

Annexe A

CCGS Des Groseilliers DRYDOCK 2018

Contract #: F3017-17N172

Date: 2018/01/15



Fisheries & Oceans Canada/Canadian Coast Guard
Integrated Technical Services/Marine Engineering

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1.0 GENERAL NOTES

1.1 Introduction

- 1.1.1 These project requirements are provided to the Contractor to define the objectives, performance, engineering standards and requirements for the Vessel Life Extension (VLE) refit of the CCGS Des Groseilliers for the Canadian Coast Guard, Department of Fisheries and Oceans Canada. This refit includes the fairing, maintenance of the propulsion and steering components and the installation of a new sonar.
- 1.1.2 It is the Contractor's responsibility to ensure that:
 - a) The execution of the work specified herein meets the requirements described and those of Regulatory Bodies.
 - b) All items and equipment supplied are deemed necessary to ensure the seaworthiness and safe operation of the vessel, as required for a vessel of this class.
- 1.1.3 Sections 10 through 29 of this Specification package define the individual work items for which the Contractor must address as part of the VLE project for the CCGS Pierre Radisson.
- 1.1.4 The performance requirements presented in Sections 1 through 9 of these project specifications must apply to Sections 10 to 29 in all respects. It is possible that the Specifications, in Sections 10 to 29, do not directly refer to Sections 1 to 9; however, they must still apply.
- 1.1.5 Abbreviations used in the Specification are provided in Appendix A.
- 1.1.6 A complete list of drawings for the CCGS Des Groseilliers is provided in Appendix B.
- 1.1.7 The crew will not be on board the ship during the work period, except for the first week after the ship arrives at the Contractor's facilities, and approximately 1 month before the end of the work. The ship must be habitable during these periods, and include accommodations, galley services, sewage systems, potable water, and the ship's alarm and monitoring system. During these periods, unless otherwise specified, there will be 22 crew members.

1.2 General Particulars of Ship

Name:	CCGS Des Groseilliers
Type:	Type 1200 Medium Icebreaker

Ice class:	Lloyd's Register 100A1 Ice Class 1A Super LMC Arctic Shipping Pollution Prevention Regulations
Arctic class:	4
Year built:	1982
Class of voyage:	Unlimited - more than 200nm
Builder:	Port Weller Dockyards, St-Catherines, (On)
Main dimensions;	
Overall length:	90.22 m
Moulded breadth:	19.51 m
Draft (full load):	9.6 m
Gross tonnage:	6097.8 gross tons,
Net tonnage:	1799.88 gross tons

Propulsion system:

Six ALCO 251F, V16 cylinder diesel engines, 2200 kW each.

Two DC electric propulsion motors, 5073 kW each

1.3 Maximum Displacement

- 1.3.1 For planning purposes, the ship's displacement should not exceed 6097.8 long tons with a mean draft of 6.28M aft, and 5.75M fwd.

1.4 Technical Data Package

- 1.4.1 The following documents make up the technical data package and define the scope of work for the CCGS Des Groseilliers VLE project:

- Technical specifications (This Specification document and appendixes)
- Design plans – electronic format
- Applicable CCG Standards and Guidelines – electronic format
- DFO 5847 – Paint and Hull Coating Standard
- DFO 9415 – Welding of Aluminum and Aluminum Alloys
- DFO 5737 – Fleet Safety Manual
- 30-000-000-ES-TE-001 – Colour Coding Standard for Piping Systems
- Asbestos Report – Hazardous Materials Management - CCGS Des Groseilliers,

- 1.4.2 Additional standards that apply to these Specifications (not provided by the CCG):

- ASTM F1321-92 (2004) – Standard Guide for Conducting a Stability Test (Lightweight Survey and Inclining Experiment) to determine the Light Ship Displacement and Centers of Gravity of a Vessel
- ASTM G82-95 (2003) – Standard Guide for Development and Use of a Galvanic Series for Predicting Galvanic Corrosion Performance
- CAN/CGSB-1.193-99 – High-Build Epoxy Marine Coating
- CAN/CGSB 1.61-2004 – Exterior and Interior Marine Alkyd Enamel
- CAN/CGSB 3-GP-11D – Naval Distillate Fuel, 2002-11-01
- CAN/CGSB 4.155-M88 – Flammability of Soft Floor Coverings - Sampling Plans
- CAN/CGSB 51.53-95 – Poly(Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- CAN/ULC-S102-03 – Surface Burning Characteristics of Building Materials and Assemblies
- CAN/ULC-S109-03 – Flame Tests of Flame-Resistant Fabrics and Films
- Canada Shipping Act, Machinery and Hull Regulations relating to a Research Vessel having general particulars as specified under Section 1.2
- CSA C22.1 SB-06 – Canadian Electrical Code, 1st part: Safety Standard for Electrical Installations
- CSA C22.2 – No 0-M91 (R2006) – Canadian Electrical Code, 2nd part – General Requirements
- CSA CAN3-Z299.3-85 (R2002) – Quality Assurance Program – Category 3
- CSA W47.1 039 – Certification of Companies for Fusion Welding of Steel
- CSA W47.2-11 M1987 (R2015) – Certification of Companies for Fusion Welding of Aluminum
- IEC 60092-504 3rd edition: 2001 – Electrical Installations in Ships - Part 504: Special Features – Control and Instrumentation
- CAN/CSA-C22.2 No 60529-05 Degrees of Protection Provided by Enclosures (IP Code)
- IEC 60533 Second Edition – Electrical and Electronic Installations in Ships - Electromagnetic Compatibility
- IEEE 45 STD -2002 – Recommended Practice for Electrical Installations Shipboard
- IEEE STD 315-1975 (1993) – Graphic Symbols for Electrical and Electronics Diagrams
- ISO 4405:1999 – 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 contaminant 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
- SOR/2010-120 – Marine Occupational Safety and Health Regulations
- PMBoK Guide 5th edition – Project Management Institute Guidelines to Project Management
- Provincial Department of Labor Industrial Health Regulations respecting removal and disposal of Asbestos
- SNAME – Rules/Guidelines for Ship and Installation Trials – latest edition
- SNAME (3-47)*1989 – Rules/Guidelines for Sea Trials – latest edition
- SOLAS – Recommendations
- TP 11469 E – Guide to Structural Fire Protection
- TP 127 E (2002) – Ships Electrical Standards
- TP 11469 E – Guide to Structural Fire Protection – 1993
- TP 1861 E – Standards for Navigation Lights, Shapes, Sound Signal Appliances and Radar Reflectors (1991)
- TP 2072 E – Deck Cargo Safety Code (1974)
- TP 7301 – Stability, Subdivision and Load Line Standards (1975)
- Transport Canada Marine Safety Bulletin 06/1989 – “Grounding Safety in Drydock”
- UL 1309 – Standard for Safety for Marine Shipboard Cable

1.4.3 Transport Canada (TP) publications are available at the following address:

<http://www.tc.gc.ca/eng/marinesafety/tp-menu-515.htm>

1.4.4 CGSB Standards and publications are available at the following address:

<http://www.scc.ca/>

1.4.5 ULC Standards and publications are available at the following address:

<http://canada.ul.com/>

1.4.6 The standards of the Canadian Standards Association are available at the following address:

<http://www.csagroup.org/global/en/services/codes-and-standards>

- 1.4.7 The standards of the International Standards Organization are available at the following address:

<http://www.iso.org/iso/home.html>

- 1.4.8 The standards and publications of the Institute of Electrical and Electronics Engineers are available at the following address:

<http://www.standards.ieee.org>

- 1.4.9 The standards of the British Standards Institution are available at the following address:

<http://www.bsi-global.com>

- 1.4.10 The standards of the American National Standards Institute are available at the following address:

<http://www.ansi.org>

- 1.4.11 The standards of the American Society for Testing and Materials are available at the following address:

<http://www.astm.org>

- 1.4.12 The standards of the American Society of Mechanical Engineers are available at the following address:

<http://www.asme.org>

- 1.4.13 The rules and guidelines of the Society of Naval Architects and Marine Engineers are available at the following address:

<http://www.sname.org>

- 1.4.14 The guidelines of the Project Management Institute are available at the following address:

<http://pmi.org>

1.5 Meeting room and Project Meetings

- 1.5.1 The Contractor must invite and inform CCG personnel of daily production meetings. The Inspection Authority will usually participate in these meetings and will discuss production and inspection activities.

- 1.5.2 The Contractor must provide a room for progress meetings. These meetings will be held every four weeks, or more often, in accordance with the directives of the Contracting Authority.

1.6 Facilities for use by personnel of Canada

- 1.6.1 The Contractor must make office spaces available to CCG and PSPC personnel that meet the following requirements:

- a) Two lockable offices that are at least 19m² (200 ft²) each;
- b) A furnished conference room that can accommodate 10 people, including a large table and chairs for 10 people;
- c) Four normal-sized desks with drawers;
- d) Eight desk chairs in addition to those in the conference room;
- e) A filing cabinet with four (4) lockable drawers;
- f) Two shelves;
- g) Two sets of keys must be provided for each lockable door, office, and filing cabinet;
- h) One direct-line telephone, in the conference room; this telephone should be "hands-free" for conference calls;
- i) The telephone line must be available 24 hours a day, ensuring communication with the outside at all times. Detailed billing of long distance calls will be sent to the attention of the CCG Technical Services representative. The Contractor must disconnect this line once the work is complete.
- j) A list of the telephone numbers for the shipyard, fire and police services and emergency numbers must be provided upon the ship's arrival to the shipyard.
- k) High-speed Internet connection via Wi-Fi or three (3) LAN connections;
- l) A multi-function color printer with copy, scanner, and fax functions, that can handle sheets measuring 8.5 x 11 in., 8.5 x 14 in., and 11 x 17 in. The multi-function color printer must be equipped with an automatic paper feeding mechanism and be serviceable within two (2) hours in the event of a breakdown. The contractor must supply the paper and ink for the printer.
- m) The offices must be equipped with heating, air conditioning and lighting system, in accordance with provincial health and occupational regulations.

- 1.6.2 The following must be provided on the Contractor's site:

- a) Washroom facilities must be located nearby;

- b) Six parking spaces must be made available to Canada personnel. The spaces should be clearly marked. If necessary, passes must be provided to regular Canada project personnel;
- c) All of the aforementioned equipment and facilities must be in good condition, to the satisfaction of Canada;
- d) Canada must have access to the facilities listed above 7 days a week, including at night, from 14 days following the awarding of the contract and up to 14 days after the work is accepted.

1.7 Storage Space

- 1.7.1 The Contractor must provide a minimum of 300 square metres secure storage space for the ship's equipment as required for this Specification package. The storage space must be climate controlled. In cold weather, the storage must be heated to 15 degrees Celsius. In summer, the relative humidity must be controlled and maintained below 80% throughout the duration of the contract period.
- 1.7.2 The Contractor must provide a sufficient number of shelves and pallets to meet storage and handling needs related to the work,
- 1.7.3 All items must be stored so that they can be easily accessible for inspection. No item must be stored directly on the ground,
- 1.7.4 The storage space must be located on the Contractor's site,
- 1.7.5 The Contractor must provide a three-ton truck with a driver and a forklift with an operator, totalling 64 hours each, to help Canada to empty and resupply the ship,
- 1.7.6 The Contractor must provide the means to transfer before and after, and to store the remaining fuel on board during the contract period. For the purposes of these Specifications, the Contractor must provide a price for the storage of 20,000 litres of diesel fuel and a unit price per 1,000 litres. If the quantity of fuel is not equivalent to 20,000 litres, the price of storage must be adjusted up or down using a 1379 form.

1.8 Not used

1.9 Not used

1.10 Initial Inspection

- 1.10.1 In collaboration with the Technical Authority and the Inspection Authority, the Contractor must perform an inspection of the condition of the vessel, the operation of equipment and the systems. The Parties taking part in the assessment must sign the report. This must be performed before the Contractor assumes responsibility for the vessel. The Contractor is responsible for providing a photographic survey inspection to the Inspection Authority and to the Technical Authority.
- 1.10.2 This inspection must meet the requirements of Section 5.3 of this Specification package.

1.11 Government Property

1.11.1 General

- 1.11.1.1 All materials and equipment removed from the vessel by the Contractor remain the property of Canada, unless the project requirements explicitly provide for their disposal.
- 1.11.1.2 The Contractor must keep and maintain these materials and equipment in their original condition while awaiting instructions from the Technical Authority.
- 1.11.1.3 The Contractor may obtain the approval of the Technical Authority to dispose of the materials and equipment, whose market value is void after being removed from the vessel.

1.11.2 Categorization

- 1.11.2.1 Any property of Canada that must be removed from the vessel either temporarily or permanently must be placed in one of the following three categories:

a) Category A:

These items must be permanently removed from the vessel and remain the property of Canada. The Contractor must store and protect these parts from weather, physical damage, or loss. The Contractor must store these parts on pallets, platforms, or containers adapted for shipping until Canada has inspected them and has accepted to take charge and store them. The Contractor is responsible for storing these parts for Canada for the duration of the contract period. It is the responsibility of Canada to remove these parts from the Contractor's premises.

b) Category B:

These items remain the property of Canada and must be temporarily removed from their location on board the vessel during the contract work. They must be returned to their original location on board the vessel before it leaves the Contractor's facility. The Contractor must protect these items from weather, physical damage, or loss. 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 the materials.

Category C:

Upon removal, these items become the property of the Contractor, who must dispose of them in accordance with all applicable laws, rules, and regulations.

- 1.11.2.2 Prior to removal of any item from the vessel, the items must be clearly identified with wire tags clearly indicating if it belongs to Category A, B, or C, in accordance with the instructions of the Technical Authority.
- 1.11.2.3 This requirement is in addition to those concerning any spare parts required for regulatory purposes. All such spare parts must be supplied packaged and individually identified with the description of the equipment, the model number, and the catalogue/part number.

1.12 Spare Parts

- 1.12.1 Unless otherwise indicated by the technical authority, all new equipment that is procured by the Contractor for installation on the vessel must be supplied complete with sufficient manufacturer's recommended original spare parts (OEM) for six months or 2,000 hours of operation whichever is greater.
- 1.12.2 All system spares must be provided in a spare parts list supplied by the Contractor in an electronic MS Excel spreadsheet format. The spreadsheet must identify, for each component of a system, the number of spare parts recommended in the previous paragraph. The list must include the following fields:
 - a) The supplier;
 - b) The manufacturer;
 - c) The manufacturer's part number;
 - d) The unit price;
 - e) The definition of the quantities (unit, case, etc.);

- f) The recommended number;
- g) The associated system/equipment
- 1.12.3 An electronic copy of the spare parts list must be must be submitted to both the Inspection Authority and the Technical Authority.
- 1.12.4 The Contractor must notify the Inspection Authority and the Technical Authority when such spare parts have been received.
- 1.12.5 The Contractor must store the spare parts in accordance with the manufacturer's requirements and ensure that they are protected from weather, physical damage, or loss.

1.13 Project Management

1.13.1 Introduction

- 1.13.1.1 As part of this project, project management refers to the management needs for ensuring the integration of both upstream and downstream activities and sub-activities, technical control, and management of deadlines required for the VLE project of the CCGS Des Groseilliers. The Contractor must provide, during the preparatory meeting for the refit, a draft of a Gantt bar chart in a MS Project 2013 or equivalent file, in accordance with subsection 1.13.6.

1.13.2 Project Action Plan (PAP)

- 1.13.2.1 The Contractor must document the management of the project work in a PAP, and must update this plan every month or more frequently as required by the Contracting Authority.
- 1.13.2.2 As a minimum, the PAP must include organization structure charts, a schedule, support schedules, subcontractor schedules and work, and delivery dates for Government and Contractor furnished equipment (GFE and CFE).
- 1.13.2.3 The monthly updates to the PAP must include schedule updates, a progress report, and review meetings. The components of the PAP and the updates are described in the following sub-sections.

1.13.3 Project Integration Management

- 1.13.3.1 Included with its bid, the Contractor must provide an organization chart of the entire project, indicating all key personnel and

subcontractors. In addition, the Contractor must identify, in whole or in part, the work attributed of the subcontractors.

1.13.4 Change Management Log

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

1.13.4.2 The Change Management Log must track project issues using the following criteria:

- a) Individual tracking number;
- b) Identification in the Specifications section;
- c) Date issue was raised;
- d) Expected resolution date;
- e) Date issue was resolved;
- f) Date resolution is accepted by the Inspection Authority;
- g) Brief note of resolution on issue;
- h) Individual who raised the issue;
- i) Individual assigned to resolve issue;
- j) Risk factor.

1.13.5 Risk management

1.13.5.1 Using an MS Excel spreadsheet, the Contractor must prepare a risk management plan of emerging risks, and classify them according to their impact on the work and the production schedule. Mitigation strategies must be developed for all high risks. This risk management plan must be updated at least every two weeks and submitted to both the Technical and Contracting Authorities. The Risk Management Plan must be included in the monthly progress meetings record of decisions.

1.13.6 Scheduling

1.13.6.1 The MS Project file under subsection 1.13.1 must contain a minimum of the following planning elements:

- a) The Work Breakdown Structure (WBS) on at least three or more levels for each section of the Specification package. More specifically, the WBS must include the strip outs, production, assembly, installation, bench testing,

system commissioning and tests and trials, the expected and required resources, and the necessary sea trials;

- b) Predecessors and successors;
- c) The start and end dates for each item;
- d) The critical path to the acceptance of the work;
- e) The subcontractors' schedules up to the same level;
- f) Long lead items and GFE;

1.13.6.2 The Contractor must update the schedules for each progress meeting and present the updates to the Contracting Authority, the Inspection Authority, and the Technical Authority.

1.13.6.3 The schedules must identify all work in the project, main milestones, and all interrelationships between the tasks. The schedules must be baseline.

1.13.6.4 Unless otherwise indicated in the contract, the initial schedule must be delivered 21 calendar days after the contract is awarded.

1.13.6.5 A schedule of milestones must be provided in the bidder's presentation.

1.13.6.6 The Guide to the Project Management Body of Knowledge, 5th edition, must be used as a reference for planning.

1.13.7 Project reports

1.13.7.1 Three (3) working days before the progress review meeting, the Contractor must provide a progress report, in which the project's progress, costs, and performance are described in the introduction. The deadlines, costs, and performance will then be examined in detail to clearly demonstrate the value earned through the IPC and the IPS. The report must indicate significant risks for the program, and the measures taken to resolve them. The risk analysis must identify any impact on the project's completion and determine the measures taken to make up for the delays that may affect the completion date of the contract. The report must be submitted on paper during the meeting, and sent electronically beforehand.

2.0 GENERAL TECHNICAL

2.1 Equipment Operating Conditions

2.1.1 All new machinery and equipment supplied and installed must be designed to operate under the following conditions:

- a) Outside air temperatures: From -40°C to 35°C ;
- b) Water temperature: From 0°C to 30°C ;
- c) Wind speed: 80 knots;
- d) Sea state: 10 on the Beaufort scale;
- e) Ship inclination of up to 35 degrees roll on either side with a cycle frequency of 10 seconds;
- f) Pitch of 10 degrees with a cycle frequency of 5 seconds and a maximum linear acceleration of 1 g;
- g) Permanent list of 25 degrees to port or starboard, and a permanent trim of 10 degrees fore and aft.

2.1.2 Equipment below Decks:

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

2.1.3 Equipment above Deck:

Equipment must be protected by a shelter and be capable of its intended operation on the upper deck. The equipment must also be protected from sea spray.

2.1.4 Electronic equipment compartments:

2.1.4.1 Compartments containing electronic equipment must be provided with a system(s) to maintain the following interior conditions:

Manned Compartments:

- Room temperature : from 20°C to 25°C
- Relative humidity: From 5 to 70%
- Noise level: 65 dBA.

2.1.4.2 Unmanned Compartments:

- Room temperature: from 20°C to 25°C
- Relative humidity: From 40 to 70%

- Noise level: 80 dBA.

2.1.5 Vibration

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

Shipboard vibrations:

- a) Up to 13.2 Hz with a displacement amplitude of +/- 1 mm;
- a) From 13.2 to 80 Hz with an amplitude of acceleration of ± 0.7 g with a maximum acceleration of 1 g;
- b) Natural frequencies of equipment supports or equipment parts must not be within the 0 to 80 Hz range, except where they cannot be kept outside of this range by constructional design methods, the vibrations must be damped so that undue amplification is avoided

2.2 Protection of Personnel

2.2.1 General

- 2.2.1.1 The Contractor must make sure to eliminate all rough edges, points, sharp corners and protrusions created during the conduct of work.
- 2.2.1.2 Smoking on board the vessel is prohibited. (See Section 7.19)

2.2.2 Hot work

- 2.2.2.1 The Contractor must take the following precautions when hot work is required:
- a) Degassing of compartments must be certified by an accredited chemist or other qualified person. The Contractor must submit copies of all certificates to the Inspection Authority before starting work. The certificates must specify "Safe for persons" or "Safe for hot work," as applicable. The Contractor must post a copy of all certificates at the entrance of the affected spaces;
 - b) Protective material must be used to prevent the spread of sparks, protecting electrical cables, machinery and other services;
 - c) A fire watch must be provided in each space where welding, grinding and burning are performed and in all adjacent spaces. The persons undertaking this fire watch must be equipped with a fire extinguisher and

trained in its correct use. They must maintain a watch at their designated location for at least thirty (30) minutes after completion of hot work.

- 2.2.2.2 Any hot work carried out onboard the vessel during the contract period must be performed in accordance with the procedures adopted by the shipyard. Contractor must demonstrate to the IA that its procedure is being followed and is in line with present contract expectations.

2.2.3 Confined Space Entry

- 2.2.3.1 The Contractor must provide a copy of the "Gas Free" certificate from a certified chemist or other qualified personnel to the Inspection Authority prior to beginning work. The certificates must specify "Safe for persons" or "Safe for hot work."

- 2.2.3.2 Any entry into confined spaces during the contract period must be conducted in accordance with during the contract period must be performed in accordance with the procedures adopted by the shipyard. The Contractor must demonstrate to the IA that its procedure is being followed and is in line with present contract expectations.

2.2.4 Rotating Machinery

- 2.2.4.1 New machinery installed must be equipped with a protective device to prevent any contact with rotating elements.

2.2.5 Electrical Equipment

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

- 2.2.5.2 All electrical lockout requirements onboard the vessel during the contract period must be in accordance with the CCGFSMS procedures and individual shipboard work instructions. Contractor must demonstrate to the IA that its procedure is being followed and is in line with present contract expectations.

2.2.6 Working Aloft and Fall Protection

- 2.2.6.1 Any work aloft must be conducted in accordance with the procedures adopted by the shipyard. The Contractor shall demonstrate that its procedure exists and is in line with expectations of the IA and with individual shipboard work instructions. Contractor must demonstrate to the IA that its procedure is being followed and is in line with present contract expectations.

2.2.7 Asbestos

Prior Information and Cautions

- 2.2.7.1 The Canadian Coast Guard has detected the presence of various materials containing non-friable asbestos on board the CCGS Des Groseilliers. Two reports of materials containing asbestos, indicating the locations and quantities of materials is available for consultation from the Technical Authority. The studies on the vessel's materials (141-19427-19_Rapport_Des Groseilliers_QAI_FINAL_201702161 et 141-19427-20_Rapp_DesGroseilliers_HazMat_FINAL_20170501) list the type of asbestos, quantities and locations where asbestos and other hazardous materials are found.
- 2.2.7.2 The Contractor must become familiar with the content of this report and attest to its content by adding an attestation to its bid as requested with Appendix J of the Call for Tenders.
- 2.2.7.3 The Contractor is responsible to ensure that its employees, subcontractors and the employees of subcontractors are informed of the presence of various materials containing non-friable asbestos or other dangerous materials onboard the CCGS Des Groseilliers.
- 2.2.7.4 It is prohibited to use new materials or to reuse materials containing asbestos. If necessary, any handling of material containing asbestos must be done by trained and certified personnel. The Contractor must provide the certificates of certified personnel to the Inspection Authority prior to beginning any handling or work.
- 2.2.7.5 It is the Contractor's responsibility to eliminate all material containing asbestos in a safe manner and it must provide the Inspection Authority with copies of certificates pertaining to the disposal of material containing asbestos, in accordance with federal, provincial and municipal regulations.

2.3 Workplace Hazardous Materials Information System (WHMIS)

- 2.3.1 The Technical Authority will provide the Contractor with a list all hazardous materials onboard the vessel in accordance with the WHMIS.
- 2.3.2 The Technical Authority will also provide the Contractor with Material Safety Data Sheets (MSDS) for the hazardous materials onboard the vessel.
- 2.3.3 The Contractor is responsible for all Contractor supplied products and materials used aboard the vessel. The Contractor must inform the Technical Authority and the Inspection Authority of the use of such material and provide a copy of the Material Safety Data Sheets.

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 or contamination.
- 2.4.2 The Contractor must ensure that electrical and electronic equipment and components are protected against direct or indirect physical damage and against the effects of temperature or other adverse environmental conditions, throughout the duration of the contract.
- 2.4.3 All surfaces, equipment, furniture and decor included in the work, which have been damaged, must be repaired to their original condition or replaced by the Contractor, at no cost to Canada.
- 2.4.4 All openings in machinery and/or systems must be kept covered by inserts, covers, plugs or blanks at all times until reconnected.
- 2.4.5 The Contractor must obtain and follow the directions of its suppliers or subcontractors regarding any special protection required the equipment they provide. These instructions must be transmitted to the Technical Authority and to the Inspection Authority.
- 2.4.6 The Contractor must ensure that the vessel's machinery, equipment and systems are protected against all hazards, including damage from ongoing work, corrosion, sandblasting (directly or indirectly), paint overspray, hot work, adverse temperatures or other environmental conditions and contaminants.

2.5 Access to Vessel and Equipment

- 2.5.1 Restricted Access Areas:

- a) The Contractor's and subcontractor's personnel may not access the following areas, except to perform work provided for this Specification package: cabins, offices, wheelhouse, control room, gymnasium, public toilets, cafeteria, dining room and lounges. The Contractor must cover all floor carpets before starting the work. The Contractor must prohibit its employees from bringing their meals onto the vessel,

2.5.2 Installation and Removal Routes

- 2.5.2.1 If the Contractor intends to modify the vessel's structure to simplify a removal or an installation, it must first obtain the approval of the Technical Authority and the Inspection Authority.
- 2.5.2.2 All items and equipment that must be removed and reinstalled for the completion of specified work, or to allow access to certain locations, must be inspected before and after their removal/reinstallation by both the Contractor and the Inspection Authority.
- 2.5.2.3 Unless otherwise indicated, all items constituting an obstacle that are protected, removed or damaged during an overhaul, removal or installation, including insulation and heat-insulating coatings, must be returned to their original condition upon completion of the work.

2.5.3 Penetrations

- 2.5.3.1 Sealing of redundant penetrations must be performed in a manner acceptable by TCMS (Transport Canada Marine Safety). The Contractor must notify the Inspection Authority of any such penetrations that have been sealed and provide copies of all TCMS documentation.

2.5.4 Access for Maintenance

- 2.5.4.1 The layout of machinery and equipment must be designed so as to allow easy access for inspection, maintenance and repair without disturbing other machinery, structures or pieces of equipment. Provisions must be made for removal of machinery components.

2.6 Assembly of System Components and Equipment

- 2.6.1 Securing Arrangements of System Components and Equipment.

- 2.6.1.1 All new and existing systems, equipment and components installed or disturbed as a result of work, must be secured to prevent damage caused by the operating conditions of the vessel, as per section 2.1 of this Specification.
- 2.6.1.2 The Contractor must follow manufacturers' recommendations for installation arrangements. If this information is not available, securing arrangements must be approved based on the regulatory requirements prior to the Contractor commencing the securing activities.
- 2.6.1.3 The Contractor must respect the manufacturer's torque specifications. If the manufacturer does not provide this information, standard SAE bolt and nut torques must be used.
- 2.6.2 Cleaning
 - 2.6.2.1 The Contractor must ensure that once the installation has been completed, assembled parts and equipment are cleaned to eliminate stains, spatter or excess solder, weld metal, metal shards or any other foreign matter. 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 must be repaired prior to closing machinery.
- 2.6.3 Damaged Items
 - 2.6.3.1 Panels, covers, components and equipment damaged by the Contractor must be repaired to their original condition or replaced at no cost to Canada.

2.7 Welding

- 2.7.1 General
 - 2.7.1.1 All welds must comply with the CSA standard W47.1 "Welded Steel Construction (Metal Arc Welding) (Metric)." The Contractor must provide a copy of the welders' certificates.
 - 2.7.1.2 The Contractor must submit CWB stamped welding specifications and weld procedure data sheets to TCMS where required. Welding procedures for joining pipe connections must be

recorded and approved by CWB in accordance with ASME section IX.

2.7.1.3 All hot work methods described in Section 2.2.2 must be respected.

2.7.1.4 All aluminium welding must conform to the requirements of CSA standard W47.2 (Certification of Companies for Fusion Welding of Aluminium). The Contractor must provide a copy of the welders' certificates.

2.7.2 Removal of Attachments

2.7.2.1 Temporary cleats, lifting eyes, and fasteners used during maintenance of structures must be removed by burning or grinding, and any remaining irregularities must be ground flush with the surface of the parent plate. **Surface to be verified by magnetic particle for the cleats having been welded on the hull.** Any damaged paint must be repaired.

2.7.3 Weld Design Requirements

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

2.8 Painting

2.8.1 General

2.8.1.1 The Contractor must prepare a painting schedule and present it to the Technical Authority and to the Inspection Authority for review and acceptance. The painting schedule must list all areas and compartments on the vessel affected by the project work and indicated the proposed paint type, painting scheme, surface preparation, type of coating, number of coats, thickness and colors. All paint used must be compatible with the existing paint on the vessel.

2.8.1.2 All pipe markings must comply with the standard CGFM 308-00-03, Color Coding Standard for Piping Systems.

2.8.1.3 All new and disturbed steel and aluminum work must be painted in accordance with publication DFO 5847 and with the paint manufacturer's specifications.

2.8.1.4 All paint must be suitable for use in the marine environment and comply with standards CAN/CGSB 1.61-2004 – Enamel Alkyd Exterior and Interior Marine Paint and CAN/CGSB 1.193-99 –

Epoxy Resin Coatings, Marine. Paints, varnishes and other coatings used on interior surfaces must be included in the list of TCMS approved products, TP 438.

2.8.1.5 Each coat of paint must be of a different shade to indicate proper coverage, and must be completely dry before application of subsequent coats. At minimum, the first coat of primer must be applied by brush or airless spray.

2.8.1.6 The final topcoats must be protected from dirt or damage until the vessel is delivered to Canada. The Contractor must ensure that furnishings and equipment liable to more serious damage due to overspray are adequately protected during the painting process.

2.8.1.7 Without limitation, the following elements must NOT be painted. When in doubt, the Contractor must consult the Inspection Authority:

- screw threads;
- grease fittings;
- bronze pins;
- door screens;
- nameplates;
- gaskets;
- stainless steel or monel metal fittings;
- machined surfaces;
- instrumentation;
- interior gratings;
- electrical wires, insulation and fittings;
- electrical panels;
- rubber seals on watertight doors and hatches;
- fire door seals;
- in general, all working parts or other exceptions stipulated by the Inspection Authority.

2.8.2 Heavy Metal Based Coatings

2.8.2.1 Paint containing lead, mercury or copper must not be used.

2.8.3 Requirements for Paint Equivalents

- 2.8.3.1 If the Contractor would like to use paint from a different manufacturer, it must demonstrate to the AT and/or the IA that all characteristics and technical specifications of the proposed paint is the equivalent of the specified paint. Where partial repairs (touch ups) are required, the Contractor must use the same type of paint already in service, as to ensure good adherence thereof.
- 2.8.3.2 No substitute will be accepted for the INTERSHIELD 163 INERTA 160 paints.

2.9 Identification

2.9.1 Nameplates

- 2.9.1.1 Nameplates must be affixed to all new equipment, compartments, doors and closures.
- 2.9.1.2 All nameplates must be written in both official languages.
- 2.9.1.3 Lettering must be clear and concise while minimizing the use of abbreviations. Primary information must be given in larger size lettering than secondary information.

2.9.2 The type of nameplate must correspond to the location on the vessel as specified below:

- a) Plastic must be used in accommodation and navigation spaces where the nameplate is not exposed to mechanical damage and does not risk being covered by ice, paint, oil, grease or dirt.
- b) Plastic nameplates must be laminated phenolic rigid type with machine engraved lettering and secured using stainless steel or brass screws. Unless otherwise indicated, nameplate must have white lettering on a black background for normal signs and white lettering on a red background for warning or emergency signs.
- c) Laminated plastic nameplates, black with white core engraved through to the center core, must be provided for all devices secured to the exterior surfaces the distribution panels/switchboard.
- d) Nameplates must be secured to the distribution panel/switchboard with machine screws. New nameplates to be fitted on the existing distribution panel/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.

- e) Warning or caution nameplates must be in laminated plastic; red with white core engraved through to the center core. They must indicate the circuit breakers provided with trip coils requiring completion of remote circuits prior to being operated, as well as those having a potential power source connected to both sides, or to any other potentially hazardous condition.
- f) Engraved metal, stainless steel or brass nameplates must be used in machinery spaces and where exposed to weather. Engraved metal nameplates must have lettering accentuated by means of black wax and secured with stainless steel or brass machine screws.
- g) Before ordering or manufacturing nameplates, a complete drawing list of nameplate must be submitted, specifying the size of the plates, the size of the lettering and their inscription, for review and acceptance by the Inspection Authority and the Technical Authority.

2.9.3 Key Tags

- 2.9.3.1 Plastic labels must be provided for all new keys. Tags must be marked to identify the space or the item they lock. The description must be identical to that used for the identification nameplate for the space or the equipment. The complete list of new keys and labels must be submitted to the Inspection Authority and to the Technical Authority.
- 2.9.3.2 All new keys and tags must be turned over to the Technical Authority as part of the acceptance of the vessel.

2.9.4 Safety Related Signs

- 2.9.4.1 All new signs must be written in both official languages, French first.
- 2.9.4.2 Painted signs for muster station directions, fire stations, emergency equipment, etc., must be provided and installed in accordance with TCMS approval.
- 2.9.4.3 The Contractor must prepare and present a drawing indicating the location, type and size of lettering for all signs. This drawing must be submitted to TCMS for approval prior to fabrication or installation of the signs.

2.10 Cleanup

- 2.10.1 The Contractor must ensure cleanliness of the vessel. Debris and waste must be removed from the vessel and disposed of at the end of each work day.

- 2.10.2 Special attention must be given to hazardous materials, such as flammable products and toxic wastes. They must be disposed of in accordance with federal, provincial and municipal regulations.
- 2.10.3 Upon the arrival, the bilge in the machinery spaces ~~will~~ must be cleaned by the entrepreneur to allow hot work. Cleaning must include pumping and disposal of bilge water, and cleaning bilges to remove grease, oil and contaminants. The disposal of additional waste performed by the shipyard, must comply with all federal, provincial and municipal regulations. Disposal certificates must be submitted to the Inspection Authority and to the Technical Authority within 24 hours after any disposal or any transfer from the vessel. The Contractor must submit a fixed price for disposal of 5,000 litres of bilge waste and a unit price per 100 litres. The PWGSC Form 1379 must be submitted to adjust the cost of bilge waste disposal up or down, as appropriate.
- 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 the acceptance or work, the Contractor must thoroughly clean all areas of the vessel to return them to their original condition, including all bilge areas. The contractor must perform an inspection in the presence of the IA to attest of their cleanness.

3.0 MECHANICAL CHARACTERISTICS

3.1 General

- 3.1.1 Unless otherwise indicated, the Contractor must supply all material or equipment necessary to complete the work in this Specification package.
- 3.1.2 All replacement machinery, equipment and fittings must be new and from a recognized manufacturer, with production and distribution facilities in North America.
- 3.1.3 All machinery and equipment must be approved by a Classification Society and must meet all applicable TCMS regulations. The Contractor must provide the Inspection Authority and the Technical Authority with copies of Classification Society approval certificates. Approval certificates must be up to date and correspond with the type and model of equipment installed by the Contractor. The Contractor must refer to Section 6 to obtain all requirements relating to the documents.
- 3.1.4 All machinery must be capable of operating under the conditions established in Section 2.1 of these Specifications.
- 3.1.5 All machinery must be installed in accordance with the manufacturer's recommendations with particular attention to the reduction of vibration and noise transmission, as well as location allowing access for maintenance. Rotating machinery must be installed on a longitudinal or vertical axis, unless otherwise approved by TCMS. The Contractor must present an installation drawing to the Inspection Authority before commencing the work.

3.2 Piping

3.2.1 General installation

- 3.2.1.1 Before beginning work, the Contractor must present to the Inspection Authority and the Technical Authority installation diagrams or drawings for approval. They must be sufficiently detailed in order to obtain regulatory approval. Piping must be installed so as to avoid interfering with:
 - a) passage through doors;
 - b) hatches and scuttles;
 - c) openings covered by removable plates or work areas;

- d) in frequently used walkways, the minimum overhead clearance must be 2 metres;
 - e) operation of machinery, equipment, controls and with routine maintenance;
 - f) the vessel's structure;
 - g) routes designated for removal of equipment or removable structural parts of the vessel designed to access equipment, removal or for maintenance of the equipment.
- 3.2.1.2 Piping must be installed in a location where there is no risk of damage, if not possible, the Contractor must provide protection for piping to the Inspection Authority's satisfaction. Piping runs must be as direct as possible and utilize the minimum amount of fittings in order to minimize friction flow.
- 3.2.1.3 Piping must be removable when close to mechanical, electrical or hydraulic systems which require periodic maintenance or refitting. Isolating valves must be provided and installed to facilitate removal of piping, so as to minimize the effects on operation as much as possible.
- 3.2.1.4 When high or low points are inevitable in the routing, vents, purge drains or other means acceptable to the Inspection Authority must be installed to guarantee adequate operation of the system.
- 3.2.1.5 Pump suction piping must also be as short as possible, of sufficient diameter, and arranged so as to avoid forming bends to prevent air pockets. Tail pipe connections must be 0.5 times the inside diameter of the pipe above the bottom of the tank, at the deepest point.
- 3.2.1.6 Bulkheads and decks must be pierced close to boundaries of compartments. Cutting bulkhead stiffeners, deck beams, plating butts and seams is not permitted unless otherwise indicated. Approval must be obtained from TCMS prior to piercing.
- 3.2.1.7 Piping must not be led through inner bottom tanks and voids, except as necessary to serve the tanks themselves, or to avoid penetrating 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 not pass through void spaces, cofferdams or other normally non-vented spaces.

- 3.2.1.8 Piping must not pass through the following spaces, unless needed to serve them:
- Chain lockers;
 - Wiring trunks and enclosures;
- 3.2.1.9 Where piping crossing through fuel oil or diesel fuel tanks is authorized by TCMS for different fluids, the thickness of the piping must be schedule 80 and joints must welded.
- 3.2.1.10 Supports must be designed and located to safely support the weight of the piping, its operating or test fluid (whichever is heavier), its insulation or lagging (where applicable), in accordance with the operating conditions of Section 2.1 of this Specification. Supports must also withstand the loads imposed by expansion and contraction of the piping and working of the vessel.
- 3.2.1.11 The number of supports installed, the type selected, and their location must prevent rubbing against any other components or excessive vibration of the piping under all operating conditions. The supports must not exert stress or transfer loads to the piping.
- 3.2.1.12 Rigid anchor points must be designed so that the noise and vibration of piping components and excessive heat from high temperature systems are not transferred through the anchor to surrounding areas.
- 3.2.1.13 Changes in direction of the piping must be done through elbows and offsets where space does not permit straight sections.
- 3.2.1.14 The use of miter joints is authorized only on pipes such as air purge vents and overflows, when their use would not cause unacceptable pressure drop or turbulence in the fluid flow. Branch connections must be located to minimize turbulent flow and the type used (crosses, single and double-sweep tees, Y and lateral fittings) must be suitable for the required flow characteristics.
- 3.2.1.15 Direct reading thermometers, pressure gauges or vacuum gauges must be installed in locations where they can be easily read and are protected from damage. All pressure gauges and vacuum gauges must be supplied and installed with an isolating valve.
- 3.2.1.16 Connections of dissimilar metals that could cause galvanic corrosion are not authorized unless otherwise accepted by the

Inspection Authority or TCMS. In this case, the Contractor must control galvanic corrosion by connecting a relatively small portion of the cathodic material to a large portion of anodic material, or by separating different kinds of metal by a short piece of very heavy galvanized steel pipe (waste piece). This device must only be installed when indicated. Raised face flanges must not be used against bronze or other relatively low strength composition valves, fittings or flanges.

- 3.2.1.17 Where pipes pass through holes in the non-watertight structures, provision must be made to keep the pipes from bearing on the structure.

3.2.2 Material Selection

- 3.2.2.1 Figure 3-1 specifies those materials that are acceptable for use in specific piping systems. Figures 3-2 to 3-8 specify materials for various piping systems and components.
- 3.2.2.2 Piping systems and components must comply with this Specification except where the specified material is incompatible with materials remaining in the system. Alternate materials not listed will be permitted only when approved or recommended by the original equipment manufacturer and/or supplier of that equipment/component. In such situations, direction must be requested from the Technical Authority before proceeding further with the work.
- 3.2.2.3 Steel pipes used for raw water must be hot-dip galvanized. The Contractor must ensure that all hot-dip galvanisation is carried out after all fabrication, all in-place adjustments, all welding of fittings and components, and all pressure testing is completed. If this is not possible, the Contractor must obtain authorization from the Inspection Authority if it intends to use cold galvanizing and must stipulate the product and corresponding standard. Before hot-dip galvanizing of steel parts, they must be free of welding slag/by products. This can be accomplished through, hammering with a welder's hammer and acid cleaning.

Figure 3-1: Acceptable products in each piping system

Element or system	Figure corresponding to the material
Raw water systems	References
Fire Main, Sewage (Black Water), Ballast, AFFF, Bilge Suction (oil/water separation)	4t, 6b, 1a, 2a, 3a, 6a, 7a, 3fl, 4fl, 5fl, 11fl, 12fl, 1f, 2f, 3f, 4f, 19f, 20f, 21f, 1v, 2v, 3v, 5v, 6v, 7v, 8v, 22v, 5g (AFFF 11g only) (4b non-bilge areas)
Main and Auxiliary Circulating Systems	4t, 9v, 10v, 11v, 12v, 8f, 9f, 10f, 11f, 12f, 20f, 21f, 4fl, 5fl, 5g, 6g, 7g, 1b, 2b, 6b, 1a, 2a, 4a
Oil Fuel, Marine Diesel and Distillate	References
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	References
Potable (including vents, overflows, sounding pipes, 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 can be used in accordance with standard ASTM B62, seals in accordance with standard ASTM B61)
Circulation (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	References
General Service (150 PSIG side)	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)	References

Element or system	Figure corresponding to the material
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 comply with standard ASTM B62, seals to standard ASTM B61)
Compressed Air	References
3,000 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	References
All “As Fitted”	5t, 4b, 6b, 5g, 6g, 4fl, 8f, 9f

Figure 3-2: Material for Pipes and Tubes

	Description	Important	
1t	Tube – seamless (tube for pressures greater than 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 Sch 40	Steel
5t	Pipe, seamless	ANSI/ASTM A 53 GR A or B Sch 40	Carbon Steel
6t	Tube	ANSI/ASTM A376-79B	Stainless Steel,

	Description	Important	
			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 Steel

Figure 3-3: Material for Valves

	Description	Important
1v	Globe, angled	ANSI/ASTM B 61-76
2v	Pressure Regulating	ANSI/ASTM B 61-76
3v	Pressure Relief	ANSI/ASTM B 61-76
4v	Y Type Filters	ANSI/ASTM B 61-76
5v	Diaphragm	ANSI/ASTM B 61-76
6v	SDNR and Lift Check	ANSI/ASTM B 61-76

	Description	Important
7v	Butterfly	ANSI/ASTM B 61-76
8v	Gate Valve, flanged	ANSI/ASTM B 61-76
9v	Globe, angle and check valve	Steel
10v	Gate valve	Steel
11v	Relief	Steel
12v	Pressure Regulating	Steel
13v	Globe, angle, check, control bleeder, ball valve	Carbon steel
14v	Globe, gate, ball valve (fire resistant)	316 stainless steel
18v	Angled, relief	316 stainless steel
19v	Butterfly	Ductile cast iron or cast steel
20v	Assorted	AISI 304, 316/A51M, A 182 Teflon packing
21v	Assorted	Alloy 642

	Description	Important
22v	Sprinkler Control Valves	ASTM B61

Figure 3-4: Material for fittings

	Description	Material
1f	Brazing	ANSI/ASTM B61 only (do not use standard ASTM B 150)
2f	Flange	ANSI/ASTM B61 only
3f	Threaded	ANSI/ASTM B61 (125 psi nominal)
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

	Description	Material
11f	Threaded	ANSI/ASTM A 105
12f	Union	ANSI/ASTM A 105
13f	Socket Weld	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	ductile iron for grooved end pipe
20f	Tube fittings	Stainless Steel (Swagelok)
21f	All 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, with slip-on flange complying with ANSI/ASTM A181-77 GR1 and ANSI/ASTM A181-GR1
4fl	Welding neck, socket weld, 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

Figure 3-6:	Description	Material
1g	O-Ring	Buna N
2g	O-Ring	Buna N
3g	Full Face	CAF Non Graphite
4g	Full Face	CAF with 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 nuts and bolts

	Description	Material
1b	Bolts	ANSI/ASTM A193-79A
	Continuous Thread	GR B16

	Description	Material
	Stud or Hex Head	ANSI/ASTM A193-79A
	Tap End	GR B16
	Nuts: Hex, HSF	ANSI/ASTM A194-79A GR4
2b	Bolts	Phosphor 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 miscellaneous 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 steel
	Y-type	
6a	Closures for Sounding Pipes	Bronze
7a	Fire hose – supply manifold	Bronze

3.2.3 Fire Fighting systems

3.2.3.1 All piping for the sprinkler system and the CO₂ fixed fire extinguishing system must comply with TCMS regulations and they system manufacturer's specifications.

3.2.4 Exhaust Piping

- 3.2.4.1 Exhaust piping must be fabricated from materials as indicated on the guidance drawings. Flanges must be forged steel 1,035 kPa, "Light Pattern", in accordance with standard 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 MC or equivalent, suitable for exhaust duty at the system's operating temperature).
- 3.2.5 Piping Fabrication
- 3.2.5.1 Flange faces must be perpendicular to the longitudinal axis 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 on the vessel. Foreign matter such as dirt, grit and shavings, must be removed by methods and materials that are compatible with the fluids employed in the service aboard the vessel.
- 3.2.6 Bulkhead and Deck Pieces
- 3.2.6.1 Bulkhead and deck pieces must be steel marine standard three-flange, galvanized for seawater, black for hydrocarbons. Penetrations must be schedule 80 pipe. Penetrations for copper piping must be in bronze, with a nut on each side of the bulkhead or deck.
- 3.2.7 Joints and Connections
- 3.2.7.1 Brazed joints must be used in non-ferrous systems and welded joints in carbon steel or alloy systems. The number of joints must be minimized through the use of pipe bending.
- 3.2.7.2 For bend radii three times the diameter or less, only prefabricated bends must be used. For bends with larger radii, the Contractor must also use prefabricated piping, unless otherwise authorized by the Inspection Authority.
- 3.2.7.3 If the Contractor wishes to fabricate joints on board the vessel, it must obtain authorization from the Inspection Authority and the Technical Authority. It must comply with all pertinent CCG safety requirements.
- 3.2.7.4 Disassembly joints must be located so as to permit sufficient clearance to ensure proper assembly and maintenance. Joints

located in locations inaccessible for maintenance must be welded or brazed. All flanged pipe joints must be connected using joint sealant appropriate for the intended service and approved by TCMS.

- 3.2.7.5 Throttle valves and valves with operate automatically or semi-automatically such as safety valves, relief valves and regulating valves must be flanged. If their nominal bore is less than 20mm (3/4"), they may have threaded connections.

3.2.8 Contact strips

- 3.2.8.1 All copper joints isolated by joining to other materials must be provided with contact strips securely fitted from flange to flange, in order to have a continuous circuit in pipelines.

3.2.9 Hydraulic Piping

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

3.2.10 Identification of Piping

- 3.2.10.1 All piping must be identified in accordance with standard 30-000-000-ES-TE-001 CCG Color Coding Standard for Piping Systems.

3.3 Pumps

3.3.1 General

- 3.3.1.1 With exception to engine driven pumps, pumps must be supplied 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 package.
- 3.3.1.2 Engine driven pumps must be engine manufacturer's standard supply. Allowance must be made for specific installation requirements when specifying pump performance parameters.
- 3.3.1.3 Pump performance criteria must correspond to the requirements of the entire system or systems to which they are connected. Pumps must operate at their nominal capacity. Pumps installed on resilient mounts must have flexible suction and discharge connections that will accept deflections arising from thrust and shock loading.

- 3.3.1.4 Radial and thrust bearings must either be of the sliding surface or rolling contact type. The selection of thrust bearings must take into account the vessel's rolling and pitching which could cause axial thrust, even when the pumps are in hydraulic balance.
- 3.3.1.5 Wear rings must be fitted to the casing of all centrifugal pumps. Wear rings must be fitted to all impellers driven at a BHP of 10 or greater at rated output.
- 3.3.1.6 Pump glands must incorporate mechanical seals.
- 3.3.1.7 Pump casings must be provided with a vent connection at each discharge stage, as well as a casing drain connection.
- 3.3.1.8 Pumps operating in parallel must be capable of continuous steady operation.
- 3.3.1.9 The major rotating elements of all pumps with connected appendages must be dynamically balanced. Documented proof of this must be submitted to the Inspection Authority.

3.3.2 Centrifugal pumps

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

- vertical in-line overhung;
- Radial split bronze casing;
- stainless steel shaft;
- mechanical shaft seal;
- aluminum bronze impeller;
- renewable wear rings;
- removable shaft spacers;
- bearings lubricated by the pumped fluid in plain bearing applications, or grease packed roller bearings.

- 3.3.2.2 Pumps must be fitted with the following accessories:

- discharge pressure gauge, liquid filled, with isolating valve;
- compound suction gauge, liquid filled, with isolating valve;
- drip tray;
- all applicable guards.

3.3.2.3 The design conception of the pump must allow the entire rotating assembly to be removed without disturbing the piping.

3.3.2.4 In cases where the discharge head can exceed the design pressure of any part of the connected piping system, pumps must be equipped with a pressure relief valve.

3.3.3 Positive Displacement Pumps

3.3.3.1 Unless otherwise specified, pumps must have the following characteristics:

- Positive, constant displacement, rotary screw;
- Nodular iron casing, maximum 18% elongation;
- steel power rotor;
- integrated adjustable relief valve;
- mechanical seal.

3.3.3.2 Pumps must be fitted with the following accessories:

- discharge pressure gauge, liquid filled, with isolating valve;
- compound suction gauge, liquid filled, with isolating valve;
- drip tray;
- all applicable guards.

3.4 Valves

3.4.1.1 All valve bodies must indicate the pressure rating, size, material, flow direction, rated temperature, application, name of manufacturer or trade mark cast or forged into the valve body or stamped in a non-stressed area. Valve handles must be located in a place where they can be easily operated.

3.4.1.2 Where a system can be supplied by more than one pump, check valves must be installed in the discharge side of each pump to prevent flow reversal.

3.4.1.3 Check valves and screw down non-return valves must be installed such that the disc opens with the flow and recloses by gravity or by means of springs. Check valves must be installed in locations where reverse flow could interfere with the proper operation of the system, or in locations where reverse flow could flood a space.

- 3.4.1.4 Globe and angle valves used for isolation must be fitted so that the system's pressure or vacuum is not exerted on the bonnet joint or stem packing when the valve is closed.
- 3.4.1.5 Manifolds must be used where ever possible.
- 3.4.1.6 Safety and relief valves and their piping must be fitted so that their discharges will not damage or endanger machinery, equipment or personnel.
- 3.4.1.7 Valves in branch lines must be mounted adjacent to the main supply line in order to maintain system integrity in the event of a line failure.
- 3.4.1.8 Butterfly valves or ball valves must not be used as hull isolation valves. Hull isolation valves must be in accordance with the CSA Machinery Regulations.
- 3.4.1.9 Position indicators are required on all valves for which stem rotation is greater than 360 degrees. Exceptions are specific valves where the position is obvious from operation of the system or from the position of the stem (unless required by TCMS).
- 3.4.1.10 Check valves must be installed where ever reverse flow could interfere with the proper operation of the system, or in locations where reverse flow could flood a space.
- 3.4.1.11 All automatically operating valves 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 pneumatic control valves must be installed. Manually operated throttle valves and their operating mechanism must have the necessary sensitivity of control.
- 3.4.1.12 Relief valves must be installed to protect pressure vessels, heat exchangers, piping systems, machinery and equipment against damage caused by excessive pressure. Relief valves must have sufficient capacity to prevent a pressure increase greater than 10% above maximum allowable operating pressure of the system.
- 3.4.1.13 A strainer must be installed in inlet piping, and a pressure gauge in the outlet piping from each pressure reducing valve. A relief valve must be installed in the discharge piping, unless otherwise

indicated. The strainer must be installed upstream of the pressure reducing valve and downstream of the bypass isolation valve. The pressure gauge and the relief valve must be fitted downstream of both the reducing valve and the bypass valve. Relief valves must be sized on the assumption that the pressure reducing valve could remain wide open. The outlet piping diameter must be increased to comply with the system's flow characteristics. A straight piece of piping, of a length recommended by the manufacturer of the pressure reducing valve must be installed at the largest end of a tapered fitting. A bypass must be installed around each reducing, unless indicated otherwise. The bypass valve must be a manually operated throttle valve that must not permit a greater flow than the reducing valve's capacity.

3.4.1.14 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 valve outlet to sub-atmospheric pressure when the valve is closed;
- c) flammable or combustible liquids;
- d) toxic or explosive gases.

3.4.1.15 All valves larger than 20mm (3/4 in.) must have flanged connections. All valves larger than 40mm (1-1/2 in.) must have a bolted bonnet, gland and screw type renewable seats.

3.4.1.16 Nameplates identifying the service must be installed on new or reconditioned valves, as shown in Section 2.9. Valves installed under the deck plates must be provided with hinged access covers. Nameplates must be fixed to the deck plate.

3.5 Machinery Insulation

3.5.1 General

3.5.1.1 New, non-asbestos containing insulation, approved by a Classification Society, must be installed on all sections of piping, machinery and equipment, in places where the insulation has been removed and on

newly installed equipment which must be insulated. The insulation must be installed by a company or qualified personnel with expertise in this field to the satisfaction of the CEW. One of them must be trained as a tinsmith. Valves and fittings must be insulated using the necessary material and thickness indicated on the original plans or according to the TCMS guidelines for adjacent piping. The Contractor must submit the complete lagging and insulation schedule to the TA and the IA for review 48 hours prior to ordering the material. Any insulation and lagging must meet the requirements of the Regulatory Body.

3.5.1.2 Piping and equipment whose design internal temperature is greater than 150°C must be insulated from their supports, or the supports insulated from the structures to which they are attached.

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

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

3.5.2 Lagging

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

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

3.5.2.2 Insulation of piping and/or equipment not exposed to weather must be covered with either a cloth or tape type lagging, when not of the pre-lagging type. Cloth type lagging must be secured by an adhesive or be sewn. Tape type lagging must be spirally wound with not less than a 10mm (3/8 in.) overlap and with the 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 standards.
Hyperlinks:

- <https://www.scc.ca/en/standardsdb/standards/13174>
- <http://www.scc.ca/en/standardsdb/standards/25791>

3.5.2.3 Insulation, insulation jackets, canvas, fiberglass mat, as well as wrapping and adhesives must be fire retardant with a maximum flame spread index of 25, and a maximum smoke development index of 100, when tested in accordance with CAN/ULC S102-M standard.

3.5.2.4 Insulation of piping or equipment exposed to weather or excessive moisture must be protected by application of a 6mm (1/4 in) thick, weather resistant type coating, secured in place prior to application of its. The presence of cracks or openings in the continuity of the completed coating lagging, especially at valves, flanges and fittings must be avoided in order to prevent the ingress of moisture, spray or water. For deck penetrations, insulation must be protected by 150 mm (6 in.) high steel kick guard, welded to the deck and covered with the same insulation coating.

3.5.2.5 In places where the insulation lagging could be easily damaged, a protective galvanized sheet metal lagging No. 2 USSG must be installed. Where the protective metal lagging is subject to frequent removal for machinery maintenance, it must be in plain or hammered aluminum, secured by quick release clips.

3.5.3 Securing Arrangements

3.5.3.1 All insulating materials must be secured to prevent settling and to allow rapid removal for equipment maintenance.

3.5.3.2 All high temperature piping system must be insulated using reusable prefabricated covers made of the following materials, from the pipe surface outwards:

- 1) Monel mesh;
- 2) Fiberglass mat, with density of about 32kg per m³ (2 lb/ft³), containing no chemical binder and resistant to operating temperatures of up to 450°C;
- 3) Foil-lined silicone-coated fiberglass lagging, secured to the insulation by stapling: all edges must be sealed.

- 3.5.3.3 Covers must be provided with stainless steel or Monel clips, secured by through hooks around which a securing wire can be wound for assembly and fastening purposes.
- 3.5.3.4 The insulation, with all joints tightly butted, must be secured to the pipe at ends with not less than two metal bands per section, minimum 20mm (3/4 in.) wide, with quick release clips.
- 3.5.3.5 In places where the pipe insulation abuts flanges or fittings, the ends of the insulation must be tapered to allow removal of bolts.
- 3.5.4 Insulation Thickness
 - 3.5.4.1 The surface temperature of insulation must not exceed 150°F (65.6°C). 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 one inch (25 mm), double layers must be used. The layers must be of equal thickness. All laps must be staggered and all end joints must be overlapped.
- 3.5.5 Insulation, Anti-condensation
 - 3.5.5.1 Cold water piping and equipment, including sewage pipes, must be insulated using anti-condensation 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 a protective screening as required where there is a potential for damage.
 - 3.5.5.2 Where piping or tubing passes through the galley or other high humidity spaces, the insulation must be double layered, with the outside of each layer being waterproofed.
- 3.5.6 Insulation, removable/reusable, covers or pads
 - 3.5.6.1 Flanges, flange fittings, flexible joints, expansion pieces or any other components of machinery or piping likely to be disassembled for inspection and maintenance must be covered by removable or reusable covers or pads. They must be made of the same material as the main pipe insulation. Gaps between pads and fitted insulation must be filled with pieces of applicable felted material, tight enough to prevent air flow.

3.5.7 Ducting

- 3.5.7.1 All ducting must be insulated with a minimum two (2) inch (50 mm) thick vapor seal duct insulation with factory applied vapor barrier (Manson AK FlexMC or equivalent). The vapour barrier dam must be a Chil-Perm™ CP30 product with fiberglass cloth 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 the approval of the Technical Authority.
- 3.5.7.2 Air duct penetrations must be sealed with non-shrink/hardening silicone based caulking.

3.6 Machinery Space Outfit

3.6.1 General

- 3.6.1.1 The engine room must be provided with ladders, gratings and floor plates, provided at convenient levels to all items of the machinery for operation and routine maintenance.

3.6.2 Deck Plates

- 3.6.2.1 Deck plates must be non-skid embossed steel tread plate supported on steel bearers and secured by 13mm (1/2 in.) countersunk stainless steel screws at the sides. The plates must not be larger than 120cm (4 ft.) by 183mm (6 ft.). Smaller portable plates must be provided where ever frequent access is required. Portable hinged openings must be provided over valves, cocks and strainers, and identified with brass nameplates. Open contours must be closed with a vertical edge, except for access openings at the base of the machinery. Floor plate supports must be painted. Supports provided must be able to support machinery weights during refits (concentrated loads of 600 lbs).

3.6.3 Protective Guards

- 3.6.3.1 Protective guards must be fitted over all rotary drives accessible to personnel. They must be light weight and portable. Open guards must be made of expanded laminated metal; closed guards in steel or aluminum. Protective guards must allow visibility of drives and dissipation of heat. Access must be provided at the centers of shaft lines.

3.6.4 Sea Suction and Overboard Discharges

- 3.6.4.1 All new sea suctions and overboard discharges must be made of the steel plate as used for the hull and protected by means of sacrificial. All components must be covered with a complete hull coating system.

3.6.5 Sea Isolation Valves

- 3.6.5.1 Each seawater suction line must have a sea isolation valve fitted as close as possible to the seawater intake. Seawater suction valves must be approved by a Classification Society and made of cast steel with stainless steel trim.
- 3.6.5.2 The valves must be attached by means of bolts to a steel pad with blind tapped bolt holes which has been welded directly to the ship's hull or sea chest. If a valve cannot be fitted directly to the hull or sea chest, extensions approved by TCMS must be installed between the valve and the steel pad. The extension piece must be as short as possible and must be connected only to the valve and the pad.
- 3.6.5.3 Sea isolation valves must be high lift globe type. High lift angle valves may be used if it is impossible to install straight globe valves. The minimum size of fasteners used on the sea side of isolation valves must be 19 mm (3/4 in.). Bolts must be made of phosphor bronze alloy; category B1 or B2 in accordance with standard ANSI/ASTM B139-79.
- 3.6.5.4 When a pump having direct sea suction, is located in a compartment remote from its sea isolating valve, another isolating valve must be located in the pump compartment.

3.7 Machinery Instrumentation

3.7.1 Pressure and Suction gauges

- 3.7.1.1 Unless otherwise indicated, only 4½ inch (115 mm) pressure gauges (or larger) must be used for instruments.
- 3.7.1.2 All pressure gauges for which the pressure exceeds 1,000 lb/in.² (7,000 kPa) or those used with compressible fluids must be safety gauges with back blow outs.

- 3.7.1.3 All gauge lines must be equipped with a capped test tee. All gauges must be equipped with a needle type isolation valve. Pulsation dampers must be fitted to keep gauge pulsations below 5% of full scale. The pressure gauge reading must be at half or two-thirds of its range respectively for fluctuating or steady state working pressures.
- 3.7.1.4 All pumps must be equipped with a suction compound gauge and a discharge pressure gauge.
- 3.7.1.5 All refrigeration compressors must be provided with suction and discharge pressure gauges, and “Schroeder” valves must be fitted at the gauge lines to allow portable refrigeration gauge manifolds to be connected.
- 3.7.1.6 All measurements for new pressure gauges must be in imperial (lb/in.²) and metric (kPa or bar) units. Dial faces must be white with black lettering, and the pointer must be of the micrometer adjustable type. Gauge movements must be in stainless steel with stainless steel over-pressure and under-pressure stops. Bourdon tubes must be in bronze or stainless steel (316), with brass or stainless steel sockets (316). The accuracy of the pressure gauge must be $\pm 0.5\%$ of scale range, in accordance with standard ASME B40.1, Grade 2A. Pressure gauges must be filled with glycerine or silicone according to ambient temperature requirements or severity of vibration expected.
- 3.7.2 Thermometers
- 3.7.2.1 Unless otherwise indicated, all thermometers must be standard 229mm (9 in.) scale thermometers with a universal adjustable angle stem, a cast aluminum enclosure with cured polyester powder coating, clear window and removable brass thermos well. Thermometers must be fitted with an acrylic window to withstand temperatures to 149°C (300°F) or double plated safety glass for temperatures greater than 149°C (300°F).
- 3.7.2.2 All thermometers must be housed in 304 or 316 stainless steel thermos well to permit removal of the thermometer without interfering with operation of the equipment. The thermometer and thermos well must enter at least $\frac{1}{2}$ the pipe diameter in the measured process. When thermometers are installed in insulated

pipes, longer stem thermometers with thermos wells with a removable extension collar must be used. The extension collar must be at least 50mm (2 in.) long.

3.7.2.3 Thermometers which measure air temperature must be fitted with a perforated guard stem and a mounting flange instead of a removable brass thermos well.

3.7.2.4 All thermometers must be filled with red alcohol. Range selection for thermometers must be such that the operating temperature of the measured process will fall approximately mid-scale. The scale face must be white with black numbering and must include graduations in degrees Fahrenheit and degrees Celsius. The accuracy of the thermometer must be ± 1 scale division.

3.8 Equipment Bases

3.8.1 Steel bases must be fitted for all motors, machinery, pumps and for all new/relocated equipment. Base scantlings must be of adequate strength and thickness and must be approved by TCMS, where required. Additional stiffening must be fitted where required to distribute loads and reduce vibrations.

3.8.2 Drip trays/save-alls must be installed around any hydraulic system and pumps installed as outlined in this Specification package.

3.8.3 An insulator must be installed between ferrous and non-ferrous materials or equipment.

3.9 Anti-Vibration Mounts for Equipment

3.9.1 Anticipated motions of the vessel are described in Section 2.1 of this Specification package. Anti-vibration mounts must provide between 75% to 85% isolation of all equipment generated vibration to the hull structure.

3.9.2 Vibration mounts must be fitted with a shock-proof device with resilient stop to withstand up to 5g acceleration. Metal parts of the vibration mounts must be protected against corrosion with Fe/Zn 8C in accordance with standard 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 Structure

3.10.1 The structural integrity of the hull must be maintained and any questions about its integrity must be referred to TCMS for resolution.

- 3.10.2 All welding must be performed in accordance with the requirements CWB Welding Standard and/or the Classification Society Rules, whichever is more stringent.
- 3.10.3 For 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 followed:
- a) the Contractor must prepare and submit a CWB engineer approved welding scheduled for approval by TCMS;
 - b) All insert on shell plating must be flush;
 - c) All underwater inserts must be subjected to a complete X-ray inspection after completion of the work;
 - d) New and existing tanks, as well as cofferdams and void spaces, where inserts have been fitted must hydrostatically tested to a head of water of 2.5 meters. These tests must be recorded and carried out in the presence of TCMS and the Inspection Authority;
 - e) The location of any new insert plates must be recorded on the vessel's Shell Expansion Drawing.

4.0 ELECTRONIC AND ELECTRICAL CHARACTERISTICS

4.1 General

- 4.1.1 The requirements specified in this section apply to all electrical work. Electrical modifications made to the vessel must comply with current regulations, in particular standards TP 127E and IEEE 45 with the approval by TCMS.
- 4.1.2 All electrical/electronic equipment, fittings and fixtures temporarily removed to allow the necessary clearance to perform work must be reinstalled in its original position, securely attached and all areas must be restored to their original condition.
- 4.1.3 Unless otherwise stated, equipment provided by the contractor must conform to the requirements of IP56 (IEC 60529) and Section 2.1 of this Specification package.
- 4.1.4 The Contractor must refer to Section 6 for documentation requirements relating to 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 paint overspray throughout the duration of the contract.
- 4.1.6 The Contractor must remove all electronic equipment from compartments in which hot work will be performed. If equipment cannot be removed, the Contractor must obtain the approval of the Technical Authority and must ensure that the equipment is protected from hot work by-products and damage.

4.2 New Electric Motors

- 4.2.1 If new electrical motors are to be installed, these motors must be of commercial marine quality and comply with all regulatory requirements. Motor enclosures for installations must comply with standard IEC 60529.
www.nema.org/Standards/.../ANSI-IEC-60529.pdf
- 4.2.2 All motor windings must be sealed with Class F insulating material, resistant to oil and water. Motors must operate in an ambient temperature of 50°C when installed inside machinery spaces and 40°C when installed on enclosed decks. For motors operating on an open deck, the low ambient temperature must be considered as -40°C. Temperature increases, as measured by a thermometer after an 8 hour heat test, must not exceed those stated in TCMS TP 127E, Class B.

- 4.2.3 All AC motors rated in excess of 0.37 kW (1/2 hp) must be squirrel cage induction motors, designed for continuous operation and able to achieve design parameters with 460 Volt, 60 Hz, 3 phase power supply, unless otherwise specified. Induction motors with a rated power less than or equal to 0.37 kW may be designed for operation on 120 Volts, single phase power supply. Before placing an order, the TA's approval must first be obtained.
- 4.2.4 Induction motors must be selected to ensure that each motor is not too large for the intended service, avoiding a low power factor inherent to under-loaded induction motors. Before placing an order, the TA's approval must first be obtained.
- 4.2.5 Motors of 0.18 kW (1/4 hp) or greater must be equipped with anti-friction bearings designed to withstand the imposed thrust and radial loads. Where motors are used with solid couplings, a thrust bearing must be fitted to the housing at the end of the shaft, and shaft endplay limited to the clearance in the bearing. Tandem ball bearings must not be used for axial thrust loads.
- 4.2.6 When anti-friction ball bearings are required for rotating electrical machinery, they must be pre-lubricated & sealed type, unless otherwise specified.
- 4.2.7 Before purchasing new motors, the Contractor must provide all technical specifications/data of the motors to the IA in order to confirm compatibility for the intended use.

4.3 Nameplates for electrical equipment

- 4.3.1 All electrical equipment must be fitted with nameplates and comply with the general instructions of Section 2.9.2. Each nameplate must identify the piece of equipment, the manufacturer's name, the type, the serial number, the model number, the rating and the date of manufacture.
- 4.3.2 All special precautions, maintenance or operating instructions must be listed on the nameplate or on a separate panel affixed to the equipment.
- 4.3.3 All electrical equipment that operates on dangerous voltages and the compartments where they are located must have a warning notice identifying the danger and must specify the system's maximum voltage.
- 4.3.4 Distribution panels (switchboards) must be fitted with nameplates containing the following information:
- Name of switchboard;

- Manufacturer;
- Serial number (if applicable);
- Date of manufacture.

4.3.5 Each circuit breaker must have a nameplate indicating the name and designation of the circuit and the setting of the breaker. The Contractor must correctly indicate the name and function of each instrument, switch, etc., on the switchboard, as well as indicated the full load value or normal operating value with a red line.

4.3.6 Distribution panels must be provided with nameplates indicating:

- The space, service, device or circuits controlled and the feeder designation.

4.3.7 Inside, switchboards, distribution panels, and motor controllers must have nameplates identifying bus bars and terminals. Bus bar must have phases identified by colour coding.

4.3.8 Electrical enclosures where several electrical or electronic equipment or devices are housed must have a unique identification code for each device, and each device must be labelled accordingly. Mechanical layout drawings of the enclosures must clearly show the layout and identification codes of the devices within the enclosure.

4.3.9 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 order from left to right and from top to bottom.

4.3.10 Nameplate size and other characteristics must comply with Section 2.9.

4.4 Cables

4.4.1 All cables must comply with TP127E, be manufactured, tested and installed in accordance with the latest TCMS publication, IEEE and the Classification Society requirements.

4.4.2 The Contractor must produce a schematic or update the single line schematic showing all new electrical cables which must be installed and all existing cables which must be reused. For each cable, the following elements must be shown:

- Conductor size;
- Current rating;
- Estimated length;
- Identification number and name of manufacturer;

- Approximate weight;
 - Voltage drop;
 - Insulation level (voltage);
 - Insulation type designation and maximum allowable temperature.
- 4.4.3 This schematic must be submitted to the Technical Authority for review and approval 2 working days before installing or removing any cables. The schematic may be submitted in sections as the detailed design develops.
- 4.4.4 New cables must not be spliced. Splicing in existing cables of 600 VAC or less, may be permitted with prior permission from TMCS providing splices are performed in accordance with TP 127E.
- 4.4.5 Coaxial cables for radio frequencies must not be spliced. In-line connectors must not be used in such cables, except to terminate the cable. All cable and wire terminations must be in accordance with TP 127E.
- 4.4.6 Where cables penetrate drip proof or watertight compartments, motors or other sheltered or sealed equipment, TCMS approved glands and/or strain relief devices must be used. Cables entering into sheltered compartments must be from the bottom or the side. Where cables penetrate the side of an enclosure, they must be routed downward of the compartment before running in an upward direction.
- 4.4.7 Cables must be concealed, except in machinery spaces, workshops and store rooms. The location of the cable runs, connection boxes, hangars/supports, concealed by paneling or linings, must be clearly indicated on the “As Fitted” drawings. Concealed connection boxes must indicate the circuit designation, stamped or painted on a part of the box that cannot be dismantled.
- 4.4.8 Adhesive or permanently printed plastic identification labels for individual cables and conductors can be used inside equipment cubicles and equipment racks.
- 4.4.9 All conductor identification markings and cable labels 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 designation and location of each end;
 - d) Conductor identification markings must be secured to the conductors to prevent them from becoming disassociated from the conductor when it is connected to a device.

- 4.4.10 Spare conductors within a cable must not be stripped back or shortened and must be tied back, and appropriately labelled as spare. Control cables and cables used for the alarm and monitoring system must contain a minimum of 10% spare conductors. Shielded control cables 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.
- 4.4.11 Low-loss coaxial cables of appropriate impedance must be used for coaxial antenna feeders.

4.5 Cable Separation

- 4.5.1 The Contractor must refer to Figure 4-1, indicating the physical separation which must be maintained between the 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 approved by TCMS and the Technical Authority and all related documentation of approved deviations must be forwarded to the Inspection Authority.
- 4.5.2 Cables must be grouped according to their categories indicated in Figure 4-1 and must comply with the following instructions:
- Cables of groups A to E inclusive may be grouped with cables from the same group and share a common cable tray with the remaining groups;
 - Grouping of cables of groups F to K inclusively is not authorized unless otherwise advised by the Inspection Authority. In this case, additional separation material must be provided and installed to the Inspection Authority's satisfaction;
 - Cables of groups F to K must use separate cable trays wherever possible, unless otherwise advised by the Inspection Authority.

Figure 4-1: Recommended cable separation (in inches)

Cable group	Cable group classification	Recommended separation (in inches) between cable groups									
		A	B	C	D	E	F	G	H	J	K
A	Ship lighting and electrical power supply	–	4	2	2	4	12	18	18	18	18
B	Receiving antenna cables	4	–	4	2	2	12	18	18	18	18

Cable group	Cable group classification	Recommended separation (in inches) between cable groups									
		A	B	C	D	E	F	G	H	J	K
C	Electrical control cables	2	4	–	2	4	12	18	18	18	18
D	TV and VHF antenna distribution cables	2	2	2	–	2	12	18	18	18	18
E	Telephone and 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	Antenna/transmitter coupler feed cables	18	18	18	18	18	18	–	18	18	18
H	Coupler and 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	–

4.6 Circuit breakers

- 4.6.1 Circuit 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.
- 4.6.2 All circuit breakers must be rated for their application taking into account voltage, current, trip value, and the number of poles.
- 4.6.3 Circuit breakers must be calibrated at 50°C.
- 4.6.4 Circuit breakers must be suitable for marine use, meeting the following criteria:
- They must be provided with a moulded enclosure;
 - They must be designed for a nominal voltage of 600 VAC, 240 VAC or 120 VAC;
 - They must be quick closing and opening;
 - They must have overcurrent inverse-time characteristics;
 - They must have an overload device for each phase.

4.7 Bulkhead/Tabletop Mounting

- 4.7.1 Equipment mounted on bulkheads must be attached directly or indirectly to the ship's structure. Under no circumstances must any equipment be supported on lining panels or ceiling panels.
- 4.7.2 Mounting equipment on tables is acceptable, but the use of window sills must be avoided, unless approved by the TA. Standard manufacturers' mounting accessories must be used wherever possible. All mounted equipment must be oriented to best serve the operator.
- 4.7.3 Enclosures of all equipment mounted on bulkheads or tables must be grounded to the ship's metal structure.

5.0 DOCUMENTS

All documents provided by the Contractor must become the property of Canada. This also includes all electronic media. Electronic media must not be protected to prevent making additional copies for internal use. Unless otherwise indicated by the TA, all documents provided by the Contractor, as indicated in this section, must be submitted in both official languages (French and English) to the TA and the IA.

5.1 Drawings

5.1.1 General

- 5.1.1.1 The Contractor must provide all drawings & diagrams necessary for the design and execution of work on the new or modified systems, including drawings & technical manuals produced by the manufacturers or the subcontractors.
- 5.1.1.2 All new drawings must be submitted as individual files in DWG format (AutoCAD Version 2013). The files must be provided to the TA on a USB key, clearly identified with the title and number of the project.
- 5.1.1.3 The drawings must provide a complete and detailed visualization of all new or modified systems (Electrical & mechanical). The drawings must include all the information so that a qualified technician can conduct a quick, complete and specific search in case of malfunction or for any other reasons.

Generally, the drawings must include or describe all of the following elements:

- a) Detailed cover page and index;
 - b) Abbreviations and symbols used;
 - c) Identification and specification of equipment;
 - d) Location, physical representation and mechanical dimension;
 - e) Block diagrams, overview of the systems;
 - f) Electrical circuits: Controls, power, cables and wiring;
 - g) All other references or details required to understand the system
- 5.1.1.4 It is the responsibility of the Contractor to update or redraw all original vessel drawings affected by the modernization project. Changes made to the old drawings must be denoted in a different colour or style. If more than 50% of an original diagram is changed, the diagram must be redrawn in full, in DWG (AutoCAD)

format. Although some original diagrams are kept in a series, this should not prevent all drawings from being homogenous in presentation, numbering and method of interpretation.

5.1.1.5 The Contractor must have an effective method to produce and update drawings throughout the work period. The Contractor must maintain an up-to-date list of drawings & revisions, and must provide this list to the TA at the monthly progress meeting. This list must include a column of all drawings sent to TCMS for approval.

5.1.1.6 The Contractor must provide the Inspection Authority and Technical Authority all drawings required by or generated by subcontractors.

5.1.1.7 A final version of the "As Fitted" drawings must be approved by the IA and TA, and provided at the end of the project. DWG (AutoCAD) files must not be electronically protected, and the CCG must be able to modify all elements as needed in any future changes.

5.1.2 Conceptual design drawings

5.1.2.1 The Canadian Coast Guard provides all technical reference drawings to the Contractor for reference purposes only. The Contractor must produce working drawings and ensure that all of these drawings receive relevant regulatory approval. The Contractor must note that the reference drawings provided are not all "As Fitted" drawings. The Contractor must physically verify each element affected, as well as all dimensions required for the work.

5.1.3 Working drawings

5.1.3.1 The Contractor must prepare the details of the project working drawings in accordance with the requirements of the regulatory agency. All changes must be included in the revisions of working drawings.

5.1.3.2 Working drawings must clearly indicate the materials or equipment being supplied, all construction details, precise dimensions, capacity, operating characteristics and performance. Each working drawing must include a unique identification

number, and blocks of numbers must be used to identify the various elements of the specification items. When multiple working drawings are required, each drawing must indicate the total number of sheets within the series.

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

5.1.3.4 The Contractor must verify all working drawings and indicating:

- a) The drawing's compliance with all specification requirements has been verified;
- b) The equipment has been coordinated with the other equipment to which it is attached or connected;
- c) All dimensions have been verified to ensure the correct installation of equipment within the available space.

5.1.4 Working drawings – Submission for Review by PWGSC and CCG for review

5.1.4.1 The Contractor must submit to the TA and IA by email with the CA cc'd, or other electronic means the working drawings, shop drawings and schedules required for the work. The TA may request up to three paper copies of these drawings. Drawings must be submitted at least 10 business days before the start of the work for the affected drawings. The IA and TA must verify specification compliance and, as needed, share their comments with the Contractor within five business days. The Contractor must make all necessary amendments and return and return the revised version of the drawing, with revision dates and revision numbers, to the TA, in the following two working days.

5.1.4.2 Reviewed drawings must not be modified in any way without written authorization from the Technical Authority. In the event of subsequent revisions to drawings already reviewed the entire drawing (all sheets, revised or not) must be resubmitted for review.

5.1.4.3 Space must be provided on the working drawings for review dates and signatures of the Inspection Authority and the Technical Authority.

- 5.1.4.4 Drawings submitted for review, unless otherwise specified, must be in the form of original drawings. Printed manufacturer's data sheets for standard components are acceptable as long as the pertinent characteristics are identified and relate to specified items.
- 5.1.5 Working drawings – Submission for TCMS approval
- 5.1.5.1 The Contractor must submit to TCMS copies, as necessary, of working drawings, ship drawings and/or layout drawings, schedules and calculations required for approval by TCMS.
- 5.1.5.2 The Contractor is responsible for ensuring that working drawings are approved by TCMS before beginning work on any section of these specifications that must be approved by TCMS.
- 5.1.5.3 Space must be provided on all 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.
- 5.1.5.4 The Contractor must communicate with the respective TCMS approval office to determine the quantities and types of materials required for approval purposes.
- 5.1.5.5 The Contractor must submit one copy of the original stamped drawing and three copies of all TCMS approved drawings to the Technical Authority.
- 5.1.5.6 The Contractor must provide the Technical Authority with a USB KEY containing all TCMS approved drawings in PDF format.
- 5.1.6 "As Fitted" drawings
- 5.1.6.1 Upon completion of 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 drawings must become the "As fitted" drawings for the project work.
- 5.1.6.2 After acceptance of the ship, the Contractor must provide the following:
- a) one copy on ANSI standard paper of the latest revision of each of the "As Fitted" drawings;
 - b) the latest revision of each "As Fitted" drawing, in AutoCAD 2013 DWG format, containing a detailed, up-to-date, MS Excel-format list of the files for each USB KEY;

c) All drawings must become the property of the Government of Canada.

5.1.6.3 If no AutoCAD drawing files are produced then scanned files (raster format) must be supplied to the Technical Authority in PDF format.

5.1.6.4 The "As Fitted" drawings must be delivered within 15 days after completion of the sea trials.

5.1.7 Framed drawings

5.1.7.1 The following drawings, modified as "As Fitted" drawings, must be printed, framed and mounted on board the ship at the locations designated by the Technical Authority:

- General Arrangement Drawings, plan view of all decks and profile view;
- Capacity plan;
- Fire Fighting Systems and Life Saving Equipment.

5.2 Manuals and Registers

5.2.1 General

5.2.1.1 Instruction Manuals and Registers must be bound in a hardcover three-ring, D-ring binder with positive locking mechanisms capable of holding 8 1/2" by 11" sheets. Larger drawings and documents must be concertina folded to suit. The following information must be printed on the cover:

- CCGS Des Groseilliers – Vessel Life Extension;
- Specification identification number and contract number;
- Identification of equipment or systems;
- equipment manufacturer;
- Revision number and date.

5.2.1.2 All sections of the manuals must be equipped with plastic tabbed indices. Major equipment components must be subdivided into separate sections in the manuals.

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

5.2.1.4 A list of names, addresses and telephone numbers of contacts associated with equipment manufacturers must accompany the

document for consultation after the completion of the project for maintenance and information data purposes.

5.2.1.5 A copy of the final and approved "As Fitted" drawings must be included in the maintenance manual.

5.2.1.6 The Contractor must provide the Technical Authority with two paper copies of all manuals and data sheets in English and in French (1 copy each) for the equipment components supplied by the Contractor prior to the completion of the contract.

5.2.1.7 The Contractor must submit two copies of all manuals and data sheets to the Technical Authority on individual USB KEYS in PDF format, prior to the completion of the contract.

5.2.2 Operating manuals – "As Fitted"

5.2.2.1 The operating manuals must include the following:

- a) A general description of the equipment's operating sequence in English and French;
- b) A detailed equipment start-up procedure in English and French;
- c) Schematic wiring diagram for the fitted equipment;
- d) All pertinent equipment performance criteria;
- e) When systems are accompanied by software or hardware, a user manual must include the following:
 - Full software documentation manual for the system, in digital format, such that Canada may revise the programs without recourse to the Contractor.
 - The minimum software documentation must include:
 - i. System level diagrams describing the overall scheme of the software/hardware system;
- f) The functional specifications describing in detail the functional capabilities of the system and of each software component;
- g) The list of project-specific programs, including all comments describing the particularities of the code functions;
- h) All listings, files, manuals and associated documentation material must be delivered to and become property of Canada.

5.2.2.2 The Contractor must supply the number of paper copies and electronic copies of the operating manuals as indicated in the section 6.2.1 above.

5.2.3 Maintenance manuals – "As Fitted"

5.2.3.1 These manuals must include the following:

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

5.2.3.2 The Contractor must supply the number of paper copies and electronic copies of the maintenance manuals as indicated in the section 6.2.1 above.

5.2.4 Tests/Trials and Inspections Registers

5.2.4.1 Tests, trials, calibration values, measurements, readings and inspections must be clearly presented in tabular form, with two hard copies provided to Canadian Coast Guard Technical Services: one to the Chief Engineer and one to the Technical Authority. This report must be submitted in PDF format. It must be divided by specification number, with page numbers and dates. Tests, trials and inspections must be performed to the satisfaction of the CCG Inspection Authority and the Transport Canada inspector before the end of the contract. This requirement must in no event abrogate the obligation to provide, in the shortest time possible, a hard copy of the measurements and test results to the Inspection Authority, to be assessed and evaluated in regards to the expectations towards the Contractor.

5.2.4.2 The Contractor must prepare a separate binder, laid out according to Section 6.2.1, to assemble all tests, trials and inspections. The binder must be indexed for each test, trial and inspection conducted.

5.2.4.3 The Contractor must maintain a complete and accurate register of all tests, trials and inspections conducted during the work. This must include tests, trials and inspections conducted at subcontractors' facilities. These registers must include all relevant documentation, test procedures, associated test sheets, including shop test data, trial and inspection data, as well as observation results.

5.2.4.4 The originals of tests, trials and inspections registers must be signed by TCMS, the Contractor and where applicable, the subcontractor and/or Field Service Representative who witnessed the tests.

5.2.4.5 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 tests performed. All copies of the documents must be dated and signed by the TCMS inspector present and by the Contractor.

5.2.5 Certificate Register

5.2.5.1 The Contractor must prepare a separate binder, arranged as per section 6.2.1 above, for the documentation of all Certificate records. The binder must be indexed for each element or piece of equipment for which Certificate records are available.

5.2.5.2 The Contractor must maintain a complete and accurate register of all certificate records for the work performed. Certificates records must be up-to-date and correspond to the type of equipment installed by the Contractor. When certificates of approval from a Classification Society are required, the Contractor must ensure that they are inserted within the Certificate register binder. When manufacturers provide equipment certificates in operating manuals, copies of these certificates must also be indexed in the Certificate register binder. The Contractor must also obtain and index all certificates issued by its subcontractors.

5.2.5.3 The Contractor must provide the number of paper copies and electronic copies of the tests, trials and inspection records as set out in section 6.2.1.

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

5.3 Photographs and Images - General

5.3.1 Initial photographs and images

- 5.3.1.1 The Contractor must hire a professional photographer to take a minimum of a 1,000 different high-resolution, JPEG-format, digital images (8 megapixel minimum), a video, or a combination of both. Images must be stored on a USB KEY. The Inspection Authority and/or the Technical Authority must be present for all photographs taken. The entire ship must be photographed with sufficient detail to identify specific parts and/or components.
 - 5.3.1.2 The Contractor must meet this requirement in conjunction with Section 1.10 of this Specification package and the conditions for custody of the ship in Appendix I of the contract.
 - 5.3.1.3 The Contractor must provide two (2) copies of all initial digital images in JPEG format on individual USB KEYS to the Inspection Authority and the Technical Authority at the first progress meeting, after the delivery of the vessel to the Contractor's facilities.
- 5.3.2 Progress photographs/images
 - 5.3.2.1 The Contractor must provide high-resolution, JPEG-format digital images (8 megapixel minimum), on USB KEY, of work progress during each phase of the project. Photography must begin at the start of work on the ship, and continue for the duration of the work.
 - 5.3.2.2 The Contractor must take sufficient photos during the work period in order to ensure that an adequate record of work progress is captured. The date on which the photograph was taken must be automatically recorded for all images.
 - 5.3.2.3 At the monthly progress meetings, the Contractor must provide (2) copies of all progress photographs in JPEG format on USB KEYS to the Inspection Authority and the Technical Authority.

6.0 TESTS, DOCK TRIALS AND SEA TRIALS

6.1 General Requirements

- 6.1.1 The Contractor must demonstrate that the completed work and equipment comply with the performance requirements described in this Specification package or those of the equipment suppliers. The Contractor must develop test and trial procedures, and must conduct all tests and trials required by this Specification package, by manufacturers or by regulatory bodies in order to obtain all appropriate certificates required for the ship. 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.
- 6.1.2 The Contractor must prepare the trials schedule showing dates, sequence, procedures and duration of each trial or set of trials. This schedule, including the proposed trial record sheets for all trials, must be submitted to the Technical Authority and the Inspection Authority for review and approval 20 business days prior to the start of any tests and trials.
- 6.1.3 The Contractor must coordinate the testing schedule with Transport Canada Marine Safety (TCMS) and Health Canada (HC) to ensure their participation, where applicable. The Contractor must ensure the availability of a Field Service Representative (FSR) or obtain written authorization from the manufacturer before initial start-up of the installed or modified equipment.
- 6.1.4 The Inspection Authority must be present for all tests, as well as the TCMS, FSR or subcontractors, where applicable.
- 6.1.5 Tests must follow the recommended procedures described below. Any defects must be corrected to the satisfaction of the Inspection Authority, TCMS and the attending FSR on. Once defects are corrected, the tests and trials must be repeated to the satisfaction of the Inspection Authority, and where necessary TCMS.
- 6.1.6 Upon completion of each specification item, the Contractor must notify the IA and TCSM (as required) so they can inspect the work prior to final acceptance of each specification item or reassembly of equipment/components. Failure to notify the IA does not absolve the Contractor from its responsibility to provide the opportunity to inspect any completed item in accordance with regulatory and contract requirements.

- 6.1.7 Inspections completed by the Inspection Authority do not in any way, replace those inspections required by TCMS and/or HC.
- 6.1.8 Shop testing, dock and sea trials must be to the standards required by TCMS. Where TCMS has no requirements for shop test procedures, the Contractor must adhere to SNAME guidelines as referenced in section 1.4 of this Specification package. The minimum standard for all electrical dock and sea trial must comply with TCMS, TP127E and IEEE 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.
- 6.1.9 Mechanical and piping systems must be tested in accordance with Section 7.2.
- 6.1.10 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 a system. As a minimum, the Inspection Authority must be notified when any components are being hydrostatically tested.
- 6.1.11 The Contractor must provide the Technical Authority with a complete list of disturbed services and ship's 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 Technical Authority twenty (20) working days prior to the testing of these systems.
- 6.1.12 The Contractor must make reference to Section 5.2.4 with respect to documentation requirements for tests, trials and inspection registers.

6.2 Mechanical and Piping Systems

- 6.2.1 All piping systems and sub-assemblies 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 onboard the ship.
- 6.2.2 Machinery and equipment must not be exposed to pressures higher than the 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. Where there 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 may be damaged by excessive pressure must be removed or otherwise protected during hydrostatic testing.

- 6.2.3 For tests, calibrated pressure gauges must be installed at the connections provided in the gauge piping for this purpose. During the tests, readings of installed gauges must be checked with the calibrated test gauges. Installed pressure gauges must be adjusted where necessary, to indicate the correct pressure. The Contractor must provide all calibration certificates for all instrumentation used for the testing of systems to the Inspection Authority and Technical Authority.
- 6.2.4 When the duration of a pressure test is not specified, the test pressure must be maintained for a sufficient length of time to permit a thorough examination of the system for leaks, to the satisfaction of the Inspection Authority.
- 6.2.5 Relief and safety valves and all other components installed to limit the operating pressure of a system must be removed, blanked, or bypassed where necessary, in order to build up the required pressure for the test. After a system has satisfactorily passed these tests, all components previously removed must be reinstalled and tested under pressure to ensure they are operating at their approved set pressures. Set pressures, as indicated on identification plates of these components must conform to the approved set pressures.
- 6.2.6 All components required for the safe operation of the system must be examined and adjusted during the operating tests to demonstrate that they comply with the requirements specified and approved for the system. Operating testing must demonstrate that the design and installation of the piping adequately meets the service requirements.
- 6.2.7 Components, such as spring clamps, must be adjusted where necessary. 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.
- 6.2.8 Where pumps or ejectors have suctions from tanks or compartments, the operating test must demonstrate the system's ability to remove the service liquid down to the level of the open end of the suction line.

- 6.2.9 Open systems such as vent lines, overflows and deck drains must be tested for unobstructed flow. This test must be conducted using a compressed air or water not exceeding 690 kPa (100 psi). Manual pump systems, portable drainage facilities and other various systems must undergo an operating test, as well as the specified pressure test. Pressure tests must precede operating testing.
- 6.2.10 All systems must undergo visual inspection and must be leak free during the specified tests.
- 6.2.11 All pressure and operating tests must be completed before system trials.
- 6.2.12 Where tanks have been opened for the purpose of conducting work, they must be cleared, cleaned and inspected by the Inspection Authority prior to being closed. Failure to notify the Inspection Authority does not absolve the Contractor of its responsibility of providing the opportunity to inspect any completed items.
- 6.2.13 Inspections completed by the Inspection Authority do not in any way, replace those inspections required by TCMS.
- 6.2.14 Upon completion of the inspection, new gaskets must be installed on all tank covers prior to closing. The Contractor is responsible for producing a register using an MS Excel spreadsheet, containing the signatures of those responsible for each inspection of each task to be inspected in the tanks. This register must include signature spaces for the Inspection Authority (CCG), TCMS inspector and the Contractor responsible representative attesting that all work and inspections have been completed.
- 6.2.15 Where work has been conducted in or on any structural part of a tank, that tank must be subjected to a hydrostatic pressure test at a water column height of 8 ft. (2.5 m). The hydrostatic pressure test must be witnessed by the Inspection Authority and TCMS. Hydrostatic pressure tests must be documented as per section 6.2 of this Specification package.

6.3 Ship Performance Sea Trials

- 6.3.1 In addition to dock trials commissioning tests of individual ship's systems specified with in this Specification package, the Contractor must perform a full set of sea trials in accordance with the "Guide for Sea Trials" as published by SNAME. 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 Technical Authority for review and approval 20 days before the start of sea trials.

- 6.3.2 After the refloating of the ship and once all the work in this Specification package has been completed, sea trials of a minimum of 8 hours must be performed. The Contractor must also provide an hourly rate, in its bid, permitting the price of these trials to be adjusted (up or down) in order to ensure they meet the regulation requirements of this Specification package.
- 6.3.3 The sea trials must be completed over the course of one day. The Contractor must provide four shipyard personnel, including one supervisor, for the duration of the trials in order to make all necessary adjustments.
- 6.3.4 Where necessary, the Contractor must organize and assume all docking costs associated with the sea trials. The Contractor must provide the necessary resources required for handling the ship's mooring lines and any tugs required for the ship's departure from and return to the dock.

7.0 BERTHING, MOORING, DRY-DOCKING AND REFLOATING

7.1 Berthing and Mooring

- 7.1.1 The Contractor must provide all materials and labour required to manoeuvre, dry-dock, and fit out a ship as identified in Section 1.2 this Specification package. Details of the berthing and mooring facilities must be included in the Bidder's proposal.
- 7.1.2 The Contractor must be responsible for docking and mooring of the ship for the duration of the contract period. The Government of Canada must have free access to the ship at all times.
- 7.1.3 The ship must be located at the Contractor's facilities for the duration of the contract.
- 7.1.4 The depth of water must be sufficient to prevent the ship from touching bottom during 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.
- 7.1.5 The Contractor must supply all mooring lines and labour required for docking/undocking, mooring, dock trials, refloating of the ship and casting off of the vessel. The Contractor may use the ship's mooring lines to tie up the vessel upon arrival, but must be immediately replace these and remove the vessel's lines to storage.
- 7.1.6 The Contractor must supply all material and labour required to dock and undock the vessel including any vessel movements, provisions for tugs, and line handling personnel.
- 7.1.7 The Contractor must supply and install a gangway fitted with a safety net in compliance with the Canada Labour Code for as long as the ship is docked at/in its facilities. The Contractor is responsible for the safety of the gangway.

7.2 General

7.2.1 Platforms

- 7.2.1.1 The Contractor must supply the labour and material for the erection of access platforms required to execute the work specified in this Specification package and any additional agreed upon work. Upon completion of the work, the platforms will be disassembled and removed from the ship. The Contractor must include the cost of these preparations must in its bid.

7.2.2 Equipment

- 7.2.2.1 The Contractor's bid must include costs for transportation services, installation of gangways and ropes, cramage and removal and reinstallation of parts and equipment required for the work.

7.2.3 Hot Work

- 7.2.3.1 The Contractor must supply the appropriate type and quantity of fire extinguishers including fire watches, required for all hot work until these surfaces and walls have cooled (see section 2.2.2). The ship's fire extinguishers must not be used except in emergency situations. If the Contractor must use one of the ship's fire extinguishers, it must be refilled and verified by an authorized company. The Contractor must supply fire-retardant protection to protect cable trays, cables, equipment and structure against slag and any hot work by-products.

- 7.2.3.2 For each day that hot work is planned, the Contractor must submit a hot work permit to the Inspection Authority ensuring that safety measures have been identified and will be applied. ~~If a permit is not available, the Contractor must alternatively submit a request to the Inspection Authority along with the safety measures planned.~~ The Contractor must maintain the fire watch (firefighter) where the hot work took place for up to 30 minutes after stopping.

7.2.4 Access and Cumbersome Items

- 7.2.4.1 The Contractor must remove any piping, inspection hole covers, components and equipment where necessary, in order to perform the work and access work spaces. Upon completion of the work, the Contractor must reinstall the removed items with new gaskets, collars, hardware and anti-seize compound to be supplied by the contractor.

7.2.5 Temporary Lighting and Ventilation

- 7.2.5.1 The Contractor must supply, install and maintain any temporary lighting and ventilation as required to carry out the work in this Specification package. Upon completion of the work, the Contractor must remove these items.

7.2.6 Cleanliness

- 7.2.6.1 The Contractor must ensure that all spaces, compartments and areas of the ship, both interior and exterior, are returned to their original state

(upon delivery of the ship). The cost of removing dust, debris and other materials must be included in the bid.

7.2.7 Certificates Issued by a Chemist

7.2.7.1 The Contractor must provide the Inspection Authority with certificates obtained from a marine chemist or other qualified person in accordance with TCMS Bulletin TP 3177E prior to conducting cleaning, painting or hot work in confined spaces or machinery compartments. These certificates must clearly indicate the type of work permitted and must be renewed in accordance with the regulations in effect. The Contractor must submit one copy to the Inspection Authority, must display one at the entrance of the affected work area.

7.2.8 Fixed Fire Detection and Extinguishing System (Sprinklers & CO₂)

7.2.8.1 Where work affects the ship's fire detection or extinguishing systems (sprinklers, CO₂), the Contractor must ensure that the ship and its occupants remain protected from any risk of fire. The Contractor may only remove or deactivate one section of these systems at a time, by installing replacement parts throughout the work or by any other means accepted by the IA.

7.2.9 Coatings

7.2.9.1 All types of coatings required must be applied in accordance with their manufacturer's instructions and specifications on surface preparation, ambient conditions, drying/curing time, time between each layer, thickness of layers and preparation of coatings.

7.2.10 Primer

7.2.10.1 Unless otherwise specified, any new or replaced steel surface or part must be covered with at least two coats, (2.0 mils dry), of Interprime 234 marine primer or equivalent. Unless otherwise specified, the primer must be supplied by the Contractor and the work must be accepted immediately upon completion by the IA. It is prohibited to use paint containing lead. All welds must be de-burred and cleaned before applying any primer.

7.2.11 Tools

7.2.11.1 Unless otherwise specified, the Contractor must supply all required tools needed to perform the work, with exception for some specialized tools that will be lent to the Contractor by the Technical Authority. Any tools

lent to the Contractor must be recorded and returned upon completion of the work.

7.2.12 Instructions

- 7.2.12.1 The overhaul and installation of all machinery and equipment specified herein must be carried out in accordance with the applicable manufacturer's instructions, drawings and specifications.

7.2.13 Workmanship

- 7.2.13.1 The Contractor must use qualified, certified and competent tradesmen and supervisors to ensure a high quality and standard of work in accordance with ship construction/building standards and to the satisfaction of the Inspection Authority.

7.2.14 Supervision

- 7.2.14.1 During all phases of the contract, the Contractor must supervise the work of its staff and subcontractors. Unless otherwise stipulated, personnel designated by the Inspection Authority will accompany the Contractor's employees at all times in accommodations and cabin spaces.

7.2.15 Smoking

- 7.2.15.1 The Public Service Smoking Policy forbids smoking aboard Government of Canada ships. The Contractor must inform and ensure its employees and subcontractors adhere to this policy.

7.2.16 Halocarbons Policy

- 7.2.16.1 A control policy for halocarbons used on CCG ships is in vigor. This policy is in Section 7.D.4 of the Fleet Safety and Security Manual. A copy is included in Appendix A on safety. The Contractor must ensure its employees and subcontractors respect this policy.

7.2.17 Disposal of Waste Oil and Hydrocarbons

- 7.2.17.1 The Contractor must dispose of all waste oil and hydrocarbons or assign the task to subcontractors holding the provincial licences required for disposal of petroleum products. Copies of these licences must be presented on request, and disposal of waste oil and hydrocarbons must be done in accordance with Canadian Coast Guard policy on handling of fuel, oil and waste oil, described in Chapter 7.C.1 of the Fleet Safety and Security Manual.

7.2.18 Waste Disposal

- 7.2.18.1 Disposal of waste generated by sandblasting and mechanical cleaning must be done by the Contractor while respecting provincial or municipal regulations, or by a subcontractor holding a licence from provincial authorities for the disposal of such material. Copies of these licences must be presented on request.

7.2.19 Standards

- 7.2.19.1 All work in this Specification package or, otherwise authorized, carried out aboard must respect Part 2 of the Canada Labour Code, the provincial regulations in effect, Maritime Occupational Health and Safety Regulations and the provisions of the Canadian Coast Guard Fleet Safety and Security Manual while the ship is in the custody of the CCG.

7.3 Dry Docking

7.3.1 Reference : Docking plan

- 7.3.2 The ship will be delivered to the entrance of the shipyard. The Contractor is responsible for docking the ship at the wharf adjacent to the dry dock, including the installation and removal of a gangway (Contractor supplied), regardless of the ship's arrival and departure times. This also applies to any docking/undocking as required for sea trials.
- 7.3.3 The Contractor must supply all labor, materials, equipment and resources necessary for handling the ship's mooring lines and tug assistance as required to perform the docking and refloating of the vessel, as well as any other movements required throughout the duration of the contract period. The Contractor must be responsible for any associated fee.
- 7.3.4 The Contractor must note that the ship will require a period of 24 hours, both before after dry docking, to allow for ballasting and fuel transfer operations necessary to obtain the desired trim of the vessel for dry docking.
- 7.3.5 The Contractor must supply a plan of the dry dock with its proposal. The plan must comply with the conditions imposed by the contract. The plan must include the date and time of foreseen entry/exit from the dry dock, as well as the availability of the adjacent wharf.

- 7.3.6 The particulars of the ship can be found in Section 1.2 of this Specification package. The Contractor's bid package must include proof that the docking facility is certified to dry dock the ship.
- 7.3.7 The stability books are included in the Technical Data Package provided to bidders.
- 7.3.8 A docking plan is available upon request to the Technical Authority.
- 7.3.9 The Contractor must supply all labour, materials and facilities necessary for dry docking and refloating the ship as required to conduct the work described in this Specification package.
- 7.3.10 The blocking plan will be provided to the shipyard by the TA during the first contractual meeting or before the ship arrives at the shipyard.
- 7.3.11 The new blocking plan must indicate the location of all keel blocks in relation to the respective frames to serve as a reference for the next dry docking, permitting work to continue on the hull in the areas covered by blocks during this dry docking.
- 7.3.12 The new blocking plan must be submitted to the TA and the IA for ~~approval~~ **consultation** before the Contractor prepares the dry dock.
- 7.3.13 Before the dry docking of the ship, the Contractor must arrange an inspection with the Inspection Authority to verify the blocks and their alignment. A report of the alignment readings must be submitted to the Inspection Authority.
- 7.3.14 The Contractor must prepare the blocks and any shoring required to maintain the true alignment of the ship's hull and machinery throughout the dry-docking period. The Contractor must dock and undock the ship and plan sufficient lay days to carry out the work described in this document, with a sufficient margin to perform unexpected work.
- 7.3.15 The Contractor must include in its bid, the total number of lay days and the unit cost per lay day.
- 7.3.16 The Contractor is responsible for recording all tank soundings, draft, trim and list of the ship, and must perform the stability calculations required for the dry-docking. These calculations must be forwarded to the Technical Authority and Inspection Authority two (2) business days prior to dry docking the vessel.
- 7.3.17 The ship must be blocked taking into consideration all docking plugs, transducers, anodes and sea inlet grids are clear and accessible. Blocks

supporting the keel and hull that prevent removal of the drain plugs from tanks will have to be moved.

- 7.3.18 The Contractor must not place blocks under the echo sounder transducer plates located between frames 138 and 140, port and starboard, nor under the Doppler sonar transducer plates located between frames 155 and 156.
- 7.3.19 There must be a minimum clearance of 1.3 m (4 ft.) under the keel.
- 7.3.20 In the event that hull fittings or foreseen work locations are covered, the Contractor must be responsible for all labour and equipment required for making alternative arrangements to drain tanks and/or move blocks to gain access to areas of specified work.
- 7.3.21 All misplaced blocks, not corresponding to the new blocking plan provided by the Contractor, must be moved at the Contractor's expense.
- 7.3.22 If the CCG requires other blocks to be moved for other reasons, the Contractor must provide a unit price for additional block displacement.
- 7.3.23 The Contractor must supply and install gangways compliant with the Canada Labour Code as long as the ship is in dry dock. The ship must be equipped with two separate and independent accesses at all times. One gangway must be installed at the front of the ship on the port or starboard side and the other must be installed at the aft of the ship on the opposite side of the forward gangway. The gangways must be safe and structurally adapted for the passage of the ship's crew and workers, in accordance with Section 2 of the Maritime Occupational Health and Safety Regulations. The gangways must be well lit at night. The gangways must be placed at both ends of the ship, in accordance with the Technical Authority's directives. The Contractor is responsible for the safety of the gangways.
- 7.3.24 Once the ship is properly resting on the blocks, the Contractor must immediately remove the ballast tank drain plugs and drain these tanks. The position of these plugs is indicated on the blocking plan.
- 7.3.25 The drain plugs must be clearly labelled as they are removed to insure they are reinstalled in their respective positions. Once the drain plugs have been removed, the Contractor must give them to the CCG Inspection Authority, who will be responsible for their storage.
- 7.3.26 The Contractor must install drain fittings to the various deck scuppers overboard drains if they interfere with the work in any way. The Contractor

must indicate a unit price for the installation of five (5) temporary drains for deck scuppers and overboard drains.

- 7.3.27 The Contractor must be responsible for the safe transfer of the ship to the berth or mooring location where it will stay until the dry docking. During dry docking, radio contact must be maintained between the ship's Commanding Officer or Inspection Authority and the Contractor's docking master. If necessary, the Contractor must include in its bid towing and/or pilotage and icebreaking services. All costs for rope handling and for the certified docking master are the Contractor's responsibility. The Contractor must provide and install a ground cable between the vessel and the dock while it is docked, as per TCMS Ship Safety Bulletin 6/89.
- 7.3.28 The Contractor must notify the CCG of all movement or refloating of the ship not required by this Specification package, seven days prior to the start of the operations. The Contractor must supply the CCG and PWGSC authorities with a plan of its intentions. The Contractor will be responsible for all costs associated with these decisions.
- 7.3.29 Within four hours of dry docking, the bottom of the ship's hull must be pressure washed (5000 psi minimum) with fresh water to remove any marine life/vegetation allowing for a preliminary hull inspection.

7.4 Numbering

- 7.4.1 The contractor must supply the necessary material and labour to temporarily number the hull frames and bulkheads to facilitate the external hull inspection. The shipyard will be responsible for keeping the frames numbered throughout the entire dry docking period until the ship is refloated.
- 7.4.2 Frames must be numbered on each side of the ship, at five-frame intervals, in conformity with the ship's construction drawings. Each number must be accompanied by a line 60 cm in height, on each side of the hull at bilge-level.

7.5 Undocking

- 7.5.1 Before refloating the ship, the Contractor must obtain the drain plugs from the GCC IA and install them in their respective locations using white lead and twine. The Contractor must verify the water tight integrity all tank drain plugs, including those that were not removed, by means of a vacuum box test. If the seal of a previously removed drain plug does not pass the vacuum box test, the Contractor must remove it and add a sealant ~~more Speed-Crete Blue Line 3700-~~

~~132 or equivalent~~ with twine and redo the test until proven watertight. The CCG IA must witness the tests.

- 7.5.2 Before refloating the ship, the Contractor must verify all grate fasteners for all sea chests, seawater intakes and hull openings to ensure that they are locked in place by welding.
- 7.5.3 Before undocking the ship, the Contractor must ensure that any protective covers and connections are removed. The Contractor must supply, install and remove, upon completion of work, all fittings and lugs required to perform the work indicated in this Specification package. Where the lugs and/or fittings are installed and removed, the welds must be ground flush with the hull. Any damaged or disturbed paint work must be performed in accordance with the instructions found in the paint section of these Specifications and of those of the paint manufacturer. Paint must be applied in accordance with the ship's colour and external marks diagram.
- 7.5.4 Before undocking the ship, the Contractor must ensure that all tanks are filled to obtain the same conditions as at docking. The Contractor is responsible for the safe refloating of the ship, taking into consideration any changes in stability resulting from the work carried out in these Specifications. The Contractor must perform the necessary stability calculations required to refloat the ship. These calculations must be submitted to the IA and TA for review, 48 hours prior to flooding the dry dock.
- 7.5.5 Prior to refloating the ship, the Contractor must clean the transducers using a mild soapy fresh water solution to eliminate any contaminants or fouling. The transducers must then be rinsed with fresh water to eliminate residual soap on their exterior surfaces.
- 7.5.6 The Contractor must ensure the safe undocking of the vessel and that no damage to the vessel will be incurred during the undocking process. The Contractor must have a sufficient number of personnel on board to respond in case of water ingress or other problems.
- 7.5.7 Prior to flooding the dry dock, the Contractor must ensure that all ship's side, including valves, are properly closed using a checklist.

7.6 Deliverables

- 7.6.1 The Contractor must prepare a new blocking plan, offsetting the blocks relative to the measurements indicated on the 2013 plan in order to permit

sandblasting of the hull and application of paint in those areas where the ship rested on keel blocks in 2013.

- 7.6.2 Prior to the ship's departure, the Contractor must provide the CCG TA with the documentation required to obtain a certificate of seaworthiness from TCMS.

8.0 SERVICES

8.1 GENERAL

- 8.1.1 The following services for which unit prices must be submitted, must be provided to the ship while it is at the Contractor's facilities. These prices must cover the entire work period. Unit prices for each service must also be submitted for adjustment purposes based on variations in the duration of services. Services identified with an asterisk (*) will be required both in dry dock and at the Contractor's wharf.
- 8.1.2 The Contractor must supply all equipment, tools and machinery required to perform the work as described in this Specification package. The Contractor cannot make execution of work conditional on provision of equipment or other machinery that is not already included in its firm price by the Government of Canada or by a subcontractor paid by the Government of Canada. Lifting equipment must be properly adapted and of sufficient capacity for its intended use. It must be accompanied by a valid certificate indicating its safe working load, or bare a permanent marking indicating its safe working load.
- 8.1.3 All welded supports or other mountings required in this section must be installed by welders certified by the Canadian Welding Bureau. Upon completion of the work, all supports and mountings used for the work described in this Specification package must be removed from the ship.

8.2 (*) TELEPHONE + HIGH-SPEED INTERNET LINES

- 8.2.1 Refer to section 1.6 of this Specification package.

8.3 (*) TEMPORARY PROTECTION OF DECKS AND BULKHEADS

- 8.3.1 In order to avoid accumulation of dirt in corridors and to protect floor coverings, the Contractor must supply and install Masonite (1/8 inch thick) on all deck surfaces and of the Main deck, Upper deck, Boat deck, Officers deck, Navigation deck, Bridge and the Control Room. The Contractor must also supply and install Masonite panels in all entries, staircases, the Chief Engineer's, the Engineers offices, the Crew's Dining Room, the laundry room deck and the rear main deck from the port propulsion room entrance to the steering gear compartment, inclusive. The total area to be covered is approximately 650 m². For adjustment purposes, the Contractor must provide a unit price per square metre (m²).

- 8.3.2 The Contractor must supply and install 48 in. x 1/8 in. thick cardboard on the lower bulkheads of all deck corridors mentioned above. The total length will cover approximately 800m. The Contractor must ensure that the cardboard and Masonite panels remain in good condition for the duration of the contract. If the cardboard and Masonite panels become damaged, they must be replaced at the Contractor's expense.
- 8.3.3 Installation of the deck and bulkhead coverings must be done as soon as the ship arrives at the shipyard facilities. The Contractor is responsible upon taking charge of the ship. Upon completion of the work, the Contractor must remove all cardboard and Masonite panels and must remove any remaining adhesive residue on decks and bulkheads. The use of polyethylene covers is prohibited.

8.4 (*) ELECTRICAL POWER

- 8.4.1 The Contractor must supply two electrical power connections (600 VAC, three-phase, 300 amps/connection) for the duration of the contract (docked or in dry dock).
- 8.4.2 The Contractor must supply the material and labour to connect and disconnect as required, two electrical cables for shore power supply, each being 150 feet long with male plugs. These two cables must be connected in parallel onboard ship. Before powering the ship, the Contractor must ensure that power sources supplied have the same phase sequence at the source and on the ship. The nominal load of the ship is between 350 and 400 kilowatts. The ship will provide two, female plugs with two meter long extensions for connection to ship yard's electrical system. These cables must not be shortened. The cables and connections must be Megger-tested before connection.
- 8.4.3 The Contractor must provide a unit price per kilowatt hour which the Contractor must use in its bid to determine a price for a block of 500 000 kilowatt hours. This unit price will also be used to adjust (up or down) the ship's total consumption at the end of the contract period via a PWGSC 1379 form.
- 8.4.4 The Contractor must supply a kilowatt-hour meter and connect it to the ship's power source to track consumption. The Contractor must read the kilowatt-hour meter in the presence of the Technical Authority before connection and disconnection of the power supply to verify the electrical consumption. The meter must be read in the presence of the Technical Authority before and after any movement of the ship.
- 8.4.5 The power supply for which the price is indicated must only be used for the ship. In Annex J of the call for tenders, the Contractor must certify its commitment to

providing the power defined in these specifications for the duration of the contract, regardless of the presence of the crew.

- 8.4.6 Upon completion of the work and disconnection of the shore power, the shore power adaptors/extensions must be disconnected from the cables and returned to the ship's Electrical Officer.
- 8.4.7 NOTE: If the Contractor powers the ship using a diesel generator installed on the wharf, it must be responsible for watch keepers and generator fuel.

8.5 HEATING

- 8.5.1 It is the Contractor's responsibility to ensure that heating and dehumidification are maintained for the duration of the contract. The Contractor is responsible for monitoring the environmental conditions onboard the ship to prevent damage from temperature variations. This must include protection from freezing of all piping systems containing liquids and protection against overheating in any spaces in which electronic equipment is susceptible to damage, such as the electronic equipment room, the wheelhouse and the engine control room. If the ship is shut down and unmanned, cooling water will not be necessary.

~~8.5.2 The Contractor shall provide a steam supply or portable steam boiler for the duration of the work period. The steam supply shall be equivalent to the vessel's rated boiler capacity (7 bars and 2000 kg/h). The Contractor shall isolate and blank each of the vessel's boilers steam stop valves and shall connect to the ship's steam piping via the 80 mm pipe steam main piping, flange diam. : 200 mm, ANSI bolts circle : 160 mm (face to face DIN 3202, flanges DIN PN 25. Condensate requirements shall be provided as determined by the Contractor's steam system; the vessel's condensate system may be utilized at the Contractor's discretion. Exact pipe routing to be at the discretion of the shipyard, but take notice that the vessel's weather tight integrity shall be maintained for the duration of the work period. Prior to sea trials, the Contractor shall return the vessel and the steam system (using new fasteners and gaskets) to the pre-work condition.~~

8.6 FRESH WATER AND FIREMAIN SEAWATER SERVICES

- 8.6.1 The Contractor must supply all material and labour to install necessary connections and supply fresh water necessary to provide the services described hereunder throughout the entire dry docking period. The Contractor must disconnect connections upon completion of work.
- 8.6.2 The Contractor must supply and install a calibrated flow meter for each domestic water supply line connected to the ship for the duration of the contract. Flow

meters must be sized for the service they are intended for. The flow meter calibration records must be presented to the Inspection Authority. All flow meters must be read by the Contractor at the beginning and at the end of the contract period, as well as before and after any vessel movements to or from the fit out wall or the dry dock, in the presence of the Inspection Authority. The following connections are required to service the vessel:

- a) The Contractor must supply and install a 1½ inch hose certified for potable water. The water must come from a source that has recently been certified safe for human consumption by a health services authority from the local municipal or provincial government. The Contractor must supply a valid potable water certificate to the Inspection Authority before making the connection. Potable water must be supplied through a pressure regulator, complete with pressure gauge and isolation valve. Potable water pressure will be held to fifty (50) psi gauge. Water consumption is approximately 8 tonnes/day. Filling of two potable water tanks (135 m³).
- b) The Contractor must supply a separate and continuous, uninterrupted non-potable water connection, which must pass through a pressure regulator and connected to the ship's fire main. The water supply must be connected immediately after the ship's entry into the dry dock. This water supply must be maintained at a pressure of 690 kPa (100 psi gauge) at all times and must be supplied by one 2.5 inch diameter hose. This installation must include an on-board pressure regulator equipped with a pressure gauge and isolating valve. The Contractor must communicate with the Inspection Authority to determine the exact locations for connecting to the ship. There must be no interruption of this supply while the ship is at the Contractor's facilities. It is the Contractor's responsibility to take all necessary precautions to ensure that lines do not freeze in cold weather. Water will be consumed as needed for firefighting and cleaning purposes. During the summer, air conditioning, refrigeration and air compressor cooling require 3,400 tonnes of water per day. In other seasons, without air conditioning, 130 tonnes are required per day.

- 8.6.3 The Contractor must include in its bid, a written price quote per cubic meter consumption of potable water, non-potable water and sea water.
- 8.6.4 The Contractor must supply separate fresh water for cleaning, testing and rinsing tanks, in accordance with these specifications. The cost of water consumption for these items of this specification package must be assumed by the Contractor.

8.7 OVERBOARD DISCHARGE/DRAINAGE CONNECTIONS

- 8.7.1 The Contractor must supply all required materials and labour to attach temporary drainage hoses to the overboard discharges as listed below, such as to prevent water from running down the hull and disturbing uncured paint. The Contractor must also supply and install temporary drainage hoses to each of the overboard scuppers in such a manner as to prevent water from running down the hull. All drainage connections must be drained to suitable disposal facilities and/or drains. It is the Contractor's responsibility to ensure that lines do not freeze in cold weather. The Contractor must disconnect and remove all temporary connections upon completion of work.

OUTLETS	DIMENSIONS	LOCATION
AIR CONDITIONING # 2 and 3	4"	STBD FR-91
AIR CONDITIONING # 4	2-1/2"	PORT FR-96
AIR CONDITIONING # 5	3"	PORT FR-36
DOMESTIC REFRIGERATION	1-1/2"	PORT FR-48
CARGO REFRIGERATION	1-1/2"	STBD FR-42
GREY WATER	4"	PORT FR-59
BLACK WATER	3"	STBD FR-94
BOILER PURGE	3"	PORT FR-96
CONDENSATE DRAIN	5"	STBD FR-96
FORWARD COMPRESSOR	2"	PORT FR-96
AFT COMPRESSOR	2"	PORT FR-95

8.8 BLACK WATER AND GREY WATER

- 8.8.1 For black and grey water, the Contractor must supply portable tanks or tanks that can be pumped out; the Contractor must be responsible for disposing of this water. All related costs must be included in this item. The Contractor must provide a unit price per cubic meter.

8.9 OILY BILGE WATER

- 8.9.1 The Contractor must indicate a price for the disposal of approximately 20,000 litres of oily bilge water from the ship's bilges. The Contractor must provide a unit price for each additional 1,000 litres regardless of the proportion. The price specified for this item must be adjusted upward/downward based on Contractor submitted invoices. The quantity stated of this item must only apply to the ship's needs and not to the Contractor's needs as required to complete any work

described in this Specification package. The Contractor must provide the Inspection Authority with the name(s) of the company(ies) registered for pumping and disposal of waste oil, and receipts for the elimination of ship hydrocarbons for inclusion in the hydrocarbon service booklet.

8.10 (*) GARBAGE REMOVAL

- 8.10.1 The Contractor must supply 4 garbage containers of 240 litres each placed on the flight deck beside the gangway for waste from the ship. These containers must be emptied daily.

8.11 CRANES AND SCAFFOLDING

- 8.11.1 Provide the services of a 5-tonne crane from the shipyard for the ship's general needs, including an operator and all personnel (signaler, rigger) needed to ensure that these operations are carried out safely. The Contractor must provide a price for this service for one (1) hour per working day, giving an average of five (5) hours per week, for the duration of the contract. For adjustment (up or down) purposes, the Contractor must provide an hourly rate for this service. The Contractor must maintain a record of crane usage that must be signed weekly by the Inspection Authority.
- 8.11.2 For the duration of the contract period, crane services must be provided by the shipyard for displacement of parts arising from the work described in this Specification package. This work must be in addition to the specific needs of the ship, and the costs must be included with each item of this Specification package.
- 8.11.3 The Contractor must provide a price for general services of a powered platform (cherry picker) including the operator. The Contractor must provide a price for this service for one (1) hour per working day, giving an average of five (5) hours per week, for the duration of the contract. For adjustment (up or down) purposes, the Contractor must provide an hourly rate for this service. The Contractor must maintain a record of use that must be signed weekly by the Inspection Authority.
- 8.11.4 The Contractor must supply all labour and materials needed to set up scaffolding, work platforms, shelters, nacelles or other lifting apparatus required to carry out the inspection of the ship's hull by the TCMS inspector or by the crew, as well as all work performed on the ship's hull. This includes, but not limited to, scaffolding and equipment to access propellers, rudder, rudder trunk, bow thruster and cathodic anodes to be replaced.

8.12 CLEAN UP

- 8.12.1 Upon termination of the Contract, the Contractor shall remove any garbage, debris and unnecessary material created by the work and shall return the vessel to a clean condition similar to that existing at the time of transfer from custody to delivery of the vessel to the hands of the contractor at the beginning of the refit period.
- 8.12.2 Upon completion of all work and final cleaning, the Contractor's Quality Assurance (QA) representative and the CCG TA must complete an inspection together of all compartments and spaces where work was performed by the Contractor. Any defect or damage noted during this visit must be recorded and compared with the digital images taken during the initial inspection (section 1.10).
- 8.12.3 The Contractor must repair any damage or defects resulting from the work carried out, at its own expense.

8.13 VESSEL SECURITY

- 8.13.1 The Contractor must ensure security of the ship while under his care, custody and control.
- 8.13.2 The Contractor must provide specialized security staff to carry out rounds all spaces, both interior and exterior, of the vessel. In addition to the requirements for hot work, the Contractor must conduct rounds every day at four-hour intervals. These rounds must include a visual inspection of every compartment. The security patroller must be trained and informed of how to immediately take appropriate action upon discovery of any risky or urgent situations for the ship.
- 8.13.3 When the ship is afloat, the Contractor must make arrangements to prevent damage to the ship due to wind, waves, tides, floods, fire and weather conditions. The Contractor must increase the frequency of security rounds in the event of bad weather conditions.
- 8.13.4 The Contractor must provide a logbook, to be submitted to the IA, and must be initialed by the security patroller must upon the completion of each round.
- 8.13.5 The Contractor must implement an alert system to intervene in case of emergency, including personnel qualified to remedy these situations and prevent potential damage to the ship. Damage to the ship due to the Contractor's failure to meet these requirements must be repaired at the Contractor's expense.

8.14 VERMIN

- 8.14.1 The Contractor must protect the ship from infestation of rats or vermin for the duration of the contract period. The Contractor must exterminate all rats or vermin found on board the ship if they come onboard during the contract period.

9.0 ADDITIONAL WORK

9.1 GENERAL

- 9.1.1 Additional work must be performed and inspected to the complete satisfaction of the IA and TCMS, as required.
- 9.1.2 The Contractor's Quality Assurance Manager must implement an updated inspection plan and agree with the IA on the points to inspect before, during and after each additional work item.
- 9.1.3 The final inspection by the IA is essential for the acceptance of the work. The Contractor must take all necessary measures to provide the IA the opportunity to inspect the additional work.
- 9.1.4 Inspection of an item by the IA does not relieve the Contractor of the inspections required by TCMS.

9.2 INSPECTION SERVICES

- 9.2.1 The Contractor must make the necessary arrangements for the presence of a TCMS inspector as required. The presence of the inspector must be organized and coordinated in advance to avoid delaying work. An allocation of \$25,000 must be planned for certification with TCMS. This amount will be adjusted upward/downward at the end of the work period by means of the PWGSC 1379 form upon presentation of supporting documentation.

9.3 ADDITIONAL WORK

- 9.3.1 All additional work not described herein but arising from this Specification package and inspections must be negotiated by the PWGSC representative using a 1379 form, and by means of a written specification.
- 9.3.2 This written description of the work required will be provided by the ~~IA~~ TA to allow PWGSC to obtain a firm price before the commencing the work.
- 9.3.3 Canada reserves the right to cancel, in part or in full, any item of this Specification package if, on the TCSM inspector's advice, it is no longer necessary to carry out an inspection due to the good condition of the component.

10.0 COATINGS

10.1 Identification

- 10.1.1 Clean the underwater hull surfaces in order to paint it with an approved coating as described in 10.2.3, such as Inerta 160 or equivalent.

10.2 References

10.2.1 Drawing

- 10.2.1.1 06149S37 Calcul de surface de la coque

10.2.2 Underwater coating:

- 10.2.2.1 The contractor must supply the coatings and paints described in this section. They must supply the product used for shell coating of Type 1200 Canadian Coast Guard vessels must have a high abrasion resistance and must be able to be applied on the hull of a Polar type Icebreaker. That coating must prevent the ice from sticking to the hull surface and have a very low friction factor.

10.2.3 The coating must possess the following criteria.

- 10.2.3.1 The product must have been used successfully on a Polar Icebreaker hull for at least three years;
- 10.2.3.2 The product must be certified by Lloyd's Register as a high abrasion resistance coating;
- 10.2.3.3 The product must keep its efficiency at temperatures as low as minus 50 degrees C;
- 10.2.3.4 The product must be applied with an anticorrosion Epoxide coating with a minimum of 90% solid particles;
- 10.2.3.5 The product must be available in at least two colors, black and red;
- 10.2.3.6 The coating must be applied on a single step with 30 mils dry thickness.
- 10.2.3.7 Abrasion resistance : Taber (ASTM D4060¹, 1 kg, CS-17 wheel) : maximum weight loss of 50mg;
- 10.2.3.8 Adhesion factor : (ASTM D4541²): 1000 psi min;
- 10.2.3.9 Kinetic friction factor with ice less than 0.03 at speeds between 10 and 25 cm/s.

10.2.3.10 Consult the 1200 « Icebreaker Coating schemeV3 » to see accepted products and equivalents.

10.2.4 Underwater hull surface is 2,820 m². It includes all underwater hull surfaces up to 900 mm above the load line, including the rudder, the rudder trunk and the stem to include the hawseholes. It also includes rope guards, sea chests grates, the bow thruster tunnel and grates.

10.2.5 Part of the hull must be painted red (from 1.6 metres below the load line to 900 millimetres above the load line), while the remaining hull, including the hawseholes, the rudder and the rudder trunk, must be painted in black.

10.3 Statement of work

10.3.1 General preparation and coating procedures

10.3.1.1 During blasting and coating operations, the Contractor must provide protection for the following items and/or locations: Accommodations, Engine room intakes, bearings, screw threads, oil grooves, grease fittings, gearing, pins, universal joints, door screens, machined surfaces, nameplates, gaskets, electrical insulation, cable tray, electrical panels and fixtures, hinges, fair leads, hawseholes, windows and all working parts in general.

10.3.1.2 The Contractor must pay special attention to the propeller blades and associated shafts, seals, liners, pintles, bow thruster, echo sounding transducers, speed log, and anodes. The Contractor must cover these elements before grit blasting and coating operations begin and keep them covered until completion of the work.

10.3.1.3 The Contractor must shield the glass from the portholes, in way of areas that are to be grit blasted and coated, with rubber gasket in such a way as to both protect the glass and allow for grit blasting of the porthole ring.

10.3.1.4 The Contractor must fit all overboard discharges and deck scuppers with a drainage plug and/or spouts to ensure that any active over boards and water runoff is drained clear of the shipside before grit blasting and coating work starts.

- 10.3.1.5 In the case of vessels that have the spar deck flush with the ship sides, the Contractor must fit a temporary barrier to the deck so as to contain or redirect snow or water runoff and prevent it from coming in contact with grit blasted or freshly coated surfaces. This work must be included in the Contractor's pricing.
- 10.3.1.6 Water run-off, rain or snow that comes into contact with fresh epoxy coatings may produce an "amine blush". These areas must be cleaned with a suitable solvent and is the responsibility of the Contractor.
- 10.3.1.7 The Contractor must ensure that all surface preparation and coating application conforms to the manufactures recommended guidelines unless otherwise stated, including recommended surface profiles, temperature, relative humidity, drying times between coats and over coating intervals, drying time upon completion of coating, wet film thickness', dry film thickness', and curing time prior to immersion of coating during dock flooding operations. This applies to all coatings used during the Work.
- 10.3.1.8 The Contractor is responsible for timely ordering of all coating products and the proper disposal of used containers and solvents.
- 10.3.1.9 All coating products must be stored by the Contractor in a dry heated space according to manufacturer's specifications.
- 10.3.1.10 The Contractor must prepare all new steel to SA2½ and give one (1) coat of Interplate 937 pre-weld construction primer on both sides as per coating manufacturer directions...
- 10.3.1.11 All areas of contamination subject to surface preparation will be solvent cleaned to SSPC SP1 by the Contractor.
- 10.3.1.12 The Contractor must perform grit blasting in order to achieve a surface profile, coarse angular, from 50 to 75 microns, unless stated otherwise in the Coating specification.
- 10.3.1.13 For areas in the specification where washing is required, the Contractor must test for chlorides and areas found unacceptable for coating must be re washed and is to the Contractors account.
- 10.3.1.14 The Contractor must monitor surface and ambient temperature and humidity, and painting can only take place when conditions are within the paint manufacturer's guidelines, or must provide suitable containment and environmental control to compensate.

- 10.3.1.15 On completion of blasting and before application of any paint or primer, the Contractor must blow the steel surfaces free of dust, using dry, oil free air. No paint is to be applied without the surface preparation being verified by the Owner's Representative or agreed Designate.
- 10.3.1.16 Prepared areas must be coated, by the Contractor, before flash rusting occurs or the blast will be considered unacceptable and will require re-blasting at the Contractor's expense.
- 10.3.1.17 The Contractor must feather all coating repairs back into sound existing coating and touch-up and recoat soiled, damaged or missed areas.
- 10.3.1.18 For items in the specification requiring spot application of coating, the Contractor must ensure that the topcoats cover undercoats completely.
- 10.3.1.19 The Contractor must apply all coatings with airless spray equipment using adequate ventilation and lighting. Areas not accessible by spray painting such as cut outs and brackets must be brushed or rolled to achieve the specified dry film thickness.
- 10.3.1.20 For coatings applied to any confined space, the Contractor must install an exterior supply / exhaust fan with adequate trunking to facilitate air circulation and the removal of solvents from the lowest areas possible to aid in the curing of the coating.
- 10.3.1.21 The dry film thicknesses specified are the minimum required and must be verified by the Contractor. The Contractor must monitor humidity, surface and ambient temperatures and record, at all times, during coating operations. All this data must be made available for the CGTA for review upon request.
- 10.3.1.22 The Contractor must take care in the application of final coats to ensure that all vessel equipment is protected from excess paint spray and, in particular, electronic or other equipment liable to more serious damage due to excess spray.
- 10.3.1.23 Excessive runs, curtains and sags in the coating must be brushed out by the Contractor while the coating is wet. If the coating dries, the Contractor must remove these defects, sand and re-coat the area at its own account.
- 10.3.1.24 Regardless of the number of coats required, lines of graphics, points of color change, names, logos and all cosmetic top coatings that are to be

- cut in by brush or masked, are to be cut sharp by the Contractor, square and be esthetically pleasing.
- 10.3.1.25 Where names and lines of graphics are to be painted over and are not clearly etched or outline welded into the substrate, the Contractor must drill or punch into the steel the outlines before over coating.
- 10.3.1.26 Note that when the Coating Specification calls for epoxy coating over Intershield 163/Inerta 160, the over coating windows are very short and finite and the Contractor must apply the epoxy coat while the coat beneath is ***"thumbprint"*** soft.
- 10.3.1.27 Any new and/or existing paint coatings that are disturbed during the performance of the Work shall be touched-up to the same specification as the existing coating system and is to the Contractor account.
- 10.3.1.28 On completion of the repairs and prior to flooding the dock, any and/or all of the above mentioned protective coverings or containments must be removed from the equipment, by the Contractor. Sand ingress, coated and/or damaged items as listed above will be cleaned, repaired or replaced by the Contractor at no cost to the Owners. The installation and removal of any protective devices should form part of the Contractor's quoted price.
- 10.3.1.29 Contractor's quoted prices must include all material, ice removal from dock, specialized equipment, water, chemicals, staging, containment, environmental controls, services, high pressure hosing machines (i.e.: pumps, hoses, nozzles, etc.), fresh water supply, stain/grease removers, special scrapers, staging, lighting, cherry pickers, sandblasting and paint spraying machine, etc. as necessary to effect the blasting and coating task in its entirety and shall include removal and disposal of sandblast grit and debris from the vessel and dock as per the applicable environmental regulations.
- 10.3.1.30 Estimated area measurements supplied by the Owner are for reference only at it is the Contractors responsibility to verify actual areas referred to in this specification prior to commencement of the Work.
- 10.3.1.31 The Contractor must clean both anchors using light sandblast and apply two (2) coats or black Intergard paint, ~~0.005" when dry, and one (1) coat of finishing Interlac No. 2, 0.002" when dry.~~

- 10.3.1.32 The Contractor must supply and install a temporary shelter covering the ship's hull ~~from the keel until above the main deck bulwark. area that is to be painted.~~ 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 only after the recommended drying time is reached. The shelter must withstand all possible bad weather and be waterproof with the vessel's hull.

10.3.2 Coating inspection procedures

- 10.3.2.1 All blasting and coating operations will be inspected by the Contractor as per an agreed Quality Assurance plan, a copy of which is to be submitted to the CGTA, and will be subject to periodic inspection by the CGTA.
- 10.3.2.2 The Contractor must measure the surface profile in accordance to NACE RP0287-95.
- 10.3.2.3 The following references shall be used for coating application inspection procedures:
- Sa2½ or SSPC SP10 - Near White metal blast cleaning
 - Sa2 or SSPC SP6 - Commercial blast cleaning
 - SSPC-SP1 Solvent cleaning
 - NACE RP0287-95 Field measurement of surface profile of abrasive blast cleaned steel surfaces using replica tape
- 10.3.2.4 The Contractor must hire a technical service representative of the coating manufacturer who must be present during the preparation, inspection and coating application for both the Underwater Hull and Ice Belt. Costs for this are to be included in the quotes for these areas.

10.3.3 Surface preparation and Coating – General

- 10.3.3.1 The scope of work may be increased or decreased upon in-docking inspection of the vessel. In order to determine variance in contract value, the Contractor and the TA must negotiate in order to define the total area to be prepared and painted in function of surface percentages described in the following sections.

10.3.3.2 The Contractor must hire an authorized representative of the firm "Peinture International" to issue expert opinions and ensure that the conditions are met for the preparation, mixing and application of their products described in this specification. He must also hire a commissioned representative of the firm who will supply the hull paint system described in section 10.2.2 to issue the same advice. The Contractor must include an allowance of \$ 15,000.00 for the services of these representatives and the final price will be adjusted upwards or downwards upon presentation of supporting documents.

10.3.4 Surface areas

- 10.3.4.1 For the purpose of this tender, the surface areas of the vessel hull will be denoted in three distinct parts; Underwater Hull, Ice Belt and Topsides. Additional areas such as sea chests/bay, lettering, draft marks and trim etc. will be addressed as separate individual items
- 10.3.4.2 The maximum load line (waterline) is denoted by weld marks placed at regular intervals around the periphery of the vessel. This will be abbreviated for the purpose of this document as **W/L**. This will be considered the base line for all hull surface area determination.
- 10.3.4.3 The Underwater Hull will be the total shell plate area denoted from the keel upwards to a point 2.0m below the **W/L**, and will include the stern tubes and supports, the rudder and stock up to the **W/L**, the exterior of any sea chest grates, interior are grates of the bowthruster tunnel and grates, and the exterior of the cover plate of any extending device.
- 10.3.4.4 For the purpose of this document, the calculated surface area of the Underwater Hull is 1885 sqm.
- 10.3.4.5 The Ice Belt will be considered the total shell plate area denoted from 2.0m below the **W/L** and 0.9m above, for a total Ice Belt height of 2.9m. In addition, this area will include the anchor pockets and surrounding protection, the area of the stem between the anchor pockets and the area immediately aft of either anchor pocket beginning at the upper aft edge of the pocket and angling downward at 45° until meeting the upper delineation of the Ice Belt at 0.9m above **W/L**.
- 10.3.4.6 For the purpose of this document, the calculated surface area of the Ice Belt is 657 sqm.

10.3.4.7 The Topsides of the vessel will be considered the total shell plate area denoted from upper demarcation of the Ice belt upwards to the rail of the vessel, including fore and aft bulwarks, and any removable bulwark plates in profile line with the shell plating.

10.3.4.8 For the purpose of this document, the calculated surface area of the Topsides is 825 sqm.

10.3.5 **Hull cleaning**

10.3.5.1 The Contractor must clean the ship's hull with high pressure (5000 psi minimum) fresh water before any sandblast / paintwork preparation. Work is to proceed from the vessel rail downwards to the keel to remove any and all salt residue from hull shell plating. Upon inspection of vessel, after dry-docking, it is determined that there exists sufficient reason to include a higher pressure fresh water wash to remove excessive residue from the hull, variance will be determined as per the provisions of 14.04(k) NACE RP0287-95.

10.3.5.2 Additional cleaning variances by way of contaminant removal such as oils, greases, soils etc., if determined to be necessary will be considered according to the provisions of 14.04(j) NACE RP0287-95.

10.3.6 **Underwater hull**

10.3.6.1 The Contractor must spot grit blast all rust spots, lifting or peeling coating, and mechanical coating damage on the Underwater Hull to Sa2½ with a coarse angular profile of 75 – 100 micron. The Contractor must feather onto sound coating by 7 – 8cm. The Contractor must clean surface by dry air blast to remove residues and grit dust.

10.3.6.2 During sandblasting, the Contractor must completely clean remaining aluminous cement from rudder plug welds. The Contractor must supply and re-fill holes using Speed Crete Blue Line 3700-132 (W.R. Meadows of Canada).

10.3.6.3 The Contractor must hold further work once completed for inspection and release of surface preparation by the IA, TA or CA. Coating manufacturer technical service representative must be consulted by Contractor to obtain directives on the surface preparation.

- 10.3.6.4 Upon authorized release and following coating manufacturer directions, the Contractor must apply one or two coats of Black (ERA163) to obtain a minimum dry film thickness of 500 micron to prepared spots of bare metal and overlapping onto feathering.
- 10.3.6.5 It is a requirement that the coating manufacturer technical service representative be present during the set-up, mixing and application of the material to advise the Contractor and confirm conformity to specification.
- 10.3.6.6 The Contractor must paint by brush the draft marks below waterline using a compatible white product (EGA010) during the time interval recommended by the manufacturer of the finishing coat. If the overcoating window for the finishing coat is missed for any reason, the Contractor must abrade the areas before the coating can be applied.
- 10.3.6.7 Total estimated grit blasting and coating surface area of the Underwater Hull for the purpose of this tender is 40% or 754m². Contractor is required to independently verify given surface areas

10.3.7 Ice belt

- 10.3.7.1 The Contractor must spot grit blast all rust spots, lifting or peeling coating, and mechanical coating damage on the Ice Belt to Sa2½ with a coarse angular profile of 75 – 100 micron. The Contractor must feather onto sound coatings by 7 – 8cm. The Contractor must sweep blast remaining areas to create 50 – 75 micron profile for full overcoat. The Contractor must clean surface by dry air blast to remove residues and grit dust.
- 10.3.7.2 The Contractor must hold further work once completed for inspection and release of surface preparation by the IA, TA or CA. Coating manufacturer technical service representative must be consulted by Contractor to obtain directives on the surface preparation.
- 10.3.7.3 Upon authorized release and following coating manufacturer directions, the Contractor must apply one or two coats of Coast Guard Red (ERA174) to achieve a minimum of 500 micron dry film thickness to prepared spots of bare metal and feathered overlap.
- 10.3.7.4 It is a requirement that the coating manufacturer technical service representative be present during the set-up, mixing and application of

the material to advise the Contractor and confirm conformity to specification.

- 10.3.7.5 The Contractor must paint by brush the draft marks below waterline using a compatible White (EGA010) while during the time interval recommended by the paint coats' manufacturer. If the overcoating window for the product is missed for any reason, the Contractor must abrade the areas before the coating can be applied.
- 10.3.7.6 The Contractor must pay an important consideration to the sub-area above the **W/L** where Topside coatings overlap onto the Ice Belt to provide a cosmetic finish.
- 10.3.7.7 Total estimated grit blasting and coating surface area of the Ice Belt for the purpose of this tender is 50% or 330 m².

10.3.8 Topsides

- 10.3.8.1 The Contractor must spot grit blast all rust spots, lifting or peeling coating, and mechanical coating damage on the Topsides to Sa2 with a coarse angular profile of 50 – 75 micron. The Contractor must feather onto sound coating by 7 – 8cm. The Contractor must clean the surface by dry air blast to remove residues and grit dust.
- 10.3.8.2 Following coating manufacturer directions, the Contractor must apply touch-up coat of Intergard 264 Red Oxide (FPL274) at 125 micron dry film thickness to prepared spots of bare metal and overlapping onto feathering.
- 10.3.8.3 In addition, the Contractor must apply the topsides finishing coatings onto the Ice Belt down to the **W/L**, cutting in with a defined demarcation line detailed in 11.3.4.7. The contractor must follow the recommendations of the representative (s) in order to obtain adequate adhesion between the finish coats of the topside and the ice belt. This may include a rolled undercoat application to the ice belt of a within very short time frame.
- 10.3.8.4 The Contractor must apply two coats of Interthane 990 RAL3000 Red at 50 micron dry film thickness over the entire Topsides area and down to the **W/L** demarcation. The Contractor must allow to dry to minimum overcoating window.
- 10.3.8.5 The Contractor must allow drying until the recommended 'hard' dry time before applying lettering and signage.
- 10.3.8.6 Total estimated grit blasting and coating surface area of the Topsides for the purpose of this tender is 20% or 165 m².
- 10.3.8.7 The contractor must provide a unit price per square meter for the blasting of the hull, a price per square meter for covering the hull, the ice belt and related works, and a price per square meter for the shell plating and of the related works in order to adjust the surfaces already included in this estimate upwards or downwards.

10.4 Proof of performance

- 10.4.1 The Contractor shall schedule the Magnetic Particle Testing that is required by Transport Canada for Hull Welded Shelter Anchors.

10.4.2 Inspection

10.4.2.1 The following inspections must be carried out in the presence of the IA:

- Visual inspection of the hull after cleaning;
- Transducer surfaces washed;
- Adequate protection of the parts described in this specification;
- Degree of cleanliness after painting;
- Removal of protective materials after painting.

10.4.2.2 The TA or IA can hire and be accompanied by a certified inspector in NACE International standards to ensure that these equivalencies are met. The contractor must allow site access to this inspector.

10.4.2.3 All stripping and coating work must be inspected by the Contractor in accordance with the agreed-upon quality assurance plan, of which a copy must be submitted to the TA, and will be subject to periodic inspection by the IA.

10.4.2.4 The surface profile must be measured in accordance with NACE International RP0287-95.

10.4.2.5 The references below must be used for the coating application inspection procedures:

- SA 2½ or SSPC SP10 – Near White Blast Cleaning of metal;
- SA 2 or SSPC SP6 – Commercial Blast Cleaning;
- SSPC-SP1 – Solvent Cleaning;
- NACE International RP0287-95 – Field Measurement of Surface Profile of Abrasive Blast-Cleaned Steel Surfaces Using a Replica Tape.

10.4.2.6 The Contractor must supply assistance and equipment (cherry picker with operator) required to the CCG representatives and the International Paint technician for inspection of work.

10.5 Deliverables

10.5.1 Before the end of the contract, the Contractor must give to the TA a comprehensive report detailing the work undertaken, defects, repairs made and measurements and readings taken.

10.5.2 The Contractor must provide the IA with a detailed Quality Assurance Report upon completion of the work. This report includes, but is not limited to, inspection reports, dry film thickness (DFT) measurements and condition monitoring data during coating application.

- 10.5.3 The Contractor shall provide the technical and data sheet of the paint products used.

11.0 FREEBOARD, DRAUGHT AND VESSEL'S IDENTITY MARKINGS

11.1 Identification

- 11.1.1 Renew the hull and freeboard markings after painting the hull.

11.2 References

- 11.2.1 CCG/6016 Federal Identity Program Guide
- 11.2.2 Drawing
 - 11.2.2.1 06149_SF
- 11.2.3 The Contractor must supply all the paint to be applied, according to the manufacturer's specifications, for all black and white markings. All paint must be compatible with the various hull coatings.
- 11.2.4 Colours and type of paint to be used:
 - 11.2.4.1 White: RAL9003
 - 11.2.4.2 Black: RAL9004
 - 11.2.4.3 Red: RAL3000

11.3 Statement of work

- 11.3.1 The Contractor must paint the load line, draught marks, forward and aft, port and starboard, letters, with two (2) coats of white paint compatible with the hull coating.
- 11.3.2 The Contractor must ensure that all paint used for the markings is applied in two (2) coats and is compatible with INERTA and INTERTHANE coatings.
- 11.3.3 List of numbering/lettering to be performed by the Contractor:
 - 11.3.3.1 **Vessel's name** on both sides, forward and aft; port of registry;
 - 11.3.3.2 On both sides, inscriptions "**Coast Guard**" and "**Garde Côtière**", and the diagonal stripes and black lines along the stripes;
 - 11.3.3.3 The "**Danger**" inscription with the **propeller** and **bow thruster symbols**, on both sides;
 - 11.3.3.4 The **Canadian flag** with the "**Canada, Pêches et Océans, Fisheries and Oceans**" inscriptions, on both sides of the vessel.

- 11.3.4 The Contractor must stop painting of the diagonal stripes and their black lines, as stated in 14.3.3.2 just above the ice belt.

11.4 Proof of performance

- 11.4.1 Freeboard markings must be inspected by the CCG Inspection Authority

11.5 Deliverables

- 11.5.1 The Contractor must provide the owner a detailed quality assurance report once the work is completed. This report must include, but is not limited to, the inspection reports, dry film thickness (DFT) measurements and condition monitoring data during the coating application.
- 11.5.2 The Contractor must provide the technical data sheet for the paint products used.

12.0 HULL PLATING WELDING JOINTS

12.1 Identification

- 12.1.1 Find out which hull plating welding joints need to be re-welded in order to comply with TCMS requirements.
- 12.1.2 The extent of this task must be defined following the hull inspection that will take place immediately after the docking of the vessel.
- 12.1.3 Following the inspection, plate replacement work is also described in this specification.

12.2 References

12.2.1 Drawings

- 12.2.1.1 68-H-3/3 Shell Expansion
- 12.2.1.2 68-H-3/1 Aft Plate Line Body Plan
- 12.2.1.3 68-H-3/2 For'd Plate Line Body Plan
- 12.2.1.4 68-H-3/3 Shell Expansion For Thicknesses Only
- 12.2.1.5 68-H-7 Framing expansion

12.3 Statement of work

12.3.1 Preparation and inspection

- 12.3.1.1 The Contractor must provide sufficient staging or mobile scaffolding to access all seams and butts of the hull so that the surveyors may ascertain the condition of the welds.
- 12.3.1.2 The Contractor must first wash the hull with fresh water to get rid of salt and other debris from the surface.
- 12.3.1.3 Once the hull has been thoroughly cleaned, the Contractor must notify both the CCG TA and the Transport Canada Marine Ship Branch Surveyor so a visual survey of the entire hull and its welds can be done.

12.3.2 Welding

- 12.3.2.1 On the side of the vessel on the port side and on the starboard side, the contractor must include in its price 2,000 linear meters of weld bead (welding passes) measuring on average the semi-automatic welder 10mm wide by 5mm height. The amount of cords to complete a weld seam (stitching and seams) may vary. The Contractor shall provide a unit

price per linear meter of weld seam defined in this paragraph. The price of the welding work will be adjusted upward or downward using PWGSC's Form 1379.

- 12.3.2.2 The Contractor must perform these works only when the tanks in contact with the areas of the hull have been emptied, cleaned, degreased and certified for hot work and when all other elements in contact with the working zone have been removed.
- 12.3.2.3 The butt joints and seams to be repaired must be marked by the TCMS surveyor. They must then be sand blasted by the Contractor, to remove the extra INERTA coating, salt deposits, dirt and grease.
- 12.3.2.4 The Contractor must gouge or rectify all the repaired welds to bring them to their original position.
- 12.3.2.5 The Contractor must grind smooth, prior to welding, any undercut edges of the weld and its boundary plates.
- 12.3.2.6 The Contractor must remove all grits from the welds and gouging by vacuuming or air blowing.
- 12.3.2.7 The Contractor must erect a polyethylene shelter or equivalent in the working areas to prevent rain, snow, ice, or their melted counterparts from rapidly quenching of the welds; See shelter (10.3.1.32)
- 12.3.2.8 The Contractor must preheat the shell welds to 93°C (200°F) prior to welding.
- 12.3.2.9 The Contractor must perform the work so the new welds present an excess of about 6mm that will be grinded then sandblasted to SA 2 ½ standard to show a rounded and rough surface. The excess should look like a sheet metal joint made with an automatic welding machine.
- 12.3.2.10 The Contractor must quote for the price of gouging 200 linear meters of full width weld on the welded surface and for grinding 200 linear meters on the same surface. The Contractor must also quote for a unit price of gouging and grinding one meter of weld. The final cost of gouging and grinding will be adjusted on a PWGSC 1379 form.
- 12.3.2.11 A "Shell Expansion" drawing (pdf) of the hull of the vessel will be included in the technical folder for the vessel supplied by the contractor. The Contractor must clearly show on this drawing, in prominent red lines for both port and starboard sides of the ship, the full extent of new shell welds, and the number of passes, done during this repair.

~~12.3.3~~ **Hull plating replacement**

- ~~12.3.3.1~~ ~~The contractor must move the blocks and adequately support the vessel for the entire duration of metal working on the hull.~~
- ~~12.3.3.2~~ ~~Using the Shell expansion design, the contractor shall cut the indicated sheet sections as a result of the inspection of the hull and tanks.~~
- ~~12.3.3.3~~ ~~The Contractor must cut all plates mentioned, taking care not to damage the frames, the beams or the floor timber that are not to be changed, and dispose of the plates.~~
- ~~12.3.3.4~~ ~~The Contractor must transport, form, adjust and weld in place the plating sections to the frames, to the satisfaction of the TCMS and the GTA. The Contractor must perform all welds full penetration back step method accepted by TCMS so as to produce a welding excess of 6mm (¼ in) on the surface. The Contractor must grind the welding excess so as to obtain a rounded and smooth surface that will facilitate paint system adhesion.~~

12.3.4 Radiographic Inspection

- 12.3.4.1 The Contractor must bid on taking twelve (12) radiographic films by a certified technician, of the welds in question. The TCMS surveyor must determine locations where these films are to be taken. A unit price per film must be provided in the Contractors bid and this unit price is to include staging or nacelle to realise the film.
- 12.3.4.2 For radiographic inspection, the Contractor must clean adequately the surfaces of welds and adjacent base material to allow accurate interpretation of the area of interest (weld zone). Discontinuities appearing on the radiographic film that subsequently are determined to be surface discontinuities must be repaired by the Contractor and the location must be re-inspected by radiographic methods.

12.3.5 Completion of the work

- 12.3.5.1 On completion of all welding, the Contractor must apply, on newly welded seams, bare and disturbed areas and new hull plates, the same preparation and paint schedule(s) as required for the area of the hull that the welding has been done. (i.e. underwater hull, icebelt or topside).

- 12.3.5.2 Once all work has been carried out and the tanks have been thoroughly cleaned, the Contractor must reinstall the manhole covers using new gaskets and galvanized steel, nuts and washers.
- 12.3.5.3 The Contractor must put the docking plugs back in place respecting the procedure in items 7.3.25-26, proceed with hydrostatic testing of each tank in the presence of TCMS.
- 12.3.5.4 **The contractor must provide a unit price for hydrostatic tests.**
- 12.3.5.5 Once testing is completed, the Contractor must:
- Drain and dry tanks;
 - Put back the docking plugs;
 - Test their water tightness using the vacuum box method, before the TCMS surveyor and the TA;
 - Install the manhole covers;
 - Ensure they are ready to be filled.

12.4 Proof of performance

- 12.4.1 Inspections to be performed by the TCMS surveyor and the TA.
- 12.4.1.1 Hull plates inspection;
- 12.4.1.2 Inspection of all hull welds, both port and starboard.
- 12.4.2 Testing to be performed by the Contractor:
- 12.4.2.1 Radiographic films taken by a certified NDT Surveyor;
- 12.4.2.2 Hydrostatic testing of each tank, in presence of the TCMS surveyor and the TA;
- 12.4.2.3 Vacuum box testing of all docking plugs, in presence of the TCMS surveyor and the TA.

12.5 Deliverables

- 12.5.1 The contractor must supply the Technical Authority:
- 12.5.1.1 An electronic copy, on a USB stick not protected by a password, in Microsoft Office Word 2013 or more recent format, a report detailing all undertaken works, defects, repairs performed and detailed results of all performed tests
- 12.5.1.2 Marked up Shell Expansion drawing showing areas of work.

- 12.5.1.3 Two (2) copies of all radiographic films taken.
- 12.5.1.4 One Quality Assurance (QA) report indicating that all areas as defined in this specification have been inspected by the Contractor's QA Department and all areas of defects established by this survey have been identified for remedial action.
- 12.5.1.5 One copy of NDT Surveyor's certification required.

13.0 BALLAST WATER TANKS AND COFFERDAMS – CLEANING, INSPECTION AND PAINTING

13.1 Identification

- 13.1.1 Opening and **cleaning to be done with high pressure cold water at 3000 psi (minimum)** of ballast water tanks and cofferdams for inspection and, if required, repairs and painting.
- 13.1.2 Perform hydrostatic pressure test on each tank and cofferdam for certification.

13.2 References

13.2.1 Drawings

13.2.1.1 CCGS Des Groseilliers 68-H-105 Docking Plan

13.2.2 Tanks and cofferdams

<u>Tank Identification</u>	<u>Frame Location.</u>	<u>CAPACITY (Metric tons)</u>	<u>Total Square Feet</u>	<u>%</u>
Fore Peak	Frames Fwd of 183	103.4	8422	50
Aft peak	Aft frame R to 0	90.3	5996	100
Fore trim	176-183	181.4	9475	100
Aft trim tank	0-18	113.7	8667	100
Port heeling tank	138 - 165	214.58	5831	20
Starboard heeling tank	138 - 165	214.58	5831	20
Echo sounder cofferdams	138-140		60	100

13.3 Statement of work

13.3.1 Preparation, cleaning and inspection

- 13.3.1.1 The Contractor must note that the tanks are used as water ballast tanks. The ship's crew, prior to docking the vessel, must empty these tanks to the minimal required level in order to achieve the desired trim.
- 13.3.1.2 Contractor must bid on draining and disposing of approximately 20 metric tons of water and debris from each of the ballast tank noted for a total of **120** metric tonnes.
- 13.3.1.3 Once the vessel has been safely docked, the Contractor must remove the docking plugs for the designated tanks in order to drain them, except the heeling tanks which are not fitted with docking plugs. The Contractor must pump them dry using a portable pump to complete the

- work. The Contractor must also drain the suction piping between the tanks and the pumps, as well as the 2 tank bottoms.
- 13.3.1.4 The Contractor must give the docking plugs to the Chief Engineer for safekeeping.
- 13.3.1.5 The Contractor must open all manhole covers and ventilate the tanks. The contractor must post a certificate, prepared by a certified chemist, near the entrance of each tank specifying a safe entry and permission to perform all required work during the whole duration of the work period.
- 13.3.1.6 Before beginning work, the Contractor must remove the level probes that are connected to the Simplicity's alarm system and install a threaded plug (3/8"). The Contractor must put them back after the tests.
- 13.3.1.7 In the identified tanks, sandblast the **entire (100%)** inner surface **identified in item 13.2.2**, in accordance with the **SAP2-1/2 commercial** standard.
- 13.3.1.8 When the surface preparation in the six ballast tanks has been completed, the Contractor must apply two coats of Intershield 300 of different colors, each 150 microns (6 mils) dry, or equivalent on all the inner surfaces **as seen in table 13.2.2**. The IA must check the quality of the painting between the two layers of different colours, and before the inspection by TCMS in the following section. All Intershield 300 paint preparation and application criteria steps are to be carried out according to paint manufacturer's technical specifications.
- ~~13.3.1.9 — For each reservoir in table 13.2.2, the Contractor must include in his price the preparation and painting of 100% of the tank surfaces.~~
- 13.3.1.10 The Contractor shall provide a unit price per m² for surface preparation and a unit price per m² for the application of the described Intershield 300 layers described in the previous section. These unit prices will be used to make upward or downward adjustments to the areas to be treated included in the previous section.
- 13.3.1.11 Once cleaned, each of the tanks must be surveyed by the TCMS Surveyor and the CCG Technical Authority. The Contractor must coordinate the presence of the TCMS Surveyor and the TA when the work is ready for inspection.

13.3.1.12 The cost associated with all remedial work, required by the TCMS Surveyor and the AT, after their inspections, will be negotiated using PWGSC 1379 form.

13.3.2 Closing, testing and certification

13.3.2.1 The Chief Engineer must inspect the tanks and in order to validate the quality of the paint application between each coat of paint and prior to the final closing of the manhole covers.

13.3.2.2 On completion of all work, the Contractor must:

- Recuperate the docking plugs from the IA and install them.
- Install the manhole covers using new gaskets, washers and nuts that he must supply. The new gaskets must be of the same material and thickness as those replaced.
- Apply an Anti-seize compound to all threaded components.

13.3.2.3 The Contractor must perform a pressure test (hydrostatic or air pressure), on each tank and cofferdam, in presence of a TCMS surveyor and the TA.

13.3.2.4 Once the hydrostatic or air pressure test are completed, if necessary the Contractor must remove the docking plugs in order to drain the tanks. The heeling tanks must be emptied using portable pumps, as indicated in section 13.3.1.3.

13.3.2.5 The Contractor must re-install the docking plugs, again supplying and installing new joints, and perform a vacuum test in the presence of the IA or TA.

13.4 Proof of performance

13.4.1 Inspections by TCMS and the IA or TA must show that all surfaces from each tank and cofferdam are in good condition and completely and uniformly coated as demanded in the current specification.

13.4.2 Hydrostatic or air pressure tests must prove that all tanks and cofferdams are watertight and be certified according to the requirements of TCMS to obtain certification. **Based on the foreseen work in this specification and the ballast tanks having been inspected in 2015, only the following tanks would be required to undergo a hydrostatic test: Forward trim tank / Aft trim tank / Port heeling tank / Starboard heeling tank. The contractor must include in his price the hydrostatic tests.**

13.5 Deliverables

- 13.5.1 The contractor must supply the Technical Authority an electronic copy, on a USB stick not protected by a password, in Microsoft Office Word 2013 or more recent format, a report detailing all undertaken works, defects, repairs performed and detailed results of all performed tests.
- 13.5.2 The Contractor must supply the TA with a detailed QA report at the completion of the Work. This must include, but not limited to, inspection records, DFT readings, and condition monitoring data during coating application, etc.

14.0 CATHODIC PROTECTION SYSTEMS

14.1 Identification

- 14.1.1 Inspection of the anodes for the cathodic corrosion protection system and the hull anodes.
- 14.1.2 Renewal of the damaged anodes
- 14.1.3 Calibration of the cathodic protection system according to the manufacturer's specifications.

14.2 References

14.2.1 Manual

- 14.2.1.1 Instruction Manual for « CATHELCO » Electrolytic Protection System

14.2.2 Drawings

- 14.2.2.1 CCGS Des Groseilliers
- 14.2.2.2 68-2730-1 Cathodic Protection in Seabays
- 14.2.2.3 ESK-26 Detail of Cathodic Protection Anode Installation
- 14.2.2.4 ECMS Industries ltd Des Groseilliers anodes
- 14.2.2.5 68-H-163 Cathodic Protection Hull Anodes
- 14.2.2.6 311381 Rolly-Royce

14.2.3 Location of anodes

- 14.2.3.1 CCGS Des Groseilliers: 54 corrosion-resistant anodes are located as follows:

Description	Location	Frame	Anode	Qty	Panel
Starboard low seabox	Sprinkler pump	30-31	KE 3.5-30-35 KE3.5-24-28	2	E
Seabay (Port and Stbd)	Propulsion motor room (7T)	55-61	KE 3.25-30-25	10	D
Port and Stbd Low seabox	Propulsion motor room	60-61	KE 3.5-30-35	4	D
Starboard High seabox	Propulsion motor room	58-61	KE 3.5-24-28	3	D
Seabay	Aft engine room (14T)	93-95	KE 3.25-30-25	10	C
Port and Stbd. low seabox	Aft engine room	92-95	KE 3.5-30-35	6	C
Port high seabox	Aft engine room	92-95	KE 3.5-24-28	3	C
Seabay	Forward engine room (14T)	95-99	KE 3.25-30-25	10	B
Starboard high seabox	Forward engine room	95-99	KE 4-24-28	2	B
Port and Stbd low seabox	Forward engine room (<i>Note: #20 Neck 6" offset</i>)	95-97	KE 4-30-35	4	B

14.3 Statement of work

14.3.1 Preparation

- 14.3.1.1 Prior to the commencement of any and all work, the Contractor must lock out the power supply for the cathodic protection system as per the Coast Guard ISM Safety Lockout Procedure 7.C.1.M S36-01 safety code.
- 14.3.1.2 The Contractor must install/remove locks and tags accordingly during the scope of work.
- 14.3.1.3 The contractor must consult the IA or TA to determine the equipment that must be locked out.
- 14.3.1.4 It must be the Contractor's responsibility to perform the actual lock out and the Contractor must supply and install its own locking devices and retain all keys during the scope of this work.
- 14.3.1.5 The Contractor must perform all work as per manufacturer's specifications and recommendations in the manufacturer's instruction manual.
- ~~14.3.1.6 — Note: There are 120 bolts 3/4" by 5" long. Nuts welded on the interior are to be removed and replaced with new nuts welded in the same place. Six (6) bolts must be shortened. All the above anodes have 5" studs and 3/4" insulators except for anodes #9, 10, 11, 12 and 13, these anodes have 10" studs.~~

14.3.2 Anodes inspection (Cathelco system)

- 14.3.2.1 The Contractor must remove the covers on all anode connection boxes which are to be opened for inspection only. Any defect found must be brought to the attention of the IA or TA for remedial action if necessary. On completion of all work, the Contractor must close the connection boxes using new gaskets.
- 14.3.2.2 To gain access to the CATHELCO system anodes, the Contractor must remove all (~~about~~ twenty-three - 23) suction pipe extensions from the sea bays. After work has been carried out, the Contractor must reinstall the same extensions using new corrosion-resistant bolts and nuts, as well as new gaskets.
- 14.3.2.3 The Contractor must disconnect the electrical connections and remove all Cathelco anodes identified in drawings 68-2730-1 and ESK-26 and present them to the IA. The Contractor must dispose of all anodes not being conserved by the CCG.

- 14.3.2.4 The Contractor must install the new anodes supplied by the TA and verify ground resistance of each anode. The Contractor must verify ground resistance of the electrical wiring linking each anode to the control panel before connecting it to the anodes. The Contractor must supply a report of the readings of the ground resistances to the IA.

14.3.3 Hull anodes

- 14.3.3.1 In order to inspect and replace each of the anodes the Contractor must supply and erect staging and/or supply a motorized nacelle to allow access. On completion of this inspection, the Contractor must remove the staging.
- 14.3.3.2 The Contractor must inspect and replace all hull anodes identified in drawings 68-H-163 and 311381 Rolly-Royce. The anodes will be supplied by the contractor. Any defect found is to be brought to the attention of the IA/TA, for remedial action.
- 14.3.3.3 In the bid the Contractor must quote the unit cost to replace one anode. The Contractor must include in his price grit blasting of the hull area under the anode to a bare steel condition of (SSPC-SP10)/NACE No. 2 (Sa 2-1/2) near white metal standards. This must be coordinated with the blasting preparation for the hull included in this specification.
- 14.3.3.4 Note: these anodes are welded to the hull.

14.3.4 Calibration

- 14.3.4.1 The Contractor must calibrate the cathodic protection system to the manufacturer's recommended levels and test its performance once all work has been completed and the ship has been re-floated.
- 14.3.4.2 The crew will perform the adjustment of the system in salt water, to a current between 1 and 2 amps.

14.4 Proof of performance

- 14.4.1 The following inspections are required to be verified by the IA or/and TA:
- 14.4.1.1 Visual inspection of connection boxes,
 - 14.4.1.2 Visual inspection of reference anodes,
 - 14.4.1.3 Visual inspection of protection anodes,
 - 14.4.1.4 Witnessing installation and connection of new anodes - if required,
 - 14.4.1.5 Witnessing the calibration of the system.

14.5 Deliverables

- 14.5.1 The contractor must supply the Technical Authority an electronic copy, on a USB stick not protected by a password, in Microsoft Office Word 2003 or more recent format, a report detailing all undertaken works, defects, repairs performed, measurements and readings taken.
- 14.5.2 The Contractor must provide a Quality Assurance (QA) report indicating that all parts of the cathodic protection system has been inspected by the Contractor's QA Department for correct installation and fit.

15.0 STRAINERS, SEA BOXES AND SEA BAYS

15.1 Identification

- 15.1.1 The objective of this item consists of opening the grates and manholes to give access to the sea boxes and the manholes for the sea bays described below
- 15.1.2 The cleaning of internal surfaces will be high pressure water jet (5000 psi minimum).
- 15.1.3 Installation of zinc anodes in the sea boxes.
- 15.1.4 Painting of designated areas in the sea boxes and seabays.

15.2 References

15.2.1 Drawings

- 15.2.1.1 68-2030-3 Seabox / Seabay Arrgt.
- 15.2.1.2 68-2030-4 1/2/3 Main Sea Water Inlet Strainer
- 15.2.1.3 68-H-105 Docking plan
- 15.2.1.4 68-H-163 Cathodic Protection Hull Anodes

15.2.2 Location of sea chests and sea bays

NOTE: For this item, the equivalent terms used are:

- Seabox = Prise d'eau (à la mer) ou Caisson de prise d'eau
- Seabay = Caisson d'eau de mer

- 15.2.2.1 The following table shows the location of the sea chests and the sea bays that must be opened for cleaning and inspection by the CCG TA.

Description	Location	Frames
Starboard low seabox	Sprinkler pump	30-31
Seabay (Port and Stbd)	Propulsion motor room (7T)	55-61
Port and stbd. low seabox	Propulsion motor room	60-61
Starboard high seabox	Propulsion motor room	58-61

Seabay	Aft engine room (14T)	93-95
Port and Starb. low seabox	Aft engine room	92-95
Port high seabox	Aft engine room	92-95
Port Evaporator Seabox suction	Forward engine room	120-123
Seabay	Forward engine room (14T)	95-99
Starboard high seabox	Forward engine room	95-99
Port and Stbd low seabox	Forward engine room Note: #Neck 6" offset	95-97
Stbd high seabox	Submersible pump	58-59

15.3 Statement of work

15.3.1 Sea Strainers – Moto propulsion Room

- 15.3.1.1 The Contractor must open the port and starboard (2) sea strainers. This will involve disconnecting the sea strainer vents & drains.
- 15.3.1.2 The Contractor must remove and clean, by hand wire brushing or hand power tool, the sea strainer grates to remove any marine growth or corrosion.
- 15.3.1.3 The Contractor must water pressure wash (5000 psi) and if necessary mechanically clean to bare steel the surfaces of the motor propulsion room strainer boxes to the SSPC.SP11 norm and, when dry, submit it to the Technical Authority for inspection. Any defects found must be brought to his attention for remedial action.
- 15.3.1.4 The Contractor must apply two coats of Intershield 300 of different colours of 125 microns (.005" DFT each) to the interior surfaces of each strainer box as well as to the underside of each strainer cover.
- 15.3.1.5 The Contractor must, after the painting is completed submit it to the IA or TA for inspection
- 15.3.1.6 After inspection of the motor propulsion strainer, the Contractor must reinstall the strainers and the covers, using new gaskets, and secure the

assembly into place. The Contractor must apply anti-seize compound on all fasteners.

15.3.1.7 The Contractor must reconnect the vents and drain piping and verify that they are working properly.

15.3.1.8 The Contractor must provide a quote for unit costs to have the motor room strainers hot galvanised after cleaning.

15.3.2 **Sea Strainers – Forward and Aft engine rooms**

15.3.2.1 The Contractor must entirely remove the 2 forward and 2 aft engine room strainers and dispose of them. The Contractor must install in the same position 4 new strainers supplied by the IA or TA. The contractor shall include 20 hours of machining in their bid for the fitting of hot galvanised steel spacers (contractor supply) on the inlet and outlets of each strainer, approximately 25mm (1”) in thickness each. Exact dimensions of spacers will be validated once the strainers are installed, taking into account necessary gaskets.

15.3.2.2 The Contractor must reconnect the vents and drain piping and verify that they are working properly.

15.3.3 **Seaboxes**

15.3.3.1 The Contractor must remove the manhole covers and the access grates (on the hull) to the seaboxes, as described in table or 15.2.2.1.

15.3.3.2 The Contractor must clean the internal surfaces, including the access grates, using high-pressure water jets with a minimum pressure of 5,000 psig, or a sand blasting process.

15.3.3.3 The Contractor must inform the TA and the attending TCMS Surveyor when the seaboxes are opened up, so they can inspect them.

15.3.3.4 The Contractor must mechanically ream all access grates’ holes to their original diameter.

15.3.3.5 The Contractor shall quote for the surface preparation and the installation of 22 Z-19 zinc anodes, and 22 Z-22 zinc anodes, in the seaboxes, at specific locations, as stated by the IA. The anodes must be

- bolted down, and the Contractor must supply 5/8" stainless steel bolts that must be welded for the anodes installation.
- 15.3.3.6 These anodes are not included in Section 14 of this specification and must be included by the Contractor in their price as well as their respective installation as described in this section.
- 15.3.3.7 The Contractor must wire brush clean any bared areas in preparation for painting.
- 15.3.3.8 The Seaboxes must be inspected by the Technical Authority, before any painting starts.
- 15.3.3.9 After inspection, the Contractor must paint each sea chest with two (2) separate coats of INTERSHIELD 300 paint, from International, 125 à 150 microns (0.005" à 0.006") for each coat, color grey, on all internal surfaces of the seaboxes, including the evaporator and sprinkler pump seaboxes.
- 15.3.3.10 The Contractor must advise the IA or TA so he (she) can witness each coat application.
- 15.3.3.11 The Contractor must provide a unit cost per square metre for each coat of paint application on bared areas and the surfaces described in 15.3.3.9.
- 15.3.3.12 The Contractor must close the seaboxes' access grates, with **stainless steel** corrosion proof new bolts, tack welded. There are 120 countersunk head bolts, ¾" (d) by 5 in. (L). The Contractor must remove the nuts (¾" UNC) welded inside the plates and replace them with new ones, welded in the same locations. Bolts and nuts must be supplied by the Contractor, and they must paint the bolts and nuts with **INERTA or equivalent used for the underwater hull**; this painting must be coordinated with the painting done on the hull.
- 15.3.3.13 The Contractor must close all manhole covers, supply and install new gaskets (6 mm thick), bolts nuts and washers
- 15.3.3.14 For bidding purposes the Contractor must quote on renewing ten (10) manhole studs, with a unit cost per stud for any additional replacements required. This quote must also cover the item 15.3.3.
- 15.3.4 Sea Bays
- 15.3.4.1 The Contractor must remove all docking plugs to drain the sea bays and give them to the Chief Engineer.

- 15.3.4.2 The Contractor must remove the manhole covers and thoroughly clean the sea bays, using high-pressure water jets with a minimum pressure of 5,000 psig.
- 15.3.4.3 On completion of cleaning, the Contractor must notify the TA or IA and the TCMS Surveyor, so they can inspect the sea bays.
- 15.3.4.4 The Contractor must wire brush clean any bared areas in preparation for painting, **estimated at 5m²**.
- 15.3.4.5 The Seabays must be inspected by the Technical Authority, before any painting starts.
- 15.3.4.6 After the inspection, the Contractor must paint all internal surfaces of the sea bays with two separate coats of grey colored INTERGARD 264 paint de 150 microns (.006" DFT each).
- 15.3.4.7 The Contractor must advise the TA or IA so he (she) can witness each coat application and perform a final inspection once the painting is completed.
- 15.3.4.8 The Contractor must provide a unit cost per square metre for each additional coat of paint application on bared areas and the surfaces described in 15.3.4.7.
- 15.3.4.9 Upon completion of all repair work, inspections and paint work, the Contractor must recuperate from the IA and install the docking plugs for the Seabays and the manhole covers. The contractor must supply new rubber jointing and new galvanized fasteners. All fasteners must receive an application of ant-seize compound by the Contractor.
- 15.3.4.10 A waterproof test must be performed by the Contractor on each docking plug, using the vacuum box system, in presence of the Technical Authority and the attending TCMS Surveyor.
- ~~15.3.4.11 The Contractor must hydrostatically test, to the equivalent pressure of not more than three (3) psig, all Seabays. The Technical Authority and the attending TCMS surveyor must be present for these tests.~~
- ~~15.3.4.12 If a hydrostatic test fails and the failure is related to the Contractor's work, the Contractor must perform the necessary repairs and repeat the items until a satisfactory hydrostatic test is performed before the technical authority and the attending TCMS Surveyor.~~

~~15.3.4.13 — If a hydrostatic test fails and the failure is NOT related to the Contractor's work or if it is necessary to perform additional work, required by the Technical Authority: the additional cost must be negotiated using PWGSC 1379 form.~~

15.4 Proof of performance

15.4.1 The following inspections must be verified by the Technical Authority and the TCMS Surveyor:

- 15.4.1.1 Sea strainer grids and strainer boxes,
- 15.4.1.2 Inspection of internal surfaces of sea chests,
- 15.4.1.3 Inspection of main sea bays after cleaning.

15.4.2 The following inspections must be verified by Technical Authority:

- 15.4.2.1 Closing up strainer covers and manhole covers.
- 15.4.2.2 Paint application on internal surfaces of sea chest and main sea bay.
- 15.4.2.3 Visual inspection of protection anodes.

15.4.3 Testing; a Hydrostatic test on all sea bays.

15.5 Deliverables

15.5.1 The contractor must supply the Technical Authority an electronic copy, on a USB stick not protected by a password, in Microsoft Office Word 2013 or more recent format, a report detailing all undertaken works, defects, repairs performed, measurements and readings taken.

16.0 REMOVAL OF MUFF COUPLINGS

16.1 Identification

16.1.1 The intent of this specification item is to remove the two Muff couplings from their respective tailshaft in order to facilitate the removal of the tailshafts from the vessel. This work must be coordinated in conjunction with the following sections:

16.1.1.1 Section 17 - Tailshafts ,

16.1.1.2 Section 21 - Tail shafts mechanical seal,

16.1.1.3 Section 20 - Propeller removal, inspection and installation.

16.2 References

16.2.1 AW-302317 Arrgt for Flange Coupling Removal

16.3 Technical description

16.3.1 The Contractor must supply all the following equipment, not limited to, ventilation, staging, chain falls, slings and shackles or other necessary to perform the work. All lifting equipment must be appropriate for the expected duties, and be accompanied by valid 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 item are to meet the welding requirement of this specification. On completion of work, all of the Contractor's work related tools and equipment must be removed from the vessel and repair according to the respective requirements of this estimate the surfaces damaged by the welding of fasteners.

16.3.2 In order to gain access to each Muff, the Contractor must move various interference items. These are, but not limited to, walkways, railings above pedestal bearings and the turning gear covers for each tailshaft. Upon completion of all work, the Contractor must return and reinstall these items to "as found" condition.

16.3.3 Contractor must remove the sixteen (16) 3" diameter studs and nuts from each Muff coupling using a special tool supplied by the ship. Contractor must note that it is important that the last nut to be removed is the one facing the

- eyebolt. Before removing the 16th nut, the Contractor must install the chain block and connect it to the eyebolt.
- 16.3.4 The entrepreneur must remove the 1 1/2 x 1/2 inch flat steel water thrower, built in two (2) sections and forming a 2 feet 8 inches in diameter circle made of grade 14 sheet metal. Both sections are secured with two (2) 1/2 inch in diameter bolts.
- 16.3.5 The Contractor must remove the port and starboard tailshafts mechanical seals following the directives as detailed in 21.0.
- 16.3.6 The contractor must also remove the Mitchel pedestal bearing covers are from the port and starboard bearings taking care to disconnect 3/4 inch in diameter lube oil connections (one per bearing).
- 16.3.7 Drain and clean completely both bearing sumps. Dispose of lube oil. Disconnect cooling connections and proceed with a hydrostatic pressure test at 45 psi.
- 16.3.8 Necessary precautions must be taken to prevent dirt from entering the bearings.
- 16.3.9 Once the tail shaft is well supported in and out of the ship, proceed with partial removal.
- 16.3.10 Contractor must partially withdraw each tailshaft aft in order to expose the end of each Muff coupling and its associated PILGRIM nut.
- 16.3.11 CCG supplied special removal tools will be supplied to the Contractor to allow him to remove the PILGRIM nut and the Muff couplings. These will include but not be limited to:
- 16.3.11.1 one hydraulic pump c/w hydraulic hoses and fittings,
 - 16.3.11.2 one 805 mm (31.69") long x 72 mm or 2.83" diameter stud,
 - 16.3.11.3 special steel plate 640 mm (25") diameter x 120 mm thick,
 - 16.3.11.4 eight (8) special studs,
 - 16.3.11.5 two (2) special sleeves,
 - 16.3.11.6 special steel plate 1,020 mm (41") diameter x 160 mm (6.3") thick,
 - 16.3.11.7 one copy of service manual for the removal and re-installation of the PILGRIM nuts.

- 16.3.12 The Contractor must only use these special tools during the removal process of the PILGRIM Nuts and Muff couplings, and any damage resulting from the misuse of these tools or the use of inappropriate tools during the course of this removal must be to the Contractor's account. On completion of all work, these specialized removal tools must be cleaned and returned to the IA in the same condition as received.
- 16.3.13 Using the supplied hydraulic pump, the Contractor must remove each PILGRIM nut and carefully place it aside. The Contractor must protect the PILGRIM Nuts to prevent any damage to their internal mating surfaces.
- 16.3.14 The Controller must perform the following procedure to remove one muff coupling. The same procedure is to be applied to both couplings.
- 16.3.14.1 The 805 mm long x 72 mm diameter stud is to be screwed into the end of each tailshaft.
 - 16.3.14.2 Once complete, the Contractor is then to install the special 640 mm steel plate and then the eight (8) special studs are to be inserted in the Muff coupling.
 - 16.3.14.3 Once installed, the eight (8) special studs will serve as a base for the second 1,020 mm diameter steel plate.
 - 16.3.14.4 The secondary steel plate is to be rigged and installed in such a way that the PILGRIM nut is between the two plates and mounted on top of the two (2) sleeves fitted on the two (2) lower Muff coupling studs.
 - 16.3.14.5 The Muff coupling is then to be jacked off its associated shaft using the PILGRIM nut and the hydraulic pump as defined in the Service Manual.
- 16.3.15 Once each coupling has been removed the Contractor must protect the mating surfaces to prevent any damage from occurring during the tailshaft withdrawal process. Any damage incurred as a result of not adequately protecting these machined surfaces must be to the Contractor's responsibility.
- 16.3.16 On completion of associated work and after the reinstallation of the tailshafts, the Contractor must reinstall on its respective shaft each muff coupling in the reverse order of procedure as laid out in 16.3. The mechanical seals previously removed must be reinstalled in their respective locations following satisfactory blueing on the cone surfaces. Both the TA and the IA must witness final hardening up of each Muff coupling and its associated PILGRIM Nut.
- 16.3.17 The Contractor must perform a dye check (liquid penetrant) on keyways.

- 16.3.18 The Contractor shall include in its price 12 adjustments (fits) with Prussian Blue. MUFF adjustments must be made in place. The contractor must also provide a unit price for a single adjustment. An adjustment of at least 80% is required. The Contractor must consult the TA for any additional adjustments and the cost will be negotiated upward or downward through PWGSC Form 1379.

16.4 Proof of performance

- 16.4.1 The following inspections are required to be verified by the IA the TA:
- 16.4.1.1 Inspection of the machined mating surfaces between the shafts and the couplings,
 - 16.4.1.2 Hardening up of all retaining nuts.

16.5 Deliverables

- 16.5.1 The Contractor must supply the TA, on an USB stick, not protected by a password and in a Microsoft Office Word 2013 or more recent format, a report detailing the work undertaken, defects, repairs made and measurements and readings taken.
- 16.5.2 The Contractor must provide a Quality Assurance (QA) report indicating that all parts of the Muff coupling and inboard tailshaft ends have been inspected by the Contractor's QA Department for correct installation and fit.
- 16.5.3 The Contractor must also provide a copy of TCMS Division III survey credit to the TA.

17.0 TAILSHAFTS

17.1 Identification

- 17.1.1 The Contractor must unship the Port and Starboard tailshafts and open up the stern tube bearings for inspection and survey by the attending TCMS Surveyor for a Division III survey credit.
- 17.1.2 The Contractor must present this survey credit to the IA and the TA prior to the flooding of the dock to re-float the vessel.
- 17.1.3 The Contractor must coordinate the work in this section with sections 16.0, REMOVAL OF MUFF COUPLINGS, 20, Propeller withdrawal inspection and installation as well as section 21.0, TAIL SHAFTS MECHANICAL SEALS.

17.2 References

- 17.2.1 Drawings (CCGS Des Groseilliers)
 - 17.2.1.1 AW201945 Tailshaft with liner
 - 17.2.1.2 AW302302 Coupling for tailshaft
- 17.2.2 Tailshafts dimensions
 - 17.2.2.1 Weight : 37 tons
 - 17.2.2.2 Length: 46 feet 1 13/16 inches
 - 17.2.2.3 Diameter: 26 inches

17.3 Statement of work

- 17.3.1 General
 - 17.3.1.1 The Contractor must be responsible for preparing the equipment and arranging for all inspections required. The Contractor must consult with TCMS prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor must advise the IA and the TA, 24 hours in advance, to allow their attendance.
 - 17.3.1.2 The Contractor must supply all equipment, chain falls, 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 item must be welded into place by CWB-certified welders only.

17.3.1.3 Whilst the vessel is still afloat, and not yet on the blocks, the Contractor must:

- Uncouple both the port starboard after tailshaft couplings;
- Take an record alignment readings;
- Measure and record the axial clearance, height and parallelism between the coupling flanges when their spigot is freed.
- Supply and install four (4) bolts, not fitted, on the couplings when measuring clearances.
- Take and record a second series of measures taken at 180° from the first readings.

17.3.1.4 These readings must be witnessed by both the IA and the TA.

17.3.1.5 Once the vessel is docked, the Contractor must remove the rope guards, measure and record the clearances between the tailshafts and the sterntube bearings. The contractor can find additional information on rope guards on the drawing "Shafting Arrangement 68-2600-1".

17.3.2 **Propeller removal**

17.3.2.1 Following description in item 20, PROPELLER REMOVAL, INSPECTION AND INSTALLATION, the Contractor must remove both propellers, and remove the propellers to the dock floor.

17.3.3 **Tailshaft removal and inspection**

17.3.3.1 Using the turning gears, the Contractor must check and record the tailshafts wear down and concentricity at each stern tube end and on the propeller tapers.

17.3.3.2 The Contractor must dismantle the lubricating oil connexions ($\frac{3}{4}$ in. diameter) and remove the intermediate bearings covers, located near the stern tubes, making sure to protect the bearing from contaminants.

17.3.3.3 The Contractor must drain and clean the intermediate bearings sumps, dispose of the oil (50 litres), uncouple the coolers connexions and dismantle the bearings.

- 17.3.3.4 The Contractor must hold on each end of the tail shafts then withdraw them enough to perform the following works:
- Remove the pilgrim nut from the Muff couplings;
 - Jack the coupling from the shaft;
 - Install a protective nut at the inner end of the tail shafts.
- 17.3.3.5 The Contractor must completely remove, the shafts from the stern tubes. The Contractor must protect, support and manoeuvre the shafts, making sure not to damage the bearings, the threads, the tapers and the vulcanised rubber coating between both shaft bearings.
- 17.3.3.6 The Contractor must support the tail shaft at all times, to avoid any warping.
- 17.3.3.7 The Contractor must transport both tail shafts into its shop, where it must always be adequately supported along its whole length.
- 17.3.3.8 The Contractor must thoroughly clean shafts and check them for wear and defects. The Contractor must pay particular attention to the following areas;
- Forward and aft keyways on shaft tapers;
 - Forward and aft shaft tapers;
 - Forward and aft ends of each of the two liners where they meet the tail shaft;
 - Fwd and aft pilgrim nuts and threads on shafting;
 - Liner wear and condition of bushing;
 - Fwd end of fwd liner in way of "MD Seal" seal;
 - Galvanised rubber coating between liners.
- 17.3.3.9 The Contractor must inspect the keyways, the tail shafts threads and tapers, the propeller nuts and the couplings with non-destructive crack detection (dye penetrant) performed by a minimum Level II certified technician. All materials for testing must be supplied by the Contractor and a report, detailing the results of this testing, must be provided to the TA within three days of completion.
- 17.3.3.10 The Contractor must set each shaft on a lathe and take a short cut on both bronze bearings of each shaft. The finish must be 32 RMS.

- 17.3.3.11 Note: The shafts must not be machined near the mechanical seals areas. The machining thickness will be decided following a dimensional analysis of the shafts.
- 17.3.3.12 While each shaft is set on a lathe, the Contractor must check for shaft run-out. The Contractor must provide run-out readings of the shaft and of a drawing showing the extent of grooving on each shaft. While in the lathe, the lathe steady rest must not interfere with the shaft surface in way of the mechanical seal. Contractor must ensure that lathe's steady rest does not groove the shaft.
- 17.3.3.13 With the shafts set on a lathe or laid on appropriate rollers, Contractor supplied, and not in the stern tubes, the Contractor must check the concentricity of both tail shafts and the presence of the TA.
- 17.3.3.14 The Contractor must perform, in presence of the AT, a Spark test on the vulcanised rubber coating of the tail shafts in order to check the adhesion of the rubber product and provide a report.
- 17.3.3.15 If the Spark test confirms the integrity of the rubber coating or after completion of required repair works, the Contractor must carefully handle the shafts and set them on temporary cradles, Contractor supplied, particularly if they cannot be reinserted immediately because of required works on the stern tubes or stern tubes bearings. If the vulcanised rubber coating is damaged and requires repairs a specialized accredited firm in this type of coating. The entrepreneur must consult the TA before choosing the firm. The cost must be adjusted using PWGSC 1379 form if necessary.
- 17.3.3.16 The contractor must provide the following option; Provide a quote for the replacement of the two propulsion shafts with new CCG supplied refurbished equivalents. Should this option be used, items 17.3.3.8-17.3.3.15 can be cancelled and converted to a credit. The costs of transport of the propulsion shafts to the contractor's installations will be adjusted through a 1379 PWGSC

17.3.4 Stern tubes bearings

- 17.3.4.1 The Contractor must hire the FSR for the install for the installation of new THORDON bearings. The Thordon representative must supervise the installation in the stern tubes. The sterntube bushings will be CCG supplied materials.

- 17.3.4.2 The Contractor must check the bronze locking bars installed to prevent rotation of the bearings and replace them if required by the TA. The machining of the inner diameter of the bearings must be determined after the tail shafts measurements are completed and performed according to the THORDON representative requirements.
- 17.3.4.3 The contractor will install Bronze key locks, supplied by the CCG. The bearings will be installed using the “freeze fit method”, under the manufacturer’s representative supervision.
- 17.3.4.4 The order of all steps regarding this sub section will be the following;
- Removal of old stern tube bearings
 - Sandblast cleaning, cavity filling of the stern tubes with Belzona Ceramic R Metal.
 - Retaining ring inspection
 - Stern tube painting
 - Key lock system installation
 - Machined tail shaft and stern tube measuring
 - Machining of the new stern tube bearings
 - Stern tube bearing installation
- 17.3.4.5 The existing forward and aft retaining rings will be removed, followed by the stern tube bearings. The rings are to be conserved by the contractor.
- 17.3.4.6 The contractor must clean and repair both stern tubes in the mid-section, between the two bearings housings using sand blast complying with the SA 2-1/2 grade. Before doing so, the bearings areas will be properly protected against sandblast.
- 17.3.4.7 Once the tubes blasted and cleaned, the cavities and porosities will be filled with Belzona Ceramic R Metal product by the contractor.
- 17.3.4.8 The contractor will include in their price five (5) kg of this product per tube, which will be increased or decreased using the PWGSC 1379 form. The contractor must provide a unit price per kilo for this purpose. Application of Belzona Ceramic R Metal will be done following manufacturer’s recommendations and under the CCG IA supervision. The date of manufacture of each package is to be given to the CCG IA to ensure the product is not expired.

- 17.3.4.9 Once the product fully cured, a mechanical preparation will be done by the contractor on the repaired spots to roughen the surface. Clean the tubes in order to remove all fine particles and prepare for painting. Apply two (2) coats of Intergard FPD 052, beige color, 0.005" thick each coat in each stern tube.
- 17.3.4.10 The contractor must inspect all stern tube bearing retaining rings, located at the end of the bearing housings, and check each bolt tightness and locking devices. The contractor must carry out a NDT (dye check) on every retaining ring. The retaining rings at each tube end will be reinstalled after the stern tube bearing replacement, using Loctite 263 threadlocker by the contractor.
- 17.3.4.11 The contractor must drill and tap the necessary holes and Install the supplied key slots in the tubes with the supplied bolt kits.
- 17.3.4.12 Inspection and measuring of the tail shaft bronze liners and bearing housings must be executed by the bushing manufacturer's representative once the tail shaft is machined and the key slot system installed. The IA or IA's representative will be present to note all readings and measurements obtained. Final machining of the stern tube bearings will be completed must be done by a specialized and accredited firm. The contractor must consult the TA before choosing the firm. The contractor must foresee a delay in his calendar between the measuring and the return of the machined bearing's delivery to the shipyard.
- 17.3.4.13 The machining of the stern tube bearings will be determined by the housing and tail shaft diameters. The manufacturer's representative will be advised when ready to take measurements, in order to cover the shafts and housings on the same visit.
- 17.3.4.14 Once the key slot system and measurements accepted by the manufacturer's representative, the new bearings must be frozen using liquid nitrogen, in a specific container for this particular application. The bushings will be installed in the sterntube under the supervision and directives of the representative.
- 17.3.4.15 The contractor must supply material, man power, all necessary tooling and machinery to install the stern tube bearings using this method. That includes the container(s) that will be needed to freeze the bearings.

17.3.4.16 Once the bearings installation completed and their temperature is stabilized, the contractor must measure all bearings' inside diameter at eight (8) points on each bearing section. Note all readings in the measurement book.

~~17.3.4.17 The cost of the work required for the stern tubes bearing must be negotiated using PWGSC 1379 form.~~

17.3.4.18 The Contractor must include in its bid an allowance of \$10,000 to cover a Thordon representative's services. This allowance must include cost per day, accommodations, meals and transportation. The \$10,000 allowance must be adjusted up or down using form PWGSC 1379 upon receipt of the representative's final invoice, along with copies of all supporting documentation attesting to actual costs.

17.3.5 Reinstallation

17.3.5.1 Upon completion of inspection and repairs, the Contractor must re-assemble all shafting, turning gears, brakes, propellers, rope guards, mechanical seals and couplings. All equipment must be assembled to a fully operable condition and as per manufacturer's recommendations where applicable.

17.3.5.2 The Contractor must coat the stern tubes bearing staves end the bronze sleeve with non-polluting water soluble grease.

17.3.5.3 The Contractor must verify the fits of the taper connection between each propeller and its associated the tail shaft taper. Verification of fits must be by machinist bluing process with a minimum surface contact area between the flanges and tapers of 75% to 80%. Final fit and hardening up of the propellers must be witnessed by the TCMS Surveyor, the IA and the TA. Copies of all readings shall be provided to the IA and the TA. The Contractor must install the MUFF couplings on the tail shafts and screw the PILGRIM nuts inside.

17.3.5.4 The Contractor must use chain blocks to match the coupling of the propeller shaft with the thrust bearing shaft in order to install the sixteen (16) 3 inches diameter bolts with their nuts and locking plates. The Contractor must take care to insert the bolts in their specific hole (#1 bolt in # 1 hole, etc.). The Contractor must fit these bolts in the coupling's face.

- 17.3.5.5 Before tightening the couplings, the Contractor must check their parallelism, before the shaft coupling is on the motor coupling spigot. This verification must be done twice at a 180° angle. The Contractor might use non fitted bolts, Contractor supplied, when the measurements are taken. The Contractor must register the readings.
- 17.3.5.6 The Contractor must complete the coupling tightening on the tail shaft taper using the hydraulic pump and the PILGRIM nut. The Contractor must drill new holes in the locking plates and install them at their specified location.
- 17.3.5.7 ~~The Contractor must install the intermediate bearings covers and adjust them with the tail shafts then connect the oil piping (3/8 in. dia.), using contractor supplied, new gaskets. The Contractor must supply new gaskets, connect the cooling system and fill up the bearing with ship supplied new oil. Refer to item 27 for intermediate bearing installation.~~
- 17.3.5.8 The Contractor must remove the brackets installed for the purpose of establishing rigging points, grind flush the affected areas, and apply a surface treatment to match the existing paint schedule of the surrounding areas. **Proceed with magnetic particle verification.**

17.4 Proof of performance

~~17.4.1 Dry dock trial~~

- ~~17.4.1.1 On completion of all work, each shaft must be turned for a period of one (1) hour using the vessel's turning gear in order to test for any leaks of the system. A one (1) hour dock trial must then be conducted using the vessel prime movers to turn the shafts in order to check for overheating and or vibration.~~

17.4.2 Additional measurements

- 17.4.2.1 Prior to refloating, the Contractor must take an additional set of clearance readings between the tail shaft and stern tube bearing. The Contractor must record these readings and provide copies to the TA.

17.4.3 Sea trials

- 17.4.3.1 After the vessel has been afloat for a minimum twenty-four (24) hours, the Contractor must take shaft alignments readings and compare them to those taken previously. ~~Any correction required due to miss-alignment must be the Contractors responsibility and to his account.~~

These alignment readings must be witnessed by the PSPC Inspection Authority, the TA and TCMS Surveyor if so requested.

17.4.3.2 Upon completion of all refit work, but prior to Acceptance; a four (4) hour sea trial must be conducted. A series of evolutions, involving a gradual increase of speed and reversals must be undertaken to test the ship's equipment. The Contractor must submit the trials program to the TA and the IA 48 hours prior to start of the trials for approval.

17.4.3.3 The vessel must be gradually worked up to full speed; the Contractor must have shipyard personnel in attendance to monitor the shafting system on a continual basis for both this trial and the dockside trial noted above. Any overheating or vibration must be remedied at no expense to Canada.

17.4.4 Inspections

17.4.4.1 The following inspections are required to be verified by the IA, the TA and the TCMS Surveyor:

17.4.4.2 Witnessing of readings taken of tailshaft alignment and clearances prior to and after docking of the vessel;

17.4.4.3 Witnessing of readings taken of tailshaft/bearing clearances prior to removal and after re-assembly;

17.4.4.4 Witnessing of NDT testing;

17.4.4.5 Witnessing of shaft run-out verification;

17.4.4.6 Witnessing of stern tube bearing clearances;

17.4.4.7 Blueing of surfaces of tapers;

17.4.4.8 Hardening up of all retaining nuts and propellers

17.5 Deliverables

17.5.1 The Contractor must supply the TA, on an USB stick, not protected by a password, in a Microsoft Office Word 2013 or more recent format, and on a paper copy, a report detailing the work undertaken, defects, repairs made and measurements and readings taken.

17.5.2 The Contractor must also provide a copy of TCMS Division III survey credit to the TA.

- 17.5.3 The Contractor must provide a Quality Assurance (QA) report indicating that all parts of the tailshafts and sterntubes shafts bearings have been inspected by the Contractor's QA Department for correct installation and fit.

18.0 THRUST BEARINGS

18.1 Identification

18.1.1 The purpose of this sub-section is to remove both thrust bearing covers for an internal inspection by TCMS.

18.2 References

18.2.1 Drawings

Drawing number	Description
49199	Mitchell Main Thrust Block with Ahead and Astern Thrust Meters
68-2120-1	Lub Oil Filling and Service Diagram
68-2120-2_6	Lub. Oil Arrangement for Propulsion Motor Room Sht 6 of 7

18.3 Statement of work

18.3.1 Set-up

18.3.1.1 In order to gain access to the thrust bearings, the Contractor must remove some equipment located above the bearing on 17' flat deck. These equipment could include. The Contractor must include in its price and without limitation the removal, storage and reinstallation of these equipments:

- Tools or hardware cabinets
- Cupboard with sink, connections located in the cupboard.
- Hand rails;
- Floor sections;
- Stairway;
- Lighting system;
- Piping;
- Ventilation ducts

18.3.1.2 The Contractor must, when visiting the ship, check carefully the working spaces in order to ascertain if it will be easier for him to displace or not all equipment mentioned above or any other equipment or structure not mentioned that the contractor deems necessary.

18.3.1.3 The Contractor must store, rebuild and replace these equipment and structures after the completion of works and include the related cost in the original bid.

18.3.2 Dismantling

18.3.2.1 The Contractor must open for inspection by TCMS the two main thrust bearings which are located in the motor room. Prior to work, the Contractor must take and record the thrust clearances and, once the shafts are uncoupled, the forward and after main bearings clearances.

18.3.2.2 The Contractor must drain completely the 250 litres of lubricating oil from both main thrust bearings. The Contractor must dispose of this oil with respect to the environment. The Contractor must make sure to isolate both thrust bearings from the bearing lubrication system i.e. the holding tank and the pump.

18.3.2.3 Work sequence is as follows in order to effectuate survey:

- Uncouple and remove all piping connected to top cover;
- Uncouple and remove all external electric instrumentation on top cover, and four (4) wires for the thermocouple on each bearing;
- Remove "End Closures" on covers;
- Slacken two turns the "Journal Shell" holding screw;
- Remove all bolts that connect both top and bottom casings and eliminate all other interference;
- Install cover gudgeons guide;
- Raise the top cover 1/16" maximum. Maintain parallelism between the couplings and the covers. Use jacking screws for this purpose.
- Open the upper section of the "Journal Shell" and their respective seat located in the top cover by tapping the holding screw and removing the top cover screws.
- Raise the top cover slowly using a jacking screw until it can be visually determined that the upper sections of the shell bearing remain on the shaft.
- Raise top cover, taking care not to damage any internal parts and proceed with inspection of internal parts, mainly the eight (8)

forward pads, the eight (8) reverse pads on each thrust bearings and the base ring assembly. When reassembling thrust bearings, ensure that forward pads are not inverse with reverse pads.

18.3.3 Inspection

18.3.3.1 The Contractor must clean and take measurements of all pads before submitting them to the TCMS surveyor and the TA inspection.

18.3.3.2 If some pads are required to be replaced, they will be supplied by CCG.

18.3.4 Reassembly

18.3.4.1 After the survey, the Contractor must reassemble the thrust bearings in reverse order of the sequence described above.

18.3.4.2 There are two (2) oil cooler tube bundles per bearing. The Contractor must :

- Disconnect water cooling piping, remove each bundle from bearing;
- Clean inside the tubing and proceed with a water pressure test of not less than 45 P.S.I. Test to be conducted in the presence of authorities concerned.
- Clean all inside parts of both thrust bearings, including sumps, removing remaining oil and contaminants, then reinstall the coolers with new contractor supply, bolts, nuts and gaskets.

18.3.4.3 Once work is completed, the Contractor must:

- Filter oil supplied by the vessel to 15 microns;
- Refill thrust bearing sump with this oil ;
- Reassemble the bearings and all dismantled elements, in reverse order of the sequence described above, supplying and using new gaskets;

18.4 Proof of performance

18.4.1.1 The Contractor must ensure that the TCMS surveyor and the TA are present for the pads and bearings inspection.

18.4.1.2 The Contractor must submit to the TCMS surveyor and the TA the bearings clearances and the pads measurements as soon as they are available.

18.5 Deliverables

- 18.5.1.1 Before the end of the contract, the Contractor must give to the TA a comprehensive report detailing the work undertaken, measurements and readings taken and the results of hydrostatic trials performed on the heat exchangers, in a Microsoft Office Word 2013 or more recent format, on an USB stick, not protected by a password.

19.0 Not used

20.0 PROPELLER REMOVAL, INSPECTION AND INSTALLATION

20.1 Identification

- 20.1.1 Perform the required five-year propellers inspection.
- 20.1.2 If the propellers are damaged but can be repaired in dry-dock, the repair work must be performed by the Contractor.
- 20.1.3 If the propellers are damaged and require to be repaired in a shop, the Contractor must ship them to a specialized firm. The Contractor must install the repaired propellers or install new propellers supplied by the Canadian Coast Guard.

20.2 References

- 20.2.1 Documentation
 - 20.2.1.1 Pilgrim nut instruction booklet;
- 20.2.2 Drawings

Drawing number	Title
Tailshaft with liner	AW201804
Shafting arrangement	AW201803

- 20.2.3 Items supplied by Canadian Coast Guard
 - 20.2.3.1 All tools and special equipment supplied to the Contractor by the CCG must be returned in good condition once the works are completed. The Contractor must sign a logbook prepared by the IA or TA for each tools or equipment loaned.
 - 20.2.3.2 The Contractor must include in is quotation the cost of handling and transport of any tools and special equipment supplied by the vessel, from and to the storing area onboard the vessel.

20.3 Statement of work

- 20.3.1 Propellers inspection:
 - 20.3.1.1 The Contractor must remove the rope guards to measure and record port and starboard tailshafts wear down. Measurements are to be taken with a feeler gauge in the presence of the IA or TA, recorded and given to the TCMS surveyor.

- 20.3.1.2 The propellers must be inspected by the TA or IA, and by the TCMS surveyor if required.
- 20.3.1.3 If one or both propellers are damaged the Contractor must perform the repairs accordingly with the TA requirements. The cost of the repair work must be negotiated using PWGSC 1379 form.
- 20.3.1.4 If the propellers are damaged and, upon advice from an expert, cannot be repaired in dry-dock, they must be shipped to a specialized firm certified by a classification society. The cost of the transport and repair work must be negotiated using PWGSC 1379 form. A written report of the propeller repairs must be prepared by the Contractor and submitted to the TA and to TCMS.

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- 20.3.1.5 The Contractor must verify, on both propellers, the propeller pitch and the blades thickness then produce a report. The Contractor must also perform a liquid penetrant test to detect any cracks on both propellers' keyways and include the results in the report.
- 20.3.1.6 If the propellers are not damaged and no specific work is required by the TCMS surveyor or by the CCG, the contractor must store the propellers during the works of item 17.
- 20.3.1.7 The Contractor must include in its bid an allowance of \$10,000 to cover a specialised firm's representative's services. This allowance must include cost per day, accommodations, meals and transportation. The \$10,000 allowance must be adjusted up or down using form PWGSC 1379 upon receipt of the representative's final invoice, along with copies of all supporting documentation attesting to actual costs.

20.3.2 Propeller removal

- 20.3.2.1 After having removed the cement, the Contractor must unscrew and remove propeller cones and place them at the bottom of the dry dock. These cones are filled with tallow.
- 20.3.2.2 The Contractor must unscrew and remove PILGRIM nuts locking plates
- 20.3.2.3 The Contractor must slack off the propeller shaft nuts and reinstall them taking care to turn them around so that the moving parts of the nuts are directed towards the exterior and not towards the propeller hub. The

Contractor must carefully clean the tailshaft threads to prevent contaminants from seizing the pilgrim nut.

~~20.3.2.4 After removing the PILGRIM nut and before turning around and installing the propeller shaft nut, the Contractor must take measurements of the longitudinal position of the propellers on the conical section of the tailshaft. The Contractor must record these measurements as guidance for installing the propellers.~~

20.3.2.5 The Contractor must position the air bleed valve vertically towards the highest point in order to completely remove the air. The Contractor must also remove the rings and rubber seal of the internal face (sterntube side).

20.3.2.6 The Contractor must install eight (8) special studs (CCG supplied) on the propeller hub).

20.3.2.7 The contractor must slide a 6" thick by 4' in diameter plate onto the studs and harden them up against the PILGRIM nut with eight (8) special nuts.

20.3.2.8 Before applying any pressure, the Contractor must purge all air remaining in the nitrile rubber ring using the MORPRESS pump, supplied by the CCG. The IA or TA or his representatives must be present during the complete removal operation of the propellers. The pump pressure can easily exceed 10000 psi, in the early stage of the withdrawal process.

20.3.2.9 Before commencing propeller clearance, the Contractor must restrain the propellers with hoists and special eye bolts, which are screwed onto the hull of the ship, and provided by the IA. The eight (8) nuts will hold the special plate against the PILGRIM nut and the pressure applied by the Contractor, with the hydraulic pump, the propeller will drop from the tapered end of the tailshaft. During propeller withdrawal, chain blocks must be rigged to support the weight of the propellers. The pressure necessary to remove the propellers must be logged by the Contractor.

20.3.2.10 The Contractor must insert the PILGRIM nut on the tailshaft after the propeller removal. The Contractor must protect the PILGRIM nuts to prevent any damage to their internal mating surfaces.

- 20.3.2.11 The Contractor must lay the propellers down on adequate structures. The Contractor must clearly identify the propellers as Port propeller and Starboard propeller.
- 20.3.2.12 Propellers and cone studs are then to be inspected. Any defects are to be brought to the immediate attention of the TA and the Inspection Authority for remedial action.
- 20.3.2.13 Handling of the propellers must be included in the item pricing.
- 20.3.3 Fitting the propellers
 - 20.3.3.1 The propellers must be adjusted and reinstalled by the Contractor on their respective tailshafts.
 - 20.3.3.2 The Contractor must include in their price 12 propeller fits using Prussian blue. Propeller fits must be done in place and the pilgrim nut shall be installed for each fit. The Contractor must also provide unit price for a single fit. An 80% minimum fit is required. The Contractor must consult the TA for any additional adjustments and the cost will be negotiated upward or downward through PWGSC 1379 Form.
 - 20.3.3.3 When performed, the TA or IA and the TCMS surveyor must be present for the fits and for the liquid penetrant tests.
- 20.3.4 Propellers installation on the tailshafts
 - 20.3.4.1 Prior to the final "hardening up" of each propeller, new Contractor supplied rubber "O" ring(s) must be fitted to the internal groove of each propeller hub.
 - 20.3.4.2 Before tightening the propellers in place, the Contractor must purge all air remaining in the nitrile rubber ring, making sure that the air bleeding valve is located on top of the ring. The IA or TA or his representatives must be present during the complete propellers installation process.
 - 20.3.4.3 The Contractor must tighten the propellers, complete with the *PILGRIM* nuts, onto the tapered end of the tailshaft with the hydraulic pump. The "PILGRIM" nuts must be installed to allow the rubber ring to push the propellers onto the tailshaft taper.
 - ~~20.3.4.4 The Contractor must not overtake the positioning marks of the propellers on the tailshaft, referring to measurements taken before their removal. The pump pressure can easily rise to 10000 psi, and even more.~~

- 20.3.4.5 Once the propellers are in place, the Contractor must tighten and lock the nuts, and drill new holes for locking devices.
- 20.3.4.6 After they have been cleaned, the Contractor must refit propeller cones and refill them with tallow.
- 20.3.4.7 The Contractor must secure in place each cone using its associated securing nuts, sixteen (16) per cone and each nut is to be locked into place using a welded " U " shaped 1/4 inch stainless steel rod.
- 20.3.4.8 The Contractor must, after the final bolt tightening; fill the cone nut recesses with high-density cement.
- 20.3.5 Manufacture and installation of the rope guards.
 - 20.3.5.1 The Contractor must include in his price the fabrication of the rope guards removed in section 20.3.1.1. He must supply the **Lloyds grade A or equivalent steel plates**, ~~of the same grade as those removed~~, 3/4" thick, manufacture, shape, and clean them with a sand blasting process to SA 2 1/2 standard then paint them, on both sides, with INTERSHIELD 163 INERTA 160 paint. If the old rope guards are considered to be in good condition by the TA, the contractor must have them sandblasted and repainted according to the description of the new plates above. A credit may be requested by the TA.
 - 20.3.5.2 Prior to re-installing the rope guard and on each stern tube, the Contractor must remove the existing welded sacrificial anodes and replace them with four (4) new five (5) pound anodes, Contractor supplied, for a total of eight (8) anodes. Dimensions of the new anodes are three (3) inches by fifteen inches (15) by one and a half (1 1/2) inch thick. Steel will be recoated as described in section 10.
 - 20.3.5.3 The Contractor must weld in place the new rope guards. The Contractor must weld the steel plates over their overall circumference as well as the joints between their half-sections.
 - 20.3.5.4 After welding the rope guard in place, the Contractor must paint the welded parts and their surroundings with INTERSHIELD 163 INERTA 160 paint.

20.4 Proof of performance

- 20.4.1 The Contractor must ensure the IA or TA are present during the complete fitting process of the propellers on the conical part of the tailshaft.

20.4.2 The Contractor must ensure the IA or TA are present during the tightening of the propellers on the conical part of the tailshaft.

20.4.3 The Contractor must ensure the IA or TA are present for the locking of the PILGRIM nuts on the threaded parts of the tailshafts.

20.5 Deliverables

20.5.1 Preliminary report of the propellers condition.

20.5.2 Tailshafts wear down readings report.

20.5.3 Final report of the propellers repairs, including all measurements and a detailed description of all work performed on each propeller.

21.0 TAIL SHAFTS MECHANICAL SEALS

21.1 Identification

- 21.1.1 Completely dismantle the two (2) tailshaft mechanical seals, Wartsila (CRANESEAL), port and starboard, for the inspection of all parts and replacement of defective parts and the reassembly of both seals afterwards.
- 21.1.2 Some parts, including the inflatable seals (2) and the fixed MANETEX (2) seats, must be replaced by the Contractor.
- 21.1.3 The Phosphor Bronze Split Seal (2) must be rectified by the Contractor in its shop.

21.2 References

- 21.2.1 Drawings and instructions

Id. Number	Description
TM-MA-01 ISSUE C	Instruction book
H72317-02	Deep Sea Seals Ltd

- 21.2.2 Newfoundland Wartsila FSR : Mr. Adam Allen

21.3 Statement of work

- 21.3.1 Dismantling of two mechanical seals:
 - 21.3.1.1 Before dismantling the seals, the Contractor must uncouple the 1" diameter cooling water connections and the 1/2" diameter air connections
 - 21.3.1.2 The Contractor must completely dismantle the two (2) tailshaft mechanical seals, port and starboard, under the supervision of the IT or AT.
 - 21.3.1.3 The Contractor must obtain the services of a Wartsila FSR for the inspection of the installed parts and designate the parts to be replaced. The Contractor must consider a \$15,000.00 provision for the Wartsila FSR services. The final cost of these services must be negotiated and raised or lowered using the PWSGC 1379 form.
 - 21.3.1.4 The dock will proceed to machining / polishing the bronze sealing ring faces of 2 units. The contractor must check grooves for O-rings.

- 21.3.1.5 Spare parts will be provided by the Coast Guard. If certain parts are not available on board, the purchase of these parts will be negotiated through the Form 1379 process.

21.3.2 Reinstallation of the 2 mechanical seals :

The Contractor must perform the following tasks under the supervision of the Wartsila Representative:

- 21.3.2.1 Install and vulcanize both bellows using the Wartsila supplied equipment.
- 21.3.2.2 Install both MANETEX seats, including new Sealing Strips supplied by the CCG;
- 21.3.2.3 Install both bronze mobile sealing rings, including both O Cords between the rings and the tailshaft.
- 21.3.2.4 Reinstall the clamp ring and adjust it to assure a perfect alignment with the fixed part of the seal.
- 21.3.2.5 Reconnect the water and air connections.

21.3.3 WARNING

- 21.3.3.1 The Contractor must cover and protect, at all times and until their reassembly, the MANETEX friction face and the bronze sealing ring seat to preserve them from any scratch, scuff mark or bumps. The contact surfaces upmost condition warranties the best performance of the seals, once assembled.

21.4 Proof of performance

21.4.1 Trials

- 21.4.1.1 The Contractor must perform the following trials in dry dock under the supervision of Wartsila :
- 21.4.1.2 The Contractor must perform a pressure test on both inflatable seals to the initial pressure of 5 bars. A pressure drop of approximately 0.7 bar over 30 minutes is allowed (ex. tailshaft diameter of 727 mm).
- 21.4.1.3 If the bellows are removed during trials, it is possible to see the inflatable seals and to make sure that they touch the tailshaft evenly and on the entire circumference.

- 21.4.1.4 Sea trials: Once the ship is afloat, seal performance and water tightness is to be tested during four (4) consecutive hours of sea trials (without interruption), at cruise speed. The Contractor's qualified personnel will be required to take measurements, perform the below tests, and to readjust the seals during trials
- 21.4.1.5 The Contractor must test the inflatable seal with the sea water pressure.
- 21.4.1.6 The Contractor must test the water tightness of both sealing surfaces, and bronze sealing ring, statically, and later, during the sea trials. The allowable leaking for such a system is 1.5 litre/100 mm (shaft diameter) per hour, which is about 9 litres per hour for the vessel.
- 21.4.1.7 The Contractor must assure the whole system alignment.
- 21.4.1.8 The Contractor must check the system alignment to make sure that there is no hot spots during the whole sea trial period.

21.5 Deliverables

- 21.5.1.1 Report of the Contractor's Actions.
- 21.5.1.2 Wartsila technician report including corrections.
- 21.5.1.3 Certification of Wartsila, and accreditation to TCMS Division 3

22.0 ROLLS-ROYCE BOW THRUSTER MAINTENANCE

22.1 Identification

- 22.1.1 Oil change on the Bow Thruster.
- 22.1.2 Clearances on the gears and the propeller.
- 22.1.3 Anode replacement.

22.2 References

- 22.2.1 311130 Rolls-Royce Oil Filling Instruction
- 22.2.2 47244-E Rolls-Royce Tunnel Thruster Instruction Manual
- 22.2.3 311381 Rolls-Royce Recommendation for Location of Anodes
- 22.2.4 9833301 Sht 1/2/3 Rolls-Royce Propeller Unit

22.3 Statement of work

- 22.3.1 The Contractor must remove the tube protection grids. These grids are attached with bolts, nuts and washers.
- 22.3.2 In accordance with No. 311130 Rolls-Royce bulletin, the Contractor must proceed with the oil change of the Bow Thruster. The Contractor must:
 - 22.3.2.1 Take one (1) oil sample at the beginning of the oil drainage and give it to the IA or TA.
 - 22.3.2.2 Dispose of the drained oil (1000 liters) according to the local environmental requirements.
- 22.3.3 The Contractor must drain the header tank, clean it and submit it to inspection to the IA for approval.
- 22.3.4 The Contractor must take and record the gear backlash, in presence of the TA, following the process described in Rolls-Royce No 47244-E bulletin.
- 22.3.5 The Contractor must fill up the tank and the entire system with CCG supplied oil. The Contractor must supply and install a new seal for the header tank cover.
- 22.3.6 After filling the system, the Contractor must perform a complete system inspection with the IA or TA in order to detect possible leaks.
- 22.3.7 The Contractor must take and record the operation clearance between each propeller blade and the bow-tube. Clearance readings must be taken twice in

the presence of the TA, at 180 degrees intervals. The Contractor must also measure and record the axial clearance of the gear box.

22.3.8 The Contractor must perform the removal and replacement of the anodes in the thruster tunnel, on the thruster frame and holding brackets following locations and process described in Rolls-Royce No 311381 bulletin. Sixteen (16) anodes, contractor supplied, must be replaced.

22.3.9 The Contractor must protect the anodes, the propeller and the thruster frame while applying the coating as specified in item 10.0.

22.3.10 Upon completion of the coating application, the Contractor must remove the protections on the anodes, propeller, etc. and manually apply the protective coating after power tool cleaning off the specific areas.

22.3.11 The Contractor must install the thruster grids using new bolts, nuts and washers once all maintenance and painting work has been completed.

22.3.12 The Contractor must touch up the grids fasteners with the coating system.

22.4 Proof of performance

22.4.1 The Contractor must inform the IA and TA at least twenty-four (24) hours before performing any measurements and for the header tank inspection.

22.4.2 The Contractor must perform a rotation trial on the propeller blades in the presence of the TA.

22.5 Deliverables

22.5.1 Before the end of work, the Contractor must give to the TA a comprehensive report detailing the work undertaken, defects, repairs made and measurements and readings taken in a Microsoft Office Word 2013 or more recent format, on an USB stick, not protected by a password.

23.0 SUCTION AND OVERBOARD DISCHARGE VALVES

23.1 Identification

23.1.1 Replace identified valves by GSM equivalents.

23.2 References

23.2.1 Drawings

23.2.1.1 68-2000-4, Sht. 1 and 2 Overboard discharges

23.2.1.2 68-2030-3 Seabox / Seabay Arrgt.

23.2.1.3 Speed Log Doppler 5005-0125-01

23.2.1.4 Soupape SRD-331

23.2.1.5 4983-0112-01

23.2.2 List of valves: Sea boxes and sea bays (CCGS Des Groseilliers)

STEERING GEAR COMPARTMENT

<u>Discharge</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Side</u>	<u>Frame</u>
bilge pump	1	1 ½"	Port	3

PROPULSION MOTOR ROOM

<u>Suction valves</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Frames</u>	<u>Ref. drwg</u>
<u>Sea box: upper starboard</u>				
Vent	23	6"	60-61	51

<u>Suction valves</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Frames</u>	<u>Ref. drwg</u>
<u>Sea bay</u>				
Sewage pump	35	1 ½"	60-61	76

AFT ENGINE ROOM

<u>Discharge valves</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Side</u>	<u>Frame</u>
Rectifier, starboard	51	2 ½"	Stbd	57

FORWARD ENGINE ROOM

<u>Suction valves</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Frames</u>	<u>Ref. drwg</u>
<u>Sea box: lower port</u>				
Re-circulation	88	8"	97-98	5

<u>Discharge valves</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Side</u>	<u>Frame</u>
Sewage system	113	3"	Port	95
Rectifier	123	2 ½"	Stbd	95

BOW THRUSTER COMPARTMENT

<u>Discharge valves</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Side</u>	<u>Frame</u>
Scupper, starboard forward main bridge (12'4")	140	6"	Stbd	166
Scupper, port forward main bridge (12'4")	141	6"	Port	166

DUCT KEEL

<u>Suction valve</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Side</u>	<u>Frame</u>
Speed Log transducer	148	2 ½"		

<u>Valve</u>	<u>Ref. No.</u>	<u>Nom. dia.</u>	<u>Side</u>	<u>Frame</u>
Fore peak		6"		185

23.3 Statement of work

- 23.3.1 The Contractor must supply all equipment, ventilation, staging, chain falls, slings and shackles necessary to perform the work.
- 23.3.2 The Contractor must remove interference items necessary to access the valves noted in this specification. These will include but not be limited to grids, floor plating and sections of piping. Location of these interference items can be sighted at the time of viewing. On completion of all work all removed interference items must be returned to "as found" condition. All sections of piping that have been removed must be reinstalled using new gaskets
- 23.3.3 The Contractor must perform, on each of the sea suction and discharge valves listed in section 23.2.2, the following works:
 - 23.3.3.1 Remove existing identified valves.
 - 23.3.3.2 Visually inspect both external and internal components of all new valves. Any defects found must be brought to the attention of the Technical Authority for remedial action.
 - 23.3.3.3 The final closing up of all valves is to be witnessed by the TA. Following inspection, all valves are to be reassembled in the closed position and checked for water tightness.
 - 23.3.3.4 Install the new CCG supplied valves.
- 23.3.4 Replace the Speed log and isolation valve by CCG supplied equivalent. Gate Valve and speed log to be installed as seen in reference "Speed Log Doppler 5005-0125-01".
 - 23.3.4.1 The shipside flange for securing the isolation valve will also have to be removed, and a new flange welded in its place. The entrepreneur will be responsible for the gas freeing of adjacent spaces, as well if necessary.

- 23.3.5 The Contractor must apply two coats of Intershield 300 to the interior of the valve surfaces as per manufacturer's recommendations. (First coat gray and the second coat red)
- 23.3.6 The Contractor must supply all gaskets, valve stem packing, cleaning fluids, rags, anti-corrosive paint, etc. New gasket and valve stem packing must be of the same type as those removed unless substitution is approved by the TA.
- 23.3.7 The Contractor must visually inspect overboard penetrations for any form of defect and report them to the Technical Authority.

23.4 Proof of performance

23.4.1 Inspections

- 23.4.1.1 The TCMS Surveyor and the TA must witness the inspection of all valves, valve spindles, valve discs and seats.

23.4.2 Testing

- 23.4.2.1 The Contractor must perform the following tests:
- 23.4.2.2 Water tight integrity of all reassembled valves,
- 23.4.2.3 Where it is necessary to remove a section of piping to service the valves, the Contractor must verify that system for water tightness integrity.

23.5 Deliverables

- 23.5.1 The Contractor must supply the TA an electronic version, in a Microsoft Office Word 2013 format on an USB stick, not protected by a password, of a report detailing the work undertaken, defects, repairs made and measurements and readings taken. The report must include findings from piping and studs examined for wastage.
- 23.5.2 The Contractor must also provide a copy TCMS Division III survey credit to the TA.
- 23.5.3 The Contractor must provide a Quality Assurance (QA) report indicating that all valves and spool pieces have been inspected by the Contractor's QA Department for correct installation and fit.

24.0 REMOVAL OF TRIMMING SYSTEM

24.1 Identification

- 24.1.1 The dismantling and elimination of the trimming system.
- 24.1.2 The preparation and closing of openings left in bulk heads and decks once the system is removed.
- 24.1.3 A Transport Canada surveyor must be present for the hydrostatic or pressurized air test performed on the four (4) tanks and duct tunnel.

24.2 References

- 24.2.1 68-2450-1 Heeling and trimming diagram
- 24.2.2 68-2450-2 Heeling and trimming arrangement
- 24.2.3 68-2550-2 Heeling and trimming gauge arrangement
- 24.2.4 68-E-19_1 Trimming sys schematic and wiring diagram
- 24.2.5 68-H-51_046 Seat for trimming pump port
- 24.2.6 68-H-51_047 Seat for trimming pump starter
- 24.2.7 AI-201173 GA of trimming pump

24.3 Statement of work

- 24.3.1 The Contractor must open all manhole covers, ventilate, **clean with high pressure cold water at 3000 psi minimum**, and degrease the tanks directly or indirectly involved in this sections' works. The contractor must post a certificate, prepared by a certified chemist, breathable air in each tank to allow access for the performance of all work required by this specification.
- 24.3.2 Before beginning work, the Contractor must remove the level probes that are connected to the Cimplicity's alarm system and install a threaded plug to avoid damaging them. The Contractor must put them back after the tests. On certain tanks, the Inspection Authority may close, rather than remove, the valves on the level probes that are connected to the Cimplicity's alarm system, the contractor must consult it. Open after the tests.
- 24.3.3 The Contractor must remove the tank plugs to drain the ballast tanks.
- 24.3.4 The Contractor must prepare the steel plates in accordance with the requirements of the TCMS representative and welding specifications CT-043-

EQ-EG-001. In the event of a conflict between the two parties, the TCMS representative has precedence. This includes, but is not limited to, preparing the plate edges, sanding the plates, and preparing the surfaces before the final installation.

- 24.3.5 With the ship electrician's assistance, the contractor must disconnect the floats from the rapid transfer system, and remove them. Seal openings by inserting and welding a steel plates of the same thickness and grade as those of the bulkheads and decks.
- 24.3.6 The contractor must remove the isolation valves and hand over to the IA.
- 24.3.7 The contractor must remove the trimming system in its entirety, including but not limited to, piping, flanges, valves, pumps, motors, beds, and supporting bracket as seen on drawing 68-2450-2. Residual welds on the ships structure following equipment/bracket removal shall be ground flat with the adjoining structure. The contractor must remove all these components from the vessel and dispose of them in accordance with the regulations.
- 24.3.8 The contractor must remove the 14" (35.5 cm) piping for the trimming system in its entirety, as seen on drawing 68-2450-2. All removed sections are to be removed from the vessel and disposed of by the entrepreneur.
- 24.3.9 The Contractor must block openings by inserting a steel plate of the same thickness and grade as the adjacent bulkhead. He can plan this work according to the new pipe to be installed in the next section. A 3 ft. (91 cm) long stiffener with the same sampling and grade as the ones currently in the tank must be added and welded to obtain the same rigidity elsewhere on the bulkhead.
- 24.3.10 All disturbed/new steel (with the exception of Fuel tanks) shall be given a surface preparation SA 2-1/2 by the contractor, and he must apply two coats of Intershield 300, 6 mils thickness or equivalent on all the inner surfaces. The IA must check the quality of the painting after each coat of different colours, and before the tanks are closed.
- 24.3.11 All blanking of all watertight bulkheads have to be done in compliance with Transport Canada rules and regulation.
- 24.3.12 Radiographic Inspection with vacuum box, magnetic particle of the welds, and hydrostatic test to the satisfaction of the TCMS inspector.

~~24.3.12.1 The Contractor must bid on taking twelve (12) radiographic films by a certified technician, of the welds in question. The TCMS surveyor must determine~~

~~locations where these films are to be taken. A unit price per film must be provided in the Contractors bid and this unit price is to include staging or nacelle to realise the film.~~

~~24.3.12.2 For radiographic inspection, the Contractor must clean adequately the surfaces of welds and adjacent base material to allow accurate interpretation of the area of interest (weld zone). Discontinuities appearing on the radiographic film that subsequently are determined to be surface discontinuities must be repaired by the Contractor and the location must be re-inspected by radiographic methods.~~

24.4 Proof of Performance

24.4.1 Inspections

- 24.4.1.1 The IA will have the opportunity to inspect that all the requested materials and equipment have been removed from the vessel, according to the specification.
- 24.4.1.2 The IA must have the opportunity to inspect all work and tests resulting from the closure of bulkheads, decks or penetrations.

24.4.2 Testing/Trials

- 24.4.2.1 Once the steel work has been completed, the contractor must install the tank plugs.
- 24.4.2.2 The contractor must close manhole covers using new joints, bolts, washers, and nuts, to be Contractor supplied. Manhole gaskets must be ¼ "thick and must be" ALBION 884 BUNA-N (NITRILE) "or equivalent resistant to petroleum products.
- 24.4.2.3 The contractor must, with the TCMS inspector present, the tanks must be subjected to a hydrostatic test to ensure their water tightness.
- 24.4.2.4 Once the hydrostatic tests have been completed, the tank plugs must be removed to drain the tanks by the contractor. The heeling tanks must be pumped using portable pumps (no tank plugs).
- 24.4.2.5 The contractor must paint the tanks. They must be cleaned first to meet the paint manufacturer's technical specifications.
- 24.4.2.6 The contractor must reinstall the tank plugs. The water tightness of the tank plugs must be demonstrated to the IA or TA by vacuum test (Vacuum box).

24.5 Deliverables

24.5.1 Documentation (Reports/Drawings/Manuals)

- 24.5.1.1 Before the end of the contract, the Contractor must give to the TA a comprehensive report detailing the work undertaken, defects, repairs made and measurements and readings taken in a Microsoft Office Word 2013 format on an USB stick, not protected by a password.
- 24.5.1.2 Prior to the close of contract, the Contractor must submit to the TA certification or other documentation attesting to the quality of new materials, including a copy of the mill test certificate for the steel used.
- 24.5.1.3 The Contractor must also provide a copy TCMS Division III survey credit to the TA.

25.0 WQP – Water quality package

25.1 Identification

- 25.1.1 The objective of this item is the installation of a new 3" suction pipe for the WQP, the sea water lubrication system for the propulsion shafts.

25.2 References

- 25.2.1 68-2450-1 Heeling and trimming diagram
- 25.2.2 68-2450-2 Heeling and trimming arrangement
- 25.2.3 68-2030-8_02 (3)

25.3 Statement of work

- 25.3.1 The contractor must include and provide a quote for the installation of 100 feet of schedule 80, hot galvanised black steel following fabrication, in accordance with the norms and regulations stated in PART 3, 3.18.1, for 3" ~~the following~~ pipe sizes ~~1", 2", 3", and 4"~~. The contractor must include; fifteen flanges, fifteen 45° and fifteen 90° elbows, ~~two "T" fittings and two 3" bronze globe valves, class 150~~. All piping touched by this work must be sand blasted and hot galvanised.
- 25.3.2 ~~The Contractor shall include and provide a quote for the installation of 20 linear feet of 2" hot-dip galvanized black steel pipe after fabrication, schedule 80, in accordance with the standards and regulations set forth in the Part 3,~~

- 3.18.1, for 2" pipe sizes. It must include (8) flanges as well as (4) 45° elbows and (8) 90° elbows.
- 25.3.3 The Contractor must provide labor and materials to fabricate and install a 3" pipe between the WQP pumps suction at its new location and the existing seawater suction at the frame 94 to valve # 157, existing piping and duplex filter. The new pipe will follow the path of the 14" pipe removed for the trim system specified in section 24. Reference drawing no. 68-2030-8_02 (3).
- 25.3.4 All new piping fabricated by the Contractor shall be tested for integrity and leakage at 150 PSI before being hot dip galvanized.
- 25.3.5 The installation shall adhere to sections 2.7 and 3.2
- 25.3.6 All watertight bulkhead penetrations have to be done in compliance with Transport Canada rules and regulation, **without damaging the galvanisation of the new piping.**
- 25.3.7 After removing the motor/pump unit and the piping for the trim system, disassemble the piping and remove the WQP unit from its current seat. Reinstall it on the seat of the removed trim system unit. Position the WQP unit on the seat as directed by the Chief Engineer. Drill bolt holes and bolt the WQP unit into position. Electrical work at the cabling level will be done by the CCG.
- 25.3.8 Dismantle the duplex filter at the suction of the pumps and reposition it near the WQP as directed by the Chief Engineer, provide equipment, fabricate and install a new seating for the duplex filter, install the filter.
- 25.3.9 Provide material and fabricate new 2 "piping to connect the discharge pipes of the WQP unit to the old plumbing. Foresee making openings in the seat for the passage of the new plumbing to the old.
- 25.3.10 Provide material and fabricate new 3 "piping to connect old and new plumbing according to drawing 68-2030-8_02 (3). Provide and install (2) new valves at specified locations according to same drawing.
- 25.3.11 Provide and install new gasket and bolting required for assembly of new piping. Provide and install all necessary piping supports for new piping.
- 25.3.12 Provide 80 sq. Ft. Of non-skid steel sheet metal, provide equipment and make necessary supports, cut sheet metal and close the floor following the removal of the trim system and the movement of the WQP system. The new parquet sheets should be level with the current ones, provide the openings of sheet metal hinged for access to the (2) new valves.

25.4 Proof of Performance

25.4.1 Inspections

- 25.4.1.1 The Contractor must arrange the attending TCMS Surveyor and the TA the opportunity to visually inspect the piping and bracket rigidity

25.4.2 Testing/Trials

- 25.4.2.1 The Contractor must afford the attending TCMS Surveyor and the TA the opportunity to witness pressure testing of installed piping.

25.5 Deliverables

25.5.1 Documentation (Reports/Drawings/Manuals)

- 25.5.1.1 Before the end of the work, the Contractor must give to the TA a comprehensive report detailing the work undertaken, defects, repairs made and measurements and readings taken in a Microsoft Office Word 2013 format on an USB stick, not protected by a password.
- 25.5.1.2 Prior to the end of work, the Contractor must submit to the TA certification or other documentation attesting to the quality of new materials.
- 25.5.1.3 The Contractor must also provide a copy TCMS Division III survey credit to the TA.



WQP aspiration des pompes



Système d'assiette



WQP aspiration et filtre duplex



WQP décharges du système



Valve #157 et tuyau de 14" du système d'assiette

26.0 MULTIBEAM SONAR

26.1 Specification C17-66-003-01 attached. In the event of a discrepancy between the multibeam sonar specification and the main specification, the main specification takes precedence over the latter.

26.2 The Contractor must obtain the services of a Kongsberg FSR for the inspection of the installed parts and designate the parts to be replaced. The Contractor must consider a \$30,000.00 provision for the Kongsberg FSR services. The final cost of these services must be negotiated and raised or lowered using the PWSGC 1379 form.

26.3 Radiographic Inspection

26.3.1 The Contractor must bid on taking twelve (20) radiographic films by a certified technician, of the welds in question. The TCMS surveyor must determine locations where these films are to be taken. A unit price per film must be provided in the Contractors bid and this unit price is to include staging or nacelle to realise the film. Prices quoted in this section for the production of x-ray film apply to any other work in this specification where X-ray inspection is required.

26.3.2 For radiographic inspection, the Contractor must clean adequately the surfaces of welds and adjacent base material to allow accurate interpretation of the area of interest (weld zone). Discontinuities appearing on the radiographic film that subsequently are determined to be surface discontinuities must be repaired by the Contractor and the location must be re-inspected by radiographic methods.

27.0 The *MITCHELL* intermediate bearings replacement

27.1 Identification

- 27.1.1 The intermediate *MITCHELL* bearings will be dismantled, removed and replaced with new Coast Guard supplied SKF roller bearings.

27.2 Reference

27.2.1 Drawings

- 27.2.1.1 1-3740975561 Manual EN v4
- 27.2.1.2 1-3740975561 Manual FR v4
- 27.2.1.3 Photos of CCGS Radisson to be used for reference.

27.3 Statement of Work

- 27.3.1 Dismantle the *MITCHELL* bearings down to their seating.
- 27.3.2 Remove the four (4) pipes and valves (two sea water valves and two lube oil valves). Piping will be dismantled down to the flanges located under the floor, and the flanges must be capped. Temperature sensors will be dismantled and reinstalled on the new bearings. Bearing lubricating oil is to be completely drained by contractor and disposed of in compliance with environmental standards.
- 27.3.3 Obtain the services of a *SKF* representative to supervise roller bearing installation work. The Contractor must include in its bid an allowance of \$20,000 to cover a *SKF* representative's services. This allowance must include cost per day, accommodations, meals and transportation. The \$20,000 allowance must be adjusted up or down using form PWGSC 1379 upon receipt of the representative's final invoice, along with copies of all supporting documentation attesting to actual costs.
- 27.3.4 Holes will be drilled in the base plates at the locations indicated on the installation plans and specified by the *SKF* representative. These holes must allow installation of the new bearings.
- 27.3.5 Contractor must ensure precise alignment of the new bearings on the shaft line. He must also ensure height shims (blocks) meet Transport Canada requirements.

- 27.3.6 Contractor must install the half-moon bearing sleeves supplied by the Coast Guard on both tailshafts. Steel Shims (blocks) must be installed between the sleeves and the tailshafts to ensure appropriate bearing capacity.
- 27.3.7 Take load readings on each of the *SKF* bearings and record the readings in the log.
- 27.3.8 The shipyard will supply the grease recommended by the *SKF* representative.
- 27.3.9 No work producing airborne metal particles must be carried out in the propulsion motor room during the dismantling and reinstallation of the propulsion bearings and shaft lines.
- 27.3.10 Contractor will install the new *SKF* bearings using the provided drawings and manufacturer's installation guide 1-3740975561, and in compliance with the *SKF* representative's instructions.
- 27.4 Proof of Performance**
 - 27.4.1 Inspections
 - 27.4.1.1 The Contractor must arrange the attending TCMS Surveyor and the TA the opportunity to visually inspect the installation process.
 - 27.4.2 Testing/Trials
 - 27.4.2.1 The bearings will be overseen for the duration of sea trials detailed in item 6.3, and a log of measurements and temperatures taken by the FSR for their duration.
- 27.5 Deliverables**
 - 27.5.1 Documentation (Reports/Drawings/Manuals)
 - 27.5.1.1 Before the end of the work, the Contractor must give to the TA a comprehensive report detailing the work undertaken, defects, repairs made and measurements and readings taken in a Microsoft Office Word 2013 format on an USB stick, not protected by a password.
 - 27.5.1.2 Prior to the end of work, the Contractor must submit to the TA certification or other documentation attesting to the quality of new materials.
 - 27.5.1.3 The Contractor must also provide a copy TCMS Division III survey credit to the TA.

28.0 Helicopter Fuel Tank

28.1 Identification

- 28.1.1 The Contractor must gas free and certify for safe entry Helicopter Fuel Tanks (Frames 4-11), and its void tank (Frames 0-14) as per the requirements and guidelines of the Fisheries and Oceans Canada, Canadian Coast Guard Fleet Safety Manual (DFO 5737). A certificate is to be obtained from a chemist who has inspected the tanks to certify that tanks are gas free. A copy of the certificates is to be posted in a visible location and another copy for each tank is to be given to the Chief Engineer.

28.2 Reference

28.2.1 Drawings

- 28.2.1.1 68-H-003 Shell expansion
- 28.2.1.2 68-H-007 Framing Expansion as fitted

28.3 Statement of Work

- 28.3.1 The Jet A1 fuel oil tanks listed in 28.1.1 must be drained, gas freed, steam cleaned, and further cleaned of all dirt and debris. Following such they must then be closed up when all work and inspections have been completed.
- 28.3.2 The Contractor will be required to pump and store ashore and then pump back Five (5) tons of Jet A1 fuel. Storage facilities shall be cleaned, uncontaminated and prior to transferring of any fuel oil to these facilities, they are to be inspected and shall be of the satisfaction of both the CCG Technical Authority and the CCG Inspection Authority. This fuel transfer operation shall be the responsibility of the Contractor. The contractor must provide a unit price per ton
- 28.3.3 The Contractor shall remove all residues at the bottom of the suction lines from the tank until they are dry. He must indicate a price for the removal and disposal of five (5) tonnes of fuel and dirt residue, recovered from the tank. The contractor is responsible for disposing these residues ashore in appropriate containers provided by him, which will in turn be disposed according to applicable regulations.

28.4 Proof of performance

28.4.1 Manhole covers must be closed using new gaskets, bolts, washers, and nuts supplied by Contractor. Manhole cover gaskets must be ALBION 884 BUNA-N (NITRILE) or an equivalent that is resistant to petroleum products.

28.4.2 Inspection

28.4.2.1 The following inspections are required to be verified by the Contractor's Quality Assurance representative, the CCG Inspection Authority and the TC-MSB surveyor:

28.4.2.2 • Inspection of each fuel oil after cleaning,

28.4.2.3 • Final inspection of all tanks prior to their being "closed-up".

28.4.3

28.5 Deliverables

28.5.1 The contractor must supply the Technical Authority an electronic copy, on a USB stick not protected by a password, in Microsoft Office Word 2013 or more recent format, a report detailing all undertaken works, defects, repairs performed and detailed results of all performed tests.

28.5.2 The Contractor must supply the TA with a detailed QA report at the completion of the Work. This must include, but not limited to, inspection records, DFT readings, and condition monitoring data during coating application, etc.

APPENDIX B

List of drawings

10.0 COATINGS

- 06149S37 Calcul de surface de la coque Des Gros

11.0 FREEBOARD, DRAUGHT AND VESSEL'S IDENTITY MARKINGS

- 06149_SF_1
- 06149_SF_2

12.0 HULL PLATING WELDING JOINTS

13.0 BALLAST WATER TANKS AND COFFERDAMS – CLEANING, INSPECTION AND PAINTING

14.0 CATHODIC PROTECTION SYSTEMS

- 68-2730-1 Cathodic Seabays
- 68-H-163 Hull Anodes
- 311381 Rolly-Royce
- ECMS Industries ltd Des Groseilliers anodes
- ESK-26
- Manual Cathelco print
- Manual Cathelco

15.0 STRAINERS, SEA BOXES AND SEA BAYS

- 68-20-30-3 alt. F. Seabox Seabay arrangement
- 68-2000-3 Chain locker & steering gear flat bilge system
- 68-2030-3 seabox - seabay arrng't
- 68-2030-4_02 Main inlet strainer 16 pouce
- 68-2030-4_03 Main inlet strainer 18 pouce
- Strainer

16.0 REMOVAL OF MUFF COUPLINGS

17.0 TAILSHAFTS

- 06149S35
- AW201945 Tail shaft
- NT-2394-11-DE100A-EX03

- Shafting arrangement hull 68 68-2600-1
- H72317-02 v1

18.0 THRUST BEARINGS

- 48482 2 Thrust bearing

20.0 PROPELLER REMOVAL, INSPECTION AND INSTALLATION

- 26801M Propeller

21.0 TAIL SHAFTS MECHANICAL SEALS

- AW201941 Crane seal
- H 44046 Crane seal2
- H72317-02 v1

22.0 ROLLS-ROYCE BOW THRUSTER MAINTENANCE

- 47244-E
- 311130
- 311381
- 311827A
- Hyd drawings
- Maintenance
- Mech Drawings
- technical data
- X991-A

23.0 SUCTION AND OVERBOARD DISCHARGE VALVES

- 4983-0112-01
- archive Speedlog-Doppler
- Soupape SRD-331
- Speed Log Doppler 5005-0125-01
- Speedlog-Doppler text
- ST-90-37
- ST-93-02
- 68-2000-4_01
- 68-2000-4_2

24.0 REMOVAL OF TRIMMING SYSTEM

- 68-2450-1 Heeling and trimming diagram

- 68-2450-2 Heeling and trimming arrangement
- 68-2550-2 Heeling and trimming gauge arrangement
- 68-E-19_1 Trimming sys schematic and wiring diagram
- 68-H-51_046 Seat for trimming pump port
- 68-H-51_047 Seat for trimming pump starter
- 68-H-121_3A
- AI-201173 GA of trimming pump

25.0 WQP – Water quality package

- TG-21215 WQP - Des Groseilliers
- 68-2030-8_03
- 68-2030-8_02 (2)
- 68-2030-8_01
- 68-2030-2_05
- 68-2030-2_03
- 68-2450-1 Heeling and trimming diagram
- 68-2450-2 Heeling and trimming arrangement
- 68-2030-8_02 (3)

26.0 MULTIBEAM SONAR

- C17-66-026-01 R0 DOCKING PLAN
- C17-66-165-01 R0 Structural Modifications
- C17-66-180-01 R0 GREY WATER SYSTEM SKID
- C17-66-185-01 R0 GPS ANTENNA ARRANGEMENT
- C17-66-185-02 R0 IMU ARRANGEMENT
- C17-66-201-01 R0 PIPING MODIFICATION
- C17-66-601-01 VESSEL MODIFICATION KEY PLAN
- C17-66-620-01 R0 CAPACITY PLAN
- C17-66-626-01 R0 Doors, hatch and manholes plan
- 403738B_RemoteControlUnit
- 407250D
- 424492_1
- 424492_1Pro01_sammenstilling
- APOS Remote hlp
- CD27864_1
- CD27864_2
- CD27865
- Hipap

- Micro+SV+User's+Manual+(v+2.2)
- POS MV Installation Check List (1)
- pos_mv_v5_installation_and_operation_guide_rev16
- POSMV_Brochure

27.0 The MITCHELL intermediate bearings replacement

- 1-3740975561 Manual EN v4
- 1-3740975561 Manual FR v4
- Photos of CCGS Radisson to be used for reference.

28.0 Helicopter Fuel Tank

- 68-H-003 Shell expansion
- 68-H-007 Framing Expansion as fitted

Surface Calculations

- NT-2513-13-CA001A
- 06149-11_01 Calculs de surfaces - Pont de navigation
- 06149-11_02 Calculs de surfaces - Pont des officiers
- 06149-11_03 Calculs de surfaces - Pont des embarcations
- 06149-11_04 Calculs de surfaces - Pont supérieur
- 06149-11_05 Calculs de surfaces - Pont principal
- 06149P06 Calcul de surface entre les tirants d'eau

Docking Plan

- Quality Control - Dry Dock Champlain
- 2613 (Des Groseillier) inspection dim. Dockage
- Docking plan 2012

Fire Control Plan

- 06149-20_01 Plan de lutte
- 06149-20_02 Plan de lutte
- 06149-20_03 Plan de lutte

Tanks

- 68-2300-1 Air and sounding diagram
- 68-2550-2
- 68-H-52 Anchor chain end brackets
- 68-H-106 Capacity plan
- 68-H-107_02 Keyplan & list of manholes

- 68-H-146 Tank Testing Plan

Machinery arrangement

- 68-2500-1_01
- 68-2500-1_02
- 68-2500-1_03
- 68-2500-1_04
- 68-2500-1_05
- 68-2500-1_06
- 68-H-101 General arrangement

Asbestos

- 141-19427-19_Rapport_Des Groseilliers_QAI_FINAL_20170216
- 141-19427-19_Rapport_Des Groseilliers_QAI_FINAL_201702161
- 141-19427-20_Rapp_DesGroseilliers_HazMat_FINAL_20170501