspections

- 9.4.1 The contractor be retaining the services of an independent NACE consultant to verify that the surface preparation, coating storage, coating preparation and application are as per this specification and the manufacturer's instructions.
- 9.4.2 The Contractor must allow the NACE Inspector to inspect the all components for surface preparation and for each of the applications of the coating system including environmental conditions, equipment, mixing and application processes. It is the contractors responsibility to arrange for the NACE inspector to be present at the required times to inspect the preparation and applications. Coating at each stage will also be to the satisfaction of the TA or designate.
- 9.4.3 The Nace surveyor shall have a minimum of 3 years experience in the inspection of ship structural painting. The Nace surveyor shall provide five signed inspection reports on behalf of the Nace surveyor of the ship's hull painting.

Certification

- 9.4.4 The Contractor must arrange for the inspection of the hull by TCMS and ensure that approvals are obtained. Afterwards, copies of the

inspection must be provided to the Chief Engineer and the Technical Authority after completion of the work.

9.5 Deliverables

Drawings/Reports

- 9.5.1 The Contractor must prepare a report that indicates;
 - a. The areas on the underwater hull that were repaired.
 - b. Which areas were blasted and indicate the blast media type and air pressure;
 - c. Which areas were coated with what type of product and how much coating was used.
 - d. Thickness measurements of the applied coatings
 - e. Atmospheric conditions (temp, humidity, dew point)
 - f. Temperature of the vessel hull.
- 9.5.2 NACE consultant must supply a complete detailed report of each inspection, describing surface preparation quality and paint application result.

10.0 TAILSHAFT/ STERNTUBE INSPECTION AND BEARING INSTALLATION

10.1 Scope

10.1.1 The Coast Guard has a requirement to remove the port and starboard tail shaft for inspection and ABS survey, and install new stern tube bushings. The new stern tube bearings are bushings replacing the current staves bearing.

10.1.2 This work must be carried out in conjunction with the following specification items:

- a) Port and Starboard Propellers

10.2 References

Drawings

- 10.2.1 61-00-01
- 10.2.2 61-10-01
- 10.2.3 61-10-02
- 10.2.4 3591-3
- 10.2.5 3591-200
- 10.2.6 Corrosion ring drawing
- 10.2.7 H71756
- 10.2.8 Martha Black condition report
- 10.2.9 P1010869
- 10.2.10 Rematech
- 10.2.11 50125
- 10.2.12 Tailshaft procedures
- 10.2.13 Tailshaft WT
- 10.2.14 TG-33970
- 10.2.15 TG-33972

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard

- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Field Service Representatives

Rematech Brema (Coating between liners) FSR Contact Information:
 Rematech Brema, 214 route 138, St-Augustin de Desmaures, PQ, G3A 2X9
 Tel.: 1-800-463-6131

RMH (Thordon FSR)

Nicolas Rioux
 Tel: 418-878-0875
 130 de Rotterdam
 Saint-Augustin-de-Desmaures, Qc, G3A 1T3

Wartsila (Sterntube Seals & Alignment)

Barry Broderick
 Tel: 709 747 4600

10.3 Technical

General and Preparation

- 10.3.1 Contractor must complete the work described below for both the port and starboard tail shafts.
- 10.3.2 The contractor must take a wear down measurement before starting any dismantling. The Contractor must dismount the propeller cone, propeller, rope guard, ring anode, and fasteners. The contractor must have 2 annular anodes manufactured according to the plan provided (corrosion ring dwg). The Contractor must scribe proof marks on the propeller and tail shaft and remove the propeller to the dock floor. The Contractor must supply all equipment, gear and NDT testing for lifting the propeller and shaft including any brackets, slings, etc that may require fabrication for this work as well as all associated labor. Any paint touch-ups must be the responsibility of the Contractor as per original paint scheme. Copy of certificates for the lifting equipment used must be provided to the Owner prior to use of the lifting equipment.
- 10.3.3 The shaft must be supported from uncontrolled movement once uncoupled. The coupling guard must be dismounted and laid aside such that it is protected from damage but out of the way of workers. The tail shaft must be let go at the shaft coupling, motor end. Coupling flanges, nuts, and fitted-bolts must be proof marked to ensure subsequent replacement in their respective original positions. The coupling guard and turning gear located in the motor room on the shaft must be dismounted and moved aside to gain access to the

pilgrim nut so as to permit shaft removal. The Pilgrim nut must be removed and the coupling must be jacked from the shaft. The Contractor must ensure the coupling and shaft are properly supported at all times. Contractor must provide to the owner a table of the fitted bolts shank measurements and their corresponding coupling flanges bores; table must include a % diameter scoring and depth of scoring for each bolt and bore.

- 10.3.4 The John Crane mechanical stern tube seal must be measured, inspected and disassembled by Wartsila FSR prior to removal of shaft to prevent damage to the seal components. All internal components must be cleaned and checked for wear and defects as per the manufacturer's recommendations. Upon completion of seal removal, the tail shaft must be withdrawn and properly supported. Contractor must supply written proof that his turning equipment is rated to turn a shaft of length 14.488 Meters and weight of 24,255 Kg without rollers/support for a distance of 4.3 Meters starting from 3.2 meters fwd of aft (propellor) end and ending 5.933 Meters from fwd (tailshaft coupling) end. With this proof provided he must remove the tailshaft to the Contractor's shop to perform the required work. Should he be unable to provide this proof he must support the tailshaft off the dock floor and construct a temporary shelter over the shaft which must be fitted with 2 access doors. The shelter must be large enough to allow full access to the shaft for repairs and work required within specification. Contractor must provide heaters, lighting, power requirements, access scaffolding and any ancillary services or equipment to allow the work to be effectively carried out by the dockyard and sub-contractors. This includes heating the space as required to carry out coating repairs and to allow workers to comfortably carry-out work at 20 Deg C. The temporary shelter must allow for completion of hi-pot test, replacing the rematech protection under manufacturers recommendation and machining of the unworn lengths of the liners if in-situ machining is the bidders choice. The shelter as per this section must be included in the total bid with cost provided separately as well for adjustment should the Contractor choose to transport the tailshafts to their workshop.
- 10.3.5 Under no circumstances are lifting devices or accessories to apply any strain to the rubber coating between liners.
- 10.3.6 The shaft must be thoroughly cleaned and checked for wear and defects. Particular attention to be paid to the following areas:
- a) Forward and aft keyways on shaft tapers.
 - b) Forward and aft shaft tapers
 - c) Forward and aft ends of each of the two liners where they meet the tail shaft.
 - d) Forward and aft pilgrim nuts and threads particularly thread roots on shafting.
 - e) Liner OD in way of Thordon bushings and condition of bushings. Forward and after liners outside diameter including unworn length of liner to be

measured and recorded at forward and after ends of forward and after liners in 120 degree intervals i.e. 3 diameter measurements each at four axial positions. Measurement locations to be shown on a copy of the dimensioned tail shaft drawing. “unworn” diameter of forward liner 560 mm; unworn diameter of aft liner is 564 mm.

f) Forward end of forward liner in way of mechanical seal inflatable seal.

g) Rubber Coating between liners.

- 10.3.7 Inspection of areas a) and d) under section above are to include crack detection inspection using dye penetrant. All materials must be supplied by the Contractor for testing. Inspection of area g above must consist of thoroughly cleaning the coating but not to include any cutting, peeling, or otherwise disturbing the coating.
- 10.3.8 Contractor must as part of their bid provide pricing on machining the unworn lengths of the liners to match the worn diameter of the liners on both tailshafts under direction of Thordon Rep and Vessels Designate upon receipt of measurements/inspection. Costing must include all labour, rigging, transportation and/or sub-Contractor costs to carry-out the machining. The tailshaft must be supported in a certified lathe capable of turning the shaft or must be machined by third party company with experience in completing in-situ machining on tailshafts or equipment of this dimension.
- 10.3.9 The Contractor must conduct a Hi-Pot Test on the tail shaft, witnessed by Transport Canada and Technical Authority representative, to ensure that the Rematech coating is sound. Include cost to heat the shelter to 20 degrees Celsius for 3 days. The Contractor’s bid must include an allowance of \$8,500 for the product manufacturer’s authorized technician expenses and services. To repair/replace the Rematech coating – the actual cost for replacing the Rematech coating will be adjusted up or down using 1379 action. Following any repair of Rematech coating the shaft must be retested to ensure integrity of coating system.
- 10.3.10 Prior to shaft installation, a complete set of dimensions of the bearings and liners will be taken, recorded and handed over to the owner's representative. The Contractor must note that the original minimum inside diameters dry of 566.07 mm aft bushing and 562.02 mm forward bushing pertained to unworn shaft liner diameters of 560 mm forward and 564 mm aft.
- 10.3.11 The actual stern tube bearings must be removed. Existing bearings consist of staves locked by two brass keys. The staves, keys and bolts must be removed and returned to the CCG. Prior to removal of the

- staves, measurements must be taken inside at four points along the length.
- 10.3.12 Contractor must take internal measurements in-way of the removed bearings in the sterntube. Measurements must be taken over 4 positions over the length of the sterntube.
- 10.3.13 Measurements must be provided to Chief Engineer or Vessel Designate and Thordon FSR in tabulated format clearly identifying location(s). The Thordon Rep must provide dimensions by email for machining the inside and outside diameters of the new bushings.
- 10.3.14 The Contractor shall order Thordon XL semi-finished grooved bushings immediately upon contract award and ship them to the Contractor's shipyard. The plans for the Thordon bushings are TG-33970 and TG-33972. RMH is the vendor for the bushings.
- 10.3.15 Contractor must provide all labour and materials for the transporting, jiggging, machining and proper installation of the Thordon bushings including dry-ice or means recommended by FSR.
- 10.3.16 Contractor must bid on machining off 25mm from the inside and outside diameters of the oversized bushings. The actual amount must be determined by Thordon Rep and Alignment Specialist (contractor supply) based off the measurements provided by the Contractor and laser alignment readings recorded from sterntube center to Propulsion Motor output shaft. There are 2 segments forward and 2 segments aft per shaft line that will require machining. The bearings blanks are shipped over length to facilitate jiggging for machining. The Contractor must cut the machined bearings to the length indicated by the FSR. Note: The bearing come with water passages already fitted. Contractor must verify the motor thrust bearing shaft journals wear down before any final fit decision compare to new 'as fitted' dimensions.
- 10.3.17 Cooling water lines to the sterntube must be proven clear.
- 10.3.18 The full length area of the stern tube housing must be mechanically cleaned (SSPC-SP-3). Once cleaning is completed, cavities are to be filled with Belzona Ceramic R. Metal. A 20 kg of this product (included in the known work) per stern tube will be adjusted (increased or decreased) on a PWGSC 1379 form and coated with two coats of Amercoat 238 Abrasion Resistant Epoxy @ 10 mils DFT to coating manufacturer's application procedure recommendations prior to the bearings installation.
- 10.3.19 Upon completion of inspection and repairs, the Contractor must assemble the shafting, couplings, new shaft mechanical seal(s), turning gears and shaft brakes as per manufacturer's

recommendations, in good running order and to satisfaction of Owner's representative and attending Marine Safety Inspector.

- 10.3.20 The contractor must carry out the five-yearly revision of the shaft seals under Warstsila FSR supervision. Spare parts will be provided by CCG.
- 10.3.21 Contractor must include in their bid optional for the shank finish machining of 2 new coupling bolts with contractor supplied material made of annealed AISI 4140.
- 10.3.22 Proof of five-year inspection and certification must be obtained from ABS for each applicable item in this specification.

10.4 Inspections, Tests and Trials

Inspections

- 10.4.1 The Contractor must provide records and readings of the initial and finished shaft alignment.
- 10.4.2 The Contractor must provide the opportunity to the Inspection Authority and the Technical Authority to witness the measuring of the tail shaft bearing clearances.
- 10.4.3 The Contractor must have the shafting alignment witnessed by TCMS, Inspection Authority and the Technical Authority.

Tests and Trials

- 10.4.4 Upon undocking of the vessel, the shafting system must be test run under load for 6 hours while monitoring and recording loading and temperatures at 30 minute intervals.
- 10.4.5 The Contractor must ensure the FSR is in attendance for the Tests and Trials.
- 10.4.6 Any leaks found during system testing must be remedied by the Contractor at the Contractor's expense.

10.5 Deliverables

Drawings/Reports

- 10.5.1 Contractor must provide 3 typewritten reports indicating shaft and stern tube measurements and specifying all work performed and materials used.
- 10.5.2 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) Tail shaft bearing readings for the forward and aft bearings on each shaft;
 - b) Stern tube bearing readings for the forward and aft bearings on each stern tube;

- c) Temperature readings of the forward seal during dock and sea trials.

11.0 THRUST BEARING AND FWD MOTOR BEARING

11.1 Scope

11.1.1 The contractor shall carry out a major overhaul of the port and starboard thrust bearings and the port and starboard propulsion engine forward bearings under the supervision of a technical representative of Michell Bearings Company. This work will earn credit for the five-year inspection of the 2 thrust bearings and 2 forward motor bearings.

11.1.2 This work must be carried out in conjunction with the following specification items:

- a) Port and Starboard Tailshafts Inspection and Installation of Thordon Bearings

11.2 References

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Manual

- a) GE instruction manual and drawings

Drawings

Drawing Number	Description
9M	Michell Marine Thrust Block

Starboardside thrust bearing information's:

Bearing no.: 91257/3

Drawing number : 49519/9

Fore and aft clearance : 1.0 mm

Journal clearance : 0.5 mm

S/N : 505-0236-2466-200

Portside thrust bearing information's:

Bearing no : 91257/3

Drawing no : 49519/9

Fore and Aft Clearance: 1,0mm

Journal clearance 0,5mm

Serial no: 505-0236-2466-201

11.3 Technical description

- 11.3.1 Contractor is to perform describe work on 4 bearings:
- 11.3.2 The contractor shall retain the services of a technical representative from Michell Company for the inspection of bearings. The representative shall perform a complete inspection of the unit and provide a detailed report on the condition of the thrust bearings.
- 11.3.3 Wear down and thrust working clearance on all 4 bearings must be recorded before any dismantling. In order to gain access to the bearings, the Contractor must remove temporarily some equipment located above the bearing on 17' flat deck. These equipment could include: hand rails; floor sections; piping and reinstall these after finishing the inspection work.
- 11.3.4 After recording the measurements the Contractor must drain all oil from the bearings and dispose of it according provincial rules. Bearings oil piping must be isolated from remaining oil piping by shutdown valves and blanks piping, to isolate the bearing from header/filling tank and pumps. Bearing inlet strainer must be opened and cleaned.
- 11.3.5 The inspection of the thrust bearings must be done according to the representative's instructions. The inspection should verify the condition of each of the critical components of the thrust bearings. It is the contractor's responsibility to verify this information with the representative prior to submitting a bid. The contractor must include the following work in its bid for the thrust bearing:
 - a) Supply and replace the two (2) shaft-bearing seals according to the manufacturer's instructions (Michell Bearing). Walkersele M1/D6 type (463mm X 513mm X 22mm) seals will be supplied by the contractor;
 - b) The Contractor must measure the axial clearance with a depth gauge before removing the pads.
 - c) The Contractor must clean and take measurements of all pads and shells before submitting them to the ABS surveyor and the CGTA inspection. If some pads are required to be replaced, they will be supplied by CCG.
 - d) Clean the inside and outside of the heat exchanger tubes and perform a hydrostatic test of at least 50 psi to the satisfaction of ABS;

- e) Clean the inside of the bearing, wipe off any oil and dirt present, check and clean the metal magnet, and reinstall the cooler with new nuts, bolts and gaskets;
- f) Supply and filter to 15-micron the oil required for filling the bearings, total quantity 300 litres, Teresso 100, 150 l. for one thrust bearing.
- g) Supply new seals for the reassembly of the thrust bearing housing.
- h) When reassembling thrust bearings, ensure that forward pads are not inversed with reverse pads.

11.3.6

Work sequence is as follows in order to effectuate forward port and starboard bearing survey:

- a) Remove the bearing cap bolts and the cap itself. Unscrew the bearing upper half and remove it. Clean the motor shaft and install four (4) plastic gauge strips on the shaft. Put back the upper bearing half on the shaft, then the cap and torque bolts as specified by the manufacturer. Remove bolts, then the cap and measure the collapsed Plastic gauge. Note the results in the measure booklet.
- b) Unplug and remove the two (2) temperature senders to allow the lower bearing half removal. Using the shaft support tool, gently lift the motor shaft to free the lower bearing half. Remove the lower half for S/S inspection.
- c) Drain the oil from the bearing and properly dispose of it, shut off the cooling valves and remove oil cooler. Clean the cooler and carry a hydro test to 40psi with the ABS surveyor presence. Thoroughly clean the bearing housing. After a ABS inspection is carried out and approved, the cooler can be reinstalled using new gaskets and seals.
- d) The Contractor must clean and take measurements of all pads before submitting them to the ABS surveyor and the CGTA inspection. If some pads are required to be replaced, they will be supplied by CCG.
- e) Lube the motor shaft and slide the lower bearing half to its place. Gently seat the motor shaft on the bearing and put back the lifting tool at its place. Install the upper bearing half, then the temperature senders. Install the bearing cap using sealant on the cap contact surfaces. Fill the bearing with oil (CCG supplied), up to the working level. The contractor must supply new Teresso 100 oil, 50 litres per bearing. Filter the oil to 15 microns for filling the bearings.

11.4 Proof of performance

Inspection

- 11.4.1 The Contractor must submit to the ABS surveyor and the CGTA the bearings clearances and the pads measurements as soon as they are available.
- 11.4.2 The Contractor must ensure that the ABS surveyor and the CGTA are present for the pads and bearings inspection.
- 11.4.3 Tests and Trials
- 11.4.4 Upon undocking of the vessel, the shafting system must be test run under load for 6 hours while monitoring and recording loading and temperatures at 30 minute intervals.
- 11.4.5 The Contractor must ensure the FSR is in attendance for the Tests and Trials.
- 11.4.6 Any leaks found during system testing must be remedied by the Contractor at the Contractor's expense.

11.5 Deliverables

Drawings/Reports

- 11.5.1 Contractor must provide 3 typewritten reports indicating bearings measurements and specifying all work performed and materials used.
- 11.5.2 L'entrepreneur doit fournir le rapport d'inspection du représentant de Michell.
- 11.5.3 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) Thrust bearings and forward bearing readings;

12.0 PROPELLER INSPECTIONS

12.1 Scope

12.1.1 The intent of this specification is to dismount the Port and Stbd propeller for inspection and survey credit by ABS Inspector.

12.1.2 This work must be carried out in conjunction with the following specification items:

- a) Port and Starboard Tailshafts Inspection and Installation of Thordon Full Form Bearings
- b) Rope Guard Fabrication

12.2 References

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Manufacturer's details

- a) Wartsila/Stone Marine propeller CME Zhenjiang Propeller, Material SUPERSTON 70, 4 Blade, Diameter 3.6 Meters, Weight 7390 Kg

Drawings

Drawing Number	Description
3591-200	Arrangement of Shafting

Owner Furnished Equipment

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

12.3 Technical

Propeller Removal

- 12.3.1 The Contractor must supply all equipment, gear and NDT testing for lifting the propeller including any brackets, lifting points, slings, etc that may require fabrication for this work as well as all associated

labor. Any paint touch-ups must be the responsibility of the Contractor as per vessels paint scheme.

- 12.3.2 Copy of valid certificates for the lifting equipment used must be provided to the Owner prior to use of the lifting equipment.
- 12.3.3 The work below must be carried out for both the port and starboard propellers.
- 12.3.4 The propeller pilgrim nut removal and fitting gear, which will be supplied by the vessel consists of hydraulic pump and fittings, special backing plate and other removal and re-installation tools. The Contractor must be responsible for moving all tools from the ship to the dry dock and returning and securing tools back on the ship after the work is completed.
- 12.3.5 The Contractor must dismount the propeller cone, rope guard, ring anode and propeller. The Contractor must scribe distinctive proof marks on the propeller and tailshaft and remove the propeller to a suitable protected nearby location. The Contractor must supply all equipment and gear for lifting the propeller including any brackets, lifting points, slings etc. that may require fabrication for this work as well as all associated labour.
- 12.3.6 Propellers and cones must be inspected for damage or deficiencies by an authorized representative of Stone Marine Canada, 420th Ave., St-Jean sur Richelieu (450) 347-3789. The Contractor must include in its bid a both way trip to the MSC facility for the propellers and cones, and a \$ 20,000 allowance for MSC services to perform this propeller inspection and repair work. The work must include polishing and balancing of the propeller.

Propeller Inspection and Fitting

- 12.3.7 The Owner's representative and ABS Inspector must together witness and approve the final fits and installation of the propeller to its respective shaft to ensure that the travel and fitting pressures are acceptable (temperature correction fitting table sheet provided to successful bidder).
- 12.3.8 The Contractor's bid must include the cost for three separate fits for the propeller. The fits must include an initial fit without the key in place – 70% contact area required and a final fit with key installed – 70% contact area is required. Contractor must provide unit cost per additional fit and the actual amount must be adjusted up or down by 1379 action. The Contractor must include in his bid an allowance of 3 000\$ for NDT Testing of keyways/thread roots etc. to be adjusted up or down by 1379 on proof of invoice. NDT Testing, including spark

testing of coating between liners must be witnessed by ABS Inspector and Technical Authority.

- 12.3.9 The Contractor must ensure that the propeller and tailshaft mating surfaces are thoroughly degreased, the tailshaft threads liberally coated with anti-seize compound and the propeller pushed up on the shaft with pilgrim nut to the required distance. Final push up distances, pressures, metal temperatures and key clearances (top and sides) must be recorded and given to the TA in three typewritten copies. The locking plates must be modified (shortened/extended) as required to suit.
- 12.3.10 The Contractor must reinstall the anodes, rope guards and propeller cones. The propeller cones must be fitted and filled with Contractor supplied tallow. All securing bolt heads/nuts must be locked in position as per original installation using stainless steel locking materials. Contractor must advise Owner's Representative when the fasteners are all secure and locked and ready for inspection. The Contractor must fair the cone bolts with cement after Owner's inspection of the locking arrangements.
- 12.3.11 The Contractor must remove all welded lugs and welding must be ground flush. The areas disturbed by lugs must be treated as per vessel hull paint scheme.

12.4 Proof of Performance

Inspection

- 12.4.1 The Owner's representative and ABS Inspector must together witness the NDT test, and approve the final fits and installation of the propeller to its respective shaft.

Certification

- 12.4.2 The Contractor must ensure the Technical Authority receives a copy of the survey credit by ABS Inspector:

12.5 Deliverables

Drawings/Reports

The Contractor must provide the following documentation:

- a) Fit-up distances/pressures etc. are received by C/E in three dated and signed typewritten copies. Serial numbers of each propeller must be recorded;
- b) Two typewritten copies of the NDT testing report delivered to the TA;
- c) Inspection and work report done on the propellers and cones by SMC, supply to the C/E.

13.0 ROPE GUARD FABRICATION

13.1 Scope

13.1.1 The Contractor must fabricate two replacement tapered Rope Guards of Steel Plate grade A36. Dimensions to be verified on site but approximately 420 mm long; large internal diameter 1140mm, small internal diameter 994mm ie require 12mm clearance all around to propeller hub.

13.1.2 This work must be carried out in conjunction with the following specification item:

- a) Tailshaft(s) and Sterntube(s) Inspection and Thordon Bearing(s) Installation.

13.2 References

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Drawings

Drawing Number	Description
61-00-SK56	Detail rope guard

Owner Furnished Equipment

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

13.3 Technical

Rope Guard Fabrication

13.3.1 Contractor must verify bossing casting outside diameter and propeller hub outside diameter and distance between same and fabricate and install replacement rope guards for port and starboard tail shafts. The

lower halves of the rope guards are to have welded nuts as per Section A-A detail.

13.3.2 The fabricated rope guards must be grit blasted to bright metal and coated internally and externally with one 20 mil coat d'Intershield 163/Inerta 160 (or equivalent) Black .

13.3.3 Upon satisfactory completion of all work on the sterntubes, tailshafts and propellers the replacement rope guards can be installed. On confirmation of satisfactory clearance all around the propeller hub the stainless steel bolts holding the upper and lower halves together are to be tightened after the rope guard is stitch welded to the bossing casting and the bolt heads tack welded to the lug. The clearances to the propeller hub are to be measured and recorded top, bottom, inboard and outboard.

13.4 Proof of Performance

Inspection

13.4.1 The Contractor must allow a Visual Inspection by Chief Engineer or Designate upon completion.

13.5 Deliverables

Drawings/Reports

13.5.1 The Contractor must provide the TA with a typewritten copy of the final propeller hub clearances longitudinal and diametrical to the new rope guards.

14.0 RUDDER AND STOCK INSPECTIONS

14.1 Scope

- 14.1.1 The intent of this item must be to open up the rudder system for inspection, cleaning, and ABS inspection. This section is optional and depends on the clearances found on the pintle and rudder stock.
- 14.1.2 This work must be carried out in conjunction with the following specification items:
- a) Port and Starboard Tailshafts Inspection and Installation of Thordon Bearings;
 - b) Rope Guard Fabrication;
 - c) Propeller Inspections.

14.2 References

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Drawings

Drawing Number	Description
H-2620	Rudder arrang't and details
H-2640	Rudder stock
D-4-677	Steering Gear Arrangement for Model LA2-33.4 X 40 deg

Owner Furnished Equipment

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

14.3 Technical

General

- 14.3.1 Contractor must lockout the steering pumps. The Steering Gear must be locked out except when required to move the rudder; at these times, the Steering Gear must be operated under the supervision of a

designated member of the ship's crew. The vessels E/O must direct Contractor to the appropriate breakers.

- 14.3.2 Contractor must gain access to steady bearing by way of no. 7 void and rudder trunk manhole covers. no. 7 void space to be tested and certified safe for personnel to enter and hot work. Contractor must also test and certify Aft peak Tank safe for personnel and hot work.
- 14.3.3 Contractor must position the rudder in each of the following positions:
 - a) hard to Port
 - b) hard to Stbd.
 - c) Midships
- 14.3.4 Contractor must measure and record each of the following clearances in each position:
 - a) Rudderstock steady bearing;
 - b) Rudder pintles THORDON bearings – Contractor to remove fairwater plates to gain access for these and Contractor subsequently to reinstall fairwater plates on completion of work;
 - c) the clearances between the rudder arms and the machined pads above each gudgeon.
- 14.3.5 Type written copies of all the specified clearances to be provided to C/E with 24 hours of measurements.
- 14.3.6 The clearance between the jumping collar and the ship must be measured at four equal distances around the collar.
- 14.3.7 Rudder drain plug must be removed to check that the rudder is dry and tight with the witness of ABS. Drain plug is then to be reinstalled and locked. The pintle and palm bolts must be checked for tightness and secured as per original.
- 14.3.8 Owner's representative to witness all measurements as they are taken.

Quadrant & Bearing Inspection

- 14.3.9 The Contractor must open the Quadrant and bearing for inspection.
- 14.3.10 Steering cylinders must be supported at tiller ends and tiller pins to be dismantled and laid aside for inspection. Steering cylinders must be swung outboard and secured in horizontal position.
- 14.3.11 Tiller nut must be dismantled and quadrant lifted and laid aside. Keyways in the rudder stock and quadrant must be inspected and key clearance to be measured and recorded.
- 14.3.12 Carrier bearing and gland housings must be unbolted and lifted aside. Carrier bearing must be cleaned and inspected for wear. Bore

measurements of the same must be taken and recorded in both radial and axial directions.

Rudder Stock Inspection

- 14.3.13 The contractor must perform the describe work for the rudder stock inspection.
- 14.3.14 The Contractor must block rudder in position. Clean, number stamp (for identification purposes), and disconnect rudder coupling bolts and nuts. Within rudder trunk apply and tighten ring clamps above and below the steady bearing. Unbolt the steady bearing housing from the stern frame. Raise the rudder stock to clear the rudder coupling key and then turn the rudder stock as required for the rudder stock coupling flange to clear the rudder. Lower the rudder stock gently to the dock bottom; turning as required to clear obstacles.
- 14.3.15 Rudder stock complete with steady bearing must be transported to the contractor's workshop. Steady bearing position on rudder stock must be marked and rudder stock and steady bearing housing surfaces to be cleaned of all corrosion and debris. Caution must be taken at all times to prevent debris from entering the steady bearing.
- 14.3.16 Rudder stock must be supported on its side; ring clamps removed aside and steady bearing assembly moved down the rudder stock clear of the normal bearing running area. Rudder stock in bearing running area to be inspected for corrosion.
- 14.3.17 The three rudder pintle pilgrim nuts must be dismounted and laid aside for cleaning and inspection. The rudder must be lifted and lowered to the dock bottom.
- 14.3.18 The pintles must be removed from the rudder, cleaned, and measured. The rudder gudgeon bushings must be cleaned and measured. Measurements for the pintles and bushings must be taken forward and aft, port and starboard, and at three locations over the length.
- 14.3.19 The pintles and bushings must be re-installed in good order. The rudder must be assembled back on the vessel and fastened as per original.
- 14.3.20 Upon completion of satisfactory repairs and inspection rudder stock and steady bearing assembly must be transported back to the vessel and re-installed as per original.
- 14.3.21 Gland housing to be cleaned and re-installed as per original using new contractor-supplied gland packing. Carrier bearing to be cleaned and greased and re-installed as per original. Quadrant to be re-installed as per original and tiller nut re-secured. Before replacing the steering

rams cylinder, take measurements of the pins and bushing at both ends of each rams. Steering rams to be re-connected to tiller.

14.3.22 Following the above work all clearances as 17.3.3 must be measured and recorded again in the same manner before the disassembly. Discrepancies from the initial readings must be rectified at no cost.

14.3.23 ABS Inspector and Chief Engineer or designate to inspect steady bearing prior to securing manhole covers. Two covers removed by Contractor are to be fitted with new jointing prior to installation.

14.4 Proof of Performance

Inspection

14.4.1 The Contractor is responsible for arranging all inspections and to ensure that ABS witness the rudder testing and measurements.

14.5 Deliverables

Drawings/Reports

14.5.1 Contractor must provide the TA with 3 typewritten reports with all measurements taken as required in the specification and work carried out.

15.0 SEABAY, SEACHESTS AND SEA STRAINER INSPECTIONS

15.1 Scope

15.1.1 The Contractor must open-up, clean and coat the internals of the ship's Sea Chests, Sea Bay and main sea strainers. This includes the tool-accessible areas inside the contained and adjacent pipe stubs. The cleaning and mud removal work to be done within the first week of dry docking.

15.1.2 This work must be carried out in conjunction with:

- a) Main cooler Replacement;
- b) Hull Cleaning, Preparation and Coating.

15.2 Reference

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Locations

Description	Location	Frame	Strainers
Propulsion motor room			
External sea chest submersible pump	P	51-53	No
External sea chest sterntube pump	C	37-39	No
Generator room			
External sea chest, lower	P	96-106	Yes
External sea chest, lower	S	96-106	Yes
External sea chest, upper	P	96-106	Same as lower
External sea chest, upper	S	96-106	
External sea chest, evaporator	S	102-106	No
Internal seabay	C	96-106	No
Science seachest	Starbord Forward hatch	133	No

Drawings

Drawing Number	Description
108 H-0022	Docking plan
108 H-0026	Capacity plan

Owner Furnished Equipment

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

15.3 Technical

Sea Chests

- 15.3.1 Contractor must use hydro blasting at 5000 psi and mechanical means (power brushing) for the cleaning of the areas in this specification item. All debris must be removed to the Contractors' premises.
- 15.3.2 Contractor must remove all marine growth, loose paint and scale. Contractor must note: The seabay, seachests and sea strainers are to be considered heavily fouled.
- 15.3.3 Contractor must remove the manhole covers and grids from all sea chests and sea boxes for cleaning and inspection. The grid and inlet areas must be cleaned and grid holes must be mechanically reamed to the original diameter. Zinc anodes must be inspected for wastage and renewed as directed specifically by the vessel's TA.
- 15.3.4 The Contractor must inform the C/E when the sea chests are open and cleaned. The Contractor must hydro blast and power brush clean the spaces to SSPC SP 3 to the satisfaction of the TA. Sea chests must be inspected by the C/E and a Marine Safety Inspector. The area of the sea chests and sea bays is 402 square meters. (Estimate 50% of the area will be bare or 200 m²).
- 15.3.5 Edges of existing coatings must be "feathered back" by blasting or suitable mechanical means to allow a sound surface to accept the new coating.
- 15.3.6 The Contractor and C/E will inspect the surface preparation before any coating is applied and mark up areas for further preparation.
- 15.3.7 All new zinc anodes and existing anodes with more than 50 % zinc remaining must be protected from coating. Temperature sensors and adjacent valve discs and seats must be protected from coating.
- 15.3.8 Any marked up areas are to be re-inspected by the Contractor and C/E before any coating is applied.
- 15.3.9 After inspection, each sea chest shall be given two (2) separate coats of INTERGARD 264 of differing colours (.006" DFT each); each coat is to be witnessed by the TA and C/E. The Contractor is to provide a

unit cost per square foot for painting. (Note: one (1) coat for bared areas and one (1) coat for complete area.).

- 15.3.10 The Contractor and C/E will inspect the previous coat and mark areas for further surface preparation between coats. Any marked up areas are to be re-inspected by the Contractor and C/E before any additional coating is applied.
- 15.3.11 The Contractor is to take DFT thickness readings between coats. The C/E is to witness the tests.
- 15.3.12 Upon completion of removal of the temporary protections applied as 3.8 and final inspection by the C/E with the assistance of a man lift operator as required; the grids must be installed in good order and secured with locking arrangements on all fasteners. Locking bars must be used. Tack welds on the bolt heads are not to be used. The Contractor's bid must include the cost of labour and materials for the replacement of 32 defective threaded fasteners (M16 x 50). All fasteners must be stainless steel.

Sea Bay

- 15.3.13 The docking plug must be removed to allow the sea bay to drain. The manhole cover (Fr. 96) must be removed. The sea bay internal spaces including pipe stub internals must be thoroughly cleaned with HP 5 000 psi water blast and power brush clean the spaces to SSPC SP 3. The resulting debris including decaying sea life must be collected and removed from the vessel promptly and frequently. Contractor must note: The seabay, seachests and sea strainers are to be considered heavily fouled.
- 15.3.14 The Contractor must inform the C/E when the sea bay are open and cleaned. Sea bay must be inspected by the C/E and a Marine Safety Inspector. (Estimate 50% of the area will be bare or 114 m²).
- 15.3.15 After inspection, apply two (2) distinct layers coating INTERGARD 264 different color (0.006 " dft each) on all surfaces of the sea bay, the C/E must attend the application of each layer. The total area of the sea bay is 228 square meters. (Note: (1) layer to bare areas and one (1) coat for all surfaces).
- 15.3.16 The zinc anodes of each box must be removed and replaced. The Contractor shall allocate its price for the supply and installation of forty-two (42) zinc Z-19 anodes. A unit price for the supply and installation of the 42 Z-19 anodes shall be specified in the Contractor's bid. They are bolted, the bolts are center to center spaced 677mm. The bolts 13mm in diameter are welded. Provide stainless steel bolts and nuts. There is :
 - a) 19 anodes Z19 x 23 pounds in the sea bay.
 - b) 10 anodes Z19 x 23 pounds , port and starboard lower sea chest;

- c) 12 anodes Z19 x 23 pounds , port and starboard upper sea chest;
 - d) 1 anode in stern tube sea chest
 - e) Anodes dimensions: 635mm x 76 x 38mm
- 15.3.17 The contractor's bid must include the cost of the labour and materials to modify and replace (4) – Z22 modified zinc anodes, one in each main sea chest.
- 15.3.18 Upon completion of inspection, anode renewal, coating repair and renewal, any repair work, removal of temporary protection from coating of zincs, sensors etc, and final inspection by the TA; then the docking plugs and manhole covers must be re-installed in good order using new Contractor supplied jointing on manhole covers.
- 15.3.19 When all seabay work and sea connections work has been satisfactorily completed and all valves are re-installed in good order then the Sea bay must be hydrostatically tested (fill to overflow the vent – static head test) with the test being witnessed by the C/E and a ABS Inspector. Should it be necessary to drain the Sea bay for the purposes of hull coating touch-up, the docking plug must be removed and on completion of being drained, the docking plug must be installed with the locking bar welded over as per original.

Sea Bay Strainers Port and Starboard

- 15.3.20 Main sea strainers must be opened for inspection, cleaning to SSPC SP 3, and reaming of strainer plate holes to original diameter.
- 15.3.21 The Contractor and C/E will inspect the surface preparation before any coating is applied and mark up areas for further preparation.
- 15.3.22 Any marked up areas are to be re-inspected by the Contractor and C/E before any coating is applied.
- 15.3.23 After inspection, the strainers are to have two (2) distinct layers coating INTERGARD 264 different color (0.006 " dft each) on all surfaces.
- 15.3.24 The Contractor and C/E will inspect the previous coat and mark areas for further surface preparation between coats. Any marked up areas

are to be re-inspected by the Contractor and TA before any additional coating is applied.

- 15.3.25 The Contractor is to take DFT thickness readings between coats and present them to the Technical Authority. The C/E is to witness the tests.
- 15.3.26 The Contractor is to supply and affix (Bolted) one M24 tank anode to each strainer screen.
- 15.3.27 All manholes covers must be closed up using new 1/4" neoprene gaskets.

15.4 Proof of Performance

Inspection

- 15.4.1 The Contractor is responsible for arranging all inspections and to ensure ABS inspects the spaces and signs off the items in the vessels Hull and Machinery Survey Record Book. The Contractor must advise the Owner's Representative in advance to allow his/her attendance.
- 15.4.2 At undocking the Contractor is to carry out leakage inspections and check for any ingress of water. Any leakage is to be corrected immediately, prior to undocking the vessel.

15.5 Deliverables

Drawings/Reports

- 15.5.1 The Contractor is to provide the TA with the DFT thickness readings prior to closing up the spaces.

16.0 RUDDER AND RUDDER TRUNK ANODES

16.1 Scope

16.1.1 The intent of this specification is to replace all wasted anodes that are fitted to the rudder and in the rudder trunk.

16.1.2 This work must be carried out in conjunction with the following:

- a) Rudder and Stock Survey
- b) Hull Cleaning, Preparation and Coating

16.2 References

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Owner Furnished Equipment

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

16.3 Technical

Anode Replacement

16.3.1 The Contractor must replace all wasted anodes that are fitted to the rudder and in the rudder trunk. Quote on supplying and fitting

quantity 20 of M24 anodes. A separate bonding cable must be attached to the rudder prior to any welding on the rudder.

16.3.2 The Contractor must ensure that old anode straps are removed and ground down. The hull steel so exposed must be primed and painted as per existing paint scheme..

16.3.3 The Contractor must provide unit cost per additional anode for supply and installation as above for adjustment purposes.

16.4 Proof of Performance

Inspection

16.4.1 The Contractor must ensure the Technical Authority is given the opportunity to inspect the replacement anodes prior to any paint being applied to the disturbed areas.

16.5 Deliverables

Drawings/Reports

16.5.1 The Contractor must submit to the Technical Authority a report describing which anodes were replaced and photos indicating the condition of remaining anodes.

17.0 GALLEY REFIT (OPTIONNAL)

17.1 Scope

- 17.1.1 The Contractor shall remodel the vessel's kitchen with new wall panels, ceilings and new deck coverings and install the supplied new kitchen equipment. This work must be done within days of the start of the docking to allow the return of a crew on board. This work is optional.

17.2 References

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) The following Coast Guard Standards and/or Technical Bulletins must be followed while executing this specification. Copies of these standards and bulletins can be obtained from the CCG Technical Authority:
 - 1. Coast Guard Welding Specification;
 - 2. Coast Guard ISM Lockout/Tagout;
 - 3. Coast Guard ISM Hotwork procedures;
- b) Fleet Safety and Security Manual (DFO/5737)
- c) IACS No. 47 - Shipbuilding and Repair Quality Standard
- d) CSA W59-08 (R2008) - Welded Steel Construction
- e) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- f) Society for Protective Coatings (SSPC) Standards
- g) TP127 – Ships electrical standard requirements

Drawings and documentation

Drawing number	Drawing description
C3057-2	20200224 SML Dessin cuisine galley dwg.pdf
C3057-1	20191209 MLB Standard equipment.pdf
9863_P1 to P4	Galley hood Hottes de cuisine dwg.pdf
108/555 H46.10	Galley arrgt. including crews mess etc
108/555 H46.10 p.2	Galley arrgt. deckhead composite, piping, vent, hood
108-H-4410	
tp11469e	
ML black-as-built	
C3057_coupe	
C3057_DISPOSITION- GENERALE	
C3057_02_1_1	
C3057_02_1_5	

Drawing number	Drawing description
C3057_02_1_6	
C3057_031_1	

Owner Furnished Equipment

- 17.2.1 The Contractor must supply all materials, equipment, and parts required to perform the specified work unless otherwise stated. All new galley equipment to be install and supplied by CCG are listed in the tables 1, 2, 3 and 4.

17.3 Technical Description, removal

Removal of appliances, ceilings, walls and floors

- 17.3.1 All sources of power, hot and cold potable water and drainage shall be locked by the Contractor with his own locks. The designated officer of the ship shall examine the location of the locks. The contractor must complete the ship's lock and tag forms.
- 17.3.2 A fire equipment specialist shall unplug and remove all fire equipment from the kitchen. Detection equipment must also be isolated and dismantled. The equipment must be stored for reinstallation during the reassembly of the kitchen equipment.
- 17.3.3 The Contractor must take digital photos of the entire space to locate all equipment for reassembly. A copy of the digital images must be provided to AT before work begins.
- 17.3.4 The Contractor shall make temporary access to the bulkhead 113 at the rear of the refrigeration units near the dumbwaiter elevator. The 60 " wide opening by 84 " height will allow easy and direct access for moving the equipment. A temporary door will have to be made to protect the opening of bad weather.
- 17.3.5 Once the equipment has been electrically isolated, the Contractor will dismount the equipment from their seating, and proceed with storage for those who will be relocated or disposed for those to be replaced, according to the table of equipment provided.
- 17.3.6 The Contractor shall remove all stainless steel cabinets to allow the removal of wall and ceiling panels. The Contractor must also remove all stainless steel countertops and articles mounted on stainless steel bulkheads, ie. clocks, spice racks, bookcases, lockers, paper towel racks, plate warmers, dishes, etc. Cabinets, counters and items found indoors must be either for disposal or stored outside the vessel in a temperature-controlled environment for future re-installation. The Contractor must assign a number to each cabinet / cabinet and properly label all the contents in the appropriate cabinet / cabinet for

subsequent placement in the appropriate location once the work is completed. The Contractor shall wear clean, never worn and disposable coveralls and gloves when handling items in cabinets / closets. The Contractor must keep all loose items in new, never used, properly protected packaging boxes with bubble / paper / foam packaging. The contractor must take care not to damage and must note any anomalies detected before the move.

- 17.3.7 The Contractor shall remove all ceiling panels and supports for disposal. The contractor shall provide the new insulated solid stainless steel perimeter ceiling panels, fasteners and gaskets. Stainless steel ceiling panel B15 # CS-109A. The supplier is Trident Marine Systems. The contractor must indicate an area of 45 m2. The longest panels should be used wherever possible. When the ends of the panels are cut to the desired length, the edges should be folded to give a finished appearance. Panels must be cut to fit fixtures that have been removed during stripping, lights, vents, etc. The ten (10) 4 'fluorescent light marine fixtures shall be replaced by an LED equivalent model provided by the Contractor.
- 17.3.8 The Contractor shall remove all panels from the two outer walls (front and starboard) and their fastening systems, as well as the insulation on the exterior bulkheads. The contractor must supply the new solid stainless steel wall panels, fasteners and moldings. Wall panels of 50mm stainless steel type Joiner B-15, 50mm X 600mm X 2250mm ., The supplier is Trident Marine Systems.
- 17.3.9 The exhaust galley fan and ducting must be degreased and cleaned up to the hoods before the hot work. The existing hoods must removed and discarded and the existing ducting adapted with its supports adapted/modified to the new hoods systems.
- 17.3.10 As per guidance drawings, the contractor must fabricate and install new foundation for all new equipment, after removal of the old foundation.
- 17.3.11 The insulation of the exterior walls of the premises must be completely removed. There is a minimum of 50 mm of insulation on the walls. The currently installed insulation is of type CAFCO Type C Spray On Insulation, 50mm thick & 25mm over the stiffeners/frames. This insulation is supported by a wire mesh and nails welded to the wall, supplemented by spring rings. The nails will also have to be removed because the new insulation will be thicker (2 times thicker), which will require longer retaining nails. In some places, especially vis-à-vis the portholes, other insulators have been installed, ex. anti-condensation paint. It will also remove this insulation. It will also remove 1 m of additional insulation from the ceiling, from the outside to the inside. This insulation is of the same type, CAFCO Type C Spray On Insulation, a thickness of 50mm, with A-60 protection. It will be necessary to execute on the ceiling a clean cut of the CAFCO

insulation, to allow a better marriage between the CAFCO and the new type of insulation. Insulating residues will be transported outside the vessel and the contractor will dispose of them in accordance with the regulations in force.

- 17.3.12 When all insulation has been removed, the Contractor shall mechanically sand surface rust on the exterior wall, ceiling and floor to the floor leveling cement. Special attention should be paid just to the base of the exterior wall as water and humidity have been particularly aggressive. Also the fixing channel of the Joiner type outer wall must be removed because it is completely corroded. The periphery of the hubs (frame) will have to be sanded. Rusty surface to be brushed and painted, 25% of surface especially 2 feet above deck, and around and under windows, apply one coat of marine alkyd primer and two topcoat.
- 17.3.13 Ceramic tile shall be completely removed, as well as leveling underlayment to ½" thick. Remove 50% of the A-60 floor area to the deck steel, for removal and installation of new counter bases. Take 100 thickness readings of the deck on the exposed surface. Prepare the steel and cover the deck up to the same height as the existing A-60 with the Dex-O-Tex Insul-Dex lightweight product (provide a price per square foot for any surface exceeding 50%). Depending on the sequence of work, a new ½" leveling sub-layer will have to be applied to the new and existing A-60 floor, compatible with the existing floor, as well as the replacement of insulating material around the plumbing drain. A new marine kitchen linoleum with certificate will have to be supplied and install with welded joints.

17.4 Technical Description, Steel Works

NDT testing and steel repair

- 17.4.1 After removal of walls and insulation, brush bare steel and then check 100 steel thickness measurement points on exterior bulkheads and floor at bulkhead junction outside and around the floor drains. A record of the readings will be submitted to AT, with a highlighting of the readings with more than 25% loss of thickness.
- 17.4.2 The Contractor must bid for the renewal of 10% of the deck area. All welding work must be 100% MPI tested. It is the Contractor's responsibility to consult with ABS on the inspection requirements prior to steel renewal. New steel must be 44 W or equivalent. All repairs must be in accordance with IACS Quality Standard No. 47 for Shipbuilding and Repair. The Contractor must include in its bid an offer for the coverage of interference elements (ie, insulation below, wiring, piping work, etc.) or removal and reinstallation later. The

price must include the application of a protective paint on the bare steel in accordance with the manufacturer's requirements.

- 17.4.3 All floor and sink drains under the countertops and on the kitchen floor shall be replaced, and a 12 " square opening made in the floor around each of the drains shall be made to carry out the work. plumbing and welding. The contractor must supply all materials. A copper ring must be provided and fastened around each of the floor drain grilles.
- 17.4.4 The sea bay and sea chest vent piping behind the wall panel, in the starboard outboard galley level must be replaced with equivalent hot galvanized steel piping, with insulation to wrap the new piping. There is an allowance of \$5,000 for this work which will be adjusted up or down on a form 1379 as a result of the work.

17.5 Technical description, installation

Installation of appliances, ceilings, walls and floor

- 17.5.1 Insulation shall be attached to bulkheads and decks with steel rods 3mm in diameter, spaced 300mm maximum. The rods should be 12 mm longer than the thickness of the insulation. Spring rings will hold the insulation in place. All steel vapor barrier joints, corners, and rod heads will be covered with a cap and aluminum tape before installing a lap panel or trim panels. Special attention should be paid to maintain the integrity of the vapor barriers. Unless otherwise specified, the last layer of insulation must be covered with a vapor barrier. All weather-exposed decks and bulkheads will have been thermally insulated in addition to their type A-15, A-30 or A-60 insulation. Insulation installation must be in accordance with TP11469, Transport Canada, and in accordance with the manufacturer's requirements.
- 17.5.2 The Contractor shall provide the new insulation to be installed on the exterior walls of the premises over the entire vertical height of the walls. The insulation shall conform to the requirements of Plan 108-H-4410, TP11469 and any other applicable regulations required by ABS. The contractor shall provide documentation and certificates demonstrating that the insulation is approved for this application. Insulation shall be installed with consideration for thermal bridging with a minimum of 50mm over the frames, with integral vapour barrier.. Be sure to insulate (with vapor barrier) the window frame

- window to ensure that there is no ice formation on the frame. It will be necessary before to have put back in place the frame.
- 17.5.3 Since the dumbwaiter is not removed, it will be necessary to replace the maximum insulation from the already opened side to cover the maximum possible behind the elevator on the outer wall.
- 17.5.4 The Contractor shall take care to protect equipment and new facilities as work progresses according to planned expertise and coordination.
- 17.5.5 New wall panels and fixing rails will be installed, installing new light switches and other wall controls. The final size of the countertops will be taken into account in relation to the width of the walls. When the temporary front access bulkhead has been closed, the welds checked to 100% NDT, we can complete the paint, insulation and closure of the wall panels.
- 17.5.6 Contractor shall install new owner-supplied kitchen equipment at locations as per counter plans. It is the responsibility of the contractor to validate the power and make the electrical and plumbing connections in accordance with the manufacturers instructions. Electrical cables that can be reused will have been tested by insulation testing, and some devices will need new cables and circuit breakers. New isolation valves are to be provided by the hot and cold water welder with silver soldering must be installed on each equipment and faucets. All service lines must be hidden. The Contractor must ensure that the seating is suitable for new deck mounted equipment. The Coast Guard will provide fact sheets to review the organization of the seating. Units must be secured with fasteners provided by the contractor. The kitchen equipment provided by the CCG is identified in the 4 tables below: note the model and manufacturing equipment may vary depending on availability and supplier.

Table 1 Galley equipment

Equipment type Référence Plan 2.1.1		Manufacture	Model	Voltage	Dimension (mm) w h	Qty.
17	Range - Induction	Garland	GME36-120C	120/.208 / 3Φ27 kW	900 x 1000 x 900 (1220 door open)	1
19	Griddle – Countertop	Accutemp	EGF2303B3605-T3	230 / 3Φ 14 kW	921 x 729 x 430	1
10	Dishwasher- Self standing	Hobart	AM15 electric	240 3Φ/24.9 A	700 x 950 x 1900	1
25	Countertop dual fryer	Garland	E24-31F/HD	230 / 3Φ 5 kW	610 x 445 x 780	1
8	Food Waste Disposer	Hobart	FD4/125-1.25 HP	230 / 3Φ 3.7 Amp.	255 dia. x 572 h	1
18	Equipment Stand / Refrigerated Base	Beverage Air	WTRCS36-1	115 / 1Φ 5 Amp.	915 x 680 x 812	1
27	Kettle – counter top	Crown	EC-10TW - TG	230 / 3Φ 12 kW	667 x 886 x 438	1
27-1	Kettle - mounting	Crown	SD-30 Stand with drain		-	1
27-2	Kettle - mounting	Crown	DF-18 Double pantry faucet		-	1
27-3	Kettle - mounting	Crown	C-10 Lift off lid		-	1
27-4	Kettle - mounting	Crown	LCH-1 Lift off cover hold		-	1
24	Combi Oven door hinges right side	Rational	SCCWE Model 61	230 / 3Φ 11 kW	847 x 771 x 782	1
24-1	Water filter	Everpure	EV9795-90 Pre-filter		-	2
24-2	Water filter	Everpure	CAL20 Calcite cart.		-	2
3	Hot Food Table	SML		230 / 1Φ	1730 x 405 x 762	1
5	Heated plate disp. housing	SML		115 / 1Φ	610 x 610	1
5-1	Heated plate dispenser	SML		115 / 1Φ	171 dia. x 698.5 h	2
5-2	Heated plate dispenser	SML		115 / 1Φ	302 dia. x 698.5 h	1
5-3	Heated plate dispenser	SML		115 / 1Φ	314 dia. x 698.5 h	1
13 & 14	Commercial fridge (right hinges)	Traulsen	RHT132DUT-FHS & FHG	115 / 1Φ 8 Amp.	610 x 1 391 x1 962 (2 114 with legs)	2
15	Commercial freezer (left	Traulsen	RLT132DUT-FHS	115 / 1Φ 11.5 A	610 x 1 391 x1962 (2 114 with legs)	1
	Slicer	Hobart	HS8N-1	115 / 1Φ	620 x 645 x 775	1
	Matting – Black anti fatigue	San Jamar	KM2100B		915 x 1525	5
7	Portable steam cleaner	Vapor Dragon	VS4000C	110 / 12.5A	250x330 x375	1

Table 2 Galley counters

After Outboard side, section 1	16 gauge top, heavy duty construction	Counter with drawers and shelves, triple sink w/vent, enclosed back and marine edge top, stainless steel legs	DWG 3057 2.1.1 livrés dessus 1 pc., cabinets 5 pcs., base 2 pcs	1
Forward Outboard side, section 2	16 gauge top, heavy duty construction	Pastry counter with drawers and shelves, enclosed back and marine edge top with maple cover, stainless steel legs	DWG 3057 2.1.2 livrés dessus 2 pcs, cabinets 1 pc, base 1 pc	1
Forward, section 3	16 gauge top, heavy duty construction	Half pastry counter with shelves, enclosed back and marine edge top with marble cover, stainless steel legs	DWG 3057 2.1.3 livrés dessus dans 2.1.2, cabinets 1 pc et base 1	1
After, section 4	16 gauge top, heavy duty construction	Service section, under counter fridge, 4 sections hot food table with warm plate dispensers.	DWG 3057 2.1.4 livrés dessus 2 pcs, cabinets 3 pc, et	1
Island, section 5	16 gauge top, heavy duty construction	Work table with back riser, enclosed back and marine edge top, stainless steel legs	DWG 3057 2.1.2 Ref. page 1, 2 and detail page 7	1
Storage cabinet and work top L shape, section 6	16 gauge top, heavy duty construction	L shape storage cabinet and work top, sink and wash section	DWG 3057 2.1.2 Ref. page 1, 2 and detail page 8	1
Forward section 3I	16 gauge top, heavy duty construction	Near existing mixer	DWG 3057 # 31 Dessus et cabinet 1 pc,	

Table 3 Hoods

Exhaust hood - island	66"x 48"x14/7" SS 430	Complete standard marine fume hood, 1275cfm air flow, with fire supp. system, duct collar 8"x 16"	9863 Cadexair Ref. P1 /P4	1
Exhaust hood - island	66"x 48"x14/7" SS 430	Complete standard marine fume hood, 1275cfm air flow, with fire supp. system, duct collar 8"x 16"	9863 Cadexair Ref. P1 /P4	1
Exhaust hood - island	66"x 48"x14/7" SS 430	Complete standard marine fume hood, 1275cfm air flow, with fire supp. system, duct collar 8"x 16"	9863 Cadexair Ref. P1 /P4	1

Table 4 Faucets / Wash sink

Equipment Type	Manufacturer	Model	Qty.
1-Faucet	T&S Brass	B-0321	2
2-Pre-Rinse	T&S Brass	B-0113-12-CR-BC	1
3-Hand Sink	Eagle Group	HSA-10-FKP	1

- 17.5.7 The contractor must supply and install new stainless steel sheets on all walls and interior sections of kitchen panels that have not been replaced, including the dumbwaiter module, and the interior of both doors. This work must be done by a professional certified tinsmith of the kitchen stainless steel sheet. The new sheet must be made of gauge 20 316 stainless steel. The sheet must extend from the deck to the ceiling for a height of approximately 8 '. All seams should end vertically in the least visible areas and inside corners. There should be no seams on the outside corners; the liner must be folded to match the profile of the outside corners. The joints must be coated with a food grade sealant and a color matched to that of stainless steel. The sheet must be fixed with rivets made of stainless steel or glued. The top edge should have a finished appearance, without sharp edges, and should have a uniform height throughout the perimeter. The coating should be cut to match the penetrations, contours, etc., found in the kitchen as before. The new sheath should be provided in the largest possible sections to minimize seams.
- 17.5.8 Contractor to supply and install new stainless steel window boxes for all three kitchen windows by certified sheet metal professionals. The new window boxes must be 20-gauge 316 stainless steel with a n ° 4 finish that matches the cladding.
- 17.5.9 The Contractor shall supply and install new stainless steel skid plates under the perimeter of all seating areas of kitchen equipment to prevent the penetration of dirt / debris by certified sheet metal workers. Protective plates must be 20 gauge 316 stainless steel with n ° 4 finish secured with stainless steel screws.
- 17.5.10 The Contractor shall complete the front and back of the exhaust hood to match the new footprint of the kitchen equipment by certified sheet metal workers. Exhaust hoods must be properly installed and supported. The material must be 316 stainless steel with a n ° 4 finish in accordance with the existing one. The fire extinguishing and lighting equipment must be modified and reinstalled according to the new configurations in the hoods.
- 17.5.11 Contractor shall supply and install an "L" anti-drip seal installed between SS panels and countertops, if less than 1/4 "instead a seal shall be caulked with quality sealant and a color matched to stainless steel by certified sheet metal professionals.
- 17.5.12 The Contractor shall replace and fix the wall mounted equipment removed during disassembly to be reinstalled and connected as originally intended. The Contractor must first confirm with the ship's

representative before reassembling the equipment to ensure the item will be reused.

17.5.13 The dumb waiter unit, D.A. Mathot, model 100 serial 17572, must have its annual maintenance and certification by an elevator specialist.

17.5.14 The Contractor shall use the services of a professional cleaning company to clean the entire kitchen, from ceiling to floor once the work is completed.

17.6 Proof of Performance

Inspection

17.6.1 100% UT must be carried out on the welds and NDT report provided to Technical and Project Authority.

Testing

17.6.2 The Contractor shall hire a galley equipment specialist to pre-check, start-up and do the commissioning all new equipment, and include a specific 8-hour period of training in French for CCG cooks with this specialist.

Certification

17.6.3 The Contractor shall provide Class Certification for the material provided, insulation, panels, flooring, etc. A certificate of return into service of the fire protection and fire extinguishing equipment must be provided.

17.7 Deliverables

17.7.1 The contractor must supply 3 copy of the galley equipment commissioning FSR service report.

18.0 CENTRAL COOLER REPLACEMENT OPTIONNAL

18.1 Scope

18.1.1 The intent of this specification is replace the existing two (2) Alfa Laval plate heat exchangers with two (2) new Owner supplied Sondex units. This work is optional.

18.2 References

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

Drawings/ Documents

71-10-01	Schéma du système de refroidissement central
72-38.01 Ann Harvey	Aux. Seats in Machinery Room
S41-S42-IS-PN10-DN150	Sondex Cooler
71931	Plate Arrgt SW Inlet (F3)
71932	Plate Arrgt. SW Inlet (F4)
171071615000	Follower Plate Port Template
104111201315/306	Follower Plate w/ Connections
	Inline Filter
	Sondex – Operation and Maintenance Manual

Owner Furnished Equipment

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

18.3 Technical

- 18.3.1 The 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.
- 18.3.2 Prior to any hotwork 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. The Contractor must also ensure that the area of work, the system, and the adjacent space is certified as gas free and suitable for hotwork as per the Fleet Safety and Security Manual.
- 18.3.3 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.
- 18.3.4 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 by the Contractor unless otherwise directed by the Owner.

- 18.3.5 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.
- 18.3.6 The Contractor must recoat all heat affected and new steel with two coats of Amercoat Red Oxide Primer followed by two topcoats of Amercoat 5450 of the appropriate colour on all surfaces for a final DFT of 3.5 mils. All coatings must be Contractor supplied.
- 18.3.7 The Contractor must provide all WHIMIS data sheets for all chemicals, coatings, solvents, etc. which are being used during the course of this specification item. All containers of such are to be removed from the work site at the end of each work day.
- 18.3.8 The Contractor must ensure that all isolating valves of the central cooler are closed and are secured using the established lock-out / tagout system as outlined in the Fleet Safety and Security Manual. Isolations must be completed under the direction of the Chief Engineer or delegate.
- 18.3.9 The Contractor must be responsible for the disposal of all surplus equipment which has been removed from the performance of this specification item unless otherwise noted. All disposals must be in accordance with municipal, provincial, and federal regulations.
- 18.3.10 The Contractor must not be permitted to make any additional openings in the vessel for the purpose of conducting this work. The Contractor must utilize the existing doors, alleyways, and hatches as they currently exist in the structure of the vessel. Should the Contractor wish to do so, the hatch located on the Officers deck, aft of the wheelhouse, may be used to remove and lower equipment to the main engine room level. This will require the partial disassembly of the equipment prior to installation.
- 18.3.11 Prior to disassembly, the Contractor must completely drain the central cooling system at its lowest possible point. The Contractor will be responsible for the disposal of all treated water and raw water released from the central cooling system. Contractor must allow for a disposal of 15 m3.
- 18.3.12 The Contractor must quote a unit price per m3 of disposal of water for the purpose of adjustment.
- 18.3.13 All piping and valves attached to the existing plate coolers must be removed back to the isolating valves flanges.
- 18.3.14 The Contractor must disassemble and remove the existing plate coolers. Disposal of the coolers will not be permitted until the new

units have been installed and verified in operation for integrity, and must remain Category “A” property storage.

- 18.3.15 Contractor must open all manhole covers, clean and vent tank #9. Clean and dispose of all debris. Remove 2 cubic meters of residual fuel from the tanks. The contractor must obtain a certificate issued by a chemist to allow the work to begin.
- 18.3.16 Close manhole covers using new gaskets, bolts, washers and nuts supplied by the contractor. Gaskets (seals) shall be compatible with diesel fuel.
- 18.3.17 Tank #9 must be hydrostatically tested for leaks in the presence of the ABS inspector.
- 18.3.18 The Contractor must modify or remove and replace top plate of the existing both plate cooler seating arrangement to suit the installation of the new units. Material must be 12.5 mm 44W Steel or better.
- 18.3.19 Final location of the new coolers must be such that it allows for the full opening of the coolers for the purpose of cleaning, inspection and maintenance while respecting the installation guidelines set forth by the manufacturer as much as possible and within the space constraints of the vessel.
- 18.3.20 The Contractor must supply all securing hardware for the final mounting of the new coolers to the newly installed seats. All fasteners must be Grade 8 or better of the size identified by the manufacturer. All mounting holes have a diameter of 18 mm and six (6) fasteners are required per cooler.
- 18.3.21 The Contractor must be responsible to mirror one cooler to the other. Piping connections on the fixed plate will be opposite that of the other cooler and will require the modification of the pressure / follower plate on the second cooler. Modification to the pressure plate will be as per Sondex drawings 171071615000 and 104111201315. The new port must be fitted with eight (8) ¾” UNC studs as per the original port and fitted with an Owner supplied port sleeve. The Contractor must also fit a Contractor supplied 316 Stainless Steel blank, rated for 13 bar, to cover the original port in the modified pressure plate. One additional, Owner supplied, titanium plate and gasket must be added to the modified cooler for the correct port alignment of the sea water strainer.
- 18.3.22 The Contractor must fabricate new pipe sections to adjust to the new coolers. Replacement piping must be as per the pipe specification on drawing 70-10-01. Replacement Cupronickel piping must be of Class 200.
- 18.3.23 The Contractor must be responsible to align the existing piping to the ports on the new coolers so as to remove all connection stresses when final piping and connections have taken place. It will be the

responsibility of the Contractor to position all piping and valves in a manner that a single design of spool must be compatible in all eight (8) spool locations. For bidding purposes, the spool pieces must be of DN150 pipe with a length not exceeding 600 mm.

- 18.3.24 The Contractor must be responsible to fabricate and install eight (8) spool pieces for the purpose of connecting the new coolers to the Contractor modified piping, including all necessary fasteners and gaskets. The spool pieces must be fabricated from ASTM A53 Grade B schedule 40, ERW and flanged 150 ASA. Spool pieces must be fitted with one (1) ½” NPT ports complete with threaded ball valves, Contractor supplied, for the purpose of bleeding or draining the system. A second ¾” NPT port must also be installed for the installation of a thermal well and compatible thermometer. Contractor must supply a total of 8 thermal wells complete with compatible thermometers. Thermometers must be Winters TIM-LF Industrial 9” Thermometers type or equivalent with a scale from -15C to 70C. The sensing element must be made of brass. The industrial thermometer must be designed to withstand the level of vibration encountered in an engine room. The thermometer must have an accuracy of plus or minus 1 per cent of full scale.
- 18.3.25 The Contractor must fabricate four (4) additional spool pieces and supply to the Owner to be used as spares complete with an AutoCAD drawing which can be used for the purpose of fabrication.

18.4 Proof of Performance

Inspections

- 18.4.1 During vessel refloating, the contractor must have all system valves closed and must have sufficient personnel on hand such that the system can be inspected for leaks. Once sufficient water depth has been obtained, all 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.
- 18.4.2 The final installation must comply with ABS requirements.

Testing

- 18.4.3 The Contractor must be responsible to pressure test all new and modified pipe sections prior to commissioning at a pressure of 6 bar for a minimum of one (1) hour.
- 18.4.4 Each cooler must be pressure tested to the maximum working pressure of 13 Bar upon final mounting and reassembly.
- 18.4.5 Valves fitted to the fresh water side of the cooler must be tested prior to admitting water into the raw water side of the cooler. During testing of the fresh water valves, the port strainer must be removed to ensure no leakage exists between the fresh water side and the raw water side

for each cooler. This test must be completed with the central cooling system filled to capacity. Prior to testing the raw water isolation valves, these port strainers must be retightened.

- 18.4.6 The central cooling piping system and header tank shall be filled with 12 m³ of distilled water supplied by contractor. Water treatment supplied by CCG shall be added to the system after the system tightness integrity is proven.

18.5 Deliverables

- 18.5.1 The Contractor must provide the TA with all material certificates for the valves, piping's and trims.

19.0 SEWAGE SYSTEM UPGRADE (OPTIONAL)

19.1 Scope

- 19.1.1 This Specification covers the upgrading of the various components of the wastewater collection system. Contractor must fabricate a new sewage transfer tank as per MSI Drawing No. 'Sewage Tank 10/18/2017' and must replace the existing tank located in the Forward Lower Engine Room. This work is optional.

19.2 References

Regulations

- a) Canada Shipping Act CSA 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations
- c) Pollution regulation and hazardous chemical products, CSA

Standards

- a) The following Coast Guard Standards and/or Technical Bulletins must be followed while executing this specification. Copies of these standards and bulletins can be obtained from the CCG Technical Authority:
 - 1. Coast Guard Welding Specification;
 - 2. Coast Guard ISM Lockout/Tagout;
 - 3. Coast Guard ISM Hotwork procedures;
- b) Fleet Safety and Security Manual (DFO/5737)
- c) IACS No. 47 - Shipbuilding and Repair Quality Standard
- d) CSA W59-08 (R2008) - Welded Steel Construction
- e) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- f) Society for Protective Coatings (SSPC) Standards
- g) IEEE 6332-3
- h) TC TP 127

FSR Information

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Drawings

Numéro de dessin	Nom de dessin
2288-A3-RO	Blower Assembly
MD	Mini Doser manual / dwg
2288-MF2-RO	Dechlorination pipe
2288-MF4-RO	Chlor-dechlor standard assembly
2288-MF15-RA	Media tank External
2288-MF16-RB	Media tank Internals
2288-MF17-RA	Media block details
CS19742	Electrical chloration-dechloration
Q-2082S02	Mini Doser Assembly
Q-2082S01	Standard drawing fast sewage system
50-00-01	Engine room arrangement
S1	St.Louis Ship Structural Details Existing Media Tank
S3	St.Louis Ship Structural Details Existing Media Tank
A1	St.Louis Ship Assembly Details of Existing Plant
CU000	Drawings
233-01	Black and Grey water sewage system
2082-M17	Minidose mounting bracket

Owner Furnished Equipment

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

Owner Furnished list of supplied equipment GSM

- 19.2.2 Media tank upgrade material (media, support grating, support angles, hold down angles, spill over piping, air drop hose and associated fittings, level switch for wet well).
- 19.2.3 2 blower assemblies (2 roots blowers, 2 electric motors, 2 motor slide bases, sheaves, belts and belt guards).
- 19.2.4 Control panel (panel complete with duplex pump controls and run light. Duplex blower controls and run light. Chlorination/De-chlorination controls. Power "ON" light. Alarm and alarm contacts.)
- 19.2.5 Chlorination/de-chlorination system (de-chlorination assembly, chlorination-de-chlorination chemical pumps, chlorination-de-chlorination plastic feed tanks).
- 19.2.6 Jetvac Automatic Sludge reduction system (control panel, mini feeder assembly, air actuated control valves, No-flex digester compound).

19.3 Technical

Sewage Media Tank

- 19.3.1 The contractor shall arrange the services of a Jetvac Contractor Field Service Representative (FSR) to provide technical support, and guidance to the contractor and to supervise the commissioning of the sewage treatment plant upgrades. The scheduling of the FSR's attendance on the vessel for commissioning shall be done in consultation with the Project Authority TA.
- 19.3.2 The Contractor must have an allowance of 50 000\$ for the services of a Jet Vac Inc FSR to oversee the upgrade installation, start-up and commissioning of the sewage system. The actual amount must be adjusted up or down via 1379 action.
- 19.3.3 In consultation with the Chief Engineer the contractor shall install a temporary bypass hose connection from the media tank inlet to the sewage overboard discharge. This connection will entail removal of pipe spools and blanking of media tank inlet. The contractor shall arrange for the provision of two (2) heated portable toilets for the

duration of the bypass connection work. Upon completion of the bypass connection the ship toilets will be returned to service.

- 19.3.4 In consultation with the Chief Engineer the contractor shall de-energize power to sewage treatment plant and perform lockout/tagout procedures accordingly.
- 19.3.5 In consultation with the Chief Engineer the contractor shall isolate sewage treatment plant inlet/outlet lines, and perform lockout/tagout procedures accordingly.
- 19.3.6 The Contractor shall supply two portable toilets during the work. Portable toilets must be equipped with heaters, a hand sanitizing station, toilet paper and cleaning wipes. Portable toilets should be cleaned daily and emptied regularly. The Contractor shall place the portable toilets on the deck of the vessel, at the locations indicated by the TA officer of the vessel.
- 19.3.7 The Contractor must schedule the work so that the sewage system is returned to service as soon as possible. Withdrawals must begin just before the completion of the cut-off for the new Wartsila generators.
- 19.3.8 The contractor shall dispose of the entire contents of the media tank. The tank internals shall be cleaned with high pressure water only. All solid residue and water from the disposal and cleaning process shall be pumped to collection tank arranged by the Contractor. For

quotation purposes the residual amount shall be bid at one thousand (4 000) litres. The total shall be adjusted up or down by 1379 action.

- 19.3.9 The contractor shall gas free the media tank prior to hot work tank as per ISM procedures.
- 19.3.10 Contractor shall provide milestone date as to when sewage the media tank will be cleaned and gas freed for entry.
- 19.3.11 The contractor shall remove the tablet chlorinator and pipe spill-over directly into wet well.
- 19.3.12 The contractor shall remove and dispose of old media from media tank.
- 19.3.13 The contractor shall install access hatch as per drawing # 2288-MF1-RO
- 19.3.14 The contractor shall install six new brackets at new height in tank to fix support angles.
- 19.3.15 The contractor shall install two new brackets to fix media hold-down angles.
- 19.3.16 The contractor shall cut PVC air-lifts and spill-over pipes to new height.
- 19.3.17 The contractor shall fit ¾ inch half coupling in top of transfer tank for mini-doser inlet.
- 19.3.18 The contractor shall install Mini-doser assembly and associated control panel. The panel dimensions are 16 inches wide X 20 inches high X 8 inches deep.
- 19.3.19 Contractor shall make an allowance of 20 bead feet of clad welding to repair any pitting found on the internal surfaces on the media tank.
- 19.3.20 Contractor shall quote an allowance for labour and materials to weld in five (5) square metres of steel plating including the steel coating to

- address any wasted sections of the media tank. The total shall be adjusted up or down by 1379 action.
- 19.3.21 All welding must be subjected to visual inspection and MPI or US by third party NDT technician.
- 19.3.22 The contractor shall recoat the entire internal surface of the media tank with Interline 944 epoxy. The steel surface profile shall be prepared in accordance with the coating data sheet.
- 19.3.23 Contractor shall provide milestone date as for completion of coating media tank to be included in the production chart.
- 19.3.24 The contractor shall fit ½ inch stainless steel 316 alloy half coupling in top of wet well for chlorine input.
- 19.3.25 The contractor shall install new float switch in wet well.
- 19.3.26 The contractor shall disconnect electrical and piping connections and remove the 2 existing blowers and motors from the existing brackets.
- 19.3.27 The contractor shall install 2 new blowers and motors on the existing brackets and make electrical and piping connections.
- 19.3.28 The contractor shall install the de-chlorination assy. In a suitable location to be determined.
- 19.3.29 The contractor shall install chlorination/de-chlorination pump and tank assembly in suitable location to be determined in the sewage compartment.
- 19.3.30 The Contractor shall install the control panel provided by CCG and in accordance with the general requirements of this specification.
- 19.3.31 New fasteners and gaskets shall be used on all new or disturbed piping.
- 19.3.32 Following the sewage upgrade work the contractor shall remove the temporarily fitted bypass hose connection from the media tank inlet to sewage overboard discharge and reinstall associated piping as per the original configuration. The contractor shall arrange for the provision of two (2) heated portable toilets to be used for the duration of the commissioning and pipe reinstallation work. Upon satisfactory reinstallation of original pipe configuration the ship's toilets will be returned to service.
- 19.3.33 Contractor shall provide milestone date for completion of sewage upgrades to be included in the production chart.

Location

- 19.3.34 Media tank and associated equipment is located in the sewage compartment frames 13 to 30.

Interferences

- 19.3.35 Contractor is responsible for the identification of interference items, their temporary removal, storage and refitting to vessel.

19.4 Proof of Performance:**Inspection**

- 19.4.1 All work shall be completed to the satisfaction of the Chief Engineer.

Testing

- 19.4.2 As per test and trials included in Jetvac field service representative commissioning.
- 19.4.3 One month after system commissioning, samples must be taken and at two weeks intervals 2 samples must be sent for analysis to a laboratory. The results must be in accordance with the regulations in force, and the Jet Vac representative will have to confirm in his report that the results of the analyzes are in good working order.
- 19.4.4 The Jet Vac Inc FSR will be responsible for executing the Jet Vac Inc commissioning plan including all configuration, measurements, record keeping and adjustments required to the sewage system in order to achieve an operational system according to existing environmental regulations.

19.5 Deliverables:**Drawings/Reports**

- 19.5.1 The Contactor shall provide copies of any NDT and hot work permits to the Chief Engineer upon completion of work.
- 19.5.2 Two (2) typewritten copies and one (1) electronic copy shall be presented to the Chief Engineer after completion.

20.0 SHIP SIDE VALVES

20.1 Scope

- 20.1.1 The intent of this item is to proceed with valve maintenance. Maintenance of shipside valves shall be carried out for a period of five years in accordance with the requirements of ABS and the load line certificate.

20.2 References:

Drawings/Documents

- 20.2.1 Valves list: sea chest and sea bay
- 20.2.2 Reference drawing no. 68-2030-3, Alt F, Sea suction valve location on sea chest and sea bay.

Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Maritime Occupational Health and Safety Regulations

Standards

- a) Fleet Safety and Security Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) CSA W59-08 (R2008) - Welded Steel Construction
- d) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- e) Society for Protective Coatings (SSPC) Standards

List of valves: external sea chests

Propulsion motor room: 9 valves

				DIA.	QTY	FRAME
1	STERNTUBE SUCTION PUMP	Center	Globe Angle	3"	1	38
2	VENT	Center	Butterfly	2"	1	38
3	DE-ICING	Center	Globe	1½"	1	38
4	COMPRESSED AIR	Center	Globe	¾"	1	38
5	SUBMERSIBLE SUCTION PUMP	Port	Angle	3"	1	51
6	VENT	Port	Butterfly	2 ½"	1	51
7	DE-ICING	Port	Globe	1½"	1	51

8	COMPRESSED AIR	Port	Globe	¾"	1	51
9	STERN TUBE PUMP	Center	Globe	3"	1	38

Generator room: 20 valves

		TYPE	DIA.	QTY	FRAME
	Port lower external sea chest:				
10	Filling internal sea chest	Butterfly	16"	1	98
11	Recirculation	Globe	8"	1	101
12	Vent	Butterfly	4"	1	103
13	De-icing	Globe	½"	1	102
14	Compressed air	Globe	¾"	1	102
	Lower starboard External sea chest:				
15	Filling internal sea chest	Butterfly	16"	1	99
16	Recirculation	Butterfly	8"	1	101
17	Vent	Butterfly	4"	1	104
18	De-icing	Globe	½"	1	102
19	Compressed air	Globe	¾"	1	102
	Upper starboard External sea chest:				
20	Filling, internal sea chest	Butterfly	16"	1	98
21	Recirculation	Butterfly	8"	1	101
22	Vent	Butterfly	4"	1	104
23	De-icing	Globe	½"	1	103
24	Compressed air	Globe	¾"	1	103
	Upper starboard External sea chest:				
25	Filling sea chest	Butterfly	16"	1	99
26	Recirculation	Butterfly	8"	1	101
27	Vent	Butterfly	4"	1	104
28	De-icing	Globe	½"	1	102
29	Compressed air	Globe	¾"	1	102

List of valves: internal sea bay**Generator room: 20 valves and 7 strainers**

		TYPE	DIA.	QTY	FRAME
	Center internal sea bay:				
30	Filling internal sea bay	Butterfly	16"	2	99
31	Fire pump	Butterfly	5"	1	100
32	Auxiliary generator	Angle	3"	1	97
33	Fire and foam pump	Butterfly	8"	1	101
34	Manifold, sea water circulation pump	Butterfly	12"	1	100
35	Fore sea water circulation pump	Butterfly	8"	1	101
36	Center sea water circulation pump	Butterfly	8"	1	100
37	Aft sea water circulation pump	Butterfly	8"	1	99
38	Ballast and bilge pumps	Angle	4"	1	99
39	Recirculation	Butterfly	8"	2	101
40	Vent	Butterfly	6"	2	101
	Starboard internal sea chest evaporators				
41	Alfa-Laval evaporator	Angle	3"	1	105
42	Reverse osmosis	Angle	1 ¼"	1	105
43	Vent	Butterfly	2 ½"	1	105
44	De-icing	Globe	½"	1	105
45	Compressed air	Globe	¾"	1	105
77	Evaporator Valve	Angle	3"	1	98

List of valves: overboard discharge**Rope store: 2 valves**

		TYPE	DIA.	SIDE	FRAME
46	Bilge pump	Globe	2"	Port	11
47	Cofferdam bilge pump	Globe	1"	Port	11

Sanitary system compartment: 2 valves

		TYPE	DIA.	SIDE	FRAME
48	Sewage and used water	Globe	3"	Starboard	19
49	De-icing	Globe	½"	Starboard	19

Propulsion motor room: 8 valves

		TYPE	DIA.	SIDE	FRAME
50	Stern tube	Globe	1 ½"	Port	31
51	Stern tube	Globe	1 ½"	Starboard	31
52	Oily water separator	Globe	2"	Port	32
53	De-icing	Globe	½"	Port	32
54	Submersible pump	Globe	3"	Port	37
55	De-icing	Globe	½"	Port	37
72	Stern tube (fire line)	Globe	1 ½"	Port	31
73	Stern tube (fire line)	Globe	1 ½"	Starboard	31

List of valves:**Generator room: 17 valves**

		TYPE	DIA.	SIDE	FRAME
56	Boiler separator	3-way	1"	Starboard	71
57	Fore and aft ballast and bilge pumps	Globe	6"	Starboard	96
58	De-icing	Globe	½"	Starboard	96
59	Fire pump	Globe	3"	Starboard	97
60	De-icing	Globe	½"	Starboard	97
61	Central cooling	Globe	10"	Port	102
62	De-icing	Globe	½"	Port	102
63	Brine evaporator	Globe	3"	Starboard	90
64	De-icing	Globe	½"	Starboard	90
65	Auxiliary generator	Globe	3"	Starboard	90
66	De-icing	Globe	½"	Starboard	90
67	Central cooling	3-way	10"	Port	102
68	Central cooling, Heat exchanger	Butterfly	4-valves x 6"	Port	72-80
80	Interconnection	Globe	2"	Port	74

Forecastle: 2 valves

		TYPE	DIA.	SIDE	FRAME
69	Bilge pump	Globe	2"	Port	170
70	Forepeak	Globe	4"	Port	175

Fore keel: 1 valve (speed log)

		TYPE	DIA.	SIDE	FRAME
71		Gate	3"	Center	162

De-icing for transducer trunk: 1 valves

		TYPE	DIA.	SIDE	FRAME
91		Globe	1"	Starboard	127

Thermosalinograph: 1 valves

		TYPE	DIA.	SIDE	FRAME
92		Globe	3"	Starboard	130
93		Globe	3"	Starboard	133
94		Globe	½"	Starboard	133
95		Globe	¾"	Starboard	133

Owner Furnished Equipment

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

20.3 Technical**Valve Maintenance**

- 20.3.1 All valves must be suitably tagged such that they may be reinstalled in their original respective locations.
- 20.3.2 Contractor must inspect all pipe stubs, flange seams and faces for defects upon removal of valves. The TA must be advised promptly when any piping defect is discovered so that photographic records may be taken and an extra raised for repairs.
- 20.3.3 The Contractor must dismount and disassemble the globe valves as listed. Spindles must be removed, cleaned and laid out for inspection. The internals of the valve bodies, valves, and sealing

- surfaces must be cleaned thoroughly cleaned, and laid out for inspection.
- 20.3.4 The butterfly valves must be removed, disassembled, cleaned and laid out for inspection.
- 20.3.5 Metal to metal seated valves must be lapped to provide a watertight seal.
- 20.3.6 The Contractor must provide a test method to ensure that a watertight seal is maintained between the valve and valve seat for the screw type valves.
- 20.3.7 This test method must be confirmed to be acceptable to the attending ABS Inspector.
- 20.3.8 To ensure that a watertight seal is maintained between the valve and valve seat, the Contractor must remove all listed valves from the vessel for overhaul and pressure testing. All valves are to be pressure tested to 100psi and witnessed by TA in contractors work shop prior to reinstallation onboard the vessel.
- 20.3.9 Following all inspections and tests, all valves must be assembled with all new gland packing and all new appropriate jointing, as applicable and installed in good order in their original respective locations and orientations.
- 20.3.10 Contractor must include in their bid for the renewal for ten units of each of the following flange size: 16" flange, 8" flange, 6" flange and 4" flange.
- 20.3.11 The Contractor must supply all materials required to carry out the specified work.
- 20.3.12 Two 3-way Leslie valves, 10" with pneumatic actuator will be provided and shall replace the valves currently in use, one on the central fresh water system and the other on the seawater system. Install and supply new flange gaskets, the valves have a weight of 500 lbs each, and will be available on the ship deck (helicopter hangar), and the removed ones will have to be returned to the ship deck.

20.4 Proof of Performance

Inspections

- 20.4.1 At undocking the Contractor is to carry out leakage inspections and check for any ingress of water. Any leakage is to be corrected immediately prior to undocking the vessel.

Testing

- 20.4.2 The Contractor must perform a hydrostatic test of the sea bay at the completion of this work and just prior to the re-floating of the vessel.

Any defects must be repaired, and the sea bay retested until there are no defects.

- 20.4.3 After re-installation, each valve will be test operated in the presence of the Owner's Representative, fully opened to fully closed. Valves will then be left in their normal operating position.

20.5 Deliverables

Drawings/Reports

- 20.5.1 Contractor must provide detailed report correlating each valve type/size to its location. The conditions of the valve as found and repairs carried out must be noted.

21.0 FRESH WATER TANK COATING

21.1 Scope

- 21.1.1 The purpose of this item is to clean, paint, test and disinfect the vessel's potable water tanks. It will also be necessary to clean, paint and test the boiler's water feed tank at the same time.
- 21.1.2 It is imperative that the preparation and application of the coating of drinking water tanks commence early during the maintenance period to allow sufficient curing time.

21.2 References

Regulations

- 21.2.1 Canada Shipping Act 2001 - Hull Construction Regulations
- 21.2.2 Maritime Occupational Health and Safety Regulations

Standards

- 21.2.3 The following Coast Guard Standards and/or Technical Bulletins must be followed while executing this specification. Copies of these standards and bulletins can be obtained from the CCG Technical Authority:
 - 21.2.3.1 Coast Guard Welding Specification;
 - 21.2.3.2 Coast Guard ISM Confined Space Entry (7.B.3);
 - 21.2.3.3 Coast Guard ISM Hotwork Procedures (7.B.4);
 - 21.2.3.4 Coast Guard ISM Fall Protection Procedures (7.B.2)
- 21.2.4 Fleet Safety and Security Manual (DFO/5737)
- 21.2.5 CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel IACS
- 21.2.6 Society for Protective Coatings (SSPC) Standards
- 21.2.7 EKME/MCGE#3280255v15 CCG Technical Bulletin Bulletin 2015-01 Potable water tank epoxy based surface coatings update, lessons learned and recommendations.
- 21.2.8 Fleet Safety Manual 7.A.12 –POTABLE WATER QUALITY
Version 4-1: 2015-12-04

Drawings

Drawings Number	Drawing Name
108-H-0026	Capacity Plan
2015-01	PotableWaterTankTB

Tank	Frame	Volume (m³)	Surface (m²)
Port potable tank	30-41	51.3	224.0
Starboard potable tank	30-41	50	222.7
Boiler feed tank	7-13	16.1	

Owner Furnished Equipment

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

21.3 Technical

Surface Preparation

- 21.3.1 The Contractor must remove the manhole covers, finish emptying the tanks with portable pumps then ventilate the tanks. A certified chemist must post a certificate attesting that each tank is gas free and safe to work inside.
- 21.3.2 The interior of the tanks is coated with white epoxy.
- 21.3.3 The Contractor must clean the inside of the three (3) tanks with high pressure (10,000 psi) water jet system.
- 21.3.4 The Contractor must remove all debris then wash and wipe dry the tanks.
- 21.3.5 The Contractor must plan on using mechanical tools to remove any loosened paint left after the water jet cleaning.
- 21.3.6 The Contractor must bid on removing and disposing of approximately of eight hundred (800) litres of water and debris.aA
- 21.3.7 The Contractor must have all three (3) tanks inspected by a ABS surveyor.
- 21.3.8 The Contractor must maintain a minimal temperature of 10°C in the tanks to be painted and on all their bulkheads.
- 21.3.9 CCG estimates that 25% of the total surface is bare metal. The Contractor must supply and apply, on these areas, two coats of a 100% solids epoxy paint, free of Volatile Organic Compound (VOC) and certified as a "Protective (Barrier) Material" for use on drinking water tanks, as indicated in Standard 61 of the National Sanitation Foundation (NSF) "Drinking Water System Components Program" and the American National Standards Institute (ANSI).
- 21.3.10 The white epoxy coating (Interline 850 one full-coat .006 coating dry-film thickness , interline 925 for partial retouching .006 coating dry-film thickness) described above shall be applied by paint brushes and

paint roller until the thickness recommended by the manufacturer, it is forbidden to use spray gun and no thinner is allowed in any way.

- 21.3.11 Instead of the suggested paint, the Contractor may use an equivalent solid epoxy based paint that meets the standard 61 of NSF and ANSI and the application requirements of the manufacturer.
- 21.3.12 The Contractor must use all new equipment for the application of the coating including pumps, hoses, brushes, etc. This is important to ensure that thinners or solvents are not inadvertently introduced by equipment previously used and then cleaned and contaminated with thinners or solvents. The re-use of pumps but not hoses may be permitted provided that the Contractor demonstrates draining plus sufficient flushing of the equipment with a product NSF 61 certified for use in potable water tanks and absent of any solvents. The Contractor must not use the product used for flushing on potable water tanks.
- 21.3.13 The Contractor shall provide the SPAC Contracting Authority no later than 14 days after contract award with the following information:
 - 21.3.13.1 Proposed paint coating being offered,
 - 21.3.13.2 Manufacturer of the coating,
 - 21.3.13.3 Proof that the paint meets the requirements specified in 25.3.9 and 10
 - 21.3.13.4 Manufacturer's working procedures sheets,
 - 21.3.13.5 Product data sheets; and Material Safety Data (MSD) sheets.
 - 21.3.13.6 The bid on having an independent certified NACE International (NACE) inspector with a minimum certification of Coating Inspector Program Level 2, who must:
 - 21.3.13.6.1 Verify the work as specified, throughout the process;
 - 21.3.13.6.2 Provide advice and feedback directly to the CCG Technical Authority;
 - 21.3.13.6.3 Certify, in a written report to the CCG Technical Authority, that the Contractor has followed correct application procedures considering the environmental conditions.

- 21.3.14 The Contractor must be responsible for ensuring that the paint manufacturers application recommendations are strictly adhered to, especially in regard to the following:
 - 21.3.14.1 Preparation of surfaces,
 - 21.3.14.2 Paint temperature and substrate temperature during coating process;
 - 21.3.14.3 Curing conditions (including temperature, humidity, dew point, ventilation and cure time),
 - 21.3.14.4 Shelf life of paint, and
 - 21.3.14.5 Compatibility with tank materials.
- 21.3.15 On completion of the surface preparation and prior to the first application of the paint schedule, the Contractor's Quality Assurance representative must provide a written statement certifying that the surface preparation has been completed in accordance with the manufacturer's instructions. Any deviations to those instructions must be noted in the certified statement.
- 21.3.16 The Contractor must be responsible for monitoring the following parameters during the application and curing period of the paint schedule:
 - 21.3.16.1 Ambient air temperature of each tank and this must be constantly monitored during the application and curing period using an electronic data recorder. The Contractor must record temperatures hourly and submit printouts to the CGTA.
 - 21.3.16.2 Before work is started, space temperature and relative humidity level in each tank.
 - 21.3.16.3 Wet and dry bulb temperatures of each tank and temperatures of the surfaces being painted. The Contractor must measure and record these values every four hours during the coating process.
- 21.3.17 The Contractor must note that the paint application must not take place when the surface temperature is less than three (3) degrees C above the dew point.
- 21.3.18 The Contractor must ensure that anyone entering the tanks for any reason after the tanks have been cleaned, during or after the tank coating process must wear suitable clean, new, non-contaminating

protective clothing, including booties/boot covers on their feet so as not to contaminate the tanks.

21.3.19 Once the coating is dry, The Contractor must rinse each tank, using fresh water.

21.3.20 Afterwards, the CGTA must inspect each tank.

21.3.21 Finally, the Contractor must install the manhole covers with new gaskets. Gaskets and anti-seizing compound used to install the manhole covers must be NSF 61 certified.

Overhaul of tanks' suction and discharge Valves

21.3.22 The Contractor must remove all suction and discharge valves on each tank and transport them to its shop for overhaul.

21.3.23 The Contractor must perform the following tasks:

21.3.23.1 a) Remove all valve bonnets;

21.3.23.2 b) Dismantle valves, clean and lap disks in with compound to ensure a good seat;

21.3.23.3 c) Clean all valve stems, examine them for wastage and then ring out;

21.3.23.4 d) Report to the Technical Authority any valve discs, seats and/or valve stems that require machining or replacement so remedial actions can be performed;

21.3.23.5 e) Inspect all contiguous piping and studs for wastage.

21.3.24 On completion of all cleaning and overhaul, the Contractor must lay out all parts for inspection and survey by the TCMS surveyor.

21.3.25 After successful completion of survey and/or repairs, the Contractor must reassemble all valves to a working order, using new gaskets and valve stem packing and then reinstall them in their respective positions using new gaskets. Gaskets used for the re-assembly of the valves must be NSF 61 certified.

21.3.26 The Contractor must supply and coat all moving parts and fasteners with an anti-seizing compound. This anti-seizing compound must be NSF 61 certified

21.3.27 The Contractor must perform the final closing up of all valves under the surveillance of the CCG Technical Authority. Following inspection, the Contractor must reassemble all valves in the closed position.

Filling and Testing

21.3.28 Following the completion of all work inside the potable water tank and prior to returning the tank to service, the Contractor must fill and then drain the tank until the water discharged from the tank is clear and the turbidity level of the discharged water measures less than 1

Nephelometric Turbidity Unit (NTU). The Contractor must be responsible for disposal of the water during flushing/ /draining.

21.3.29

21.3.30 Upon successful completion of rinsing and draining, the Contractor must conduct the port & starboard potable water tank filling and testing activities listed in Table 1.

Table 25.1- Port and Starboard Tank Filling and Testing

Process	Description	Duration	Sampling and Deliverables
1. Super-chlorination of tank	Fill the tank and super-chlorinate the water using bleach to a level of 50 mg/L of free chlorine	The super-chlorinated water must sit for a minimum of 4 hours in accordance with article 3.5 "Disinfection" of section 7.A.12 "Potable Water Quality" of the GCC FSM	The Contractor must supply the TA with the calculations used to determine strength of chlorine solution to be used and the number of containers to be used, prior to super-chlorinating the tank
2. De-chlorination and discharge	The super-chlorinated water must be de-chlorinated to a free chlorine level below 0.1 mg/L in accordance with article 3.5 "Disinfection" of section 7.A.12 "Potable Water Quality" of the GCC FSM. The tank must then be drained	De-chlorination to be conducted not less than 4 hours after super-chlorination of the tank	None
3. Fill and chlorination	The tank must be filled, and chlorinated. The level of free chlorine in the tank must be maintained at a level between 0.2 mg/L to 0.5 mg/L of free chlorine	<p>1. Influent water samples to be collected during the filling of the tank</p> <p>2. Effluent water samples must be collected from the starboard side tank approximately 4 hours after filling is completed</p>	<p>1. The Contractor must collect influent water samples from the hose that will be used to fill the tank. The Contractor must send the samples to an accredited laboratory for analysis</p> <p>2. The Contractor must collect effluent water samples directly from the sampling valve located on the starboard side tank. The Contractor must send the samples to an accredited laboratory for analysis</p> <p>The quantity of influent and effluent samples collected must be sufficient to conduct the analysis of the twenty-eight (28) health based objective and aesthetic objective parameters listed</p>

			in the CCG Fleet Safety Manual section 7.F.12 "Potable Water Quality", section 3.6, paragraph f) inclusive. The effluent analysis results must meet the acceptable limits listed in the CCG Fleet Safety Manual section 7.F.12 "Potable Water Quality", section 3.6, paragraph f) before continuing with the remaining work
4. Final Sampling	The chlorinated water in the tank from the "Fill and chlorination" process must sit for 3 days	Effluent water samples must be collected from the starboard side tank 3 days after the successful completion of the "Fill and chlorination" process	The quantity of samples collected must be sufficient to conduct an analysis of the twenty-eight (28) health based objective and aesthetic objective parameters listed in the CCG Fleet Safety Manual section 7.F.12 "POTABLE WATER Quality", section 3.6, paragraph f) inclusive. The water sample analysis reports from the laboratory must be delivered to the TA. The analysis results must meet the acceptable limits listed in the CCG Fleet Safety Manual section 7.F.12 "Potable Water Quality", section 3.6, paragraph f) before continuing with the remaining work

- 21.3.31 The water from the tank must not be used for ships consumption until receipt of acceptable drinking water certificates.
- 21.3.32 The Contractor must supply all of the equipment and materials required for tank disinfection and subsequent flushing. The Contractor must be responsible for disposal of the water during

flush/drain. The flushed/drained water must be discharged in accordance with the applicable regulations.

21.3.33 All costs related to water testing must be covered by the Contractor.

21.3.34 Contractor is responsible for the identification of interference items, their temporary removal, storage and refitting to vessel.

21.4 Proof of Performance

Inspections

21.4.1 All work must be completed to the satisfaction of the TA within the scope of the specification.

21.4.2 Contractor must hire and retain an independent NACE inspector prior to coatings to schedule inspection points for surface preparation, environmental conditions and coating applications adhere to manufacturer recommendations and best industry practices.

21.5 Deliverables

Drawings/Reports

21.5.1 Contractor must provide report on coatings applied including environmental and atmosphere conditions monitored from independent NACE inspector:

21.5.2 The application procedures, product data sheets, and safety data sheets for the coating product.

21.5.3 Copies of all tank entry certificates;

21.5.4 Temperature and relative humidity values in the tank during coating and curing;

21.5.5 Copies of the waste and hyper-chlorinated water disposal certificates;

21.5.6 Copies of certificates stating that all hoses and pumps used during tank filling and draining operation are for fresh water use only; and

21.5.7 Copies of all test water sampling results issued by the testing laboratory.

22.0 FIRE FIGHTING SYSTEMS

22.1 Scope

- 22.1.1 Contractor must arrange for inspection, testing and recertification of all ship's fire extinguishing systems and fire detection system, as described and listed below, by an authorized service provider. Proof of credentials and certification of service provider must be made available to Chief Engineer.

22.2 References documents

- 22.2.1 Fixed extinguishers list
- 22.2.2 Portable extinguisher list

22.3 Technical

General

- 22.3.1 Contractor is to tender for "an authorized service provider" to complete all work as outlined in the specification including all Travel and Living expenses.
- 22.3.2 No components or parts must be replaced without the prior consent of the Technical Authority.
- 22.3.3 All certificates and service reports issued by the Contractor for this work must refer to each serviced component's serial number and location on the vessel.
- 22.3.4 All systems must be left in an operational condition overnight.
- 22.3.5 Contractor must inform Chief Engineer prior to making any system inoperable due to maintenance/inspection. All bottles must be disconnected before tests are completed.
- 22.3.6 Final inspection of completed work must be undertaken by Contractor's charge hand in the presence of the designated Ship's Officer. All work must be to the satisfaction of the Chief Officer and ABS.

FM200 Systems

- 22.3.7 All independent systems, Chemetron fixed FM-200 fire extinguishing systems must be thoroughly examined by qualified technicians and inspection certificates issued. Systems must be inspected to current TCMS standards and as per current Chemetron FM-200 marine maintenance manuals for the FM-200 systems. Service provider must be currently certified by Chemetron for this inspection service and

must produce documentation to verify same. Inspection and testing of all equipment must be witnessed by the Technical Authority.

- 22.3.8 All manual and electric pull cables must be inspected and tested.
- 22.3.9 All gas piping must be inspected, blown through, proven clear and pressure tested.
- 22.3.10 All sirens, horns and bells must be inspected and tested.
- 22.3.11 All gas cylinders must be weighed and Net weight determined and recorded.
- 22.3.12 All time delay functions must be tested and proven correct.
- 22.3.13 All pressure activated switches for fire alarm initiation must be tested.
- 22.3.14 All pressure activated switches for shutdown functions must be tested.
- 22.3.15 Contractor to visually inspect all FM200 bottles at deck level for possible excessive amounts of corrosion or rust accumulation of exterior of bottles. The Technical Authority must be advised immediately if any problems are found.
- 22.3.16 System must be properly reassembled in good working order. All cylinders must be firmly secured in their respective mountings. Inspection certificates must be submitted to ABS with three (3) typewritten copies given to the Chief Engineer.

Galley Chemical System

- 22.3.17 The Contractor perform maintenance and inspect the chemical system in the kitchen. The replacement of kitchen hoods during the Galley refit includes the dismantling of kitchen extinguishing equipment and the modification / addition of fire extinguishing equipment to the new exhaust hoods of the kitchen. The contractor must include the necessary material and technician to perform the reinstallation and modification.
- 22.3.18 Contractor must test and prove clear the piping and nozzles and ensure there are no foreign materials in the piping system that could prevent these systems from working correctly. All piping support brackets must be verified in place and correctly fastened.
- 22.3.19 Contractor must inspect cylinder, cylinder valve and control head assembly. Cylinder should not show evidence of corrosion or damage. Cylinder charge must be determined and verified correct.

All functions and adjustments of control head must be verified correct.

- 22.3.20 Contractor must clean linkages, cabling and pulleys and renew the fusible links in the canopy release cabling.
- 22.3.21 Operation of Fire-Shutter to Crew's Mess to be proven.
- 22.3.22 Contractor must obtain a sample of the chemical in service; to be sent off to lab for testing to ascertain that chemical in service is in good order. Copy of lab testing must be provided to Coast Guard.
- 22.3.23 Upon completion of the servicing of the above system all must be reconnected in good order.

CO₂ Fire Smothering System Inspection

- 22.3.24 Contractor must have maintenance and testing of CO₂ systems performed by qualified personnel.
- 22.3.25 The CO₂ firefighting systems must be thoroughly examined and tested:
- 22.3.26 As per Ship Safety requirements.
- 22.3.27 All tests to be witnessed by Owner's representative and attending Ship Safety Surveyor.
- 22.3.28 All bottles must be disconnected before tests are conducted. The Technical Authority must be advised prior to disconnecting. All hand control levers, pull handles, cables, cocks, and valves must be checked and proven operational. The piping must be blown through with dry compressed air or nitrogen to prove the lines are clear and that the

time delays and sirens are operational. All pressure-operated switches must be proven operational.

- 22.3.29 All CO2 flexible hoses must be inspected.
- 22.3.30 All CO2 bottles are to have their levels ascertained. Any recharging must be done by 1379 action. The contents must be recorded. Contractor must replace any CO2 discharged.
- 22.3.31 List of fix systems and bottles, see Annex tables.
- 22.3.32 Manual release systems operated from:
 - 22.3.32.1 Manually at CO2 bottles.
 - 22.3.32.2 Outside FM200/CO2 Room.
- 22.3.33 Contractor to confirm operation of all local/remote manual releases.
- 22.3.34 Upon completion of testing CO2 system must be re-connected and in working order.
- 22.3.35 Copies of certificates must be forwarded to the Technical Authority and ABS Inspector.

Helicopter Hanger FireCombat Twin Agent and Minute Man II

- 22.3.36 FireCombat Twin Agent skid mounted unit consists of a 100L 3%AFFF Foam Tank and a 500lb Purple K Dry Chemical Tank. Each tank is fitted with a nitrogen driver cylinder. The Minute Man is a fix 3% AFFF foam system.
- 22.3.37 Contractor must ascertain level in nitrogen tanks. Any loss of nitrogen must be dealt with by PSPC 1379 action and the cause of the loss rectified.
- 22.3.38 Contractor shall take 4 samples of the AFFF and send off to lab for analysis to determine that AFFF is within recommended guidelines.
- 22.3.39
- 22.3.40 Contractor shall open Purple K Dry Chemical tank to inspect its content. Contractor shall thoroughly mix its content to ensure there is no caking of the agent occurring.

Fixed Foam Firefighting System – Monitors & Hose Reels

SECURIPLEX Balanced Pressure Proportioning System

Model: 1015-118

(500 liters 3% AFFF concentrate.)

Located: FM200 Room- Port Side Boat Deck

- 22.3.41 Contractor must perform the annual inspection and servicing of the ship's fixed foam fire fighting system, as per manufacturer's recommendations.
- 22.3.42 Any recharging/repairs to be covered by PWGSC 1379 action.
- 22.3.43 The Contractor must ensure lockout/tagout permits are in place and must inform the Technical Authority before work begins.
- 22.3.44 Pressure balancing valve to be carefully disassembled for inspection. Any deposits left by foam concentrate to be cleaned from valve internals. After inspection, valve to be reassembled in good order.
- 22.3.45 Level and contents of foam concentrate tank to be checked. Concentrate sample to be taken from foam tank. Sample to be tested and copies of results given to Chief Officer.
- 22.3.46 Condition of nozzles, valves, gauges, piping, hoses and hose reels, monitors and pumps to be checked.
- 22.3.47 Following testing/inspection the contractor will restore the system to operational readiness.
- 22.3.48 Contractor must provide certificates and service reports of Inspection for the system inspected.

Mircom Fire Detection System

- 22.3.49 Contractor must perform maintenance and inspection of the Mircom Fire Detection system completed by a qualified service provider.
- 22.3.50 Contractor must test each device in the fire detection system for operation and ensure that it sounds and displays on the main panel on the bridge deck and the mimic panels in the control room.
- 22.3.51 Contractor must provide Fire Alarm device maintenance, test and inspection for all detection devices, smoke, fire detectors and manual pull station.
- 22.3.52 Contractor must provide maintenance and inspection records, showing that all devices operated correctly or corrective action that was taken.
- 22.3.53 Any defects must be addressed by 1379 action.

22.4 Proof of Performance

Inspection

- 22.4.1 Contractor must provide proof of performance of the all of the above noted systems as indicated throughout.

Testing

- 22.4.2 N/A

Certification

- 22.4.3 Contractor must provide a certificate for all systems serviced throughout specification.

22.5 Deliverables

Reports

- 22.5.1 Contractor must provide annual inspection certificates for all firefighting systems.
- 22.5.2 Contractor must provide chemical and foam analysis reports from labs to Coast Guard.
- 22.5.3 Contractor must provide service reports indicating all inspections/work carried out.

23.0 DIVING COMPRESSOR MAINTENANCE

23.1 Scope

- 23.1.1 Supply material and labour to perform inspection, annual maintenance and certification of the breathing air compressor, used to fill the breathable air bottles.

23.2 References

Manufacturer: JORDAIR, model K100-3EH
Manufactured: 1996
Pressure: 5000 PSI
SCFM: 5.8
Filling station: MAKO
Outside air suction
Air analysis Standard: CAN/CSA-Z180.1-00

23.3 Technical

- 23.3.1 The Contractor must supply parts, oil and man power to perform the following task.
- 23.3.2 Replace the oil and the oil filter, both compatible with the compressor. The oil will be supplied by the Contractor.
- 23.3.3 Change the air filter cartridges.
- 23.3.4 Check that the purges are working properly.
- 23.3.5 Adjust the system for an available pressure of 2900 psi.
- 23.3.6 Supply two (2) spares filter cartridges and one (1) spare separator element compatible with the compressor. For this work, use the cartridges, oil and filter already aboard the vessel. The new cartridges will be delivered to the vessel and kept as spares.

23.4 Proof of Performance

Trials

- 23.4.1 The Contractor must fill up a breathable air bottle showing the compressor is working correctly.

Testing

- 23.4.2 When the maintenance is complete, the Contractor must supply parts and manpower and perform an air analysis test according to Z180

standard. All cost related to the analyses process, including those for certification must be included in the bid.

23.5 Deliverables

- 23.5.1 The Contractor must send the air analysis report and the certificate to the vessel upon reception.
- 23.5.2 The Contractor must supply, to the CGTA, a detailed maintenance report describing all verification, lubrication, adjustment and calibration works including the parts replaced.

24.0 HELICOPTER HANGAR (OPTIONAL)

24.1 Scope

- 24.1.1 The Contractor shall perform the necessary corrective maintenance to allow full deployment of the helicopter hangar sections. The helicopter hangar is of the telescopic type manufactured in aluminum by DAF Indal ltd. with 3 mobile sections and one fixed section. This work is optional.

24.2 References

Manuals and Drawings

Drawing Number	Description
DWG1	Track Guide
DWG2	Rails

24.3 Technical

- 24.3.1 Background: Currently, the last moving section cannot complete its last 12 inches of deployment travel due to rail misalignment.

- 24.3.2 The Contractor shall retain the services of CME Company to supervise the work and supply parts required for the work. The contact information for the seconded representative (FSR) is :

Dean Mitchell

Canadian Maritime Engineering Ltd

90 Thornhill Dr.

Dartmouth, Nova Scotia

B3B 1S3

Tel: 902-468-1888

Cell: 902-225-4342

E-mail: dmitchell@cmelimited.com

- 24.3.3 All remedial work on the helicopter hangar shall be done in accordance with the recommendations of the manufacturer or its representative, and the Contractor shall include in its bid an allowance of \$30,000 to cover the services of a representative of CME, including subsistence costs (accommodation, meals and transportation). The allowance of \$30,000 must be adjusted upwards or downwards using the 1379 form after receipt of the representative's final invoice,

accompanied by copies of all supporting documentation to verify the actual expenses.

- 24.3.4 Prior to commencing the overhaul of the hangar, the Contractor shall conduct a test run of the garage in the presence of the inspection authority and the FSR.
- 24.3.5 A preliminary check of the straightness of the rail alignment shall be made before work begins in the presence of the inspection authority and the FSR. The alignment must be done by laser, theodolite or piano wire. The data must be recorded in a report and submitted to the inspection authority. Instructions issued by the FSR related to disassembly must be part of the report.
- 24.3.6 The contractor shall disassemble and remove the last complete rail section (Frame -4 to 9).
- 24.3.7 The Contractor shall bid for the replacement of 20 heating cable restraint assemblies for the track de-icer system. For bidding purposes, a heating cable retainer kit includes the retainer bar (1209-19-4), one flat head socket screw, 5/16-18 UNC, 2" lg, stainless, one flat washer, 5/16", stainless and one hex nut, 5/16-18 UNC, stainless.
- 24.3.8 The contractor shall clean the bottom of the well under the dismantled sections. The contractor shall touch up paint to treat any exposed or corroded metal surfaces. Two coats of Interbond 201 paint, red, 6.0 mils DFT. Paint will be supplied by the vessel. For tender purposes, mechanical preparation and application of two coats of paint on a 25 sq. ft. surface is required.
- 24.3.9 The last sections of track must be reinstalled and re-aligned to allow full deployment of the mobile section. The shims under the rails must be replaced by new shims. Phenolic insulator must be installed between steel and rail components to prevent galvanic action between steel and aluminum. On the last section of the rails, the translation rack must be disassembled, cleaned and reassembled in place. On the

lead section, the phenolic strip guide bars must be replaced with new ones. All equipment must be supplied by the contractor.

- 24.3.10 At the end of the work, carry out a deployment test of the mobile sections to demonstrate the correct operation of the system.

24.4 Proof of Performance

Testing

- 24.4.1 Demonstrate the proper operation of the hangar, in open and close modes repeatedly. Check motor current with a portable ammeter and record readings.

24.5 Deliverables

Report

- 24.5.1 The contractor must provide a report from the manufacturer's representative.
- 24.5.2 The contractor must provide a report to the inspection authority of the rail alignment measurements. The measurements must be taken before, during and at the end of the work.

25.0 LIFEBOAT

25.1 Scope

- 25.1.1 The contractor must carry out the annual inspection and certification of the lifeboat and lifeboat davit.

25.2 References

Regulations

- 25.2.1 Canada Shipping Act 2001 - Hull Construction Regulations
25.2.2 Maritime Occupational Health and Safety Regulations

Standards

- 25.2.3 Fleet Safety and Security Manual (DFO/5737)
25.2.4 Coast Guard ISM Confined Space Entry (7.B.3)
25.2.5 Coast Guard ISM Hotwork Procedures (7.B.4)
25.2.6 Coast Guard ISM Fall Protection Procedures (7.B.2)
25.2.7 Canadian Coast Guard Welding Specification
25.2.8 CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
25.2.9 Society for Protective Coatings (SSPC) Standards

Manuals and Drawings

Model	Drawing name
LBT 750C	Technical specifications
LBT 750C	GA
NPD 11300H	Technical specifications
NPD 11300H	GA
NPD 11300H	Hydraulic diagram
NPD 11300H	Electrical diagram
	Lifting lifeboat

Owner Furnished Equipment

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

25.3 Technical Description

- 25.3.1 Provide the equipment and manpower for the annual inspection of the NPD 11300H davit and the LBT 750 C lifeboat.
25.3.2 The Contractor shall retain the services of the authorized representative of Palfinger Canada to supervise the work. When

replacing components, all parts shall be original equipment manufacturer (OEM). The Contractor shall provide an inspection report completed and signed by the Palfinger representative.

- 25.3.3 Perform the annual inspection of the davit in accordance with the manufacturer's recommendations.
- 25.3.4 Carry out the annual inspection of the lifeboat in accordance with the manufacturer's recommendations.
- 25.3.5 Carry out the inspection of the lifeboat release and launch system according to the manufacturer's recommendations.
- 25.3.6 The contractor shall replace the hydraulic oil and filter. The oil must be filtered when refilling. The oil will be supplied by CCG.
- 25.3.7 The lifeboat shall be removed from the ship immediately after the ship arrives at the yard. The shipyard shall provide safe storage space for the lifeboat at these facilities during the work. The lifeboat shall be protected from sandblasting dust and paint. The rowboat shall be returned to its davit only at the end of the work to allow for annual testing. For lifting the boat, the contractor must use two slings corresponding to 1.5 x length of the boat.

25.4 Proof of Performance

Inspection

- 25.4.1 The inspections must be done according to the requirement from ABS and the manufacturer's representative.

Testing

- 25.4.2 Following the inspection, the contractor will be required to conduct a test of the system to demonstrate that the system is functioning properly. The test shall be done according the FSR requirement.

Certification

- 25.4.3 The Contractor shall provide an annual inspection certificate to the vessel in accordance with the requirements of ABS.

25.5 Deliverables

- 25.5.1 The Contractor shall submit an official Palfinger inspection and test report.

26.0 MIRANDA AND BARGE DAVIT

26.1 Scope

- 26.1.1 The Contractor shall perform a five-yearly overhaul of the barge davit (P.H.A. hydraulic davit) and Miranda MRT 3900 davit.

26.2 References

Regulations

- 26.2.1 Canada Shipping Act 2001 - Hull Construction Regulations
26.2.2 Maritime Occupational Health and Safety Regulations

Standards

- 26.2.3 Fleet Safety and Security Manual (DFO/5737)
26.2.4 Coast Guard ISM Confined Space Entry (7.B.3)
26.2.5 Coast Guard ISM Hotwork Procedures (7.B.4)
26.2.6 Coast Guard ISM Fall Protection Procedures (7.B.2)
26.2.7 Canadian Coast Guard Welding Specification
26.2.8 CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
26.2.9 Society for Protective Coatings (SSPC) Standards

Manuals and Drawings

Drawing Number	Description
405596	
405539A	
405564	
408043	
	Schematic bossoir péniche A

Owner Furnished Equipment

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

26.3 Technical Description

- 26.3.1 Provide equipment and labour for the five-year inspection of the barge davit (P.H.A hydraulic davit) and Miranda MRT 3900 davit.
26.3.2 The Contractor shall retain the services of the authorized Palfinger (Schat-Harding) representative to supervise the work. When replacing components, all parts shall be original equipment manufacturers

- (OEM). The Contractor shall submit an inspection report completed and signed by the Palfinger representative.
- 26.3.3 Perform cable disassembly and inspection;
 - 26.3.4 Referring to the plans provided by the CCG, identify and dismantle of all the blocks, sheaves, axes identified and to clean each parts for inspection;
 - 26.3.5 Each block and sheave should be cleaned by sandblasting, and conduct a visual inspection and NDT testing. The paths must be cleaned of grease on the bearings, sheaves, pulleys, etc.;
 - 26.3.6 All the axes, pivots, bearings should be measured and recorded in two books provided by the contractor, provide a copy to chief officer of the ship and a copy to the Inspector of ABS. The parts to be replaced will be identified in the books and dimensions of the parts replaced must also be noted. All axes must be checked by an NDT test;
 - 26.3.7 All defective and found worn parts will be replaced by equivalent parts supplied by the contractor. The extra costs will be negotiated on Form 1379 by an appropriate description;
 - 26.3.8 The Contractor will be responsible for contacting the inspector of ABS, the project officer of the ship and the chief officer for the inspection of all parts prior to painting and reassembly;
 - 26.3.9 After inspection and acceptance by a ABS inspector, it is necessary to repaint the blocks, sheaves and the davit's steel structures that have been damaged. The paint will be provided by the ship;
 - 26.3.9.1 Primer: INTERGARD 264 RAL 9003 (white), thickness: 159 microns (.0062 inches) wet 127 microns (.005 inches) dry (as recommended by the manufacturer);
 - 26.3.9.2 Finish: INTERTHANE 990 RAL 9003 (white), thickness 88 microns (.004 inches) wet, 50 microns (.002 inches) dry;
 - 26.3.10 All davits then be refitted properly lubricated with grease supplied by the ship. Pulleys and shafts should be greased before assembly. Bolts used on shafts lock's should be coated with anti-seize compound during installation. The wires must be re-installed on their davit's, after a visual inspection;
 - 26.3.11 Perform verification of disc brake and centrifugal brake on each of davits. Clean the inside and bands. Reinstall mechanisms and adjust;
 - 26.3.12 Change the oil in the gearboxes. Make a inspection of the gearbox components. Oil will be supplied by CCG.
 - 26.3.13 Check the limit switches for correct operation.
 - 26.3.14 The contractor will provide the services of a crane;
 - 26.3.15 The FRC boat on Miranda davit will not be on the vessel during the maintenance period. This boat will be disembarked and taken on

board for maintenance at the CCG base. Testing will therefore have to be done outside the contract period when the vessel returns to base.

- 26.3.16 The workboat shall be disembarked from the vessel immediately after the vessel arrives at the yard. The shipyard shall provide secure storage space for the work barge in these facilities during the work. The workboat shall be protected from sandblasting dust and paint. The workboat shall be returned to its davit only after completion of the work to allow for testing.

26.4 Proof of Performance

Inspection

- 26.4.1 The inspections must be done according to the requirement from ABS and the manufacturer's representative.

Testing

- 26.4.2 After reinstalling all parts of the davits, the contractor will perform a load test to 110% of SWL (weight of the boat in operational state over the distributed weight equal to the number of people that the boat is fit including pulleys and derrick stay plus a 10% safety factor) for each of davits. The necessary weight (certified weight) for test shall be provided by the contractor. All tests must be carried out in the presence ABS, CCG.
- 26.4.3 The contractor will return the weight used for various tests and reinstall the boats at their respective location;

Test weight data:

- 26.4.4 Miranda Davit SWL 3900 kg x 1.1 = 4290 kg
- 26.4.5 Barge Davit SWL 12000 kg x 1.1 = 13200 kg total, 6600 kg per arm

Certification

- 26.4.6 The Contractor shall provide five-year inspection certificates to the vessel in accordance with the requirements of ABS. The certificate for the barge and Miranda davit shall be T2 certificate in accordance with CSA.

26.5 Deliverables

- 26.5.1 The Contractor shall submit an official Palfinger report.

27.0 CERTIFICATION OF FUEL TRANSFER HOSES

27.1 Scope:

- 27.1.1 Perform hydrostatic checks and tests, as per RMA publication IP-11-4, on eight (8) fuel transfer hoses (diesel, gasoline and Jet A1).

27.2 Technical description:

- 27.2.1 List of hoses:
 - 27.2.1.1 Two (2) CONTINENTAL extreme flexpetroleum diesel fuel transfer hoses, 3 in. dia. and 50 feet long. (Test at 300 psi).
 - 27.2.1.2 One (1) Jet A-1 fuel transfer hose, 1½ in. dia. and 85 feet long (leave no trace of water in this hose): # 1217-3 (Q-054) (test at 300 psi).
 - 27.2.1.3 One (1) Jet A-1 fuel transfer hose, 1½ in. dia. and 85 feet long (leave no water residue): # 1217-3 (Q-054) (test at 300 psi).
 - 27.2.1.4 One (1) ¾ in. by 50 feet long fuel transfer hose. # 2751 (Q-053) (test at 225 psi).
 - 27.2.1.5 One (1) 1 1/2" diesel hose by 60 feet long. # 87025 (Q-052) (test at 225 psi).
 - 27.2.1.6 Two (2) Petroleum Goodyear hoses, ¾" x 50 feet long. (Q-051 and Q-050) (test at 225 psi).
- 27.2.2 The contractor must provide the material, tools and labour to perform a hydrostatic test on the eight (8) hoses listed above in RMA publication IP-11-4.
- 27.2.3 The contractor must provide a price, at the time of bidding, for the disposal of water used for testing and according to the environmental standards for the disposal of 40 liters of oily water.
- 27.2.4 The hoses will be given empty to the contractor and will have to come back empty.

27.3 Report

- 27.3.1 Provide a certificate attesting to the successful completion of the test for each hose.
- 27.3.2 The certificate will be valid for a period of 1 year from the date of issue.

28.0 AIR CONDITIONING AND REFRIGERATION SYSTEM

28.1 Scope

- 28.1.1 Perform the annual inspection and maintenance on air conditioning and refrigeration systems.

28.2 Reference

Drawings and manuals

- 28.2.1 4316-3 CCGS MARTHA BLACK AIR CONDITIONING PLANT TECHNICAL MANUAL
- 28.2.2 Bronswerk HVAC Unit General Arrangement, DWG No. 4316-030-001-1, Rev A.
- 28.2.3 Bronswerk HVAC Unit General Arrangement, DWG No. 4316-030-001-2, Rev A.
- 28.2.4 Refrigeration flow diagram

Regulation

- 28.2.5 Canada Shipping act and regulations
- 28.2.6 Federal Halocarbon regulations, 2003
- 28.2.7 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems, Environment Canada

28.3 Statement of work

Domestic Refrigeration

- 28.3.1 Systems Data:
- 28.3.1.1 Two (2) Carrier compressors Model 5F30-C654,
- 28.3.1.2 These systems operate with R-134.
- 28.3.2 The Contractor must provide parts and labor to perform the following tasks.
- 28.3.2.1 Inspect the mechanical joints and replace if necessary. Provide a quote for this item (parts and labor) ;
- 28.3.2.2 Renew the lubricating oil and the dryers;
- 28.3.2.3 Open, clean and inspect compressor crankcase;
- 28.3.2.4 Check and adjust the unloader ;
- 28.3.2.5 Adjust the start and stop signals, cutout and thermostatic valve;
- 28.3.2.6 Perform complete inspection of systems.
- 28.3.2.7 Perform refrigerant leak test. All piping must be checked for leaks, including piping in ceiling, on main deck. S'assurer de leur étanchéité. Check system for gas tightness. Contractor must preserve ceiling tiles from damage, during removal, storage and reinstallation.
- 28.3.2.8 Clean and inspect evaporator units and defrosting systems, four (4) rooms and one lobby.
- 28.3.2.9 Check evaporator drains, heating cables and drains. Ensure drains are free. Repair insulation upon completion.
- 28.3.2.10 Include a price for 10 kg of refrigerant gas R-134.
- 28.3.2.11 Contractor must check all operating parameters.
- 28.3.2.12 The on-line compressor will be serviced first and brought back on-line while the second one will be maintained. At the end of the maintenance of the second compressor, it will be brought on-line and the first one stopped. This way, the back up compressor, at the beginning of the process, will be on-line at the end.

Air Conditionning Systems S1, S2 and S3

- 28.3.3 System data:
- 28.3.4 Two (2) Carrier compressors Units S1et S2, Bitzer semi hermetic compressor model 4GE-30Y-50S,
- 28.3.5 compressor S3 model (wheelhouse) 06DM 3160FA0120.
- 28.3.6 These systems operate on R-407C.

- 28.3.7 The Contractor must provide parts and labor to perform the following tasks.
- 28.3.7.1 Perform complete inspection of HCAC systems.
 - 28.3.7.2 Perform compressor maintenance according to manufacturer instructions. Perform oil change on the compressors.
 - 28.3.7.3 Perform dryers maintenance according to manufacturer instructions..
 - 28.3.7.4 Perform refrigerant leak test.
 - 28.3.7.5 Include a price for 10 kg of refrigerant gas R-407C.
 - 28.3.7.6 Check all operating parameters.
 - 28.3.7.7 Perform system start-up.
 - 28.3.7.8 Make necessary adjustments.

28.4 Proof of performance

Testing

- 28.4.1 The Chief Engineer or his delegate must be present to witness trials.

Certification

- 28.4.2 Provide original, individual certificates for each system, identifying the firm performing the inspection, certificate number, name and signature of technician Contractor must also provide the certificate originals to the Chief Engineer and also electronic format (.pdf), to the Chief Engineer and to the Vessel Maintenance Manager.

Deliverable

- 28.4.3 Contractor must provide a written report describing in detail all work performed the causes of noted deficiencies, corrective actions taken and parts replaced (.
- 28.4.4 The technicians must be HRAI certified and provide us with his membership number in order to update our files.
- 28.4.5 The Contractor must provide the Chief Engineer and the Vessel maintenance manager with an electronic report (.pdf).

29.0 HIAB CRANES

29.1 Scope:

- 29.1.1 Perform a five-year inspection and certification on 2 Hiab cranes, 201-4 model.

29.2 Statement of work:

- 29.2.1 Perform a five-year inspection and certification on the two Hiab cranes, model 201-4.
- 29.2.2 The work must be in compliance with Regulation on Cargo, Fumigation and Tackle Part 3 Articles 303-312 and Annex 4.
- 29.2.3 The contractor shall perform the analysis of hydraulic oil on both units, make operational and performance tests witness by the ABS inspector and the inspection authority. Oil and oil filters will have to be replaced by the contractor. Filters will be supplied by CCG.
- 29.2.4 The contractor shall provide the certified weights and staff for performance testing.
- 29.2.5 A technician specialized in hydraulic power transmission will have to evaluate and repair an operating problem with the Polar 5300 wireless control system. For this work, the job site must bid for 16 hours of work by the hydraulic technician.

29.3 Proof of Performance

Inspection

- 29.3.1 The level of inspections shall be established by the ABS inspector.

Certification

- 29.3.2 The contractor must submit to the chief officer the original copy of the T2 test certificates and an electronic copy in PDF format. The contractor will also send an electronic copy of the maintenance record, dimensions and work to the maintenance manager of the ship.

Report

- 29.3.3 The Contractor shall provide a complete report detailing the work performed, the cause of the failures (if any), the modifications required and the parts replaced.
- 29.3.4 The Contractor shall provide the Chief Officer and the person in charge of maintenance with an electronic copy in PDF format of both reports.

30.0 ASSESSMENT OF THE CONDITION OF THE SHIP'S STRUCTURE

30.1 Scope:

- 30.1.1 The purpose of this item is to conduct a structural inspection of the hull via thickness measurement following the requirements of the classification society ABS in accordance with Special Survey #4 for general dry cargo vessels 15 years of age or older.

30.2 Reference

Drawings and documents

- 30.2.1 H-0002
- 30.2.2 H-2_1
- 30.2.3 H-2_2
- 30.2.4 H-2_3
- 30.2.5 H-3_1
- 30.2.6 H-3_2
- 30.2.7 H-3_3
- 30.2.8 H-0005
- 30.2.9 H-0006

Regulation and standards

- 30.2.10 ABS Rules for survey after construction, part 7-3-2

30.3 Statement of work:

- 30.3.1 The Contractor must retain the services of a certified technician to take the ultrasonic measurements. The technician and the measuring devices used must have valid certification from ABS or another classification society recognized under Transport Canada's Delegated Statutory Inspection Program.
- 30.3.2 The Contractor must indicate a fixed price for all work set out in the specifications. The Contractor must indicate an hourly rate for taking additional measurements including report writing. For bidding purposes, the Contractor must indicate a price for an additional 40 hours of work.
- 30.3.3 The Contractor must take thickness measurements in accordance with the provisions of the ABS rules. The requirements governing thickness measurement are defined in Part 7: Rules for survey after construction under section 7-3-2, Hull surveys / Vessels for unrestricted service. Thickness measurements must be taken in

compliance with special survey #4 for general dry cargo vessels 15 years of age or over.

- 30.3.4 The Contractor must take representative readings of the condition of all ice belt strakes.
- 30.3.5 The Contractor must also take thickness measurements at four points on each hull penetration for overboard discharge.
- 30.3.6 The Contractor must supply all equipment and labour required to assist the inspector, non-destructive testing technician and IA in gaining access to the exterior and interior portions of the vessel's hull and structure that need to be surveyed, including clearing away interference items. Gas freeing and certification of tanks as safe to enter must be included where necessary.
- 30.3.7 The Contractor must provide an approved work platform or man lifts so that the classification society can thoroughly inspect the hull and internal structure, and so that it is possible to conduct an ultrasonic thickness inspection. The Contractor must quote a price for use of an approved mechanical lift, including operator, for a 30-hour period and must specify the unit cost per hour for use of the lift and operator services using Form 1379 if necessary.
- 30.3.8 The Contractor must do paint touch-ups at all locations where the steel has been exposed for thickness measurement. Paint touch-ups must be compatible with the existing system and comply with paint manufacturer requirements. Paint for touch-ups will be provided by the CCG.

30.4 Proof of Performance

Inspection

- 30.4.1 Prior to commencing work, the Contractor must supply a drawing indicating thickness measurement locations to the ABS inspector and the IA for approval.

Tests and trials

- 30.4.2 The Contractor must provide the IA with proof of calibration of its ultrasonic measuring device.

Report

- 30.4.3 The Contractor must supply the IA and TA with a typed copy of a structural thickness report. For each thickness measurement, the report must indicate the following at minimum: thickness measurement location, current steel thickness, percentage steel loss and original

steel thickness. Each ultrasonic shot must be identified on a structural drawing of the vessel.

31.0 FIVE-YEAR INSPECTION OF CIRCUIT BREAKERS AND MULTI-FUNCTION RELAYS (MFRS).

31.1 Scope:

- 31.1.1 The purpose of this item is to carry out the five-year inspection of circuit breakers and protection relays.

31.2 Reference documents:

Drawings and documents

- 31.2.1 Breakers and protective relays list
- 31.2.2 Breakers and relay reports (for reference only)

Regulation and standards

- 31.2.3 TP 127

31.3 Statement of work:

- 31.3.1 The Contractor shall provide the equipment and labour to perform maintenance, trials, calibration and calibration of the protective relays and breakers as part of the five-year inspection required by Transport Canada regulations.
- 31.3.2 Maintenance tasks must be in accordance with the manufacturer's recommendations.
- 31.3.3 Protective relays list:
 - 31.3.3.1 Shore power (52-S)
 - 31.3.3.2 Auxilliary generator (52-AG)
 - 31.3.3.3 Emergency tie (52-ET)
 - 31.3.3.4 Main tie (52-T)
 - 31.3.3.5 Staboardside propulsion
 - 31.3.3.6 Portside propulsion
 - 31.3.3.7 Starboardside main generator (52-G1)
 - 31.3.3.8 Center main generator (52-G2)
 - 31.3.3.9 Portside main generator (52-G3)

- 31.3.4 Breakers list :
- 31.3.5 Starboardside propulsion 52-P1
- 31.3.6 Portside propulsion 52-P2
- 31.3.7 Portside main generator 52-G3
- 31.3.8 Starboardside main generator 52-G2
- 31.3.9 Center main generator 52-G1
- 31.3.10 The Contractor shall be responsible for the disconnection, disassembly, transportation, reassembly and return to service of circuit breakers and protective relays.

31.4 Proof of Performance:

Inspection

- 31.4.1 Prior to the commencement of the work, the Contractor shall validate whether the ABS inspector has any special requirements regarding this review.
- 31.4.2 Testing and inspection shall be in accordance with the requirements of TP127.

Certification

- 31.4.3 The Contractor shall provide a certificate certifying that the five-year overhaul of circuit breakers and relays has been completed in accordance with ABS requirements.

Report

- 31.4.4 The Contractor shall provide the IA and the TA with a typed copy of a maintenance report. The report must contain the following information :
 - 31.4.4.1 The date and time when the circuit breaker refurbishment/complete check was certified by ABS.
 - 31.4.4.2 The name of the person who carried out the certification;
 - 31.4.4.3 The serial number or identification number of the circuit breaker;
 - 31.4.4.4 The date and time of commencement and completion of the work and the number of hours for each working day.
 - 31.4.4.5 A description of the work performed and the anomalies detected.
 - 31.4.4.6 The list of parts replaced.
 - 31.4.4.7 Photographs of anomalies.

32.0 GALLEY HOOD CLEANING

32.1 Scope:

- 32.1.1 Perform annual cleaning of the hood and duct ventilation range hood.

32.2 Statement of work:

- 32.2.1 Clean and degrease the conduit of the kitchen extraction hood exhaust fan located to the upper deck starboard side.
- 32.2.2 The Contractor must open and close the access panels after cleaning.
- 32.2.3 The hood and its components must also be cleaned.
- 32.2.4 The Contractor must deliver kitchen and cleaning product locker in the same state of cleanliness as they were before the works.

33.0 CATERPILLAR C32 ENGINE MAINTENANCE

33.1 Scope:

- 33.1.1 The purpose of this item is to carry out the annual maintenance of the C32 Caterpillar engine.

33.2 Reference documents:

Drawings and documents

- 33.2.1 Maintenance interval schedule

33.3 Statement of work:

- 33.3.1 The Contractor shall provide the services of a certified technician to service marine Caterpillar engines. The technician shall perform maintenance for 5000 hrs (including 250, 500 and 1000 hrs). The contractor must provide the necessary equipment for the maintenance.
- 33.3.2 The technician shall issue an operating report from the engine computer. The technician will have to bring the necessary equipment to connect to the computer. This report should provide the engine load rate and fuel consumption.
- 33.3.3 The Contractor shall bid for 16 hours on a regular basis to investigate and correct a foaming problem in the cooling water. We suspect a leak in the aftercooler.

33.4 Proof of Performance:

Report

- 33.4.1 The Contractor shall provide the IA and the TA with a typed copy of a maintenance report.

34.0 DUMBWAITER

34.1 Scope:

- 34.1.1 The purpose of this item is to perform annual maintenance and inspection of the dumbwaiter in order to recertify this equipment.

34.2 Statement of work:

- 34.2.1 Monte-plats: Maker : D.A. Mathot, Model : 100, SN :17572
- 34.2.2 The Contractor shall provide parts and specialized labour to perform the annual inspection and maintenance of the vessel dumbwaiter as specified in Section 12 of CAN/CSA-B44-M90.
- 34.2.3 Following completion of the Work, the Contractor shall update the maintenance log for each piece of equipment.
- 34.2.4 The Contractor shall provide the Chief Engineer with the original copy of the inspection certificates upon completion of the Work. The Contractor shall also send an electronic copy of all reports and certificates to the person in charge of vessel maintenance.

35.0 REPLACEMENT OF WINDOW GLASS IN WHEELHOUSE (OPTIONAL)

35.1 Scope:

- 35.1.1 The purpose of this item is to replace a window pane (glass) in the wheelhouse. This work is optional.

35.2 Reference documents:

Drawings and documents

- 35.2.1 H-2860 with notes

35.3 Statement of work:

- 35.3.1 The Contractor shall supply the material and labour for the replacement of 4 window glass. The windows are identified in drawing H-2860 with notes (W003, W001, W005, W002)..
- 35.3.2 Windows W001, W003, W005 are heated windows. The installation includes a power supply and two sensors for heating.
- 35.3.3 Replacement glass will be provided by CCG.
- 35.3.4 The paint on the window frames contains asbestos and lead. This paint shall be removed in accordance with regulatory requirements for asbestos and lead removal. After the installation of the windows, the interior contour of the windows shall be retouched with a white insulating anti-condensation paint "Mascoat Marine-DTM Thermal Barrier Coating" or equivalent. The preparation of the steel and the application of the paint must be done according to the manufacturer's requirements.

36.0 DERRICK (OPTIONAL)

36.1 Scope:

- 36.1.1 The Contractor shall clean and degas fuel tanks #5 and #6 to permit work to allow for modification of the derrick. The goal of the modification is to raise the capacity of the 5T lifting point to 8T.

36.2 Reference documents:

Drawings and documents

- 36.2.1 H-0013
- 36.2.2 555-H-0022
- 36.2.3 108-H-0026

36.3 Statement of work:

- 36.3.1 The Contractor shall open all manhole covers, clean and ventilate tanks. Clean and dispose of all debris. Remove 2 cubic metres of residual fuel from the tanks. The contractor must obtain a certificate from a chemist to allow the work to begin.
- 36.3.2 Close manhole covers using new gaskets, bolts, washers and nuts supplied by the contractor. Gaskets shall be compatible with diesel fuel.
- 36.3.3 Tanks shall be hydrostatically tested for leaks in the presence of the ABS inspector and AI.
- 36.3.4 A study is currently underway to modify the lifting point from 5T to 8T. The 5T winch will have to be modified to increase its capacity to 5T. The cables, pulleys and other accessories will have to be modified to increase the capacity to 8T. This work will be processed on a 1379 form if the results of the study demonstrate the feasibility of the modification..

37.0 REPLACEMENT OF 2 CIRCUIT BREAKERS (OPTIONAL)

37.1 Scope:

- 37.1.1 This task involves replacing two 300-amp circuit breakers located on the vessel's main switchboard panel in the transformer room.
- 37.1.2 This work must be carried out in conjunction with the five-yearly overhaul of the main circuit breakers and associated multi-function relays.
- 37.1.3 This work is optional

37.2 Reference documents:

Regulations

- a) Canada Shipping Act, 2001
- b) Maritime Occupational Health and Safety Regulations (SOR/2010-120)

Standards

- a) DFO5737 - Fleet Safety Manual
- b) TP127E – Ships Electrical Standards (2018)
- c) IEEE 45 – Recommended Practice for Electrical Installations on Shipboard (2002)

Drawings

Drawing number	Drawing name
30300-0D01-01	Main Switchboard – Front View
30300-0D01-02	Main Switchboard – One line diagram
30300-0D01-03	Main Switchboard – Bill of Material
SC1812-W01	Main Bus – Schematic STBD Excitation Breaker
SC1812-W03	Main Bus – Schematic PORT Excitation Breaker
SC1812-W23	52-E1 Breaker – Control Schematic
SC1812-W24	52-E2 Breaker – Control Schematic
SC1812-W27	52-E1 Breaker – Wiring Diagram
SC1812-W34	52-E2 Breaker – Wiring Diagram

Circuit Breakers identification

Breaker #	Description
52-E1	Propulsion Starboard - Excitation & Control Breaker
52-E2	Propulsion Port - Excitation & Control Breaker

Owner-provided equipment

Part Number	Description	Quantity
<u>T5V300TWA3KM4U4</u>	ABB Breaker 300 Amp 125 AC-DC motor operator Thermal Trip Adjustment : 210-300A	2

	Magnetic Trip Adjustment : 1500-3000A Auxiliary Contacts: 3 Form C + 1 Bell Alarm	
<u>KT5R-3</u>	Rear Terminals for Bus bar	4
<u>KT6ADP-5</u>	Base Connector for UVR under voltage release	2
<u>KT6ADP-12</u>	Base Connector aux. contacts 3C+1BA (3 form C + bell alarm)	2

37.3 Statement of work:

- 37.3.1 All work of an electrical nature must be carried out by qualified and experienced personnel. Before removing existing circuit breakers, all electrical wires must be clearly identified to facilitate the installation of new equipment. Existing circuit breakers must also be tested to confirm that everything is functional before work begins.
- 37.3.2 The various power sources in connection with the work to be carried out must be padlocked. This operation must be carried out in conjunction with the Electrician Officer stationed on the vessel and in compliance with the safety standards established by the CCG (Fleet Safety Manual, sections 7.B.5 & 7.B.6). The lockout equipment is the responsibility of the contractor and it is the contractor's responsibility to keep the keys in a safe place.
- 37.3.3 The preceding table lists the equipment and accessories that will be provided by the shipowner (CCG). All other equipment and accessories that may be required during installation are the responsibility of the contractor.
- 37.3.4 The new circuit breakers provided by CCG are not of the same type and size as the older models. It is the contractor's responsibility to mechanically and electrically adapt the new circuit breakers to fit into the existing cabinets. This includes the cabinet doors that will need to be adapted for safe access and a professional-looking exterior finish. If necessary as a result of the modifications, the contractor will have to completely repaint the doors to hide the exposed metal parts.
- 37.3.5 The 2 existing circuit breakers must be removed by the contractor. They shall be kept in good condition on board the vessel until the new circuit breakers are installed and deemed fully functional by the Inspection Authority (IA) and the classification society representative.
- 37.3.6 The electrical circuit of each of the circuit breakers includes a control part which includes several external components. The contractor is

responsible for making all connections so that the new circuit breakers can operate identically to the old circuit breakers.

- 37.3.7 Connections of the power cables must be tightened using a torque wrench in order to comply with the ratings required by the circuit-breaker manufacturer.
- 37.3.8 As with the old circuit breakers, the control circuits of the new circuit breakers must pass through removable connectors to allow for easier replacement of the devices. The old electrical connectors cannot be retained.
- 37.3.9 The trip thresholds of the new circuit breakers must be adjusted by the contractor using the same values present on the old circuit breakers.

37.4 Proof of Performance:

Inspections

- 37.4.1 The contractor must ensure that the final installation is inspected and approved by the Inspection Authority (IA) and the classification society representative (ABS).

Commissioning

- 37.4.2 New Circuit breakers must be tested in all modes of operation to confirm that everything is functional, including :
 - a) Closing and opening test, locally and remotely from the control room ;
 - b) Tripping test via the undervoltage function ;
 - c) Tripping test via the grounding detection system ;
 - d) Verification of AMS alarm operation during tripping tests ;
 - e) Check that all indicator lights are working properly ;
 - f) Electrical reset of circuit breakers following a fault/Trip. Note: Following a circuit breaker fault/trip, it must be possible to re-close it by pressing "open" and then "close".

38.0 ANCHORS AND CHAINS

38.1 Scope:

- 38.1.1 The Contractor shall inspect and certify the vessel's anchors and chains due to the five years inspection.

38.2 Statement of work:

- 38.2.1 Anchors and their chains shall be lowered to the bottom of the dry dock for inspection by ABS. Brush the chain meshes or clean with a sandblast. Open all shackles and detachable chain links for inspection, heat them to facilitate dismantling, then close them in good order and seal them by pouring molten zinc. Measure the wear of the mesh and record on the report. Measure one link per length of chain.
- 38.2.2 Two (2) lengths of chain must be disconnected from the well "stirrups" and reconnected at the other end of the chains to the anchors to distribute the wear.
- 38.2.3 Supply and apply two coats of epoxy anti-rust paint on the chains.
- 38.2.4 Paint in white the first links corresponding to the number of links from the anchor on each side of the detachable link and wrap the forestay with stainless steel wire
- 38.2.5 e on the last forestay link painted in white by a number of turns corresponding to the number of links on each side of the detachable link. Paint the detachable mesh red.
- 38.2.6 Remove the hinged leg anchors. Check the condition of the anchor pins and record the measurements in the report. Clean the anchors with a light sandblast and apply two (2) coats of semi-gloss "ALKIDE" black paint.
- 38.2.7 Reassemble the chains and their anchors in good order on the vessel.
- 38.2.8 Make the necessary paint touch-ups once the anchors and chains are back in their initial position (anchor, hull, hawser basket).

38.3 Proof of Performance:

Inspections

- 38.3.1 Inspection requirements shall be validated and established by the ABS inspector.

Report

- 38.3.2 The contractor shall provide a report indicating the measurements of the components

39.0 RADIO INSPECTION

39.1 Scope:

- 39.1.1 The Contractor shall carry out an annual inspection of the navigational and telecommunication equipment.

39.2 Reference documents

- 39.2.1 Radio equipment list
- 39.2.2 Radio inspection report (for reference only)

39.3 Statement of work:

- 39.3.1 The Contractor shall perform annual radio inspections in accordance with Transport Canada requirements for the Great Lakes Basin and the Coasts of Canada valid in the VHF, MF and MF-HF coverage areas.

39.4 Proof of Performance:

Inspections

- 39.4.1 Inspection requirements shall be validated and established by the ABS inspector.

Report

- 39.4.2 The Contractor shall provide an inspection report that will enable the ABS inspector to issue the Radio Certificate.

40.0 BOW THRUSTER

40.1 Scope:

- 40.1.1 The Contractor shall carry out an inspection of the bow thruster

40.2 Reference documents

- 40.2.1 DAAW008946-SH001-A
- 40.2.2 PAAF589818_TT-FT Martha L. Black

40.3 Statement of work:

- 40.3.1 The Contractor shall remove the tunnel grates to allow access to the pod and to allow for paint touch-ups.
- 40.3.2 The Contractor shall take the backlash at the gearbox.
- 40.3.3 The Contractor shall visually inspect the propellers, pod, anodes, fasteners and welds. Any leaks or anomalies shall be reported and recorded in the report.

40.4 Proof of Performance:

Inspections

- 40.4.1 Inspection requirements shall be validated and established by the ABS inspector.

Report

- 40.4.2 The Contractor shall provide an inspection report that will enable the ABS inspector to issue the Radio Certificate.

41.0 GENERAL ELECTRICAL WORK (OPTIONAL)

41.1 Scope:

- 41.1.1 The Contractor shall provide the services of electricians to perform maintenance on the electrical components of the vessel. This work is optional.

41.2 Reference documents

- 41.2.1 TP 127

41.3 Statement of work:

- 41.3.1 The Contractor shall bid to provide the services of marine electricians for a 200-hour work period on a regular rate.
- 41.3.2 The electricians shall have a minimum of three years experience in the maintenance or installation of electrical components on ships.

- 41.3.3 The electricians shall comply with the requirements of TP 127 for all electrical work.

41.4 Proof of Performance:

Report

- 41.4.1 The Contractor shall provide the IA and the TA with a typed copy of a work report. The report must contain the following information :
 - 41.4.2 The name of the technician;
 - 41.4.3 The date, start time and end time of the work for each day of work;
 - 41.4.4 A description of the work performed.

42.0 GENERAL MECHANICAL WORK (OPTIONAL)

42.1 Scope:

- 42.1.1 The Contractor shall provide the service of mechanics (millwright) to perform maintenance on the mechanical components of the vessel. This work is optional.

42.2 Statement of work:

- 42.2.1 The Contractor shall bid to provide the service of mechanics for a 200-hour work period on a regular rate.
- 42.2.2 The mechanics shall have a minimum of three years experience in the maintenance or installation of mechanical components on ships.

42.3 Proof of Performance:

Report

- 42.3.1 The Contractor shall provide the IA and the TA with a typed copy of a work report. The report must contain the following information :
 - 42.3.2 The name of the technician;
 - 42.3.3 The date, start time and end time of the work for each day of work.
 - 42.3.4 A description of the work performed

43.0 WORK PERFORMED BY CCG STAFF

43.1 Scope:

- 43.1.1 The Contractor shall take into consideration that CCG personnel will be working on the ship's systems during the dry-docking period. The complete list of work is listed in the reference document provided in

the appendix in the document List of Work Performed by CCG Personnel.

43.2 Reference documents

43.2.1 List of work performed by CCG Personnel

43.3 CCG material transportation

43.3.1 The contractor shall arrange for the carriage of 4 life-rafts for inspection. This work will be processed on a form 1379.

ANNEX A

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.

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.

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 Ω 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

Millivolts

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

PSPC

Public Services and Procurement 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

ANNEX B

PAINT LOCATION AND CROSS REFERENCE

Location	International	Amercoat
Underwater Hull	Intershield 163/Inerta 160 Black	Sigmashield 1200 ou Système Amercoat 238 / Amercoat 339
Icebelt	Intershield 163/Inerta 160 CG Red	Sigmashield 1200 ou Système Amercoat 238 / Amercoat 339
Topsides	Intergard 264 Red Oxide and Interthane 990 CG Red	Amercoat 235 and Amercoat 450H
Lettering/Draftmarks/T rim (draft below 7.00m)	Interseal 670HS White	Amercoat 235
Lettering/Draftmarks/T rim (name, registry, draft)	Interthane 990 White	Amercoat 450H
Lettering/Draftmarks/T rim (vessel flash)	Interthane 990 White	Amercoat 450H
Sea Chests/Bays	Intergard 264	Amercoat 235 (international dis ça serait plus le 240)
Exterior Fittings (anchor chains)	Interlac 665 Black	Amercoat 5450
Internal Spaces (chain lockers)	Intergard 264	Amercoat 235 (international dis ça serait plus le 240)
Fresh Water Tanks	Interline 850 (entire tank) Interline 925 (touch-up and repair)	Amercoat 133
Void Spaces & cofferdams	Interseal 670HS	Amercoat 240
Ballast Tanks	Interbond 600 Clear, Interseal 670HS White	Amerlock Sealer, Amercoat 240
Double Bottom Tanks #4 Port & Stbd	Interbond 600 Clear, Interseal 670HS White	Amerlock Sealer, Amercoat 240
Internal Spaces (engine room bilges, tank tops)	Intergard 264	Amercoat 235 (international dis ça serait plus le 240)
Exterior Fittings (transducer & trunking)	Intershield 300 Bronze, Intershield 300 Aluminum, Interspeed 640 Red Oxide	Amercoat 235 (Off-White) , Amercoat 235 (Light Gray), ABC #4