

STATEMENT OF WORK

CCGS GEORGE R. PEARKES Vessel Life Extension



PART A – General Information & Technical Requirements

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1.0 SCOPE OF THIS DOCUMENT

1.1 This document defines the Statement of Work (SOW) for the Vessel Life Extension (VLE) Program for the CCGS GEORGE R. PEARKES.

1.2 Due to the size of this document it has been broken down into five (5) separate sections as follows:

- Part A – General Information and Requirements (this document)
- Part B – Hull Related Specifications
- Part C – Mechanical Related Specifications
- Part D – Electrical Related Specifications
- Part E – Optional Items

Note: Each of these Sections will come with its own Table of Contents.

1.3 The CCGS GEORGE R. PEARKES current range of operation is the in territorial waters of Eastern Canada.

1.4 In general, the SOW found here in, will describe the objectives, standards, engineering requirements and the performance criteria for the following major installations that will be required to be performed during the defined Contract period:

- The installation of complete new propulsion generator units
- The installation of new cycloconverter units
- The installation of a new auxiliary (Ship Service) generator unit
- The installation of a new bow thruster unit
- Complete Galley Upgrade

1.5 This SOW will also include the standard refit requirements that will have to be performed to meet both normal planned maintenance of the vessel and regulatory and certification requirements. These will include but will not be limited to the following:

- The docking and undocking of the vessel;
- The pulling and inspecting of the tail shafts, seals, stern tubes, propellers, and rudder; and
- Miscellaneous regulatory surveys of the sea bays, sea chests, and void spaces;
- Etc.

2.0 GENERAL PARTICULARS OF VESSEL

Name:	CCGS George R. Pearkes
Type:	Type 1100 High Endurance Multi-tasked Vessel (HEMV)
Ice Classes:	Lloyd's Register \times 100A1 Ice Class 1A Super LMC
Notation:	Navais Tender / Light Ice Breaker
Year Built:	1985
Voyage Class:	Unlimited, beyond 200nm
Builder:	Burrard Dry Dock, Vancouver, British Columbia

Principal Dimensions:

Length Overall	83.0 meters
Length BP	75.0 meters
Breadth, molded	16.2 meters
Draft	5.75 meters
Tonnage	3,727 GRT, 1,503 NT
Displacement, Full Load	4,662.0 MT
Lightship Weight	3,305.4 MT

The CCGS GEORGE R. PEARKEs is a three (3) engine, twin-screw vessel, powered by three (3) ALCO 251F medium speed diesel engines complete with integral propulsion generators. The prime mover generators provide power to the two propulsion motors and their associated shafts. Each shaft drives a fixed pitch propeller. The existing bow thruster is a fixed pitch (FP) type thruster. The single rudder is fitted with an independent electro-hydraulic steering gear.

3.0 GENERAL NOTES

3.1 Responsibilities

3.1.1 The Contractor must be responsible to ensure that:

- a) The execution of all work specified herein is to the approval and verification of compliance with all of the specific requirements of the project documentation by the Canadian Coast Guard Inspection and Technical Authorities and meets all Regulatory Bodies (Class) requirements;
- b) All items and equipment supplied are approved for the application intended and meet all Class and Transport Canada requirements, for a vessel of this class, to ensure the safe operation and seaworthiness of the vessel.

3.1.2 Each specification detailed within this SOW, will define the required drawings (i.e. guidance and approved) as well as all reference documentation that will be needed in support of the intent of the individual work item. All defined drawings and documentation for the CCGS GEORGE R. PEARKEs will be provided as part of this technical data package.

3.1.3 The vessel will be unmanned during the Work Period requiring the Contractor to take custody, and be responsible, for the vessel. There will be a team of Canadian Coast Guard personnel present during the project work period but they will not be living aboard the vessel. It is expected that the vessel will be re-manned for both the commissioning and sea trial period.

3.1.4 The Contractor will take custody of the vessel upon arrival at their facility. All requirements necessary to protect the vessel from weather, ingress and any other hazards is the responsibility of the contractor. This includes all winterization requirements, including but not limited to; heating, draining lines and systems, snow clearing etc. A copy of the ship's Clayton Boiler manual is included in the TDP for reference and to provide the Contractor with more specific detail on vessel heating requirements, however, the Contractor will be responsible for providing their own independent heating source for the vessel. All of these associated costs must be included in the Contractor's financial tender submission.

3.1.5 The Contractor must provide all labour, materials, tools and services required to perform all specification items unless specifically stated otherwise.

3.2 Definitions

3.2.1 For the purpose of this SOW, the following key definitions must apply:

American Bureau of Shipping (ABS)	ABS is recognized by Transport Canada, under the "Delegated Statutory Inspection Program (DSIP)", as the "Recognized Organization (RO)"
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Approved Documentation	Drawings or standards that have been reviewed and Stamped Approved by an approved Classification or Regulatory Body.
As-Fitted Drawings	A final drawing showing the “As-Fitted” condition of all equipment and system fittings. The “As-Fitted” drawings must be the final revision of the drawing documenting the mark-ups of the working drawings during installation
Assistant Project Manager (APM)	The CG authorized representative of the Project Manager who will be the on-site contact for all technical related matters.
Canada	Represented by Public Services Procurement Canada (PSPC) and the Canadian Coast Guard.
Client	The Government of Canada as represented by Public Works and Procurement Services Canada (PSPC) Public Services and Procurement Canada - 11 Laurier St, Phase III, Place du Portage Gatineau, QC K1A 0S5
Contract Authority (CA)	An officer of Public Services and Procurement Canada responsible for the management and administration of the Contract on behalf of Canada and the only person with authority to negotiate or effect amendments or any other variation to any provisions of the Contract.
Contractor	The Shipyard of Ship Repair Unit that is the successful bidder to the Contract of this VLE Project.
Dock Trials	The alongside acceptance trials of machinery systems and sub-systems prior to the commencement of the sea trials.
Environmentally Controlled	The heating and cooling of an environment that impacts the temperature and humidity of a physical space
Field Service Representative (FSR)	An authorized representative of either the Contractor or Sub-Contractor (OEM) who supervises the installation, and commissioning and testing the newly installed machinery and equipment.
Government Supplied Materials (GSM)	Equipment and material furnished by the Government and delivered to the Contractor's premises for installation or use onboard the vessel.
Guidance Drawings	An Guidance Drawing provides information for properly positioning and installing items relative to their supporting structure and adjacent items, as applicable. Information may include; Dimensional Data, Hardware Descriptions, and General Configuration information for the installation site.
Inspection Authority (IA)	The CCG designated individual, on site, who is responsible for the inspection of the work and acceptance of the finished work under as defined by the Contract.
Or Equivalent	The term “or equivalent” (also “or equal”) means a substitute which has equal or better characteristics than that specified. Where the Contractor selects an “or equivalent” it must be subject to review and approval by the CG Technical Authority.
Owner Sea Trials	Additional sea trials conducted by CG and subsequent to the sea trials performed by the Contractor, the purpose of which is to demonstrate the correct operation and performance of the vessel and its equipment as a whole to the Coast Guard.
Sea Trials	A series of trial of all equipment and systems under operational conditions at sea. These trials must be carried out only after all dock trials are complete

Shop Test	Tests performed in a controlled environment ensure that the machinery has been built to Specification and is approved by the regulatory body prior to delivery.
Sub-Contractor	A competent service facility or service provider under contract to the Contractor
Technical Authority (TA or CCG PM)	The CCG designated individual who is responsible for all technical and operational aspects of the project's requirements
Working Drawings	Detailed engineering drawings produced by the Contractor or sub-Contractors and are used for field installations and must be marked-up with any corrections during field installations

3.2.2 List of Abbreviations and Acronyms

ABS	American Bureau of Shipping
AMS	Alarm and Monitoring System
APM	Assistant Project Manager
CAD	Computer Aided Drafting
CCGS	Canadian Coast Guard Ship
CFM	Contractor Furnished Material
CGSB	Canadian General Specifications Board
CP	Controllable Pitch
CPU	Central Processing Unit
CSA	Canadian Standards Association
C.S.A.	Canadian Shipping Act
CWB	Canadian Welding Bureau
DFO	Department of Fisheries and Oceans Canada
DSIP	Delegated Statutory Inspection Program
ECR	Engine Control Room
EMI	Electromagnetic interference
FAT	Factory Acceptance Test
FSR	Field Service Representative
FMEA	Failure Mode Effect Analysis
FSM	Canadian Coast Guard Fleet Safety Manual
GM	Vertical distance between the Center of Gravity and the Metacentre.
GZ	Perpendicular distance between the lines of action of the force of buoyancy and the weight of the vessel.
GSM	Government Supplied Materials
IA	Inspection Authority
IMO	International Maritime Organization
IO	Input/Output, as in device or list
JB	Junction Box
LAN	Local Area Network
LED	Light Emitting Diode
MCT's	Multiple Cable Transits
MNS	Marine Navigational Services
MOSH	Marine Occupational Safety and Health Regulations as per Canada Shipping Act

MSDS	Material Safety Data Sheet
N.C.	Noise Criteria
N.F.P.A.	National Fire Protection Association
NFU	Non-follow-up, as in alarm
OEM	Original Equipment Manufacturer
PAP	Project Action Plan
PCS	Propulsion Control System
PID	Proportional, Integral, Derivative control loop
PIT	Portable Interface Terminal
PLC	Programmable Logic Controller
PM	Preventative Maintenance
PSPC	Public Services and Procurement Canada
RCS	Remote Control System
RFI	Radio Frequency Interference
RIO	Remote Input/Output
RPU	Remote Processing Unit
RPU-TU	Remote Processing Unit for Terminal Units
SCR	Silicone Controlled Rectifier
SOLAS	Safety of Life at Sea Convention as per IMO
TCMS	Transport Canada Marine Safety
TA	Technical Authority (or CCG PM)
UPS	Uninterrupted Power Supply
VLE	Voltage Direct Current
WHMIS	Workplace Hazardous Material Information System
WOG	Water, Oil, Gas

3.3 Technical Data Packages

3.3.1 The Contractor will be provided with the following technical data packages to fully define the scope of work for the CCGS GEORGE R. PEARKE'S Vessel Life Extension Refit Project:

- Technical Specifications (Sections A-E);
- Guidance Drawings (provided in electronic format);
- CCGS GEORGE R. PEARKE'S Vessel Drawings (provided in electronic format);
- CCGS GEORGE R. PEARKE'S Hazardous Materials Assessments (provided in electronic format);
- Applicable CCG Standards and Guidelines (provided in electronic format);

- Vessel Virtual Scan - In lieu of an in person vessel viewing, due to current travel restrictions, a complete virtual scan of the vessel has been developed. Access will be provided to interested parties.

3.3.2 The following is a list of references documents that will be pertinent to this VLE document. It is the responsibility of the Contractor to ensure that the necessary applicable standards and or regulations said there in, are being met to the satisfaction of the CCG Technical Authority and ABS. It will be the responsibility of the Contractor to obtain access to these documents as applicable and will not be provided by CCG.

Note: The most recent version of each document, standard and or regulation, noted below must be used

- ABS Classification Society Standards (Rules and Regulations) for vessel construction for vessels of the same type as this vessel (Current)
- ABS Thickness Measurement and Close-Up Survey Guidance
- ASTM F1321-14 – Standard Guide for Conducting a Stability Test (Lightweight Survey and Inclining Experiment) to determine the Light Ship Displacement and Centers of Gravity of a Vessel
- ASTM G82-98 – Standard Guide for Development and Use of a Galvanic Series for Predicting Galvanic Corrosion Performance
- CAN/CGSB 3.11-2010 – Naval Distillate Fuel
- CAN/CGSB 4.155-M88 - Canadian General Standards Board Flammability of Soft Floor Coverings – Sampling Plans
- CAN/CGSB 51.53-95 – Poly (vinyl chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Duct
- CAN/ULC-S102 – Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- CAN/ULC-S102.2-10 – Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies
- CAN/ULC-S109-14 – Standard Method for Flame Tests of Flame-Resistant Fabrics and Films
- CAP437 – Standards for Offshore Helicopter Landing Areas

- Canada Shipping Act 2001, Arctic Shipping Safety and Pollution Prevention Regulations (SOR/2017-286)
- Canada Shipping Act 2001, Hull Construction Regulations (C.R.C., c. 1431)
- Canada Shipping Act 2001, Hull Inspection Regulations (C.R.C., c. 1432);
- Canada Shipping Act 2001, Tackle Regulations (C.R.C., c. 1494)
- Canada Shipping Act 2001, Vessel Pollution and Dangerous Chemicals Regulations (SOR/2012-69)
- Canada Shipping Act 2001, Vessel Fire Safety Regulations (SOR/2017-14) CCGS
- Canada Shipping Act 2001, Machinery and Hull regulations (SOR/90-264) pertaining to a Vessel having general particulars as specified under Section 2.0
- CSA W47.1-09 (latest version)– Certification of Companies for fusion welding of steel
- CSA W47.2-11 (latest version) – Certification of Companies for fusion welding of aluminum
- CSA W59-08 (R2008) - Welded Steel Construction
- CAN/CSA-C22.2 No. 60529-05 (R2010) Degrees of protection provided by enclosures (IP Code)
- CSA C22.1-15 – Canadian Electrical Code Part I Safety Standard for Electrical Installations
- CSA C22.2 – No. 0-10 (2014) – General Requirements – Canadian Electrical Code Part II
- DNVGL Ship Rules (latest version)
- IACS Recommendation 82 (latest version) Surveyor's Glossary Hull Terms and Hull Survey Terms
- IACS Requirements concerning Survey and Certification (latest version)
- IACS No. 47 - Shipbuilding and Repair Quality Standard

- IEC 60092-504 ED 3.0 CORR1:2001– Electrical Installations in Ships – Part 504: Special Features – Control and Instrumentation
- IEC 60533 Second Edition – Electrical and Electronic Installations in Ships – Electromagnetic Compatibility
- IEEE 45 STD -2002 – Recommended Practice for Electrical Installations Shipboard
- IEEE STD 315-1975 (Reaffirmed 1993) – Graphic Symbols for Electrical and Electronics Diagrams
- ISO 4406 – 1999 – Hydraulic fluid power -- Fluids -- Method for coding the level of contamination by solid particles
- ISO 18413:2002 – Hydraulic fluid power – Cleanliness of parts and components – Inspection document and principles related to containment collection, analysis, and data reporting
- ISO/TR 10949:2002 – Hydraulic fluid power – Component cleanliness – Guidelines for achieving and controlling cleanliness of components from manufacture to installation
- ISO/TS 16431:2002 – Hydraulic fluid power – Verification of cleanliness
- ISO 15748-1:2002 - Ships and marine technology - Potable water supply on ships and marine structures - Part 1: Planning and design
- ISO 15748-2:2002 - Ships and marine technology - Potable water supply on ships and marine structures - Part 2: Method of calculation
- ISO 2081 – 1986 – Metallic Coatings – Electroplated Coatings of Zinc on Iron or Steel;
- Lloyd's Classification Society Rules for the Classification of Ships (2018)
- Lloyd's Classification Society Code for Lifting Appliances in a Marine Environment 2016
- MOSH (SOR/87-183) – Marine Occupational Safety and Health Regulations
- PMBoK 7th 2000 Edition – Project Management Institute guidelines to project management
- Provincial Department of Labour Industrial Health Regulations respecting removal of Asbestos

- S.N.A.M.E – Rules/Guidelines for Shop and Installation Trials – latest edition
- S.N.A.M.E.(3-47)*1989 – Rules/Guidelines for Sea Trials – latest edition
- SOLAS Consolidated Edition 2014
- TP 11469 E – Guide to Structural Fire Protection (1993)
- TP 127E (2002) – Ship Safety Electrical Standards
- TP 1861E Standards for Navigation Lights, Shapes, Sound Signal Appliances and Radar Reflectors (1991)
- TP 2072E Deck Cargo Safety Code 1974
- TP 4414E – Guidelines Respecting Helicopter Facilities on Ships
- TP 7301 Stability, Subdivision, and Load Line Standards 1975
- TP 12260 Equivalent Standards for the Construction of Arctic Class Ships
- TP 5021E Personal Safety on Ships (1984)
- Safe Working Practices Regulations (C.R.C., c. 1467)
- Canada Labour Code Part II
- Maritime Occupational Health and Safety Regulations
- T.C.M.S. Ship Safety Bulletin 06/1989 Grounding Safety in Dry-dock
- UL 1309 – Standard for Safety for Marine Shipboard Cable

3.3.3 Applicable Regulations and Standards can be found in the following websites:

- TP Publications: <https://www.tc.gc.ca/en/services/marine.html>
- CGSB Standards and publications: <http://www.scc.ca>
- ULC Standards and publications: <http://www.ulc.ca>
- Canadian Standards Association: <http://www.csa.ca>
- ISO Standards: <http://www.iso.org>
- IEEE Standards and publications: <http://www.standards.ieee.org>
- British Standards: <http://www.bsigroup.com/en-GB/>

- ANSI Standards: <http://www.ansi.org>
- ASTM Standards: <http://www.astm.org>
- ASME Standards: <http://www.asme.org>
- S.N.A.M.E. Rules/Guidelines: <http://www.sname.org>

3.4 Facility Requirements for Government Personnel

3.4.1 The Contractor must provide a minimum of fifty (50) square meters of secure office space with the following requirements for CCG personnel:

- a) Two (2) lockable offices with a minimum of 20 square meters each;
- b) One (1) boardroom with furnishings to seat ten (10) people (arrangements must consist of one large boardroom table with seating for ten). The boardroom must also be furnished with a 1.2 meter by 1.8 meter whiteboard on one wall.
- c) Three (3) desks, full size with double pedestals containing drawers:
 - i. Desk drawers must be lockable.
 - ii. One (1) desk must be an “L” shaped secretary style desk with side tables
- d) One (1) desk size table.;
- e) Ten (10) chairs, of which six (6) must be fully adjustable and fitted with a swivel base and casters (in addition to the boardroom furnishings);
- f) Two (2) bookcases – 1.2 meter wide by 1.8-meter height;
- g) Three (3) filing cabinets – four (4) drawers per cabinet. All cabinets are to be lockable.
- h) Four (4) keys must be provided for each lockable door, desk and filing cabinet.
- i) Three (3) direct telephones – one (1) of which must be in the boardroom;
- j) Three (3) high speed internet connections;
- k) One (1) office copier capable of handling 216 by 279 mm paper, 216 by 356 mm paper and 279 by 432 mm paper sizes. The copier must be equipped with an auto sheet feeder and serviceable within two (2) hours of any breakdowns.

3.4.2 The offices must be supplied with heating, ventilation/air conditioning, and lighting as per provincial health and occupancy regulations.

3.4.3 Washroom facilities must be located on site for CCG personnel use.

3.4.4 Three (3) parking spaces must be allocated within the confines of the shipyard for Government personnel. The spaces must be clearly marked and the required passes provided to Government personnel.

3.4.5 All of the above equipment and facilities must be clean and in good condition to the full satisfaction of Canada.

3.5 Storage Space

3.5.1 Immediately upon contract award, the Contractor must provide secure, completely enclosed, indoor, environmentally controlled storage space for the ship's equipment, materials and GSM. The storage space environment must be maintained at a minimum of 15 degrees centigrade and at a maximum relative humidity of 70 percent for the duration of the contract.

3.5.2 The storage space must have a minimum of 1,000m² total space for GSM equipment, parts and materials as required. A minimum of 500m² of this storage space must be flat laydown surface area with ample walking room to thoroughly inspect vessel equipment, parts and components. The Contractor must provide sufficient new pallets for the storage of all Government supplied items.

3.5.3 All items must be stored in such a manner so as to be easily accessible for inspection. No items must be stored directly on floors, other than large GSM machinery, they must remain properly secured in their original crates/shipping arrangements or suitably strapped to pallets.

3.5.4 The allocated storage space must have one (1) desk with two (2) chairs.

3.5.5 The storage space must be located on the premises of the Contractor's facility.

3.5.6 The Contractor must provide the use of a crane and its operator(s) as well as one (1) three (3) ton truck and driver and one (1) forklift and forklift driver for a period of three (3) days each for the purpose of storing and de-storing vessel furniture, equipment, spares and components currently on the vessel or additional CCG supplied parts/equipment not detailed in this SOW (Total six days for storing/de-storing overall). The Contractor must provide all required labour necessary to remove, store and re-install all furniture, equipment, spares and vessel components currently on the vessel. All of these items must be stored in a completely enclosed, secure, indoor, heated location that is protected from all potential weather ingress and damage while in storage during the work period. This storage space is in addition to the vessels equipment storage detailed in section 3.5.2 above. Any vessel items damaged while being stored by the contractor must be replaced at the contractor's expense.

3.6 Fees and Costs

3.6.1 The Contractor must include the necessary pricing and/or allowances in their bid price for the following fees and costs (as described and accounted for under each of applicable section describing the work):

- a) Services
- b) Factory Service Representatives
- c) Tests and Trials of equipment and vessel
- d) Provision of safety services, e.g. gas freeing of tanks, fire protection, cocooning asbestos containing areas;
- e) Certification of lifting devices as required.
- f) The Contractor must be responsible for contacting, coordinating and scheduling all regulatory inspections and/or class surveys by the applicable authority: i.e. ABS, Health Canada, Environment Canada or others as detailed in this SOW.

NOTE: The CCGS GEORGE R. PEARKEs is enrolled in the Delegated Statutory Inspection Program (DSIP), whereby Transport Canada has delegated regulatory inspections for the ship to a Recognized Organization – in this case the American Bureau of Shipping (ABS). The delegation allows for most, but not all inspections to be carried out by ABS. Canada will bear the costs of all ABS inspections. If an inspection by Transport Canada is required, Canada will also bear the costs of these inspections as well.

3.7 Quality Assurance

3.7.1 The Contractor must deliver, as part of its bid package, confirmation that its Quality Assurance program is in accordance with the terms and conditions specified at Contract clause 1.19 and 1.21.

3.8 As Delivered Inspections

3.8.1 The Contractor in conjunction the Technical Authority (TA) and the Inspection Authority (IA), must carry out an operational inspection of the vessel on its arrival. All parties must sign off on the operational assessment of vessel's equipment and systems. This activity must be carried out before hand-over of the vessel to the Contractor. The Contractor must provide a photographic survey, (reference Section 8.6) with notes of any defects of the inspection to the IA and the TA.

3.8.2 These inspections must meet the requirements of Section 8.6.1 of this Specification

3.8.3 A detailed Inspection Test Plan (ITP) must be developed by the contractor for every specification item detailed in this SOW. A CCG developed template is included in the attached technical data package and must be used for the development of the contractor's ITP. An example of a detailed specification item is provided within the ITP Template MS Excel document.

3.8.4 The Contractor must develop the entire ITP document in the CCG supplied template to the satisfaction of the Contracting Authority and the CG TA/IA. This fully developed ITP must be submitted to CCG for review and approval within 2 months of contract award. It is the responsibility of the contractor to arrange all inspections, provide all certifications/reports and arrange for signatures from each required party (CCG, Class, NACE, Vessel representative etc.) for each job specific hold point.

3.9 Property of Canada

3.9.1 General

3.9.1.1 All materials and equipment removed from the vessel, by the Contractor, unless specifically identified within the project requirements for disposal as scrap (i.e. scrap is Category C, defined in next section), must remain the property of Canada.

3.9.1.2 All such equipment and materials must be held and retained in good condition by the Contractor pending instructions from the IA or TA.

3.9.1.3 The Contractor must obtain agreement of both IA or TA for the disposal of materials and equipment that will have any market value after removal from the vessel (materials belonging in Category C). Cost estimation must be supplied and environmental regulations may apply on some products.

3.9.2 Categorization

3.9.2.1 Property of Canada that is to be either permanently or temporarily removed from the vessel must be identified and tagged by the Contractor as being in one of the following three (3) categories as determined by the TA and this Specification:

3.9.2.2 **Category "A"**: These items must be permanently removed from the vessel and must remain the property of Canada. The Contractor must store and protect these items from incurring any physical damage. The Contractor must store these items on pallets, skids, or in containers suitable for shipment until such a time as they have been inspected and accepted into the care and custody of Canada. The Contractor must provide storage to Canada of these items for the

whole of the contract period. Canada must be responsible for the removal and transport of these items from the Contractor's premises.

- 3.9.2.3 **Category "B"**: These items must remain the property of Canada, and must be temporarily removed from their location on the vessel during the contract work. They must be returned to their original location on the vessel prior to the vessel leaving the Contractor's facility. The Contractor must protect these items from weather or physical damage. These items must be stored to allow easy relocation or movement of the items to permit access for inspection, refurbishment and/or maintenance of these items as necessary. The Contractor must take the necessary precautions to prevent any damage to the stored equipment and material.
- 3.9.2.4 **Category "C"**: Upon removal, these items must become the property of the Contractor and are to be disposed of in accordance with all applicable laws, rules and regulations. Copies of all applicable disposal certificates must be provided to the CCG TA.
- 3.9.2.5 Prior to removal of any items from the vessel, the items must be clearly identified with metal tags secured with wire denoting the category they fall in ("A", "B", or "C").

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

3.10 Project Integration Management

- 3.10.1 The Contractor must provide an overall project organizational chart identifying all key personnel (in accordance with the terms and conditions specified at Contract clause 1.20) and sub-Contractors. Further, the Contractor must identify the contract-related work each sub-Contractor is responsible for.
- 3.10.2 As detailed further in the ITT contract document, the contractor must supply the services of a full time, dedicated Project Management team to effectively manage, oversee, coordinate and successfully complete and deliver the work as detailed in this SOW. At a minimum, the project management team must be composed of the following four (4) individuals:
- Project Manager
 - Propulsion Machinery/Engine Room Integration Manager
 - Quality Assurance, Inspection and Testing Manager
 - General Vessel Supervisor/ Superintendent

These individuals must be experienced marine professionals with in depth knowledge and recent experience in managing and successfully delivering large scale marine refit projects.

3.10.3 The members of the PM team must be regularly on-site and fully dedicated to the CCGS Pearkes VLE project. They must also be in attendance for the bi-weekly (at a minimum) technical review meetings and monthly (at a minimum) Progress Review Meetings. Further details regarding the specific requirements for these four (4) individual positions is described in the ITT Contract document.

3.10.4 Change Management Log

3.10.4.1 During the course of the project, the Contractor must be responsible for developing and updating a Change Management Log to manage project changes.

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

- a) Individual tracking number;
- b) Date issue was raised;
- c) Expected resolution date;
- d) Date issue was resolved;
- e) Brief note of resolution on issue;
- f) Individual who raised issue;
- g) Individual assigned to resolve issue;
- h) Risk Factor.

3.10.4.3 Any issues that require a change in the know work they must be dealt by via the PWGSC 1379 Form (refer to Annex F in contract clauses).

3.10.5 Risk Management

3.10.5.1 The Contractor must produce a Risk Management Register which identifies emergent risks and rank these risks by impact on the work. Mitigation strategies must be identified for all "High" risks. The "Risk Management Register" must be updated and provided bi-weekly to the Technical and Contracting Authorities. The "Risk Management Register" must be included and reviewed in the monthly progress meeting Record of Decisions.

3.10.6 Scheduling (Refer to terms and conditions specified at Contract clause 1.16)

3.10.6.1 The Contractor must provide a schedule(s) that breaks the work down to the system and component level, WBS 3 (work breakdown structure). The schedule must include sub-Contractor schedules to the same level. The contractor must provide a preliminary schedule at Contract award and an updated, complete master schedule two (2) weeks prior to the arrival of the vessel at their facility. The Contractor must include an allowance of \$100,000.00 in their pricing for these scheduling costs that must be updated monthly throughout the project work period (\$25,000.00 for the acceptance of the initial master schedule and \$5,000.00 for each monthly update – 16 total). The final cost will be adjusted by PWGSC 1379 based on the final number of completed and accepted monthly schedules. Each schedule must be delivered monthly, three (3) working days prior to the monthly progress review meeting.

3.10.6.2 The schedule(s) must identify all work in the project (including additional work identified using PWGSC 1379, (per Annex F of the contract clauses, Procedure for Unscheduled Work). It must include long lead items, GSM, CSM, strip outs, production, assembly, installation, bench testing, system commissioning and tests and trials, as well as all scheduled and required resources.

3.10.6.3 The schedule(s) must include all man power loading, the sources of the manpower, identify all major milestones, the critical path and all interrelationships between tasks. Scheduling must include the required time to carry out all required engineering, designing, hazardous material abatement and work execution for each project SOW item.

3.10.6.4 PMBoK (7th edition) must be used as the reference for scheduling.

3.10.6.5 The Contractor must use a commercially available project management software, either MS Project or equivalent approved by the TA, that is able to track tasks, predecessors, critical path and milestone markers within the software.

3.11 Project Reporting

3.11.1 The Contractor must provide a monthly Progress Report describing the status of the project's Timeline, as well as the Cost and Performance as an introduction. Time, Cost and Performance must then be addressed in detail. The report must identify significant risks to the program and the actions taken to resolve these risks. The risk analysis must identify any impact upon delivery and actions taken to recover any slippage that may affect the contract delivery date. The report must be delivered monthly, three (3) working days prior to the progress review meeting, to the Contract Authority (CA), the IA and the TA. The progress report must include all sub-Contractor and major component supplier activity.

- 3.11.2 During the time period between Contract Award and the vessel arriving at the contractor's facility, the contractor must conduct regular bi-weekly meetings with CCG and PSPC, either in person or digitally. These meetings must be attended by all members of the PM team and will serve as production and planning review meetings to discuss all pre-planning and work activities with the contractor. The goal of these meetings are to ensure that all preparatory work and pre-planning, pre-engineering and design activities are complete by the time the vessel arrives at the contractor's facility.
- 3.11.3 Within one (1) month of Contract award, the successful contractor must supply CCG with a full Purchase Order (PO) report for review and acceptance. This report must contain supporting evidence that all PO's for long lead items (4 Weeks + delivery), CSM equipment/parts and FSR's have been issued. All CSM procurements and FSR attendance must be effectively incorporated into the overall project master schedule along with delivery and installation timelines as detailed in section 3.10.6 above.
- 3.11.4 During the time period between Contract Award and the vessel arriving at the contractor's facility, the Contractor will be provided access to the vessel for two (2) days to carry out their own full hazardous assessment of the vessel. This survey must be carried out by a fully certified, accredited, third party testing and abatement organization that must provide a full report based on their findings. This report must be provided to CCG for review and will be compared against the hazardous material assessments in the TDP that are provided to the Contractors for bidding purposes. All costs for this contractor provided vessel hazardous assessment report must be included in the Contractor's firm bid price.
- 3.11.5 Any differences found between the CCG supplied assessments and the Contractor provided assessment will be reviewed. Any new hazardous material findings that arise from this new report must be fully abated by the contractor within the first month (30 days) of the vessel arriving at their facility along with the abatement of all pre-identified hazardous materials detailed in the appended hazardous material matrix. The costs of abatement for any newly identified hazardous materials will be covered off on the allowances detailed in sections 4.2.7.7 & 4.2.8.9 below. The costs to abate and dispose of all other hazardous materials already identified by CCG as referenced in the attached hazardous material matrix and assessments in the TDP must be included in the Contractor's firm pricing for each related specification item.
- 3.11.6 The successful contractor must provide certification to CCG that they have identified and removed all hazardous materials and waste required to carry out the work detailed in this SOW within the first 30 days of the vessel arriving at their facilities.

4.0 GENERAL TECHNICAL

4.1 Physical Operating Conditions for Equipment

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

- a) Outside air temperature:
 - Winter: – 40 °C
 - Summer: +35 °C
- b) Sea Water temperature:
 - Winter: -1 °C
 - Summer: +30 °C
- c) Wind Velocity: 80 knots
- d) Sea State: 6
- e) Ship inclination of up to 35 degrees roll on either side, with a cycle frequency of 10 seconds, and a 10 degree pitch with a cycle frequency of 5 seconds and maximum linear acceleration of 1.0g;
- f) Permanent list of 22.5 degrees port or starboard, and permanent trim of 10 degree fore and aft

4.1.2 Equipment Located Below Decks

All new machinery and/or equipment must be capable of its intended operation at the ambient conditions of 95% relative humidity at temperatures to 50 °C.

4.1.3 Equipment Located on the Weather Deck

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

4.1.4 Electronic Compartments

4.1.4.1 Manned Compartments

- a) Room temperature: 20°C to 25°C;
- b) Relative humidity: 30 to 90%;
- c) Noise level: 65 dBA.

4.1.4.2 Unmanned Compartments

- a) Room Temperature: 15°C to 35°C;
- b) Relative humidity: 40 to 70%;
- c) Noise level: 80 dBA

4.1.5 Vibration

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

4.1.5.2 Shipboard Vibration:

- a) Up to 13.2 Hz with displacement amplitude of +/- 1.0 mm;
- b) 13.2 to 100.0 Hz acceleration of +/- 0.7 g with a maximum acceleration of 0.7 g;
- c) Natural frequencies at supports for equipment and parts of equipment must not be within the 0 to 100 Hz range, except where they cannot be kept outside this range by constructional design methods, the vibration must be damped so that undue amplification is avoided.

4.2 Protection of Personnel

4.2.1 General

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

4.2.1.2 Smoking must not be permitted aboard this vessel at any time.

4.2.1.3 The contractor must ensure all openings, i.e. manhole covers, are clearly taped off with caution tape and illuminated

4.2.2 Gas Free Certification

4.2.2.1 The following precautions must be taken prior to entering any confined space:

- a) All compartment(s), tanks or void spaces requiring entry for work to be performed, must be certified gas free by a certified marine chemist or a provincially recognized and qualified individual trained and certified for gas

free certification. Note: Proof of certification is to be provided to the CCG Inspection Authority.

- b) The Contractor must provide copies of all gas free certificates issued, to the CCG IA. Certificates must specify, "Safe for Persons" (manned entry) and/or "Safe for Hot Work" as appropriate. Gas free verification is to be performed daily and a copy, showing the date and time, of the latest verification, must be posted at the point of entry of each effected space(s);

4.2.3 Confined Space Entry

- 4.2.3.1 The Contractor must ensure that each compartment, tank, void space, etc. that is identified for work in this VLE document, is suitably ventilated and cleaned and provided with a gas free certificate, either certified by a marine chemist or other qualified person(s).
- 4.2.3.2 For all work requiring entering or working in confined spaces; the Contractor is to note that Canadian Coast Guard vessels are presently working under the ISM Code and that each ship has a Fleet Safety Manual onboard. This manual will be made available to the Contractor upon request.
- 4.2.3.3 As a minimum the Contractor must comply with the work requirements as outlined in the Fleet Safety Manual during the contracted work period. In accordance with the CCG Fleet Safety and Security manual, all work involving the entering of confined spaces must make use of a qualified rescue team. This team is to be used at all times when tanks or confined spaces are to be entered.
- 4.2.3.4 Any entry into confined spaces during the contract period must be conducted in accordance with the Canadian Coast Guard Fleet Safety Management System procedures and individual shipboard work instructions. The Contractor's Standard Operating Procedures (SOP's) may be substituted for this requirement based upon a review and acceptance of the Contractor's SOP's by the Contract Authority and the TA.
- 4.2.3.5 The costs associated with all known work requiring the services of a confined space rescue team must be the responsibility of the Contractor.

4.2.4 Hot Work

- 4.2.4.1 The following precautions must be taken where hot work is to be conducted:
 - a) The compartment(s) affected must be certified gas free suitable for Hot Work

- b) Protective noncombustible non asbestos material must be used to prevent the spread of sparks, protecting electrical cables, machinery and other services;
- c) A Fire Watch must be provided and maintained in the compartment, tank or void, where the hot work is being performed and in all adjacent compartments. Fire watches must be provided with an appropriate fire extinguisher and must be trained in its use. The designated fire watch for each job must be in view of the hotwork being performed at all times. A moving firewatch will not be permitted.
- d) The fire watches must be maintained for a minimum of thirty (30) minutes after all hot work has been completed.
- e) Any hot work carried out onboard the vessel during the contract period must be conducted in accordance with the Canadian Coast Guard Fleet Safety Management System (CCGFSM) procedures and individual shipboard work instructions. Copies of the manual and site-specific work instructions are available from the TA.
- f) The Contractor's Standard Operating Procedures (SOP's) or Provincial Legislation may be substituted for this requirement based upon a review and acceptance by the Contract Authority and the TA.

4.2.5 Lock-Out / Tag-Out

- 4.2.5.1 Any lock-out requirements onboard the vessel, during the contract period, must be conducted in accordance with the Canadian Coast Guard Fleet Safety Management System procedures and individual shipboard work instructions. The Contractor's Standard Operating Procedures (SOP's) may be substituted for this requirement based upon a review and acceptance of the Contractor's SOP's by the Contract Authority and the TA.
- 4.2.5.2 When working on electrically operated equipment, or a potential energy source (I.e. hydraulic accumulators, charged air receivers, etc.) physical lock-outs must be used to isolate the equipment. Caution tags must be utilized and posted at the source and are to be clearly visible. In the case of electrical lockouts, the switches/breakers located on the main switchboard and the respective distribution panels which provided power to equipment must be locked-out to ensure that the power is not present.

4.2.6 Working Aloft

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

substituted for this requirement, based upon a review and acceptance of the Contractor's SOP's by the Contract Authority and the TA.

4.2.7 Asbestos

- 4.2.7.1 No material containing asbestos is permitted to be used. The contractor must reference the attached Hazardous Materials Assessment Matrix along with all attached Hazardous Materials Assessments for the George R. Pearkes. All identified areas of Asbestos in way of the work detailed in this SOW must be completely removed and abated by certified professionals within the first month (30 days) of the vessel arriving at the contractor's facility. All related costs for the removal and abatement of these materials must be included in the contractor's firm pricing for each related specification item.
- 4.2.7.2 Any handling of existing material found onboard, containing asbestos (reference Note below) must be performed by qualified personnel trained and certified in accordance with Provincial Labour Regulations. The Contractor must provide the certificates of certified personnel to the IA prior to the commencement of any such work.
- 4.2.7.3 The Contractor must be responsible for the safe disposal of any asbestos containing material where such material is disposed of. The Contractor must provide the IA with copies of certificates pertaining to the disposal of the asbestos containing material in accordance with Federal, Provincial and Municipal regulations.

Note: The latest surveys performed in 2020 & 2021 has determined that there are small quantities of friable and non-friable ACMs (Asbestos Containing Materials) onboard the CCGS George R. Pearkes. The latest reports (2020 & 2021), in PDF format, are included in the Technical Data Package. The Contractor must follow an Asbestos Management Plan when handling, disturbing, or working in the direct vicinity of these identified ACMs. Type 2 Work procedures are necessary to work with the friable materials; and Type 1 work procedures for the non-friable materials.

- 4.2.7.4 There is a comprehensive list provided in the 2020 & 2021 surveys of spaces and materials regarding their ACM composition. As noted in these documents, there are various electrical transits/junctions throughout the vessel that contain firestop putty containing Asbestos. The Contractor must include in their firm pricing for the complete abatement and disposal of 30 transits/junctions containing this putty throughout the vessel by a certified third party organization. The Contractor must obtain specific job site information from the TA to determine if ACMs are present in any other specific area of the vessel. All necessary documentation of compliance with these standards must be completed and given to the TA prior to, during, and after completion of all work as applicable to the process.

- 4.2.7.5 Air quality testing must be carried out prior to and after completion of the work by certified personnel with the proper equipment. Copies of all air quality testing reports and certifications must be provided to the TA.
 - 4.2.7.6 The Contractor must include in their pricing the cost for collecting and analyzing a minimum of thirty (30) Asbestos samples on various surfaces that will be disturbed by the refit activities. A unit price per test/analysis is to be provided in the Contractor's bid and any additional tests/analyses required will be dealt through the PWGSC 1379 Form (Per Annex F).
 - 4.2.7.7 In addition to the known abatement required as referenced in line item 4.2.7.1 and 4.2.7.4, the Contractor must also include an allowance of \$50,000.00 in their pricing for all costs related to any Asbestos identification, abatement, disposal and air testing/quality activities that arise during this project. This abatement and testing must be carried out by a certified, third party hazardous abatement and testing organization. This allowance will be adjusted by PWGSC 1379 (Per Annex F) based on final invoice. This allowance must be used for newly identified, unknown areas that arise during the project only. Any areas of hazardous material abatement identified in this SOW and detailed in the attached Hazardous Material Assessments and Matrix must be included in the contractor's firm pricing for each affected specification item and must be carried out within 1 month of the vessels arrival at the contractors facility.
 - 4.2.7.8 As noted above in Sections 3.11.4 – 3.11.5, the successful contractor must carry out their own hazardous material assessment of the vessel prior to the vessel arriving at their facility and a report must be provided based on the findings. This contractor provided report will be compared against the CCG supplied assessments and any newly identified areas containing hazardous materials that will be disrupted in order to carry out the work detailed in this SOW must be abated within one (1) month of the vessel arriving at the contractor's facility.
- 4.2.8 Lead Paint
- 4.2.8.1 The Contractor must not use lead-based paints in any application. The contractor must reference the attached Hazardous Materials Assessment Matrix along with all attached Hazardous Materials Assessments for the George R. Pearkes. All identified areas of Lead Paint in way of the work detailed in this SOW must be completely removed and abated by certified professionals within the first (1) month (30 days) of the vessel arriving at the contractor's facility. All related costs for the removal and abatement of these materials must be included in the contractor's firm pricing for each related specification item.
 - 4.2.8.2 CCG vessels have been painted with lead-based paints in the past and as a result some of the Contractor's processes such as grinding, welding and burning have the potential of releasing this lead from the coatings.

- 4.2.8.3 The Contractor must ensure that existing coatings in all affected work areas are tested for lead content prior to the work being performed and that the work is performed in accordance with applicable Federal and Provincial regulations.
- 4.2.8.4 The Contractor must demonstrate that the appropriate lead paint work procedures are in place and have been approved by the workplace Occupational Health and Safety Committee and that these safe work procedures are in compliance with provincial regulations.
- 4.2.8.5 Upon Contract award, the successful Contractor must demonstrate that its supervisors, sub-contractors, and/or workers performing any lead abatement procedures have been trained and that records are available for inspection, proving that this training is current and has taken place. Training received must at a minimum conform to *Section 6 of EACO Lead Guideline for Construction, Renovation, Maintenance or Repair*, latest edition.
- 4.2.8.6 The Contractor must demonstrate that their health and safety department has the capacity to monitor on-site work progress, is capable of performing air quality monitoring on an ongoing basis as required by the Occupational Health and Safety Regulations and is able to assess the affected areas post abatement process.
- 4.2.8.7 The Contractor must provide the TA with all records from lead abatement processes and the final disposal certificates for all materials generated from the abatement process.
- 4.2.8.8 The Contractor must include in their bid the cost for collecting and analyzing a minimum of fifty (50) lead paint samples on various surfaces that will be disturbed by the refit activities. A unit price per test/analysis is to be provided in the Contractor's bid and any additional tests/analyses required will be dealt through the PWGSC 1379 Form (Per Annex F).
- 4.2.8.9 In addition to the known abatement required as referenced in line item 4.2.8.1, the Contractor must include an allowance of \$150,000.00 in their pricing for all costs related to any Lead coating identification, abatement, disposal and air testing/quality activities that arise during this project. This abatement and testing must be carried out by a certified, third party hazardous abatement and testing organization. This allowance will be adjusted by PWGSC 1379 (Per Annex F) based on final invoice. This allowance must be used for newly identified areas that arise during the project only. Any areas of hazardous material abatement identified in this SOW and detailed in the attached Hazardous Material Assessments in the TDP must be included in the contractor's firm pricing for each affected specification item.

4.2.8.10 This allowance is to include all related sub-Contractor costs, disposal costs of contaminated waste and contaminated materials and certificates. This cost will be adjusted to actual using PWGSC 1379 Form (Per Annex F).

4.2.8.11 The Contractor must provide Health Canada product approval for all underwater hull surface paints controlled by Health Canada and the Pest Management Regulatory Agency.

4.2.8.12 As noted above in Section 3.11.5, the successful contractor must carry out their own hazardous material assessment of the vessel prior to the vessel arriving at their facility and a report must be provided based on the findings. This contractor provided report will be compared against the CCG supplied assessments and any newly identified areas containing hazardous materials that will be disrupted in order to carry out the work detailed in this SOW must be abated within one (1) month of the vessel arriving at the contractor's facility.

4.2.9 Workplace Hazardous Materials Information System (WHMIS)

4.2.9.1 The TA will identify to the Contractor any hazardous materials that are onboard the vessel in accordance with the Workplace Hazardous Materials Information System (WHMIS).

4.2.9.2 WHMIS Material Safety Data Sheets for identified hazardous materials onboard the vessel will be provided to the Contractor by the TA.

4.2.9.3 The Contractor is responsible for all Contractor supplied products and materials used aboard the vessel. These materials must be identified to the TA and the IA. Copies of the associated Material Safety Data Sheets (MSDS) must be provided to both the IA and the TA.

4.2.10 Protection of Equipment

4.2.10.1 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 are protected against damage, soiling, and/or contamination.

4.2.10.2 All electrical and electronic equipment and components must be protected during the contract against damage by direct or indirect physical contact or by the effects of adverse temperatures or other environmental conditions.

4.2.10.3 Any damage to surfaces, equipment, furnishings or decor incurred prior to acceptance by Canada must be returned to "As Delivered" condition by the Contractor at no expense to Canada.

- 4.2.10.4 All openings in the machinery and/or systems prior to connections being made must be kept covered by inserts or covers at all times. Rags stuffed into open pipes will not be acceptable. All openings into the superstructure or hull must be kept covered to prevent water or contaminant ingress into the vessel.
- 4.2.10.5 The Contractor must obtain and follow instructions from it's the OEM or sub-Contractors for any special protection required for sub-Contractor furnished equipment during the project work. Such instructions must be made available to both the TA and the IA.
- 4.2.10.6 The Contractor must ensure that the ship's machinery, equipment and systems are protected from all hazards, including but not limited to damage from ongoing work, corrosion, sandblasting (directly or indirectly), paint over spray, hot work, adverse temperature or other environmental conditions and contaminants.

4.3 Access to Vessel and Equipment

4.3.1 Installation and Removal Routes

- 4.3.1.1 Disturbing the physical structure of the vessel, to gain access to facilitate removal or installations of large equipment, must require approval by the TA prior to work commencing.
- 4.3.1.2 The Contractor must be responsible to identify all readily visible interference items that will require removal to facilitate removal routes.
- 4.3.1.3 All interference items removed or disturbed, including lagging and/or insulation, must be renewed in good order to an "As Delivered" condition on completion of work, unless otherwise specified.

4.3.2 Penetrations

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

4.3.3 Access for Maintenance

- 4.3.3.1 The layout of the newly installed machinery and equipment must be designed and constructed to permit ready access for inspection, maintenance and repair without disturbance of other machinery, equipment or structures. Future removal routes of the aforesaid machinery components must be taken into account by the Contractor.

4.4 Assembly and Cleanliness of System Equipment and Component

4.4.1 Securing Arrangements of System Equipment and Components

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

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

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

4.4.2 Cleaning

4.4.2.1 The Contractor must ensure that after installation, all parts and assembled equipment are:

- clean and free of all smudges,
- excess solder,
- weld splatter
- metal chips or dross or
- any other foreign material.

This includes any particles that could loosen or become dislodged during the normal expected life of the equipment.

4.4.2.2 All corrosive material must be removed. This cleaning must take place before final assembly of the equipment parts. Any disturbed paint is to be repaired prior to closing machinery.

4.4.3 Damaged Items

4.4.3.1 Machinery, equipment covers, cowlings, and components damaged by the Contractor, during the Contract period, will be repaired or replaced by the Contractor at no expense to Canada.

4.5 Welding

4.5.1 General

- 4.5.1.1 For the fusion welding for steel, the Contractor must be certified in accordance with the most recent version of the Canadian Welding Bureau (CWB), CSA/ACNOR W47.1-09. All such welding performed must be to the most recent version of SA Standard W59 - Welded Steel Construction (Metal Arc Welding). Individuals performing in steel fusion welding must be certified by the Canadian Welding Bureau to CSA Standard W47.1-09 and for the type of weld positions that they are required to perform.
- 4.5.1.2 All aluminum welding performed by the Contractor, of its qualified sub-Contractor, must be certified to must conform to the requirements of the most recent version of CSA Standard W47.2-11 "Certification of Companies for Fusion Welding of Aluminum". Individuals performing aluminum welding must be certified by the Canadian Welding Bureau to CSA Standard W47.2-11 and for the type of weld positions that they are required to perform.
- 4.5.1.3 The Contractor must submit a list names and the qualifications of all of the welders who will be working on this project and well as copies of their CBW certifications. This List is to be provided to the TA and is to be updated as required when new welders are introduced to the project.
- 4.5.1.4 The Contractor is to provide a CBW recognized Welding Engineer developed and CWB approved welding specifications and weld procedure data sheets to both the TA and the regulatory body (ABS) where required.
- 4.5.1.5 Weld procedures for joining pipe connections must be recorded and approved by CWB in accordance with ASME Boiler and Pressure Vessel Code, Section IX. All procedures pertaining to hot work must be adhered to. All pipe welding must be performed by qualified pipe welders qualified for the pipe application intended.
- 4.5.1.6 The Contractor must perform NDT on welds in accordance with ABS rules or the CCG Welding Standard, whichever is more stringent.
- 4.5.2 Weld Design Requirements
 - 4.5.2.1 The size, length and details of welds must be approved by the Classification Society related to that specification item, or ABS.
- 4.5.3 Removal of Temporary Attachments.
 - 4.5.3.1 Temporary cleats, lifting eyes and fastenings for servicing structures must be removed by burning or grinding, and any remaining irregularities must be ground flush with the surface of the parent plate. Any disturbed paint is to be repaired in accordance with Section 4.7
- 4.6 Painting

4.6.1 General

- 4.6.1.1 Prior to the commencement of any painting, the Contractor must prepare a paint schedule and submit this schedule to the TA and the IA for review and acceptance. The paint schedule must list all areas and compartments on the vessel affected by the project work and indicate the proposed paint type, painting scheme, surface preparation, type of coating, number of coats, Dry Film Thickness (DFT) and colors. All paint used must be compatible with the existing paint on the vessel.
- 4.6.1.2 All pipe markings must be in accordance with the Canadian Coast Guard Color Coding Standard for Piping Systems.
- 4.6.1.3 All new and disturbed steel and aluminum work must be painted in accordance with publication Canadian Coast Guard Paints and Coatings Standard, unless otherwise stated in this document, and to the paint manufacturer's specifications.
- 4.6.1.4 Paint, varnish and other finishes used on interior surfaces must have a Classification Society Type Approval certificate from a Transport Canada authorized Registered Organization. Copies of these certificates are to be provided to the TA.
- 4.6.1.5 Each coat of paint must be of a different shade to indicate proper coverage, and thoroughly dry before application of subsequent coats. As a minimum, the first primer coat must be applied by brush, roller or by airless spray. The final topcoats must be protected from soiling or damage until the custody of the vessel is returned to Canada. Care must be taken in the application of paint to ensure that furnishings, and equipment liable to more serious damage due to excess spray, must be adequately protected.
- 4.6.1.6 The following must **NOT** be painted:
 - a) Exposed screw threads;
 - b) Grease fittings;
 - c) Bronze pins;
 - d) Door screens;
 - e) Name plates;
 - f) Gaskets;
 - g) Stainless steel or Monel metal fittings;
 - h) Machined surfaces;
 - i) Instrumentation;
 - j) Interior gratings;
 - k) Electrical wires, insulation and associated fittings;
 - l) Electrical panels;
 - m) Rubber seals of watertight doors and hatches;
 - n) Fire door seals, and;

o) In general, all working parts.

4.6.1.7 All paint intended for the painting the vessel's hull, or for an application on the underwater hull surface, must be registered and approved for use by Environment Canada. The Contractor must provide copies of these approvals to both the IA and the TA.

4.6.1.8 The Contractor must ensure that the ambient environmental conditions, as called for by the paint manufacturer are within the acceptable parameters for the application of any coatings. The Contractor must include in their bid, the cost of enclosing the vessel and the necessary heating required to meet the minimal temperature and humidity ambient conditions during the dry docking to permit the correct application of the specified hull coatings.

4.6.2 Heavy Metal Based Coatings

4.6.2.1 Paints or any other coating containing lead, mercury or copper must not be used under any circumstances.

4.7 Identification

4.7.1 Nameplates

4.7.1.1 Nameplates must be fitted for all new equipment, new compartments, new doors and closures.

4.7.1.2 All nameplates must be in English, except where required by Transport Canada to be in English and French for reasons of emergency operation.

4.7.1.3 Lettering must be clear and concise with the minimum use of abbreviations. Primary information must be given in larger size lettering than secondary information.

4.7.1.4 The type of nameplates must suit the location in the vessel as specified below:

- a) Plastic must be used in accommodation and navigation spaces where the nameplate is free of exposure to mechanical damage or covering over by ice, paint, oil, grease, or dirt.
- b) Plastic nameplates must be laminated phenolic rigid type with machine engraved lettering and secured with stainless steel or brass machine screws. Unless otherwise specified, nameplates must have white lettering on black for normal signs and white lettering on red background for warnings and emergency signs.

- c) Laminated plastic nameplates, black with white core engraved through to the center core, must be provided for all devices located on the exterior surfaces of the switchboard.
- d) Nameplates must be secured to the switchboard with machine screws. New nameplates to be fitted on the existing switchboard must be consistent in size and lettering with those already fitted. Nameplates for feeder circuits must identify each circuit by name and number and the fuse size and/or trip element rating.
- e) Warning or caution nameplates must be laminated plastic, red with white core engraved through to the center core, and must identify circuit breakers with shunt trips requiring completion of remote circuits prior to being operated, and those having a potential power source connected to both sides, or to any other potentially hazardous condition.
- f) Engraved Metal, stainless steel or brass nameplates must be used in machinery spaces and where exposed to the weather. Engraved metal nameplates must have lettering accentuated by means of black wax and secured with stainless steel or brass machine screws.
- g) A complete drawing list of nameplates, detailing size of plate, size of lettering and inscription must be submitted to the IA and the TA for review and acceptance prior to ordering and/or manufacturing.

4.7.2 Key Tags

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

4.7.3 Safety Related Signs

- 4.7.3.1 Any new signs required as a result of this Contract must be All new signs must be in English except where required, by Transport Canada to be in both English and French for safety reasons.
- 4.7.3.2 Painted signs for muster station directions, fire stations and emergency equipment, etc. must be supplied and located in accordance with ABS Rules and Regulations.

- 4.7.3.3 If required the Contractor must prepare and submit a drawing indicating the location, type and size of lettering for any new all signs. This drawing must be submitted to ABS for approval prior to construction or installation of the signs.

4.8 Vessel Cleanliness

- 4.8.1 The Contractor must maintain the vessel in a clean condition during the course of the whole Contract. Debris and garbage must be removed from the vessel and disposed of at the end of each working day.
- 4.8.2 Attention must be given to hazardous materials such as flammable or toxic waste products. These must be disposed of in accordance with federal, provincial and municipal regulations.

4.9 Cleaning of Bilges

- 4.9.1 Prior to any work commencing in the machinery spaces, the bilge in the machinery spaces must be cleaned. Cleaning must include pumping and disposal of all bilge water and washing of all bilges to remove all grease, oil and contaminants.
- 4.9.2 Disposal of waste must be in accordance with all federal, provincial and municipal regulations. Disposal certificates must be provided to both the IA and the TA.
- 4.9.3 For bidding purposes the Contractor must include pricing for the removal and disposal of 15 m³ of oily bilge waste for disposal upon arrival at the contractors facility, which is further detailed in specification H-01 - Services. PWGSC 1379 Form (Per Annex F) must be submitted to adjust the cost of bilge waste disposal up or down to actual. This allowance is separate from all Bilge and mechanical space cleaning and removals as detailed in individual specification items. All bilge pumping, cleaning and removal requirements as detailed throughout this SOW must be included in the pricing of each individual specification item.
- 4.9.4 Vessel cleanliness must extend to the bilge areas which must be maintained free of oil, water, and debris for the duration of the project. Prior to acceptance by the Coast Guard, the Contractor must thoroughly clean, to the satisfaction of the TA, all spaces of the vessel including all bilge areas if there is an accumulation of any liquids.

5.0 MECHANICAL REQUIREMENTS

5.1 General

- 5.1.1 The Contractor must supply all materials and/or equipment within the intent of these SOW requirements.
- 5.1.2 All replacement machinery, equipment and fittings must be new and unused, manufactured by a recognized manufacturer, having established facilities and can supply of parts and service in North America.
- 5.1.3 All machinery and equipment must be approved by a Classification Society for use onboard this class of ship, and must meet all applicable ABS regulations. The Contractor must provide copies of Classification Society approval certificates to the IA and the TA. Approval certificates must be current, with sufficient validity period after the work is finalized and be for the type and model of equipment being installed by the Contractor. The Contractor must reference to Section 8.0 of this document for the complete documentation requirements.
- 5.1.4 All machinery must be capable of operating under the conditions set out in Section 4.1 of this Specification. All machinery must be installed to the manufacturer's recommendations with particular attention to the reduction of vibration and noise transmission.
- 5.1.5 All rotating machinery must be installed with axis fore and aft or vertical unless otherwise approved by ABS.
- 5.1.6 Location of all units must be done in accordance to the provided guidance drawings and the Contractor is to take into account accessibility for maintenance and repair of the newly installed unit or machinery.

5.2 New Piping Requirements

5.2.1 General

- 5.2.1.1 All new piping must be installed so as not to interfere with:
 - a) Passage through doors, hatches, scuttles, openings covered by portable plates or working areas. In frequently used walkways, the minimum overhead clearance of the piping must be 6 feet 6 inches (1981mm).
 - b) Operation of machinery, equipment, controls, and with routine maintenance of machinery and the vessel's structure;

- c) Designated equipment removal routes or removable structural portions of the ship provided for equipment access, removal, and/or maintenance.
- 5.2.1.2 Piping must be located where it would not likely be subject to physical damage. Protection for piping must be provided wherever susceptibility to physical damage is unavoidable.
- 5.2.1.3 Piping runs must be as direct as possible and utilize the minimum amount of fittings that would increase the frictional flow characteristics of the piping run.
- 5.2.1.4 Piping must be portable in way of mechanical, electrical or hydraulic systems requiring periodic overhaul. Isolating valves must be provided in order to facilitate piping portability in such a way as to minimize the effect on operation of the remainder of the system.
- 5.2.1.5 Where high and low points in piping are unavoidable, vents, drains or other effective means must be installed to ensure proper system function.
- 5.2.1.6 Pump suction piping must be as short as practical, of sufficient diameter, and arranged to rise without forming bends likely to cause air pockets. Tail pipe connections must be 0.5 D above the bottom of the tank at the deepest point, D being the inside diameter of the suction pipe.
- 5.2.1.7 Bulkheads and decks must generally be pierced close to boundaries of compartments. Cutting bulkhead stiffeners, deck beams and plating butts and seams is not permitted without prior ABS approval.
- 5.2.1.8 Piping must not be led through inner bottom tanks and voids, except as necessary to serve the tanks themselves, or to avoid penetrations of fuel tanks, potable water tanks and ballast tanks.
- 5.2.1.9 Piping that operates under pressure must be kept out of voids, cofferdams and other normally non-vented spaces.
- 5.2.1.10 Deflections of bulkheads, decks and other structures due to working of the ship must be considered and the piping must be arranged for the necessary clearance and flexibility.
- 5.2.1.11 The amount of piping led through messing and living spaces must be minimized. Piping in such places must be symmetrically and neatly arranged for the necessary clearance and flexibility.
- 5.2.1.12 Piping must be kept clear of the machinery control room, and in general not pass over electrical installations. Piping must not be led through the following spaces, except as necessary to serve the space:
- Chain lockers;
 - Wiring trunks and enclosures.

- 5.2.1.13 When systems other than those serving a tank or similar tanks are permitted to pass through fuel oil or diesel oil tanks, the piping must be Schedule 80 thickness and must have welded joints.
- 5.2.1.14 Supports must be designed and located to safely support the weight of the piping, its operating or test fluid (whichever is heavier) and its insulation and lagging (where installed). The supports must also carry the loads imposed by expansion and contraction of the piping and working of the vessel.
- 5.2.1.15 The number of supports installed, the type selected and their location must prevent excessive vibration of the piping under all system operating conditions. They must not constrain the piping for all operating conditions, so as to cause excessive transfer of load from support to piping, from support to support or excessive stress from being transmitted by the piping to machinery, equipment or the vessel's structure.
- 5.2.1.16 Rigid anchors must be designed so that noise and vibration from piping system components and excessive heat from high temperature systems are not transferred through the anchor into surrounding areas.
- 5.2.1.17 Changes in direction of piping must be made by pipe bends and offsets where space permits; otherwise, straight length of pipe and pipefittings specified for the system must be used.
- 5.2.1.18 Miter joints must be permitted only in piping such as, air escape vents and overflows where their use would not cause unacceptable pressure drop or turbulence in the fluid flow.
- 5.2.1.19 Branch connections must be located to minimize turbulent flow. The type used, (crosses, single and double-sweep tees, "Y" and lateral fittings), must be suitable for the required flow characteristics.
- 5.2.1.20 Direct reading thermometers, pressure, and/or compound gauges must be located in positions where they can be easily read and safe from damage.
- 5.2.1.21 All pressure and compound gauges must be provided with an isolating cock.
- 5.2.1.22 Galvanic corrosion must be minimized in the sea water systems that couple dissimilar metals. Control of galvanic corrosion may be obtained by the coupling of a relatively small area of cathodic material to a large area of anodic material or the dissimilar metals may be separated with a short length of extra heavy galvanized steel pipe (waste piece). The latter must be fitted only when specified. The permissible potential difference must be no greater than 0.4 volts.
- 5.2.1.23 Raised face flanges must not be used against bronze or other relatively low strength composition valves, fittings or flanges.

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

5.2.2 Material Selection

5.2.2.1 Figure 5-1 specifies those materials that are acceptable for use in specific piping systems. Figures 5-2 to 5-8 specify materials for various piping systems and components.

5.2.2.3 New piping systems and components must comply with this Specification except where the specified material is incompatible with materials remaining in the system. Alternate materials not listed must be employed only when approved or recommended by original equipment manufacturer and/or supplier of that equipment/component. In such instances direction must be requested from the TA before proceeding further with the work.

5.2.2.4 Steel piping employed for raw water service must be hot dipped galvanized upon complete fabrication. Prior to the hot dipping process, the sections of piping fabricated must be pressure tested to 1.5 times the operating pressure that the pipe will be subjected to.

Figure 5-1: Acceptable Materials for Specific Piping Systems

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

All "As-Fitted"	5t, 4b, 6b, 5g, 6g, 4fl, 8f, 9f.
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Figure 5-2: Material for Pipe and Tube

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

Figure 5-3: Material for Valves

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

Figure 5-4: Material for Fittings

	Description	Material
1f	Brazing	ANSI/ASTM B61 only (no ASTM B 150)
2f	Flanged	ANSI/ASTM B61 only
3f	Threaded	ANSI/ASTM B61 (125 psi rating)
4f	Unions	ANSI/ASTM B61 only
5f	Solder Joint	Wrought Copper ANSI B16.22
6f	Brazing Bosses	ANSI/ASTM B61 only
7f	Refrigeration	Wrought Copper ANSI B16.22
8f	Butt Welding	ANSI/ASTM A234-WPB
9f	Socket Welding	ANSI/ASTM A 105
10f	Welding Bosses	ANSI/ASTM A 105
11f	Threaded	ANSI/ASTM A 105
12f	Union	ANSI/ASTM A 105
13f	Socket Welding	AISI 316L
14f	Butt Welding	AISI 316L
15f	Flanges	AISI 316L
16f	Brazing	Bronze
17f	Union	Bronze
18f	Butt Welding	90-10 CU-NI
19f	Victaulic Type	Ductile iron for grooved end pipe
20f	Tube Fittings	Stainless steel (Swagelok)
21f	All Compression fittings	316L or carbon steel

Figure 5-5: Material for Flanges

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

Figure 5-6: Material for Gaskets

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

Figure 5-7: Material for Bolts and Nuts

	Description	Material
1b	Bolts	ANSI/ASTM A193-79A
	Continuous Thread	GR B16
	Stud or Hex Head	ANSI/ASTM A193-79A
	Tap End	GR B16
	Nuts: Hex, HSF	ANSI/ASTM A194-79A GR4
2b	Bolts	Phosphorous, Bronze ASTM
	Continuous Thread	ANSI/ASTM B139-79
	Stud or Hex Head	Alloy B1 or B2
	Tap End	
	Nuts: Hex, HSF	
4b	Bolts	Mild Steel
	Stud or Hex head	Hot dipped galvanized
	Nuts hex	
5b	Stud Bolts	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 5-8: Material for Assorted Components

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

5.2.3 Fire Fighting Systems

5.2.3.1 Should new piping be required to be fabricated and installed on the existing FM 200 Fighting system the piping must conform and comply with the pertinent ABS regulations and the manufacture's specifications.

5.2.4 Exhaust Piping

5.2.4.1 Exhaust piping must be fabricated from materials as specified on the guidance drawings. The flanges must be forged steel 1035 kPa Light Pattern ASTM A181-59T.

5.2.4.2 Expansion joints pieces must be free flexing with flange joints, one fixed and one free floating flange, internal stainless-steel sleeves (Senior Flexsonic™ or equivalent, suitable for exhaust duty at the system's operating temperature.

5.2.5 Piping Fabrication

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

5.2.6 Bulkhead and Deck Penetrations

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

5.2.7 Joints and Connections

5.2.7.1 Brazed joints in non-ferrous systems, welded joints in carbon steel and alloy systems must be used to the maximum extent, where deemed practical. The number of joints must be minimized through the use of pipe bending. For bends, 3D radius and below, prefabricated bends must be used.

5.2.7.2 Prefabrication of piping system assemblies must be utilized to the greatest extent, where deemed practical. Joints fabricated onboard the ship must be located in areas that provide adequate clear space for welding and brazing. Takedown joints must be located such as to ensure sufficient clear space for proper assembly and maintenance. Joints located in inaccessible areas for maintenance must be welded or brazed. All flanged piping joints must be connected using jointing material suitable for the service intended and approved by ABS.

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

5.2.8 Contact Strips

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

5.2.9 Hydraulic Piping

5.2.9.1 Unless otherwise stated in the guidance or approved drawings all hydraulic piping must heavy walled stainless steel seamless tubing suitable for the application and pressures intended.

5.2.9.2 Should steel hydraulic piping be specified it must be phosphate pickled, neutralized, flushed with oil and blown dry prior to installation. The cleanliness of the flushing fluid must meet ISO 4406 class 18/16/13, and be determined on the basis of a fluid sample.

5.2.10 Pipe Identification

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

5.3 New Pump Installations and Requirements

5.3.1 Any new pumps (centrifugal, positive displacement pumps, excluding engine driven type) required by this Contract must be supplied complete with electric motors suitable for the power supply specified on the single line diagram. Pump motor and starter characteristics must be as specified under Section 6.0 of this Specification.

5.3.2 Engine driven pumps must be engine manufacturer's standard supply. Allowance must be made for specific installation requirements when specifying pump performance parameters.

5.3.3 Pump performance characteristics must match the full range of the system(s) to which they are connected. Pumps must operate at or close to their design point.

5.3.4 Pumps installed on resilient mounts must have flexible suction and discharge connections that will accept deflections arising from thrust and shock loading.

5.3.5 Pumps must be fitted with the following accessories:

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

5.3.6 Pump glands must incorporate mechanical seals. Pump casings must have a vent connection at each discharge stage and a casing drain connection.

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

5.3.8 The major rotating elements of all pumps, complete with all connected appendages, must be dynamically balanced. Documented proof of this must be supplied to the IA.

5.4 New Valve Requirements

5.4.1 Any new valve that are required to be supplied and installed as a result of this Contract must meet the following parameters and requirements.

5.4.2 All valve bodies must have the pressure rating, size, manufacturer's name or trade mark cast or forged integral with the valve body, or stamped in a non-stressed area. Valves fitted to the hull must be Regulatory approved for the application intended and come complete with certificates. Copies of certificates are to be provided to the TA.

5.4.3 Valve hand-wheels must be located where they can be conveniently operated. Where a system can be supplied by more than one pump, non-return valves must be fitted in the discharge side of each pump to prevent flow reversal.

5.4.4 Check valves and screw down non-return valves must be installed such that the disc will open with the flow and such that disc closure is possible using gravity or by means of springs. Check valves must be installed where reversal of flow would be detrimental to proper function of the system or where that reversal of flow could flood a space.

5.4.5 Globe and angle valves used for isolation must be fitted such that system pressure or vacuum is not exerted on the bonnet joint or stem packing with the valve closed.

5.4.6 Valve manifolds must be utilized wherever possible and practical.

5.4.7 Safety and relief valves and their associated piping must be arranged such that their discharges do not damage or endanger machinery, equipment or personnel.

5.4.8 Valves in branch lines must be fitted adjacent to supply main, to maintain the system integrity in the event of a branch line failure.

5.4.9 Butterfly or ball valves must not be used as sea isolation valves, unless otherwise approved by both the Regulatory Body (ABS) and the TA. Sea water isolation valves must be as specified under Section 5.4.

5.4.10 Position indicators are required on all valves having stem rotation of greater than 360 degrees. Exceptions are specific valves where position status is obvious from operation of the system or position of the stem (unless required by ABS). Automatic 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 air operated

valves must be installed. Manually operated throttle valves and their operating mechanisms must have the necessary sensitivity of control. Relief valves must be installed to protect pressure vessels, heat exchangers, piping systems, machinery and equipment from damage due to excessive pressure.

- 5.4.11 Relief valves must have sufficient capacity so as to prevent a pressure increase of more than 10 per cent above maximum allowable operating pressure of the system.
- 5.4.12 A strainer must be installed in the inlet piping and a pressure gauge in the outlet piping from each pressure-reducing valve. A relief valve must be installed in the outlet piping, except where otherwise stated. The strainer must be upstream of the reducing valve and downstream of the branch going to the by-pass isolating valve, where fitted. The pressure gauge and the relief valve must be downstream of both the reducing valve and branch from the bypass valve. Relief valves must be sized on the assumption that the reducing valve could stick wide open. The outlet piping must be increased in size to meet system flow characteristics. A straight piece of piping, of a length recommended by the manufacturer of the reducing valve, must be installed at the large end of a tapered fitting. A by-pass must be installed around each reducing valve, unless otherwise specified. The valve in the by-pass must be a manually operated throttle valve that must not permit a greater flow than the reducing valve's capacity.
- 5.4.13 Relief valves must not have a packed stem stuffing box. Relief valves discharging to pump suctions or vacuum piping must not be fitted with rubber or neoprene stem sealing sleeves. Enclosed spring design with tight covers must be used for the following services:
- a) Discharge to a closed system or tank that subjects the valve outlet to a back pressure when the valve is closed;
 - b) Discharge to a closed system or equipment that subjects the outlet to sub-atmospheric pressure when the valve is closed;
 - c) Flammable or combustible liquids;
 - d) Toxic and explosive gases.
- 5.4.14 All valves over 19mm must have flanged connections. All valves over 40mm diameter must have bolted bonnet, gland and screwed type renewable seats.
- 5.4.15 Nameplates identifying the service must be installed on all new or relocated valves as specified under Section 4.8.1. Valves installed under deck plates must be provided with hinged access covers. Associated nameplates must be fitted either directly on the access cover or immediately adjacent. Nameplates in this configuration are to be secured with screws.

5.5 Machinery New Insulation Requirements

5.5.1 General

- 5.5.1.1 All new, approved, non-asbestos containing insulation must be installed on all sections of piping, machinery and equipment where insulation was previously removed and all newly installed equipment requiring insulation. Valves and fittings must be insulated with material and thickness required for adjacent piping.
- 5.5.1.2 The Contractor must submit a complete lagging and insulation schedule to the TA and the IA for review prior to ordering any material. All insulation and lagging must meet the applicable Regulatory Body requirements and where possible be from one manufacturer.
- 5.5.1.3 Piping and units of equipment with design internal temperatures of more than 65.6°C (150°F) must be insulated from their supports or the supports insulated from the structures to which they are attached.
- 5.5.1.4 All flanges, flange fittings, flexible joints, expansion pieces or any components of machinery or piping susceptible to takedown for inspection and maintenance must be covered by removable, reusable cover or pad. They must be made of the same material as the main pipe insulation. Voids between pads and fitted insulation must be filled with pieces of applicable felted material, tight enough to prevent airflow.
- 5.5.1.5 Piping hangers for piping with internal temperatures below 5°C must be insulated from the steel structure to which they are attached. Piping exposed to the weather must be effectively insulated against freezing. This requirement does not apply to systems in which a fluid is normally flowing or where the exposed portion of a respective system can be secured and drained to prevent freezing.

5.5.2 Lagging

- 5.5.2.1 New, approved, non-asbestos containing lagging must be installed. Lagging (protective covering or coating over insulating materials) must be suitable for temperature and location and must be either of the following:
 - a) Fibrous glass cloth, tape and thread, Flextra™ or equivalent.
 - b) Aluminum mechanical protective guards, plain or hammered, secured with quick release fasteners.
- 5.5.2.2 Piping and/or equipment insulation not exposed to weather must be covered with either a cloth or tape type lagging, when not of the pre-lagged type. Cloth type lagging must be secured by an adhesive or by sewing. Lagging in tape form must be applied spirally wound with not less than 10mm overlap and with ends

fastened to the insulation and/or lagging by adhesive, stitching or stapling. Insulation and cements used for lagging purposes must comply with ABS standards and requirements.

5.5.2.3 Insulation, insulation jackets, canvas, fiberglass mat and wrapping and adhesives must be fire retardant with a flame spread rating and must comply with ABS standards and requirements.

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

5.5.2.5 In locations where the completed insulation and lagging are liable to physical damage, a protective galvanized sheet metal must be installed. Where protective metal lagging is subject to frequent removal when servicing machinery, it must be plain or hammered aluminum secured by quick release clips.

5.5.3 Insulation Thermal Requirements

5.5.3.1 Surface temperature of insulation must not exceed 65.6°C (150°F). The maximum temperatures must determine the thickness of insulation and must correspond to 10% overload of a respective machine or engine.

5.5.3.2 Where the total required thickness of insulation is greater than 25mm (1 in), double layers must be used. These layers must be of equal thickness.

5.5.3.3 All laps must be staggered and all end joints must be overlapped.

5.5.4 Securing and Retention Arrangements

5.5.4.1 All insulation materials must be properly secured to prevent settling and to permit ready removal for maintenance of equipment.

5.5.4.2 All high temperature piping systems must be insulated using reusable pre-made covers of the following materials, from pipe surface outwards:

a) Monel mesh;

b) Fiberglass mat, of approximately 9-lbs/ft³ density and must contain no chemical binder and be resistant to service temperatures up to (232.2°F);

- c) Foil-lined silicone-coated fiberglass lagging secured to insulation by stapling: all edges are to be sealed.
- 5.5.4.3 Covers must have stainless or Monel clips, secured by through-hooks around which stainless steel lacing wire can be wound for mounting and securing.
- 5.5.4.4 The insulation, with all joints tightly butted, must be secured to the pipe at ends with not less than two metal bands per section, minimum 19mm wide, with quick release clips.
- 5.5.4.5 Where pipe insulation abuts flanges and fittings, the ends of the insulation must be tapered to permit removal of bolts.
- 5.5.6 Anti-Condensation Insulation
 - 5.5.6.1 Cold-water piping and equipment, including sewage pipes, must be insulated with anti-sweat type insulation. Anti-condensation insulation, other than elastomeric, foamed plastic type, must be covered with cloth lagging or tape lagging secured with adhesive to form a moisture proof finish. Anti-condensation insulation must be protected by lagging or protective screening as required where there is a potential for damage.
 - 5.5.6.2 Where piping or tubing pass through the galley or other high humidity spaces, the insulation must be double layered and waterproofed outside each layer.
- 5.5.7 New Ventilation Ducting Insulation
 - 5.5.7.1 All duct work must be insulated with an ABS approved vapor seal duct insulation with a 50mm factory applied vapor barrier (Manson AK Flex™ or equivalent). Vapor barrier dam must be Chil-Perm™ CP30 with fiberglass cloth reinforcing or an approved equivalent. Two (2) layers of canvas mat wrap, 16 oz weight, must be applied with Bakor™ insulation cement or equivalent as a final finish for all ducting. Alternative products may be used with approval of the TA
 - 5.5.7.2 Air duct penetrations must be sealed with non-shrink/hardening silicone based caulking – while adhering to the applicable Fire Safety Regulations and ABS regulations.

5.6 Machinery Space Outfit Requirements

5.6.1 General

5.6.1.1 Where directed by the guidance drawings the machinery spaces must be outfitted with ladders, gratings and floor plates, providing access at convenient levels to all items of machinery for routine operation and maintenance.

5.6.1.2 Where applicable and upon approval by the TA, existing ladders, gratings and floor plates can be modified and reused.

5.6.2 New Floor Plates Requirements

5.6.2.1 New floor plates must be fabricated from 10 mm multi-grip aluminum tread-plate, supported on steel bearers and secured by 13mm stainless steel counter-sunk screws at sides. All new deck plates located specifically in the engine room machinery area must be made of steel as per SOLAS regulations.

5.6.2.2 Panels must not exceed 1220mm by 1830mm. Smaller portable plates must be provided wherever frequent access is required.

5.6.2.3 Portable hinged openings must be arranged over valves, cocks, and strainers and identified with brass nameplates. Open boundaries must be bordered by upturned angle, except in way of low access openings in machinery.

5.6.2.3 All new bearers for floor plates must be painted. Bearers must be provided to allow for supporting machinery weights during refits (275 kg safe concentrated loads).

5.6.3 Protective Guards

5.6.3.1 Guards must be provided over all rotating drives accessible to personnel and be light weight and portable where ever possible, to allow for easy removal.

5.6.3.2 Open guards must be of the rolled expanded metal, closed guards of steel or aluminum. The guards must allow visibility of drives and dissipation of heat.

5.6.3.3 Access must be provided at the centers of shaft lines

5.6.4 Sea Suction and Overboard Discharges

5.6.4.1 Any new sea suction and overboard discharges, required by this specification, must be made from an ABS approved material and protected by means of sacrificial anodes. All internal surface components must be given a full hull coating system

- 5.6.4.2 Each new installed sea suction line must have a sea isolation valve fitted as near the sea inlet as practicable.
- 5.6.4.3 New sea suction valves must be Classification Society approved, cast steel with stainless steel trim and come with certificates. Copies of the certificates are to be provided to the TA.
- 5.6.4.4. New hull valves must be attached by means of bolts to a steel pad with blind tapped bolt holes which has been welded directly to the ship's hull or sea chest. If it is not possible to attach the valve directly to the hull or sea chest, an ABS approved extension piece(s) must be installed between the valve and steel pad. Extension piece(s) must be as short as possible and must have no joints other than to the valve and pad.
- 5.6.4.5 Sea isolation valves must be of the high lift globe type. High lift angle valves may be used if globe valves are impracticable. The minimum size of fasteners used for connections on the sea-side of isolations valves must be 19mm. The bolting material of fasteners must be phosphor bronze to ANSI/ASTM B139-79 alloy B1 or B2.
- 5.6.4.6 Where a pump or an eductor, having a direct sea suction, is located in a compartment remote from the sea isolating valve, an additional sea-isolating valve must be located within the pump compartment.

5.7 Machinery Instrumentation

5.7.1 Pressure/Suction Gauges

- 5.7.1.1 Unless otherwise specified, only 115mm diameter or bigger fluid filled gauges must be used for instrumentation.
- 5.7.1.2 All gauges with pressures exceeding 7,000 kPa (1,000 PSI) or those used with compressible fluids must be safety gauges with back blow outs.
- 5.7.1.3 All gauge lines must have a capped test tee. All gauges must have needle type isolation valves. Pulsation dampers must be fitted to keep gauge pulsation below 5% full scale. Gauge indication must be at $\frac{1}{2}$ or $\frac{2}{3}$ of its range respectively for fluctuating or steady state working pressure.
- 5.7.1.4 All pumps must be fitted with suction compound and discharge pressure gauges.
- 5.7.1.5 All refrigeration compressors must be fitted with suction and discharge pressure gauges and Schroeder valves must be fitted at the gauge lines for the connection of portable refrigeration gauge manifolds.

- 5.7.1.6 All new gauges must read either in imperial (PSI) or metric units (kPa or Bar). The dial face must be white with black figures and the pointer must be of the micrometer adjustable type. Gauge movements must be stainless steel with stainless steel bushings and over-pressure and under-pressure stops. Bourdon tubes must be bronze or 316 stainless steel with brass or 316 stainless steel sockets. Gauge accuracy must be $\pm 0.5\%$ of scale range, ASME B40.1 Grade 2A.
- 5.7.1.7 Gauges must be filled with glycerin or silicone according to ambient temperature requirements or severity of vibration expected.

5.7.2 Temperature Gauges

- 5.7.2.1 Unless otherwise specified all new thermometers must be a standard 9 inch scale thermometer with a universal adjustable angle stem, cast aluminum case with cured polyester powder coating, clear window and brass separable thermowell. Thermometers must be fitted with an acrylic window to 150 degrees Celsius and a double plated safety glass at temperature ranges above 150 degrees Celsius.
- 5.7.2.2 All thermometers must be housed in a 304 or 316 stainless steel thermowell to allow removal of the thermometer without disturbing the measured process. The thermometer and thermowell must extend at least $\frac{1}{2}$ the pipe diameter into the measured process. Where thermometers are installed in pipes fitted with insulation, longer stem thermometers must be used with extension neck separable thermowells. Extension necks must be at least 50mm long.
- 5.7.2.3 Thermometers for measuring air temperatures must be fitted with a perforated guard stem and a mounting flange instead of a brass separable thermowell. All thermometers must contain red spirit fills. Range selection for thermometers must be so that the operating temperature of the measured process will fall approximately mid-scale. The scale face must be white with black figures and must contain Celsius reading scales. Thermometer accuracy must be ± 1 scale division.

5.8 Equipment Foundations

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

5.9 Anti-Vibration Mounts for Equipment

5.9.1 All main engines and vessel service generator sets must be mounted on anti-vibration mounts. The Contractor must coordinate the mounting requirements of the equipment with the equipment supplier and/or manufacturer taking into consideration the following information:

- a) Weight of the combined equipment complete with sub-base;
- b) Center of gravity of the equipment;
- c) The requirement to limit vertical, longitudinal and lateral motion of the equipment to minimize impact on ancillary systems and services while maintaining the required isolation.

5.9.2 Anticipated motions of the vessel are defined in Section 4.1 of this SOW Item; Vibration mounts must provide between 75 to 85% isolation of all equipment generated vibration to the hull structure.

5.9.3 Vibration mounts must be fitted with collision blocks to withstand up to 5g of acceleration. Vibration mount metal parts must be corrosion protected with Fe/Zn 8C as per ISO 2081 for the marine environment.

5.9.4 The resilient mounts must be protected with a cover to prevent contamination of the damping elements and are to be date stamped when they have been installed and under load.

5.10 Spare Parts

5.10.1 All new machinery and equipment procured by the Contractor for installation on the vessel must be supplied complete with sufficient manufacturer's recommended spare parts for six months or 2,000 hours of operation whichever is greater, or unless otherwise specified.

5.10.2 All system spares must be provided in a spare parts list supplied by the Contractor in an electronic MS Excel spreadsheet format listing individually the quantity of installed base and unit price of each spare listed. This list must include the following fields:

- a) Supplier;
- b) Manufacturer;
- c) Manufacturer's Part Number;
- d) Price per Unit;
- e) Unit definition (each, case, etc.);
- f) Recommended Quantity;
- g) Associated System/Equipment.

- 5.10.3 An electronic copy of the spares parts list must be supplied to the IA and the TA.
- 5.10.4 The Contractor must notify the IA and the TA when such spare parts have been received for visual inspection.
- 5.10.5 The Contractor must store the spare parts in accordance with manufacturer's requirements ensuring that the spares are protected from weather, physical damage, or complete loss.
- 5.10.6 The Contractor must deliver the spare parts to after inspection by TA:

Canadian Coast Guard
CCGS George R. Pearkes
CCG Technical Stores
280 Southside Road.
St. Johns, NL A1C 5X1

5.11 Hull Structure and Integrity Requirements

- 5.11.1 Note: Structural integrity must be preserved and any questions involving such integrity must be referred to ABS for resolution and approval.
- 5.11.2 All welding required to reinstall removed hull, deck or superstructure access panels must meet the requirements of the CWB Welding Standard and/or approved the Classification Society (ABS) Rules.
- 5.11.3 New structures and where permanent removal of fittings will result in the necessity of fitting insert plates in shell plating, watertight bulkheads and/or watertight decks, the following procedure must be adopted:
- a) The Contractor must prepare and submit a CWB approved Weld Engineer approved welding procedure and work instructions for approval by ABS;
 - b) All inserts on shell plating, decks and superstructure must be installed flush;
 - c) All underwater inserts must be subject to 100% radiography on completion;
 - d) New tanks and existing tanks and void spaces and where inserts have been fitted must be hydrostatically tested to a head of water of 2.5 meters. The tests must be recorded, witnessed by both the ABS surveyor and the IA;
 - e) The Contractor will be responsible for modifying the vessels vessel's Shell Expansion Drawing to reflect the locations of the new insert plates.

6.0 ELECTRICAL AND ELECTRONICS REQUIREMENTS

6.1 General

- 6.1.1 The requirements specified in this section apply to all electrical work. The electrical modifications to the vessel must be in accordance with TP 127E and IEEE 45 STD -2002 with approval by ABS.
- 6.1.2 All electrical/electronic equipment, fittings and fixtures temporarily removed for access must be reinstalled and secured and the areas restored to the “As Delivered” condition.
- 6.1.3 Contractor supplied equipment must conform to the requirements of IP56, IEC 60529 and Section 4.1 of this SOW item.
- 6.1.4 The Contractor must make reference to Section 8.0 for documentation requirements concerning the electrical system.
- 6.1.5 Electrical conducting surfaces, heat transfer surfaces and ventilation screens must not be painted. Such areas must be protected from dirt and debris including painting overspray during the contract.
- 6.1.6 The Contractor must remove all electronic equipment from compartments in which work such as cutting, welding grinding, etc. is being performed. The Contractor must obtain the TA’s approval for equipment that will remain in place and such approval must require the equipment to be protected from all possible hazards.

6.2 Load Analysis

- 6.2.1 The Contractor must prepare a new load analysis for the vessel, including the project work. The Contractor must update the load analysis bi-monthly and an electronic copy must be presented to the IA and the TA at progress reviews or at each design change which has a significant impact on the electrical loads.
- 6.2.2 The final “As-Fitted” load analysis must be ABS approved. The load analysis must be configured to represent the Single Line Diagram for ease of equipment identification and direct derivation of data for bus bar, transformer, rectifier and cable sizing. All changes on the Single Line Diagram must be immediately reflected in the load analysis and vice versa.
- 6.2.3 The Contractor must provide documentation with regards to the “As-Fitted” load analysis to the TA as detailed in Section 8.0.

6.3 Electrical Single Line Diagram

- 6.3.1 The Contractor must maintain an updated Single Line Diagram of all new electrical installations and an electronic copy must be provided to both the IA and the TA at

monthly progress reviews or at each design change which has a significant impact on the electrical system.

- 6.3.2 The final “As-Fitted” electrical single line diagram must be provided to all parties and be ABS approved.

6.4 Co-ordination Study of Main and Emergency Distribution Systems

- 6.4.1 The Contractor must conduct and provide a Co-ordination Study of Main and Emergency Distribution Systems and an electronic copy of this study must be provided to the IA and the TA at progress reviews or at each design change which has a significant impact on the electrical system.

- 6.4.2 The final “As-Fitted” Co-ordination Study of Main and Emergency Distribution Systems must be ABS approved and provided to all parties.

- 6.4.3 The Contractor must provide the following documentation with regards to the “As Fitted” Co-ordination Study of Main and Emergency Distribution Systems to the TA:

- a) Four (4) paper copies of the final ABS approved Co-ordination Study of Main and Emergency Distribution Systems of the “As-Fitted ” electrical system;
- b) Four (4) copies of the final ABS approved Co-ordination Study of Main and Emergency Distribution Systems of the “As-Fitted” electrical system in electronic format. The electronic files must be in Microsoft Office format and must be on individual disk copies with a detailed listing of all files.

6.5 Short Circuit Current Analysis

- 6.5.1 The Contractor must conduct and provided a short circuit current analysis and it must be maintained. The Contractor must update the short circuit analysis monthly and an electronic copy must be provided to the IA and the TA at monthly progress reviews or at each design change which has a significant impact on the electrical system. The analysis calculation must be in accordance with Transport Canada requirements.

- 6.5.2 The final “As-Fitted” short circuit current analysis calculations must be ABS approved and provided to all parties.

- 6.5.3 The Contractor must provide documentation with regards to the “As-Fitted” short circuit current analysis to the TA as detailed in Section 8.0.

6.6 New Rotating Electrical Machinery

- 6.6.1 New electric motors required by this SOW item or purchased for this project, must be commercial marine quality meeting all regulatory requirements for the application intended. Motor enclosures for installations must conform to IEC 60529. Motors must be continuously rated except for deck machinery where one (1) full rated load, and continuous light running load are applicable.
- 6.6.2 All electrical motors must have their windings covered with a class F insulating material, resistant to oil and water, and must operate in an ambient temperature of 50 °C when installed inside machinery spaces and - 40 °C when installed on enclosed decks. For motors operating on the open deck, the low ambient temperature must be considered as – 40 °C.
- 6.6.3 Rotating machinery with enclosed slip rings or commutators must not have any form of silicone-impregnated material incorporated into their windings, or introduced into the enclosure.
- 6.6.4 Any rotating equipment incorporating brushes must be fitted with inspection windows
- 6.6.5 All A/C motors rated in excess of 0.37 kW (1/2 HP) must be of squirrel cage induction type, rated for continuous duty and capable of reaching design parameters at 600 Volts, 60 Hz, 3 phase, unless otherwise specified. Induction motors of 0.37 kW rating and less may be designed for operation on 120 Volts, 1 phase.
- 6.6.6 Particular care should be exercised in the selection of induction motors to ensure that each motor is not too large for the intended service and thus avoid the low power factor inherent in under-loaded induction motors. Single speed induction motors must be of a 4-pole 1800-RPM, unless otherwise specified.
- 6.6.7 Motors of 0.18 kW (1/4 HP) and over must be equipped with anti-friction bearings designed to meet the imposed thrust and radial loads. Where motors are used with solid couplings a bearing to take thrust must be fixed to the shaft end housing, and shaft endplay limited to the clearance in the bearing. Tandem ball bearings must not be used for axial thrust loads.
- 6.6.8 Motors equipped with anti-friction bearings using pressure grease fittings must have positive means, either by relief plugs or fittings, or by a clearance differential relief system, to prevent grease from being forced out onto the motor windings. Where anti-friction type bearings (ball bearings) are specified for rotating electrical machinery, they must:
 - a) Be rated and suitable for the type of drive;
 - b) Be noise tested;

- c) Be of the deep groove type where the drive introduces end thrust;
 - d) Be of the pre-lubricated type, unless otherwise specified.
- 6.6.9 Axial flow fan motors must be equipped with factory sealed pre-lubricated ball bearings or factory sealed pre-lubricated ball bearing housings. The bearing housing must not be drilled.
- 6.6.10 Motors for V-belt applications must have their bearings designed for this purpose.
- 6.6.11 Motors rated above 0.75 kW (1 HP) must have their rotor both statically and dynamically balanced. All windings must be vacuum pressure impregnated followed by oven curing. Attention must be paid to the elimination of dust and dirt traps within both windings and the motor enclosure. Records of the static and dynamic balancing must be submitted to the IA and the TA.
- 6.6.12 Induction motors driving ventilation fans or pumps requiring both high and low operating speeds must be of the 2 speed 2 winding type with the top speed not greater than the 4 pole design, unless otherwise specified.
- 6.6.13 The Contractor must confirm all pertinent characteristics of replacement motors prior to procurement and to ensure compatibility with requirements of retained machinery.
- 6.6.14 Before placing any purchase orders, the Contractor must submit for review and approval to the TA, a list of all electric motors to be installed. As a minimum this list must detail the following:
- a) Manufacturer's name;
 - b) Duty/service factor;
 - c) kW and full load speed;
 - d) Enclosure type;
 - e) Efficiency;
 - f) PF for full, $\frac{3}{4}$ and $\frac{1}{2}$ load (A/C motors);
 - g) Locked rotor torque and current;
 - h) Weight
 - i) NEEMAC design characteristics;
 - j) Insulation Class;
 - k) Full Load Current;
 - l) Temperature rise class;
 - m) Voltage;
 - n) Frequency;
 - o) Frame size.

6.7 Anti-Condensation Heaters

- 6.7.1 Black heat, tubular or strip type space heaters must be fitted to all new motors and generators rated 15 kW or higher, and to electric equipment installed in open decks or in damp or unheated spaces, where specified. These space heaters must be arranged for operation from a separate supply. Heaters must be suitable for operation from 120/1/60 VAC.
- 6.7.2 A rated interlocking arrangement must be provided at the equipment control station to ensure that the heater is de-energized when the respective equipment comes into service.
- 6.7.3 Visual ON/OFF status indication must be provided at the equipment control station as detailed:
 - a) For motors on their respective control station or local starting panel;
 - b) For electrical control equipment on the relevant panel.
- 6.7.4 Isolation switches or control station disabling arrangements must be provided at equipment requiring local maintenance where the feeder breaker is not in sight. The isolating switch or lock-out station must be within sight and easily accessible from the protected equipment – as per TP127E, clauses 17.4 and 17.8.

6.8 Electrical Nameplates (English unless otherwise noted)

- 6.8.1 All electrical equipment must be fitted with nameplates. Each nameplate must identify the piece of equipment, and in addition must include: the manufacturer's name, type, serial number, model number, rating and date of manufacture.
- 6.8.2 Any special precautions, maintenance or operating instructions must be included on the nameplates or on a separate plate attached to the equipment.
- 6.8.3 All electrical equipment and compartments housing hazardous voltages must carry a warning notice indicating that a hazard exists and specify the maximum system voltage.
- 6.8.4 Switchboards must have nameplates listing:
 - a) Name of switchboard;
 - b) Manufacturer;
 - c) Serial number, if applicable;
 - d) Date of manufacture.
- 6.8.5 Each circuit breaker must have a nameplate showing the name and designation of the circuit and the setting of the breaker. Instruments, switches, etc., on the

switchboard must be adequately marked with their function and designation as well as a red line at the full load or normal operating value.

- 6.8.6 Distribution panels must have nameplates showing the: space, service, apparatus or circuits controlled, and the feeder designation.
- 6.8.7 Internally, switchboards, distribution panels and motor controllers must have marking plates identifying bus bars and terminals. Bus bars must have phases identified by color-coding.
- 6.8.8 Electrical enclosures that house a multiple of electrical or electronic equipment and devices must have a unique identification code for each device and the device must be labeled as such. Mechanical layout drawings of the enclosures must clearly show the layout and identification code of the devices within the enclosure.
- 6.8.9 Terminal blocks and terminal wiring must be marked with the circuit designation and must be treated as devices within enclosures. Terminal blocks must be labeled consecutively and ascending from left to right and top to bottom.
- 6.8.10 Nameplate size and other characteristics must comply with Section 4.8.

6.9 Cables

- 6.9.1 All newly installed cabling must meet TP127E requirements, be manufactured, tested and installed in accordance with the latest ABS Publication, IEEE and Classification Society requirements and come complete with certificates.
- 6.9.2 The Contractor must develop a schedule of all new electrical cables to be installed and existing cables to be reused. As a minimum the following must be listed for each cable:
 - a) Conductor size;
 - b) Current rating;
 - c) Estimated length;
 - d) Identification number and name of manufacturer;
 - e) Approximate weight;
 - f) Voltage drop;
 - g) Insulation level (voltage);
 - h) Insulation type designation and maximum allowable temperature.
- 6.9.3 This schedule must be submitted for review and approval to TA before any cables are installed and/or removed. The schedule may be submitted in sections as the detailed design develops.
- 6.9.4 New cables must not be spliced. Splicing in existing cables of 600VAC or less cable may be permitted with prior permission by ABS and the TA providing splices

are performed in accordance with TP 127E. Radio frequency co-axial cable must not be spliced. In-line connectors must not be used in such cables other than as required to terminate the cable. All wire and cable terminations must be in accordance with TP127E.

- 6.9.5 Where cables enter drip proof or watertight cubicles, motors, or other equipment, ABS approved glands and/or strain relief devices must be used. Cable entry into drip proof enclosures must be from the bottom or side of the enclosure.
- 6.9.6 Where cables enter the side of an enclosure, they must run downward from the cabinet before running in an upward direction.
- 6.9.7 A minimum of 15% spare space must be provided on each new raceway and on all modified cable runs.
- 6.9.8 Cables must be concealed, except in machinery spaces, workshops, and storerooms. The location of cable runs, connection boxes, hangers, etc., concealed by paneling or linings must be clearly indicated on the "As-Fitted" drawings. Concealed connection boxes must have the circuit designation stamped or painted on a part of the box not subject to being removed.
- 6.9.9 All permanently installed cables must be tagged with the circuit designation at all points of connection and on both sides of bulkheads and decks. Tags must be of metal compatible with the cable sheathing. Both ends of the tags must be strapped to the cable with metal strap after all painting has been completed. Straps must pass through holes in the tags so that tags are positively secured. Strap ends must be permanently folded and crimped.
- 6.9.10 Adhesive or permanently printed plastic identification tags for individual cables and conductors may be used inside equipment cubicles and equipment racks.
- 6.9.11 All conductor identification markings and cable tags must be reflected in the "As-Fitted" system drawings and must be as follows:
 - a) Cable tags must be printed with indelible ink and must not be handwritten;
 - b) Each cable must have an identifier unique to the installation;
 - c) Each cable tag must have the following information: unique cable name and location for each end, and;
 - d) Conductor identification markings must be secured to the conductors to prevent them from becoming disassociated from the conductor when it is terminated to a device.

- 6.9.12 Spare conductors within a cable must not be stripped back or shortened and must be tied back and appropriately marked as spare. Control cables and cables for the alarm and monitoring system must contain a minimum of 10% spare conductors. Shielded control cable must have the shield bonded to ground at one end of the cable run only, preferably at the input signal end. The cable must not be grounded at both ends.
- 6.9.13 To avoid mutual interference, cables must be grouped and separated as specified per Figure 6-1. If the spacing is impractical, additional shielding must be provided as approved by ABS.
- 6.9.14 Low loss co-axial cables of correct impedance must be used for co-axial cable antenna feeders.
- 6.9.15 Where foam core dielectric cables are used, crimp shield connectors must be fitted. The Contractor must not use solder type connectors.
- 6.9.16 The routing of new generator cables must be as direct as possible and such cables must be run on the wire ways carrying existing generator cables or if this is impractical, then on wire ways specifically designed for this purpose. When taking generator cables to their respective machines, provision must be made for sufficient slack to permit the machine to be subsequently disconnected and reconnected without damaging the cable.

6.10 Separation of Cables

- 6.10.1 The Contractor must refer to Figure 6-1 indicating the physical separation to be maintained between various categories of cables. The separations do not apply to cables crossing at, or close to, right angles. Cables of all types must be kept well separated from antennas, antenna couplers and feed wires. Deviations must be preapproved by ABS and the TA and IA must be provided documentation of the approved deviations.
- 6.10.2 Cables may be bundled according to their categories in Figure 6-1 and the following guidelines:
- a) Cables from group A to group E inclusive may be bundled with cables from the same group and share a common wire way with the remaining groups;
 - b) Bundling of cables from Group F to Group K should be avoided and, if necessary, additional screening material should be provided;
 - c) Cables in Group F to Group K should use separate wire ways wherever possible.

Figure 6-1: Recommended Cable Separation (inches)

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

6.11 Circuit Breakers

6.11.1 Breakers must be equipped with individually insulated, braced and protected connectors. Tripped indication must be clearly shown by the handle at a position between ON and OFF and/or a visual trip indicator.

6.11.2 All breakers must be rated for the application with due consideration to voltage, amps, interrupting rating, number of poles, auxiliaries, etc., as determined by the final approved "Short Circuit Current Analysis" (Section 6.5) and selected as per the coordination study.

6.11.3 Breakers must be calibrated at 50 °C.

6.11.4 Breakers must be suitable for marine application;

- a) Be the molded case type;
- b) Be rated for 600VAC, 240 VAC or 120VAC
- c) Be the quick make/quick break type;
- d) Have inverse time over current characteristics.
- e) Have overload device in each phase.

6.12 Motor Controllers

6.12.1 Motor controllers must be rated for marine duty. Motor controllers and contactors controlling machines which require continuous operation, must be fitted with low voltage release complete with timing circuitry, adjustable from 0.5 to 10 seconds, which must restart all running motors in case of a short duration power interruption.

6.12.2 Motors 30 kW and above must be equipped with solid-state reduced voltage starters (soft starts) to limit the inrush current.

6.12.3 Individual starters controlling 3-phase AC motors must conform to the latest edition of TP 127E and IEEE STD 45-2002 and must be:

- a) Fitted with a means of locally isolating the motor where the starter is not located adjacent to the motor;
- b) Fitted with indicating lights at the starter to indicate the state of the isolating switch;
- c) Fitted with molded case type circuit breaker for each motor circuit to isolate the power supply and provide short circuit protection. The circuit breaker must have means to indicate its status locally and auxiliary contacts for remote monitoring;
- d) Fitted with two indicating lights: one to show when the associated motor is operating and one to show when it is stopped;
- e) Indicating lights must be LED type;
- f) Fitted with drip proof or watertight type START and STOP pushbutton;
- g) Fitted with one (1) externally operated, overload reset button mounted in the front, for all three overload relays;
- h) Fitted with auxiliary contact to operate anti-condensation heaters where required;
- i) Arranged for bottom cable entry through glands;
- j) Fitted with an ammeter with selector switch for individual phase amperage readings for motor ratings of 20 kW and over.

6.12.4 Where alarm indication lights are provided at the local control station, facilities must be provided for a lamp test.

6.12.5 Where alarm buzzers are provided at the local control stations, facilities must be provided for buzzer mute.

- 6.12.6 Starters controlling single phase motors less than 0.37 kW, unless they are for automatic duty, must be totally enclosed, double pole, manually operated, marine type switches, complete with overloads, provided the required protection is included within the switch enclosure.
- 6.12.7 All internal wiring must be permanently numbered. Numbering must be included in schematic and wiring diagrams to be supplied under the “As-Fitted” requirement. Each motor controller or starter must have a wiring diagram mounted on the inside of the door or cover.
- 6.12.8 A schematic diagram for each starter must be submitted. In the event that a number of motors have the same control schematic, the submission of one drawing must suffice providing that it is cross-referenced with a table listing the conductor identification for each circuit.
- 6.12.9 The Contractor must submit for review and approval to the TA, a list of all motor starters for motors to be fitted during the vessel life extension. This list must detail the following:
- a) Manufacturer's name;
 - b) Duty;
 - c) Type of starter;
 - d) Type of protection – over-current under voltage;
 - e) Weight;
 - f) Enclosure;
 - g) Schematic wiring diagram;
 - h) Starter size

6.13 Transformers

- 6.13.1 Any new transformers that are required to be Contractor supplied must meet the following parameters.
- 6.13.2 Where a 3-phase transformers are to be supplied or installed they must be made of three (3) 1- phase transformers connected delta/delta, except where specified otherwise. Transformers must be fitted with electrostatic shields.
- 6.13.3 In general, the following principles must apply to transformers:
- a) Be of the single phase type (unless otherwise specified);

- b) Be suitable for 3-phase operation, delta/delta;
- c) Be suitable for bulkhead and/or deck mounting up to 50 kVA and platform or deck mounting above 50 kVA;
- d) Be of the air cooled type;
- e) Have a drip proof enclosure with louvers;
- f) Have a winding insulation of Class F or better;
- g) Have final operating temperature not exceeding Class B temperature rise;
- h) Have $\pm 2 \frac{1}{2} \%$ and $\pm 5\%$ taps on all primary windings (2 FCAN and 2 FCBN);
- i) Be supplied with copper windings;\
- j) Be built in accordance with the latest edition of TP 127E and IEEE 45 STD - 2002;
- k) Sound levels must be at or below the latest CSA standards;
- l) Transformers must have nameplates consisting of the following:
 - i. Manufacturer's name;
 - ii. Rating in kVA
 - iii. Rate full load temperature rise;
 - iv. Primary and secondary voltage ratings;
 - v. Frequency in Hz;
 - vi. Rated impedance;
 - vii. Noise level.

6.13.4 Where a transformer may be de-energized for relatively long periods of time, the transformer enclosure must include a space heater as specified in Section 6.7. Space heaters must be capable of raising the internal temperature to, and maintaining it at 5 degree C above ambient.

6.13.5 The Contractor must supply to the IA and the TA ABS approval certificates for all transformers with a 15 kVA rating or greater. Certification documentation must be as per Section 8.2.5 of this SOW item.

6.14 Electronic Equipment Installation

- 6.14.1 The Contractor must prepare layout drawings showing the location of electronic equipment at both rack/console as well as the compartment level. These must be prepared for all compartments containing electronic equipment. An Antenna Layout Diagram must also be prepared where necessary.
- 6.14.2 The Contractor must prepare drawings based upon the manufacturers' installation data showing the electrical details of the installation of each electronic system, e.g. cable details such as identifier number and type, connector detail, power supply detail. Point connection detail must be supplied separately but the drawing must reference the source.
- 6.14.3 The Contractor must provide a device list showing all device information and associated parts manufacturer data. Where devices are software and/or hardware configurable, such as DIP switches and device memory settings, the Contractor must record and provide all software and hardware configuration settings along with the device documentation to the TA and the IA in an electronic format that is editable.
- 6.14.4 Each field device within each discrete field location must be uniquely identified. This identification must correspond to the identification for the field device used within all other documentation.
- 6.14.5 Field device identification labels must contain the following information:
- a) Location of field device;
 - b) Primary drawing associated with field device.
- 6.14.6 The intent of the field documentation is to provide a system by which all devices have a unique identifier thus allowing the cross referencing of all related OEM data, device specific configuration settings, schematic drawings, and electrical connections to a specific device within the system.

6.15 Safety Switches

- 6.15.1 Each piece of electronic equipment must be capable of being switched off locally. This may be achieved by means of a normally provided front panel switch. For equipment not provided with such a feature and which is remotely activated, a local ON/OFF safety switch must be provided.
- 6.15.2 Where any electronic unit or terminal box is obscured by ceiling tiles or liner board, access to the obscured equipment must be provided. The access panel must be clearly and permanently marked with the identity of the obscured equipment as detailed in Section 4.8.1.

6.16 Rack/Console Mounting

- 6.16.1 Rack and/or console mounting is the preferred method for the mounting of electronic equipment. The Contractor must supply racks and/or consoles required to mount the electronic equipment.
- 6.16.2 Racks and/or consoles must be all welded steel construction and must be well secured in a vertical position. The rack/console must be properly braced to meet the shock and vibration requirements of Section 4.1.
- 6.16.3 Racks and/or consoles must be designed for the retractable, slide mounting of standard 19 inches (483 mm) electronic equipment to an equipment depth of 24 inches (600 mm). Console height should be the maximum consistent with its purpose and surroundings.
- 6.16.4 The mounting slides must be of 2-piece construction with one piece attached to the rack, the other piece to the equipment. A means must be provided to prevent cable snags during slide insertion and/or withdrawal.
- 6.16.5 The racks must be designed with removable side panels. Racks must be arranged so that adjacent racks may be bolted together without interior side panels. Racks must be given to racks that are easily adapted for forced air ventilation.
- 6.16.6 The mounting of equipment must be by means of the retractable slides. Any equipment not mounted in this way must be supported from below. Equipment must be retained in the rack by front panel retaining screws. The retaining screws must be standardized for maintenance reasons.
- 6.16.7 Heavy equipment must be located at the bottom of the rack while lighter equipment without front panel controls, must be at the top. Equipment requiring frequent maintenance or control actions must be mounted in the center portion.

6.17 Bulkhead/Tabletop Mounting

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

6.18 Overhead Mounting

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

7.0 ELECTRO-MAGNETIC INTERFERENCE REQUIREMENTS

7.1 General

- 7.1.1 The Contractor must identify sources of electromagnetic interference caused by the installation of equipment and for the subsequent suppression of the interference.
- 7.1.2 The following standards contain the acceptable limits for the specified frequencies of RF current and for radiated fields:
 - a) IEC No. 60533 ed 2.0, en 1999; Electrical and electronic installations in ships - Electromagnetic compatibility
 - b) Appendix 7 of IEEE 45 std-2002, Recommended Practice for Electrical Installations on Shipboard;
 - c) IACS Test Specification for Type Approval E10.

7.2 Limits of Interference

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

7.2.2 Radiated Interference (above 150 kHz)

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

7.2.3 Conducted Interference (30 Hz to 15 kHz)

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

7.2.4 Conducted Interference (above 15 kHz)

- 7.2.4.1 Voltage interference levels measured at the terminals of any single piece of electrical equipment must not exceed the levels given in the Department of Communications Circular No. S11-10-47, Interference Suppression in Marine Craft.

7.2.4.2 Class 1 limits must apply where equipment or cables are poorly screened, such as:

- a) Above decks in general, unless proper screening has been used;
- b) Where close coupling exists between the affected equipment and their associated cables.

7.2.4.3 Class 2 limits must apply in well-screened situations, such as:

- a) Within the metallic structure of the vessel;
- b) Where screening has been specially provided.

7.2.4.4 Measurements must be made using instruments compliant to Canadian Standard C108.1.1. Measurements should be made under the worst-case conditions.

7.3 Interference Suppression

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

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

7.4 Screening of Cables

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

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

7.5 Grounding and Bonding

7.5.1 Grounding and bonding must be in accordance with TP127E.

7.5.2 Racks and Consoles

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

- a) Racks and consoles must be of all welded construction with direct electrical connection of the rack or console to ship's metal. Where direct connection is not feasible, ground straps are required.
- b) The use of non-welded racks and consoles is subject to the requirement that each individual member is properly grounded. Members may be either individually grounded or they may be bonded to each other by means of a strap. Electrically continuity between adjacent members must not be inferred from their proximity and mechanical connection.

7.6 Equipment Cases

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

- a) Cases must be connected to the ground rail or metal of the rack or console in which they are mounted;
- b) Each case must be individually grounded, i.e. case-to-case connection is not allowed for grounding;
- c) If practical, equipment within a single system must be located close together and connected to a single point ground;
- d) The grounding of equipment cases must not rely upon their retaining hardware;

- e) Access doors/covers must be bonded to the equipment case;
- f) Slide mounted equipment must use straps which allow for the withdrawal of equipment;
- g) On permanently mounted equipment, the ground strap must be as short as possible;
- h) Flexible braid straps may be used only where movement of equipment or components so dictates.

7.6.2 Methods and Materials

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

- a) All contact surfaces must be clean and free from paint, scale, rust or any material considered likely to impair the contact efficiency;
- b) The contact surface area must be as large as practical;
- c) Contact surfaces must be bonded using a method that will not impair contact efficiency, i.e., welding welded stud, etc.;
- d) Straps must be of 25 mm (1 inch) solid copper, 0.6 mm (0.025 inch) thick and as short as possible while avoiding the creating of sharp bends and corners;
- e) Ground straps and joints must be readily accessible for maintenance;
- f) Other low resistance, chemically compatible, corrosion-resistant materials may be approved for use by ABS;
- g) All bonding hardware must be of low resistance, corrosion-resistant material, and preferably stainless steel. Upper deck hardware must be of stainless steel.

7.6.3 Additional Precautions

7.6.3.1 Care must be taken in the grounding and bonding of metallic structures and of equipment in areas of high-level radio frequency energy, such as radio and electronic equipment rooms. Antennae, antenna tuners and radar transceivers are also critical regardless of where they are located. In these locations, all floating metallic structures such as conduit, air ducting, water pipes, box cable, cable screens, and metal support frames for liner board or ceiling tiles must be grounded at intervals of less than 1m. The use of metal faced liner board and/or ceiling tiles must be avoided in these locations.

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

8.0 DOCUMENTATION REQUIREMENTS

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

8.1 Drawings

8.1.1 General

- 8.1.1.1 All drawings supplied by the Contractor must be AutoCAD 2017 DWG format compatible, or later edition. Electronic drawings must not be protected so as to be “Read-Only” files. Fonts for text must be AutoCAD 2017 standard. Blocks are not to be grouped. All text included in a block must be an attribute.
- 8.1.1.2 A complete list of layer names and brief description of each layer’s use must accompany all files. Layer names, layer colour codes, and layer line types must be standardized across the drawings, or drawing types.
- 8.1.1.3 Electronic drawings must be provided to the TA via email, FTP server or USB device. All files must be clearly labelled with the project number, file names and drawing numbers. Files must be labelled “As-Fitted” drawings for those drawings that have been approved and finalized.
- 8.1.1.4 A complete list of symbol (block) names with a description of each symbol must be provided. One block per drawing must be provided in electronic format suitable for use with AutoCAD 2017. Drawing sheet sizes, including where possible vendor drawings, must be ANSI standards with standard border and title block in the layout section.
- 8.1.1.5 “As-Fitted” prints/plots must not contain markings or corrections by hand, i.e. marker, pen, pencil.
- 8.1.1.6 The Contractor must provide the IA and the TA with all drawings required by or generated by the sub-Contractors.
- 8.1.1.7 Schematic drawings of systems must include all pertinent system information, including sizes, dimensions, labelling, equipment locations, and all information relating to system fittings.
- 8.1.1.8 The Contractor must have in place a complete system of documenting and controlling all drawings and drawing revisions affected by the work (i.e. drawing index to provide per 6.1.8). The Contractor must maintain an up-to-date list of drawings and revisions and must provide this list to the IA and the TA at the

monthly progress meeting. This list must include a column of all drawings sent to ABS for approval.

8.1.2 Guidance Drawings

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

8.1.3 Working Drawings

- 8.1.3.1 The Contractor must develop detailed working drawings for all project work and regulatory body approval purposes. All variations must be incorporated into the working drawing revisions.
- 8.1.3.2 Working drawings must clearly indicate the materials and/or equipment being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each working drawing must have a unique identification number and blocks of numbers must be used to identify the various specification items. Where multiple working drawings are required each drawing must indicate the total number of sheets within the series.
- 8.1.3.3 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.
- 8.1.3.4 The Contractor must sign off on all working drawings indicating:
 - a) The drawing has been checked for conformance with all Specification requirements;
 - b) The equipment has been coordinated with other equipment to which it is attached and/or connected;
 - c) All dimensions have been verified to ensure the proper installation of equipment within the available space

8.1.4 Working Drawings – Submission for Review by CCG

- 8.1.4.1 The Contractor must submit to the TA two (2) copies of all working drawings, shop drawings and schedules required for the work. Drawings must be submitted to the TA and the IA at least fourteen (14) days prior to commencement of work for the affected drawings. The IA and the TA must review the drawings within five

(5) working days. This review will consist of verification of adherence to the requirements of the specification. Where necessary the TA will return one (1) copy of the drawing to the Contractor with comments from the IA and the TA. The Contractor must make any required amendments and return two (2) copies of the revised drawing, with revision dates and revision numbers, to the TA.

8.1.4.2 Reviewed drawings must not be modified in any way without written approval of the TA. In the event of subsequent revisions to drawings already reviewed the entire drawing, i.e., all sheets, whether revised or not, must be resubmitted for review.

8.1.4.3 Space must be provided on the working drawings for review dates and signatures of the IA and the TA.

8.1.4.4 Drawings submitted for review, unless otherwise specified, must be in the form of plotted originals. Manufacturer's printed data sheets for standard items are acceptable providing pertinent characteristics are identified and relate to specified items.

8.1.5 Working Drawings – Submission for ABS Approval

8.1.5.1 The Contractor must submit to ABS copies, of working drawings, ship drawings and/or layout drawings, schedules and calculation required for approval by ABS.

8.1.5.2 It must be the responsibility of the Contractor to ensure working drawings are ABS approved prior to the start of work for any section of the specification where ABS approval is required.

8.1.5.3 Space must be provided on the working drawings for ABS approval stamps. This space must be clear of all technical information and must not be on the back of any sheets.

8.1.5.4 The Contractor is responsible for contacting the respective ABS approvals office to determine the number and type of materials required for approval submissions.

8.1.5.5 The Contractor must supply one (1) original stamped drawings and one (1) copy of all ABS approved drawings to the TA.

8.1.5.6 The Contractor must supply four (4) scanned copy, electronic TIF and PDF format, of all ABS approved drawings via email, FTP server or USB device to the TA.

8.1.6 As Fitted Drawings

- 8.1.6.1 Upon the completion of all work, the Contractor must ensure the transfer of 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. All affected ships drawings are detailed in the attached MS Excel drawing Appendix. This document must be regularly updated and maintained by the contractor and submitted to the CGTA and CA during regular PRM meetings.
- 8.1.6.2 The Contractor must include in their pricing a Naval Architecture drawing allowance of \$40,000.00 for the services of a fully certified and accredited naval architecture firm to update engineered drawings and develop new “as fitted” drawings for all ships drawings affected by work detailed in this SOW. This allowance will be adjusted by PWGSC 1379 based on final invoicing. The Contractor must provide a complete breakdown of hourly rates and hours billed for this work.
- 8.1.6.3 This allowance is for the updating and development of ship’s drawings only. The costs for all planning, engineering and designing requirements as detailed in this SOW must be carried out by the contractor and included in their firm pricing for each specification item.
- 8.1.6.4 The engineered drawings must be redlined to reflect their as-fitted condition after all affected work is complete. The contractor must note that many of the ships drawings provided are not as-fitted verified and may contain inherent inaccuracies. The drawings are to be redlined in the format shown below:
- 8.1.6.5 The following is a guide that the Contractor must follow for the redlining of engineered drawings:
- Use a red pen to identify the area of changes in the drawing complete with dimensions, sketches, and callouts to indicate all changes precisely. Add notes describing exactly what is changed. If needed, provide a separate page detailing redlines to drawing with more precise accuracy.
 - If the mark-up is a removal: draw a hatching over the area to be removed and strike out accompanying notes, titles, and arrowheads with a single red line. Add notes describing removal details.
 - Use red pen and mark the date of the changes and the person proposing the changes.
 - Write “MARK-UP” after the drawing title in the title block.
 - You may wish to mark up the drawing with additional colors depending on the complexity of the changes involved, if this is the case a legend accompanying the colors is required on the drawing.

- Do not reference any letters or memos in the drawing, write out the completed description of what is being changed instead. (IE. Instead of writing “see memo #15 for changes) write “transits removed from bulkhead”). Never make a revision reference such as “Changed as per CO instructions”, this does not describe the actual change to the drawing. Attach all supporting documentation to the drawing and submit together.

For AutoCAD specifically:

- Create a new layer in AutoCAD with the new revision number, all revision details will be on this layer.
- Cloud revisions in the drawing which are additions and use hatching for removals.
- Include accompanying revision triangles and notes that fully describe what has changed.

8.1.6.6 The Contractor must provide the as-fitted drawings within 6 weeks after the last day of the vessel refit. The Contractor must allow for 7 business days for drawing reviews from the CGTA after delivery of each drawing. If additional revisions of drawings are required after review, the Contractor must complete the revisions within 7 business days after request.

8.1.6.7 The Contractor must supply the following to the CGTA:

- a) Two (2) plotted copies of the latest revision of each of the “As-Fitted” drawings;
- b) Four (4) electronic copies of the latest revision of each “As-Fitted” drawing via email, FTP server or USB device in AutoCAD 2017 DWG or later format.;
- c) Plotted drawings must be on standard ANSI paper sizes.

8.1.6.8 All drawings identified under each specification work item must be redlined and delivered to the CGTA. All reports, drawings, and other deliverables will become property of CCG.

8.1.6.9 If no AutoCAD drawing files are produced, then scanned files (raster format) must be provided to the TA in a TIF format. “As-Fitted” drawings must be delivered within 30 working days after the completion of sea trials.

8.1.7 Framed Drawings

8.1.7.1 Should the following drawings need to be modified I.e., General Arrangement Drawings including Plan View of all Decks and Profile; Capacity Plan, and the

Fire Fighting Systems and Life Saving Equipment, they are to be modified to reflect the actual “As-Fitted” status for the vessel. The modified drawings must be printed, framed and mounted on board the vessel in locations to be designated by the TA.

- 8.1.7.2 Note the Fire Fighting Systems and Life Saving Equipment drawing will require approval by ABS prior to mounting.

8.2 Manuals and Records

8.2.1 General

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

- a) CCGS GEORGE R. PEARKES – Vessel Life Extension
- b) Equipment/System Identification;
- c) Equipment Manufacturer;
- d) Revision number and date.

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

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

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

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

- 8.2.1.6 The Contractor must supply four (4) paper copies of all manuals and data sheets in English for all CFE items to the TA prior to the completion of the contract.

- 8.2.1.7 The Contractor must supply four (4) copies of each manual and all associated data sheets via email, FTP server or USB device in electronic PDF file format to the TA prior to the completion of the contract.

8.2.2 Operation Manuals – “As-Fitted”

8.2.2.1 Operation manuals must include the following items:

- a) General description of equipment operating sequence;
- b) Step by step procedure to follow in commissioning the equipment;
- c) Schematic wiring diagram for the fitted equipment;
- d) All pertinent equipment performance criteria;
- e) Where software/hardware systems are fitted, the operation manual must include the following:
 - i. Full software documentation manual for the system and via email, FTP server or USB device such that Canada may revise programs without recourse to the Contractor.
 - ii. The minimum software documentation must include system level diagrams describing the overall scheme of the software/hardware system.
- f) The functional specifications, which must describe in detail the functional capabilities of the system and each software components;
- g) Project specific program listings including all comments describing the details of the code functions;
- h) All listings, files, manuals and associated documentation materials must be delivered to and become the property of Canada. Drawings must not have any restricted usage notations of any kind.

8.2.2.2 The Contractor must supply the number of paper copies and electronic copies of the operations manuals as set out in Section 8.2.1

8.2.3 Maintenance Manuals – “As-Fitted”

8.2.3.1 Maintenance manuals must be Bilingual (English/French) and must include:

- a) Manufacturer's maintenance instructions for each item of the equipment requiring maintenance activity;
- b) Instructions are to include installation instructions, part numbers, part lists, master drawings and exploded views with part identification for all mechanical, electrical and electronic parts, name of suppliers;

- c) Summary list of each item of the equipment requiring lubrication, indicating the name of the equipment item, location of all points of lubrication, type of lubricant recommended, and frequency of lubrication;
- d) Troubleshooting sections must be included for all equipment in the maintenance manual under a separate heading.

8.2.3.2 The Contractor must supply the number of paper copies and electronic copies of the maintenance manuals as set out in Section 8.2.1.

8.2.4 Tests / Trials and Inspection Records

8.2.4.1 The Contractor must prepare a separate binder, arranged as per Section 8.2.1, for the documentation of all Test, Trials and Inspection Records. The binder must be indexed for each test, trial and inspection performed.

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

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

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

8.2.5 Certificate Records

8.2.5.1 The Contractor must prepare a separate binder, arranged as per Section 8.2.1, for the documentation of all Certificate Records. The binder must be indexed for each item or piece of equipment for which Certificate Records are available.

8.2.5.2 The Contractor must maintain a complete and accurate record of all certificate records applicable to the work. Certificate records must be current and for the type of equipment being installed by the Contractor. The Contractor must ensure that where classification society approval certificates are required, these

certificates are provided within the Certificate Records binder. Where manufacturers have supplied certificates for equipment within operational manuals, copies of these certificates must be indexed within the Certificate Records binder. The Contractor must also obtain and index all certificates issued by its sub-Contractors.

8.2.5.3 The Contractor must supply the number of paper copies and electronic copies of the test, trials and inspection records as set out in Section 8.2.1.

8.2.5.4 NOTE: Where original certificates are provided, especially ABS certificates, one of the four (4) paper copies must be the original document.

8.3 Electrical System Documentation

8.3.1 The Contractor must provide the following documentation with regards to the “As Fitted” load analysis to the TA:

- a) Two (2) paper copies of the final ABS approved load analysis and calculations of the “As-Fitted” electrical system. This must be provided as detailed in Section 8.2.1;
- b) Four (4) copies of the final ABS approved load analysis and calculations of the “As-Fitted” electrical system in electronic format. The electronic files must be in Microsoft Excel format and must be via email, FTP server or USB device with a detailed listing of all files.

8.3.2 The Contractor must provide the following documentation with regards to the “As Fitted” short circuit current analysis to the TA:

- a) Two (2) paper copies of the final approved short circuit current analysis and calculations of the “As-Fitted” electrical system. This must be provided as detailed in Section 8.2.1;
- b) Four (4) copies of the final approved short circuit current analysis and calculations of the “As-Fitted” electrical system in electronic format. The electronic files must be in Microsoft Excel format and must be via email, FTP server or USB device with a detailed listing of all files

8.4 Inclining Experiment Documentation

8.4.1 The Contractor must refer to Section 11.1 of this SOW item for the details required for the Inclining Experiment.

8.5 Stability Booklet Documentation

- 8.5.1 The Contractor must refer to Section 11.2 for the details required for the Trim and Stability Booklet.

8.6 Photographs and Images

8.6.1 “As Delivered” Photographs/Images

- 8.6.1.1 The Contractor must supply a professional photographer to deliver a minimum of one thousand (1,000) high resolution (minimum 12 Mega Pixel) digital images in JPEG format. Images must be delivered via email, FTP server or USB device media. The IA and the TA must be in attendance for all images. The entire ship must be photographed with enough detail to point out specific parts and/or pieces. If Canada requests more images to be taken, the price must be prorated.
- 8.6.1.2 The Contractor must fulfill this requirement in conjunction with Section 3.7 of this SOW item.
- 8.6.1.3 The Contractor must provide two (2) copies of all “As Delivered” digital images via email, FTP server or USB device to the IA and the TA at the first progress meeting after the delivery of the vessel to the Contractor’s facility.

8.6.2 Progress Status Photographs/Images

- 8.6.2.1 The Contractor must provide high-resolution (minimum 12 Mega Pixel) JPEG digital images delivered via email, FTP server or USB device of the work in progress during each phase of the project. The photographs must commence when the work on the vessel begins and continue as long as work is in progress.
- 8.6.2.2 The Contractor must take sufficient exposures during the modernization project to ensure that an adequate record of work progress is captured. The date of exposure must be automatically recorded for all images.
- 8.6.2.3 The Contractor must provide two (2) copies of all progress photographs delivered via email, FTP server or USB device media in JPEG format to the IA and the TA at monthly progress meetings.

9.0 FIELD SERVICE REPRESENTATIVE REQUIREMENTS

- 9.1 The Contractor is responsible for obtaining the services of accredited FSR teams from each major equipment and/or system manufacturer or supplier.
- 9.2 Each individual specification item in this SOW details the Field Services Representatives (FSR) required to be present during the course of this project. This includes the company or OEM that they represent, their necessary contact information, the associated VLE Specification item that will require their attendance and the bid price allowance for these services. Allowance values that are included for certain specification items include all onsite attendance (including training), travel, accommodation and meals and will be adjusted, as required, upward or downwards by using PWGSC 1379 Form (Per Annex F). Certain specification items do not provide an allowance. The contractor must provide a firm price for the FSR's services and associated costs for these specification items.
- 9.3 The CCG has provided primary FSR contact information for the Bidders to use. CCG recognizes that some of the firms listed have offices throughout Canada and the Bidder may use a local office to arrange for the FSR. Regardless of the source of the FSR, it is incumbent on the Contractor to provide the TA with documentation that proves that the FSR attending the VLE is accredited by the parent company to perform the tasks listed the required specification item. The Contractor must not substitute "other companies to perform jobs". "Other companies" may have a general working knowledge of the equipment in question, but they are not up to date with the specific systems and equipment that CCG is installing on the CCGS Pearkes.
- 9.4 NOTE: The allowances detailed in each SOW item are for the purpose of having the FSRs on site only and do not include other references to other pricing requirements that may be found throughout these specifications. These are to be dealt with separately by the Contractor, when he formulates his bid price for each individual SOW item.
- 9.5 The contractor must plan and schedule travel and on-site visits for all FSR's as efficiently as possible. Additional costs due to a lack of scheduling and excessive FSR downtime will be paid for at the contractor's expense.

10.0 TESTS, DOCK TRIALS AND SEA TRIALS

10.1 General Requirements

- 10.1.1 The Contractor must demonstrate that the completed work and equipment is in compliance with the performance requirements of this SOW. The Contractor must develop test and trial procedures, and conduct all tests and trials required by this Specification and as may be required by the regulatory bodies in order to permit the issue of all appropriate certificates for the vessel. The Contractor must obtain all necessary certificates for the vessel to ensure that the vessel is fully certified and seaworthy for a vessel of its class prior to the completion of the contract.
- 10.1.2 The Contractor must provide the TA with a complete list of disturbed services and ship's systems that require functional and operational tests prior to the completion of each specification requirement. The Contractor must develop specific test procedures to test the operational and functional condition of each of the disturbed services and/or ship's systems. The Contractor must submit the list of disturbed services and ship's systems and the associated specific test procedures for review to the IA and the TA twenty (20) working days prior to the start of these system tests.
- 10.1.3 The Contractor must prepare a trials schedule showing dates, sequence, procedures, and duration of each trial or set of trials. This agenda, including the proposed trial record sheets for all trials, must be submitted for review and comment to the TA and the IA twenty (20) working days prior to the start of any tests and trials.
- 10.1.4 The Contractor must coordinate the trials agenda with ABS to ensure attendance where necessary. The Contractor must ensure a manufacturer's FSR or written authorization from the manufacturer must be available prior to initial start-up of newly installed or modified equipment. All trials must be witnessed by the IA and where necessary, by ABS, FSR's and any sub-Contractors. All tests must be completed on individual components of a system and all defects corrected to the satisfaction of the IA, ABS and/or the attending FSR. Once defects are corrected, the test and trial must be repeated to the satisfaction of the IA and where necessary ABS.
- 10.1.5 Shop testing, dock and sea trials procedures must be to the standards required by ABS. Where ABS has no requirements for shop test procedures, the Contractor must adhere to the S.N.A.M.E. guidelines as referenced in Section 3.2 of this SOW item. The minimum standard for all electrical dock and sea trials must be in accordance with ABS, TP127E and IEEE Std 45-2002. All electronic equipment static tests must be completed prior to sea trials with only the operational tests to be carried out at sea.

- 10.1.6 Mechanical and piping systems must be tested in accordance with Section 5.2. CCGS Hydrostatic testing of piping and components forming part of any system must be completed prior to any operational testing of the system. The Contractor must have on hand signed and witnessed test sheets showing the results of hydrostatic tests prior to the operational tests of the system. As a minimum the IA must be notified when any components are being hydrostatically tested.
- 10.1.7 The Contractor must make reference to Section 8.2.4 with regard to the documentation requirements for the tests, trials and inspection records

10.2 Mechanical and Piping Systems

- 10.2.1 All sub-assemblies and piping systems fabricated by the Contractor must be hydrostatically tested to 1.5 times the system's working pressure and proven tight to the satisfaction of the IA prior to installation on the vessel.
- 10.2.2 Machinery and equipment must not be subjected to pressures higher than their maximum allowable operating pressure during system pressure tests. Valves at the components may be closed, or the connection blanked off to protect such components from excessive pressure. If there are any flanged joints in the piping between a tank isolating valve and the open end of the tail pipe, or where a tank isolating valve has not been installed, the flanged joint next to the open end of the tailpipe must be temporarily blanked off so the system may be pressure tested up to that point. Instruments, pressure switches and other components that could be damaged by excessive pressure of system tests must be removed or otherwise protected during the tests.
- 10.2.3 For tests, calibrated pressure gauges must be installed at the connections provided in the gauge piping for this purpose. During tests, readings of installed gauges must be checked with the calibrated test gauges. Installed gauges must be adjusted where necessary to register pressure accurately. The Contractor must provide calibration certificates for all instrumentation used for the testing of systems to the IA and the TA.
- 10.2.4 When the duration of a pressure test is not specified, the test pressure must be held a sufficient length of time to permit a thorough examination of the system for leaks to the satisfaction of the IA.
- 10.2.5 Relief and safety valves and all other components installed to limit operating pressures must be removed, blanked or bypassed where necessary to build up to the pressure specified for the test. After a system has satisfactorily passed these tests, such components must be reinstalled and tested under pressure to assure they operate at approved set pressures. Set pressures indicated on identification plates of these valves must conform to the approved set pressures.

- 10.2.6 All components necessary for the safe operation of the system must be checked and adjusted during the operating tests to demonstrate compliance with the requirements specified and approved for the system. Operating tests must demonstrate that the piping design and installation adequately meet the service demands.
- 10.2.7 Components, such as spring hangers must be adjusted where necessary and flexible piping connections slip joints, expansion joints and noise isolation pipe fittings must be checked for satisfactory operation while the system in which they are installed is being operated.
- 10.2.8 Where pumps or ejectors have suctions from tanks or compartments, the operating test must demonstrate the ability of the system to remove the service liquid down to the level of the open end of the suction tail pipe.
- 10.2.9 Open systems such as air escapes, overflows and deck drains must be tested for unobstructed flow with compressed air or water at not more than 100 PSI. Systems for hand pumps, portable drainage facilities and similar miscellaneous systems must be given an operating test and the specified pressure test. Pressure tests must precede operating tests.
- 10.2.10 All systems must have a visual inspection and must be leak-free during the specified tests.
- 10.2.11 All of the system pressure and operating tests must be completed before the system trials.
- 10.2.12 Where tanks have been opened for the purpose of conducting work, all tanks are to be cleared, cleaned and submitted for inspection to the IA prior to closing of the tank or space. Failure to notify the IA does not absolve the Contractor of the responsibility of providing the opportunity to inspect any completed items. Inspection of any tanks or spaces by the IA does not substitute for any required inspection by ABS. At the completion of the inspection, all tank covers are to be fitted with new gasket material prior to the closing of the tanks.
- 10.2.13 Where work has been carried out in or on any structural part of a tank, that tank must be subjected to a hydrostatic pressure test of 2.5 m head of water. The hydrostatic test must be witnessed by ABS and the IA. The hydrostatic tests must be documented as per Section 8.2.4 of this SOW item.

10.3 Vessel Performance Sea Trials

- 10.3.1 In addition to dock trials and commissioning tests of individual Vessel systems specified within this SOW item the Contractor must perform a full set of sea trials in accordance with the "Guide for Sea Trials" as published by S.N.A.M.E. (Section 3.2 of this SOW item). The Contractor must develop all sea trial

procedures and data sheets. The sea trial procedures with attached data sheets must be submitted to the IA and the TA for review and approval twenty (20) working days prior to the start of the Sea Trials.

11.0 INCLINING EXPERIMENT, TRIM AND STABILITY BOOKLET

11.1 Inclining Experiment

- 11.1.1 The Contractor must provide the services of a certified Naval Architect firm to:
- a) Conduct a Lightship Survey and produce the Lightship Survey report, and;
 - b) Provide supervision and direction to the Contractor in order to conduct the Inclining Experiment, and;
 - c) Provide an Inclining Experiment Report.
- 11.1.2 The Contractor must perform the Inclining Experiment in the presence of an ABS Surveyor upon completion of all specified work and prior to vessel starting sea trials. The Contractor is responsible for the preparation and execution of the Inclining Experiment and must provide all necessary services, including necessary certified weights and other equipment mentioned in the Inclining Experiment Procedure, document 5659-152-005 and any ABS requirements under the International Code on Intact Stability, 2008, for the execution of the Experiment.
- 11.1.3 The Contractor is to include a firm price as part of their financial tender submission for the services of a fully certified Naval Architecture/Engineering firm to conduct the Lightship Survey and supervise and direct the Inclining Experiment. This survey and all related documentation must be performed to the satisfaction of ABS and CCG.
- 11.1.4 The Inclining Experiment and Lightship Survey must be carried out in accordance with the procedures outlined in document 5659-152-005.
- 11.1.5 The Contractor is to include a firm price as part of their financial tender submission for the services of a fully certified Naval Architecture/Engineering firm to develop the Inclining Experiment Report and Lightship Survey Report and to submit these documents to ABS for approval. The cost for the production of the Reports will form part of the contractor's overall financial submission price.
- 11.1.6 The Contractor must refer to Section 8.4 of this SOW item with regards to the documentation requirements for the Inclining Experiment Report.

11.2 Trim and Stability Booklet

- 11.2.1 The Contractor must prepare a Trim and Stability Booklet, in metric units, for the vessel in the condition at time of return of custody to Canada. The format must conform to TP7301E, Stability Standard Stab. 2 and the International Code on Intact Stability, 2008 and must be ABS approved.

11.2.2 The Contractor must refer to Section 8.5 of this SOW item for the documentation requirements for the trim and Stability Booklet.

11.2.3 The baseline for the Stability Booklet must be the lightship centers of gravity determined from the inclining experiment as detailed in Section 11.1 of this SOW item.

11.3 Stability Book Documentation

11.3.1 The Contractor must prepare and supply four (4) stamped and ABS approved paper copies of the CCGS George R. Pearkes' Trim and Stability Booklet, in metric units, for the modernized vessel, and two (2) complete electronic copies provided on discs. The format must conform to TP7301E Stability Standard Stab. 1. The Contractor must deliver these copies to the Technical Authority in sufficient time for the document to be reviewed and approved by ABS prior to the completion of the contract.

12.0 VESSEL COMMISSIONING

12.1 Identification

12.1.1 The intent of this SOW item is for the Contractor to provide a framework for the commissioning of the CCGS George R. Pearkes' various propulsion related systems, with multiple sub-contractors required to perform commissioning tasks prior to conducting full dock and sea trials.

12.2 References

12.2.1 Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Canada Shipping Act - Tackle Regulations
- c) Canada Shipping Act – Marine Machinery Regulations
- d) Canada Shipping Act - Hull Inspection Regulations
- e) Canada Shipping Act – Safe Working Practices Regulations
- f) Maritime Occupational Health and Safety Regulations
- g) ABS Rules and Regulations

12.2.2 Standards

- a) CCG Fleet Safety Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- d) EEE STD 45 – Recommended Practice for Shipboard Electrical Installations
- e) IEC 60092-504-electrical Installations in Ships – Part 504: Special Features –Control and Instrumentation
- f) IEC 60533 – Electrical and Electronic Installations in Ships – Electromagnetic compatibility

12.2.3 Documents

Wartsila Project Documents	
Document Number	Description
DBAE957879	George R. Pearkes Installation Planning Instructions (IPI) a3
DBAE591721	George R. Pearkes Commissioning Manual

DBAE787193	George R. Pearkes ITP
ABB Project Documents	
3AFV6106125	Dock Trial Test Specification for CCGS T1100
3AFV6106242	Sea Trial Specification for CCGS T1100 Rev A

12.3 Technical

12.3.1 General

12.3.1.1 Due to the scope of work needed for the CCGS George R. Pearkes, it is necessary for the Contractor to ensure that the assets are in place to commission the various propulsion systems and interfaces. In order to facilitate these goals, Canada will provide the Contractor with a Wartsila Site Manager for the duration of the project under the existing Wartsila Propulsion Generator Replacement contract. The contract and amendments can be found at <https://buyandsell.gc.ca>.

12.3.1.2 In addition to the scope of tasks in the Propulsion Generator Replacement, the Wartsila Site Manager will also coordinate, with the Contractor's Project Manager, the development and execution of the final commissioning of the vessel.

12.3.1.3 The commissioning of the various vessel systems will require the coordination of the following firms and inspectors that will comprise the Integration Team:

- Contractor – Project Management and FSR support;
- Wartsila Canada – Propulsion Generator Replacement and Site Manager;
- ABB – Cycloconverter and Propulsion Control Replacement;
- Madsen – Woodward Governor System Modifications, System integration/terminations and Alarm and Monitoring System upgrade
- ABS – Recognized Organization under DSIP
- TA – CCG Inspectors;
- CA – PSPC Contracting Authority

12.3.1.4 The Contractor must ensure that throughout the course of the project, each party noted above provides their individual requirements for commissioning the individual systems, including support personnel required, services required, and the prerequisites required for the commissioning.

12.3.1.5 The Contractor, in conjunction with the Wartsila Site Manager, must develop an integrated commissioning plan to be provided to the TA and ABS for review no less than twenty (20) working days prior to any commissioning tasks to provide time for review, development of hold points for inspector attendance.

12.3.1.6 The Contractor must ensure all parties are notified of the progress of the commissioning on a daily basis to ensure that all relevant parties are in attendance when required.

12.3.1.7 As the commissioning progresses, the Contractor must adjust the schedule as required to accommodate any delays or advances in the systems testing.

12.3.1.8 Once each system is declared operational, subsequent systems may be brought on-line. As subsequent systems are commissioned, the previous system's FSRs must be present to ensure correct interaction with the subsequent systems.

12.3.1.9 The Contractor must ensure the requirement of Section 10.0 – Tests, Dock Trials and Sea Trials is complied with in conjunction with the requirements of this SOW item section.

12.3.1.10 The Contractor must ensure that the Dock and Sea Trials include all the system testing, trials and inspections required from the individual parties of the Integration Team.

12.3.2 Wartsila Commissioning

12.3.2.1 The Contractor must ensure the Wartsila commissioning process is followed in accordance with the instructions of the FSR's. While the Wartsila Site Manager is supplied under a separate contract with Canada, the additional Wartsila technicians/FSRs are to be supplied by the Contractor as noted in Specification E-01 – Propulsion Generator Replacement, and Specification H-30 – Bow Thruster Replacement.

12.3.2.2 The Wartsila FSR will be responsible for executing the Wartsila commissioning plan including all configuration, measurements, record keeping and adjustments required to the Propulsion Generators in order to achieve an operational propulsion system.

12.3.2.3 The Contractor must supply the services of two (2) personnel to work under the direction of the Wartsila FSRs for the duration of the commissioning of the Propulsion Generators and all tests and trials of the vessel. The Contractor must provide a per day cost of an additional person to assist in the commissioning, with the final personnel loading to be determined in conjunction with the Contractor and Wartsila Site Manager.

12.3.2.4 Canada will ensure that the Wartsila Site Manager provides the commissioning requirements noted in 12.3.1.4 to the Integration Team within two (2) weeks of contract award in order to permit timely integration with the other system commissioning plans.

12.3.3 ABB Canada – Cycloconverter Commissioning

- 12.3.3.1 The Contractor must ensure the ABB commissioning process is followed in accordance with the instructions of the ABB FSR. The ABB FSR is supplied under contract with Canada as noted in Specification E-02 – ABB Cycloconverter Installation. However, all additional ABS planning, engineering, labour and materials required for the installation and commissioning of the new cycloconverter units as detailed in Specification E-02 – ABB Cycloconverter Installation - and the attached ABB installation documents, must be included in the Contractor's firm pricing. In addition to the firm pricing for the services of the ABB certified FSR's, the Contractor must include an allowance of \$100,000.00 in their pricing for all reasonably incurred travel and living expenses. This allowance will be adjusted by PWGSC 1379 based on final invoicing.
- 12.3.3.2 The ABB FSR will be responsible for executing the ABB commissioning plan including all configuration, measurements, record keeping and adjustments required to the Cycloconverter in order to achieve an operational propulsion system.
- 12.3.3.3 The Contractor must supply the services of two (2) personnel to work under the direction of the ABB FSR for the duration of the commissioning of the cycloconverter and all tests and trials of the vessel.
- 12.3.3.4 Canada will ensure the ABB FSR provides the commissioning requirements noted in 12.3.1.4 to the Integration Team within two (2) weeks of contract award in order to permit timely integration with the other system commissioning plans.

12.3.4 Madsen – Woodward Governor Modifications/Commissioning and Alarm & Monitoring System Upgrade/Integration

- 12.3.4.1 The Contractor must ensure that the commissioning of the Woodward engine controls is followed in accordance with the instructions of the Madsen FSR. The Contractor must include firm pricing to cover all services of the required Madsen FSR's, including all required materials and equipment. They must also include an allowance of \$100,000.00 in their pricing to cover all reasonably incurred travel and living expenses of the certified Madsen FSR's. This allowance will be adjusted by PWGSC 1379 based on final invoicing. These representatives will be responsible for carrying out the modifications and commissioning of the Woodward Governor Engine Control System and will also assist with the upgrade, integration, and commissioning of the Trihedral Alarm and Monitoring System. Additional details involving Madsen's work scope requirements are detailed in the attached TDP document titled "TR408828 - Pre Work Package CCGS George R. Pearkes."

12.3.4.2 The Madsen FSR's will be responsible for executing the Madsen commissioning plan including all configuration, measurements, record keeping and adjustments required to the Woodward Governor system in order to achieve an operational propulsion system.

12.3.4.3 The Contractor must supply the services of two (2) personnel to work under the direction of the Madsen FSR for the duration of the commissioning of the Woodward Governor system and all tests and trials of the vessel.

12.3.4.4 The Contractor must ensure the Madsen FSR provides the commissioning requirements noted in 12.3.1.4 to the Integration Team within two (2) weeks of contract award in order to permit timely integration with the other system commissioning plans.

12.4 Proof of Performance

12.4.1 Inspection

12.4.1.1 The Contractor must ensure all parties are notified of the progress of the commissioning on a daily basis to ensure that all relevant parties are in attendance when required for inspections in accordance with the integrated commissioning plan.

12.4.1.2 The Contractor must publish and distribute to all members of the Integration Team an inspection schedule based on the input from all members of the Integration Team. This master inspection list will be revised and redistributed as needed to ensure all parties are present when required for inspections

12.5 Deliverables

12.5.1 The Contractor must ensure each FSR completes commissioning reports for their respective system. The reports must include, as a minimum, the following:

- a) Commissioning checklist;
- b) Records of final system parameter settings;
- c) Report of any component failures, damage and corrective actions;
- d) FRS final commissioning report indicating compliance with the commissioning checklist and the system is fully operational.

12.5.2 The Contractor must provide the TA and ABS with copies of all commissioning reports.

- 12.5.3 The Contractor is responsible to ensure that ABS witness the commissioning and sign off the items in the vessels Hull and Machinery Survey Record Book.

STATEMENT OF WORK

CCGS GEORGE R. PEARKES Vessel Life Extension



PART B – Hull (“H”) Specifications

Prepared by:
Vessel Life Extension Program
200 Kent Street
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H-01 SERVICES

1.0 General

- 1.1 Services must be connected upon arrival at the Contractor's facility and maintained for the duration of the refit. Services must include any connections, disconnections, consumption, and any interim arrangements.
- 1.2 The Contractor must supply and erect two (2) gangways complete with safety nets in compliance with the Canada Labor Code while the vessel is secured alongside and while it is in the dock at the Contractor's facility. The Contractor must be always responsible for the safety and the security of the gangways.
- 1.3 The following services for which unit prices must be submitted, must be provided to the vessel for the entire work period while at the Contractor's facilities. All services must be provided and maintained while the vessel is on dock and alongside at the contractor's wharf as necessary.
- 1.4 The Contractor must supply all equipment, tools and machinery required to perform the work as described in this SOW 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 sub-contractor 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.
- 1.5 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 SOW package, must be removed, ground flush and receive the applicable paint schedule for the associated area.
- 1.6 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 vessel's hull by the ABS Surveyor or by the vessel's crew, as well as all work performed on the vessel's hull. This is to include, but not limited to, scaffolding and equipment needed to access the propellers, rudder, rudder trunk, bow thruster and cathodic anodes etc.
- 1.7 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and

included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 Shipboard Telephone and Wireless Internet

2.1 In addition to the requirements, as defined in Section 3.3.1 one direct-line telephone and internet connection, is to be installed/provided aboard the vessel with its location to be determined by:

- i. The telephone line and internet access must be available at all times, 24 hours a day, always ensuring communication with the outside.
- ii. 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.
- iii. A list of the telephone numbers for the shipyard, fire and police services and emergency numbers must be provided upon the vessel's arrival to the shipyard.

3.0 Temporary Protection of Decks and Bulkheads

3.1 The Contractor must provide, install and remove 350m² of protective floor covering consisting of 3mm Masonite or equivalent boards with flame retardant covering secured to them with flame retardant tape. This floor covering must be fitted to all access alleyways throughout the vessel in areas to be used by the Contractor for access to the required work areas. The Contractor must provide, install, and remove an additional 700m² of the same materials to the bulkhead panels up to 2m height above the deck level in the alleyways. All edge joints must be taped to prevent the ingress of dirt and prevent migration of the applied sections. The Contractor must complete the installation of the protective floor covering within 48 hours of the vessel's arrival at the Contractor's facility. The Contractor must remove the protective floor and bulkhead coverings as well as any residue adhesive from all surfaces that have been covered. residue on decks and bulkheads. The use of multipurpose plastic film covers is prohibited. All covering removals that occur no earlier than 24 hours before the vessel's departure from the Contractor's facility for sea trials. The contractor must replace deck and bulkhead protection when there is noticeable wear and tear from regular use and/or weather related deterioration. The contractor must also remove and replace all protection when required to carry out any work items detailed in this SOW. At no times shall decking be left unprotected. Any damage to the deck from being unprotected must be repaired / replaced at the contractors expense.

4.0 Electrical Power

- 4.1 Electrical power requirements are one connection of 600 volts AC, rated at 300 amps, 60 Hz, 4-wire, three phase. The power supply must be connected before the vessel is docked and must remain connected for the duration of the contract. The shore power must be supplied through an independent kilowatt hour meter that is maintained by the Contractor.
- 4.2 The Contractor must read the kilowatt hour meter in the presence of the IA prior to power connection and disconnection to verify power consumption. Readings must be taken before and after any vessel movement to or from the fit out wall and be read in the presence of the IA.
- 4.3 The Contractor must supply the electrical cable from the shore junction to the vessel and all labour needed to connect and disconnect, as required. The cable is to be sized to handle both the voltage and amperage requirements noted above and is to be of sufficient length so as not to be placed under any stress when installed, between the shore side and vessel side connections. Cable is to come the necessary shipboard male connection to allow connection to the corresponding shore connection plug on the vessel.
- 4.4 Before powering the vessel, the Contractor must ensure that power source supplied are in the same phase sequence at the source and on the vessel.
- 4.5 The Contractor must provide a price quote per unit kW/Hr. of electrical power at 600 VAC, 60 Hz, 3-phase. The quote must be based on 50A average current draw whilst the vessel is unmanned and 225A while the vessel is being manned. The Contractor must quote on a fifty (50) day period of the vessel being manned.
- 4.6 *NOTE: Should the Contractor decide to supply power to the vessel using a diesel generator installed on the wharf, the Contractor must be responsible for ensuring that the generator is capable of supplying the power required, capable of running at all times, 24/7 as well as being responsible for the necessary watch keepers and generator fuel requirements.*

5.0 Shipboard Environmental Requirements

- 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 vessel 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. When the vessel is shut down and unmanned, cooling water will not be necessary. It is the responsibility of the contractor to provide their own independent heating source/system for the vessel.

- 5.2 The contractor must carry out all winterization activities as required. Shore Steam Supply (if required) and or supplementary electric heat to a number of outside spaces (to be determined by the TA) must be supplied during cold weather to maintain these defined spaces in an above freezing temperature. All piping and systems must be drained down to the satisfaction of the CCG TA prior to the arrival of freezing temperatures. The Contractor must be responsible to repair any damage caused by frozen pipes or related machinery at their expense.
- 5.3 The Contractor must protect the vessel from all environmental effects, including the supply and installation of any encapsulation required to allow painting and curing to be performed in temperature and humidity ranges required by the paint manufacturer's requirements, and confirmed by a NACE inspector and the TA.
- 5.4 The Contractor must ensure that environmental conditions are monitored aboard the vessel throughout the contract period to prevent damage from temperature variations.

6.0 Fresh Water and Firemain Seawater Service Requirement

- 6.1 The Contractor must supply all material and labour to install necessary connections to supply both potable fresh water, for domestic use and a constantly pressurized raw water supply for the connection to the firemain. These water services will be required throughout the entire contracted period unless otherwise noted in this specification. The Contractor must allow for 2 fire main connections- 1 foreward and 1 aft, should firemain sections passing through affected engine room areas be cut out or removed. The ends of these sections must be capped off to maintain fire pressure. The Contractor must disconnect all connections upon completion of work.
- 6.2 The Contractor must provide and install a calibrated flow meter(s) for each domestic potable water supply connected to the vessel for the duration of the work period. Flow meters are to be sized for the service they are intended for. Calibration records for the flow meters must be presented to the IA. All flow meters must be read by the Contractor at the beginning and end of the contract period, as well as before and after any vessel movement to or from the fit-out wall in the presence of the IA.
- 6.3 Prior to connecting to the domestic potable water system of the vessel the Contractor must have the shore side water connected source tested, by a certified laboratory, to ensure that the water quality meets the Health Canada standards for potable water. Copy of these results are to be provided to the TA, and water is only to be provided to the vessel upon the affirmation of approval by the TA.
- 6.4 The following water connections will be required to service the vessel:

- a) A pressure regulated raw water supply at 670 kPa must be connected to the vessel's fire main. The water supply must be connected immediately following the docking of the vessel. This supply is to remain fully charged without interruption for the full duration of the Contracted period. Consumption will be on an "as-required" basis for firefighting and cleaning purposes. As detailed in section 6.1 above, the Contractor must include pricing for 2 fire main connections.
 - b) A pressure regulated water supply at 380 kPa must be connected to the vessel's sanitary water supply system. The water supply must be connected immediately prior to the arrival of the crew for trials. Once connected this regulated supply is to be provided at all times, 24/7, without any interruption. Consumption is estimated at 4,000 liters of water per day when the vessel is crewed. The Contractor must quote on 42 day's supply of this service.
 - c) A pressure regulated potable water supply at 380 kPa must be connected to the vessel's potable water supply system. The water supply must be connected immediately prior to the arrival of the crew for trials. Once connected this regulated supply is to be provided at all times, 24/7, without any interruption. The vessel will be consuming an estimated 6,000 liters of potable water daily when the vessel is being manned. The Contractor is to quote on 42 day's supply of this service.
- 6.5 The Contractor must include, a unit cost per cubic meter consumption of potable water, non-potable water and raw water.
- 6.6 The Contractor must also supply a separate supply of fresh water for cleaning, testing and rinsing tanks, etc. in accordance with the requirements of this Statement of Work. The cost of this water consumption for the aforementioned items of this SOW package must be assumed by the Contractor.
- 6.7 For all pressurized water lines connected to the vessel, the Contractor must be responsible to take all the necessary precautions to ensure that the water lines do not freeze during cold weather. Special attention must be given to the fire main supply line.
- 7.0 Overboard Discharge/Drainage Connections & Oil Disposal**
- 7.1 The Contractor must supply all required materials and labour to attach temporary drainage hoses to the overboard discharges as required 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.

- 7.2 For black and grey water, the Contractor must supply and install hull discharge hoses and portable tanks or tanks that can be pumped out; the Contractor must be responsible for the regular pumping out of these and disposing of their contents in an approved manner acceptable to both provincial and municipal regulations. All related costs must be included in this item. The Contractor must provide a unit price per cubic meter. The estimated amount is 50 m³. The total disposal amount will be adjusted by PWGSC 1379 based on the total volume pumped/disposed. Upon arrival at the Contractor's facility, the Contractor shall flush through all black and grey water lines and pump contents ashore. The complete flushing of lines must be to the satisfaction of the CCG TA. In addition to these removals and disposals, the contractor must include pricing for the complete supply and installation of 2 heated porta-potties to be located on the main deck of the vessel for the use of CCG representatives. These portable units must be cleaned and pumped out weekly for the duration of the contract period.
- 7.3 The Contractor is to quote a price for the pumping out and disposal of approximately 15 m³ of oily bilge water from the ship's bilges upon arrival at the contractor's facility, as noted in specification 4.0 - General Technical - Section 4.9 of this SOW. The Contractor must provide a unit price for each additional m³. The price specified for this item will be adjusted upward/downward based on the Contractor's submitted invoices. Any additional bilge or machinery space cleaning or pump-outs needed as a result of the Contractor's work detailed throughout this SOW must be included in the contractor's firm pricing for each individual specification item.
- 7.4 The contractor is to quote a price for the pumping out and disposal of approximately 40 m³ of diesel fuel that will aboard the vessel upon the arrival at the contractor's facility. A unit price per m³ shall be quoted for the purpose of adjustment and any difference in the removal/disposal quantity of the fuel will be adjusted, either up or down, via the PWGSC 1379 form (refer to Annex F in contract clauses for Procedure for Unscheduled Work).
- 7.5 The Contractor must provide the Inspection Authority with the name(s) of the company(s) registered for pumping and disposal of waste oil, and receipts for the elimination of ship hydrocarbons for inclusion in the hydrocarbon service booklet.
- 7.6 Copies of all disposal certificates for all the above-mentioned fluids must be maintained by the contractor and provided to the TA when requested.
- 8.0 Garbage Removal**
- 8.1 The Contractor must supply one (1) garbage container of at least ten (10) cubic yard, placed on the flight deck beside the gangway for waste from the vessel. This

is for CCG personnel and vessel waste and is not to be used by the contractor. This container must be emptied weekly.

9.0 Weight Control

- 9.1 The Contractor must develop, implement, and submit in accordance with all Specifications herein, a weight control program for all of the removals and installations of the existing and new equipment(s) and machinery defined in this document. The contractor must use an electronic, marine software program that includes descriptions of the Contractor's procedures for determining weights (Kgs), frame locations, deck levels as well as all equipment identification of the unit that is being replaced.
- 9.2 The Weight Control Program must be submitted to the Technical Authority and the Inspection Authority for review prior to each Progress Review Meeting.
- 9.3 The weight reports must have detailed items grouped in accordance with the system involved with the vessel (i.e. propulsion system). The weight report must accurately reflect the condition of the vessel within 10 days of the submittal date.

10.0 Cranage and Additional CCG Assistance

- 10.1 The Contractor must include pricing for 50 hrs. of cranage services (minimum 75 tonne - including a rigger, spotter and operator), 30 hrs. of man lift services (minimum 60ft. boom and including operator) and 30 hrs. of forklift services (minimum 5 tonne and including operator) to be used for additional surveys or requirements as requested by CCG in addition to the work detailed in this SOW. Unit hourly rates must be provided for adjustment by PWGSC 1379 based on actual additional assistance required.
- 10.2 The Contractor must provide a daily and weekly rate for the supply, connection, maintenance and disconnection/removal of a Compressed Air Line at a minimum of 100psig. If required, this line must provide continuous, uninterrupted air pressure. This total cost will be adjusted by PWGSC 1379 based on actual usage.
- 10.3 In addition to the gas freeing and tank watch requirements detailed throughout this SOW in various specification items, the contractor must also include pricing for 40 additional gas free certificates and a unit cost per gas free certificate for additional tank inspections requested by CCG outside of this SOW. The contractor must also include 24 hrs. of labour for tankwatch services. All gas freeing and tankwatch services must be provided by fully certified and trained professionals. The total cost will be adjusted by PWGSC 1379 based on actual certificates required and and tankwatch hours required.

11.0 Machining

- 11.1 The contractor must include an allowance of 200 machining hours at a blended rate for all shop equipment, including but not limited to milling machines, lathes etc. This allowance will be adjusted by PWGSC 1379 based on the total machining hours required

12.0 Ultrasonic Thickness (UT) Measurements

- 12.1 In addition to the UT measurements detailed throughout this SOW in various specification items, the contractor must also include pricing for 1,000 UT shots to be taken in various areas around the vessel as required by CCG. The contractor must include a unit cost per shot that must be inclusive of all cleaning/powertooling/labour required to take each individual shot. All UT shots must be taken by a fully certified, third party NDT organization. This cost will be adjusted by PWGSC 1379 based on the actual number of shots taken. All NDT carried out throughout this SOW must be included in the contractor's final report as detailed in the General section of this SOW item.

13.0 Cleanliness

- 13.1 While the vessel is under the Contractor's custody, the Contractor must be responsible for maintaining all work areas in a clean and safe manner. At the end of each working day the Contractor is to clean up and remove all garbage and debris from the vessel. The Contractor must maintain continuous safe and illuminated access throughout the vessel, including the engine room space, for CCG and TA inspections to be carried out.
- 13.2 Prior to transferring the responsibility vessel back to the custody of the Canadian Coast Guard, the Contractor will be responsible for returning, as a minimum, the vessel to the condition it was when it arrived at the Contractor's facility.
- 13.3 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 new defects or damage noted during this inspection must be recorded and compared against the digital images taken during the initial inspection (reference Part A of SOW General - Section 8.6.1)
- 13.4 The Contractor must repair at their expense, any damage or defects incurred as a result of the work carried out by the Contractor.

14.0 Vessel Security

- 14.1 As the vessel will be unmanned and under the care and custody of the shipyard, the Contractor must have the vessel fully secured within the Contractor's controlled

facility, where access to the vessel, whether in dry dock or alongside at a fit-out berth, is controlled through the shipyard's main guard house.

- 14.2 The Contractor's controlled facility, including the dry dock and fit out berth, must be fully fenced to prevent access to the vessel by the public. The vessel must be under constant 24-hour/day video surveillance with automatic recording of the vessel. Recording must be retained for a minimum of 48 hours. The video surveillance must be able to monitor all access points to the ship, and the vessel's mooring lines when alongside the Contractor's facility
- 14.3 The Contractor must also ensure that all the necessary provisions are in place to prevent damage to the vessel due to wind and wave action, tides, flooding, fire, and ambient temperature conditions.
- 14.4 In order to meet the above requirement, the Contractor must regularly monitor the mooring lines, at a minimum every 4 hours, and increase the frequency of the monitoring during adverse weather conditions.
- 14.5 The Contractor must also provide security rounds of the vessel, at a minimum of every four (4) hours, outside of the main working hours. These rounds must include a visual inspection of all compartments, regardless of whether work is taking place there or not. Any adverse condition(s) that could affect the vessel must be reported and actioned immediately.
- 14.6 Records of these rounds must be presented to the TA/IA, at a minimum, weekly or upon request.
- 14.7 Should rounds not be able to be performed at the minimum four (4) hours frequency, a remote sensing system, with alarms for fire, flooding and intrusion into the vessel must be installed and monitored at all times, 24/7.
- 14.8 The Contractor must have a call out system in place to respond to any emergency, that may arise, with personnel qualified to remedy the situation and prevent damage to the vessel. A copy of these emergency numbers and call outs must be supplied to the TA and IA.
- 14.9 Any damage incurred to the vessel as a result of the Contractor's failure to meet the above requirements will be repaired at the Contractor's expense.

15.0 Vermin

- 15.1 The Contractor must protect the vessel from infestation of rats or vermin for the duration of the contract period.

- 15.2 Should the vessel become infested with vermin whilst under the custody of the Contractor, the Contractor will be responsible for the extermination and removal of this vermin and provide, to the TA, the necessary certificates denoting same.

H-02 BERTHING, MOORING, DOCKING/UNDOCKING**1.0 General**

- 1.1 The Contractor must include provision of all material and labor required to handle, the docking, undocking, mooring, and the fit out of the vessel. The Contractor will be provided electronic versions of the stability books as part of the electronic files provided.
- 1.2 Details of the intended the Mooring facilities are to be included.
- 1.3 The Contractor must be responsible for the docking of the vessel accordance with the draft requirements of docking as provided in SOW item E-01 – Propulsion Generators and noted on Drawing 5659-101-002, entitled “Temporary accessibility plan for conversion (Deck Cut-Outs)”.
- 1.4 The Contractor must include the cost for five (5) keel block moves, and five (5) bilge block moves while the vessel is in dry dock. The Contractor must also provide a unit price per keel block move and a separate unit price per bilge block move for adjustment up or down by PWGSC 1379 action.
- 1.5 The Contractor must be responsible for the berthing and the mooring alongside of the vessel, for the duration of the contract period. All fendering must be supplied by the contractor. Canada must have unrestricted access to the vessel at all times.
- 1.6 The depth of water, when moored alongside, must be sufficient to prevent the vessel touching bottom under any tidal or low water conditions. The Contractor must ensure that there is sufficient water under the keel to allow propulsion system testing during dock trials.
- 1.7 The Contractor must supply all mooring lines and labor required in mooring, dock trials and “casting off” for the vessel. The Contractor may temporarily use the vessel's lines to tie up the vessel on its arrival but must immediately replace these with their own lines and remove the vessel's lines to dry storage.
- 1.8 The Contractor must supply all material and labor required to move the vessel including any vessel movements, provisions of tugs, and line handling personnel.
- 1.9 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of

discrepancy between content sources, the content in this SOW item must take precedence.

2.0 Docking

- 2.1 The Contractor must supply all labor, materials and facilities to safely dock and undock the vessel and to perform the work required for all of these specifications. The vessel will be delivered to the Contractor's facilities by the Canadian Coast Guard. All subsequent vessel moves will be the responsibility of the Contractor. The Contractor will be responsible for the handling of the vessel's mooring lines and tug assistance as required to perform the docking and undocking of the vessel and any other vessel movements required during the contract period. The Contractor is responsible for all associated fees.
- 2.2 The Contractor must provide proof that the docking facility is certified to dry dock a vessel with the particulars of the CCGS George R. Pearkes as defined in the General Section (Part A) of this SOW.
- 2.3 The Contractor must prepare the blocks and necessary shoring to maintain the true alignment of the vessel's hull and machinery throughout the docking period.
- 2.4 The Contractor is responsible for recording all tank soundings, draft, trim and list of the vessel, with the CCGTA in attendance, and performing the necessary stability calculations for the successful docking of the vessel. These calculations must be forwarded to the TA and the IA for review 48 hours prior to docking the vessel.
- 2.5 The vessel must be docked so that all docking plugs, transducers, anodes and sea inlet grids are clear and accessible. A minimum clearance of 1,600 mm (5.25 feet) must be available below the keel in accordance with drawing 5659-101-002 entitled Temporary Access Plan. Should any hull fittings be covered, the Contractor will be responsible for all labor and materials required for making alternative arrangements to drain tanks and/or move blocks to gain access to areas of specified work. The Contractor must refer to the Docking Plan provided.
- 2.6 The Contractor must provide a ground cable between the vessel and the dock while the vessel is docked as per TCMSS Ship Safety Bulletin 6/89.
- 2.7 Once set on the blocks in the drydock, the Contractor must ensure that the vessel will not be moved from its location in the drydock until all the underwater work has been completed and accepted.

3.0 Undocking

- 3.1 Before the refloating of the vessel, the Contractor must ensure that all tanks are re-filled to obtain the same conditions as found prior to docking.

- 3.2 The Contractor is responsible for the safe the undocking of the vessel taking into consideration the stability changes resulting from the work involved as part of these specifications. The Contractor must be responsible to perform the necessary stability calculations for undocking of the vessel to ensure that the vessel is refloated in an upright condition. These calculations must be forwarded to the IA and the TA for review 48 hours prior to flooding the dry dock.
- 3.3 The Contractor must, in conjunction with the CCG TA, ensure that all shipside openings, including valves, drains and docking plugs are secured and the vessel is watertight before flooding the dry dock.
- 3.4 The Contractor must ensure that all tanks that have had docking plugs removed have been pressure tested or vacuum box tested on hull after final installation of the plugs, with CCGTA in attendance, and a report given to CCGTA before undocking.
- 3.5 The Contractor must supply and install and remove upon completion, any necessary fittings and lugs necessary to carry out the work in this SOW item. Where lugs and/or fittings are installed and removed, the welds must be ground flush with the hull.
- 3.6 Any damaged and/or disturbed paint work must be treated in accordance with the paint manufacturer's requirements and painted according to the vessel's paint schedule for that area.

H-03 HULL CLEANING AND PAINTING

1.0 Scope

- 1.1 The intent of this specification item is for the Contractor to clean the entire hull, repair any defective paintwork and paint the ship's hull to the top of the bulwarks.
- 1.2 This work must be carried out in conjunction with the following specification items:
- H-06 Sea bay & Sea Chests
 - H-09 Hull Anodes
 - H-30 Bow Thruster Replacement
 - E-01 Propulsion Generator Replacement
 - E-02 Cycloconverter Replacement
 - E-03 Auxiliary Generator Replacement
 - E-04 Sterntube Bearing Wear-down
 - E-06 Port & Stbd Tailshaft, Bearing & Seal Surveys
 - E-07 Rudder and Rudder Stock Inspections
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- Society for Protective Coatings (SSPC) Standards

2.3 Drawings

- 555-H-0026 – Capacity Plan
- 555-H-0022 – Docking plan
- 555-H-0023 - GA
- CCG Fleet Identity Program Guide

3.0 Owner's Supplied Equipment.

- 3.1 CCG will provide a NACE level II Coatings Inspector, who will be part of the CCG On-site team, to oversee all painting required by this SOW item. The Contractor will be responsible to ensure that all surface preparation, paint applications, dry film thickness, etc. are to the satisfaction of the NACE Inspector.
- 3.2 It is the Contractor's responsibility to arrange for the CCG NACE inspector to be present at the required times to inspect the surface preparation, level of cleanliness and all paint applications. Coatings applied at each stage must also be to the satisfaction of the CCG NACE Inspector and be approved prior to the applying the next coat.

4.0 Encapsulation

- 4.1 Should the environmental and steel temperature conditions, required by paint manufacturer, not be met then the Contractor will be responsible for encapsulating the defined work areas and provide sufficient heat (forced air) to meet the temperature and humidity requirements of the paint being applied.
- 4.2 The cost of this encapsulation must be included and will form part of the contractor's total evaluated price. This cost must include the installation and removals and all fuel needed to maintain the required temperatures during the whole course of the paint applications. If this shelter is not required, this cost shall be credited back to Canada by PWGSC 1379.
- 4.3 The Contractor is to note that the presence of lead has been detected in the vessels hull coatings in the past. Therefore, the Contractor must strictly follow all federal and provincial regulations when carrying out the removal and disposal of these coatings. All costs related to the sheltering of the vessel or containment and disposal of paint, debris or related materials must be included in the contractor's firm pricing for this specification item.

5.0 Technical

5.1 General

- 5.1.1 Within twelve (12) hours of docking, the entire underwater hull, including the areas above the waterline up to the top of the bulwarks, rudders, propellers and the

thruster tube must be cleaned by high pressure fresh water washing (7,500 PSI minimum) to remove all marine growth, and allow for a preliminary hull inspection.

- 5.1.2 The Contractor must ensure that all marine growth, salts, and surface contaminants are removed and disposed of in accordance with local regulations.
- 5.1.3 Prior to commencing the hydro blasting, all hull mounted equipment and openings must be fully protected from physical and water damage. This is to include but not be limited to the following:
- Four (4) anodes
 - Two (2) reference electrodes
 - Two (2), echo sounders
 - One Speed log
- 5.1.4 The aforementioned items must be suitably protected against damage during cleaning of the hull, abrasive blasting and application of new coatings. All protective coverings must be removed upon completion of all work
- 5.1.5 The Contractor must provide a cost to supply and apply hull filler putty (International Interguard 822) around the echo sounder plates, speed logs, anodes and cathodes, and any slot welds in way of the stern post or rudder. Putty is to be faired and feathered around each of the aforementioned to insure smooth laminar flow of water when the vessel is in the water and underway.
- 5.1.6 The TA, CG NACE Inspector, the attending ABS Surveyor and a Contractor's representative will inspect the entire hull and the existing hull coatings and determine the extent of any bare areas requiring repair. Such areas must be agreed upon by the both the Contractor and the TA.
- 5.1.7 The Contractor must take precautions to ensure that no damage, unnecessary cleaning, or repairs will accrue from abrasive blasting and/or the application of coatings.
- 5.1.8 Grit used for blasting must not be allowed to enter any part of the vessel or its exposed equipment, and where such ingress may occur, the equipment must be suitably protected.
- 5.1.9 Prior to grit blasting the hull, the Contractor must temporarily mark the original location of each hull symbol so that the GSM decals may be applied. The Contractor must fix these decals in place, in their subsequent original locations, upon completion of all coatings.
- 5.1.10 The Contractor must ensure that all deck scuppers and overboard discharges are plugged or are diverted to prevent any liquids from contaminating areas being prepared or coated.

5.1.11 Measures must be taken to ensure that the following surfaces, areas, and equipment are protected from grit blasting or overspray:

- sterntubes
- seabay and seachests
- overboard discharge valves
- machinery spaces
- funnel outlets
- searchlights
- navigation equipment
- air intake plenums and air intake and exhaust trunking;
- accommodations air intake and exhaust plenums and trunking
- barge, lifeboat, FRC
- deck machinery including crane and winches\
- exposed steel wires for davits, winches, etc.
- rudder trunk void
- any inlets or discharges will not be blocked by the coating or grit.

5.1.12 The Contractor must be responsible for removing any over spray as a result of this work. Deck machinery and other equipment, susceptible to damage, by grit or coating material, must be adequately protected at all times.

5.1.13 Seabay grids must be protected during application of all coatings. Orifice diameters must be recorded prior to first coating and verified by Contractor as original before undocking (i.e. not blocked or reduced).

5.1.14 The Contractor is responsible for ensuring that the hull is clear and clean prior to, during, and immediately after the coating application.

5.1.15 The underwater area of the ship's hull and rudder is presently coated with an International Inerta 163 coating from the keel to the top of the ice belt. The ice belt then continues from the anchor pocket.

5.1.16 New coatings must be applied with the atmospheric and steel temperature conditions acceptable to paint manufacturer and the CCG NACE Inspector. Environmental and temperature conditions must be measured and recorded daily, by the Contractor, and prior to starting any painting, in any area. Typed copies of these environmental reports are to be submitted to the TA. Should the environmental conditions be outside the paint manufacture's recommendations painting is not to take place until the correct conditions can take place.

6.0 Underwater Hull Painting - Keel to Ice Belt

- 6.1 The underwater hull area is defined as the area from the keel to the 4.7m draft mark (Forward and Aft). It is the responsibility of the contractor to determine and confirm the entire surface area of the underwater hull surface area.
- 6.2 Identified damaged areas, approved for repairs must be prepared and coated as follows:
- a) Dry abrasive blasting to bare steel condition of Sa2½ ISO 8501-1 or SSPC-SP10 standards.
 - b) Coating edges must be feathered back a minimum of 300mm.
 - c) The surface profile must have a minimum roughness of 2-3 mils for feathered back areas. Surface profile required on the bare metal of 3-4 mils.
 - d) Using compressed air, sweep clean all traces of grit.
 - e) Apply Black Inerta 163 to 20 mils DFT before visible oxidation occurs. If oxidation does occur, the entire oxidized surface must be re-blasted to the standard specified above at Contractor's expense.
- 6.3 The Contractor must quote on repairing 15% of the underwater hull coating as described above. Cost for Mobilization / Demobilization of equipment/personnel. A unit price per square meter must be provided for adjustment purposes by PWGSC 1379.

7.0 Ice Belt Including Anchor Pocket

- 7.1 The Ice Belt is defined as the area from the 4.7m draft mark (Forward and Aft) to the 7.2m draft mark (Forward and aft). It is the responsibility of the contractor to determine and confirm the entire surface area of the ice belt/anchor pocket areas.
- 7.2 Identified damaged areas (including the anchor pockets), approved for repairs must be prepared and coated as follows:
- a) Dry abrasive blasting to bare steel condition of Sa2½ ISO 8501-1 or SSPC-SP10 standards.
 - b) Coating edges must be feathered back a minimum of 300mm.
 - c) The surface profile must have a minimum roughness of 2-3 mils for feathered back areas. Surface profile required on the bare metal of 3-4 mils.
 - d) Using compressed air, sweep clean all traces of grit.

- e) Apply International Inerta 163 (Coast Guard Red - RAL 3000 & Black) to 20 mils DFT before visible oxidation occurs. If oxidation does occur, the entire oxidized surface must be re-blasted to the standard specified above at Contractor's expense.

- 7.3 The Contractor must quote on repairing 15% of the Ice Belt coating as described above. Final cost must be adjusted per costs provided for Mobilization/Demobilization of equipment/personnel plus a unit price per square meter to be adjusted by PWGSC 1379.
- 7.4 Upon the completion of touch up repairs, the entire ice belt and anchor pocket area must be grit blasted to SP-7 to obtain a suitable profile. The entire area must then be coated with 1 full coat of Inerta 163 (Coast Guard Red – RAL 3000 & Black) at 10 mils DFT.
- 7.5 The Contractor must ensure all coatings are applied in strict accordance with the manufacturer's instructions and to the CCG NACE Inspector's satisfaction.

8.0 Above Waterline Hull Area

- 8.1 The vessel's above water hull area is defined as all hull areas above the 7.2m draft mark, minus the anchor pocket. It is the responsibility of the contractor to determine and confirm the entire surface areas of the above waterline hull.
- 8.2 Identified damaged areas of the above water hull, approved for repairs must be prepared and coated as follows:
 - a) Dry abrasive blasting to bare steel condition of Sa2½ ISO 8501-1 or SSPC-SP10 standards.
 - b) Coating edges must be feathered back a minimum of 300mm.
 - c) The surface profile must have a minimum roughness of 2-3 mils for feathered back areas. Surface profile required on the bare metal of 3-4 mils.
 - d) Using compressed air, sweep clean all traces of grit.
- 8.3 Apply paint scheme as follows:
 - 8.3.1 Two (2) coats Interprime 234 at 3 mils per coat. NOTE: The Contractor must apply the primer coat before visible oxidation (flash rusting) occurs. Should oxidation does occur, the entire oxidized surface must be re-blasted to the standard specified above, at Contractor's expense.
 - 8.3.2 One (1) coat of International Interlac 665 (Coast Guard Red - RAL 3000) at 3 mils.

- 8.3.3 The Contractor must quote on repairing 15% of the Above Water Hull coating as described above. Final cost to be adjusted per costs provided for Mobilization/Demobilization of equipment/personnel plus a unit price per square meter as described above.
- 8.3.4 The Contractor must coat the entire above water hull area with one coat of International Interlac 665 (Canadian Coast Guard Red - RAL 3000) at 3 mils.
- 8.3.5 The Contractor must remove the helicopter deck net and stanchions, fit temporary stanchions to helicopter deck and fit rope to protect yard/ship personnel from falling overboard.
- 8.3.6 The Contractor must grit blast and paint the twenty-seven (27) removed stanchions to SSPC-SP7 standards, having a minimum profile of 3 mils, in preparation for application of coatings as follows:
- i. One (1) stripe coat of Intershield 300 (5 mil DFT).
 - ii. One (1) full coat of Intershield 300 (5 mil DFT).
 - iii. One (1) stripe coat of White (RAL 9003) Interthane 990 (2.5 mil DFT).
 - iv. One (1) full coat of White (RAL 9003) Interthane 990 (2.5 mil DFT).
- 8.3.7 All traces of grit used for blast cleaning must be removed by the Contractor. The Contractor is responsible for ensuring that the hull is clear and clean prior to, during, and immediately after the coating application.
- 8.3.8 The Contractor is to refer to the CCG Fleet Federal Identity Program Guide to verify all markings and symbols required on the vessel.
- 8.3.9 The Contractor must add a white diagonal stripe, joining the forward end of the superstructure, extending 5.66m aft. The stripe must extend to the waterline, on a 30° vertical angle, tilted aft. The product used for this stripe must be two (2) coats of Interlac 665 (White - RAL 9003) at 3 mils DFT.
- 8.3.10 A 190 mm wide black line must be painted along the forward and aft edges of the diagonal white stripe. The product used for this line must be two (2) coats of Interlac 665 Black - RAL 9004) at 3 mils DFT.
- 8.3.11 The Contractor must install the four (4) Coast Guard supplied hull symbol decals in the locations as identified in the CCG Fleet Federal Identity Program Guide.
- 8.3.12 The Contractor must paint the following hull markings, using Interlac 665 (White - RAL 9003) and apply this paint as two (2) separate coats at 3 mils DFT.
- Draft marks,
 - Load lines,

- Thruster symbols, and
- All government symbols, names and icons

8.3.13 The Contractor must remove all protective materials from the machinery, equipment and hull openings on completion of the coating work. All grit, dirt, debris, rust, scale, etc. must be removed from all decks and areas of accumulation and disposed of ashore by the Contractor. Contractor is responsible for all disposals and copies of all disposal certificates are to be provided to the TA.

9.0 Inspections, Tests and Trials

9.1 Inspections

9.1.1 The Contractor must allow the NACE Inspector to inspect the all components for surface preparation, cleanliness and for each paint application of the coating system. This is also to include but not be limited to the environmental conditions, steel surface temperatures, equipment, mixing and the application processes.

9.2 Tests

9.2.1 As a minimum the Contractor is to arrange take sixty (60) wet film thickness measurements; thirty (30) per side, in areas where hull has been cleaned to bare steel. These measurements must be witnessed by the CCG NACE inspector and recorded with locations referenced to the attached shell expansion drawing. Unwitnessed measurement will not be accepted.

9.2.2 Using a calibrated DFT gauge, a minimum fifteen (15) measurements per 9.28 m² (100 ft²) must be taken and recorded, at an agreed upon consistency with the TA and the GG/ NACE Inspector.

10.0 Deliverables

10.1 Drawings/Reports

10.1.1 The Contractor must provide the TA with a final report, consisting of two (2) typewritten copies and one (1) electronic copy, in PDF format – containing the following information as the minimum:

- The areas on the ice belt and above waterline hull that were repaired.
- The areas that were blasted, the blast media type and air pressure.
- The areas that were coated, with what product, and the volume of coating used.
- A list of batch numbers with corresponding dates of manufacture.
- The record of quantity and type of any solvent added.

- Measured and recorded of all of the daily ambient conditions (air and steel temperature, humidity, barometric pressure).
- Recoded details of all spray tips and pressures used.
- All WFT and DFT readings taken as prescribed in this specification.

10.2 Certification

10.2.1 Typed copies of the inspections reports must be provided to the TA after completion of the work.

H-04 BILGE CLEANING AND PAINTING

1.0 Scope

- 1.1 The intent of this SOW item must be to clean and paint the listed bilges including tank tops, framing, equipment supports and piping. The work area extends from the deck plate level to tank tops and bilge wells.
- 1.2 This work must be carried out in conjunction with the following SOW items :
- E-01 – Propulsion Generator Replacement
 - E-02 – Cycloconverter Replacement
 - E-03 – Auxiliary Generator Replacement
- 1.3 Listed areas are: Generator room bilge, propulsion motor room bilge, and Sewage room bilge.
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 The following list of Guidance Drawings/Nameplate Data are provided as references for the Contractor when performing the following work:
- 555-H-0026 – Capacity Plan
 - 555-H-025 – GA Decks
 - H-0004 – Engine Room Flats
 - 555-H-2740 - W.T. Manholes and W.T. Access and Escape Hatches
 - 50-00-001_01 & _02 – Machinery Arrangements 1 & 2
 - 50-00-03_01 & _02 – Machinery Arrangements Sectional 1 & 2
 - 67-30-01 – Air and Soundings Diagram

- Interbond 998 Product Description & Application Guidelines

2.2 Standards

2.2.1. The following list of Standards are provided as references for the Contractor when performing the following work:

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

2.3.1. The following list of Regulations are provided as references for the Contractor when performing the following work:

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

2.4.1 The Contractor must be responsible for providing all materials, equipment, and parts required to perform the specified work unless otherwise stated.

2.5 Interferences

2.5.1 The Contractor is responsible for the identification of all visible interference items, their temporary removal, storage, and refitting to the vessel.

3.0 Technical Description

3.1 General

3.1.1 The bilge deck plates are to be removed prior to cleaning for access to the bilges and locations marked, and installed after work and inspections are completed. The contractor must coordinate this work with the various other SOW items being carried out in the machinery space areas.

3.1.2 Mechanical ventilation must be provided to exhaust fumes to the exterior of the vessel and must remain operational for the duration of the specified work.

3.1.3 All electrical boxes, electrical wiring, motor junction boxes, lighting, FM 200 fire suppression system and nozzles, propulsion motors, cooling fans, bearings, electric motors and pumps, and general engine room machinery must be covered to prevent the ingress of dirt, dust, water or paint. The protective covering(s) are not limited to the above as all machinery in and around the bilges must be protected by the Contractor.

3.1.4 The CCG IA must inspect the areas prior to cleaning to ensure all equipment is covered. Any ingress of water or damage to any equipment caused thereby will be corrected by the Contractor at their expense.

3.1.5 The areas to be dealt with are as follows:

Generator Room

- Fwd and Aft Bulkheads
- Side Bulkheads
- Tank top
- All Framing and Structural Members
- All under deck structure, piping, brackets, hangars, fittings etc.

Motor Room

- Fwd Bulkhead
- Aft Bulkhead

- Bilge Flat Surface
- All Framing and Structural Members
- All under deck structure, piping, brackets, hangars, fittings etc.

Sewage Compartment

- Fwd Bulkhead
- Aft Bulkhead
- Bilge Flat Surface
- All Framing and Structural Members
- All under deck structure, piping, brackets, hangars, fittings etc.

Note: The contractor is responsible for determining the total surface areas of the locations as listed above.

3.2 Cleaning

- 3.2.1 The listed rooms must be sealed off and water and debris from the cleaning must be contained and cleaned up continuously during the cleaning process of the work.
- 3.2.2 Any splashing of dirt, debris, oily sludge or other substance onto any area above or beyond areas dealt with is to be contained and limited to as great a degree as is reasonably practical. Any areas so affected are to be cleaned by the Contractor. All areas are to be left in a clean condition.
- 3.2.3 The Contractor is to note that the bilges are extremely dirty with oil, grease, and other dirt build up over the years. These areas require extensive cleaning. The bilges extending from the forward engine room bulkhead to the aft end of the sewage room bulkhead must be power washed with high pressure water at minimum pressure of 3,000 psi and strong degreaser agent. The surfaces must be brushed with (Turks head style brush) following the application of the degreaser to loosen the dirt and then power washed with water. The areas must include all bulkheads, stiffeners, support framing, and piping in the bilge. (Piping under deck plates) All areas must be thoroughly degreased with suitable solvent cleaner and high pressure washed to SSPC-SP-1 standard.
- 3.2.4 All areas of loose scale or accumulated sludge are to be hand scraped as required to facilitate removal of same.
- 3.2.5 All sludge, scale and accumulated debris in all suction wells and frame spaces in which various suction pipes are located must be removed and disposed of ashore.
- 3.2.6 All pipes must be inspected, and damaged pipe must be brought to the attention of the CCG TA for remedial action. Any pipe work found requiring repair or needing

replacement, that has not already been addressed by another specification in this in this refit must be addressed via PWGSC 1379.

- 3.2.7 All debris resulting from the repair work must be removed from the vessel and discarded according to provincial and federal regulations.

3.3 Painting

- 3.3.1 Prior to the start of the paint applications, all locations and bilges in the defined areas are to be inspected by the CGTA and NACE inspector as per section 4.1.1 of this SOW item.
- 3.3.2 Once found satisfactory all the noted areas of failed or failing coatings, scale and bare steel must be power tool cleaned to an SP-3 standard.
- 3.3.3 All loose paint, scale and rust must be removed and edges feathered back to sound, adhered coatings. The Contractor must assume 40% of the entire area will require repairing to an SP-3 standard back to sound, adhered coatings. These bare areas requiring repair will require a touch up spot coat of International Interbond 998 Grey at 14 mils. The Contractor must provide a separate unit cost per square foot for scraping, cleaning and coating to be adjusted by PWGSC 1379 based on the actual repair areas
- 3.3.4 All areas of intact coating must be prepared as necessary for proper surface profile for adhesion as per the manufacture's instructions. All work areas must be adequately ventilated to exterior of ship to prevent dust from surface prep from migrating to other areas within machinery space and/or contaminating machinery in the space.
- 3.3.5 All fluids and debris from cleaning effort must be removed from the vessel and discarded according to provincial and federal regulations.
- 3.3.6 All unused brackets and other redundant outfit must be removed from areas dealt with. The Contractor must include an allowance of eighty (80) man hours for this requirement. The CCG TA will confirm with the contractor which unused brackets be removed under the allowance. If the removal of this redundant hardware is to exceed the allotted time allowance, it is to be brought to the attention of the CCG TA prior to continuing on with the removals. The CCG TA will decide if the work is to continue and this will be dealt with via PWGSC1379 action.
- 3.3.7 The Contractor must notify both the CCG TA and the vessel's CCG IA, of any severely corroded and pitted structural areas discovered during the surface preparation. All repairs required, that have not already been identified elsewhere in other SOW items of this refit, will be done via PWGSC 1379 action.
- 3.3.8 All valve bonnets must be wrapped and taped with suitable protective material.

- 3.3.9 All electrical cabling identification tagging must be taped to prevent damage and overspray.
- 3.3.10 Means of paint application must be via airless spray and over spray must be limited and contained. Any over spray on structure or machinery above deck plate level must be top coated to original colour scheme.
- 3.3.11 After the completion of spot repairs as detailed in section 3.3.3 above, the entire surface area must receive one (1) stripe Coat, covering all hard edges and welds, with International Interbond 998 Grey. After the stripe coat is cured, the entire area must receive one (1) full coat of International Interbond 998 at 14 mils. Note: A topcoat must be applied to Interbond within specific time period as specified by manufacturer for proper adhesion. Final coat must be white in colour. All paint applications are to be inspected as per section 4.1.1 of this SOW item.
- 3.3.12 After all coating applications are completed and cured, all taping and other protective materials must be removed and disposed of by the contractor.
- 3.3.13 A unit cost per ft² must be provided by the Contractor should additional painting be required outside of the defined scope of work. Addition painting requirements will be dealt via PWGSC 1379 action.

3.4 Piping

- 3.4.1 In conjunction with the cleaning of the mechanical bilge areas detailed in Section 3.1.5, the contractor must inspect all temporarily removed bilge piping and pressure wash the internals with hot water at 3,000 PSI to remove all blockages prior to re-installing on the vessel. The contractor is responsible for cleaning and disposing of all water and debris.
- 3.4.2 The contractor must also include in their pricing an allowance of \$25,000.00 for the fabrication of any sections of existing piping determined to be in poor condition after its temporary removal. Any UT testing requirements must be carried out by a certified, third party, NDT organization and costs will be taken out of the UT thickness measurement allowance detailed in section 12.0 of SOW item H-01 – Services.
 - 3.4.3 All new piping must be air tested to the satisfaction of the CG TA and ABS inspector in the contractor's shop prior to installation on the vessel, and all welds must be tested with 100% MPI. Piping must be installed with all new gaskets, stainless fasteners and coated with two coats of marine primer and a suitable top coat.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All cleaned and prepared surfaces must be inspected by CCG's NACE Certified Coating Inspector and the CCGTA prior to and after the application of each coating.
- 4.1.2 Thickness measurements must be taken between coatings to ensure manufactures recommended DFT readings are being obtained.

4.2 Testing

- 4.2.1 Prior to starting any painting, the Contractor must be responsible for recording the environmental conditions and temperatures (both ambient as well as steel surface temperature) to ensure that the paint application(s) is being applied in accordance with the manufacturer's requirements for the type of paint being used. Contractor must not apply any paint applications should these requirements be exceeded.
- 4.2.2 Any section of new piping required must be blanked and pneumatically tested in the contractor's shop prior to installation on the vessel. All welds must be tested with 100% MPI.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The Contractor must provide a Quality Assurance (QA) type written final report recording the humidity and air/surface temperatures pre-coating and during coatings cure times, DFT's of each paint coating application, Batch numbers with corresponding dates and details of all spray tips and pressures used.
- 5.2.2 Three (3) hard copies and one electronic copy of these aforementioned reports must be provide to the CG TA.
- 5.2.3 NDT reports must be provided to the CG TA for all NDT carried out as part of this specification item.

H-05 HULL INSPECTION AND WELDING

1.0 Scope

- 1.1 The Coast Guard has a requirement to inspect the entire hull by both the TA and the attending ABS Surveyor.
- 1.2 This work must be carried out in conjunction with the following SOW items:
- H-04 Hull Cleaning and Coating
 - H-06 Sea bay, Sea chests and Strainer Inspections
 - H-30 Bow Thruster Replacement
 - E-04 Sterntube Bearing Wear-down
 - E-06 Tailshaft, Bearing & Seal Surveys
 - E-07 Rudder and Rudder Stock
 - E-01 Propulsion Generator Replacement
 - E-02 Cycloconverter Replacement
 - E-03 Auxiliary Generator Replacement
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction

- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- CCG Welding Specification CT-043-EQ-EG-00
- Society for Protective Coatings (SSPC) Standards

2.3 Drawings

- H-0002 – Framing Expansion
- 555-H-0022 – Docking Plan
- 555-H-0023 – GA

2.4 Contractor Furnished Equipment

- 2.4.1 Unless otherwise stated, all materials, labour, and equipment required to complete all requirements of this SOW item must be supplied by the Contractor.
- 2.4.2 The Contractor must provide the use of a certified man-lift (with operator) for two working days.
- 2.4.3 All equipment required for test and inspection must be calibrated and certified and copies of certificates are to be provided to the TA.

3.0 Technical Description

- 3.1 The Contractor is responsible for arranging all inspections and must consult with the ABS surveyor, prior to commencement of work, to determine an inspection schedule. At each inspection point, the Contractor must advise the TA, in advance, to allow his/her attendance.
- 3.2 The Contractor must quote separately on the preparation and repairs to one hundred (100) linear feet (30.48 m) of butt and seam welding on the vessel's hull.
- 3.3 A liner foot is to include fifteen (15) passes on Grade "E" steel, for a total of 1,500 bead feet. The quote must include any staging or man lifts required for the repairs.
- 3.4 The Contractor must also provide a quotation per bead foot of welding, as well as per additional linear foot of gouging – this unit cost must include any staging or man lifts required for the repairs.
- 3.5 The Contractor must not apply any hull coatings (above or below waterline) until ABS Inspector has completed the required inspection, and TA has provided permission to proceed. The Contractor must complete all repairs as outlined in the ABS inspection report and allow for a follow up inspection prior to coating. The Contractor must notify the TA and ABS Inspector prior to the application of any coatings.

- 3.6 All work must be conducted on the vessel's outer hull; as hot work is required, tank access will be required to access the interior surfaces of the hull plating. Contractor is to ensure that all such spaces are gas reed prior to any exterior welding taking place.
- 3.7 There are no known exterior interferences. It is the Contractor's responsibility to identify any visible interference items for the known scope of work.

4.0 Proof of Performance

- 4.1 All work must be carried out to the satisfaction of the TA and attending ABS Inspector.
- 4.2 Testing
 - 4.2.1 The Contractor must include the cost of 24 hours of non-destructive MPI testing on the new welds; location of these tests will be as directed by the attending ABS Surveyor.
 - 4.2.2 The Contractor must provide a unit cost for 20 x-ray tests, should ABS require it. The unit cost must be all-inclusive and must include all expenses for travel, living and NDT testing/reporting services.

5.0 Deliverables Drawings/Reports

- 5.1 The Contractor must provide the TA with a final report, consisting of two (2) typewritten copies and one (1) electronic copy, in PDF format. At a minimum, the report must include a listing of all welds performed, locations and results of all readings taken, NDT readings, a marked-up shell expansion drawing showing the location of the repaired welds, certificates, results/recommendations, etc. identified in this specification item.
- 5.2 Certification
 - 5.2.1 The Contractor must contact ABS and arrange for all required inspections in order to gain surveyor certification for Division 3 survey item 3LL040.

H-06 SEA CHEST AND SEA BAY INSPECTIONS

1.0 Scope

- 1.1 The Sea bay and Sea Chests require entry for Cathodic Protection system installation. The intent of this SOW item is to detail the work required to open up and clean the Sea Chests and the Sea bay; this work is to be carried out in conjunction with SOW Items H-03 - Underwater Hull Cleaning and Painting & H-07 – Sea Water Vent Lines.
- 1.2 This work must be carried out in conjunction with the following SOW items:
- H-03 Hull Cleaning and Coating
 - H-07 Sea Water Vent Lines
 - H-08 AF & ICCP System Servicing
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 The Sea Chests are located as follows:
- Propulsion Generator Room
 - Port High Sea Suction – Frm. 96-106 TC/MS Field #3L118
 - Port Sea Suction – Frm. 96-106 TC/MS Field #3L120
 - Starboard High Sea Suction – Frm. 96-106 TC/MS Field #3L119
 - Starboard Sea Suction – Frm. 96-106 TC/MS Field #3L121
 - R.O. & Distiller Sea Bay – Frm. 102-106 TC/MS Field #3L117
 - Propulsion Motor Room Aft Sea Chest - Frm. 51-53 TC/MS Field #3L122
 - Stern tube Suction – Frm. 38

3.0 Technical Description

- 3.1 The sea strainers, port & starboard are to be opened up; this will involve disconnecting the sea strainer vents & drains. The cover gaskets are to be

inspected by the Owner's representative and reused if satisfactory; replacement, if deemed necessary, is to be by PWGSC 1379 action. The sea strainer grids are to be removed and cleaned, by hand wire brushing, to remove any marine growth or corrosion.

- 3.2 After inspection by the Owner's representative (or designate), the sea strainer covers are to be replaced; anti-seize compound is to be used on all fasteners. Vents and drain piping is to be reconnected.
- 3.3 The grids and manhole covers are to be removed from all Sea Chests and Sea bays for cleaning and inspection. The grids and inlet areas are to be cleaned and grid holes are to be mechanically reamed to the original diameter.
- 3.4 The Contractor is to inform the Owner's representative when the Sea Chests are opened up, but prior to cleaning. The Sea Chests will then be inspected by the Owner's representative. The contractor must supply and install all necessary staging and scaffolding as required.
- 3.5 The Contractor must thoroughly clean the Sea Chests using high pressure water jets; minimum pressure is to be 3000 PSI. The Contractor must then hand scrape any loose, flaky coatings and powertool loose edges to feather back to adhered coatings. After inspection by the Owner's representative the spaces are to be given two (2) coats of Intershield ENA 300 of differing colours (.006" DFT each); each coat is to be witnessed by the Owner's representative (or designate). The Contractor is to provide costs for repairing 60 m² of coatings in the sea chests as detailed. It is the responsibility of the contractor to determine and confirm the total surface area of the sea chests. The TA and the Canadian Coast Guard supplied NACE inspector must inspect the area prior to coating, and before and after each coat to ensure conditions are suitable for painting, and DFT measurement requirements are being met.
- 3.6 The Contractor must replace all the sacrificial zinc anodes mounted in the Sea Chests. The Contractor to provide the cost for replacing twenty-three (23), 48 pound anodes in the sea chests. The Contractor to supply a unit cost for additional anodes for adjustment via PWGSC 1379.
- 3.7 The anodes to be supplied and installed in the aft sea chests will require minor contractor modifications prior to being fitted and installed on the vessel.
- 3.8 Sea Chest access grids are to be closed up, using thirty-four new 3"X ¾" UNC stainless steel bolts; the bolts are to be locked by tack welds. The thirty-four captive ¾" UNC stainless steel nuts inside the Sea Chests are also to be replaced.
- 3.9 All manholes to be closed up, using new ¼" neoprene gaskets and new nuts and washers; the Contractor is to quote on replacing 10 studs, with a unit cost per stud to be adjusted by PWGSC 1379 based on the final number.

- 3.10 The Main Sea bay (TC/MS Field #3L123) is located in the Propulsion Generator Room, Fr 96-102; it is accessed via a manhole at Fr 96. The docking plug(s) will have been removed as part of SOW Item H-02 - Berthing, Mooring, Docking / Undocking.
- 3.11 The manhole cover must be removed and the space thoroughly cleaned using high pressure water jets with a minimum pressure of 3,000 PSI. The Contractor must then hand scrape any loose, flaky coatings to bare metal and powertool loose edges to feather back to adhered coatings. All debris is to be removed ashore at the completion of each day's work. After initial cleaning, the Seabay must be inspected by the CCG TA and ABS surveyor. The Contractor must provide costs for repairing 100 m² of the sea bay as detailed above and coating each of these bare/powertooled areas with a coat of Intershield ENA 300 at 6 mils thickness. It is the responsibility of the contractor to determine and confirm the total surface areas of the Sea Bay. The CCG TA and the Coast Guard supplied NACE inspector must inspect the area after prep work is complete (prior to coating) and after the touch up coat is complete and cured. The contractor must ensure that all conditions are suitable for a painting, and DFT measurements are being met.
- 3.12 After the initial inspections and the initial repair/touch up coat is complete, the Main Sea bay is to be given two full coats of Intershield ENA 300 of differing colours (0.006" DFT each); each coat is to be witnessed by the Owner's representative (or designate).
- 3.13 The Contractor must replace all the sacrificial zinc anodes mounted in the Sea Bays. The Contractor must provide the cost for removing and installing eighteen (18), 22 pound zinc anodes. The Contractor must supply a unit cost for additional anodes for adjustment via PWGSC 1379.
- 3.14 Upon completion of all inspection and repair work, the docking plug and manhole cover are to be re-installed, using new jointing and new galvanized fasteners on the manhole cover (twenty-six (26) $\frac{3}{4}$ " nuts) and new neoprene gaskets.
- 3.15 The entire internal seabay/seachest area and related piping must be hydro tested to the satisfaction of the CCGTA and ABS surveyor. It is the responsibility of the contractor to supply all blanks, blinds, fittings, hoses, water etc. as required to successfully carry out this test prior to the vessel undocking.
- 3.16 The Contractor must supply all labour, materials, to complete this SOW item.

4.0 Proof of Performance

- 4.1 The Contractor is responsible for arranging all inspections and must advise the Owner's representative, ABS surveyor and NACE inspector in advance to allow

his/her attendance. All work must be carried out to the satisfaction of the ABS surveyor, NACE inspector and the CCG TA.

- 4.2 The final hydro test as detailed in line 3.15 above must be successfully carried out to the satisfaction of the CCG TA and ABS inspector. Any leaks found or repairs required due to the contractor's work must be effectively corrected by the contractor at their expense. The CCG TA must do a final inspection on the seabay/seachest areas after the final testing and before the contractor completes the final close up of these areas.

5.0 Deliverables

- 5.1 At undocking, the Contractor is to carry out leakage inspections and check for any ingress of water. Any leakage is to be corrected immediately, prior to undocking the vessel.
- 5.2 Drawings/Reports
 - 5.2.1 The Contractor must provide a Quality Assurance (QA) type written report recording the humidity and air/surface temperatures pre-coating and during coatings cure time as well as the DFT of each paint coating application.
 - 5.2.2 Three (3) hard copies and one electronic copy of these aforementioned reports, must be provide to the CCG TA.

H-07 SEA WATER VENT LINES

1.0 Scope:

- 1.1 The intent of this SOW item is to have the sea bay and sea chest vent lines renewed from their connections at tank tops to minimum of 3 feet above the tween deck level. This must be carried out in conjunction with SOW item H-06 – Sea Chest and Seabay Inspections.
- 1.2 The Contractor must remove, supply, fabricate and install new piping and fittings for the sea water vent lines. All new piping must be schedule 80 hot dip galvanized, connection fittings must also be schedule 80 hot dip galvanized.
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 2.1.1 The following list of Guidance Drawings are provided as references for the Contractor, when performing the following work:

- 67-30-01 – Air and Soundings Diagram
- H-0004 – Engine Room Flats
- 555-H-2740 – W.T. Manholes & W.T. Access and Escape Hatches
- 50-00-001_01 & _02 – Machinery Arrangements 1 & 2
- 50-00-01_01 & _02 – Machinery Arrangements Sectional 1 & 2

2.2 Standards

- 2.2.1 The following list of Standards is provided as references for the Contractor, when performing the following work:

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures

- Coast Guard ISM Lock out Tag out Procedures
- Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504, 60332-3, 60364-5-52, 60533, 60754-0, 1, 2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standard
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

2.3.1. The following list of Regulations is being provided as references for the Contractor, when performing the following work:

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

2.4.1 The Contractor must be responsible for the supply of all labour, materials, equipment, and parts required to perform the specified work, unless otherwise stated.

3.0 Technical Description

3.1 General

3.1.1 The Contractor must remove the existing seawater vent lines from their connections at the ship side isolation valves to approximately three (3) feet above the Engine Room tween deck.

3.1.2 The following vent lines are to be replaced:

- Port and Starboard Sea bay Vents
- Port and Starboard Lower Sea Chest
- Port and Starboard Upper Sea Chest
- Evaporator/Reverse Osmosis Sea Chest
- Aft Sea chest
- Stern Tube Cooling Sea Chest
- Port and Starboard Sea Bay Strainer Vents

3.1.3 All new vent line piping must be constructed with Schedule 80 hot dip galvanized seamless steel pipe.

3.1.4 All measurements provided are approximate and the Contractor must be responsible for verifying all measurements.

3.1.5 All connection fittings such as elbow, tee's, etc. must be socket welded schedule 80 hot dip galvanized. Welds must receive 100% MPI testing and 100% Visual inspection by a certified third party NDT organization.

3.1.6 Each section of vent piping must be fabricated in sections to allow for easy removal in the event of failure. Joining connections at these removal points must be ABS approved grooved Victaulic, or grip style such as Straub or Teekay.

3.1.7 All new piping sections installed must be supported to preventing sagging and vibration. The contractor must supply and install all new pipe hangars and brackets as required to suitably support all new piping.

3.1.8 The Contractor must remove the existing piping from the vessel side valve to a minimum of three (3) feet above the tween deck.

3.1.9 All penetrations must be approved and inspected by the ABS surveyor and CCG TA.

3.1.10 The Contractor is responsible for the removal and replacement of bulkheads, deckheads, protective sheathing, insulation and any other identified interference items required to gain access to the piping.

3.1.11 All removed interference items must be properly stored in safe location(s) for re-use on completion the work. Any loss or damage as result of mishandling and storage must be at the Contractor's expense.

3.1.12 The Contractor must supply all equipment, enclosures, ventilation, staging, chain falls, craneage, slings and shackles necessary to perform the work. All lifting equipment must be appropriate for the expected duties, and be accompanied by current certification indicating, or be permanently marked as to being, of an

adequate safe working load for the expected duties. Any brackets or other welded attachments required in the performance of this specification.

- 3.1.13 Prior to any hot work taking place, the Contractor must ensure that the area of work and all equipment, wiring, transits, etc. have been sufficiently protected from any sparks or metal filings. The Contractor must also ensure that the area of work, the system, and the adjacent space is certified as gas free and suitable for hot work as per the Fleet Safety and Security Manual. This must include the cleaning and gas freeing of and tanks in which work is required.
- 3.1.14 The Contractor must protect adjacent areas from damage during hot work and cutting, any damages must be repaired at the Contractor's expense.
- 3.1.15 The Contractor must be responsible to ensure that all areas have been thoroughly cleaned and free of any debris resulting from the performance of this SOW item.
- 3.1.16 The Contractor must make suitable arrangements to isolate and ventilate the work areas to prevent smoke and fumes from migrating throughout the vessel.
- 3.1.17 After installation, any heat affected or damaged areas of the vessel's coatings must be repaired. Damaged areas must be feathered and receive two (2) primer coats, and two (2) top coats in accordance to the vessel paint scheme. All paint must be Contractor supply.
- 3.1.18 Upon completion of the work the vent lines must be blanked at their connection to the vessel side valves, and filled with water to their exit points on the upper decks. Pipes must be inspected for leaks, and any defects corrected at the Contractors expense. The Contractor is responsible for the removal and replacement of any vent heads required to complete the testing.
- 3.1.19 Newly installed piping located above the engine room deck plate level must be coated with two (2) coats of primer (galvanized compatible), and two (2) to coats of "Krylon rust tough white".
- 3.1.20 The following are the vent pipes that have been identified to be replaced along with their size and approximate length and the type of connections currently being used.

- Aft Sea Chest Vent

Location:	Port side forward motor room
Size:	2.5-inch diameter pipe
Approximate Length:	Twenty-seven (27) feet
Connection Type:	Flanged connection to ship side valve, to connection before penetrating void tank side. Currently contains grooved Victaulic connections, and elbows

- Stern Tube Cooling Sea chest

Location: Located motor room center. Note: Pipe penetrates into port void tank, and will require gas freeing of the tank prior to commencement of any hot work.

Size: 2-inch diameter pipe

Approximate Length: Thirty (30) Feet

Connection Type: Grooved locked Victaulic connections, and elbows

- Port Sea Bay Vent

Location: Port side forward engine room, Note: Pipe passes through ER tween deck into control room area. Will require removal and replacement of section of control room bulkhead, UPS isolation transformer and transfer switches. Vertical section of pipe contains connection points for a 3-inch crossover line to sea chest vents, and 1 ¼ inch sea strainer vent

Size: 6-inch diameter piping

Approximate Length: Twenty-four (24) feet

Connection Type: .

- Port Upper and Lower Sea Chest Vents

Location: Port side forward engine room. Note: Passes through ER tween deck into control room area. Required removals are in the work scope for Port Sea Bay Vent Specification. Vent lines from each chest join into a single vent line before passing through the deck.

Size: 3-inch diameter piping

Approximate Length: Twenty-two (22) feet

Connection Type: Grooved locked Victaulic connections, and elbows as well as welded joints, and pipe bends

- Starboard Sea Bay Vent

Location: Starboard side forward engine room. Note: Passes through ER tween deck into electrical workshop. Will require removal and replacement of steam heater and section of tool board. Vertical section of pipe contains connection points for 3-inch crossover line to sea chest vents, and 1 ¼ inch sea strainer vent.

Size: 6-inch diameter piping

Approximate Length: Twenty-six (26) feet

Connection Type: Grooved locked Victaulic connections, and elbows as well as welded joints, and pipe bends

- Starboard Upper and Lower Sea Chest Vents

Location:	Starboard side forward engine room. Note: Passes through ER tween deck electrical workshop. Required removals are in the work scope for Starboard Sea Bay Vent. Vent lines from each chest join into a single vent line before passing through the deck.
Size:	3inch diameter piping
Approximate Length:	Twenty-two (22) feet
Connection Type:	Grooved locked Victaulic connections, and elbows as well as welded joints, and pipe bends

- Evaporator Sea Bay Vent

Location:	Starboard side forward engine room. Note: Passes through ER tween deck electrical workshop. Required removals are in the work scope for Starboard Sea Bay Vent.
Size:	2.5 - inch diameter piping
Approximate Length:	Twenty-three (23) feet
Connection Type:	Grooved locked Victaulic connections, and elbows

- Port and Starboard Sea Bay Strainer Vents

Location:	Port and starboard side forward engine room area
Size:	1 ¼ - inch diameter piping
Approximate Length:	Twelve (12) feet
Connection Type:	Threaded fittings

Note: The Contractor must also supply and install three (3) 1 ¼ inch stainless steel ball valves per side along with all related fittings, flanges and hardware etc. required for this new piping. The Contractor must provide unit pricing per foot for the supply, fabrication and installation of 1 ¼", 2", 2 ½", 3" and 6" piping as detailed in this specification for adjustment purposes, if required, by PWGSC 1379.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to the satisfaction of the CCG TA And the vessel's CCG IA.
- 4.1.2 All watertight penetrations must be proven to be watertight and witnessed and signed off by ABS surveyor

- 4.1.3 Areas where work was carried out to be inspected to ensure all debris has been removed.

4.2 Testing

- 4.2.1 All welded pipe seams must be visually inspected and tested in accordance to ABS guidelines as required. All welds are to receive 100% Visual inspection and be tested with 100% MPI by a certified third party NDT organization.
- 4.2.2 All welded seams are to be cleaned of all welding dross and or slag and welded joint are to receive two (2) separate coats of a cold galvanizing paint both internally and externally.
- 4.2.3 Upon completion of the work the vent lines must be blanked at their connection(s) to the ship side valves and filled with water to their exit points on the upper decks. Pipes must be inspected for leaks, and any defects corrected at the Contractors expense. The Contractor is responsible for the removal and replacement of any vent heads required to complete the testing.

4.3 Certification

- 4.3.1 Welders must be CWB Certified for the work intended and testing must be carried out by certified NDT specialists.
- 4.3.2 The Contractor must supply material certs for all materials being used.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The Contractor must supply copies of all NDT tests performed to the CCG TA and the attending ABS surveyor.

H-08 AF AND ICCP SYSTEM SERVICING

1.0 Scope

- 1.1 The intent of this specification is to have the Contractor exchange the Anti Fouling anodes in the Sea Chests, remove and replace existing ICCP rectifier unit, as well as remove and replace damaged ICCP anodes. This item to be carried out in conjunction with item H-06 - Sea Bays and Sea Chests inspections.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Reference documents:

- Manual IC8 - ICCP System (ships office)
- G.04/02, rev 9, ANFOMATIC Instruction Manual Installation and Commissioning, section 3.3

NOTE: The power supply for the AF anodes is to be isolated at breaker P103-20 located in the control room.

2.2 FSR

FSR Contact
Yves Girouard, Corppo
504-346-3007
yvesgirouard@aegion.com

The Contractor is to include an allowance for the sum of \$10,000 for the attendance of a certified FSR for oversight and inspection of the work. This amount will be adjusted upwards or downwards by PWGSC 1379 action and based on final submitted invoices from the FSR.

3.0 Technical Description

3.1 Anti-Fouling System

- 3.1.1 The Contractor is to replace eight (8) antifouling anodes. Two (2) anodes, one (1) aluminum and one (1) copper are fitted in each of the four (4) sea chests.
- 3.1.2 The sheeting and insulation on the high sea chests is to be removed Port and Stbd to allow access to the high sea chest anodes. Sheeting and insulation is to be reinstalled upon completion of the anode installations.
- 3.1.3 Cofferdam lids are to be removed and the wiring disconnected from the anodes.
- 3.1.4 The securing nuts are to be removed and the anodes lifted from the mounting boss.
- 3.1.5 The nitrile gasket is to be removed and a new owner supplied used upon reinstallation.
- 3.1.6 New, owner supplied, anodes are to be installed and secured. Contractor to ensure that one (1) aluminum and one (1) copper anode are installed in each sea chest in the same location as the old anodes.
- 3.1.7 Contractor to rewire the anodes and place the cofferdam lids in place with new owner supplied "O" rings.

3.2 ICCP System

- 3.2.1 With the assistance of a certified system FSR, the Contractor is responsible for the removal of the existing ICCP system and installation of the new CCG supplied Aquamatic system.
- 3.2.2 With the assistance of the vessel electrical officer, the Contractor must lock out the vessels ICCP system P-620-13.
- 3.2.3 With the oversight of a certified FSR the contractor must disconnect and remove the existing rectifier unit located in the vessel propulsion motor room aft. Care must be taken to clearly label all electrical connections. The Contractor must dispose of the old unit as per federal and provincial regulations.
- 3.2.4 The contractor must install the new rectifier unit as per manufacturer instructions, in the same general location as the old unit. Any modifications to the existing mounting system must be the contractors responsibility. Refer to Aquamatic instruction manual for detailed installation instructions.
- 3.2.5 The contractor must remove the existing ICCP anodes located at frames 32.5 on the port and starboard side of the vessel.

- 3.2.6 New CCG supplied anodes must be installed as per the manufacturer's instructions, and connections made to the new ICCP rectifier unit. Refer to Aquamatic instruction manual for detailed installation instructions.
- 3.2.7 An epoxy dielectric shield of low density profile 1 filler must be applied around the double and anode to allow smooth transition to the hull.
- 3.2.8 The contractor must inspect the shaft grounding systems on both the port and starboard shafts and any defects must be identified and presented to the Canadian Coast Guard technical authority.

4.0 Proof of Performance

- 4.1 All items to be inspected by the CCG IA and the CCG Inspection Authority prior to reassembly.
- 4.2 Prior to and after the vessels undocking the anodes are to be inspected to ensure there is no ingress of water. The Contractor must be responsible for all repairs related to the appropriate installation of these anodes.
- 4.3 Once in the water, the system is to be powered and the readings taken to ensure the system is operating properly. Copies of these readings are to be taken, recorded and provided to the CCG TA

5.0 Deliverables

- 5.1 Type written copies of all reports and or records related to and taken during the course of this installation. Copies are to be provided to the CCG TA.
- 5.2 All removed AF anodes are to be placed and secured aboard the vessel in a location designated by the CG IA.

H-09 HULL ANODES

1.0 Scope

- 1.1 The Contractor must replace all Z-22 wasted anodes that are fitted to the hull, stern tubes and rudder locations. This item must be carried out in conjunction with SOW item H-03 – Hull Cleaning & Coating.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 Guidance Drawings/Nameplate Data – Not Applicable
- 2.1 Regulations
 - Canada Shipping Act 2001 - Hull Construction Regulations
 - Maritime Occupational Health and Safety Regulations
 - ABS Rules and Regulations
- 2.2 Standards
 - Fleet Safety and Security Manual (DFO/5737)
 - IACS No. 47 - Shipbuilding and Repair Quality Standard
 - CSA W59-08 (R2008) - Welded Steel Construction
 - CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
 - CCG Welding Specification CT-043-EQ-EG-00
 - Society for Protective Coatings (SSPC) Standards

3.0 Technical Description

- 3.1 The Contractor and the CCG TA must visually inspect all Z-22 zinc anodes secured to the vessel's hull plate and replace the wasted anodes that are fitted to the hull, stern tubes and rudder. Any remaining anodes are to be left in place.

- 3.2 The Contractor must provide a cost for supplying and replacing/installing forty (40) Z-22 zinc anodes. The contractor must provide a unit price per anode for adjustment by PWGSC 1379 based on the actual requirement.
- 3.3 The Contractor is to ensure that an additional four (4) anodes (two (2) per side) are installed in the area of the propellers, as directed by the Technical Authority. These four (4) anodes are part of the forty (40) anodes that the Contractor is to provide.
- 3.4 Anodes are to be properly covered during hull coating and this protection is to be removed prior to the vessel being refloated. The contractor must remove and dispose of all coverings upon the completion of work.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All anodes to be installed to the satisfaction of the CCG TA.

4.2 Testing – Not Used

4.3 Certification

- 4.3.1 The Contractor must provide certified CWB tickets for all welders.

H-10 SPEED CRANE 5 YEAR SURVEY

1.0 Scope

- 1.1 The intent of this specification is to cover the quinquennial inspection (as formerly required as a quadrennial) of the Speed Crane Buoy Derrick System for ABS credit.

The inspection will generally be covered in three parts as follows:

- (1) Block and attachments servicing and inspection;
- (2) Boom and trunnion bearing inspection;
- (3) System load test.

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

- H-03 Hull Cleaning and Painting
- H-30 Bow Thruster Replacement
- H-33 Bridge Window and Steel Replacement

- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 Nameplate Data: Speed Crane by Pacific Winches, 20t SWL

- 2.2 Reference Drawings

- 555-H-0023 – 0025 – General Arrangements
- 80-58 & 59 – Speed Crane Block and Electrical Drawings
- Speed Crane Quinquennial Inspection Report 2018
- DS 1394/1395 – Trunion and Limit Switch Arrangements

- 2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Maritime Occupational Health and Safety, Canada Labour Code Regulations

- CSA 2001- 33, Canada Shipping Act – Marine Machinery Regulations
- CSA 57, Canada Shipping Act – Safe Working Practices Regulations
- ABS Rules and Regulations

2.4 Standards

- Fleet Safety and Security Manual (DFO/5737)
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- CCG Welding Specification CT-043-EQ-EG-00
- Society for Protective Coatings (SSPC) Standards

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor is responsible for all inspections and is to consult with ABS and CCG, prior to the commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the Technical Authority, in advance, to allow his/her attendance.
- 3.1.2 The Contractor must supply all required labour, craneage, forklifts and related rigging and lifting equipment/appliances necessary to carry out the work detailed in this specification. This also includes all necessary scaffolding/staging, straps, slings, cable reels with supports, and sufficient protective covering (1/4" masonite or equivalent) to prevent the wood sheathing on the Well Deck from becoming fouled with grease from the wires. All lifting equipment/appliances, straps and slings must be fully certified and tested for the loads being applied. Copies of the these weight rating certificates must be made available to the CCG TA upon request.
- 3.1.3 The Contractor must include a \$5,000.00 allowance in their pricing for non-destructive testing (principally dye penetrant and magnetic particle inspection) as directed by the attending ABS Inspector on components of the blocks, such as pins, eyes and swivels, and on various welds on the boom. This value will be adjusted by PWGSC 1379 based on proof of final invoice.
- 3.1.4 When removed from the vessel, all sections of the crane must be suitably supported, protected and stored at the contractor's facility to the satisfaction of the CGTA.
- 3.1.5 New wires will be owner supplied and any replacement parts (such as bearings, races or seals etc.) must be contractor supplied and covered in the material

allowance described in section 3.2.10 of this SOW item. All lubricants, greases, coatings and related materials must be Contractor-supplied and included in their firm pricing for this SOW item. The vessel will not specifically lock out the Speed crane; individual motors may be locked out as conditions warrant. Any lockouts requested will be completed by the contractor under the direction of the vessel's Electrical Officer.

3.2 BLOCKS AND ATTACHMENTS

- 3.2.1 The Contractor must supply the necessary labour for the de-rigging and subsequent rigging of all Speed crane wires and blocks. All de-rigging must be carried out with guidance from a member of the ship's crew, however, as there will be limited crew available during the project period all removals and re-installations must be carried out by the contractor.
- 3.2.2 The existing Speed crane wires must be removed from their respective winches. The Contractor must be responsible for the disposal, as per applicable provincial regulations, of the wires removed for this work.
- 3.2.3 Flexible grease lines to the upper blocks are to be removed and discarded; protective jackets must be retained for reuse. The Contractor must remove the blocks as detailed in the list below; the blocks are to be conspicuously tagged with the identifying number. The blocks must be removed ashore to the Contractor's facilities where they shall be disassembled for cleaning, measured, and inspected for defects. The blocks and components must be laid out for inspection by the Technical Authority (or designate) and the attending ABS Inspector; extreme care must be taken to ensure components of each block remain separated.

Note: Some blocks may only require partial assembly before reattaching to the Speed crane. This is meant to save the Contractor time and labour, as it will be necessary to pass the thimbles and eyes of various wires through some of the blocks and pulleys. The Contractor must note such blocks during the disassembly of the Speed crane rigging. Once all wires have been reeved, the partially assembled components must be closed up.

Table 3.7-1

BLOCK	NAME	SWL	TEST LOAD	SHEAVES	BEARINGS
#1	Main cargo lead block	7.15	28.6	1	LM48548/8510
#2	Cargo dee	7.01	28.04	1	LM48548/8510
#3	Jib head sheave, inner	7.15	28.6	1	
#4	Main cargo hook block	20	40	1	2788/2720
#5	Jib head sheave, outer	14.3	57.2	1	
#6	8T Aux. cargo lead	8.4	33.6	1	3780/3720
#7	8T Jib heel	16.48	65.92	1	27/88/2720
#8	8T Aux. jib head block	8.27	33.08	1	
#9	Mast head topping dee block	16.48	65.91	1	3780/3720
#10A	Topping jib head (P)	8.23	32.92	1	3982/3920

#10B	Topping jib head (S)	8.23	32.92	1	3982/3920
#10C	Topping mast head crossmember	8.23	32.92	1	3982/3920
#10D	Topping mast head port	8.23	32.92	1	3982/3920
#11	Topping delta block	18.8	75.2	1	3780/3720
#12	Delta Plate	18.8	37.6	---	---
#13A	Upper compensator (P)	9.49	37.96	1	3982/3920
#13B	Upper compensator (S)	9.49	37.96	1	3982/3920
#14A	Middle compensator block (P)	11.1	44.4	1	3982/3920
#14B	Middle compensator block (S)	11.1	44.4	1	3982/3920
#15A	Lower compensator block (P)	14.24	56.96	1	3982/3920
#15B	Lower compensator block (S)	14.24	56.96	1	3982/3920
#16A	Slew lead (P)	8.4	33.6	1	3780/3720
#16B	Slew lead (S)	8.4	33.6	1	3780/3720
#17A	Slew post (P)	40	64.32	2	3780/3720
#17B	Slew post (S)	40	64.32	2	3982/3920
#18A	Upper slew blocks (P)	31	56	2	3982/3920
#18B	Upper slew blocks (S)	31	56	2	3982/3920
#19	5T Whip cargo lead block	5.25	21	1	2788/2720
#20	5T Whip jib heel block	5.25	21	1	3780/3720
#21	5T Whip jib head block	5.17	20.68	1	

The following swivels must be cleaned, serviced, and inspected as previously described for the blocks:

Table 3.7-2

ITEM	NAME	SWL	TEST LOAD	BEARINGS
#11A	Topping end swivel	18.8	37.6	Thrust race #51307
#22	5T Whip hook/swivel assembly	5	10	Sealed roller thrust bearings in the swivels
#23	8T Aux. hook/swivel assembly	8	16	

- 3.2.4 Each block must be completely disassembled. All components including sheaves, bearings & races, Nilos seals, and sheave pins & bores must be cleaned of grease, dirt, rust, and scale for inspection and measurement. The bearings must be suitably protected from dirt and debris during all work.
- 3.2.5 Swiveling overhaul balls (items 22 & 23) are to be disassembled and inspected as detailed on the attached 2018 Inspection Report (form #8). Replacement of these items will covered on the material allowance detailed in section 3.2.10 of this SOW item.
- 3.2.6 Attachment pins must be withdrawn. Bores, pins, and bushings must be cleaned of all grease, dirt, rust, and scale for inspection and measurement.
- 3.2.7 All pins and bushings must be measured and recorded by the Contractor. The pin diameter must be measured at the shoulder, middle, and adjacent to the thread. Bushing diameter must be measured in perpendicular directions, at each end and in the middle of the bushing bore. All measurements must be in inches, to the third

decimal, and are to be presented in tabular format, using the number convention in tables 3.7-1 & 3-7-2. The contractor must include pricing for the fabrication and installation of 12 new pins and include a unit price per pin. This total will be adjusted by PWGSC 1379 based on the actual requirement.

- 3.2.8 The Contractor must prove all greases fittings and grease passages, channels, and grooves free and clear of old grease by pumping Contractor-supplied grease through them. Any defective grease fittings must be renewed, using Contractor-supplied replacements.
- 3.2.9 In conjunction with the removal of the compensator blocks, the Contractor must remove the compensator block cross pin to permit inspection and servicing. After the compensator blocks are removed, the cross pin locking plates and fasteners must be removed and the cross pin withdrawn. Prior to any cleaning, the cross pin in way of the bushings must be inspected to determine if grease is reaching all surfaces. The cross pin must be cleaned and inspected for wear and defects. The cross pin bushings shall be cleaned and inspected for wear and defects. All grease passages must be cleaned and proven clear. Upon completion of all cleaning and inspections, the cross pin must be installed with all locking devices.
- 3.2.10 The Technical Authority (or designate) and the attending ABS Inspector are to inspect each disassembled block and component after cleaning and measuring. New contractor-supplied tapered roller bearings, races and Nilos seals will be used to replace all such components deemed defective. The contractor must include a material allowance of \$5,000.00 for these replacement parts deemed necessary on site. This total value will be adjusted by PWGSC 1379 upon proof of final invoice.
- 3.2.11 Sheave cheek plates must be grit blasted on all surfaces. Upon completion of grit blasting, each cheek plate must be given two (2) coats of Contractor-supplied, marine grade primer. All areas of disturbed coating on the blocks & swivels are to feathered back by wire-brushing and receive one (1) coat of Contractor-supplied, marine grade primer. Prior to reassembly, all parts are to receive one (1) full coat of marine grade, black finish paint.
- 3.2.12 The Contractor must reassemble all blocks upon completion except for those blocks requiring partial assembly for rigging purposes. (see note in 3.7)
- 3.2.13 All motion surfaces of the blocks (i.e. pins, bushings, bearings) must be thoroughly greased with Contractor-supplied grease prior to and during reassembly. Damage to the Nilos seals shall be avoided.
- 3.2.14 All threaded fasteners must be thoroughly cleaned. Any defective fasteners must be renewed; The cost of new contractor-supplied replacement fasteners will be included in the material allowance detailed in section 3.2.10 of this SOW item. All

fastener threads must be liberally coated with a Contractor-supplied copper-based anti-seize compound prior to re-installation.

- 3.2.15 The Contractor must load test each block to the values specified in Table 3.7-1. This SOW item must include the disassembly of each block for visual inspection by the attending ABS Inspector after testing and subsequent reassembly upon completion.

3.3 BOOM AND TRUNNION BEARING INSPECTION

- 3.3.1 The Contractor must perform the following work to dismantle the trunnion to permit inspection and servicing of the trunnion bearing and boom. The boom will be in the stowed position prior to commencing any disassembly. Reference drawings DS1394 & DS1395.
- 3.3.2 The Contractor must ensure that the limit switch wires are tagged prior to commencing any disassembly of the boom. The ship's Electrical Officer must witness the limit switch connections and tagging before disassembly.
- 3.3.3 The Contractor must proof mark the crosspin in respect to its position with the fork end, thereby ensuring that the crosspin is replaced in its original position as correct operation of the topping limit switch depends on this.
- 3.3.4 The wiring to the limit switches is to be disconnected. Remove the slewing quadrant and the limit switches and holders; remove the bobbin from the cable tube. Remove the countersunk screws from the trunnion cover plate and carefully lift the cover plate off over the cable tube.
- 3.3.5 Remove the drain plug from the oil reservoir and drain off the oil; the Contractor will be responsible for all provincial environmental requirements for disposal of oil residues.
- 3.3.6 Remove the end cap from the crosspin and withdraw the crosspin. When withdrawing the crosspin, care must be taken to move the topping limit switch actuating lever clear of the slot in the crosspin to prevent damage. **Note:** There are o-rings between the fork ends and the trunnion casting.
- 3.3.7 The power supply cable to the junction box for the Speed crane Boom Floodlight at the base of the boom will have been disconnected. The boom heel must be lifted clear of the trunnion and the boom must be lifted ashore.
- 3.3.8 The trunnion base must be raised straight up exercising caution with the cable tube and limit switch wires. Once the trunnion assembly is clear of the wires, the bottom cover must be unbolted and removed, drawing straight down until the cable tube clears the trunnion base, ensuring first the oil seal gland has been slackened off.

- 3.3.9 The trunnion must be transported to the contractor's facilities. The trunnion must be disassembled and the upper and lower tapered roller bearings must be removed. All components must be cleaned and inspected for wear and defects by the Technical Authority (or designate) and the attending ABS Inspector. The grease passages must be proven free and clear of old grease by pumping Contractor-supplied grease through them. The oil reservoir and oil passage must be carefully cleaned, due to previous contamination by seawater.
- 3.3.10 The boom must be carefully supported in a suitable location at the contractors facility, as determined by the Technical Authority.
- 3.3.11 The boom and its attachments must be cleaned for inspection. All boom welds, as well as all attachment welds, must be grit blasted to bare metal (SA 2.5 or better) and inspected for defects. The derrick head and the boom heel, in way of the trunnion pin, must be grit blasted to bare metal on all the external surfaces; any additional areas of the boom identified by the Technical Authority (or designate) must be grit blasted as above. Upon completion of boom inspection, all bare areas must receive two coats of Contractor-supplied, marine grade primer. The Contractor is to include pricing for grit blasting and priming 150 ft², with the total area to be adjusted by PWGSC 1379 based on the actual requirement. All preparatory coating work must be inspected and approved by the CCG TA and CCG supplied NACE inspector prior to coatings being applied. All grit and related debris must be cleaned up and disposed of by the contractor as per provincial and federal guidelines.
- 3.3.12 The entire boom is to be given 2 complete top coats of marine grade, CCG buff finish coat; the Contractor must ensure that all areas of the boom are addressed, including any areas under supporting members. With the concurrence of the Technical Authority (or designate), the areas under any supporting members must be addressed and effectively prepped and coated once the boom is remounted; the Contractor is to ensure the finished appearance is equivalent to the previously coated areas.
- 3.3.13 Upon completion of trunnion inspection, the trunnion must be reassembled and returned to the vessel. All components removed for the boom and trunnion inspection must be reassembled. Bearing adjustment ring must be adjusted to give a nominal preload of 0.002" on the bearing. Fasteners for the bearing retaining plate must be torqued to 495 to 525 ft-lbs.
- 3.3.14 The shaft that the limit switches are attached to (the cable tube) must be secured in place, as it is loose; this makes accurate set-up of the limit switches difficult. Prior to installing the bottom cover on the trunnion, the four socket head securing cap screws are to be secured with the appropriate torque; the cable tube is then to be carefully installed in the trunnion base and the gland is to be tightened.

- 3.3.15 During re-installation, all necessary precautions must be taken to protect the cable tube and limit switch wires. The threads on the trunnion to deck plinth through bolts must be liberally coated with a Contractor-supplied copper-based anti-seize compound prior to re-installation; they must be torqued to 2100 to 2150 ft-lbs.
- 3.3.16 The Contractor is allow \$1,500.00 to renew the 16 flexible grease lines at the Wheelhouse front cross member; any grease fitting deemed defective must be replaced with Contractor-supplied replacements. The cost of the grease lines will be adjusted by PWGSC 1379 action on proof of final invoice.
- 3.3.17 Contractor-supplied grease must be applied, as required, to all components; the trunnion tapered roller bearing must be greased until grease emerges from the release hole on the aft side of the trunnion. The cross pin oil reservoir must be completely filled with contractor-supplied SAE 20W50 oil.
- 3.3.18 Upon completion of all inspections, the Speed crane must be rigged with new owner supplied wires and made operational. Rigging must be under the guidance of ship's personnel as designated by the Technical Authority.
- 3.3.19 Prior to, or during, the reeving of all wires, the wires must be greased with a pressure greasing system; Contractor-supplied ESSO Arkan I grease must be used and liberally applied to all wires.

4.0 Proof of Performance

4.1 Testing

- 4.1.1 System testing and load testing must be carried out. The Contractor must supply certified weights, load cell, as well as all appliances, hardware, and manpower necessary to load test the Speed crane. All equipment and scales used must be fully certified and calibrated and certs provided to the CCG TA.
- 4.1.2 The contractor must handle/adjust all mooring lines and provide the crew advanced notice to ready machinery for the testing of the derrick system; the Contractor is to provide a minimum of 24 hours notice.
- 4.1.3 Prior to conducting the load test, the Speed crane must be proven operational. The boom must be traversed fully outboard, port to starboard, and from the stowed to the fully topped positions. Using a 2 tonnes weight to set the wires onto the winch drums, each of the three hoists shall be tested, up and down, with the boom topped to a 45° angle.
- 4.1.4 The various limit switches shall be set to the required parameters (available from the Technical Authority) and proven operational prior to proceeding with the load test.

- 4.1.5 The SWL of the system is 20 tonnes on the Main (#1) Hoist, 8 tonnes on the 8T (#2) Hoist, and 5 tonnes on 5T (Whip) Hoist. Test loads must be 25 tonnes, 10 tonnes, and 6.25 tonnes respectively. There shall also be a simultaneous load test to 35 tonnes of the #1 and #2 Hoists, consisting of 25 tonnes on #1 and 10 tonnes on #2; this is to certify the Topping Lift.
- 4.1.6 All load testing must be witnessed by the Technical Authority (or designate) and the attending ABS Inspector.
- 4.1.7 Upon receipt of a valid T-3 certificate as issued by ABS, the Contractor must mark the SWL of the Speed crane on the boom in a manner acceptable to the attending ABS Inspector.
- 4.1.8 Upon completion of all testing, the Contractor shall remove all test hardware and appliances and return the Speed crane to an operational condition.
- 4.2 Inspection
 - 4.2.1 All work detailed in this specification must be carried out to the satisfaction of the CCGTA and ABS inspector.
 - 4.2.2 All coatings and related prep work must be inspected and approved by the CCGTA and CCG supplied NACE inspector prior to coatings being applied.

5.0 Deliverables

5.1 Report

- 5.1.1 The Contractor must provide the original test certificates and two copies for the load test of each block and component as detailed in Tables 3.7-1 & 3-7-2 and described in 18.20; three copies of a detailed inspection report, containing all measurements recorded, all defects discovered and the subsequent corrective action is also to be prepared & provided within 3 working days of the completion of all work.
- 5.1.2 The contractor must provide the CCGTA with all NDT reports for all welds tested on the speed crane.
- 5.1.3 The contractor must provide the CCGTA with a full coating report including batch numbers, temperature/humidity, dates and thickness readings.

5.2 Certificates

5.2.1 The contractor must provide the CCGTA with all calibration and testing certs for all lifting/rigging equipment and scales used as part of the specification item.

H-11 VOID SPACE AND BALLAST TANK INSPECTION AND SURVEY

1.0 Scope

- 1.1 The intent of this SOW item is to open up the spaces listed below for cleaning, inspection and testing to cover the continuous survey for Transport Canada Marine Safety (TC/MS) and ABS.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

Tank	Frame Location	Capacity m ³ @ 100%	Field #
No. 2 Void (Stbd)	106-117	38.3	3L040
No. 4 Void (Port)	30-54	43.5	3L085
No. 4 Void (Stbd)	30-54	43.5	3L086
No. 5 Void (Port)	13-30	55.7	3L087
No. 5 Void (Stbd)	13-30	55.7	3L088
Pipe Tunnel FWD	102-163		3L114
Forepeak Tank	175-Stem	85.3	3L067
FWD Wing WB (Port)	163-175	43.4	3L068
FWD Wing WB (Stbd)	163-175	46.7	3L069
Side Empty Comp No 2 (Port)	106-117	35.8	3L079
Side Empty Comp No 2 (Stbd)	106-117	35.8	3L080
DB Empty Comp. (Port)	102-106		3L081

2.1 Drawings

- 555-H-0026 – Capacity Plan
- 555-H-2740 – W.T Manholes and W.T Access and Escape Hatches
- 67-30-01 – Air and Soundings
- Intershiel 300 Product information and Application Guidelines

2.2 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.3 Standards

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

3.0 Technical Description

- 3.1 The Contractor must provide a method to have the spaces certified Gas Free, safe for personnel to enter and safe for hot work. Certificates must be forwarded to the Owner's representative and a copy must be posted in a conspicuous location near the entrance to each space. Certificates must be renewed each day.
- 3.2 The void spaces and ballast tanks are to be thoroughly pressure washed and cleaned; all scale, dirt and debris is to be removed ashore. Any rusty areas are to be power tool cleaned. All vent and sounding pipes are to be proven clear.
- 3.3 The tank vents are to be opened for inspection; this will involve the removal of both cover plates, both screens and the ball. Any defective screens will be renewed with Owner-supplied replacements. Cover plate fasteners are to be replaced with new Contractor-supplied fasteners; the Contractor's quote is to include the replacement of 10 damaged cover plate fasteners.
- 3.4 Following the cleaning of the void spaces and ballast tanks, the tanks and vents will then be inspected by the Owner's representative and the attending ABS Surveyor.
- 3.5 The Contractor is to remove any loose, flaky coatings and powertool these areas to feather back loose edges to adhered coatings. The Contractor is to allow for 200 m² of coating repairs, and is to provide a cost per m² for preparation and re-coating as detailed above; the final cost to be adjusted using PWGSC 1379. All repaired areas to be coated with 2 coats Intershield 300, at a minimum of 5 mils per coat. A fully equivalent, marine grade alternative product may be used if approved with the NACE inspector and the CCG TA.

- 3.6 Following the repairs/recoating of the void spaces and ballast tanks, the tanks and vents will then be re-inspected by the Owner's representative and the attending ABS Surveyor.
- 3.7 The CCG TA (or designate) will be present when the manhole covers are reinstalled. The Contractor must clean the sealing surfaces around the manhole and cover and install the cover using new ¼ inch thick Contractor supplied neoprene gaskets. Anti-seize compound must be used on all threads. The Contractor is to include pricing for the replacement of 10 studs and must quote separately a unit cost per stud to replace any broken manhole securing studs.
- 3.8 The Contractor must include the cost of the pneumatic testing of each individual tank, This pricing must include the installation and removal of blanks for suctions, overflow pipes and vent head removals, additional tank openings, HSE confined space requirements and additional tank drainage/cleaning if required.
- 3.9 Proposed testing method is to be approved by the attending ABS Surveyor. All tests must be witnessed by the attending ABS Surveyor and the CCG Technical & Inspection Authorities.
- 3.10 Contractor is to include an allowance of \$10,000 for potential tank vent piping repair/replacement. This will be adjusted upwards or downwards by PWGSC 1379 action.

4.0 Proof of Performance

- 4.1 The Contractor is to be responsible for all inspections and is to consult with ABS prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the CCG TA, in advance, to allow his/her attendance.
- 4.2 All tanks must be tested to the satisfaction of the CCGTA and ABS surveyor prior to adding ballast to tanks for undocking.

5.0 Deliverables

5.1 Inspections

- 5.1.1 All cleaning and preparation work must be inspected 100% by the CCG TA and NACE inspector prior to the application coatings. The CCG TA and NACE inspector must also inspect coatings applications after each coat.
- 5.1.2 Upon completion of all repairs and testing, the Contractor and the CCG TA (or designate) must conduct a final inspection and ensure all tanks, covers, vents and

pipings connections have been returned to operating conditions and the attending ABS Surveyor has completed all inspections. Any damages found must be corrected at the contractor's expense.

5.2 Reports

- 5.2.1 The Contractor must provide a Quality Assurance (QA) type written report recording the humidity and air/surface temperatures pre-coating and during coatings cure time, DFT's of each paint coating application and corresponding Batch numbers.
- 5.2.2 Three (3) hard copies and one electronic copy of these aforementioned reports, must be provide to the CCG TA.

H-12 BALLAST TANK COATINGS

1.0 Scope:

- 1.1 The intent of this SOW item is to open the listed water ballast tanks for the cleaning, the removal of existing coatings by Grit blasting the entire tanks to SSPC-SP-10 Near White Metal and applying new coatings as defined herein. All inspections and testing must be witnessed by the CCG Representative.
- 1.2 The Coast Guard will arrange, as part of their onsite team, to have available a certified NACE inspector to oversee the full paint prep and application process performed on each tank to ensure that the paint manufacturer's requirements are being met.
- 1.3 This work is to be carried out in conjunction with SOW items H-03 – Hull Cleaning & Painting and H-04 – Bilge Cleaning and Painting.
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

- 2.1.1 The following list of Guidance Drawings and documentation will be provided to the Contractor for reference should the Contractor require clarification(s):
 - H-0026 – Capacity Plan
 - H-2740 -W.T. Manholes and W.T. Access and Escape Hatches
 - 67-30-01 – Air and Soundings
 - H-0016 -General Arrangement (1:50 Accommodation Layout)- Main Deck
 - H-0017 -General Arrangement- Main Deck Forward
 - H-0018 -General Arrangement (1:50 Accommodation Layout)- Upper Deck
 - H-0019 -General Arrangement- Foc'sle Deck (Page 1/1)
 - H-0020 -General Arrangement (1:50 Accommodation Layout)- Boat Deck
 - Intershiel 300 Product Description and Application Guidelines

2.1.2 The following ballast tanks are to be cleaned and painted as defined within this specification.

Tank	Location	Capacity (m3)
#2 DB WB Port	126-152P	49.9
#2 DB WB Stbd	126-152S	49.9
Aft DB WB Stbd	54-70S	43.4
Wing WB Port	152-163P	51.4
Wing WB Stbd	152-163S	51.4
FWD Wing WB Port	163-175 P	43.4
FWD Wing WB Stbd	163-175 S	46.7
Aft Peak Tank	1-13 C/L	112.4

NOTE – It is the responsibility of the contractor to determine the entire surface areas of the affected tanks. The contractor must note that the FWD Wing WB Tanks (P&S) are also due for ABS Survey and Credit as per SOW item H-11 – Void Space and Ballast Tank Inspection and Survey.

2.2 Standards

2.1.1. The following list of Standards are to be used or reference purposes should the Contractor require clarification(s):

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

2.3.1 The following list of Regulations are to be used or reference purposes should the Contractor require clarification(s):

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

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

2.5 Interferences

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

3.0 Technical Description

3.1 General

3.1.1 The tanks listed above must be opened for cleaning, grit blasting, coating, and survey by an ABS Surveyor and the CCG TA. The Owner will provide the services of a NACE inspector to witness all aspects of preparation and painting.

3.1.2 The tanks must be pumped down to their lowest levels by the vessel's crew leaving approximately two (2) cubic meters total residue per tank to be disposed of by the Contractor in accordance with Provincial and Federal Environmental Regulations.

3.1.3 The Contractor must quote a unit cost per m³ for adjustment up or down by PWGSC 1379 action.

3.1.4 Prior to entry, tank is to be certified "Safe for Workers" or "Safe for Hot Work" as required by Transport Canada Marine Safety TP3177E. The certificates must be given to the CCG IA and copies posted by the tank manhole and gangway. Certifications must be renewed each day.

3.1.5 All of the above listed tanks are to be inspected by an ABS Surveyor, the CCG TA and the CCG NACE inspector prior to grit blasting.

- 3.1.6 The Contractor must provide robust liquid-proof lighting adequate for the safety of workers within the tank and will be responsible for all staging requirements in order to safely gain access to all areas of the tanks.
- 3.1.7 The Contractor, prior to water and grit blasting, must plug all outlets (pump suction/discharge, level transducer) sounding, vents.
- 3.1.8 The Contractor must ensure that any equipment that maybe damaged by grit blast is protected from direct blast or debris. This is to include but not limited to extended spindles, universals, valves, level transducers and any electrical and mechanical equipment in close proximity to the tank openings. Tanks with manholes in the internal structures of the vessel must be held under negative pressure while blasting to prevent the ingress of dust into the vessel.
- 3.1.9 The Contractor must clean all interior surfaces in preparation for the application of protective coatings. The Contractor is to remove all chlorides, dirt and oil from the surfaces by way of high-pressure water washing (3,000-5,000 PSI). Chlorides must be checked following washing. Chlorides must be at or below 5 mg/cm². If chloride ion level, as specified is not attained, a re-wash of the affected area must be carried out using a soluble salt remover, such as Chlor-Rid Liquid Salt Remover at a dilution ratio of 1:100, sprayed on the affected area at a minimum of 20 mps (3,000 psi).
- 3.1.10 The Contractor must remove all the resulting liquid and debris from the tank and wipe all surfaces dry. Contractor must force warm dry air through the tank to prevent flash rusting of the newly bare sound steel. Once washing is completed, chloride levels are acceptable and all surfaces are dry, the Contractor must abrasive blast internals of the defined tanks.
- 3.1.11 All sharp edges found within each tank must be ground smooth prior to sand blasting to form a rounded contour of minimum edge radius of two (2) mm. This two (2) mm rounding may be achieved by minimum two (2) to three (3) strokes of a grinding disc as recommended by coating manufacturer.
- 3.1.12 The Contractor is to grit blast to bare metal to SSPC SP-10/NACE 2 (Near White) to achieve an angular surface profile of 50 to 75 microns (2-3 mils) for the total surface area of each tank.
- 3.1.13 The Contractor is to quote a unit price per m² should additional or less cleaning/preparation/coating be required, adjustments upwards or downwards will be done via PWGSC 1379 action.
- 3.1.14 Upon completion of all blasting each tank is to be cleaned of all abrasive residue and then inspected by the CCG TA, ABS and the vessel's CCG TA to determine the extent of any necessary steel repairs.

- 3.1.15 The Contractor must allow the sum of \$25,000.00 for supply of all materials and labour to renew any wasted tank top, ladder treads, pipe and/or extended spindle brackets. This allowance must include the overhaul of each tank's suction and discharge valves. This allowance must be adjusted up or down by PWGSC 1379 action.
- 3.1.16 Contractor must remove all debris from grit blasting put ashore and properly disposed of it in accordance with its provincial environmental regulations. NACE inspector must inspect tank cleanliness before application of any coating.
- 3.1.17 Copies of disposal certificates are to be provided to the CCG TA.
- 3.1.18 Once the level of cleanliness in each tank has been approved, the Contractor must apply the following coatings in accordance with the manufacturer's instructions.
- 3.1.19 The internal coating in each tank is to be Intershield 300 and applied in multiple coats as per the products recommended application guidelines. This includes 2 full coats with 2 stripe coats in between, each coat applied at a minimum of 5 mils. The Contractor must coat the total surface area, including manhole covers, of each tank. Applications are to be carried out as per the manufacturer's application guidelines and inspections are to be carried out by CCG and the NACE inspector between each coat. The contractor must arrange all of these inspections, any defects found due to missed inspections will be repaired at the contractor's expense. Fully compatible, marine grade substitutions may be used if approved by the CCG TA and NACE inspector.
- 3.1.20 Any additional requirements deemed necessary for tank access or blasting/coating/curing activities is the responsibility of the contractor and must be included in their pricing. This includes additional tank inserts for access, ventilation, sheltering or heating/curing activities.
- 3.1.21 Any inserts cut in the vessel for preparation or coating requirements must be approved by CCG and ABS prior to cutting. Inserts must be re-installed as per ABS, CCG and CWB guidelines with full pen welds. All welds are to receive 100% visual inspection by a level 2 CWB welding inspector (or higher) and be tested with 100% UT at a minimum in addition to ABS testing requirements. Any affected external hull coatings in way of these inserts must be properly cleaned, prepared and coated as detailed in specification H-03 – Hull Cleaning and Painting - after inserts have been re-installed and welds tested.
- 3.1.22 All affected tanks in way of temporary inserts must be pneumatically or hydrostatically tested to the satisfaction of the ABS surveyor and CCG TA as detailed further in section 3.1.28 below. These tests must be carried out prior to adding any ballast to the vessel for undocking.

- 3.1.23 On completion of satisfactory paint applications each tank is to be re-inspected to identify any “holidays” that may be present.
- 3.1.24 After satisfactory inspection by the CCG NACE inspector all temporary protections must be removed from the extended spindle, universals, valve stem, gland and level transducer, etc. by the Contractor and removed ashore for disposal. Extended spindle(s) universals are to be greased using new EP2 grease and each extended spindle must be proven operational. This must be witnessed by the CCG TA and the vessel’s CCG IA.
- 3.1.25 The Contractor must re-install all tank manhole covers with a new Contractor supplied gasket of the appropriate material. After testing and prior to final close-up each tank is to be inspected by the CCG TA and the CCG IA.
- 3.1.26 Should any of the manhole cover studs require replacement they must be brought to the immediate attention of the vessel’s CCG IA. The Contractor must provide pricing for the replacement of 10 manhole cover studs and a unit cost per stud to be adjusted by PWGSC 1379 action. Any manhole cover stud that are damaged by the Contractor must be renewed at the Contractor’s expense.
- 3.1.27 All vent pipes including vent head screens and sounding pipes are to be proven clear and this is to be witnessed by the CCG TA and the CCG IA.
- 3.1.28 On the completion of all work and after each tank has been inspected and closed, each tank defined must be tested pneumatically. to the satisfaction of the attending ABS surveyor and CCGTA. This must include the installation and removal of blanks for suctions, overflow pipes and vent head removals, additional tank openings, HSE confined space requirements and additional tank drainage/cleaning if required. As per line 3.1.25 above, all tanks are to receive a final inspection from the CCGTA prior to final closing.

4.0 Proof of Performance

4.1 Quality Control

- 4.1.1 The Contractor must require strict quality control over surface preparation and application of coatings to ensure compliance with the specifications and applicable requirements of the paint manufacturer.
- 4.1.2 The following tests and checks must be carried out before, during, and after the painting process. A Coating Application Log of these tests must be maintained and submitted to the CCG TA upon completion of the Project. Contents of this log must incorporate as a minimum the following:

- a) Surface preparation including anchor profile and abrasive used.
- b) Wet and Dry film thicknesses.
- c) Surface temperature, ambient temperature, room temperature, relative humidity, dew point and coating temperature.
- d) Continuity of Paint to be checked using low voltage detector (Sponge Test) as specified by the CCG NACE Inspector
- e) Adhesion tests as specified by the CCG NACE Inspector.
- f) Coating Batch Numbers.

4.2 Workmanship

- 4.2.1 All coatings must be applied in accordance with the paint manufacturer's published application instructions. Such instructions are deemed a part of this technical SOW item.

4.3 Inspection

- 4.3.1 All cleaned and prepared surfaces must be inspected by the CCG NACE Certified Coating Inspector prior to and after the application of each coating. All tank inspections will be 100% visual by CCG TA and the CCG NACE inspector surveyor.
- 4.3.2 At the completion of the painting and as part of acceptance of the Work by the CCG TA, the Contractor must, in the presence of the CCG TA and NACE Inspector, inspect the painting system for damage
- 4.3.3 Any damaged areas found must be clearly noted by the CCG TA and the Contractor will be required to repair these areas to the level that is acceptable to the CCG NACE Inspector and TA.

4.4 Testing

- 4.4.1 Upon completion of all repairs, all tanks must be pneumatically tested. Upon the completion of successful tank testing, the Contractor and the CCG TA must conduct a final inspection and ensure all tanks, covers, vents and piping connections have been returned to operating conditions and the attending the ABS Surveyor has completed all inspections.
- 4.4.2 Any temporary inserts cut in the vessel for preparation or coating requirements must be approved by CCG and ABS prior to cutting. Upon the completion of coating repairs, inserts must be re-installed on the vessel with full penetration

welding and receive 100% visual inspection from a Level 2 CWB welding inspector (or higher) and 100% UT testing.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The Contractor must provide a Quality Assurance (QA) report recording the chloride readings, and surface profiles of random selected areas throughout the tank.
- 5.1.2 The Contractor must also provide a Quality Assurance (QA) report recording the humidity and air/surface temperature in the depths/extremities of the tank pre-coating and during coatings cure time as well as the paint thickness readings reported throughout the painting process and corresponding batch numbers.
- 5.1.3 Photos of each tank, condition, tanks before cleaning, after cleaning, surface preparation, after each coat of paint and on completion are to be taken. Each photo is to be identified as to what tank it was taken in and the general location of each photo taken. Copies of these photos are to be provided electronically to the CCG TA.
- 5.1.4 Three (3) type written copies and one electronic copy of all reports must be provided to the CCG TA.
- 5.1.5 The contractor must provide all NDT reports from a certified third party organization for any insert requirements or steel work carried out.

5.2 Certifications

- 5.2.1 The contractor must provide all CWB welder certs and welding procedures.

H-13 DOMESTIC WATER PIPING

1.0 Scope

- 1.1 The intent of this SOW item is to have the Contractor replace all deteriorated Hot & Cold Fresh Water piping with new. Piping must be replaced from both the port and starboard potable water tanks to the local isolation valves on all pumps, pressure tanks, calorifiers, wash basins, sinks, galley equipment, ice machines, humidifiers, and all other equipment within the system.
- 1.2 This work must be carried out in conjunction with the following SOW items
- H-23 Sanitary Water Piping Removal
 - H-24 Sewage Piping
 - H-32 Galley Upgrades
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 65-30-01-Domestic and Sanitary Fresh Water Systems
- 65-30-02 - Arrangement Domestic F.W. and Sanitary (Page 1/3)
- Arrangement Domestic F.W. and Sanitary (Page 2/3)
- Arrangement Domestic F.W. and Sanitary- Plan Beneath Officers Dk and Wheelhouse Floor (Page 3/3)
- 65-10-03 – Fresh Water Generator
- H-0016 - General Arrangement (1:50 Accommodation Layout)- Main Deck
- H-0017 - General Arrangement- Main Deck Forward
- H-0018 - General Arrangement (1:50 Accommodation Layout)- Upper Deck
- H-0019 - General Arrangement- Foc'sle Deck (Page 1/1)
- H-0020 - General Arrangement (1:50 Accommodation Layout)- Boat Deck

- H-0021 - General Arrangement (1:50 Accommodation Layout)- Officers Deck and Wheelhouse

2.3 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.4 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.5 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

NOTE: The Contractor is to note that performing the work described herein will require extensive removals of bulkhead paneling, deckhead paneling, insulation and interference items such as sinks, shower stalls, vanities, etc. The Contractor must be responsible for the identification, removal, safe storage and the re-installation to an "as found" condition after work has been completed. Insulation that cannot be reused must be replaced with new, equivalent ABS approved insulation. The Contractor must also be responsible for identifying and protecting all areas of the vessel and equipment in way of this work. This includes but is not limited to flooring, tiling, non-removed paneling, cabin contents, equipment etc. so as to prevent any potential damage. Any damage resulting from inappropriate protection must be repaired or replaced by the Contractor at their expense. As the Contractor will be replacing this piping system in its entirety, it is the responsibility of the Contractor to confirm all pipe lengths, sizes, fittings, penetrations etc. as detailed in the attached ship's drawings. The contractor will also have the opportunity to view during the on-site vessel viewing.

3.1 General

- 3.1.1 Prior to commencement of the work the Contractor must inform the CCG TA. Contractor must, with the help of the CCG TA, ensure any other systems required to be removed to access the Fresh Water piping are locked out and drained before removal.
- 3.1.2 Contractor to lockout and tagout two domestic freshwater pumps and the power to the hot water circulating pumps and the power to the hot water calorifiers. The vessel's Electrical Officer will assist by showing the locations of the power sources for the above-mentioned pumps.
- 3.1.3 The hot and cold water lines system must be completely drained by the Contractor prior to starting work.
- 3.1.4 All new piping, dimensions, fittings and penetrations must be as per original system. Piping is to be Type "K" Copper using screwed, soldered, or Viega style joints. All valves installed are to bronze, #125.
- 3.1.5 Piping routes and penetration locations must be as per original build as detailed in the ship's drawings unless modifications are deemed necessary and approved by the CCG TA. The contractor must provide per meter unit costs for the removal of existing and the supply and installation of ½", 1", 1.5", 2", 2 ½" & 3" piping as part of this SOW item for adjustment by PWGSC 1379, if required.
- 3.1.6 Pipe supports and hangers must be installed at sufficient intervals, where existing hangers are in poor shape and cannot be re-used, to prevent sagging and

vibration. Supports and hangers must suitably isolate the copper piping from any dissimilar metal to prevent possible corrosion issues.

- 3.1.7 Water lines must be insulated using ABS approved material to an R value meeting or exceeding original. All joints and seams must be sealed and or taped and necessary.
- 3.1.8 All piping must be clearly marked to identify their contents at both sides of deck or bulkhead penetrations and at reasonable intervals throughout each space
- 3.1.9 Any welding required must be completed to CWB standards for the application required and to the approval of the attending ABS Surveyor and CCG TA. All new welds must receive 100% MPI testing by a certified third party organization.
- 3.1.10 The Contractor must clean up all debris and removed piping and valves (that has been replaced) and dispose same ashore.
- 3.1.11 The Contractor must install new, ABS approved, valves to allow for isolation of the domestic freshwater system at each accommodation deck level. These valves must be placed in easily accessible locations approved by the CCG TA. Valve locations must be permanently marked on the drawings and locally on the deck head or bulkhead panels.
- 3.1.12 The Contractor must replace all system isolation valves, currently fitted, throughout the domestic hot and cold water system excluding those at locally at domestic fixtures or equipment /machinery. Valves must be ABS approved and any location changes must be approved by the CCG TA.
- 3.1.13 The Contractor must include the cost of the painting of any new bulkhead, deck and hull penetrations and any disturbed coatings with a minimum of two coats of marine grade primer and two matching top coats matching the existing colour scheme in the area.

3.2 Navigation Bridge Deck

- 3.2.1 Note: The water lines servicing these spaces are feed from the Officers deck below.
- 3.2.2 The Contractor must remove all required deck head panels, bulkhead panels, insulation, and vanities needed to access piping, label, and store for re-use.
- 3.2.3 The Contractor must cut out and remove all copper Hot & Cold Fresh Water piping on this level between the bulkhead and deck penetrations to local isolation valves at each fixture or appliance, this must include the through deck/bulkhead portion.

- 3.2.4 The threaded pipe used as deck penetrations are to remain unless the CCG TA or ABS Surveyor instructs otherwise. Should they require replacement, then they are to be replaced with similar type penetrations. Any replacement required will be done by PWGSC 1379 action. All sealing arrangements within penetration caps must be replaced.
- 3.2.5 The Contractor must install new copper piping following the same route as the removed piping.
- 3.2.6 The Contractor must fabricate and install a new supply line for the flushing water for one toilet on this deck. This line must be connected into the domestic cold water system keeping the length of this line as short as possible. This new line must be fitted with a Contractor supplied approved back flow preventer mounted in an easily accessible location.
- 3.2.7 The Contractor must reuse existing hangers and pipe supports where possible and replace any deemed to be unusable by the CCG TA. Pipe supports and hangers must be installed at sufficient intervals to prevent sagging and vibration. All supports or hangers must have new non-conductive isolation material installed to separate the copper piping from any dissimilar metal to prevent possible corrosion issues.
- 3.2.8 Contractor must reinstall all removed deck head, bulkhead panels, insulation and sink cabinet, to the satisfaction of the CCG TA.
- 3.3 Officer's Deck
 - 3.3.1 Note: The water lines servicing these spaces on this level enter through the deck and are feed from the Boat deck below. Main lines enter the boat deck through the deck in the Foam Compartment located on the port side of the vessel.
 - 3.3.2 The Contractor must remove all required deck head panels, bulkhead panels and insulation needed to access piping, label, and store for re-use. The Contractor is responsible for the removal, storage, and replacement of any vanities deemed necessary to remove.
 - 3.3.3 The Contractor must cut out and remove all of the copper Hot & Cold Fresh Water piping on this level between bulkhead and deck penetrations to local isolation valves at each fixture or appliance, this must include the through deck/bulkhead portion. The Contractor must unscrew pipe caps for deck penetrations and dispose.
 - 3.3.4 The threaded pipe used as deck penetrations are to remain unless the CG TA or ABS Surveyor instructs otherwise. Should they require replacement then they are

to be replaced with similar type penetrations. Any replacement required will be done by PWGSC 1379 action. All sealing arrangements within penetration caps must be replaced

- 3.3.5 The Contractor must install new copper piping following the same route as the removed piping.
- 3.3.6 The Contractor must fabricate and install new supply lines for flushing water for the three (3) toilets located on this deck. The lines must be connected into the domestic cold water system keeping lines lengths as short as reasonable possible. This new lines must be fitted with a Contractor supplied approved back flow preventer mounted in an easily accessible location. The lines can enter washrooms through existing deck penetrations for old sanitary water lines removed in SOW item H-22 - Greywater Pipe Replacement. All open penetrations are to be sealed.

3.4 Boat Deck

- 3.4.1 Note: The water lines servicing the spaces on this level enter through the deck and are feed from the Upper Deck below. Water lines enter from the Upper Deck on the port side near frame 45, cabin 228.
- 3.4.2 The Contractor must remove all required deck head panels, bulkhead panels and insulation needed to access piping, label, and store for re-use. The Contractor is responsible for the removal, storage, and replacement of any vanities, or appliances if deemed necessary.
- 3.4.3 The Contractor must cut out and remove all of the copper Hot & Cold Fresh Water piping on this level between bulkhead and deck penetrations to local isolation valves at each fixture or appliance, this must include the through deck/bulkhead portion. The Contractor must unscrew pipe caps for deck penetrations and dispose.
- 3.4.4 The threaded pipe used as deck penetrations are to remain unless the CCG TA or ABS Surveyor instructs otherwise. Should they require replacement, then they are to be replaced with similar type penetrations. Any replacement required will be done by PWGSC 1379 action. All sealing arrangements within penetration caps must be replaced
- 3.4.5 The Contractor must install new copper piping following the same route as the removed piping.
- 3.4.6 The Contractor must fabricate and install new supply lines for the flushing water for the two (2) toilets located on this deck. The lines must be connected into the domestic cold water system keeping lines lengths as short as reasonable possible.

This new lines must be fitted with a Contractor supplied approved back flow preventer mounted in an easily accessible location. The lines can enter washrooms through existing deck penetrations for old sanitary water lines removed in spec H-23 - Sanitary Water Piping Removals. All open penetrations must be sealed by the contractor to the satisfaction of the ABS surveyor and CCG TA.

3.5 Upper Deck

- 3.5.1 Note: The water lines servicing this level are run throughout the deck head on the upper deck along the vessel perimeter and also are feed from the deck head of the Main Deck below.
- 3.5.2 The Contractor must remove all required deck head panels, bulkhead panels and insulation needed to access piping, label, and store for re-use.
- 3.5.3 The Contractor must cut out and remove all of the copper Hot & Cold Fresh Water piping on this level between bulkhead and deck penetrations to local isolation valves at each fixture or appliance, this must include the through deck/bulkhead portion.
- 3.5.4 The Contractor must cut out copper Hot & Cold Fresh water piping from the deck penetrations back to main supply on the boat deck, this must include the through deck portion.
- 3.5.5 The threaded pipe used as deck penetrations are to remain unless the CG TA or ABS Surveyor instructs otherwise. Should they require replacement, then they are to be replaced with similar type penetrations. Any replacement required will be done by PWGSC 1379 action. All sealing arrangements within penetration caps must be replaced.
- 3.5.6 The Contractor must install new copper piping following the same route as the removed piping.
- 3.5.7 The Contractor must fabricate and install new supply lines for flushing water for the eleven (11) toilets on this deck. The lines must be connected into the domestic cold water system keeping lines lengths a short as reasonable possible. The lines must be connected into the domestic cold water system keeping lines lengths a short as reasonable possible. This new lines must be fitted with a Contractor supplied approved back flow preventer mounted in an easily accessible location. The lines can enter washrooms through existing deck penetrations for old sanitary water lines removed in spec H-23 - Sanitary Water Piping Removal. All open penetrations are to be properly sealed to the satisfaction of the ABS surveyor and CG TA.

3.6 Main Deck

- 3.6.1 Note: The water lines servicing this level are run throughout the deck head on the main deck.
- 3.6.2 The Contractor must remove all required deck head panels, bulkhead panels and insulation needed to access piping, label, and store for re-use. The Contractor is responsible for the removal, storage, and replacement of any sink, vanities, toilets, or appliances if deemed necessary.
- 3.6.3 The Contractor must cut out and remove all of the copper Hot & Cold Fresh Water piping on this level between bulkhead and deck penetrations to local isolation valves at each fixture or appliance, this must include the through deck/bulkhead portion.
- 3.6.4 The threaded pipe used as deck penetrations are to remain unless the CCG TA or ABS Surveyor instructs otherwise. Should they require replacement, then they are to be replaced with similar type penetrations. Any replacement required will be done by PWGSC 1379 action. All sealing arrangements within penetration caps must be replaced.
- 3.6.5 The Contractor must install new copper piping following the same route as the removed piping.
- 3.6.6 The Contractor must fabricate and install new supply lines for the flushing water for the nine (9) toilets located on this deck. The lines must be connected into the domestic cold water system keeping lines lengths as short as reasonable possible. This new lines must be fitted with a Contractor supplied approved back flow preventer mounted in an easily accessible location. The existing sanitary water lines on this deck enter the washroom through the bulkheads behind the toilets. The Contractor is responsible for the removal and re-installation of toilets if required.

3.7 Below Main Deck (Machinery Spaces)

- 3.7.1 The Contractor must remove all required deck head panels, bulkhead panels and insulation needed to access piping, label, and store for re-use. The Contractor is responsible for the removal, storage, and replacement of any sink, vanities, toilets, or appliances if deemed necessary.
- 3.7.2 The Contractor must cut out the main copper Hot & Cold Fresh Water feed piping between both freshwater tank penetrations to local isolation valves at each system component to the main deck penetrations outside central stores. Smaller branch lines up to ¾ inch can remain in place.

- 3.7.3 Contractor must also cut out and remove the Hot and Cold Fresh water piping that enters the Engine room from the main deck near the forward control room door including the through deck penetrations. The lines must be replaced from the point of entry to the isolation valves at the drinking water fountain and to hose connections in the port fueling station on the main deck. Branch line connections servicing other areas do not need to be replaced but must be reconnected to the renewed piping.
- 3.7.4 The piping route from the fresh domestic freshwater pressure tank to the calorifiers must be simplified to remove unnecessary valves and shorten the length of the piping run. This work must be completed in conjunction with spec items H-14 - Calorifier Replacement and H-15 - Potable Water Hydrophore Replacement.
- 3.7.5 The threaded pipe used as deck penetrations are to remain unless the CCG TA or ABS Surveyor instructs otherwise. Should they require replacement, then they are to be replaced with similar type penetrations. Any replacement required will be done by PWGSC 1379 action. All sealing arrangements within penetration caps must be replaced.
- 3.7.6 The Contractor must install new piping following the same route as the removed piping.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to the satisfaction of the CCG TA and IA.
- 4.1.2 All watertight penetrations must be proven to be watertight and witnessed and signed off by the attending ABS surveyor
- 4.1.3 System must fully tested and proven functional to the satisfaction of the CCG TA. All defects found resulting from inappropriate installation must be repaired by the Contractor and to their account.

4.2 Testing

- 4.2.1 All newly installed piping must be hydrostatically tested to 6.5bar. This test is to be witnessed and to be to the satisfaction of the CCG TA and IA and the attending ABS surveyor.
- 4.2.2 On completion of a successful hydrostatic test, the entire potable water system including hot and cold water is to be flushed, using treated potable water, from the potable water tanks to the point farthest away on each deck. Flushing duration is

to be done for a minimum of fifteen (15) minutes and is to be to the satisfaction of the CCG IA.

4.2.3 All MPI testing reports must be provided to the CCG TA.

5.0 Deliverables

5.1 Drawings/Reports

5.1.1 The Contractor must, at a minimum, develop and supply updated versions of the following drawings and any other affected ship's drawings in both electronic (AutoCAD) and paper copy. Drawings must reflect the new "as fitted" arrangement.

- 65-30-01-Domestic and Sanitary Fresh Water Systems (Page 1/1)
- 65-30-02 - Arrangement Domestic F.W. and Sanitary (Page 1/3)
- Arrangement Domestic F.W. and Sanitary (Page 2/3)
- Arrangement Domestic F.W. and Sanitary- Plan Beneath Officers Dk and Wheelhouse Floor (Page 3/3)

5.2 Certifications

5.2.1 The contractor must provide the CCG TA with material certificates for all piping and related materials.

H-14 CALORIFIER REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW is to have the Contractor replace the existing hot water calorifier system with new "Contractor supplied" marine approved units including local electrical control panel(s). The existing units have reached their life expectancy and are rated below desired system operating pressure ratings.
- 1.2 The new system must be a dual tank installation, with each tank having two (2) electric heaters fitted along with the associated tank mount equipment needed to complete the installation and make these units operable.
- 1.3 This job to be carried out in conjunction with SOW items H-13 – Domestic Water Piping and H-15 – Potable Water Hydrophore Installation.
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 65-30-01 - Domestic and Sanitary Fresh Water Systems
- 65-30-02 _01-03 - Arrangement Domestic F.W. and Sanitary, 3 Sheets
- 65-10-03 – Fresh Water Generator
- 555-H-0016 - General Arrangement (1:50 Accommodation Layout)- Main Deck
- 555-H-0017 - General Arrangement- Main Deck Forward
- 555-H-0018 - General Arrangement (1:50 Accommodation Layout)- Upper Deck
- 555-H-0019 - General Arrangement- Foc'sle Deck (Page 1/1)
- 555-H-0020 - General Arrangement (1:50 Accommodation Layout)- Boat Deck
- 555-H-0021 - General Arrangement (1:50 Accommodation Layout)- Officers Deck and Wheelhouse
- Existing Unit Manual and Photos – The existing unit manual, photos and Name plate data is included in the TDP

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
 - IACS No. 47 - Shipbuilding and Repair Quality Standard
 - CSA W59-08 (R2008) - Welded Steel Construction
 - TC TP 127e
 - IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
 - IEEE 60332-3
 - IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
 - IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
 - CCG Welding Specification (CT-043-eq-eg-001-E)
 - CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
 - Society for Protective Coatings (SSPC) Standards
 - CWB CSA 47.1 latest revision Division I, II or III
- Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.*

2.4 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.3 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

3.1.1 Existing System Details

- Two 156 US Gallon Tanks
- 5B96 Alloy 655 Everdur
- Design Pressure – 50 psi @ 200F (Note: This is below current system requirements)
- Insulation – Fiberglass AF 545
- Caloritech, CXC-624-5R 600V/3ph/ 24 KW electric immersions heaters–2
- Dry Weight 450 LBS per tank
- Note: Photos and nameplate data is included in the TDP

3.1.2 New System minimum requirements

- Two (2) tanks, volume must meet or exceed that of existing system
- Max operating pressure for the tanks must be a minimum of 6 bar
- Dimensions must allow transport through existing vessel doorways.
- Must be constructed of same material as original, or other with similar corrosion resistant properties. Any changes must be agreed upon with by the CCG TA.
- Tanks must be fitted with dual heating elements of 24 kW capacity.
- Tanks must be at a minimum fitted with the same surface mounted equipment as per original design documented in manual 2V-1 i.e. pressure gauges, temperature gauges, relief valves, etc.
- New system must include local electrical control panel, minimum Nema IV enclosure. Controls panel must include local disconnect switch, and include at a minimum the indicators and controls as per original design.

3.1.3 Work areas must be certified gas-free and safe for hot work prior to the performance of any burning/welding activity.

3.1.4 All lifting and handling of equipment, piping and associated hardware is to be conducted using correct safety practices in accordance with CCG Fleet Safety Manual and the Repair Facilities Safety Program. All lifting and handling equipment is to be inspected and certified for the appropriate Safe Working Load (SWL) required. The use of vessel's structure as an anchor to clamp or temporary fasten lifting gear is allowable provided due care is taken not to damage or to compromise the associated structure in any way. Any scarring or scratches to structure caused by the lifting gear is to be restored to original condition.

3.1.5 With aid of the vessel's electrical office, the Contractor must lock out all electrical components related to the calorifier system, including heaters and circulation pumps. Panel P-620 feeds the calorifier units, P-611 and P-612 feed the hot water circ pumps.

3.1.6 Note: The calorifier water temperature must be allowed to cool to a safe level prior to draining the units of their contents.

- 3.1.7 The Contractor must disconnect all electrical and piping from the units and remove them from the vessel. This work must be completed in conjunction with SOW item H-13 - Domestic Freshwater Piping Replacement.
- 3.1.8 The Contractor must also remove the existing calorifier control panel located on the port bulkhead of the calorifier space.
- 3.1.9 The Contractor must remove ashore all components of the calorifier system from the vessel (excluding the circulation pumps) and dispose of all components as per federal and provincial regulations. With the current fitted insulation, the calorifier tanks will not fit through the compartment's doorway. The Contractor must remove the existing insulation to reduce the equipment size and cut the tanks up in sections as required for removal through the doorway.
- 3.1.10 The Contractor must cut and dispose of the existing equipment foundations from the deck, and grind flush to the steel deck. The contractor must note that, as per the attached hazardous material assessments and matrix, the deck area possesses coatings with potentially high levels of lead. Therefore the entire area around the foundation of the existing Calorifier that must be removed must be abated and disposed of by a certified third party abatement organization. All costs for this abatement and disposal must be included in the contractor's firm pricing for this SOW item.
- 3.1.11 The Contractor must design/engineer, fabricate and install new equipment foundations as required to affix the new calorifier footprint and support the new unit. New foundations are to receive two (2) separate coats of primer followed by two (2) separate coats of paint to match the deck's colour scheme. All engineering work must be carried out by certified Marine Naval Engineers/Architects.
- 3.1.12 The Contractor must install the new calorifier units and connect them to the vessel's domestic hot water piping system which is all being renewed as detailed in SOW item H-13-Domestic Water Replacement. Piping arrangements must maintain all functions as per original design. All new welds must receive 100% MPI testing by a certified third party organization.
- 3.1.13 Drain line(s), and relief valve ports must be directed downward and terminate at deck level into the calorifier catchall.
- 3.1.14 The Contractor must modify the existing current control panel mounts in order re-use them to secure the new control panel.
- 3.1.15 The Contractor must connect the new control station to the existing power feeds and make all the necessary electrical connections/terminations to the calorifier system components. The Contractor is responsible for supply and installation of all wiring, glands and electrical components required. All cables must follow existing trays and be secured in an approved manner to prevent sagging.

- 3.1.16 Upon completion of all work the unit's must be filled with water, and all system valves opened and tanks pressurized. Thermostat controls must be set as per Chief Engineers instructions, approximately 140 °F. The system must be tested for leaks, all controls function tested, and monitored for steady temperature control.
- 3.1.17 All areas of disturbed coatings must receive two (2) separate coats of marine grade primer, followed by two (2) separate coats of marine grade paint to match the vessels original colour scheme.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to the satisfaction of the CCG TA.
- 4.1.2 All watertight penetrations must be proven to be watertight and witnessed by the attending ABS surveyor

4.2 Testing

- 4.2.1 The system must fully tested, proven fully functional and to be accepted by the CCG TA. All defects found must be corrected by the Contractor at their expense.
- 4.2.2 All piping has to be hydrostatically tested to 6.5bar to be witness by the CCG TA, Engineer and the attending ABS Surveyor.
- 4.2.3 All welding performed in support of this installation must be visually inspected by both the ABS Surveyor and the CCG IA MPI reports must be provided to the CCG TA.

4.3 Certification

- 4.3.1 Welders must be CWB Certified for the type of welding they are required to perform.

5.0 Deliverables

5.1 Drawings

- 5.1.1 The Contractor must provide to the CCG TA detailed construction and wiring diagrams for the new calorifier system which will become property of Canada.

5.2 Reports/Manuals

- 5.2.1 The contractor must provide the CCG TA with all product and system technical data sheets and manuals, which will become the property of Canada.

5.2.2 The contractor must provide the CCGTA with all related piping hydro testing results.

5.3 Spare Parts

5.3.1 The Contractor must supply two spare heating elements, along with a list of other manufacture recommended spares for the new unit. CCG will direct the Contractor as to what spares to supply as part of this Contract and purchase of the identified spares will be done via PWGSC 1379 action.

H-15 POTABLE WATER HYDROPHORE REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW item is to replace the existing domestic fresh water hydrophore system with a new "*Contractor supplied*" marine approved unit. The existing unit has reached its life expectancy and is rated below desired system pressure ratings.
- 1.2 The new system supplied must be of a constant pressure design with variable frequency drive pumps. The new system must be able to fit in the general location as the existing equipment and be fully plumbed into the vessel potable water system. A constant pressure system will require the install of an emergency relief line to each of the potable water tanks.
- 1.3 This work must be carried out in conjunction with SOW items H-13 – Domestic Water Piping & H-14 – Calorifier Installation.
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 65-30-01 - Domestic and Sanitary Fresh Water Systems
- 65-30-02 _01-03 - Arrangement Domestic F.W. and Sanitary, 3 Sheets
- 65-10-03 – Fresh Water Generator
- 555-H-0016 - General Arrangement (1:50 Accommodation Layout)- Main Deck
- 555-H-0017 - General Arrangement- Main Deck Forward
- 555-H-0018 - General Arrangement (1:50 Accommodation Layout)- Upper Deck
- 555-H-0019 - General Arrangement- Foc'sle Deck (Page 1/1)
- 555-H-0020 - General Arrangement (1:50 Accommodation Layout)- Boat Deck
- 555-H-0021 - General Arrangement (1:50 Accommodation Layout)- Officers Deck and Wheelhouse

- Photos – Photos of the existing unit along with Name plate data is included in the TDP

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

3.1.1 Existing System Details

- One 107 US Gallon Tank
- 5B96 Alloy 655 Everdur
- Design Pressure – 50 psi @ 200F
- Insulation – Fiberglass AF 545
- Two Pumps

Note: Photos and additional name plate data is included in the TDP.

3.1.2 New System Requirements

- Constant pressure hydrophore system, fitted with dual pumps with variable frequency drives, and single pre-charged buffer tank.
- System capable of delivering at 8m³/h at 6.6 bar
- Dimensions must allow transport through existing vessel doorways.
- Pumps, tank, and skid piping must be constructed of stainless steel.
- Each pump must be rated to handle 100% of the peak demand at the design pressure.
- Each variable frequency drive is to have a dedicated redundant pressure transducer circuit and can individually control the system in case of emergencies.
- Stand by pump must have an auto start feature in the event of power loss, or low system delivery pressure.

3.1.3 The Contractor must supply a newly engineered constant pressure hydrophore system to meet the system requirements above.

3.1.4 The TA must be allowed to review the PO prior to ordering to ensure compliance with the requirements of this specification. All new unit documentation must be provided to the CCGTA for review and must be approved by the CCG TA prior to purchase.

3.1.5 With aid of the vessel's electrical officer the Contractor must lock out all electrical components related to the existing hydrophore system. Panel P-611 and P-612 feeds the existing hydrophore pumps.

3.1.6 The existing hydrophore pressure tank must be drained of its contents and disconnected both electrically and mechanically from its associated piping and removed ashore for disposal as per federal and provincial regulations.

- 3.1.7 Existing circulation pumps must be given to the vessel's Chief Engineer and will be retained as spares.
- 3.1.8 The existing foundations are to be removed and ground flush to the deck.
- 3.1.9 The Contractor must engineer/design, fabricate and install new equipment foundations to accept the footprint of the new Hydrophore. Foundations are to be receive two (2) separate coats of primer followed by two (2) separate coats of paint to the compartments colour schedule. All engineering work must be carried out by certified Marine Naval Engineers/Architects.
- 3.1.10 The new Hydrophore assembly is to be installed and secured to the new foundations.
- 3.1.11 Once installed, the Contractor must then connect the new unit into the vessel's domestic fresh water piping system. The Contractor must be responsible for the necessary piping, fittings, and valves required to do so. Material for these fittings and valves is to be the same as what is being replaced.
- 3.1.12 The Contractor is to supply and install a non-return valve on the common outlet line.
- 3.1.13 The Contractor must supply and install a new adjustable bronze pressure relief valve fitted within the common portion of each pump discharge. The relief valve discharge line must branch to each of the domestic freshwater tanks.
- 3.1.14 Contractor must install a new penetration into each tank for the purpose of these relief lines. Penetrations must be flanged and fitted with Contractor supplied bronze screw down non return valves. All tank penetrations must be approved by ABS. Locations are to be determined by the CCG TA and the vessel's Chief Engineer. Affected tanks must be air tested to 3 PSI for a minimum of 30 mins. to the satisfaction of the CCG TA/ABS upon the completion of all tank penetrations.
- 3.1.15 All piping must be schedule type K copper, dimensioned to be able to handle full load output flow. An approximate distance of 75 feet of new 2" piping including all required fittings and hardware must be fabricated and installed by the contractor. Piping must be secured with non-conductive pipe supports to prevent sagging and vibration. The contractor must supply and install a minimum of 15 support brackets. The contractor must include unit costs per foot of piping and per piping support to be adjusted by PWGSC 1379.
- 3.1.16 Upon completion of the steel work, all damaged areas of the freshwater tank coatings (both internally and externally) must be repaired to the satisfaction of the CCG TA and NACE inspector. The internal coating is Interline 975P from International Coatings. Internal damaged areas are to be feathered back to an

SP-11 standard to obtain a smooth, adhered coating edges. All paint dust and debris must be completely cleaned by the contractor and two (2) separate coats of the aforementioned paint must be applied to all affected areas. The Contractor must include pricing for power tooling and coating 40 M² of internal tank areas, with the total area to be adjusted by PWGSC 1379 based on the actual requirement. All areas of external coating damage must receive two (2) separate coats of primer followed by two separated coats of paint to the compartment's colour schedule.

- 3.1.17 The Contractor must strictly adhere to the paint manufacturers applications instructions for the internal and external tank coating repairs. All preparation and coating work must be inspected and approved by the NACE inspector and CCG TA at all steps of the application process. Any additional coating requirements including heating, fans, shelters, inserts etc. necessary to carry out the coating repair work detailed in this specification item must be carried out by the contractor and included in their firm pricing. The Contractor must strictly adhere to the paint manufacturers application instructions for the internal and external tank coating repairs and must provide all heating, ventilation and sheltering requirements necessary.
- 3.1.18 As noted in section 3.1.16 above, coating repairs are required inside the fresh water tanks due to this installation. The Contractor must completely clean and sanitize the tanks internals and flush multiple times with a certified potable water tank cleaning solution upon the completion of work in the fresh water tanks. A 28 parameter water sample test must be carried out by a certified third party laboratory and results must be provided to CCG. The tank must be cleaned and sanitized as required until CCG receives safe drinking water results.
- 3.1.19 The Contractor must connect the new hydrophore controls to the existing power feeds, and make all necessary electrical connections/terminations to the calorifier system components. The Contractor is responsible for the supply and installation of all wiring, glands and electrical components required. All cables must follow existing trays and be secured in an approved manner to prevent sagging.
- 3.1.20 Upon completion of all work, the unit must be tested for leaks, all controls function tested, and monitored for steady pressure control. System operating pressure must be set to maintain approximately seventy (70) psi on the domestic freshwater system. System testing must be as per manufacturer's instructions, and all control functions of the system witnessed and proven. Any defects noted during testing due to errors carried out during the installation of the new unit must be repaired at the contractor's expense.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to the satisfaction of the CCG TA and IA.
- 4.1.2 All watertight penetrations must be proven to be watertight and witnessed and signed off by the attending ABS surveyor.
- 4.1.3 System must fully tested and proven fully functional and to the satisfaction of the CCG TA.

4.2 Testing

- 4.2.1 All piping has to be hydrostatically tested to 6.5bar to be witness by CCG IA and the ABS Surveyor. Any leaks or damage must be corrected by the Contractor. Affected tanks must be pneumatically tested with 3 PSI for a minimum of 30 min. to the satisfaction of the CGTA and ABS surveyor.
- 4.2.2 All welds are to be visually inspected by both the attending ABS surveyor and the CCG IA and to be tested with 100% MPI by a certified third party organization.
- 4.2.3 The Contractor is to develop a four (4) hour test procedure to be performed during sea trials of the vessel. This procedure proposed is to be approved by the CCG TA and to record as a minimum the following for both units.
 - Pressures, recorded at 15-minute intervals for the first hour then hourly thereafter.
 - Amperage reading of associated electric motors
 - Water output (litres per min)
 - Megger readings of the associated electric motors taken before the trials starts and afterwards.
 - Low pressure auto start feature testing

4.3 Certification

- 4.3.1 Welders must be CWB Certified for the type of welding they are to perform in this specification.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 Contractor must provide to the CCG TA a detailed construction drawings and wiring diagrams for the new hydrophore system which will become property of Canada.

5.2 Spare Parts

- 5.2.1 The Contractor must supply a list of manufacturer recommended spares for the new unit. CG will direct the Contractor as to what spares to supply as part of this Contract and purchase of the identified spares will be done via PWGSC 1379 action.

5.3 Manuals/Reports

- 5.3.1 The contractor must provide the CCG TA with all product and system technical data sheets and manuals, which will become the property of Canada.
- 5.3.2 The contractor must provide the CCGTA with all related piping hydro testing results.

H-16 FRESHWATER GENERATOR INSTALLATION

1.0 Scope

1.1 The intent of this SOW item must be for the Contractor to:

- a) Remove and dispose of the existing Nirex Fresh Water Distiller and to install an GSM supplied Alfa Laval Fresh Water Generator complete with new ancillary equipment and piping.
- b) The new installation must also include fabrication and installation of a new mounting arrangement, trials, Original Equipment Manufacturer commissioning and training.
- c) The Contractor must install the Fresh Water Generator as per the appended technical drawing package from Allswater Marine Consultants Ltd. as well as the specifications contained herein.

1.2 The Contractor must be responsible for following tasks in order to complete the owner's requirements for the scope of work:

- Identification and removal of all interference items required to complete the work item.
- Piping and electrical modifications.
- Management of field service representation (FSR) for installation guidance, commissioning and training.
- Installation.
- Recoating of new and disturbed steel.
- Review and revision of as fitted drawings.
- Identification and reinstallation of interference items required to complete the work item.
- Scheduling of inspections, provision of testing and reports

1.3 This work must be carried out in conjunction with the following SOW items :

- E-01 - Propulsion Generator Replacement
- H-04 – Bilge Cleaning and Coating

1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of

discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

- 20068-580-A-045 - Allswater Drawing – Mounting Arrangement & Structural Detail
- 555 H-003 - Tank Top Structural Plan & Sections
- 555-H-0023 - General Arrangement
- 50-00-01_01 & 02 – Mechanical Arrangement Sheets1 & 2
- 65-10-03 – Fresh Water Generators
- Alfa Laval Aqua Blue C80- HWS Manual
- Alfa Laval drawing 985 26783(page 95 of Alfa Laval manual)

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- Coast Guard ISM Confined Space Entry Procedures
- Coast Guard ISM Hotwork Procedures
- Coast Guard ISM Lock out Tag out Procedures
- Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel including Annex M
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III
- Society for Protective Coating (SSPC) Standards
- SP1 - Solvent Cleaning
- SP2 - Hand Tool Cleaning
- SP3 - Power Tool Cleaning

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Government Supplied Material

2.4.1 The Coast Guard will supply one Alfa Laval Aqua Blue C80-HWS evaporator unit complete with the following:

- Hot Water Steam piping system
- Fresh water pump type PVVF-1532 (loose supply)
- Ejector pump type CNL 65-65/160 (loose supply)
- Control panel (loose supply)
- Dosing unit (loose supply)

2.5 Contractor Furnished Material

2.5.1 The Contractor must supply all labour and material required, including any material required to complete the work which is not explicitly identified in this SOW item.

2.5.2 The Contractor must refer to Allswater drawing 20068-580-A-045 for foundation and related material requirements.

2.5.3 The Contractor is responsible for obtaining ABS approval for all Contractor supplied materials used in this SOW item.

2.5.4 All Contractor Furnished Material must be new and of suitable quality for their intended purpose, equal to or better than existing and must also include;

- 3" Simplex Bronze strainer, class 150, with a 2 mm mesh size.

2.6 Field Service Representation (FSR)

2.6.1 The Contractor is to arrange to have one Alfa Laval Field Service Representative (FSR) on site for the installation guidance, commissioning and testing of the fresh water generator .

2.6.2 The Contractor must include an allowance of \$10,000.00 to cover the expenses of an FSR which is to include onsite presence as well as travel and living expenses.

This will be adjusted upward or downwards based on submitted final invoice and will be done via PWGSC 1379 action.

2.6.3 FSR contact information is as follows:

Gina Smith
Field Service Manager, Global Sales and Service
Tel direct: +1 416 297 6343 - Mobile: +1 416 318 3294
Email : gina.smith@alfalaval.com

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor is responsible for the identification of interference items, their temporary removal, storage and refitting to the vessel. Pipes requiring temporary isolation must be blanked off with suitable flanges and gaskets, or pipe caps of the correct size. Electrical circuits must be de-energized in consultation with the CCG TA.
- 3.1.2 From the time the new unit and all associated parts arrive at the contractor's facility until they are successfully installed on the vessel, the contractor is responsible for provided heated, dry and secure storage. The contractor must supply all craneage, forklifts, rigging, labour and all other related equipment and mechanical requirements necessary for the successful installation of the new f/w generator unit. This includes all movements around the contractor's facility, on/off trucks, in/out of storage and on/off the vessel. These requirements also apply to the existing distiller unit which must be removed from the vessel and disposed of as per Provincial and Federal Guidelines.
- 3.1.3 In consultation with the CCG TA and with the assistance of the vessel's Electrical Officer, the Contractor must de-energize power to the distiller motors, control panel circuits, local alarm circuits and power distribution panel and perform lockout/tag out procedures accordingly.
- 3.1.4 In consultation with the CCGTA the Contractor must isolate the distiller fresh water, jacket water, sea water and steam lines and perform lockout/tag out procedures accordingly.
- 3.1.5 The Contractor must supply all equipment, enclosures, ventilation, staging, chain falls, craneage, slings and shackles necessary to perform the work. All lifting equipment must be appropriate for the expected duties and be accompanied by current certifications indicating, or be permanently marked as to being, of an adequate safe working load for the expected duties. Any brackets or other welded attachments required in the performance of this specification must be welded into place by CWB certified welders certified to the above-noted welding standards.

- 3.1.6 The Contractor must protect the Fresh Water Generator and associated equipment through the duration of the installation work and up to its commissioning. Any damages resulting from the performance of this specification item will be repaired at the Contractor's expense.
- 3.1.7 The location of the work area is within frames 87 to 92 of the starboard lower engine room.
- 3.1.8 For any technical clarifications arising from the technical drawing package the Contractor must contact the following:

Russell Woodman, P.Tech.,
Senior Project Manager, Allswater Marine Consultants Ltd.
+1 709 747 9100 PHONE +1 709 730 9100 MOBILE
EMAIL rwoodman@allswater.com
WEB www.allswater.com

3.2 Removals

- 3.2.1 The Contractor must remove in its entirety and dispose of the existing Nirex Fresh Water Distiller. The Contractor must drain the distiller and dispose of all liquids prior to disconnecting any piping. The Contractor must remove the minimum amount of seawater, jacket water, fresh water and steam lines necessary to enable removal of the existing Nirex Fresh Water Distiller.
- 3.2.2 The Contractor must label and disconnect electrical cables to/from the distiller and secure the cables in a suitable location for temporary storage and protection.
- 3.2.3 The Contractor must remove all mounting fasteners and provide rigging and craneage necessary to remove the distiller and its associated equipment from the vessel. The contractor must utilize the temporary insert cut in the engine room hull for the installation of the new propulsion generators to rig the old f/w generator out and rig the new unit onto the vessel.
- 3.2.4 The final disposal of the distiller by the Contractor must be done in consultation with the CCG TA. The contractor must include in their pricing for the disposal of the existing unit as per provincial and federal guidelines.

3.3 Installation

- 3.3.1 The affected work areas must be cleaned of all debris prior to the installation of the new freshwater generator and components.
- 3.3.2 Contractor must power tool clean all damaged coating, bare and rusted areas to bare metal SSPC-SP-3, Power Tool Clean Standard. The Contractor must recoat

area prior to installation of new freshwater generator and its associated components. Contractor must apply two (2) coats of Amercoat 5105 – Alkyd Primer (Red Oxide) or equivalent at 2-3 mils DFT per coat and two (2) separate topcoats of Amercoat 5450 Alkyd Marine Enamel (Grey) or equivalent at 2 mils DFT per coat as per Manufacturer's instructions.

- 3.3.3 The Contractor must fabricate and coat a new foundation assembly as per the instructions detailed in the appended Allswater drawing 20068-580-A-045.
- 3.3.4 The Contractor must install the new Alfa Laval Freshwater Generator under the guidance of the Alfa Laval Field Service Representative and following the instructions detailed in the appended Allswater drawing 20068-580-A-045 and the appended Aqua Blue C80-HWS Manual.
- 3.3.5 The Contractor must mount the loose components included with the Alfa Laval Fresh Water Generator namely fresh water pump, ejector pump, control panel and dosing unit as per Aqua Blue C80- HWS Manual and in consultation with the Alfa Laval Field Service Representative.
- 3.3.6 The contractor must include a \$25,000.00 allowance for piping modifications required as part of the new Freshwater Generator installation. It is intended the Contractor will perform the modifications and connections in consultation with and to the satisfaction of the Technical Authority and Alfa Laval FSR. New piping sections must be 90/10 CuNi piping complete with fittings, flanges, gaskets and new hardware to tie into the existing piping system. The contractor must refer to the Alfa Laval Aqua Blue C80 Manual and dimensional drawing # 985 26783 for specific sizing requirements. All new piping must be primed and painted with a white marine grade top coat. All welding must be carried out by certified CWB welders with appropriate tickets and all new welds must be tested with 100% MPI by certified third party organization. This total cost must be adjusted by PWGSC 1379 based on the agreed upon actual hours worked on the piping modifications/fabrication and the material invoicing.
- 3.3.7 New modified pipe sections will be assembled at the Contractors shop and a pressure test must be performed. The test pressure must be six (6) Bar for a minimum of thirty (30) minutes. CCG IA and the ABS survey must be invited to must witness these tests.
- 3.3.8 The Contractor must use new fasteners and gaskets on all new or disturbed piping and install sufficient pipe hangers and supports to properly secure the piping. The hangers must prevent any undue stress from being exerted on the piping and evaporator. New chafing material must be fitted to each clamping surface.
- 3.3.9 The Contractor must apply two (2) coats of primer and two (2) topcoats to all disturbed new and disturbed piping of the space's colour schedule. Coatings used are to be approved by the CCG TA.

- 3.3.10 The Contractor must supply and must install any new wiring necessary for the new evaporator unit. The Contractor must re-connect the control panel, power panel and alarm & monitoring circuits under the supervision of the Alfa Laval Field Service Representative and in consultation with the CCGTA or designate. The system must be proven functional in the presence of CCG TA.
- 3.3.11 The new electrical wiring is to be secured to existing cable runs where ever possible. All work must be as per TP127 and Canada Shipping Act and to the satisfaction of the attending ABS surveyor.

4.0 Proof of Performance

4.1 Commissioning

- 4.1.1 Upon completion of the installation of the new Alfa Laval Fresh Water Generator the Contractor must, under the guidance of the Alfa Laval FSR, perform pre-start checks, startup, operation and shut down procedures in accordance with the Aqua Blue C80- HWS Manual. The CCG TA and IA are to witness this commissioning.

4.2 Test and Trials

- 4.2.1 The Contractor is to develop a four (4) hour test procedure to be performed during sea trials of the vessel. This procedure proposed is to be reviewed and accepted by the CCG TA and the Alfa Laval FSR and is to record as a minimum the following:
- Temperature and pressures, recorded at 15-minute intervals for the first hour then hourly thereafter.
 - Amperage reading of associated electric motors
 - Water output (litres per min)
 - Salinity levels of the output water
 - Megger readings of the associated electric motors taken before the trials starts and afterwards.

- 4.2.2 All MPI testing reports, CWB tickets and material certs must be provided to the CCG TA.

5.0 Deliverables

- 5.1 A three (3) type written copies and one electronic copy (PDF) of all readings recorded is to are to be given to be provided to the CCG TA.

H-17 CHAIN LOCKER SURVEY

1.0 Scope

- 1.1 The intent of this SOW item is to open both Chain Lockers for ABS survey, in conjunction with SOW items E-10 - Anchor Windlass Survey and H-18 - Anchors and Chains.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Drawings

- 555-H-0026 – Capacity Plan
- 555-H-023 - GA
- 555-H-2740 – W.T Manholes and W.T Access and Escape Hatches
- 67-30-01 – Air and Soundings
- H-3110 – Anchor Windlass Arrangement

3.0 Technical Description

- 3.1 *Note to Contractor. The Chain Lockers are to be considered as confined spaces under the Coast Guard's Safety Management System. The Contractor must ensure confined space entry permits and lockout/tag outs, as required, are in place.*
- 3.2 The Port and Starboard Chain Locker access manhole covers are located behind the tool board above the foc'sle workbench. The Contractor is responsible for the removal and replacement of the tool board in order to gain access to the chain lockers. Both anchors and anchor chains (H-18) must be removed prior to opening manholes covers.
- 3.3 All internal surfaces of the chain lockers must be hydro-blasted at a minimum of 3,000 PSI and cleaned of all scale, and debris. The false floor plates must be

unfastened and lifted up for thorough cleaning and subsequent painting on both sides. All scale and debris must be disposed of ashore.

- 3.4 Bilge wells to be thoroughly cleaned inspected and suctions proven clear.
- 3.5 After internals are cleaned, dry and accepted by the CGTA and NACE inspector, the contractor must power tool approximately 60 m² of loose, flaky interior surface coatings to bare metal with adhered coated edges. These bare areas must be cleaned after all powertooling/prep work and receive a coat of Amercoat Amerlock #2 Surface Tolerant Epoxy (Aluminum), or equivalent Epoxy, at 6 mil thickness. A price must be provided per m² which will be adjusted by PWGSC 1379 based on the actual repairs/coatings required. After this repair coat, the entire Chain Lockers and false floors must be coated with two (2) full coats of Amercoat Amerlock #2 Surface Tolerant Epoxy (Aluminum) or equivalent. Coatings are to be applied at 6 mils DFT per coat.
- 3.6 Sounding pipes, drains, and vents must be proven clear. Both Chain Lockers must be inspected by the Technical Authority, the Inspection Authority and the attending ABS Surveyor prior to the re-stowing the anchor cables. Upon completion of inspection, the false floor plates must be secured in place, using new Contractor-supplied S/S fasteners.
- 3.7 Upon completion of items H-18 - Anchors and Chains and E-10 - Anchor Windlass Survey, the Contractor must clean the sealing surfaces around the each manhole and cover and install the covers, using new ¼" thick rubber gaskets. Anti-seize compound must be used on all threads.
- 3.8 The Contractor is to include pricing for the replacement of 10 studs and quote a unit cost per stud to replace broken or defective manhole securing studs, should it be required. Studs damaged by the contractor must be replaced at their expense. The CG Technical Authority must perform a final inspection of the chain lockers prior to having them closed up and is also to witness the installation of the manhole covers.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 The Contractor is to be responsible for all inspections and is to consult with ABS prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is also to advise the CCG TA, in advance, to allow his/her attendance. All preparation and coating work will receive 100% visual inspections by CCG TA and the CG NACE inspector surveyor.

4.2 Reports

- 4.2.1 The Contractor must provide a Quality Assurance (QA) type written report recording the humidity and air/surface temperatures pre-coating, batch numbers and coating cure times as well as the DFT of each paint coating application.
- 4.2.2 Three (3) hard copies and one electronic copy of these aforementioned reports, must be provide to the CCG TA.

H-18 ANCHORS AND CHAINS

1.0 Scope

- 1.1 The intent of this SOW item is to remove both Anchors and Chains for cleaning and ABS survey. This work must be carried out in conjunction with SOW item E-10 - Anchor Windlass Survey and H-17 – Chain Locker Survey.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 Drawings
 - H-3110 – Anchor Windlass Arrangement

3.0 Technical Description

- 3.1 The bitter ends of both cables must be let go. The port and starboard anchors with their respective cables (9 shots of 40 mm SL chain per side) must be run out and ranged on the dock floor for inspection by the CCG TA/Engineer and the attending ABS surveyor.
- 3.2 Both anchor cables must be ranged in a suitable area for cleaning, inspection, and subsequent painting of shot markings. The joining shackles must be broken at both anchors.
- 3.3 Each cable must be hydro blasted clean at a minimum of 10,000 PSI, ensuring all previous painted links show no residual markings; all seizing wire markings to be removed from each cable. All links and studs on each cable must be hammer tested and visually inspected for defects. Any defective links and studs must be marked for identification and brought to the attention of the Chief Engineer.
- 3.4 The first two shots on each cable must be removed and re-attached at the bitter end.

- 3.5 Contractor is to measure three (3) random links in each shot of chain port and stbd. All measurements are to be tabulated and a copy given to the CCG TA/Engineer and the ABS Surveyor. Four (4) measurements per link must be taken. If additional measurements are requested by the ABS surveyor, it will be captured by PWGSC 1379.
- 3.6 After inspection, the joining shackles must be re-assembled and the tapered pins sealed in place with lead. Cable shots must be marked as per accepted marine practice using new seizing wire. The shot lengths must be marked off as per Figure 1 using white marine enamel and joining shackles must be painted with red marine enamel; the Contractor must ensure the entire links are painted. Care must be taken to prevent grit, sand, or other debris from contacting the paint before it has dried.

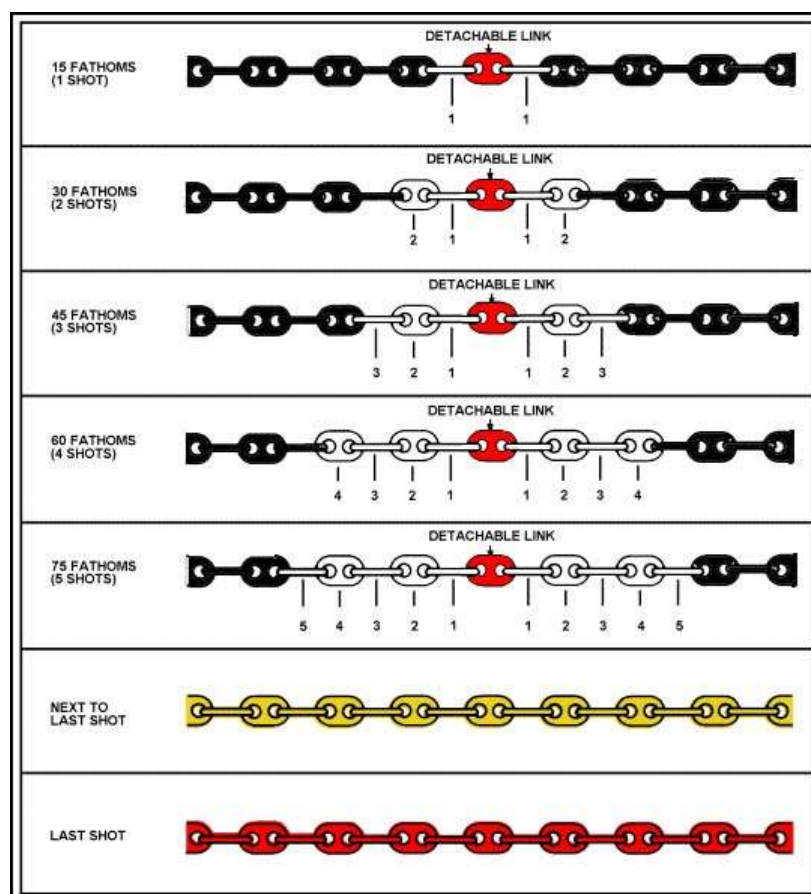


Figure 1

- 3.7 The Contractor must grit blast both anchors to SSPC-SP-6 and must apply two coats of Amercoat 238 Abrasion Resistant Epoxy (Black) at 10 mils DFT per coat. A fully certified, marine grade equivalent may be used if approved by the CCG TA and NACE inspector.

- 3.8 After coatings and inspections are complete, the Anchors must be reconnected and both Anchors and Chains must be stowed onboard, ensuring proper fleeting of the cables within the Chain Lockers. Bitter ends must be reattached.
- 3.9 The Contractor must note that stowing of the cable must be carried out in conjunction with SOW item E-03, Anchor Windlass Inspection.

4.0 Proof of Performance

- 4.1 The Contractor is to be responsible for all inspections and is to coordinate with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to also advise the CCG TA, in advance, to allow his/her attendance.
- 4.2 The Chief Engineer is to witness the attachment of the bitter ends prior to closing up the Chain Lockers.

5.0 Deliverables

5.1 Inspections

- 5.1.1 All work to be witnessed by the CCG TA, ABS Surveyor and NACE inspector.

5.2 Reports

- 5.2.1 The Contractor must provide a Quality Assurance (QA) type written report recording the humidity and air/surface temperatures pre-coating and during coatings cure time as well as the DFT of each paint coating application.
- 5.2.2 Three (3) hard copies and one electronic copy of these aforementioned reports, must be provide to the CCG TA.

H-19 EXTERIOR DRAIN SCUPPER REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW item is to remove and renew the existing exterior deck drain scuppers on the vessel's Main, Upper and Forecastle decks.
- 1.2 This SOW item must be completed in conjunction with the following SOW items:
 - H-03 Hull Cleaning & Coating
 - H-11 Void Space & Ballast Tank Inspections
 - H-12 Ballast Tank Coatings
 - H-32 Galley Upgrades
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 555-H-0016 - GA (1:50 Accommodation Layout)- Main Deck
- 555-H-0017 - GA Main Deck Forward
- 555-H-0018 - GA (1:50 Accommodation Layout)-Upper Deck
- 555-H-0019 - GA - Foc'sle Deck (Page 1/1)
- 65-40-01 Sheets 1-4 – Deck Drains and Scuppers
- 67-50-01 Sheets 1-4 – Weather Deck Scuppers

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard

- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

- 3.1.1 Prior to any hot work taking place, the Contractor must ensure that the area of work and all equipment, wiring, transits, etc. have been sufficiently protected from any sparks or metal filings. The Contractor must also ensure that the area of work, the system, and the adjacent space is certified as gas free and suitable for hotwork as per the Fleet Safety and Security Manual. This must include the cleaning and gas freeing of and tanks in which work is required.
- 3.1.2 The Contractor must remove and re-install all required deck head panels, bulkhead panels, insulation, and sheathing required to gain access to the scuppers. Any

disturbed insulation must be replaced with class approved material and secured as per vessel construction regulations.

- 3.1.3 Any damage to paneling, ceiling tile, Tee Bar sections, cabinets or any other equipment that was taken out and put back, by Contractor, to carry out this work must be repaired or replaced by the Contractor at their expense.
- 3.1.4 The Contractor must be responsible to ensure that all areas have been thoroughly cleaned and free of any debris resulting from the performance of this specification item.
- 3.1.6 The Contractor must make suitable arrangements to isolate and ventilate the work areas to prevent smoke and fumes from migrating throughout the vessel.

3.2 Removals and Installations

- 3.2.1 The Contractor must cut out and remove the existing deck scuppers in their entirety from deck penetration to the ships side, care must be taken to ensure hole sizes are maintained within tolerance to weld in new scupper pipes. New sections of piping are to be fabricated and re-installed in the existing locations on the vessel.
- 3.2.2 The Contractor must include the removal of twenty-four (24) scuppers (fourteen (14) on the upper deck, six (6) on the main deck, and four (4) on the forecastle deck.).
- 3.2.3 New scupper sections are to be fabricated from new schedule 80 pipes and must be of equal or slightly greater dimensions to the removed original units.
- 3.2.4 Guidance for design and sizes can be found on drawing 67-50-01 Deck Scuppers sheet 1 and 4. Note: Sheet one is not as built. Fabrication/supply must include new stainless steel grid plates for each scupper, as identified in the previously mentioned drawings.
- 3.2.5 The scuppers to be replaced on the upper deck pass through accommodation spaces, the scuppers to be replaced on the main deck pass through void and ballast tanks, two (2) scuppers on the foc'sle deck are mounted externally, while the remaining two (2) pass through foc'sle work areas.
- 3.2.6 The two (2) after most scuppers on the main deck pass through void tank sides within the winch room area. **Note: the void tank exterior sides are coated with an asbestos insulation material which will require abatement before hotwork can proceed. The contractor must include all asbestos removal and abatement costs and air quality testing related to this area in their firm pricing for this SOW item.**

- 3.2.7 Newly constructed scuppers must be hot dip galvanized upon construction. After installation heat affected areas of the vessels hull coatings must be repaired in conjunction with vessels hull painting spec, deck areas must be receive one coat of red oxide primer followed by two (2) separate coats of paint to the area's colour scheme. Heat affected areas within tanks and voids must receive two (2) separate coats on Intershield 300 or fully approved, marine grade equivalent. All paint must be Contractor supply.
- 3.2.8 All scupper pipes passing through internal accommodation areas of the vessel must be suitably insulated to prevent condensation. Insulation must be ABS approved and is to be supplied and installed by the Contractor.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to be verified by the CCG TA and IA.
- 4.1.2 All watertight penetrations must be proven to be watertight and tested as per ABS surveyor instructions. inspections.
- 4.1.3 System must be fully tested and proven fully functional. All defects noted must be corrected by the Contractor.

4.2 Testing

- 4.2.1 New scupper and piping section must be flushed with water to test for leaks. Any leaks or damage must be corrected by the Contractor at no cost to Owner.
- 4.2.2 Welds must be tested with 100% MPI by a certified, third party organization. Weld inspections and any additional NDT testing required must be completed as per direction of ABS surveyor and to his or her satisfaction.

4.3 Certification

- 4.3.1 Welders must be CWB Certified for the type of welding they are to perform by this SOW item.
- 4.3.2 The contractor must provide the CCGTA with all certificates and documentation regarding all Asbestos/Hazardous material abatement carried out by a certified third party abatement professionals.

5.0 Deliverables

5.1 Drawings/Reports

5.1.1 Copies of all welding inspection (NDT) reports must be provided to the CG TA.

5.1.2 The contractor must update all ships drawings affected by the work in this specification. At a minimum, new “as fitted drawings” must be developed for 65-40-01 – 04 – Deck Drains and Scuppers - and all related General layout and General Arrangement drawings.

H-20 INTERIOR DRAIN SCUPPER REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW item is to remove and replace approximately twenty (20) existing internal steel deck scuppers.
- 1.2 This work must be carried out in Conjunction with the following SOW items:
 - H-19 Exterior Drain Scupper Replacement
 - H-22 Grey Water Pipe Replacement
 - H-32 Galley Upgrades
 - H-35 Common Area Flooring & Wall Covering Renewals
 - H-36 Washroom Upgrades
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 555-H-0016 - GA (1:50 Accommodation Layout)- Main Deck
- 555-H-0017 - GA Main Deck Forward
- 555-H-0018 - GA (1:50 Accommodation Layout)-Upper Deck
- 555-H-0019 - GA - Foc'sle Deck (Page 1/1)
- 65-40-01 Sheets 1-4 – Deck Drains and Scuppers
- H-3510 – Deck Covering Plan
- 67-50-01 Sheets 1-4 – Weather Deck Scuppers

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hot work Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures

- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must crop out and renew approximately twenty (20) internal deck scuppers. All scuppers in the galley must be all replaced and the remaining scuppers to be replaced are shower scuppers, machinery space scuppers, galley and passage-way scuppers. The contractor must provide a unit cost per scupper to be adjusted by PWGSC 1379 in case it is determined on site that additional scuppers need replacement.

- 3.1.2 Once the piping identified in SOW item H-22 – Grey Water Piping Replacement - is removed, the scuppers to be replaced by this specification must be identified by the CCG TA. The Contractor must quote individual unit prices for the shower scuppers, the galley scuppers and the passageway scuppers for adjustment purposes via PWGSC 1379.
- 3.1.3 The Contractor must make suitable arrangements to isolate and ventilate the work area to prevent smoke and fumes from migrating throughout the vessel.
- 3.1.4 Prior to any hot work taking place, the Contractor must ensure that the area of work and all equipment, wiring, transits, etc. have been sufficiently protected from any sparks or metal filings.
- 3.1.5 The Contractor must be responsible to ensure that all areas have been thoroughly cleaned and free of any debris resulting from the performance of this SOW item.
- 3.2 Removals and Installation
 - 3.2.1 The Contractor must cut out and remove the deck scuppers identified by the CG TA.
 - 3.2.3 The Contractor must quote on replacing approximately one hundred (100) feet of 2 ½ inch piping connecting the grey water main pipe to the scuppers including all associated fittings and hardware. The Contractor must quote on a unit price per foot of pipe replacement for adjustment purposes by PWGSC 1379. Note: this SOW item is in conjunction with the grey water system piping replacement and pipe replacement is to only be submitted once.
 - 3.2.4 The Contractor is responsible for the removal and replacement of any deck coverings and interference items needed to gain access to the steel below. The Contractor will supply and install all new flooring where removal is required. The contractor must include an allowance of \$40,000.00 for flooring repairs required in way of the scupper replacements. This allowance must only be used for any required flooring repairs not covered in specification item H-35 – Common Area Flooring and Wall Covering Renewals or H-36 – Washroom Upgrades. All flooring repairs must be carried out by fully certified flooring installers and repairs are to be carried out as per the existing flooring scheme in the area of the scupper. This allowance will be adjusted by PWGSC 1379 based on final invoicing.
 - 3.2.5 The Contractor must dispose of all piping and flooring as per federal, provincial, and municipal regulations.
 - 3.2.6 The Contractor must supply and install a new ABS approved deck scupper complete with debris grates.

- 3.2.7 Each scupper must be welded into the deck into the existing position, and tied into the new PVC style piping being installed as part of specification item H-22 – Grey Water Pipe Replacement.
- 3.2.8 The Contractor must recoat all heat affected and new steel with two (2) separate coats of *Krylon Rust Tough 250* of the appropriate colour on all surfaces
- 3.2.9 The Contractor must re-install the disturbed floating floor or install new ABS Canada approved material in its place.

3.3 Interferences

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

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to the satisfaction of the CCG TA and IA.
- 4.1.2 All watertight penetrations must be proven to be watertight and tested as per ABS surveyor instructions.
- 4.1.3 System must fully tested and proven fully functional. All defects noted must be corrected by the Contractor.
- 4.1.4 Each new scupper and associated piping sections must be flushed with water to test for leaks and witness by the CCG IA. Any leaks or damage must be corrected by the Contractor.

4.2 Certification

- 4.2.1 Welders must be CWB Certified for the type of welding they are to perform in support of this SOW item.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The contractor must update all ships drawings affected by the work in this specification. At a minimum, new “as fitted drawings” must be developed for 65-40-01 – 04 – Deck Drains and Scuppers - and all related General layout and General Arrangement drawings.

H-21 KICK PIPE/WIRE PENETRATIONS REPLACEMENT

1.0 Scope

- 1.1 The intention of this SOW item is for the Contractor to replace various kick pipes throughout the vessel, locations and images listed below. This work must be carried out in conjunction with SOW items H-03 – Hull Cleaning and Painting and H-30 – Bow Thruster Replacement.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

- H-0016 - GA (1:50 Accommodation Layout)- Main Deck
- H-0017 – GA - Main Deck Forward
- H-0018 - GA (1:50 Accommodation Layout)- Upper Deck
- H-0019 – GA - Focsle Deck (Page 1/1)
- H-0020 - GA (1:50 Accommodation Layout)- Boat Deck
- H-0021- GA (1:50 Accommodation Layout)- Officers Deck and Wheelhouse
- 80-25 - Power deck plan bridge dk. & wheelhouse top
- 80-26 - Power deck plan officers' & boat decks
- 80-27 - Power deck plan upper deck
- 80-28 - Power deck plan main deck

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- Coast Guard ISM Confined Space Entry Procedures
- Coast Guard ISM Hotwork Procedures
- Coast Guard ISM Lock out Tag out Procedures
- Coast Guard ISM Fall Protection Procedures

- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

- 2.4.1 The Contractor must be responsible for supplying all materials, equipment and tools needed to complete the task described below.

2.5 Interferences

- 2.5.1 The Contractor must be responsible for identifying, removing, storing, and replacing to an as found condition any and all visible or identified interference items needed to perform this task

3.0 Technical Description:

3.1 General

- 3.1.1 With the aid of the vessel's electrical officer, the Contractor must isolate the electrical power to each of the following equipment listed below in section 3.2, disconnect the associated wires from the terminal boxes, and pull the wires back through. All Cabling to be labelled, wrapped and protected from any potential

damage. Any repairs to cabling due to work activities must be repaired at the contractor's expense.

- 3.1.2 Contractor must cut out and remove existing corroded kick pipes. Contractor must dispose of all material in accordance with federal, provincial, and municipal regulations.
- 3.1.3 The Contractor must fabricate and install new galvanized steel kick pipes. New pipes are to be of the same length and schedule as existing.
- 3.1.4 All new and heat affected steel must be coated with two (2) separate coats of marine grade primer and a top coat matching the existing area colour scheme.
- 3.1.5 Existing cables must be pulled back through new kick pipes and new gland arrangements fitted. The Contractor must ensure they are properly packed and sealed to prevent the ingress of water. The Contractor is responsible for the reconnection of the wiring from to the associated pieces of equipment.
- 3.1.6 The cable lengths must be secured in the same manner prior to removal.
- 3.1.7 The Contractor is responsible for the identification and removal of all interference items. This includes all deck head panels, bulkhead panels, insulation, sheathing, electrical and piping as needed to gain access to the underside of the transits. Removed items are to be labeled and stored in so as not to incur damage.
- 3.1.8 The Contractor must ensure that all interior spaces and furnishings are properly protected from hot work, dust, and debris and ensure the spaces are properly cleaned after the work is completed. Any damaged components as a result of inappropriate storage or handling must be replaced at the Contractor's expense.
- 3.1.9 The Contractor must be responsible for contacting and arranging the site visits by ABS and schedule all return visits according to the Inspectors requirements.
- 3.2 Kick Pipe Locations
 - 3.2.1 Port Gangway Light Switch



- Penetrates into Freezer space main deck.
- Approx. 25.5 inches long, nominal ½ inch piping
- Contractor must also replace receptacle and switch with new marine waterproof components.
- This kick pipe enters the vessel above the freezer space on the main deck. The Contractor will be required to cut and access hatch in the freezer deckhead below the kick pipe location. The Contractor must install a hinged insulated freezer hatch in the location of the opening for future access to the area.

3.2.2 Old Anchor Windlass Wiring



- Located on the vessel foc'sle deck. Penetrates the deck above the bow thruster MCC cabinets. Repairs will have to be made in conjunction with the bow thruster replacement.
- Five (5) kick pipes must be cut from the deck and openings sealed. Any inserts must meet IACS guidelines, and ABS approval.
- Wiring must be pulled and removed from the vessel in their entirety.

3.2.3 Starboard Hanger Talk Back System



- pipes penetrate into near aft bulkhead of cabin

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- $\frac{1}{2}$ inch piping required, approximates lengths forty-four (44) and seventy-four (74) inches

3.2.4 Starboard Well Deck Fire Station #14



- Penetrates into winch room starboard side
- $\frac{3}{4}$ nominal piping, approx. fifty-four (54) inches long

3.2.5 Starboard Well Deck Talk Back Control



- Penetrates into winch room starboard side
- $\frac{3}{4}$ nominal piping, approx. Forty-eight (48) inches long

3.2.6 Old Anchor Windlass Hydraulic Piping



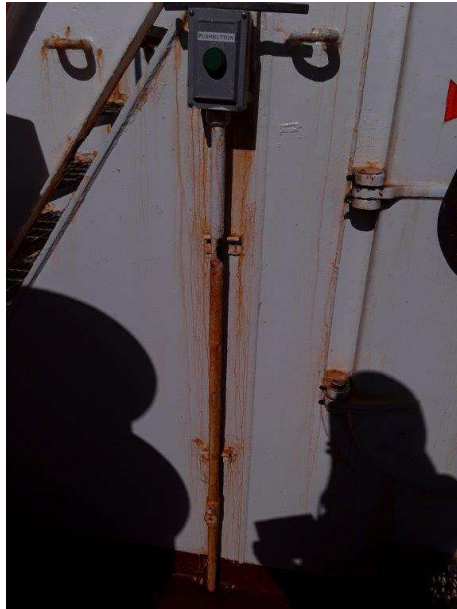
- Located on the vessel foc'sle deck, under step plate. Penetrates the deck above the bow thruster MCC cabinets. Repairs will have to be made in conjunction with the bow thruster replacement.
- Kick pipes must be cut from the deck and openings sealed. Any inserts must meet IACS guidelines, and ABS approval.
- Hydraulic piping must be pulled and removed from the vessel in their entirety.

3.2.7 Starboard Nav Light and Flood Light



- Two (2) pipes total
- Penetrates aft outboard corner of officer's lounge
- ½ inch nominal pipe, approx. 8 inches long each
- Contractor must replace the three (3) existing junction boxes with new marine approved waterproof fixtures.

3.2.8 Talk Back Control Port Well Deck



- Penetrates into winch room port side
- $\frac{3}{4}$ inch pipe, approx. Fifty-four (54) inches in length

3.2.9 Fire Main Heating



- Penetrates into cabin 234
- $\frac{3}{4}$ inch pipe, approx. Thirty-seven (37) inches long

3.2.10 Talk Back Helicopter Fueling Station



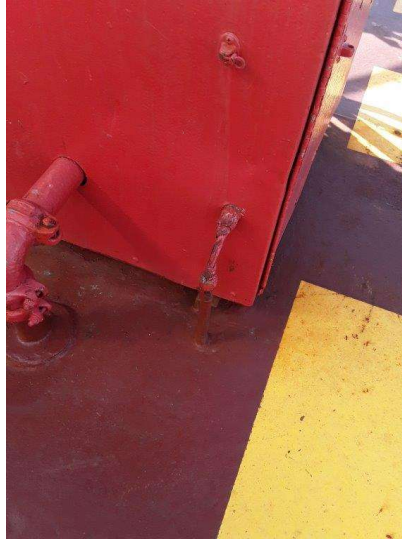
- Penetrates into cabin 234
- ½ inch pipe, approx. Forty-two (42) inches long

3.2.11 Foam Pump and Monitor Pump (Port and Starboard)



- Four (4) Pipes Total
- Located on boat deck port and starboard sides near aft stairwells
- Penetrates near aft bulkheads in cabin 240 and 241
- ½ inch pipes, approx. Twenty-four (24) inches each.

3.2.12 Fire Station 32 Boat Deck



- Penetrates into washroom of cabin 241, upper deck
- ½ inch pipe, approx. Ten (10) inch long

4.0 PROOF OF PERFORMANCE

4.1 Inspection

4.1.1 All work completed will be subjected to an inspection by the CCG TA and IA.

4.1.2 All welding will be subjected to 100% visual inspection by the CCG TA and IA and is to meet with the approval of the attending ABS surveyor.

4.2 Testing

4.2.1 The newly installed kick pipes and glands must be hose tested and witnessed by and be to the satisfaction of both the CCG IA and the attending ABS Surveyor. Any deficiencies found will have to be repaired at the Contractor's expense.

4.2.2 All welds are to be tested with 100% MPI by a certified third party organization and reports are to be provided to the CCGTA.

H-22 GREY WATER PIPE REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW item must be to have the grey water system piping and the listed associated components replaced. All new Grey water piping must be made up of an approved plastic piping system, including adhesive. This work must be carried out in conjunction with SOW item H-24 – Sewage Vacuum Piping & Separator Replacement.
- 1.2 The Contractor must remove, supply, fabricate and install new piping and fittings for the grey water system and supply and install all new as fitted.
 - Grey water pipe.
 - Check valves.
 - Unions
 - Victaulic couplings
 - Valves
 - Various scuppers.
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data:

- 65-50-01-01 & 02 – 2 Sheets - Sewage and Grey Water Diagrams
- H-0016 - GA (1:50 Accommodation Layout)- Main Deck
- H-0017 - GA - Main Deck Forward
- H-0018 - GA (1:50 Accommodation Layout)- Upper Deck
- H-0019 – GA - Focsle Deck (Page 1/1)
- H-0020 - GA (1:50 Accommodation Layout)- Boat Deck
- H-0021 - GA (1:50 Accommodation Layout)- Officers Deck and Wheelhouse
- H-3510 – Floor Covering Plan
- H-3810 – H VAC Main deck
- H-3820 – H VAC upper deck

- H-3810 – H VAC boat deck
- 65-40-01- 4 Sheets – Deck Drains and Scuppers

2.2 Standards:

2.2.1 The following Coast Guard Standards and or Technical Bulletins must be adhered to in the course of executing this specification. Copies of these standards and bulletins can be obtained from the CCG Technical Authority.

- Canadian Coast Guard Fleet Safety Manual (DFO 5737)
- Coast Guard ISM Confined Space Entry 7.D.9
- Coast Guard ISM Hotwork procedures
- Coast Guard ISM Fall Protection procedures
- Canadian Coast Guard Welding Specifications for Ferrous Materials, Revision 4. (TP6151 E)
- CWB CSA 47.1 latest revision Division I, II or III
- SSPC-SPT

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations
- CSA Fire Regulations

2.4 Owner/Contractor Furnished Equipment :

2.4.1 The Contractor must be responsible for supplying all labour, materials, equipment, and parts required to perform the specified work, unless otherwise stated.

3.0 Technical Description

3.1 General

3.1.1 The electrical and piping systems associated with these particular pipes must be locked out and tagged out in consultation with the Chief Engineer and vessel's Electrical Officer.

- 3.1.2 Tanks must be drained, opened up, washed down with high pressure water and then certified gas free and safe for persons to enter. One copy of each gas free certificate must be posted outside of subject tank, near manhole, and one copy of each certificate must be given to the Chief Engineer prior to persons entering the tank. Each tank interior is then to be washed with high pressure water/degreaser mixture, and remnants disposed of. Tanks are then to be wiped dry and free of particles.
- 3.1.3 The Contractor must remove and replace all of the grey water pipe from every sink trap, scupper, shower drain, grease trap, laundry washers, drinking fountains, deck scuppers, wash basin trap, and ice maker to the grey water, ejector, galley water injector, and sewage tank. All pipes are to be replaced with new pipe, sized, length as per the pipes being replaced.
- 3.1.4 *SeaCore Piping Systems Solutions* for Marine Applications, or a fully certified, class approved equivalent, must be used and confirmed by ABS as being an acceptable supplier prior to procurement/installation.
- 3.1.5 The Contractor must ensure that the supplied pipes/fittings are permanently marked with Manufacturer's name, type designation, size, pressure ratings, design standards, date of fabrication and serial number as per EU MR TR – Plastic Piping Systems (Components) Section 4 noted on Confirmation of Approval Document 15-HS1456208-1-PDA.
- 3.1.6 The installer must be certified to ASME B31.3 Bonder certification.
- 3.1.7 Only SeaCor Marine cement and Primer, or certified equivalent, must be used for joints and joining techniques are to be in accordance with Manufacturer's installation guidelines as per EU-MR TR- Plastic Piping Systems (Components) 1.d (a.).
- 3.1.8 The Contractor must lay 6 mil plastic sheeting on the deck, furniture, etc. in-way of piping removals. All items must be covered and seams taped to prevent contamination of spaces.
- 3.1.9 The Contractor must be responsible for the identification, removal, storage and re-installation of all interference items including ceiling and bulkhead panels, and any sanitary appliances required to be removed to gain access to the grey water piping. All items removed must be re-installed upon completion of repairs in that space to the satisfaction of the CCGTA.
- 3.1.10 Pipes must be fitted in as straight of runs as possible with as few turns as possible. The Contractor must reuse existing hangers and pipe supports where possible and must supply and install new as required. Pipe supports and hangers must be installed at sufficient intervals to prevent sagging and vibration. The contractor

must include pricing for the complete replacement of 40 piping hangers/supports and provide a unit cost per hanger to be adjusted by PWGSC 1379.

3.1.11 It is the responsibility of the Contractor to confirm piping routes and locations as detailed in the attached ship's drawings. The contractor will also have the opportunity to view during the on-site vessel viewing. The contractor must provide per foot unit costs for the removal of the existing and supply and installation of $\frac{3}{4}$ ", 1", 1 $\frac{1}{2}$ ", 2", 2 $\frac{1}{2}$ ", 3" & 4" piping as part of this specification item for adjustment by PWGSC 1379 based on the actual requirement. The Contractor must include in their pricing to supply, fabricate and install the following lengths of piping as detailed below:

- 200 feet of 100 mm (4 inch) pipe, fittings and associated hardware and quote a unit price per foot for required adjustments via PWGSC 1379.
- 150 feet of 75 mm (3 inch) pipe, fittings and associated hardware and quote a unit price per foot for required adjustments via PWGSC 1379.
- 700 feet of 50 mm (2 inch) pipe, fittings and associated hardware and quote a unit price per foot for adjustment via PWGSC 1379.
- 200 feet of 65 mm (2 1/2 inch) pipe, fittings and associated hardware and quote a unit price per foot for adjustment via PWGSC 1379.
- 200 feet of 32 mm (1 $\frac{1}{4}$ inch) pipe, fittings and associated hardware and quote a unit price per foot for adjustment via PWGSC 1379.
- 100 feet of 25 mm (1 inch) pipe, fittings and associated hardware and quote a unit price per foot for required adjustments via PWGSC 1379.
- 75 feet of 20 mm ($\frac{3}{4}$ inch) pipe, fittings and associated hardware and quote a unit price per foot for required adjustments via PWGSC 1379.
- A separate unit cost for 1 $\frac{1}{2}$ " piping must be supplied for adjustment via PWGSC 1379 if required on site.

Note: The unit costs provided above must also be applicable to the piping replacements carried out in specification item H-24 – Sewage Vacuum Piping and Separator Replacement. These unit costs must be used for adjustment of the sewage piping replacements by PWGSC 1379, if required.

3.1.12 All bulkhead and deck penetrations must be replaced, at a minimum, with galvanized sched. 40 piping or equivalent to meet ABS requirements and must be approved by the attending ABS inspector prior to installation.

3.1.13 The Contractor must renew piping to the following specifications:

- a. The new pipe must be A.S.T.M. grade A or better quality if approved by the CG TA.
- b. Connections for piping up to 32 mm nominal diameter must be screwed unions.
- c. Any required Gaskets are to be Neoprene or equivalent.
- d. New valves are to be bronze body and bronze trim, or ABS approved Seacor equivalent if available
- e. Valves up to 32 mm to have union bonnets and screwed connections, or ABS approved Seacor equivalent if available
- f. Valves 40 mm and up to have bolted bonnets and flanged 150 # A.S.A, or ABS approved Seacor equivalent if available
- g. Branch connections must be 45 degrees and bends must be large radius.
- h. All clean-out facilities existing must be replaced as fitted. Two (2) additional clean out facilities must be installed as per locations directed by the CCG TA.

3.1.14 The Contractor must ensure the work areas are kept clean and all debris from this job is cleaned up daily so as not to present tripping hazards or other related hazards to other workers in the areas.

3.1.15 The entire vessel must be thoroughly cleaned to the satisfaction of the CCG TA after the completion and testing of this SOW item. The vessel must be given back to CCG in “as delivered” condition.

3.2 Interferences

3.2.1 The Contractor must be responsible for identification of interference items, their temporary removal, storage, and their refitting to the vessel. It is the responsibility of the contractor to set up all staging and scaffolding requirements as necessary to gain access to all areas of this piping system and to suitably protect all areas of the vessel while carrying out the work detailed in this SOW item.

4.0 Proof of Performance

4.1 Inspections

4.1.1 All work must be completed to the acceptance of the CCG TA, IA and attending ABS inspector.

4.1.2 All new pipes must be pressure tested to 6 PSI prior to installation. These tests are to be witnessed by the CCG IA

4.2 Testing

4.2.1 The systems are to be tested and proven operational. All tests to be witnessed and found to be to the satisfaction of the CCG IA.

4.2.2 All welding to be tested with 100% MPI by certified third party organization. Reports must be provided to the CCG TA.

4.3 Certifications

4.3.1 Welders must be CWB Certified for the type of welding required by this specification. Material certs must be provided to the CGTA.

4.3.2 Certified Marine Chemist must be used.

5.0 Deliverables

5.1 Drawings/Reports

5.1.1 All reports from the work specified must be type written and provided to the CCG TA. Copies of all invoices must be provided to the CCG TA along with all material and installer certifications.

5.1.2 The contractor must update all relevant ship's drawings based on the new piping installation. This includes, at a minimum, drawings 65-50-01-01 & 02 – Sewage and Grey Water Diagrams and all related General Layout and General Arrangement drawings.

5.2 Spares

5.2.1 The Contractor must supply the following piping of the approved plastic material. Contractor must provide these spares to the vessel complete with a priced itemized list of material same including contact information for Contractor's Supplier. This list will be used for future purchases:

- Twenty (20) feet each of 4", 2 ½", 2" and 1 ¼" Pipe
- Two (2) containers of approved sealant.
- Two (2) each of 4", 2 ½", 2" and 1 ¼" check valves
- Two (2) each of 4", 2 ½", 2" and 1 ¼" Y clean-out assemblies
- Two (2) each of 4", 2 ½", 2" and 1 ¼" T-Shape Clean outs
- Two (2) each of 4", 2 ½", 2" and 1 ¼" T-Shape Clean outs

- Two (2) each of 4", 2 ½", 2" and 1 ¼" Isolation Valves
- Four (4) each of 4", 2 ½", 2" and 1 ¼" pipe unions
- Four (4) each of 4", 2 ½", 2" and 1 ¼" pipe coupling
- Four (4) each of 4", 2 ½", 2" and 1 ¼" of 90-degree elbows
- Four (4) each of 4", 2 ½", 2" and 1 ¼" of 45-degree elbows

H-23 SANITARY WATER PIPING REMOVALS

1.0 Scope

- 1.1 The Contractor must remove the galvanized steel sanitary water system from the vessel in its entirety. This system is used to supply flushing water to the vessels toilets.
- 1.2 This work must be carried out in conjunction with the following SOW item H-13 – Domestic Water Piping.
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 65-30-01 - Domestic and Sanitary Fresh Water Systems
- 65-30-02 _01-03 - Arrangement Domestic F.W. and Sanitary, 3 Sheets
- 65-10-03 – Fresh Water Generator
- 555-H-0016 - General Arrangement (1:50 Accommodation Layout)- Main Deck
- 555-H-0017 - General Arrangement- Main Deck Forward
- 555-H-0018 - General Arrangement (1:50 Accommodation Layout)- Upper Deck
- 555-H-0019 - General Arrangement- Foc'sle Deck (Page 1/1)
- 555-H-0020 - General Arrangement (1:50 Accommodation Layout)- Boat Deck
- 555-H-0021 - General Arrangement (1:50 Accommodation Layout)- Officers Deck and Wheelhouse

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures

- Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504, 60332-3, 60364-5-52, 60533, 60754-0, 1, 2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

- 2.4.1 The Contractor must be responsible for supplying all labour materials, equipment, and parts required to perform the specified work, unless otherwise stated.

3.0 Technical Description

3.1 General

- 3.1.1 If the Potable Water system is to remain charged prior to commencement of any work on the sanitary water system, the Contractor must ensure the system isolation valve is locked out and the system is drained of any water.
- 3.1.2 The Contractor must remove all piping and insulation related to sanitary water system on each deck of the vessel. The piping must be removed from the isolation

valve located in the motor room starboard side aft to the local isolation valves on all vessel toilets throughout the accommodations.

- 3.1.3 Contractor must use drawing # 65-30-01 and 65-30-02 (3 Sheets) to determine pipe lengths with cabin/frame locations provided. NOTE: Piping length from engine room to main deck cannot be determined using this drawing. This run of piping is approximately fifteen (15) feet.
- 3.1.4 The Contractor must be responsible for the removal of all required deck head panels, bulkhead panels, insulation, sheathing and sanitary fixtures as needed to access piping, label, and store for re-use. All items must be labeled to ensure they are returned to their original location.
- 3.1.5 Any through deck or bulkhead penetrations that are no longer required must be permanently and suitably sealed using an ABS approved method and to the satisfaction of the CCG TA.
- 3.1.6 Through deck and bulkhead penetrations within the washrooms must be reused for new domestic fresh water supply. NOTE: Sanitary water supply to toilets on main deck are currently being fed from deck head and runs behind the bulkhead to the toilets.
- 3.1.7 All removed piping and associated components must be disposed of as per Provincial and Federal regulations.
- 3.1.8 The following is the number and location of the toilets that will be addressed by this specification:
 - One (1) Bridge Deck
 - Three (3) Officer Deck
 - Two (2) Boat Deck
 - Eleven (11) Upper Deck
 - Nine (9) Main Deck
- 3.1.9 The Contractor is responsible for the re-installation any deck head panels, bulkhead panels insulation, and sanitary fixtures. Materials must be returned in as found condition, and damages or replacement requirements as a result of inappropriate handling and or storage must be repair or replace by the Contractor and to their account.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work completed to be accepted the CGC TA and IA.

4.2 Testing

- 4.2.1 All watertight penetrations must be proven to be watertight and witnessed and signed off by ABS surveyor.
- 4.2.2 Any welds must be tested with 100% MPI by a certified third party organization and the testing report must be supplied to the CCG TA.

4.3 Certification

- 4.3.1 N/A

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 At a minimum, the Contractor must supply updated versions of the following vessels drawings in both electronic and paper copy along with any other affected drawings. Full details of the development of new as built drawings are detailed in the General Section 8.1 – Drawings of Part A of this SOW. All new Drawings must reflect the new as fitted arrangement.
 - 65-30-01 - Domestic and Sanitary Fresh Water Systems (Page 1/1)
 - 65-30-02 - Arrangement Domestic F.W. and Sanitary (Page 1/3)
 - Arrangement Domestic F.W. and Sanitary (Page 2/3)
 - Arrangement Domestic F.W. and Sanitary- Plan Beneath Officers Dk and Wheelhouse Floor (Page 3/3)

H-24 SEWAGE VACUUM PIPING & SEPARATOR REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW item must be to remove and dispose of the existing PVC and Steel vacuum piping found throughout the entire accommodation spaces and replace with an approved plastic piping and adhesive system such as SeaCore Piping Systems Solutions for Marine Applications . This work must be carried out in conjunction with SOW item H-22 – Grey Water Piping Replacement.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this specification item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

- 65-50-01-01 & 02 – 2 Sheets - Sewage and Grey Water Diagrams
- 65-50-02-01 & 02 – 2 Sheets – Vacusan OMS
- H-0016 - General Arrangement (1:50 Accommodation Layout)- Main Deck
- H-0017 - General Arrangement- Main Deck Forward
- H-0018 - General Arrangement (1:50 Accommodation Layout)- Upper Deck
- H-0019 - General Arrangement- Foc'sle Deck (Page 1/1)
- H-0020 - General Arrangement (1:50 Accommodation Layout)- Boat Deck
- H-0021 - General Arrangement (1:50 Accommodation Layout)- Officers Deck and Wheelhouse
- 70-80-01 Casing Module – Miscellaneous Piping, Ladder and Platforms

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction

- TC TP 127e
- IEC 60092-504, 60332-3, 60364-5-52, 60533, 60754-0, 1, 2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

- 3.1.1 Contractor must replace the 1.5” and 2” sewage PVC and Galvanized steel piping located within the accommodation spaces, as detailed in the vessel’s drawings, with ABS approved plastic piping system.
- 3.1.2 *SeaCore Piping Systems Solutions* for Marine Applications, or a fully certified, class approved equivalent, must be used and confirmed by ABS as being an acceptable supplier prior to procurement/installation.
- 3.1.3 The Contractor must ensure that the supplied pipes/fittings are permanently marked with Manufacturer’s name, type designation, size, pressure ratings, design

standards, date of fabrication and serial number as per EU MR TR – Plastic Piping Systems (Components) Section 4 noted on Confirmation of Approval Document 15-HS1456208-1-PDA.

- 3.1.4 The installer must be certified to ASME B31.3 Bonder certification.
- 3.1.5 Only SeaCor Marine cement and Primer, or certified equivalent, must be used for joints and joining techniques are to be in accordance with Manufacturer's installation guidelines as per EU-MR TR- Plastic Piping Systems (Components) 1.d (a.).
- 3.1.6 The Contractor must lay 6 mil plastic sheeting on the deck, furniture, etc. in-way of sewage piping removals. All items must be covered and seams taped to prevent contamination of spaces.
- 3.1.7 The Contractor must be responsible for the identification, removal, storage and re-installation of all interference items such as ceiling and bulkhead panels, and any furniture or sanitary appliances required to gain access to the sewage vacuum piping. All items removed must be re-installed upon completion of repairs in that space and all areas must be cleaned to the satisfaction of the CCG TA.
- 3.1.8 Replacements must include the 2" main runs and the 1 ½" branch runs to each toilet. The branch runs must connect to main runs by wye connections. Replacements must include the entire Accommodation Spaces from the separator box through to the Bridge Deck washroom. The piping must be renewed to the toilet connection including steel deck and bulkhead penetrations. Through deck and bulkhead penetrations must be schedule 40 galvanized steel unless ABS approval is granted for the use of an alternated approved transit system and SeaCor piping.
- 3.1.9 The number of toilets and their locations area as follows:
 - nine (9) toilets located on the Main Deck,
 - twelve (12) toilets located on the Upper Deck,
 - two (2) toilets located on the Boat Deck,
 - three (3) toilets located on the Officers Deck and
 - one (1) toilet located Wheelhouse Deck.
- 3.1.10 It is the responsibility of the Contractor to confirm all pipe lengths, sizes, fittings, penetrations etc. as detailed in the attached vessel's drawings. The Contractor will also have the opportunity to view during the on-site vessel viewing. The Contractor must use drawings # 65-30-02 - Arrangement Domestic F.W. and Sanitary, 65-50-01-01 & 02 – Sewage and Grey Water Diagrams and 65-50-01-01 & 02 – Vacusan OMS specifically to determine pipe lengths with cabin/frame locations provided. All Sewage piping on all decks above the engine room area, throughout the entire accommodations must be replaced with new.

- 3.1.11 The Contractor must be responsible for the sewage vacuum piping disposal as per Federal, Provincial and or Municipal regulations. The Contractor must use vessel General Arrangement and Arrangement Vacusan O.M.S drawings to determine material required based on cabin and washroom locations. Each deck has a main run port and stbd which branches off to each toilet. As noted in section 3.1.11 of Specification item H-22 – Grey Water Pipe Replacement – The unit costs provided for the removal of existing piping and the fabrication and installation of new Seacor piping for the grey water system must also be applicable to this specification item for adjustment purposes, if required. The unit costs provided will be used to adjust the final sewage piping replacement by PWGSC 1379 if deemed necessary on site.
- 3.1.12 Each space must be completely cleaned and disinfected in-way of work at the conclusion of pipe replacement. Each affected area must be in “as delivered” condition upon the completion and testing of work.
- 3.1.13 The Contractor must fit new type approved plastic piping and fittings for the complete replacements including all piping, connections and fittings (elbows, Tee’s, valves etc.)
- 3.1.14 A two (2) inch backwater / check valve must be installed on the branch lines to all toilets with vertical lift requirements as per original design. Placement of the valve must in in the deck head similar to the original design.
- 3.1.15 “Y”-Style cleanouts arrangements must be fitted on the 2” main vacuum line as per original drawings, additional cleanouts must be installed as identified in this specification items, Addendum A. Care must be to ensure all “Y”-style cleanouts are orientated in the correct direction of flow.
- 3.1.16 Contractor must be responsible for the removal and re-installation of interference items and protection of equipment, wiring, etc. in the course of completing work.
- 3.2 Installation
- 3.2.1 Pipes must be fitted in as straight of runs as possible with as few turns as possible. Contractor must reuse existing hangers and pipe supports where possible and must fit new as required. Pipe supports and hangers must be installed at sufficient intervals to prevent sagging and vibration. The contractor must include pricing for the complete replacement of 40 piping hangers/supports and provide a unit cost per hanger to be adjusted by PWGSC 1379.
- 3.2.2 Contractor must be responsible to ensure all bulkhead and deck penetrations are in accordance with the bulkhead fire/divisional rating. Penetrations must be made tight by ABS approved methods such as fire stop caulking or sealing compounds which are class approved and recognized by ABS. Contractor must weld or fit

approved steel threaded fittings where the sewage vacuum lines pass through steel bulkheads or decks to meet the divisional requirements. Any steel piping used must be schedule 40 galvanized.

- 3.2.3 The Contractor must reinstall all ceiling panels, bulkhead panels and interference items removed to carry out the sewage piping replacements. The Contractor must include for the supply and replacement of twenty-five (25) new ceiling panels and twenty-five (25) new bulkhead wall panels within the accommodation spaces above that were removed to carry-out sewage piping replacements. The longest ceiling panels must be used where possible. Where panel ends are cut to length, the edges must be folded in to give a finished appearance and must be cut out to fit fixtures that were removed during strip-out. Bulkhead wall panels must be class approved, marine grade, joiner system wall panels or equivalent that match the existing colour scheme and fit within the existing system.
- 3.2.4 The Contractor must provide a unit cost per new ceiling panel and wall panel, including cutting/fitting of the panels, folding of edges for finished appearance and securing onto support channels/tracks. The total cost is to be adjusted by PWGSC 1379 based on the final requirement.

3.3 Sewage Separator Replacement

- 3.3.1 The Contractor must fabricate and install a new galvanized steel sewage separator.
- 3.3.2 The Contractor must fabricate the new separator to the same design and dimensions as the original to ensure alignment with existing piping.
- 3.3.3 The separator must be constructed at a minimum using schedule 40 Pipe or ¼-inch plate depending on the material used. After construction, the separator must be hot dip galvanized
- 3.3.4 Each space must be completely disinfected in-way of work at the conclusion of separator replacement.
- 3.3.5 Pictures and basic dimensions of the existing separator can be found in this specification items Addendum B, and these are provided for reference only. The Contractor is responsible for actual detailed dimensions as required.
- 3.3.6 Contractor must be responsible for the existing sewage separator disposal as per Federal, Provincial and or Municipal regulations.

3.4 Separator Outlet Piping Replacement

- 3.4.1 The Contractor must replace the three (3) inch separator outlet piping from the penetration at the aft bulkhead of the casing to isolation valve at the equalizing tank. This run is a combination of steel and PVC and must be replaced with new, approved marine grade PVC piping other than the sched. 80 penetration.
- 3.4.2 The piping run extends aft from the engine room casing to the vessels aft inboard area of the crew's laundry room where it proceeds downward to the equalizing tank. There will be two bulkhead penetrations and one deck penetration. The piping run is approximately fifty (50) feet in length. The Contractor is responsible for verifying actual piping length. Note: Replacement of piping in the Laundry room will require the removal of the crew's laundry room cabinets, countertop and potentially other furniture if required for access. The contractor must identify all interference items and is responsible for the temporary removal, storage and re-installation upon the completion of work.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work must be completed to the satisfaction of the CCG TA and IA.

4.2 Testing

- 4.2.1 After install piping it must be tested by placing the newly installed piping under vacuum and it be held in this state for a minimum two (2) hours. Any defects and leakages found are to be repaired by the Contractor and to their account.
- 4.2.2 All welds to receive 100% MPI testing by certified third party NDT professional.

4.3 Certification

- 4.3.1 The contractor must provide all certifications for material approvals and welders must all be CWB certified

5.0 Deliverables

5.1 Drawings/Reports

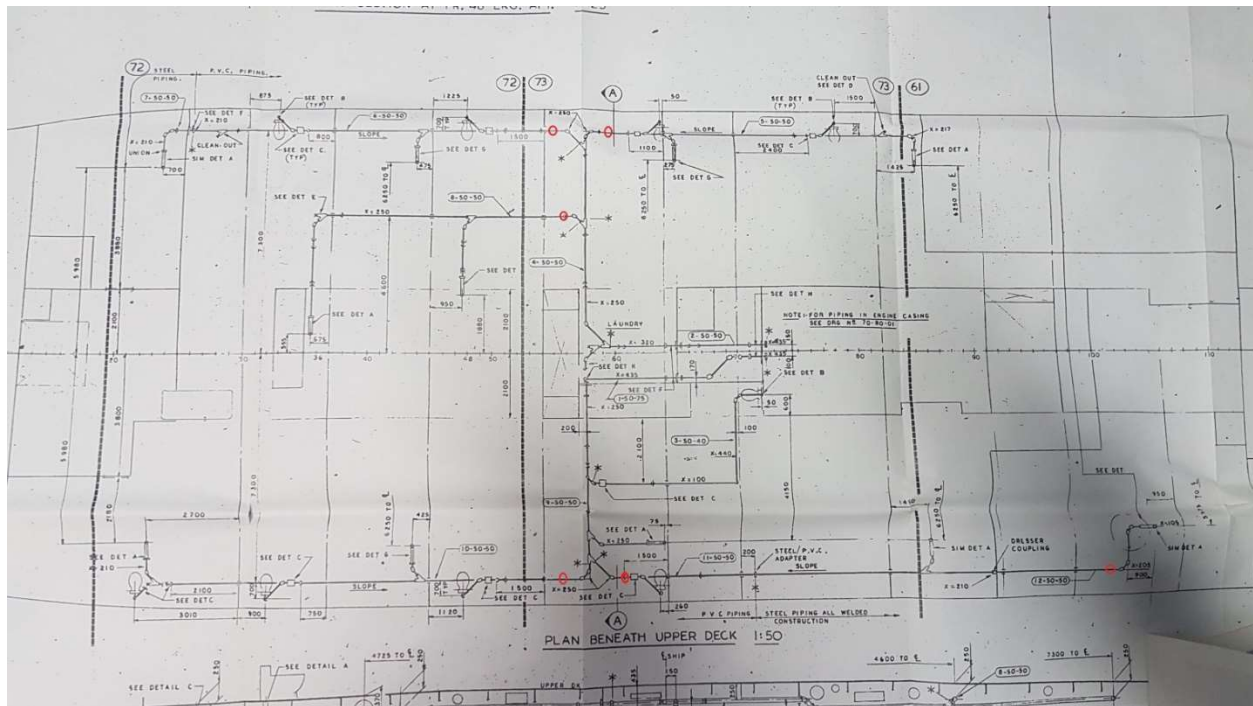
- 5.1.1 Contractor is responsible for providing to the CCG TA updated drawings for the following systems, in both paper and electronic format. Drawing should reflect the new as fitted design which, at a minimum, must include:
 - 65-50-01 & 02 - Sewage and Greywater Diagrams
 - 65-50-01 Arrangement Vacusan O.M.S

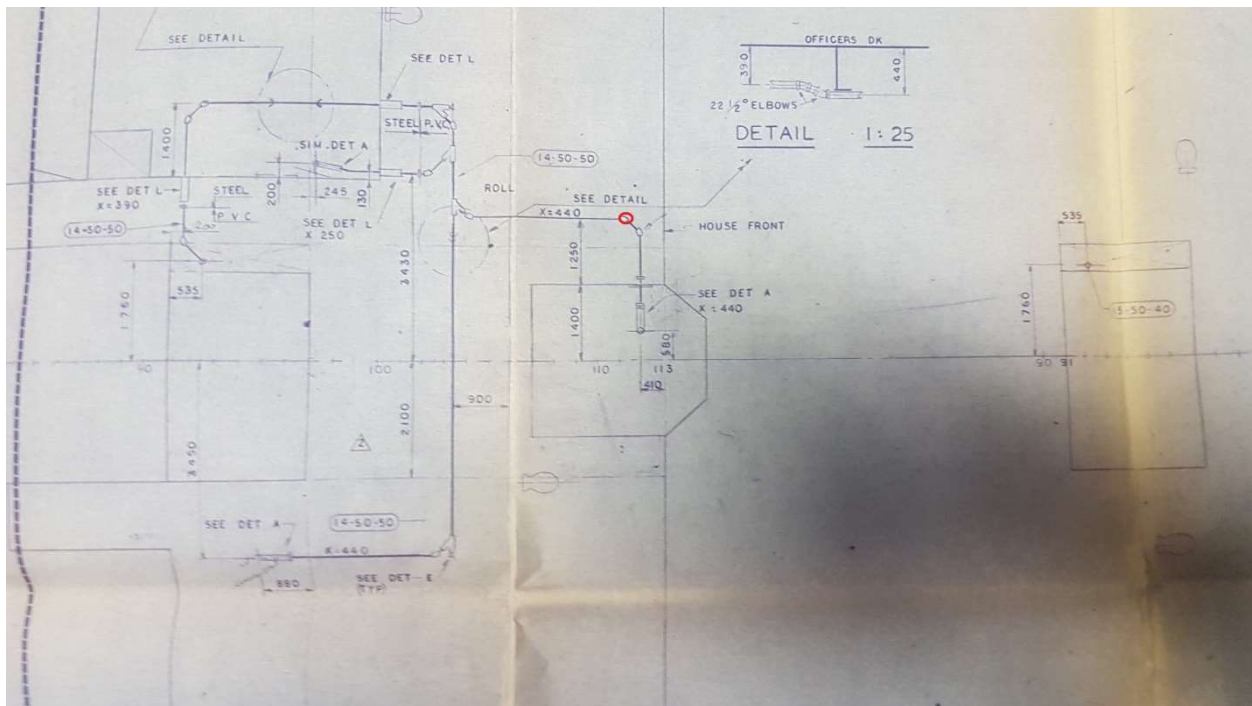
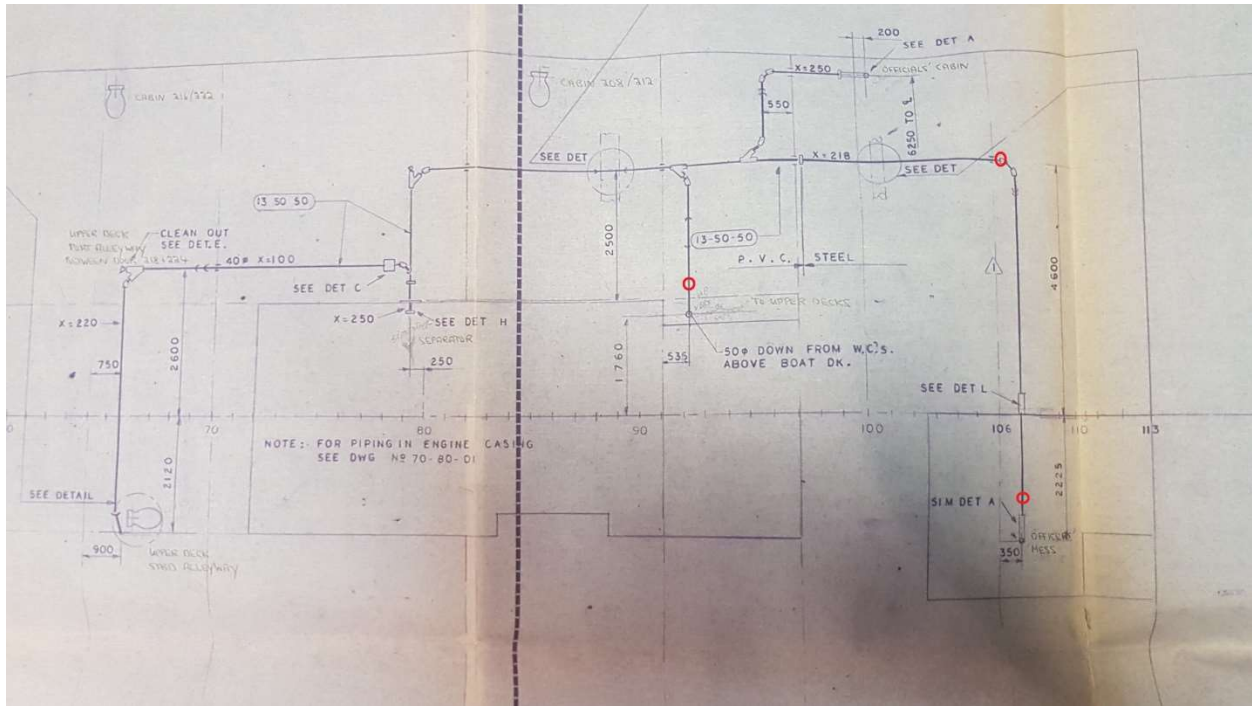
5.2 Spares

5.2.1 Contractor must supply the following piping of the approved plastic material. Contractor must provide these spares to the vessel complete with a priced itemized list of material same including contact information for Contractor's Supplier. This list will be used for future purchases:

- Forty (40) feet of both 2" and 1 ½" Pipe
- Two (2) containers of approved sealant.
- Ten (10) 2" Backwater check valves
- Two (2) of 2" Y clean-out assemblies
- Two (2) of 2" T-Shape Clean outs
- Two (2) of 1.5" T-Shape Clean outs
- Three (3) of 2" Isolation Valves
- Four (4) each of 2" and 1.5" pipe unions
- Four (4) each of 2" and 1.5" pipe coupling
- Four (4) each of 2" and 1.5" of 90-degree elbows
- Four (4) each of 2" and 1.5" of 45-degree elbows

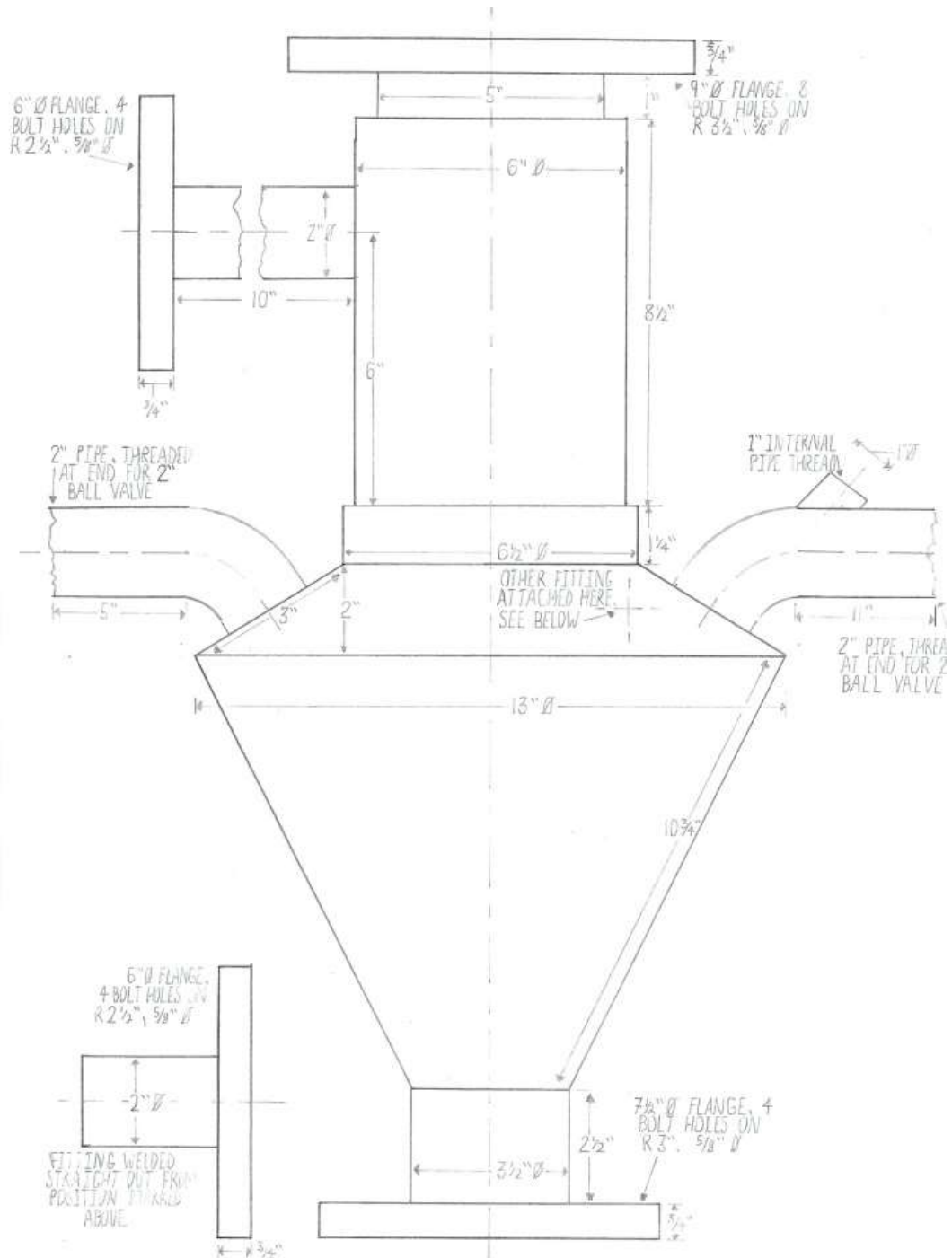
Addendum A





Addendum B





Provided for reference only. The Contractor must be responsible for confirming all dimensions

H-25 DAVITS ANNUAL INSPECTIONS

1.0 Scope

- 1.1 The intent of this SOW item is to have the Contractor supply the services of a Palfinger-Harding FSR to perform the annual inspection of the ship's Miranda Davit, Barge Davit, Lifeboat and Lifeboat Davit.
- 1.2 This work must be carried out in-conjunction with SOW item H-26 – Liferaft Annual Inspections.
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

- 07277-10-01_01 & _02 – Lifesaving Plan, 2 Sheets
- H-0016 - General Arrangement - Main Deck
- H-0017 - General Arrangement- Main Deck Forward
- H-0018 - General Arrangement Upper Deck
- H-0020 - General Arrangement - Boat Deck

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- All repairs and materials used must be in compliance with up to date ship building and repair standards as defined in the General Section of this specifications

2.3 Regulations

- Canada Shipping Act 2001 – Marine Machinery Regulations

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must include an allowance of \$15,000.00 for the services of the Palfinger-Harding FSR.
- 3.1.2 The Contractor must ensure the Palfinger-Harding FSR completes an early summary inspection to identify any obvious deficiencies that require parts that require long lead times to obtain.
- 3.1.3 The Palfinger FSR must carry out all the inspections as per manufacturer's instruction manual, working within the limits and tolerances provided.
- 3.1.4 The main hydraulics for the davit systems must be inspected by the Palfinger FSR for deficiencies, and noted in the inspection report to be installed during the next maintenance period.
- 3.1.5 The Palfinger FSR must inspect the braking system on all davits and ensure suitable material remaining for the next operating year.
- 3.1.6 The Palfinger FSR must inspect all wire ropes and block and supporting tackle for future use.
- 3.1.7 The Palfinger FSR must complete the gearbox inspection on each davit, installing a new gasket on the inspection cover when complete. Anything remaining open for extended periods must be suitably protected to prevent the ingress of water while not being attended to.
- 3.1.8 All access covers removed must be properly sealed upon completion to ensure weather tight.
- 3.1.9 Once all the inspections are complete, a function test must be performed on each davit, using the necessary weights as determined by the FSR. The Contractor must arrange for all equipment, weights, crane, rigging and labour requirements necessary to perform load / function tests as required by Palfinger FSR.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work must be subject to inspection and to the satisfaction of the CCG TA, Chief Engineer and FSR.

4.2 Testing

- 4.2.1 The function test with the predetermined weights must ensure smooth, trouble free, operation.
- 4.2.2 The Contractor is to be responsible for all inspections and is to consult with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the Owner's representative, in advance, to allow his/her attendance.

4.3 Certification

N/A

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 Contractor must provide Three (3), typed work inspections to the Owner's Representative, showing work completed and deficiencies that require correction.

H-26 LIFERAFT ANNUAL INSPECTION

1.0 Scope

- 1.1 The intent of this SOW item is for the Contractor to arrange and subcontract the annual servicing and certification of the vessel's life rafts and hydrostatic releases to an authorized service facility.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Regulations

- Canada Shipping Act 2001 – Lifesaving Equipment Regulations (C.R.C., c. 1436)
- Maritime Occupational Health and Safety Regulations (SOR/87-183)
- [TP 14475 E - Canadian Life Saving Appliance Standard](#)
- ABS Rules and Regulations
- Standards
- Fleet Safety and Security Manual (DFO/5737)

2.2 Nameplate Data

Location	Serial Number	Capacity	Description
Stbd Boat Deck	508631022 0541	25	SurvitecZodiac MK IV TO
Port Officer's Deck	508631021 5740	25	SurvitecZodiac TO
Port Officer's Deck	508631021 5950	25	SurvitecZodiac TO
Barge	XDC1FZ96D616	4	SurvitecZodiac Coastal
Port Flight Deck	10914007	10	10DK+

2.3 Government Furnished Equipment

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

3.0 Technical

3.1 Life Raft Survey

- 3.1.1 The Contractor must remove the life rafts and their hydrostatic releases from their stowed positions on the vessel and transport them to and from the sub-contractor's premises for servicing.
- 3.1.2 The Contractor must arrange to sub-contract the annual inspection and the re-certification of the life rafts to an ABS/Transport Canada approved service facility that meets the OEM certification requirements.
- 3.1.3 The Contractor must be responsible for ensuring the life rafts are witnessed by the ABS Inspector as required, and for providing the necessary certificates for the life rafts, as appropriate.
- 3.1.4 On completion of the re-certification of these units, the Contractor must return the life rafts and restow them aboard the vessel in their respective locations.
- 3.1.5 The Contractor is responsible for the identification of any interference items, and their temporary removals, storage and refitting to the vessel. All removed interference items are to be replaced to as found condition.
- 3.1.6 The Contractor is responsible for protecting the surrounding area and equipment while carrying out this work

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 The Contractor must subcontract the annual inspection and recertification of the life rafts to an approved Transport Canada service facility that meets the OEM certification requirements.

4.2 Testing

- 4.2.1 Inspection and testing required for re-certification is the Contractor's responsibility.

5.0 Deliverables

5.1 Reports

- 5.1.1 The Contractor must provide a report to the CCG TA, for each life raft, listing the work that was performed including 'as found condition and as re-certification condition.

5.2 Certification

- 5.2.1 The Contractor must provide to the CCG TA copies of all test certificates, and endorsement of safe operation required by ABS for certification in vessel's Division 3.

H-27 HELICOPTER FUELING SYSTEM SERVICING

1.0 Scope

- 1.1 The Contractor must arrange for the annual routine servicing of the Helicopter Fueling System to be performed by a certified sub-contractor.
- 1.2 The Contractor must provide for the services of qualified Service technician; an allowance of \$10,000.00 to be adjusted by PWGSC 1379 for their services upon proof of invoice.
- 1.3 This work must be carried out in conjunction with SOW item H-31 – Hangar Refurbishment and Steel Replacements.
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Nameplate Data:

2.1.1 The existing Helicopter Fueling System is:

Newmar Refueling System

Reference: AB1703 – M036

Suggested Supplier Atlantic Region: National Energy Equipment, 18 Dundee Avenue, Mount Pearl, NFLD)

3.0 Technical Description

- 3.1 Prior to the commencement of work the Helicopter Refueling System the Contractor must, with the assistance of the Ship's Electrical Officer lock the system out at breaker P-613-3 in MCC #3, located in the MCR.

- 3.2 Any components, such as the Sample Pump, requiring servicing located in the Aviation Fuel Tank Cofferdam must be governed by the Contractor's Confined Space Entry procedures.
- 3.2 The servicing of this system must be, but not limited to the following:
- a) The draining and disposal of all fuel residue and the opening up, gas freeing, cleaning and inspection of the Helicopter Fuel Storage Tank.
 - b) Suction Vacuum Relief Valve is to be removed, taken ashore to a certified facility for overhaul. Unit is to be bench tested to 0.5" Hg and recertified. Units are to be reinstalled aboard the vessel.
 - c) Uniact Pressure Relief Valve is to be removed, taken ashore to a certified facility for overhaul. Unit is to be bench tested to twelve (12) psig and recertified prior to being returned to the vessel for reinstallation.
 - d) Fire Engulfment Relief Valve is to be removed, tested at 17 psi and re-certified by a qualified service representative. It is then to be re-installed on the vessel.
 - e) Silica Gel Vent Dryer is to have the desiccant replaced with 25 pounds of Contractor-supplied Indicating Drierite (particle size 2.5 – 6 mm on 8 mesh).
 - f) The Vent Flame Arrester is to be removed, cleaned and inspected, as detailed in the system manual. The flame arrester is to be disassembled, cleaned in a suitable solvent, and then blown through with compressed air. The element is composed of 9 layers of 316 stainless steel mesh (0.112mm wire X 0.254 pitch)
- 3.4 Dispensing Unit (Fueling hose):
- 3.4.1 Refueling hose is to be hydrostatically tested, using JET A-1, to 150 psig and a test certificate provided.
- 3.4.2 Bonding cable is to be visually inspected for defects and tested for continuity to ground.
- 3.4.3 Dispensing meter calibration is to be verified and calibrated as required. The meter is a positive displacement flowmeter, Bopp & Reuther 0150M5F5, calibrated for use with JET A1.
- 3.5 Pumping Unit & Sample Pump:
- 3.5.1 Calibration of pressure & suction gauges on Dispensing Pumps must be verified and certificates provided. Gauges consist of two (2) 0-100 PSI pressure gauges and two (2) 0-30" Hg suction gauges; all gauges can be removed for calibration by shutting off the respective isolating valve.

- 3.5.2 The operation of the Dispensing Pump pressure relief valves & record lifting pressure are to be verified; this can be done by slowly closing in on the discharge valves while the unit is pumping. Any adjustment or repair to be by PWGSC 1379 action.
- 3.5.3 Remove pump end plates, on the end opposite the drive shaft, on the three pumps; check for wear and the presence of foreign bodies, as detailed on page 44 of the Newmar manual. The pumps are Blackmer vane-type positive displacement pumps.
- 3.5.4 The Dispensing Pump reduction gearboxes are to be drained of their lubricating oil and the oil is to be disposed of ashore. Disposal process is to meet provincial and federal disposal requirements.
- 3.5.5 Gear box(s) are to be refilled each with 2.38 kg of Shell Tellus T46 oil, or an equivalent suitable for a temperature range of -40°C to +35°C.
- 3.5.6 The Sample Pump is to have its pump bearings greased with low temperature grease. Drive coupling alignment to be checked and confirmed and copies of the readings taken must be supplied to the CCG TA.
- 3.6 Piping System:
 - 3.6.1 The Contractor is to verify the electrical continuity of all the piping associated with the system.
- 3.7 Heat Detector:
 - 3.7.1 Operation of the heat detector, a component of the ship's Fire Detection System and located in the Aviation Fuel Tank Cofferdam, is to be verified and the testing must be witnessed by the CCG IA and the Contractor is to provide evidence of satisfactory results of this testing.
- 3.8 System Reassembly
 - 3.8.1 All components of the system are to be reassembled, using new gaskets; gaskets are to be compatible with JET A1, (e.g. C.A.F. type with PTFE envelope) Any specialized seals, such as those used on the Dispensing Pumps, must be supplied as GSM.
 - 3.8.2 Existing fasteners may be re-used, if judged by the CCG TA that they are in an acceptable condition. Any fastener replacements will be done via PWGSC 1379 action.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be inspected and carried out to the satisfaction of the CE and CCG TA/IA.

4.2 Testing

- 4.2.1 Upon the completion of all work associated with the Helicopter Fueling System, a functional test will be required, proving the operation of all components. Under the supervision of the FSR and the operation by vessel's crew, fuel will be re-circulated through the water separator, re-circulated through the hose, dispensed from the nozzle, and dispensed from the sampling point.

5.0 Deliverables

5.1 Reports/Certificates

- 5.1.1 Copies of all test & calibration certificates and reports must be furnished to the CCG TA upon completion of the specified work.

H-28 FIRE FIGHTING SYSTEM INSPECTION & MAINTENANCE

1.0 Scope

- 1.1 The Contractor must arrange for inspection, testing and recertification of all vessel's fixed fire extinguishing systems, as described and listed below, by an authorized service provider. Proof of credentials and certification of the service provider must be made available to Chief Engineer. Copies of all re-certification certificates must be given to CCG on the completion of all work.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 FM 200 SMOTHERING SYSTEMS INSPECTION

- 2.1 The FM 200 firefighting systems are to be thoroughly examined and tested as per Transport Canada/Marine Safety (TC/MS) and ABS requirements. All tests to be witnessed by the Technical Authority (or designate) and the attending ABS Surveyor.
- 2.2 References

TYPE	CON*	LOCATION	SPACE PROTECTED
FM 200	B	Propulsion Motor Room (port platform)	Main D/G Rm (lower) – F
	B		Main D/G Rm (lower) – A
	B		Converter Room
	B		Transformer Room
FM 200	B	Propulsion Motor Room (starboard platform)	Purifier Room
	B		Main D/G Rm (upper) – F
	B		Main D/G Rm (upper) – A
FM 200	A	Propulsion Motor Room Flat	Central Stores

FM 200	B	Stores Handling Room, Main Deck Aft	Propulsion Motor Rm - lower
	B		Propulsion Motor Rm - bilge
	B		Propulsion Motor Rm - upper
	B		Sewage Compartment
	A		Helicopter Fuel Cofferdam
	B		Steering Gear
FM 200	A	Speed crane Winch Room	Speed crane Winch Room
FM 200	A	Upper FM-200 Room	Emergency D/G Room
	B		Main D/G Room - Stack
FM 200	A	Forward CO ₂ Room	Forepeak Winch Rm
	A		Bosun Stores
	A		Paint Locker
FM 200	A	Forepeak Winch Room	Bow Thruster Comp't
FM 200	A	Lower Main D/G Room	Main D/G Room bilges (F)
	A		Main D/G Room bilges (A)

*Legend

- “A” – ECS Series; FM-200/nitrogen bottle
- “B” – ADS Series; FM-200 with separate nitrogen bottle(s)

- 2.3 The Contractor is to be responsible for all inspections and is to consult with ABS prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to also advise the Technical Authority, in advance, to allow his/her attendance.
- 2.4 All inspections are to be completed by a company certified for FM 200 systems and a type written report as to the status of the system is to be provided.
- 2.5 All bottles are to be disconnected before any tests are conducted. The CCG Technical Authority must be advised prior to disconnecting any bottles or system components. The Contractor is to limit hot work in areas where the FM-200 system has been disconnected for testing.
- 2.6 All hand control levers, pull handles, cables, cocks, and valves are to be checked and proven operational. The piping must be blown through with compressed air or nitrogen to prove the lines are clear and the time delays operational. All pressure-operated switches are to be proven operational.
- 2.7 All FM-200 bottles are to have their levels ascertained. The contents are to be recorded and a copy provided to the Technical Authority in the service report.
- 2.8 The Contractor to confirm operation of all local/remote manual releases and this is to be witnessed by both the CCG TA and the attending ABS Surveyor.

- 2.9 Upon completion of testing, the FM 200 systems are to be reassembled and placed in working order. Should any bottles be accidentally discharged as a result of testing, the Contractor must be responsible for replacing the discharged gas at his expense.
- 2.10 Copies of all certificates are to be forwarded to the CCG IA and the attending ABS Surveyor. A complete service report with all test results is to be submitted to the Technical Authority.

3.0 VESSELS PORTABLE FIRE EXTINGUISHERS

- 3.1 The Contractor is to remove the vessel's fire extinguishers and transport them to an authorized service centre for servicing and testing.
- 3.2 The extinguishers are to be removed so that the total ashore at any one time does not exceed one-third the total of the extinguishers onboard. The Chief Engineer will determine which extinguishers go ashore at any given time. Any extinguisher that is discharged by the contractor must be recharged at the contractor's expense.
- 3.3 Upon completion of servicing ashore, the Contractor is transport all extinguishers back onboard the vessel and is to install them in their original positions as directed by the Chief Engineer.
- 3.4 List of Extinguishers found on board:

TYPE	SIZE	QTY
Dry Chemical	5 lb.	5
	10 lb.	51
	18 lb.	1
	20 lb.	3
	50 lb.	2
Wet Chemical	10 lb.	1
CO ₂	5 lb.	2
	10 lb.	11
	15 lb.	2
	20 lb.	2
<u>Foam (AFFF)</u>	2.5 gal.	2
	TOTALS	82

- 3.5 The contractor is to include a \$5,000.00 allowance for the correction of any deficiencies or repairs. This is not a guarantee of work and is to be adjusted by PWGSC 1379 based on final invoice.

- 3.6 The Contractor is to obtain all test certificates and forward them to the Chief Officer with a detailed description of any repairs carried out. Each extinguisher is to be “tagged” to show the inspection date.

Table 1- List of Vessel's Fire Extinguishers

#	Type	Location	Serial #	Last Hydro	Next Hydro	Full Weight	Next 6 Year Maintenance
1	5 lbs CO2, BC	W/H A/C Rm Port Inside Door	409198	2017	2022	13 1/8	N/A
2	10 lbs CO2, BC	Bridge, Stbd	122744	2019	2024	26 1/8	N/A
3	10 lbs Dry Chem, ABC	Bridge, Port	R-307190	2015	2027	17	2021
4	10 lbs Dry Chem, ABC	Bridge, Stbd	R-307702	2015	2027	17	2021
5	10 lbs CO2, BC	Bridge, Port	121030	2019	2024	26	N/A
6	10 lbs Dry Chem, ABC	Outside Capt's Cabin	R-307011	2015	2027	17	2021
7	10 lbs Dry Chem, ABC	Outside CH/O's Cabin E/R Casing, on aft side of casing ladder	5847598	2020	2032	17	2026
8	10 lbs Dry Chem, ABC		5848994	2020	2032	17	2026
9	10 lbs Dry Chem, ABC	Next to Off. Lounge	R-307700	2015	2027	17	2021
10	10 lbs Dry Chem, ABC	Next to Elect. Equip. Rm	R-307007	2015	2027	17	2021
11	10 lbs CO2, BC	Elect. Equip. Rm.	121021	2019	2024	26	N/A
12	10 lbs CO2, BC	Computer Room	122759	2019	2024	25	N/A
13	10 lbs Dry Chem, ABC	A/C Fan Room	R-305044	2015	2027	17	2021
14	20 lbs. Dry Chem, ABC	Helicopter Hanger Workshop	X-366625	2010	2022		2022
15	5 lbs. Dry Chem, ABC	Helicopter Hanger Workshop	15108226	2020	2032		2026
16	10 lbs Dry Chem, ABC	Flight Deck, Port	72373859	2019	2025	17	2031
17	20 lbs. Dry Chem, ABC	Helicopter Hanger	K-209091	2015	2027		2021
18	10 lbs Dry Chem, ABC	Flight Deck, Port	72373856	2019	2025		2031
19	10 lbs CO2, BC	Helicopter Hangar	128179	2015	2026	25	2026

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20	150 lbs. Dry Chem, BC Purple K	Helicopter Hanger	7457	2015	2027		2021
21	150 lbs. Dry Chem, BC Purple K	Helicopter Hanger	7521	2015	2027		2021
22	10 lbs Dry Chem, ABC	Emerg. Generator Compt.	N997616	2015	2027		2021
23	10 lbs Dry Chem, ABC	Officers Mess	R-307424	2015	2027	17	2021
24	10 lbs Dry Chem, ABC	Port Alleyway @ Stn #7	H-695620	2015	2027	17	2021
25	10 lbs Dry Chem, ABC	Stbd Alleyway @ Stn #8	R-307960	2015	2027	17	2021
26	10 lbs Dry Chem, ABC	Stbd Alleyway @ Stn #10	H-695956	2015	2027	17	2021
27	10 lbs Dry Chem, ABC	Port Alleyway @ Stn #9	R-307194	2015	2027	17	2021
28	10 lbs Dry Chem, ABC	Port Alleyway @ Stn #17	H-695768	2015	2027	17	2021
29	10 lbs Dry Chem, ABC	Port Alleyway @ Stn #15	Z-760521	2016	2028	17	2022
30	20 lbs. Dry Chem, ABC	Stores Handling Room	BT-763942	2013	2025	17	2025
31	10 lbs Dry Chem, ABC	Stores Handling Room	R-307516	2015	2027	17	2021
32	10 lbs Dry Chem, ABC	Stores Handling Room	R-305733	2015	2027	17	2021
33	10 lbs Dry Chem, ABC	Steering Gear Compt.	R-307696	2016	2028	17	2022
34	15 lbs CO2, BC	Deck Workshop Aft	385833	2017	2022	26	N/A
35	10 lbs Dry Chem, ABC	Stbd Alleyway @ Stn #18	R-307510	2015	2027		2021
36	10 lbs Dry Chem, ABC	Stbd Alleyway @ Stn #16	R-307699	2015	2027		2021
37	1.5 gal Foam, AB	Incinerator Flat.	AB-884231	2019	2024		N/A
38	1.5 gal Foam, AB	Incinerator Flat.	AB-884226	2019	2024		N/A
39	6 litre Wet Chem, K	Galley Fwd Door	AC57308	2019	2024		N/A
40	Chemical Wetting Agent	Galley	58561505	2018	2024		2030
41	10 lbs Dry Chem, ABC	Deck Entranceway	72373147	2019	2025	17	2031
42	10 lbs CO2, BC	Cargo Hold, Tween Deck	122674	2020	2025	26 1/8	N/A
43	10 lbs CO2, BC	Cargo Hold	191335	2015	2027	12	2026
44	10 lbs Dry Chem, ABC	Bowthrustrer Compartment	46894493	2018	2024		2030

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45	10 lbs Dry Chem, ABC	Well Deck, Fwd	46894244	2018	2024		2030
76	10 lbs Dry Chem, ABC	Bosun's Stores	Z-759806	2010	2022		2022
46	20 lbs. Dry Chem, ABC	Forecastle	BT-763945	2013	2025		2025
47	10 lbs Dry Chem, ABC	Outside Control Room, Fwd	R-307514	2015	2027		2021
48	10 lbs CO2, BC	Control Room, Fwd	121020	2019	2024	25	N/A
49	10 lbs CO2, BC	Control Room, Aft	187820	2019	2024	26 1/8	N/A
50	10 lbs Dry Chem, ABC	Gen. Room, Aft Port	N-996192	2015	2027		2021
51	10 lbs Dry Chem, ABC	Entrance to Transformer Rm	R-307699	2015	2027		2021
52	10 lbs Dry Chem, ABC	Gen. Room, Aft, Stbd	R-307512	2015	2027		2021
53	10 lbs CO2, BC	Outside Elect. Workshop	122663	2019	2024	36 1/8	N/A
54	10 lbs Dry Chem, ABC	Engineer's Workshop	5849368	2020	2032		2026
55	10 lbs Dry Chem, ABC	Speed Crane Winch Rm	307010	2015	2027		2026
56	20 lbs CO2, BC	Speed Crane Winch Rm	5746	2019	2024	35 1/2	N/A
57	20 lbs CO2, BC	Speed Crane Winch Rm	5767	2019	2024	35 ½	N/A
58	10 lbs Dry Chem, ABC	Chlorifier Room	R-305563	2015	2027		2021
59	10 lbs Dry Chem, ABC	Central Stores, Fwd	5847985	2020	2032		2026
60	10 lbs Dry Chem, ABC	Port Gen. Room Fwd,	R-307008	2015	2027		2021
61	10 lbs Dry Chem, ABC	Gen. Room Fwd, Stbd	R-307009	2015	2027		2021
62	10 lbs Dry Chem, ABC	Gen. Room Aft	N-996189	2015	2027		2021
63	15 lbs CO2, BC	Gen. Room Aft	46260	2019	2024	34	N/A
64	10 lbs Dry Chem, ABC	Purifier Room	R-305562	2015	2027		2021
65	10 lbs Dry Chem, ABC	Propulsion Motor Rm Fwd	R-307515	2015	2027		2021
66	10 lbs Dry Chem, ABC	Propulsion Motor Rm Aft	CC-989906	2014	2026		2026

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68	5lbs Dry Chem, ABC	Lifeboat	B00265263	2015	2027		2021
69	5 lbs Dry Chem, ABC	CG 299	S/N2973331	2011	2023		2023
70	5 lbs Dry Chem, ABC	CG 299	S/N5008296	2014	2026		2020
67	5lbs Dry Chem, ABC	Sar Locker	50019151	2018	2023		2024
90	5 lbs Dry Chem, ABC	Barge - Inside wheelhouse	B10704046	2016	2028		2022
91	2.5 lbs Dry Chem, ABC	Barge - Inside wheelhouse	B69962165	2016	2028		2022
75	5 lbs Dry Chem, ABC	Barge - On equipment Box	15108363	2020	2032		2026
	10 lbs CO2, BC	Central Stores	72773792	2020	2032		2026
81	5 lbs Dry Chem, ABC	Central Stores	307010	2014	2026		2026
77	10 lbs Dry Chem, ABC	Central Stores	B76507529	2016	2028		2022
78	10 lbs Dry Chem, ABC	Central Stores	B76506475	2016	2028		2022
79	5 lbs Dry Chem, ABC	Central Stores	N-938475	2015	2027		2021
	10 lbs Dry Chem, ABC	Central Stores	5848614	2020	2032		2026
83	10 lbs Dry Chem, ABC	Central Stores	VP 293020	2016	2028		2022
44	10 lbs Dry Chem, ABC	Central Stores	N-996193	2015	2021		2021
	10 lbs Dry Chem, ABC	Central Stores	46893668	2018	2023		2024
	10 lbs Dry Chem, ABC	Central Stores	B13506290	2016	2028		2022
	10 lbs Dry Chem, ABC	Central Stores	AB-532465	2016	2028		2022
	12 lbs CO2, BC	Central Stores	4687721	2020			
	10 lbs Dry Chem	Central Stores	15108120	2020	2032		2026
	10 lbs Dry Chem	Central Stores	15108607	2020	2032		2026
	20 lbs Dry Chem	Central Stores	88378692				

4.0 CO₂ SYSTEM SERVICING

- 4.1 The CO₂ Fire Fighting System protecting the Cargo Hold is to be thoroughly examined and tested as per ABS requirements.
- 4.2 Bottles are located in the Forward CO₂ Room, port side Well Deck forward; there are a total of thirteen (13) bottles of 75 Kg Tare Wt. (45kg CO₂).
- 4.3 The Contractor is to be responsible for all inspections and is to consult with ABS prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to also advise the Technical Authority, in advance, to allow his/her attendance.
- 4.4 All work is to be performed by a company certified to work on CO₂ Fire suppression systems.
- 4.5 All bottles are to be disconnected before tests are conducted. The CCG Technical Authority must be advised prior to disconnecting.
- 4.6 All hand control levers, pull handles, cables, cocks, and valves are to be checked for proper operation and that they are proven operational. The piping must be blown through with dry nitrogen to prove the lines are clear and that the time delays and sirens are operational. All pressure-operated switches, local/remote electronic and manual releases are to be proven operational. These tests must be witnessed by both the CCG TA and ABS.
- 4.7 All CO₂ bottles are to have their levels ascertained. The contents are to be recorded and a typed written copy given to the CCG Technical Authority. The Contractor must be responsible for replacing any CO₂ accidentally discharged in the performance of this work.
- 4.8 Upon completion of testing, the CO₂ System is to be reassembled and returned to operational condition. This is to be confirmed by the Chief Officer of the vessel.
- 4.9 Copies of all certificates are to be forwarded to the CCG Technical Authority and the attending ABS Surveyor.

5.0 PROPULSION CO₂ SYSTEM SERVICING

- 5.1 The CO₂ Fire Fighting Systems protecting the Propulsion Alternators and Motors are to be thoroughly examined and tested as per ABS requirements.
- 5.2 Bottles are located in the Machinery Spaces; there are three (3) fifty (50) lb. bottles in the Lower D/G Room (aft of each D/G) and two (2) seventy-five (75) lb. bottles in the Propulsion Motor Room (inboard of each motor).

- 5.3 All work is to be performed by a company certified to work on CO₂ Fire suppression systems.
- 5.4 All bottles are to be disconnected before tests are conducted. The CCG Technical Authority must be advised prior to disconnecting.
- 5.5 All hand control levers, pull handles, cables, cocks, and valves are to be checked for proper operation and that they are proven operational. The piping must be blown through with dry nitrogen to prove the lines are clear and that the time delays and sirens are operational. All pressure-operated switches, local/remote electronic and manual releases are to be proven operational. These tests must be witnessed by both the CCG TA and ABS.
- 5.6 All CO₂ bottles are to have their levels ascertained. The contents are to be recorded and a typed written copy given to the CCG Technical Authority. The Contractor must be responsible for replacing any CO₂ accidentally discharged in the performance of this work.
- 5.7 Upon completion of testing, the CO₂ System is to be reassembled and returned to operational condition. This is to be confirmed by the Chief Engineer of the vessel.
- 5.8 Copies of all certificates are to be forwarded to the CCG Technical Authority and the attending ABS Surveyor.

6.0 GALLEY RANGE FIRE EXTINGUISHING SYSTEM

- 6.1 The Contractor is to provide the services of an certified fire protection service company to perform annual inspection, servicing and a condition report of the Galley range fire smothering system as per manufacturer's recommendations.
- 6.2 Existing fire extinguishing system nameplate Data: Kitchen Knight PCL-460 Wet Chemical
- 6.3 The servicing and inspection on the system is to include as a minimum the following:
 - a) Disconnect the cylinder. Contents of cylinder to be ascertained and recorded
 - b) Clean linkages, cabling and pulleys.
 - c) Prove the associated piping is clear.
 - d) Pressure switches, hand controls, control head, fusible links and electrical shutdowns are to be proven operational.

- 6.4 Upon completion of the above, the system is to be reconnected and returned to operational status.
- 6.5 The Chief Officer is to be given 48 hours' notice prior to commencement of this work to enable scheduling changes to minimize disruption to the Galley staff.
- 6.6 All tests to be witnessed by both the CCG Technical Authority (or designate) and the attending ABS Surveyor.
- 6.7 Copies of the test certificates and a typed copy of the systems condition report is to be provided to the CCG Technical Authority.

7.0 FOAM FIREFIGHTING SYSTEM – HELICOPTER HANGAR

- 7.1 The Contractor is to provide the services of a certified fire protection service company to perform annual inspection, servicing and a condition report of the Helicopter Hangar foam firefighting system, as per the manufacturer's recommendations.
- 7.2 Particulars of the system: Manufacturer – Ansul & Sub-assembly – Fire Combat.
- 7.3 The Contractor must supply all labour, materials, equipment and parts required to perform the specified work unless otherwise stated in this SOW item.
- 7.4 Integrity of diaphragm in each of the 450-gallon capacity tanks must be proven. A sample to be taken from each foam tank and sample strength to be tested and copies of results given to the CCG Technical Authority.
- 7.5 The Contractor is to replace the tank manhole gaskets replacing it with new and similar gasket material.
- 7.6 Upon completion of the above, the system is to be secured in good operational condition with all valves in proper positions.
- 7.7 Copies of the test certificates and a typed copy of the systems condition report are to be provided to the CCG Technical Authority.

8.0 FOAM FIREFIGHTING SYSTEM – MONITORS AND HOSE REELS

- 8.1 The Contractor is to provide the services of a certified fire protection service company to perform annual inspection, servicing and provide a condition report of the Foam firefighting system, as per the manufacturer's recommendations.
- 8.2 System Nameplate Data: SKUM SKA 50/MP100 Balanced Pressure Proportioning System, Model MK/MJ 100 (500 litre three percent AFFF concentrate)
- 8.3 Pressure balancing valve to be carefully disassembled for inspection. Any deposits left by foam concentrate to be cleaned from valve internals. After inspection, the valve to be reassembled in correct operating condition.
- 8.4 Level and contents of foam tank to be checked. A sample to be taken from foam tank. Sample strength to be tested and copies of results given to Technical Authority.
- 8.5 Condition of hoses, nozzles, valves, gauges, piping, hoses and hose-reels, monitors and pumps to be checked. Correct operation of local and remote start/stop switches for foam pump and sea water pump to be witnessed by the CCG TA and verified.
- 8.6 Upon completion of the above the system is to be secured in operational condition with all valves in proper positions.
- 8.7 Any recharging/repairs to this system that are required will be done via PWGSC 1379 action.
- 8.8 Copies of the test certificates and a typed copy of the systems condition report are to be provided to the CCG Technical Authority.

9.0 Notifier Fire Detection System

- 9.1 The Contractor must contact a designated ABS representative and schedule of a Marine surveyor to witness any required testing of the systems stated in this SOW item.
- 9.2 The Contractor must test the operation of all smoke, heat and flame detectors located throughout the vessel. All detectors must activate the Notifier Panel located on the Bridge with correct location observed on Notifier print screen. Also the operation of the general alarm must be determined for each detector being tested.

- 9.3 Contractor must ensure that LED on Mimic panel located on the Bridge, Motor Control Room, and both quartermaster stations are activated while each detector is tested.
- 9.4 Contractor must test the operation of the vessels general alarm from each general alarm pull station.
- 9.5 Contractor must test Notifier Panel emergency batteries and advise Chief Engineer of status. If batteries need replacement the contractor must replace batteries with owner supplied batteries.
- 9.6 Contractor must test the operation of all shutdowns activated from the Notifier panels and correct operation of watertight and fire doors.
- 9.7 Upon completion of annual testing of Notifier Fire Detection an inspection certificate must be issued, satisfactory to ABS and CCG.
- 9.8 Certification must be on a date as close as practicable to the completion of refit.

H-29 DUCT WORK CLEANING

1.0 Scope

- 1.1 The intent of this SOW item is to have various areas of the vessels ductwork opened and cleaned by certified professionals. All work must be completed near the end of the refit period. Copies of system condition reports/certificates must be provided to CCG upon the completion of work.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 GALLEY EXHAUST DUCTING CLEANING

- 2.1 The Galley exhaust ducting is to be given its regular cleaning.
- 2.2 Note this work is to be scheduled by the Contractor after the implementation of SOW item H-32 Galley Upgrades as the ventilation arrangements will change.
- 2.3 The contractor with the aid of the ships electrical officer will be responsible for locking out the Galley range (breakers P-216-1 & -2), Deep Fryer (breaker P-216-3), Steam Kettle (breaker P-216-4) and the Galley Exhaust Fan (breaker P-615-8) prior to the commencement of work. The Contractor is responsible for ensuring that power has been isolated prior to commencement of work.
- 2.4 The Contractor is to be aware that the exhaust ducting contains fusible links & actuating wires connected to the fire suppression system; any accidental discharge of this system, as a result of this cleaning, must be rectified by the Contractor and to his account.
- 2.5 All materials, equipment, chemicals, cleaners, etc. required to perform the cleaning must be supplied by the Contractor.
- 2.6 Any neutralizing chemicals or specialized protective equipment required to perform this cleaning must be provided by the Contractor.

- 2.7 The exhaust ducting from the range and aft appliance hoods to the Upper Deck is to be cleaned of all deposits; the tube axial Exhaust Fan motor and fan blades are also to be cleaned. Access to the axial fan can be gained through a bolted 27" square panel located in the Upper Deck breezeway and a bolted grill on the fan outlet.
- 2.8 Grease deflectors above the appliances are to be removed prior to the ducting cleaning; they are to be stored in a secure location as directed by the vessel's Chief Engineer. Upon final inspection, the grease deflectors will be reinstalled by vessel's crew.
- 2.9 The level of cleanliness of the duct work and fan assembly is to be inspected and to the satisfaction of the CCG TA prior to being closed-up.
- 2.10 The work areas are to be inspected at the completion of this specification by the Technical Authority (or designate); any debris, residue or general untidiness resulting from work performed in this item must be removed/rectified by the Contractor at the Contractor's expense. All work must be completed to the satisfaction of the CCG IA.
- 2.11 All WHMIS-controlled products, used onboard during the course of this SOW item must be accompanied by a current MSDS.

3.0 DRYER DUCT CLEANING

- 3.1 The ducting from the clothes dryers in the Crew's and Officer's Laundries requires an annual cleaning. The Laundry Exhaust Fan will be isolated by the contractor with the aid of the Ship's Electrical Officer at MCC 5, Breaker P-615-5. The Contractor must be responsible for ensuring that the power to the fan has been isolated prior to commencement of work.
- 3.2 The Contractor is to retain the services of a specialized vacuum duct cleaning firm to remove the lint accumulations from the Officer's Laundry dryer ducting.
- 3.3 The ducting runs above the deck head panels aft to outside the bulkhead on the Boat Deck in the vicinity of Fire Station #3. There are two outlets (one from each dryer), four (4) inches in diameter, each approximately five (5) feet in length, at which point they tie together into one outlet, four (4) inches in diameter, approximately twenty-two (22) feet in length. The Contractor is also to ensure the Exhaust Fan, including the fan blade and the outlet screen are also cleaned.
- 3.4 The Contractor is responsible for the removal of the deckhead panels need to gain access to the above ducting.

- 3.5 The lint accumulations are also to be cleaned from ducting from the four (4) dryers in the Crew's Laundry on the Main Deck. The four (4) steel goosenecks in the Upper Deck (P) breezeway for the Crew's Laundry dryers are also to be cleaned. The ducting from the Crew's Laundry has four (4) outlets, four (4) inches in diameter, each approximately twelve (12) feet in length.
- 3.6 After cleaning the duct work is to be inspected by the CCG TA and is to be to his or her satisfaction. After successful inspection removed deck head panels are to be replaced in their respective locations; any panels damaged as a result of this cleaning must be repaired to "as found" condition or replaced at the Contractor's expense.

4.0 SMOKING LOUNGE EXHAUST DUCT CLEANING

- 4.1 The Contractor is to retain the services of a specialized vacuum duct cleaning firm to clean the cigarette-smoking related accumulations from the interior of the Smoking Lounge Exhaust Fan & its natural vent ducting.
- 4.2 The smoking lounge exhaust fan will be locked out by the contractor with the aid of the ship's Electrical Officer at breaker L-104-20. Contractor must be responsible for ensuring that the power to the fan has been isolated prior to commencement of work.
- 4.3 All materials, equipment, chemicals, cleaners, etc. required to perform the cleaning must be supplied by the Contractor.
- 4.4 Three (3) louvers in the Lounge are to be removed & cleaned. The external ducting from the Exhaust Fan has a bolted clean-out panel located just aft of the external bulkhead of the space, and a removable screen on the outboard end of the ducting. The inlet on the natural vent ducting also has a removable screen.
- 4.5 The Contractor is to replace six (6) ½" UNC stainless steel fasteners and install them on the clean-out access panel.
- 4.6 There is approximately twenty (20) feet of external & internal ducting associated with the Exhaust Fan with a further six (6) feet of internal natural vent ducting to be cleaned.
- 4.7 The Contractor is responsible for the removal of any interference items and or deckhead panels needed to gain access to the above ducting.
- 4.8 After cleaning the duct work is to be inspected by the CCG TA and is to be to his or her satisfaction. After successful inspection removed interference are to be replaced in their respective locations; any damage incurred, as a result of this cleaning must be repaired to "as found" condition or replaced at the Contractor's expense.

- 4.9 All WHMIS controlled cleaners utilized must be accompanied by a current MSDS and copies provided to the CCG TA.

5.0 TOILET EXHAUST FAN DUCT CLEANING

- 5.1 The Toilet Exhaust Fan, which services the twenty-six (26) washrooms and six (6) other spaces onboard, requires the removal of any accumulations of dust & lint from this network of ducting.
- 5.2 Spaces to be accessed:
- Wheelhouse - one (1) Washroom
 - Officer's Deck - three (3) Washrooms
 - Boat Deck - two (2) Washrooms, Officer's Laundry, Officer's Lounge, & Bar Stores
 - Officer's Deck - eleven (11) washrooms & Officer's Pantry
 - Main Deck - nine (9) Washrooms, Crew's Laundry, & Linen Locker
- 5.3 Vessel's drawings H-3810 through H-3840 will be provided to the Contractor for reference purposes.
- 5.4 The Toilet Exhaust Fan will be locked out by the contractor with the aid of the vessel's Electrical Officer at breaker P-615-9 on MCC #5 prior to commencement of work.
- 5.5 The Contractor is responsible for the removal of any interference items and or deckhead panels needed to gain access to the above ducting.
- 5.6 The Contractor is to retain the services of a specialized vacuum duct cleaning firm to remove the dust and lint accumulations from the ducting. A HEPA-filtered vacuum unit is to be used to create a negative pressure in the ducting from the outlet side of the fan in the A/C Unit Room, located on the Boat Deck. A screwed 18" X 20" access panel on the aft side of the ducting is to be removed for this purpose.
- 5.7 A "whisker line" is to be employed from the inlet side of each leg of ducting to agitate the accumulated lint and other debris towards the suction side of the vacuum unit.
- 5.8 The vent louvers, deflectors and grills found in each space are to be removed and cleaned, and after inspection by the CCG TA, replaced.
- 5.9 Once all the suction ducts up to the Toilet Exhaust Fan are found to be satisfactorily clean, the following is also to be cleaned and inspected:

- fan blades and associated housing
- outlet ducting from the fan to the mushroom vent

- 5.10 After cleaning, the duct work must be inspected and accepted by the CCG TA.
- 5.11 After successful inspection removed interference are to be replaced in their respective locations; any damage incurred, as a result of this cleaning must be repaired to “as found” condition or replaced at the Contractor’s account.
- 5.12 The Contractor must be responsible for providing a service/condition report detailing the work performed and methodology used. Type written copy(s) of this report is to be provided to the CCG TA within three (3) working days of the completion of this specification.

H-30 BOW THRUSTER REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW item is for Contractor to remove the existing bow thruster unit and install a new, Canada supplied, electrically driven Wartsila FT 175H-D transverse tunnel thruster,
- 1.2 The Contractor must arrange to provide for the services of a Wartsila authorized and qualified Field Service Representative to be present for the purposes of the supervision of the installation of the bow thruster as well as its start-up, commissioning, and both the dock trials and sea trials, This technician will be identified in this SOW item as: WFSR (Wartsila Field Services Representative). The FSR's resume showing his or her experience on the installation of this model of bow thruster will be presented for review and acceptance by the CCG TA. Only an FSR with significant recent experience on the installation of this model bow thruster will be accepted.
- 1.3 The Contractor must arrange for the services of a Wartsila FSR to supervise the bow thruster installation and commissioning. Contractor must include an allowance of \$100,000.00 to cover all expenses of the Wärtsilä FSR, inclusive of accommodation and travel. This allowance will be adjusted up or down as necessary by the PWGSC 1379 process upon proof of invoice.
- 1.4 The Contractor must schedule all work in this SOW item and the attendance of the FSR so that no delays are incurred and there are no excess costs for additional down time. If there are delays as a result of Contractor's scheduling of work or extra costs due to excess FSR down time, then the Contractor must be responsible for covering any additional costs associated with retaining the Wartsila FSR.
- 1.5 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 Standards and Regulations

2.1.2 The following standards are required as part of this specification. In case of conflict between any of the below standards, then the most stringent requirements will prevail.

- CSA W47.1-03 & 09, Certification of Companies for Fusion Welding of Steel
- CSA W59-03 & 08, Welded Steel Construction (Metal Arc Welding)
- CSA 17, Canada Shipping Act - Tackle Regulations
- CSA 2001- 28, Canada Shipping Act - Hull Construction Regulations
- CSA 2001- 33, Canada Shipping Act – Marine Machinery Regulations
- CSA 29, Canada Shipping Act - Hull Inspection Regulations
- CSA 57, Canada Shipping Act – Safe Working Practices Regulations
- MOSHR, Canada Labour Code – Marine Occupational Safety and Health Regulations
- TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- IEEE STD 45 – Recommended Practice for Shipboard Electrical Installations
- IEC 60092-504-electrical Installations in Ships – Part 504: Special Features Control and Instrumentation
- IEC 60533 – Electrical and Electronic Installations in Ships – Electromagnetic compatibility
- IACS No. 47 Shipbuilding and Repair Quality Standard (1996) Part B – Repair Quality Standard for Existing Ships
- ABS Rules & Regulations
- Society for Protective Coating (SSPC) Standards , SP1 – Solvent cleaning
- Society for Protective Coating (SSPC) Standards , SP2 – Hand tool cleaning
- Society for Protective Coating (SSPC) Standards , SP3 – Power tool leaning

2.2 Drawings and Documents

2.2.1 NOTE: All new drawings generated as a result of this installation, that are not in AutoCAD DWG format are to be converted to AutoCAD DWG format by the Contractor, updated and verified by an independent third party consultant hired by Contractor.

2.2.2 A final “as fitted” version adapted to the George R. Pearkes, must updated for each drawing concerned with the BT replacement. Final approval/review must be performed by CCG TA

2.2.3 The following list of Drawings will be provided to the Contractor and are to be used for reference and guidance purposes during the course of this installation.

DRAWINGS #	DRAWING NAME
Ship's Drawings	
H2_1 & 3	Construction Sections – Fore Body & Bulkheads
H3_1 & 2	Profiles and Decks – Engine Room/Tank Top & Main Deck and Above
555-H-0002	Framing Expansion

DRAWINGS #	DRAWING NAME
555-H-0003	Tank Top And Double Bottom
555-H-0004	Engine Room Flats
555-H-0005	Main Deck
555-H-0006	Main Watertight Bulkheads Below Main Deck
555-H-0017	GA Main Deck FWD
555-H-0019	GA Focsle Deck
555-H-0022	Docking Plan
555-H-0023 - 0025	Vessel General Arrangements
555-H-0026	Capacity Plan
H-0029_01	Lines Plan Fore Body
555-H-2740	Manholes, Hatches, & Access Covers
H-4410	Insulation Plan
7317G-207-01	Bow Ice Knife Unit & Lines Plan
07352S11	Tunnel Surface (Calcul De Surface Intérieure Du Tunnel)
54-10-01_01	Bow Thruster Arrangement
62-20-01_01	Bow Thruster Ventilation
67-10-06_01 & 02	Bow Thruster Ballast Arrangement OMS, 2 sheets
86-05	Wire Way Deck Plan ER Flat
80-56	BT Control System Block Diagram
80-57_01	BT System Elementary Wiring Diagram
8102482	BT lubrication schematic
SC1812-W22	52-6 BT AC schematic
Wartsila Drawings	
DAAF356703	Transverse Thruster Arrangement
DAAF322383	Assembly of the propeller gearbox, part of IPI_DBAE310215
DAAF332626	Flexible Coupling, part of IPI_DBAE310215
DAAF359943	Block Diagram Hydraulic System, part of IPI_DBAE310215
DAAK113254	Lubrication Pump Set, of the prop gearbox, part of IPI_DBAE310215
DAAK113255	Lubrication Pump Set Hydraulic Diagram, part of IPI_DBAE310215
DAAK113256	Lubrication System Manifold, part of IPI_DBAE310215
DAAK015657	Dimension Sheet Header Tank (35 dm3), part of IPI_DBAE310215
DAAF323637	E-motor drawing, part of IPI_DBAE310215
DAAF322758-SH001	Tunnel assembly, part of IPI_DBAE310215
DAAF322758-SH002	Tunnel assembly, part of IPI_DBAE310215
DAAF370697	Side Grids Arrangement, part of IPI_DBAE310215
DAAW008946	Anodes plan. part of IPI_DBAE310215
DAAF326774	Steel plate 1, part of IPI_DBAE310215
DAAF327425	Steel plate 2, part of IPI_DBAE310215
DAAF344924	Installation Drawing Support Plate, part of IPI_DBAE310215
DAAF357836_1	VFD Cabinet Outline Dimensions
DAAF357836_2	VFD Cabinet Outline Dimensions
DAAF357836_3	VFD Cabinet Outline Dimensions
DBAE310215	Installation Planning Instructions (IPI) – Transverse Thruster System
DBAE475709	Operating and Maintenance Manual - VFD and Controls
DBAE358991	Installation Planning Instructions (IPI) –Electrical and Controls

DRAWINGS #	DRAWING NAME
DBAE475551	Operating and Maintenance Manual - Transverse Thruster System
DBAE235806	System Integration Plan
DAAF357837	Panel Layout Bow Thruster Control
DAAF362960	Project Electrical Drawings
DAAF362961	Cable plan
DBAE224529	Modbuslist AMS
Allswater Drawings	
18067-400-A-001	BT removal and installation plan movement
18067-400-S-001	BT structural arrangement
18067-400-S-002	Tunnels grids details
18067-400-A-002	Forecastle electric equipment arrangement
18067-400-S-005	VFD, hydraulic tank and hydraulic HPU, foundations
18067-400-S-003	Penetration Infill Arrangement
18067-400-S-004	Temp. Bulkhead Transit Opening and Louvre Removal and Infill
Bill of Materials	
PAAF589190	BOM- Bow Thruster controls
PAAF588209-A	BOM report_Headlines
PAAF577088	Panel Forecastle - BOM
PAAF434841	Panel WHP - BOM
PAAF434842	Panel WHS - BOM
DAAF362962	VFD cabinet - BOM
DBAE492010	E-drive commissioning protocol
	Field service acceptance protocol
	TT commissioning protocol
	Transverse Thruster acceptance protocol V03

2.3 Contractor Responsibilities

- 2.3.1 All new steel plates and shapes required, as defined in the aforementioned guidance drawings must ABS approved with certificates or equivalent unless noted. The steel necessary to plate over any openings in the shell must have the same steel grade as the surrounding plating. Copies of all steel plate certificates are to be provided to the CCG TA.
- 2.3.2 The Contractor must supply and install all electrical cabling unless otherwise stated for the installation of the new bow thruster unit. The existing main feeder cables from the main switchboard Bow Thruster (BT) breaker are to be re-connected to the VFD cabinet via a new junction box, which must be supplied and installed by the contractor in a location approved by the CCGTA, FSR and ABS. All other power cables, control cables, communications, AMS and data cables are to be Contractor supplied, and installed according to Wartsila DAAF358732 Project Electrical Drawings. Existing cables not reused are to be disconnected and

removed from the vessel. Supplied cables must be approved by the FSR and meet all regulatory requirement.

- 2.3.3 An updated stand-alone Wartsila document - 'DAAF362961 Cable plan' is provided in the TDP for bidding purposes, with approximate lengths. The Contractor will be responsible for determining and confirming the actual lengths required. The Contractor must submit a report with actual cable lengths to the CCGTA for review prior to ordering any cables. Any cables ordered by the contractor that are too short, will be reordered and reinstalled, at the expense of the contractor. Changes to cable requirements found in the agreed upon contractor cable report and the DAAF362961 Cable Plan will be adjusted by PWGSC 1379, if required. The Contractor must quote unit cost per additional meter of cables in the cable plan.
- 2.3.4 The Contractor must be responsible for developing engineered welding procedures and NDT schedule that will be required for the modifications of the existing structure to facilitate the installation of the bow thruster and its components. The welding procedure and NDT schedule must be developed by a CWB approved Welding Engineer and ABS prior to the commencement of any structural work.

2.4 Government Supplied Material Furnished Equipment

- 2.4.1 The following list is the Government Supplied Material that will be delivered to the Contactor's facilities for installation as part of this SOW item.

Item #	GSM Description
1	Bow Thruster, Wartsila model FT175H-D, consisting of propeller, pod with right angle drive and support plate
2	Stainless Wear Ring to be installed within the existing tunnel
3	Thruster Drive Motor – Asynchronous Marelli Motor B5M 400LB4
4	Variable Frequency Drive - Vacon NXP/Frequency Converter
5	Hydraulic System – pump set, filters, 35 liter header tank, and starter cabinet
6	Two (2) Wheelhouse Wing Control Stations

- 2.5 New Bow thruster Name Plate Data
 Motor RPM: 1789
 Propeller Dia: 1565mm
 kW: 600
 Type: FT175H-D
 Manufacturer: Wartsila Thruster Hub, Marelli Main motor
 Total Weight of Hub+Propeller: 2255kg

2.6 FSR

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3.0 Technical Description

3.1 Removals of Existing Bow Thruster and Installation of New Unit

3.1.1 General

- 3.1.1.1 A new electrically driven Wartsila FT 175H-D transverse tunnel thruster is to be installed in the bow thruster compartment and will replace the existing thruster unit. After removal of the existing thruster unit, the new bow thruster must be installed within the existing tunnel and modifications will be required to the top portion of the tunnel and supporting structure above to suit installation of the new unit.
- 3.1.1.2 This SOW item is intended to be read in conjunction with the Wartsila IPI Doc ID DBAE310215. Refer to Wartsila IPI Doc ID DBAE310215 for all Welding, Processes, Quality, Materials, Tolerances, Heat Treatment, and Filler Materials.
- 3.1.1.3 Upon the arrival of the new unit at the contractors facility, the contractor must carry out unit inspections and pay close attention to necessary actions required as detailed in sections 1 and 2 of the Wartsila Bowthruster Installation Planning Instruction (IPI). The contractor must also provide and maintain effective storage of the new unit, all related parts and equipment as required prior to its installation on the vessel. This includes storage in an enclosed, heated and dry building storage facility safe from all outdoor weather and shipyard debris as detailed in Section 3.5 of SOW item 3.0 – General Notes .
- 3.1.1.4 From the time the new bow thruster unit and all associated parts arrive at the contractor's facility until they are successfully installed on the vessel, the contractor is responsible for all craning, forklifts, rigging, labour and all other related equipment and mechanical requirements necessary for the successful installation of the new unit. This includes all movements around the contractor's facility, on/off trucks, in/out of storage and on/off the vessel. These requirements

also apply to the existing bow thruster unit which must be removed from the vessel and disposed of as per Provincial and Federal Guidelines.

- 3.1.1.5 Items which are electrically energized must be electrically isolated (locked-out) at their supply breakers with the concurrence of the CCG TA and the vessel's electrical officer. All interference items must be stowed safely by the Contractor. Pipes must be blanked off with suitable flanges and gaskets, or pipe caps of the correct size rags stuffed in to piping opening s will not be allowed. Any items that are not removed and subsequently damaged during the removal or installation process must be repaired at Contractor's expense.
- 3.1.1.6 Prior to disconnecting the Contractor, with CCG TA present, is to test the existing supply and motor power feeds insulation to ground, prior to commencement of removals. These readings are to be recorded and provide to the CCG TA for his records.
- 3.1.1.7 Any piping, manholes, parts and/or equipment requiring removal to carry out specified work and/or to gain access must be refitted upon completion with new Contractor supplied fasteners, anti-seize compound, gaskets, clamps and brackets as applicable.
- 3.1.1.8 Contractor must arrange for the services of the WFSR to supervise the installation and for the commissioning of the new thruster. The installation must meet all relevant ABS rules and regulations and conform to the installation instructions and drawings supplied by Wartsila.
- 3.1.1.9 The WFSR must be on site full time for the mounting and alignment, electric installation, commissioning, and mechanical start-up of the new installation. The WFSR must also be on site for both the dock and sea trials.
- 3.1.1.10 The Contractor, under the guidance of the WFSR, is responsible for the correct function of all equipment upon completion of the installation. The Contractor must perform all work under the direction of the certified WFSR.
- 3.1.1.11 The Contractor must perform all removals and install all new equipment, including all electrical cabling from the source to delivery point, all associated cabling needed for the interconnection between consoles and all associated cabling needed for the connection of the consoles to the Variable Frequency Drive (VFD) in the forecastle, between the VFD and the main motor, etc. as explained in references documents DAAF362960 Project electrical drawings and DBAE475709- Operating and Maintenance Manual - VFD and Controls.
- 3.1.1.12 It is not the intent of this SOW item to detail all minor items requiring removal, modification or fabrication to carry out the required work. It is the contractor's responsibility to examine all drawings and documents in the Technical data package to understand and execute the full scope of work. This includes the

temporary removal, storage and reinstallation of all interference items in way of the work detailed in this SOW item.

3.1.1.13 The Contractor must be responsible for supplying and installing the necessary CAT 6 Ethernet communication cables and connectors from the Wheelhouse to the Engine rooms Control Room for the Alarm Monitoring System. For bidding purposes, 70 meters of cable will be required. It is the responsibility of the contractor to determine the actual length of cable required and submit it to CCGTA for review before purchase.

3.1.1.14 The existing SYSTEM-ULSTEIN 900TT bow thruster unit consists of the following components:

- One 1200 rpm 600 kW wound rotor motor;
- Motor/starter control cabinet;
- Resistor banks for speed control;
- Thruster unit, propeller shaft, seals, coupling, propeller, and gear housing;
- Control system including two (2) remote controls from the wheelhouse and local control at motor starter panel
- Thruster tunnel, 1,600 mm inner diameter and 1,800 mm long

3.2 Existing Bow Thruster Removal

3.2.1 It is not the intention of this SOW item to detail all minor items requiring removal to carry out the required work. Any additional removals and replacement of or relocation of existing equipment or items not affected by the work, and readily seen at the time of the vessel's viewing must be included by Contractor in the scope of work. Contractor is to refer to drawing, 18067-400-A-001 - BT Removal and Installation Movement Plan for guidance in the removal process.

3.2.2 The Contractor must seal all openings in watertight or fire rated decks and bulkheads, including bolt holes, caused by removal of steel structure, cables and piping not being reused. Openings must be sealed with welded plate inserts approve by ABS on watertight bulkheads and decks.

3.2.3 All work must be approved by CCG TA and follow ABS' standards and regulations.

3.2.4 Existing ice guards on both sides of the tunnel must be cleanly cut away and the contact point ground flush.

3.2.5 The Contractor must remove the following existing bow thruster components. The Contractor is to refer to the attached Allswater Marine Drawings for further guidance on the removal of the larger sized items within the Winch Room, Thruster Compartment and Thruster Tunnel areas. At a minimum, these include:

- Bow Thruster Unit (propeller, pod and ice grids)
- Existing Stainless Liner in Tunnel
- Bow Thruster Electrical Motor
- Bow Thruster Motor Control Cabinet and associated Seating
- BT winch room local control cabinet
- BT wheelhouse wing controls
- Resistor Bank and seating
- Oil Header Tank and seats, oil piping and supports
- Various Cabling not intended for reuse

Note: Some of these items may require additional effort for removal due to their nature and age. The Contractor must account for this extra effort in their pricing and include this in their overall bid.

- 3.2.6 The Contractor must remove the BT drain plugs and remove approximately 300 liters of oil from the thruster unit. The oil must be drained and collected by Contractor for disposal as per local environmental requirements. Copies of invoices detailing disposal of the oil are to be given to the CCG TA.
- 3.2.7 The Contractor must remove the stainless-steel ring from the tunnel and grind smooth the welds on the inside of tunnel. The existing tunnel is to remain in place.
- 3.2.8 All cabling to be re-used must be labelled and documented before being disconnected. The Contractor must protect and stow this cabling, as detailed in section 3.5 of SOW item 3.0 – General Notes, in a safe place until they are needed to be reinstalled. All other power and control cabling are to be removed and gaps closed per ABS requirements. Any unused transits, cable penetrations or glands must be sealed up/re-packed, meeting ABS requirements.
- 3.2.9 Within the Winch Room and Bow Thruster Compartment areas there are various items requiring temporary removal or relocation to facilitate removal of the existing thruster unit components and to allow installation of the new bow thruster components. These are to include and not be limited to the following.
 - a) Winch Room Forecastle -The supply air fan and ducting on the starboard side from the bulkhead at Frame 161 to the flanged connection at approximately Frame 168, just aft of the existing motor control cabinet must be temporarily removed. This includes the branch ducting running to port towards the Bow Thruster Compartment.
 - b) The communication system (phone, speaker), lighting equipment, fire extinguishing system (pull station, bell, piping etc) and fire detection system, if needed, must be removed temporarily, stored and replaced after work.

- c) The vertical post and handrail located at the forward starboard corner of the motor tunnel and attached to the existing motor control cabinet must be temporarily removed and modified to suit the new unit installation.
- d) Miscellaneous panels and cabling attached to the aft side of the existing motor control cabinet that are not involved with the operation of the existing bow thruster must be temporarily removed. Upon completion of the installation of the new control cabinet these items must be secured back in the same fashion to the new motor control cabinet.

3.3 Bow Thruster Compartment: (Frames 163-169)

3.3.1 The Contractor must unbolt, remove and store the Thruster Compartment hatch along with the bolts for future re-installation upon the completion of work. A temporary weatherproof shelter must be erected over the compartment opening to prevent ingress of weather into the Bow Thruster compartment. It is the responsibility of the contractor to maintain an effective shelter during all stages of the bow thruster removal/installation process.

3.3.2 The following items must be temporarily removed or relocated:

- a) Remove and store vertical air ducting on forward bulkhead of the Bow Thruster Compartment.
- b) Remove and store bilge, ballast, fuel oil, steam, and condensate piping lines in the compartment which will interfere with the removal or installation of the Thruster Motor. The pipes must be marked prior to removal to aid with re-installation. In addition, the Contractor must temporarily blank all pipes to prevent ingress of contaminants. The contractor must include an allowance of \$20,000.00 for the fabrication of new pipe, if required, after these temporarily removed sections are inspected by the CCG TA. This total value must be adjusted by PWGSC 1379 based on the actual amount of pipe fabricated and the negotiated pricing agreed to between the CCG TA and the contractor.
- c) Remove and store the various small pipes running along the starboard and forward bulkhead. The pipes must be marked prior to removal to aid with re-installation. In addition, the Contractor must temporarily blank off all exposed open pipes.
- d) Remove and store all lights, sirens, bells, and other small miscellaneous items located on the compartment bulkheads which may interfere with the removal and installation of the thruster motor. The Contractor will be responsible for supplying any temporary lighting required to allow work to continue safely.
- e) Electrical junction boxes mounted on the starboard bulkhead.

- f) Remove and store all miscellaneous brackets and interference items in way of the clear opening. Remove and store, the access ladder, ladder lugs along the bulkhead if needed, the two (2) landing gratings along with the landing support structures IWO the clear opening.
 - g) The Contractor must disconnect the electrical power and instrument cabling from the fiberglass electrical connection box and the steel electrical outlet box located on the starboard side of the hatch coaming. The Contractor must ensure all cabling is marked prior to being disconnected to aid with re-installation. The Contractor must then remove and store the fiberglass electrical outlet box and the electrical connection box. The welded steel electrical box may have to be removed due to the small clearance, and the Contractor will be responsible for doing so if required at his cost.
- 3.3.3 Once the components have been removed from the vessel, the Contractor is responsible for their storage, and reinstallation onto the vessel after work is completed, as well as any modifications required. Any items that must be disposed of must be done in accordance with Provincial and Federal safety and environmental regulations.
- 3.3.4 Areas where brackets, seats and mounts have been removed, are to be ground smooth to the parent metal.
- 3.3.5 After the removals of all the existing equipment, the Contractor must mechanically clean the bulkheads, deck, bilges and all other areas of disturbed paint in the bow thruster compartment (motor tunnel) to SSPC-SP6 standard.
- 3.3.6 Existing disturbed paint must be feathered back smooth to adhered coatings by means of powertooling. Various equipment such as and not limited to; phones, electrical outlets, wiring, heater, bilge manifold (and valves) must all be protected from any damage resulting from the mechanical cleaning.
- 3.3.7 Means of paint application must be via airless spray and over spray must be limited and contained. Any over spray on structure or machinery above deck plate level must be top coated to original colour scheme.
- 3.3.8 The contractor must include pricing for the repair and coating of 50 m² bare areas inside of the Bow Thruster Compartment and must provide a unit price per m² for a final adjustment by PWGSC 1379.
- 3.3.9 Repaired bare areas are to receive 2 coats of marine grade primer. All surface areas in the Bow Thruster Compartment must then be coated with two (2) full coats of International Interbond 808, each coat of contrasting colour, and one topcoat of International Interthane 990 or marine grade equivalent. Note: A topcoat must be applied to Interbond within specific time period as specified by manufacturer for

proper adhesion. Final coat must be white in colour. All paint prep work and applications are to be inspected by the CCG TA and CCG supplied NACE inspector and all work must be carried out to their satisfaction and approval.

3.4 New Bow Thruster Installation

- 3.4.1 It is the responsibility of Contractor to complete modifications to the new machinery seats and foundations to allow for correct fit, alignment, and oil/water tightness. Detailed disassembly steps are located in Wartsila Document No. DBAE310215 IPI (Installation Planning Instruction) are to be followed by the Contractor where applicable. The Contractor must design and fabricate a special alignment tool using shipbuilding experience and know-how which will greatly assist in alignment of the Bow thruster gearbox in the thruster tunnel.
- 3.4.2 The Contractor is responsible for the total installation, testing and commissioning of all electrical and mechanical installations necessary to provide a fully functioning tunnel thruster system. This must include all cabling, cableways, safety interlocks, protection and the necessary deck and bulkhead penetrations for the cables. The intent is to reuse the existing supply feeder cables to the existing thruster drive motor starter cabinet.
- 3.4.3 All cabling associated with this installation, both old and new, must be meggered in the presence of the CCG TA and readings recorded prior to cable terminations. Readings to be presented to CCGTA upon completion for their records.
- 3.4.4 The support plates will need to be machined to the correct size, to be bolted and welded in place once the thruster is in final position. Refer to Wärtsilä guidance drawing DAAF344924 and Allswater guidance drawing 18067-400-S-001 for further details.
- 3.4.5 The Contractor must supply an approved CWB engineered Welding procedure to ABS, CCG TA and the WFSR for final approval. The procedure is required to prevent any distortion occurring of the support ring.
- 3.4.6 Once the bow thruster propeller is fitted into the final position on the shaft, machining of the retainer plate will be required by the Contractor as per Wartsila IPI DBAE310215. Exact measurements will be taken with WFSR in attendance

3.5 Electrical Requirements

- 3.5.1 All electrical equipment supplied by the Contractor must be marine rated, comply with TP 127E, IEEE 45, and be current production makes and models.

- 3.5.2 The Contractor must supply and install any cabling not identified as being supplied by the CCG TA, as per attached cables list file. All new and used cables to be installed or modified requiring new terminals or lugs, as well new S8x1, welded Roxtec cable transit systems and blocks, or certified equivalent, must be supplied and installed by the Contractor. For bidding purposes, the contractor must include the cost for the supply, installation and packing of eight (8) S8x1 Roxtec, welded transit kits (Complete with frame, blocks, wedge kit, stay plate etc.), or certified equivalent. The contractor must provide a unit price per transit to be adjusted by PWGSC 1379 based on the actual requirement.
- 3.5.3 All new power and control cables supplied by Contractor must be 0.6/1kv 110c of a low smoke zero halogen (LSZH) designation unless otherwise identified in the wiring specification. Unless otherwise identified, all new cable must be braided and armored.
- 3.5.4 All glands utilized to secure motor supply cables must be of a metal construction; fiber or composite glands will not be acceptable.
- 3.5.5 The Contractor is required to determine the necessary cable lengths of all new conductors to comply with requirements for fault current calculations.
- 3.5.6 New cable installation must follow TP127, IEEE 45 and ABS requirements.
- 3.5.7 Prior to installation the new bow thruster motor must be meggered as per IEEE43-2000 and TP 127 requirements (i.e. 500VDC for a 60 second duration). This megger test must be witnessed by the CCG TA and readings recorded. Contractor is to provide to the CG TA a valid calibration certificate for the instrument being used. The temperature of the equipment being tested is to be recorded and if required the megger readings must be corrected to 40°C as per IEEE43-2000. Contractor must inform the CCG TA of any Megger readings found below the limits as defined in TP127.
- 3.5.8 A Polarization Index (PI) must be completed on the bow thruster motor based on IEEE43-2000. Contractor is to provide a copy of the valid calibration certificate for the instrument being used to the CCG TA. The temperature of the equipment being tested must be recorded and the readings must be corrected to 40°C as per IEEE43- 2000. The PI test must as a minimum consist of a ten (10) minute test duration with the first reading being recorded fifteen (15) seconds after start of the test and then continue to record readings at one (1) minute intervals over the remaining ten (10) minute test. The Contractor must inform the CCG TA of any readings outside the defined limits of this test, as per IEEE43-2000.
- 3.5.9 All Contractor developed electrical drawings must be presented to both the CCG TA and ABS for review and approval prior to commencement of the work.

- 3.5.10 The existing cable trays are to be utilized wherever possible. In locations where new (intermediate) trays are required, these must be supplied and installed by Contractor.
- 3.5.11 Communication, monitoring and signal cables must be installed at a safe distance from power cables in order to prevent EMI interference signal. Special attention in this respect must be given to the cable installation in the Engine Room, the Wheelhouse, and Bow Thruster compartment.
- 3.5.12 New cabling run in the accommodation area must be concealed in the ceiling and behind bulkhead panels and secured appropriately in either new or existing wire ways. The contractor is responsible for the temporary removal, storage and re-installation of all panels and related interference items.
- 3.5.13 All power circuits must have over-current and short circuit protection, as set out by ABS. The protection must be an automatic circuit breaker type and are to meet the short circuit level and the selectivity requirements for the location.
- 3.5.14 The Contractor must supply, arrange and install all the necessary wiring, wire trays terminals, junction boxes, and cable transits necessary for all connections to the Alarm and Monitoring System.
- 3.5.15 The Contractor is responsible for supplying and mounting a new ABS approved IP54 junction box enclosure with terminals suitable for the existing power cables feeding the VFD. The junction box is to be mounted on the port side of the new VFD in the best possible location per FSR and CCGTA instructions. The minimum size of the new junction box is to be 20 inches wide x 36 inches high x 12 inches deep. Contractor must also supply and install new power cables from this junction box to the VFD inputs, as well as all cable lugs, securing arrangements and glands for both new and existing cables. The cable required is 4 runs of marine grade, armoured, 3 conductor x 350 mcm, 4 meters (16 meters total). Contractor must supply and install a S8x2 Roxtec transit in the lower port side of the VFD for Power cables to pass through.
- 3.5.16 In addition to the attached cable plan, the contractor must supply and install the main power cable from the new VFD cabinet, down to the new E-motor. The contractor is also responsible for any and all interference items, cable trays, transits and the new cable must be installed meeting all regulations and standards. Contractor must supply and install all cable lugs, cable straps, and any other securing arrangement required to complete the installation. The cable required is 4 runs of 3x 120 mm² and 1 run of 3 x 70 mm² marine grade, armoured – approx. 25 meters per run. New cables are to be routed through the newly installed Roxtec transit in the VFD lower port side, then down to the new E-motor following the same path as existing cables.

- 3.5.17 The Contractor must supply and install the necessary marine rated CAT 6 Ethernet communication cables and connectors required to connect the alarm and monitoring points from the new thruster system to the (AMS) alarm and monitoring system. Two (2) CAT 6 Ethernet cables will be required supplied with one from the Winch Compartment to the Motor Control Room (MCR) which will be connected to the AMS system. The second cable will be fitted from the Winch Compartment to one of the wing control consoles fitted in the Wheelhouse (for future use). The Contractor must note that the Cable Plan states CAT 7 Ethernet cables for the AMS however, CAT 6 Ethernet cables are required.
- 3.5.18 The Contractor must supply a new OEM gateway converter for the vessels Alarm and Monitoring system. Alarm function integration and commissioning will be included as part of Madsen's pricing, as referenced in Section 12.3.4 (Part A, Commissioning section of this SOW.) The Contractor must arrange to have Madsen incorporate the new thruster alarm functions.
- 3.5.19 The Contractor is responsible for making then terminations and connections to the systems electrical power. Specialized equipment found within the cabinets or termination of control or signal wiring, must only take place under the direction and supervision of the WFSR.
- 3.5.20 The following IOs must be incorporated into the AMS system:
- Main Voltage (Into Drive)
 - Bow Thruster motor run indication
 - Torque Demand %
 - Motor speed
 - Motor temperature
 - Motor voltage
 - Motor current
 - Motor KVA
 - Control Lever Reference
 - Station in Control
 - Drive Temperature
 - Hydraulic Tank low level alarm
 - Oil temperature indication of lubricating oil
 - System main oil pressure indication and low pressure alarm
 - Motor overload alarm and auto stop

3.6 Motor Control Cabinet In Winch Room/Forecastle Compartment

- 3.6.1 A new Variable Frequency Drive (VFD) will be installed in the Winch Room in the same general location as the existing control cabinet (Note* Drawing 18067-400-A-002 shows the existing cabinet forward of Bulkhead 167. This is in fact the Forward MCC which will not be changing location. The existing and new VFD

location is aft of bulkhead 175, facing aft). The Contractor will be required to remove the existing cabinet foundations and design/engineer, fabricate and install the new foundations for the VFD cabinet. Due to the height size of the new cabinet the new seating must be constructed using short angle bar sections welded to the Winch Room deck. The Contractor must take note that the VFD cabinet is not allowed to deflect when secured. The tolerances can be found in the Operation and Maintenance Manual ref ID DBAE475709. There is a camber to the forecastle deck, so the seats will need to be made to match. The Contractor is to add extra supports securing the top of the cabinet to the deck head. Locations to be determined on site by the CCGTA and WFSR. The Contractor must also install cross members fore and aft in the VFD seat to help support the cabinet as well as fabricate cross over clips to assist in securing the bottom of the cabinets to these cross members. All engineering and design work must be completed by certified marine engineering/naval architecture professionals.

- 3.6.2 The installation of the new VFD will require a Temporary bulkhead opening. The Contractor must use Allswater drawing 18067-400-S-004 for reference as a guidance drawing only. The Contractor is responsible for identification of all interference items, their removal, storage and refitting to the vessel upon completion. The forward MCC may require temporary removal to perform this work. It is the responsibility of the contractor to determine whether or not this unit must be temporarily removed, protected, stored and re-installed and they must carry out all of this work as necessary. The Contractor must take care when disconnecting cables, being sure to label all wires and protect them while the work is being performed. All MCC components are to be functionally tested with CCGTA in attendance upon completion
- 3.6.3 The cabling inputs to the cabinet are located on the top of the VFD. Due to height clearance limitations, the cable inputs must be relocated to the side of the cabinet.
- 3.6.4 The Contractor is also responsible for installing a new local control panel (GSM) and it is to be mounted in the same location as the previously removed unit. Measurements of the new control panel are approximately 30 in. x 30 in. x 12 in. The Contractor is responsible for supplying and installing a NEMA approved panel enclosure suitable for application intended, to accommodate the mounting of this panel.
- 3.6.5 In addition to the previous requirements, the Contractor must also take into account the following requirements that will need to be performed by the Contractor for this installation:
- Installation of new insert plates and framing in way of Forward forecastle bulkhead access opening located on starboard side in way of the existing louvers.

- Removal of both the inboard and outboard louvers exterior louvers, hinged exterior covers and interior plenums, and installation of new insert plate.
- Installation of a deck cable trays with protective covers.
- Reconfiguration of an existing deck head fitted cable tray.
- Identification/Relocation/Reinstallation of miscellaneous interference items to facilitate install of VFD components. It is the responsibility of the contractor to identify, temporarily remove, re-install and test all applicable interference items as required to successfully carry out this installation.

3.6.6 For guidance purposes only, the following is a summary of scantlings and plate thicknesses of steel in way of access openings. Final material requirements are per provided drawings and ABS requirements.

- Forecastle bulkhead plating at Fr. No. 167 - 6.4mm (1/4")
- Forecastle bulkhead stiffening - L4"x3"x1/4" O.A
- VFD Cabinet Assembly Seat Frame - L4" x 8"x 3/8" O.A
- VFD Cabinet Assembly Seat frame cut-out rim - 1/4" x 2" F.B
- Deck Fitted Cable Tray Guard - 3/16" Diamond Thread Plate

3.7 Structural and Mechanical Installations

- 3.7.1 The Contractor must reference Wartsila's Document No. DBAE310215 IPI, section 7.1 & 7.3 for detailed installation and assembly steps and these must be used for each step of the specification where applicable.
- 3.7.2 The Contractor must align and weld (reference Wartsila Document No. DBAE310215 IPI), the new GSM Stainless Steel ring into place as per ref. Allswater Drawing No. 18067-400-S-001, New seating Arrangement. The Contractor must inject the defined adhesive into the stainless-steel ring as per the requirements of Wartsila Document No. DBAE310215 IPI.
- 3.7.3 The Contractor must prepare and align the new adapter ring and top plate and weld it in place as per Allswater Drawing No. 18067-400-S-001, BT Structural Arrangement and Tunnel Assembly Drawing DAAF322758 in the IPI. Contractor must note machining of the top plate will be required again once welded in place as per the IPI

- 3.7.4 The Contractor must install the cathodic protection system which consists of anode supports and aluminum anodes and identified in Wärtsilä drawing # DAAW008946.
- 3.7.5 The Contractor must install the new hydraulic oil system, along with the header tank and starter cabinet as per manufacturer's instructions and drawings provided.
- 3.7.6 The Contractor must install stainless-steel (S/S) hydraulic piping and S/S interconnections required between the hydraulic pumps, motors, reservoirs and controller in accordance with the thruster manufacturer's requirements. Drawings are provided in Wartsila's IPI DBAE310215, and Allswater guidance drawing 18067-400-S-005.
- 3.7.7 The Contractor must fabricate and install two (2) bolt on ice grids designed by the thruster manufacturer to prevent the ingress of ice or other debris into the tunnel. Contractor must perform the necessary work required to mount the two (2) new grids. Reference Allswater Drawing No.18067-400-S-002 and Wartsila Document No. DBAE310215 IPI for guidance.
- 3.7.8 The Contractor must properly prepare, prime, and paint all new modified pipe sections, disturbed pipe sections, pipe clamps, mounts and any disturbed or new steel. All areas that have been affected by this work must be mechanically cleaned to SSPCSP-11 Standards and must be given two (2) separate coats of primer paint. And once cured followed by two (2) separate topcoats of fire Retardant white or grey (depending on location), Paint is to be applied as per OEM instructions.
- 3.7.9 Surface preparation and coatings of the underwater portion of the tunnel and the tunnel ice grids must receive the same paint schedule as defined in SOW item H-03 – Hull Cleaning & Painting.
- 3.8 Modifications and Additions to Structure in way of New Thruster
 - 3.8.1 The existing electrical motor distance ring must be removed and disposed of. The Contractor must machine and drill the top side of the motor flat per Wartsila instructions. The Contractor must machine and drill a new motor distance ring as per Wartsila instructions and install at the same location as the existing. The final thickness of the new motor distance ring will be determined after final install of the Bow thruster gearbox into the tunnel, and the machining completed of the motor flat top, with WFSR in attendance. Ref. Drawing DAAF322758 (Note: IPI states to reuse the existing motor distance ring, contractor must instead fabricate a new ring)
 - 3.8.2 The two transverse web plate stiffeners located forward of Frame 165, and aft of Frame 167 which connect the top portion of the existing tunnel to the underside of the motor flat must be cut back to suit installation of the new thruster and will also provide access to the coupling and shaft.

- 3.8.3 New frame reinforcements must be installed in way of the modified transverse plate stiffeners. In addition, the web plate stiffener at this location must be modified to suit the new installation as well.
- 3.8.4 The existing tunnel opening at top must be increased in size to suit the larger diameter thruster unit trunk plate and tunnel trunking. The exact size must be decided in consultation with CCG TA and the WFSR. *NOTE: This will require machining in situ and the Contractor is to take this into account.* Ref. Drawing DAAF322758.
- 3.8.5 Pipe penetrations must be installed in the forward port corner of the thruster motor deck to provide water tight passage for three (3) oil lines connecting the oil pump and lubrication manifold within the bow thruster compartment to the thruster and the header tank located in the Winch Room. The exact locations will be determined by the WFSR and the CCG TA.
- 3.8.6 The new oil lines must be installed in such a way to provide as much access as possible to the thruster shaft, coupling and mounting bolts.
- 3.9 Lubricating Oil Header Tank and Pump Set
 - 3.9.1 A new oil pump set must be mounted in the aft port corner of the Bow Thruster compartment on the port side and secured in place with bolted connections to welded angle bars at the Bulkhead.
 - 3.9.2 The lubrication oil manifold must be located within the Bow Thruster Compartment on the aft bulkhead over the existing valve manifold at the motor flat level. The unit must be secured in place with bolted connections to welded angle bars. The electric pump starter, and pump, must be wire from the VFD control cabinet, and the starter box install next to the pump unit.
 - 3.9.3 The Bow Thruster Compartment sounding tube, two (2) inch line, must be modified in order to mount the lubrication oil manifold. Exact location will be determined with CCG TA at time of install.
 - 3.9.4 The new angle bar supports must be installed and drilled to suit the bolting pattern of the oil ump set and oil manifold, the units must be secured in place using stainless steel fasteners.
 - 3.9.5 A new 35-liter oil header tank must be installed on the center/starboard of the Forecastle Winch Room and secured in place as close to the deck head as possible while still maintaining the minimum required for free access space. The tank must be secured using angle bar welded to the existing deck head structure or bulkhead, the exact location will be determined by the WFSR and the CCG TA.

- 3.9.6 The Contractor must supply and install new 42mm x 2mm seamless stainless-steel tubing from the thruster unit to the motor deck level, and from the motor deck level to the pump, manifold, and header tank.
- 3.9.7 The lines will also connect with the oil header tank located on the center/ starboard side of the Winch Room. The lines will also connect with the oil header tank located on the center/ starboard side of the Winch Room. Note: in Drawing DAAF259943, valve SOV9 is noted as "Optional". This valve has been reclassified as Mandatory, and the Contractor must ensure it is installed per the block diagram.
- 3.9.8 New 18mm x 2mm seamless stainless-steel tubing must be used to connect the oil pump set and the lubrication manifold.
- 3.9.9 All oil piping must be degreased, pickled, neutralized, and blown dry prior to installation. The flushing process must be witnessed by the WFSR and the TA.
- 3.9.10 All hydraulic piping must be hydrostatically tested to 1.5 times the working pressure of the system, prior to system operation. The working pressure is 5 Bar, the test pressure must be 7.5 Bar for 1 hour. This test must be witnessed by CCG TA and the attending ABS Surveyor.
- 3.9.11 The Contractor must supply approximately 1000 litres of new hydraulic oil (Mobilgear 600XP100) for the purpose of filling the hydraulic system of the new Bow Thruster. The entire system must be flushed prior to final filling as further detailed in section 4.1.2 of this SOW item.
- 3.9.12 The Contractor must provide and install sufficient pipe and tubing hangers and supports to properly secure the tubing. Contractor is to note that these components are in an area of high shock loads and vibration, so this is to be taken into account by the Contractor when determining the number of supports needed. When installed, the support hangers must prevent any undue stress from being exerted on the tubing and lubrication unit. New anti-chafing material must be fitted to each clamping surface.
- 3.10 Specific Welding Requirements
 - 3.10.1 All welding must be as per original specification. The existing welding scheme is as follows:
 - a) Bulkhead plate seam welds - Full penetration
 - b) Bulkhead stiffener welds - As per original. (3/16" Staggered intermittent Welds, 3-12). Rejoined stiffeners to be full penetration butt welding.

- c) Seat frame fabrication welds - 1/4" fillet welds
- d) VFD Seat frame to deck- (1/4" Staggered intermittent Fillet welds.)
- e) Full penetration welds to be subject to 100% ultrasonic thickness testing. All remaining welds subject to 100% MPI. And inclusions found are to be repaired by the Contractor and the area retested. As a minimum NDT Technician must be a qualified to a Level II Certified for the type of testing to be performed. Copies of all NDT Test reports are to be provided to both the CCG TA and ABS

3.11 Coatings and Insulation Requirements.

- 3.11.1 Prior to installing any new insulation, the Contractor must prepare and coat all new steelwork as well as the heat affected zones in way of the damaged paint access openings in both the bulkhead and deck plating.
- 3.11.2 The Contractor is to supply all coatings which must be in accordance with the ships painting system. The Contractor must ensure that the steel preparation follows the coating manufacturer's recommendations for each application.
- 3.11.3 Prior to recoating the affected steel, the Contractor must ensure that all edges have been feathered by means of power tooling and inspected by either NACE or CCGTA with 48 hour notice.
- 3.11.4 New rock wool insulation (ABS approved) must be supplied, installed and secured in all areas of the vessel where it had been temporarily removed for this installation. Insulation pin fasteners are to be welded and not glued into position. An ABS approved vapor barrier is to be installed over all new insulation and painted with two separate coats of white fire-retardant white paint.
- 3.11.5 New insulation installed in high traffic areas that could be subject to damage, must be covered with a galvanized sheet metal protective layer. Sheet metal covering is to receive the same paint schedule as noted above.
- 3.11.6 Copies of WHMIS data sheets for all chemicals, coating, solvents, etc. used during the course of this specification item are to be provided to the CCG TA.

3.12 Wheelhouse Wing Control Boxes

- 3.12.1 The Contractor must install the two (2) GSM wing control stations in the Wheelhouse wing consoles. Final location of these units on each console will be determined by the CCG TA.

- 3.12.2 The GSM insert plates have been provided but modification will still be required to adapt to the console. The Contractor is responsible for the completion of these modifications and these are to be completed to the same degree of finish and quality as the supplied panel.
- 3.12.3 The Contractor is responsible for connecting and installing all the interconnecting communication wiring, power feeds and control panels for the Wheelhouse controls.
- 3.12.4 NOTE: The "Request/Accept" control changeover must be configured so that either station can take control from the active station at any time, but the station taking control must have the control lever in a neutral/off position to be able to take control.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to satisfaction of the CCG IA, ABS and the WFSR, as applicable.
- 4.1.2 The oil flushing process must be witnessed by both the CCG TA and the WFSR and final particle contamination readings are to be to the satisfaction of the WFSR. The Contractor must flush the new piping as described in the IPI DBAE310215 section 9.2.1.6. Flushing method to achieve a cleanliness ISO level of 17/15/12 or NAS Class of 6. The oil to be used is to be Mobilegear 600XP100. The Contractor to dispose of oil after successful flushing and cleanliness levels are achieved or exceeded. This is for clarification on the new hydraulic oil being used and the standards of cleanliness that need to be met.

4.2 Testing

- 4.2.1 The Contractor must arrange and be responsible for the operational and load testing of the bow thruster after final installation. The operational and Bow thruster load tests must be performed in accordance with ABS requirements and both the CCG TA and the attending ABS Surveyor are to witness these tests and trials.
- 4.2.2 Contractor must functionally prove that the bow thruster operates as per the performance requirements set out in this specification and the attached Wartsila documentation.
- 4.2.3 The Contractor must be responsible for developing the necessary tests, trials, and procedures to prove that all aspects of the thruster installation and associated equipment are satisfactory. These test procedures must be submitted to the CCG TA and the ABS for review and approval prior to any system testing.

4.2.4 Functional tests must include the operation of all control systems and safety devices. Tests must include but not limited to the following:

- a) Correct operational function of variable frequency drive and loading of ship's power supply.
- b) Correct operation of load limiting devices.
- c) Correct operation of all controls and interlocks associated with the bow thruster, including electrical, electronic, hydraulic, and support equipment required for the safe operation of the bow thruster.
- d) Correct operation of all of the alarms and monitoring functions associated with this installation.

4.2.5 The Contractor must arrange to perform a total harmonic distortion test on the bow thruster system; it must be verified during the commissioning by a power quality test.

4.2.6 The Contractor must also arrange to have a complete set of vibration readings taken while the new bow thruster motor is being trialed. During the course of this test the machine temperature must be logged into the test report. Vibration readings must be taken at the Drive End and Non- Drive end of the bow thruster motor. Measurements must be taken in three (3) planes, vertical, horizontal, and axial. The readings must be printed out in a Velocity Spectrum format.

4.2.7 The Contractor must megger test all power and motor feeds insulation to ground and record readings with CCG TA present. Motor winding resistance readings must be taken along with the motor winding temperature before any testing of the motor and after the completion of the dock trials of the motor.

4.3 Sea Trials

4.3.1 The Bow Thruster sea trials must include, as a minimum, the following requirements:

- a) With the vessel stopped in the water and heading into the wind, the bow thruster unit must be used to turn the vessel through 360 degrees both to port and to starboard. The weather and sea state conditions must be recorded.
- b) The following data must be recorded during the trial:
 - i. Time and date of the test and base heading.
 - ii. Time to rotate vessel through 360 degree (port and starboard).
 - iii. Compass headings to nearest degree every 10 seconds.

- iv. Depth of water and sea conditions.
- v. Wind speed and direction.
- vi. Trial draft.
- vii. The current and voltage readings on the bow thruster motor at full thrust, and the time to respond from zero to full thrust in both the port and starboard directions.
- viii. Temperature of bow thruster components including motor and VFD unit.
- ix. Bow Thruster Compartment ambient temperature.

4.3.2 The bow thruster must also be demonstrated capable of maneuvering the vessel while underway. The following test listed must be recorded as installation tombstone date for future reference:

- a) Trial # 1 – Vessel proceeding at a speed of 3, 4, 5, and 6 knots with rudder amidships, apply thruster to achieve course deviations to 20 degree to port and starboard.
- b) Trial # 2 – Vessel proceeding astern at a speed of 3 knots, apply the thruster to achieve course deviation to 20 degrees to port and starboard.
- c) The following data must be recorded each time;
 - i. Time to achieve course heading, degree of over swing.

4.3.4 Any defects found, during the course of these trials, must be corrected and or repaired by the Contractor and to his account.

4.3.5 The Contractor must again megger test all power and motor feeds insulation to ground and record readings with CCG TA present. Tests must be performed prior to and after sea trials. In addition, motor winding resistance readings must be taken along with the motor winding temperature again prior to the sea trial testing of the motor and after the sea trials of the motor.

5.0 Deliverables

5.1 Drawings/Reports

5.1.1 The Contractor must prepare a separate binder for the documentation of all Tests, Trials and Inspection Records performed pertaining to the installation of the bow thruster. The binder must be indexed for each test, trial and inspection performed.

5.1.2 The Contractor must maintain a complete and accurate type written record of all tests, trials, and inspections conducted during the execution of this installation. This must include those tests, trials and inspections performed at sub-Contractor's facilities. The records must include all relevant documentation, test procedures,

associated test sheets, including shop test data, and test, trial and inspection data and observation results.

- 5.1.3 All original records of the test, trial and inspections must be signed by ABS, Contractor and where necessary by the sub-Contractor and FSR(s) who witnessed the tests.
- 5.1.4 The Contractor must provide “As Fitted” drawings affected by the installation of the bow thruster. At a minimum, this must include all related ship’s drawings as described in section 2.2 of this SOW item. Drawings are to be delivered in AutoCAD DWG format. Final versions for the drawings are to be provided to the CCG TA. Copies of any all ABS approved drawings developed during this installation must be delivered to the CCG TA prior to completion of the contract.
- 5.1.5 The Contractor must provide three (3) hardcopy copies and three (3) electronic copies of the drawings developed. Electronic copies can be delivered either on a CD ROM or on USB format thumb drive.
- 5.1.6 All hard copy version of the drawings submitted must be standard ANSI paper size and must be in, at minimum, AutoCAD 2017 DWG format, and conform to the CCG National CAD Standard [MECTS-#2860606-v1].

5.7 Spares

5.7.1 N/A

5.8 Training

5.8.1 N/A

5.9 Manuals

5.9.1 N/A

5.10 Certification

- 5.10.1 All welders must have current CWB certificates for the weld positions they are required to perform.
- 5.10.2 The Marine Chemist or an approved equivalent must be certified and qualified according to Maritime occupational Health and Safety Regulations / SOR/2010-120.

- 5.10.3 Technicians for NDT testing must be certified to Level II and qualified for the specific type of test to be performed.
- 5.10.4 All new steel is to be ABS approved and come complete with approved Mill Certificates.
- 5.10.5 Copies of all the aforementioned certificated are to be provided to the CCG TA.

H-31 HANGER REFURBISHMENT AND STEEL REPLACEMENTS

1.0 Scope

- 1.1 The intent of this SOW item is to have the Contractor renew the steel deck and underdeck stiffening in-way-of the helicopter hangar tracks as per an appended technical specification package from Poseidon Marine Consultants Ltd. This work must be carried out in conjunction with SOW items H-03 – Hull Cleaning and Painting and H-27 Helicopter Fueling System Servicing.
- 1.2 The Contractor must refurbish the hangar under the supervision of a Contractor-arranged Daf Indal Authorized Field Service Representative. This work must also include inspection, maintenance and cleaning work described herein.
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

- 2.1.1. The following guidance drawings and documentation is provided to the Contactor and is to be used in conjunction with this specification.

- Poseidon Marine Consultants Ltd. Document # 18-165-00
- CCG Dwg. No. 555-H-0008 Boat Deck Plating

2.1.2. Hangar Details:

- Telescopic Aluminum Helicopter Hangar.
- Manufactured by Daf Indal Ltd. 3570 Hawkestone Rd. Mississauga, Ontario
- Estimated weight of hangar (15,100lbs),
- Estimated weight of track (3,500lbs)

2.2 Standards

- 2.2.1. The following standards are to be referred to during the course of this SOW item:

- Fleet Safety and Security Manual
 - 7.B.2 – Fall Protection
 - 7.B.4 – Hotwork
 - 7.B.5 – Lockout and Tagout
- Society for Protective Coatings (SSPC) Standard
- IACS No. 47 – Shipbuilding and Repair Quality Standard
- CSA W59-08(R2008) – Welded Steel Construction
- CSA W47.1-09 – Certification of Companies for Fusion Welding of Steel
- TCMS Ship Safety Electrical Standard TP-127e

2.3 Regulations

2.3.1. The following regulations are to be referred to during the course of this specification:

- Canada Shipping Act 2001 – Hull Construction Regulations
- Canada Shipping Act 2001 – Hull Inspection Regulations

2.4 Owner/Contractor Furnished Equipment

2.4.1. The Contractor must supply all labour, materials, , equipment, and parts required to perform the specified work unless otherwise stated in this specification.

2.4.2. The following table contains a list of Owner supplied parts:

Part Number	Quantity
1163-13-2 Pinion	2
1200-17-3 Guide Track	14
1209-079-7 Heater	4
1209-079-1 Heater	4
1209-079-9 Heater	4
1209-079-3 Heater	4
1209-079-11 Heater	4
1209-079-5 Heater	4
1209-34-1 Retaining Bar	120
1209-19-4 Retaining Bar - Rev. E	120
1208-202-1 Hangar Track Assembly	1
1200-355-3 Wheel	6

3.0 Technical Description

3.1 Field Service Representation

3.1.1 The Contractor must arrange the services of:

Daf Indal Authorized FSR Atlantic Canada
Dean Mitchell
Canadian Maritime Engineering Ltd
Head Office: 90 Thornhill Drive,
Dartmouth Nova Scotia, Canada B3B 1S3
Tel: 902-468-1888 Fax: 902-468-1890

3.1.2 The *Daf Indal* FSR will be responsible for providing the following services:

- Supervision of disassembly and removal from ship.
- Supervision of reassembly and reinstallation.
- Supervision pre-start checks, tests and run ups.
- Provision of a written report including corrective action taken, parts used, readings and other information deemed to be relevant by the FSR.
- Supervision of inspection and maintenance.
- The contractor must include an allowance of \$25,000.00 for the services of the certified FSR. This total will be adjusted by PWGSC 1379 based on final invoicing.

3.2 Removals & Steel Replacements

3.2.1 The Contractor must operate helicopter hangar to determine any deficiencies prior to start of work, under the direction of the FSR. Any defects found must be immediately provided in writing to the TA.

3.2.2 The Contractor must with CCG lock-out the helicopter hangar drive, track heating, lighting, limit switches and associated equipment to ensure it is safe for servicing.

3.2.3 The Contractor must be responsible to remove hangar sections and adjacent workshop off vessel to complete steel replacement. Contractor must make all electrical disconnections and mechanical disconnections necessary and take precautions to protect components during disassembly. The Contractor must ensure that lifting brackets / lugs supplied and installed by the Contractor are sufficient in strength and position so that distortion of any section does not happen during the lifting of each section. The Contractor must supply the crane, operator and a sufficient number of personnel to safely remove the hangar sections.

3.2.4 The Hangar sections must be stored at the contractors facilities during steel replacements. All sections/parts must be neatly stored and protected in an

enclosed, sheltered location away from weather and wind. The Contractor must be responsible for supplying all required blocking and supports for stowing the hangar sections. The Contractor must ensure that stowage does not cause distortion of the hangar sections.

- 3.2.5 The aluminum track/heaters need to be removed in order to renew steel in-way of track sections. Hangar tracks are approx. twenty-eight (28) feet outside track, forty-two (42) feet middle track and fifty-eight (58) feet of inside track.
- 3.2.6 The Contractor must identify and temporarily remove, store and re-install all deck-head panels, insulation, lighting, equipment and all other required interference items in way of this steel work.
- 3.2.7 The Contractor must provide protection of all accommodation spaces, electrical, piping and all vessel equipment during steel replacements. Any damage caused to the vessel must be repaired at the contractor's expense.
- 3.2.8 The Contractor must arrange with ABS and the CG TA for inspection points during steel replacement.
- 3.2.9 The area of steel deck under the track must be cropped and renewed as per appended Poseidon Marine Consultants Ltd. Document # 18-165-00. As described in the "George R. Pearkes Lead Paint Assessments 2020 & 2021," and the attached hazardous material matrix, there are coatings around the helicopter hangar deck area that contain high lead content. The contractor must follow all provincial and federal guidelines while removing and disposing of all lead coatings as required to successfully carry out the work detailed in this SOW item. All removals and disposal necessary as identified in the attached reports must be carried out by a certified, licensed third party organization and all costs must be included in the contractor's firm pricing for this SOW item.
- 3.2.8 The Contractor must supply ABS Approved (c/w Mill Certs) steel plate as required for this steel replacement and provide all required certs along with CWB certified welding tickets and welding procedures.
- 3.2.9 The Contractor must provide a unit price per m² of complete steel plate replacement in case an adjustment is required. The total area of steel renewal must be agreed upon before work starts. The actual cost must be adjusted up or down by PWGSC 1379 action based on the total amount of additional steelwork required.
- 3.2.10 All full penetration welds must be 100% UT and fillet welds 100% MPI, all welds to receive 100% visual inspection.

- 3.2.11 The Contractor must be responsible to fit/install new track blocks and complete proper alignment of tracks as per manufacturer recommendations / tolerances. Contractor must provide alignment report to CCG upon completion.
- 3.2.12 All drains to be proven clear and witnessed by the CCG TA.
- 3.2.13 All affected steel areas must be coated with two (2) coats marine grade primer and two (2) topcoats at 2 mil DFT per application. The Contractor must apply coatings as per the vessel's paint schedule.
- 3.2.14 The Contractor must provide adequate protection from the outside elements during steel replacement to protect vessel internals from water / outside elements.
- 3.2.15 Upon completion of steel replacements, the Contractor must fit the pads / tracks / heaters including fitting new mounting holes, proper alignment tolerances and levelling as required under direction of OEM FSR. Contractor must provide report of alignment of track sections upon completion of work scope.
- 3.2.16 The Contractor must supply 100 litres (per side) of Bee's Wax that has to be heated and poured after tracks are laid to prevent water pooling in the spaces between the pads under the tracks.
- 3.2.17 The Contractor must remove the existing hanger seal arrangements between each section of the hanger. The seals are fastened to the aluminum hanger structure using flat bar and rivets, New EPDM seals must be supplied and installed by the contractor using the existing flat bar where possible. The Contractor must use all new manufacturer approved rivets to secure the new seals in place. Both edges of the new seals must be sealed using Sikaflex 221 to help prevent water ingress under the seal arrangement.

3.3 Re-Installation

- 3.3.1. The Contractor must install each hangar section removed for steel repairs ensuring correct alignment. Contractor must manually test traverse operation of all hangar sections prior to testing electrically.
- 3.3.2 The Contractor must re-install all electrical and mechanical disconnections carried out to remove hangar sections.
- 3.3.3 The Contractor must have an allowance for a sum of \$10,000 for materials/parts found to be defective / damaged and require replacement during the scope of repairs. This allowance must be adjusted by PWGSC 1379 based on invoicing from the contractor.

3.3.4. The Contractor must re-connect all power supplies locked-out.

3.3.5. The Contractor must functionally test Telescopic Hangar System including door drive and traverse operation of the hangar sections. Under the direction of the FSR, the Contractor must adjust all limit switches to provide correct operation of the door and traverse movement of the hangar sections during telescoping in and out to its extreme positions.

3.4 Maintenance

3.4.1. The Contractor must carry out the following maintenance under the supervision of the FSR:

- a) Wheel and Side Rollers: Wheel and side roller assemblies must have their shafts and center bolts removed and inspected. Any defects must be identified and CCG IA notified. Contractor must remove any corrosion and accumulated debris. Assemblies must be lubricated as per page 4-4 of the hangar manual. Wheels must be inspected for flat spots and wearing according to figure 4-4 of the manual, any wheels that do not meet specification must be clearly marked and CCG IA notified. Upon assembly the wheel and roller assembly must be proven rotationally free.
- b) Hangar Brake: Brake assembly covers to be removed and wiring inspected. Linkages must be cleaned and lubricated. Any defects must be identified and provided to the CCG IA. Brakes must be operated to ensure they move freely and properly engage with track when brake is de-energized.
- c) Curtain Door: The curtain door must be inspected for damaged weather stripping, damaged slats, correct interlocking, and to ensure all center blocks are in place. Any defects must be identified and provided to the CCG IA.
- d) All Windlock and Endlock Assemblies must be inspected for damage. Damaged components must be replaced to ensure proper alignment of the door slats are maintained.
- e) Door upper and lower limit switch operation must be tested and rotary limit switches adjusted if required.
- f) In order to check motor brake function. Open fully then press close, stop door $\frac{3}{4}$ open and if curtain drifts more than 25mm the brake requires adjustment.
- g) Change oil in gearbox, grease bearings, and drive assembly as indicated in the hangar manual page 4-7 and 4-8.

- h) Upon completion of the work the door must be first tested using the manual hand crank to ensure no binding, and then operated using the electric drive system. Motor current reading must be taken to ensure operating within the normal operating values.
- i) Hangar Drive: Remove covers and lubricate pinions, racks, bearings and universals and pillow blocks. Inspect all shafting components for damage and wear, and deficiencies should be brought forward to the CCG IA. Change all oil in gearboxes and reducers, refer to hanger manual for oil and grease type and quantity, page 4-7 and 4-9.

Note: Any additional repairs/deficiencies found are to be corrected by PWGSC 1379.

3.5 Cleaning of Hangar Interior

- 3.5.1 The Contractor must thoroughly clean the hangar interior to remove soot and grease using high pressure water and a degreasing solution. Care must be taken to ensure pressure used is not significant enough to damage existing hanger coatings.
- 3.5.2 All electrical components, such as lighting, fans, switches, and junction boxes must be suitably protected from the ingress of water.
- 3.5.3 All firefighting equipment and tool storage must also be protected. Any damages as a result of poor coverage and protection must be repaired at the Contractor's expense. Any stubborn areas must be manually cleaned using stiff bristle brushes.

Note: Aft bulk contains a large portioning of electrical equipment and is best suited for hand cleaning using rags, and degreasing solution.

3.6 Interferences

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

4.0 Proof of Performance

4.1 Inspection

- 4.1.1. All work must be completed to the satisfaction of the CCG IA.

4.2 Testing

4.2.1 Contractor must functionally test Hangar prior to start of work and upon completion of repairs outlined above to the satisfaction of the CCG TA and FSR.

4.2.2 The contractor must provide NDT reports from the certified third party company carrying out all weld testing requirements.

4.3 Certification

4.3.1 Not Used

5.0 Deliverables

5.1 Drawings/Reports

5.1.1 Contractor must provide a detailed survey report including all corrective actions taken, parts used, readings and results etc. in addition to a complete report from the FSR.

5.2 Spares
N/A

5.3 Training
N/A

5.4 Manuals
N/A

H-32 GALLEY UPGRADES

1.0 Scope

- 1.1 The intent of this specification is to have the Contractor to completely refurbish the vessel's Galley with new ceiling panels, new deck covering, and new galley equipment (all CSM). The refurbishment will be based on the design and specification as provided by Smart Galley Designs. Smart Galley Designs has already carried out the galley design, layout arrangement and equipment requirements for the galley upgrade.
- 1.2 The Contractor is to arrange for the services of Smart Galley Designs, or a fully certified equivalent, to supply all new galley equipment as defined in the attached Smart Galley Designs Layout drawing and details package. This equipment must be ordered within 2 weeks of contract award to limit any potential delays. A field service representative must be on site while this refurbishment is being done to oversee the equipment installation, commissioning and overall galley upgrades.
- 1.3 This SOW item must be carried out in Conjunction with the following SOW items:
 - H-13 Domestic Water Piping
 - H-20 Interior Drain Scupper Replacements
 - H-22 Grey Water Piping Replacement
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This specification item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

- 2.1.1. The following drawings and documentation will be provided to the Prime Contractor for guidance purposes:
 - George R. Pearkes Smart Galley Design Layout Arrangement Dwg. Plan & Details
 - Equipment Info – VLE Galley – Smart Galley Designs

- 555-H-005 - Main Deck Layout
- 555-H-0016 - General Arrangement Main Deck
- H-3810 - HVAC Main Deck
- H-3860 - Natural Ventilation
- H-4410 - Insulation Plan
- H-3510 - Deck Covering Plan
- 555-H-4610_01 & 02 – Galley Arrangement, 2 Sheets
- 555-H-2860 - Windows and Sidelights Schedule

Galley Perimeter – 26 meters

Galley Area – 40 meters squared

Mess Area – 32 meters squared

Note – These are approximate measurements to be used for guidance only. The contractor must confirm all exact measurements and sizing requirements.

2.1.2 Field Service Representative(s)

- 2.1.2.1 The Prime Contractor is to arrange to have the following company, or a fully certified equivalent, to provide the galley equipment and FSR required to oversee the installation of the new equipment and galley upgrade.

Smart Galley Designs
Monica Jansen
506-871-3314
monica@smartgalleydesigns.com

The contractor must include an allowance of \$25,000.00 for the FSR travel, living and services to oversee the galley upgrades. This total will be adjusted by PWGSC 1379 upon receipt of final invoice. The Contractor must schedule all work in this specification and the attendance of the FSR so that no delays are incurred and there are no excess costs for additional down time. If there are delays as a result of Contractor's scheduling of work or extra costs due to excess FSR down time, then the Contractor must be responsible for covering any additional costs associated with retaining the FSR.

2.2 Standards

- 2.2.1. The following Coast Guard Standards and or Technical Bulletins must be adhered to in the course of executing this specification. Copies of these standards and bulletins can be obtained from the CCG Technical Authority.

- Canadian Coast Guard Fleet Safety Manual (DFO 5737)
- Coast Guard ISM Confined Space Entry 7.D.9

- Coast Guard ISM Hotwork procedures
- Coast Guard ISM Fall Protection procedures
- Canadian Coast Guard Welding Specifications for Ferrous Materials, Revision 4. (TP6151 E)
- CWB CSA 47.1 latest revision Division I, II or III
- SSPC-SPT

2.3 Regulations

2.3.1. The following regulation and or standards are to be used as guidance during the course of this installation

- Hull Construction Regulations CSA
- TP 127E Latest Revision – Shipboard Electrical Standards

2.4 Owner/Contractor Furnished Equipment

2.4.1. The Contractor must be responsible for the supply of all materials, equipment, and parts required to perform the specified work unless otherwise stated.

3.0 Technical Description

3.1 Removals

- 3.1.1 The Contractor must disconnect all power supplies, water pipes, and drains for the work described in the SOW item.
- 3.1.2 The Contractor must under direction of CE or EO lock out all related galley equipment and power supplies. Galley equipment is feed from P-104, P-105 and P-216 found in the forward port corner of the Galley.
- 3.1.3 The Contractor must arrange services of a certified company to disconnect and remove the galley Kitchen Knight PCL-460 fixed fire extinguishing system and fire detection heads. The FSR must store the system and re-install upon completion of Contractor work.
- 3.1.4 Water lines must be locked out by valves located at each local device affected or the entire potable water system can be isolated and drained. CE must advise of locations if required.
- 3.1.5 All stored items for reuse must be stored in a safe location to prevent damage to the units.

- 3.1.6 Any items not removed must be covered with a protective fire resistant covering to protect it from dirt and damage.
- 3.1.7 The Contractor must take digital pictures of the entire space to locate all equipment for reassembly purposes. Copy of digital pictures must be provided to CE prior to commencement of work.
- 3.2 Strip Out
 - 3.2.1 Galley equipment must be transported to and from the Galley through the existing door and alleyways. Disassembling some equipment may be required and must be completed by a manufacturer's representative, if needed.
 - 3.2.2 The Contractor must remove and store all existing appliances in a climate controlled space. CCG representatives must provide details regarding the disposal or retention of each item.
 - 3.2.3 The Contractor must be responsible to disconnect required pipe work and wiring to allow for removal(s). The Contractor must remove all equipment bases/seats to steel deck in-way of equipment removals.
 - 3.2.4 The Contractor must be responsible for emptying all cabinets of their contents. Contractor must wear clean, never worn, disposable coveralls and gloves when handling items located in cupboards / cabinets. Along with these items the Contractor must also remove all items mounted on S/S bulkhead sheathing, i.e. clocks, spice racks, bookshelves, paper towel holder, etc. All items must be stored in new, never used before, packing boxes suitable protected with bubble wrap/ paper/foam packing. The Contractor must take care not to damage and must note any deficiencies found prior to removals. Each box must be numbered and must be properly labeled to identify the contents. Items must be stored in off the vessel in a climate-controlled environment, CCG representatives must provide details regarding the disposal or retention of each item.
 - 3.2.5 The Contractor must remove all the S/S cabinets and counter tops to allow for removal of ceiling panels, and installation of new bulkhead coverings. SS cabinets and countertops must be stored in the vessel's cargo hold and protected from damage for the duration of the project.
 - 3.2.6 The Contractor must remove all ceiling panels for disposal. The Contractor must supply and install new insulated, solid stainless steel ceiling panels, clips and perimeter trim for the entire galley and mess areas. C-511/C-512 Stainless Steel Ceiling Panels are cut to length, the edges must be folded in to give a finished appearance and installed. Panels must be cut out to fit the new Contractor supplied, marine certified, anti-flicker LED lighting fixtures.

- 3.2.7 The Contractor must remove the two (2) existing Ventilation Hoods and fire suppression arrangement. The Contractor must install new ventilation hood arrangement as per Smart Galley design, or equivalent certified design. Ventilation ducting and Kitchen Knight fire suppression piping must be modified to make the connection to the new ventilation hood. Modifications to the Knight Fire Suppression system must be completed by and authorized FSR.
- 3.2.8 The existing six (6) flush mount light fixtures, two (2) surface mount light fixtures and one flush mounted two foot light fixture must be removed and disposed of. The ventilation diffusers fitted in the panels must be dismantled to the point where the panels can be removed and must be disposed of. The Contractor must supply new stainless steel ventilation diffusers upon re-installation with all joints being sealed with approved sealant and taped. The smoke detectors fitted in the panels must be hung up above the ceiling for reuse. The PA speakers fitted in the panels must be hung up above the ceiling for reuse. The ceiling support track system must remain in place to be used for the new panels if possible. The Contractor must include the cost of replacing thirty (30) feet of support track system, which will be adjusted up or down as required on PWGSC 1379.
- 3.2.8 The light switches, receptacles etc. must be disconnected and laid aside for reuse.
- 3.2.9 The Contractor must remove the entire deck covering system in the galley and the crews mess which includes 12 mm thick quarry tile, 10mm dexotex and 70mm floating floor to bare steel including the perimeter border (Of the space, equipment remaining, internal bulkheads etc.). The crews mess will only have minimal equipment upgrades carried out at this time, so all panels, equipment and furniture will have to be suitably protected from all dirt and debris.
- 3.2.10 The entire steel deck and borders must be power tooled cleaned to bare metal SSPC SP-11. The Contractor must provide barrier to all adjacent vessel compartments. Barrier must be taped to prevent debris from contaminating rest of vessel. Debris generated must be removed daily as to not be tracked through vessel.
- 3.2.11 Extraction fans must be used to remove all airborne debris during removals and steel replacements. The fans must be vented to the exterior of the vessel.
- 3.2.12 The Contractor must arrange third party certified NDT Technician to complete UT shots of complete galley/officer's mess deck areas. The Contractor must provide the cost for performing one hundred (150) shots and must provide a unit cost per additional ten (10) shots. NDT report must be provided to CE and Project Authority within 24 hrs. of completion in electronic format. Note: Deck plate original thickness is 9mm.
- 3.2.13 Insulation found under the outboard perimeter of the galley deck consists 45mm Thick "A60 CAFCO Deck Shield". Insulation is covered with 16 GA perforated

galvanized sheathing. The Contractor must remove as required to complete shots and steel replacements. All equipment in-way of insulation removals must be covered and protected. Debris generated must be removed daily as to not be tracked through vessel.

- 3.2.14 Galley Deck Head insulation is CAFCO type C spray on insulation in varying thicknesses as indicated on drawing H-4410.
- 3.2.15 Insulation replacements upon completion of work must be completed by Red Seal Accredited Insulator. Areas affected must be re-insulated with a Roxul Insulation board meeting insulation requirement noted on Insulation Arrangement Drawing, 4410 as found acceptable by CE. Insulation must be pinned in place, Contractor must allow a bid allowance of \$15, 000 to be adjusted up or down by PWGSC 1379 upon proof of invoice. This includes materials and labour to re-insulate including re-fitting or new perforated sheathing, if required.
- 3.2.16 The Contractor must include the cost for the replacement of 200 ft² of steel deck area. All welding must be subject to 100% visual and MPI testing. The Contractor must be responsible to consult with ABS on their requirements for inspection prior to completing steel replacements. New steel must be ABS approved grade 44 W or equivalent and receive 2 coats of marine grade primer. All repairs to follow IACS No. 47 Shipbuilding and Repair Quality Standard.
- 3.2.17 The Contractor must include for the removal, replacement and covering of any related interference items (i.e. insulation below, wiring, pipe work, etc.) including their removal and subsequent replacement upon work completion. Any staging/scaffolding or access requirements must also be included in this price.
- 3.2.18 The Contractor must provide a unit cost per ft² of steel deck replacement to be adjusted up or down via PWGSC 1379 action based on the actual replacement requirements.

3.3 Installations

- 3.3.1 The Contractor must fit new seats to match galley equipment footprints. Seats must consist of ¼ inch thick angle iron, dimensioned to maintain industry standard working heights for the equipment and counter areas. New seats must take into account the deck camber so as to maintain a level working surface. All seats must be welded to deck by continuous fillet weld. Upon completion of welding of the new foundations all welds and new seating are to receive a coat of primer. Once cured the new foundations are to be filled with concrete as per original.
- 3.3.2 The surface of the steel deck must be prepared in accordance with the manufactures specification for the new deck covering system. The deck area must be coated with two coats of epoxy primer of contrasting colors upon completion of steel replacements.

- 3.3.3 The Contractor must include the supply / application of dexotex underlayment over steel deck in the galley and mess. The Dexotex system must meet or exceed the original fire rating and sound dampening characteristics of the original flooring system. New floor system must be installed to original deck thicknesses. Note: The Contractor must then install dexotex color-flake IMO approved topcoats system. The color scheme of the dexotex continuous system must be determined with the aid of the Contractor supplied color charts to choose from at the time of application including color flakes. All coatings must be applied in accordance with manufacturer's application instructions with particular attention to curing times. The covering must be sloped toward all scupper drains. The Contractor must use certified Dexotex installers for the complete application process.
- 3.3.4 The new CSM galley equipment must be fitted as per arrangement noted on the Smart Galley Designs Equipment Schedule. All rigging, crange and installation requirements necessary must be carried out by the Contractor. The Contractor must be responsible to make electrical and plumbing connections as per manufacturer instructions and must perform all seating and foundation removals and fabrications necessary in order to securely mount all new equipment to the deck.
- 3.3.5 The Contractor must ensure the new seats will suit the new deck mounted equipment. The fabrication of the seats must be done to the satisfaction of the CGTA/IA with class approved, steel plating, Coast Guard will provide data sheets for reviewing the seat arrangements. Units must be fastened with all new, contractor supplied fasteners.
- 3.3.6 The Contractor must provide a unit price for renewing cables from Galley panel P-216 where existing electrical supplies are too short to meet locations of new equipment. Galley panel is located in galley forward port side. The Contractor must provide costing for 10M per run of AWG #4 4C cable and an overall price for the supply, installation and termination of 150 m of this cable. Note: Actual cable required will be confirmed on site as the majority of equipment is run off AWG #14-3 C, however for the purposes of providing unit pricing, AWG #4 is to be supplied. All disturbed transits and collars must be repacked by the contractor. The contractor must include pricing for the supply, installation and packing of six (6) S8x4 Roxtec, welded transit systems, or certified equivalent, if required. The contractor must provide a unit price per transit to be adjusted by PWGSC 1379 based on the actual requirement.
- 3.3.7 The Contractor must supply, fit and install new stainless steel sheathing atop of the current galley bulkheads by certified, professional sheet metal installers. The new sheathing must be 20 Gauge, 316 Stainless steel with #4 finish. The sheathing must extend from the deck to deckhead for a height of seven (7) feet. All seams must butt vertically in areas of least visibility and inside corners. There must be no seams on outside corners; the sheathing must be bent to match the profile of the

outside corners. Seams must be caulk with food grade sealant and color matched to the stainless steel. The sheathing must be fastened with stainless steel rivets. The top edge must have a finished appearance with no sharp edges and must be an even height over the entire perimeter. The sheathing must be cut to match penetrations, outlines etc. found in galley as before.

- 3.3.8 Contractor must supply and fit new stainless steel window boxes for the two (2) galley windows by certified professional sheet metal trades. The new window boxes must be 20 Gauge, 316 Stainless steel with #4 finish to match bulkhead sheathing.
- 3.3.9 All bulkhead mounted equipment that was removed during the strip out must be reinstalled and connected as originally found. The Contractor must first confirm with vessel representative prior to remounting fixtures to ensure that the item will be reused.
- 3.3.10 All remaining items stored for reuse must be re-installed with connections as per found.

3.4 Interferences

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

4.0 Proof of Performance

4.1 Inspection

- 4.1.1. All work must be completed to the satisfaction of the CCG IA and the FSR.

4.2 Testing

- 4.2.1 All equipment that was removed or disturbed including new equipment must be tested for full operational features.
- 4.2.2 The Contractor must test all new piping and electrical galley connections related to the new equipment installations to the satisfaction of the CCG TA and FSR.
- 4.2.3 The contractor must provide CCG with NDT reports from a certified, third party organization for all steel renewals.

4.3 Certification

- 4.3.1 The contractor must provide CCG with certified welder/electrician tickets as requested.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The contractor must update all of the vessels related as built drawings and submit to ABS/TCMS for approval. This includes, at a minimum, the galley/mess layout/arrangement drawings, deck plans and associated system drawings as referenced in section 2.1 of this SOW item.

5.2 Manuals

- 5.2.1 The contractor must provide CCG with all documentation and manuals for the new equipment. This documentation will become property of Canada.

5.3 Spares

N/A

5.4 Training

N/A

H-33 BRIDGE WINDOW AND STEEL REPLACEMENT

1.0 Scope

- 1.1 The intent of this item is to have the Contractor replace the existing four (4) bridge horizontal sliding windows in their entirety, as well as the seventeen (17) fixed glass windows. The contractor is responsible for the complete removal and disposal of the existing windows and the supply and installation of all new windows.
- 1.2 This work must be carried out in conjunction with the following specification items:
 - H-10 Speed Crane 5 Year Survey
 - E-01 Propulsion Generator Replacement
 - E-02 Cycloconerter Replacement
 - E-03 Auxiliary Generator Replacement
 - E-12 Steering Upgrade
 - L-04 ICS Replacement
 - L-06 TV Distribution Upgrade
 - L-07 Master Clock Replacement
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- H-2860 – Window and Sidelight Schedule
- H-0016 - General Arrangement (1:50 Accommodation Layout)- Main Deck
- H-0017 - General Arrangement- Main Deck Forward
- H-0018 - General Arrangement (1:50 Accommodation Layout)- Upper Deck
- H-0019 - General Arrangement- Foc'sle Deck (Page 1/1)
- H-0020 - General Arrangement (1:50 Accommodation Layout)- Boat Deck
- H-0021 - General Arrangement (1:50 Accommodation Layout)- Officers Deck and Wheelhouse

2.2 Furnished Equipment

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

2.3 Standards

- Fleet Safety and Security Manual (DFO/5737)
 - Coast Guard ISM Confined Space Entry Procedures
 - Coast Guard ISM Hotwork Procedures
 - Coast Guard ISM Lock out Tag out Procedures
 - Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.4 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must replace 4 complete, horizontal sliding Bridge windows with new, identical replacements. There are also 17 fixed glass windows on the bridge

windows that must be replaced with new units. These new windows and panels must be class approved, marine rated Beclawat style windows or certified marine equivalent. The contractor must reference drawing # H-2860 – Window and Sidelight Schedule - for further detail. The contractor must note that there is a catwalk outside of the bridge that may be worked off for some of these window removals/installations. However, it is the responsibility for the contractor to supply and install all scaffolding/staging and manlift requirements necessary to safely and successfully carry out all work detailed in this specification item. There are also crane blocks and cables that may interfere with this work. In conjunction with specification item H-10 – Speed Crane 5 Year Survey - it is the responsibility of the contractor to effectively coordinate all work and temporarily remove, store-reinstall and test all items as required.

- 3.1.2 During the course of these installations any steel work requiring repairs must be performed by the Contractor. The Contractor must allow for the replacement of 60ft² of steel in their pricing. This includes the complete removal of existing steel and the supply and installation of new steel with full pen welds. A unit price per ft² will be included in the bid pricing to be adjusted upwards or downwards as required via PWGSC 1379 action based on the actual requirement.
- 3.1.3 All welding must receive 100% visual inspection and be tested with 100% MPI. The contractor must supply all new ABS approved steel plate (c/w Mill Certs) required for this steel replacement. All new steel must receive 2 coats of marine grade primer and correlating tie/top coats to match existing superstructure paint scheme where applicable. All repairs to follow IACS No. 47 Shipbuilding and Repair Quality Standard
- 3.1.4 The contractor must include in their pricing for the cost for 150 UT shots to be taken in the wheelhouse area by a certified third party NDT professional in order to determine areas and extent of potential steel replacements.
- 3.1.5 The contractor must also include in their pricing the cost to replace 100 ft² of wheelhouse flooring. This includes the removal of existing flooring to bare steel and the installation of new, class approved 10mm dex-o-tex underlayment, 7.5mm fire retardant urethane cushion and top vinyl to match existing colour scheme. All bare steel is to be properly powertooled clean and must receive 2 coats of marine grade primer prior to any flooring being installed. A price per ft² will be included for adjusting upwards or downwards as required via PWGSC 1379 action. All flooring must be installed by certified marine flooring professionals to the satisfaction of the CCG TA.
- 3.1.6 During removals and installations, the window openings are to be suitably sealed to protect the ships interior from weather. The Contractor must be responsible to ensure that all equipment, flooring, fittings controls, etc. are properly protected against damage from the ingress of weather or from the work in progress. This includes the entire crawlspace area below the wheelhouse which must have all

electronics, cabling and equipment suitably wrapped and protected from any potential steelwork/hotwork activities. Any damages incurred as a result of inappropriate protection measures must be repaired at the contractor's expense.

- 3.1.7 During all cutting and welding, work areas are to be properly ventilated. Hotwork permits must be completed and followed during this work.
- 3.1.8 Areas of new, bare, or heat affected steel must be power tooled to SSPC-SP 3 and painted with two (2) separate coats of marine grade primer, followed by two (2) separate coats of marine white as per vessels painting specifications.
- 3.1.9 The Contractor must be responsible for all rigging of windows on/off the vessel and disposal of the removed windows ashore. The new windows must be procured by the contractor within 2 weeks of contract award to ensure that there are no delays due to the ordering of these items.
- 3.1.10 The Contractor must be responsible for the supply of the required windows and all windows must be TC/ABS approved.

3.2 Sliding Window Replacement (4)

- 3.2.1 The Contractor must remove the existing Beclawat sliding windows from their current locations. Existing windows are currently bolted to the vessel's superstructure. Bolts are in poor condition and will likely need to be cut off.
- 3.2.2 The Contractor is to remove any deck head paneling, bulkhead covering, sun shades and trim in order to access all of the frames of each window identified in this and the following section (3.3) to perform the work. Note: All removed interference items including the window trim-outs items are to be reused upon installation of the new windows. The Contractor must clearly mark and store the removed items to ensure components are returned to their original positions. Any loss or damage as a result of improper removal and storage will be at Contractor's expense.
- 3.2.3 To gain access to certain windows the Contractor is to disconnect and remove bow thruster controls, rudder angle indicator, and searchlight controls, to remove the stainless sheathing and wooded window ledges covering the window frame bolts. This will be required to be done on both the port and starboard sides of the bridge.
- 3.2.4 On completion of work all removed controls noted above are to be reinstalled and their functionality must be proven. This is to be witnessed by the CCG IA. Any control issues that occur due to improper installation must be corrected by the Contractor and to their account.

- 3.2.5 The Contractor is to include an allowance for the sum of \$5,000 dollars for the modification, replacement, or repair of any of the existing wooden window ledges that the CG TA identifies as require replacement and or repair. The actual cost must be adjusted up or down with PWGSC 1379, if required, based on final invoicing.
- 3.2.6 The Contractor must remove the internal seal frames to expose specific manufacture serial numbers. The Contractor must provide all information, numbers, and measurements as required to Beclawat (or a CCG approved alternate) to have new windows fabricated for direct fit into existing locations.
- 3.2.7 The Contractor must install the newly supplied windows as per manufactures instructions using new securing fasteners and approved sealant.
- 3.2.8 All removed interference and trim items must be re-installed as per as found condition.
- 3.3 Fixed Window Glass Replacement (17)
- 3.3.1 The Contractor must replace the glass in a total of seventeen (17) fixed Beclawat windows on the vessel's bridge. The type of windows required are as follows:
- Five (5) Heated Windows
 - Two (2) c/w with holes to suit 380mm Clearview screens
 - Ten (10) Clear Safety Glass
- 3.3.2 The Contractor lockout and disconnect all wiring from existing heated windows and clear view screens. The Contractor is responsible for their re-connection and testing upon installation of the new windows.
- 3.3.3 The Contractor must provide the dimensional details for of window glass to Beclawat Canada and have replacement glass window manufactured.
- 3.3.4 Heated windows must be 20 W/DM2, 220 VAC/1/60 Hz, conductive panel type with integral controls, inclusive of thermostat. Additional window information can be found on drawing H-2860 – Window and Sidelight Schedule.
- 3.3.5 The Contractor must install and seal the new windows as per manufacture instructions. All removed interference and trim items must be re-installed as per original as found condition.
- 3.3.6 Once all of the newly supplied windows have been installed and prior to the reinstallation of insulation and the window trim each window must to be subjected to a hose test to ensure they are water-tight and there is no leakage around the

sealing faces. This hose test must be witnessed and to be to the satisfaction of by the attending ABS surveyor and both the CCG TA and IA.

4.0 Proof of Performance

4.1 Inspection/Inspection

4.1.1 Upon completion windows must be inspected for good seal contact and hose tested and proven watertight to the satisfaction of the Technical Authority and the attending ABS surveyor.

4.1.2 All work areas to be thoroughly cleaned upon completion of all work to the satisfaction of the CCG TA.

4.2 Testing

4.2.1 All welds must be receive 100% Visual inspection and 100% MPI testing from a certified third party organization.

4.2.2 All new windows must be hosed tested to ensure proper installation. Any deficiencies found will be corrected by the contractor at their expense.

5.0 Deliverables

5.1 Drawings/Reports

5.1.1 Copies of all manuals and/or certificates for the newly supplied windows and any drawings developed of modified by this specification must be provided to the CCG TA.

5.2 Certificates

5.2.1 The contractor must provide CCG with new steel, and flooring certificates.

5.2.2 The contractor must provide CCG with all NDT reports from the third party weld testing organization.

5.2.3 The Contractor must provide CCG with all CWB welders tickets and welding procedures.

H-34 INCINERATOR SLUDGE TANK INSTALLATION

1.0 Scope

- 1.1 The intent of this SOW item is for the Contractor to mount a GSM supplied sludge tank for the incinerator located on the incinerator flat.
- 1.2 This work must be completed in conjunction with SOW items E-01 - Propulsion Generator replacement and E-03 – Auxiliary Generator Replacement.
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 50-00-03_01 & _02 – Machinery Arrangements Sectional 1 & 2
- 50-00-01_02 - Machinery Arrangement
- 2007599 – Sludge Tank Drawing

2.2 Regulations

- Canada Shipping Act 2001 – Marine Machinery Regulations
- ABS Rules and Regulations

2.3 Standards

- CCG Fleet Safety Manual (DFO/5737)
- TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- IEEE STD 45:2002 – Recommended Practice for Shipboard Electrical Installations
- CSA W47. - Canadian Welding Bureau Standard for Fusion Welding of Steel
- CSA W47.2 – M1987(R1998) – Canadian Welding Bureau Standard for the fusion welding of aluminum and aluminum alloys
- Society for Protective Coatings (SSPC) Standards
- SP1 – Solvent Cleaning

- SP3 – Power | Tool Cleaning
- CCG Welding Specification

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.4 Owner/Contractor Supplied Material

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

2.4.2 The sludge tanks specified is being supplied as GSM

3.0 Technical Description

3.1 General

3.1.1 The Contractor must be responsible for the identification of interference items, their temporary removal so as to gain access to the work specified, their storage, and refitting to vessel on completion of work.

3.1.2 The Contractor must not make any additional openings in the vessel for the purpose of conducting this work without the approval of the CCG TA. The Contractor must utilize, where possible, the existing doors, alleyways, and hatches as they currently exist in the structure of the vessel.

3.2 Tank Foundation

3.2.1 The Contractor must be responsible for designing and fabricating the necessary foundation to fit the sludge tank footprint.

3.2.2 The foundation is to be suitably mounted so as to have the tank supported on the deck and securely bracketed at the top to the existing uptake support beams.

3.2.3 The tank foundation is to be designed the support for a minimum of 2,000 kg load.

3.3 Tank Mounting and Installation

3.3.1 The Contractor is to install the new sludge tank (Dwg. 2007599) within the funnel casing at the Officers Deck level, aft of frame 70. The new tank is to be installed as close as practical to the after side of the uptakes. Alternate locations must be discussed with and approved by CCG TA

- 3.3.2 Installed location of this tank is to allow access to all ancillary equipment which currently is fitted in the area – piping, valves, etc. – and will allow access for the purpose of maintenance to any of future installed equipment resulting from this specification item.
- 3.3.4 Once the sludge tank has been installed and secured into place the damage or burnt paint areas must be cleaned back and feathered. Two (2) separate coats of Amercoat Red Oxide Primer is to be applied followed by two (2) separate topcoats of Amercoat 5450 of the appropriate colour for a final DFT of 3.5 mils. Certified marine equivalents may be used if approved by the CCG TA.
- 3.3.5 The Contractor must note that, as referenced in the attached Hazardous assessments and matrix, there are areas in the stack that possess coatings with high lead content. Therefore, all existing coating removals required to mount and install the incinerator tank must be abated and disposed of by a certified third party abatement organization. All costs for this abatement and disposal must be included in the contractors firm pricing for this specification item.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 All work must be witnessed and accepted by the CCG TA.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The Contractor must provide the Chief Engineer with a typewritten report of the Contractors work in both electronic and hardcopy formats outlining the details of the inspection and any alterations / repairs made prior to the acceptance of this item.
- 5.1.2 The contractor must update the related ships original drawings with new “as fitted” drawings based on this installation.

STATEMENT OF WORK

CCGS GEORGE R. PEARKES Vessel Life Extension



PART C – Mechanical (“E”) Specifications

Prepared by:
Vessel Life Extension Program
200 Kent Street
Ottawa, ON K1A 0E6

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E-01 PROPULSION GENERATOR REPLACEMENT

1.0 SCOPE

- 1.1 The intent of this SOW item is to remove the three (3) existing main propulsion generators and remove all piping, ventilation ducting, structural components, lighting, brackets, fire suppression systems and all other equipment that is located in the removal and installation path of the new Propulsion Generator Sets (PGSs).
- 1.2 The intent is to install three (3) new Wartsila W8L26 series propulsion generator sets, associated bed plates, auxiliary systems, piping, wiring and commission and test in accordance with the manufacturer's guidelines, instructions and recommendations. All items removed from the removal and installation path must then be re-installed.
- 1.3 This work must be carried out in-conjunction with the following SOW items:
 - 12.0 – Vessel Commissioning
 - H-03 – Hull Cleaning & Coating
 - H-04 – Bilge Cleaning & Coating
 - H-06 – Sea Chest & Seabay Surveys
 - E-02 – Cycloconverter Replacement
 - E-03 – Auxiliary Generator Replacement
 - L-02 – Thermography Inspections
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 REFERENCES

2.1 Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations (C.R.C., c. 1431)
- b) Canada Shipping Act - Tackle Regulations (C.R.C., c. 1494)
- c) Canada Shipping Act – Marine Machinery Regulations (SOR/90-264)
- d) Canada Shipping Act - Hull Inspection Regulations (C.R.C., c. 1432)

- e) Canada Shipping Act – Safe Working Practices Regulations (C.R.C., c. 1467)
- f) Maritime Occupational Health and Safety Regulations (SOR/2010-120)

2.2 Standards

- a) CCG Fleet Safety Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- d) IEEE STD 45 – Recommended Practice for Shipboard Electrical Installations
- e) IEC 60092-504-electrical Installations in Ships – Part 504: Special Features – Control and Instrumentation
- f) IEC 60533 – Electrical and Electronic Installations in Ships – Electromagnetic compatibility
- g) CSA W59-08 (R2008) - Welded Steel Construction
- h) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- i) Society for Protective Coatings (SSPC) Standards
- j) CCG Welding Specification

2.3 Drawings & Documents

Wartsila Project Documents	
Document Number	Description
DMCA00048815	George R. Pearkes Installation Planning Instructions (IPI)
DBAE591721	1100 Commissioning Manual
DBAE850131	George R. Pearkes ITP
DAAE027798	Installation of W26 Generator Sets on Resilient Mounts
DAAF446589	DG Set General Arrangement (w/ Pipe Connections)
5659 ebm	3D model for use in Cadmatic eBrowser viewer
5659 installation 3D	3D model for use in AutoCAD

Wartsila Design Drawings	
Drawing Number	Description
5659-101-001	General arrangement
5659-101-002	Temporary accessibility plan (Deck Cut-Outs)
	Stability Documentation
5659-152-004	Preliminary stability Calculation
5659-152-005	Inclining Experiment Procedure
	Lay Out Arrangements, Machinery Compartments
5659-106-001	Lay out arr. In Engine room
5659-740-001	Exhaust gas arrangement in ER and casing
	Class Drawings, Main Structure
5659-144-001	Docking Plan

Wartsila Design Drawings	
Drawing Number	Description
5659-202-001	Material List
5659-209-002	Welding table
5659-220-001	Sections in Generator room
5659-223-001	Main Engine foundation
	Class Drawings, Foundation Main Equipment
5659-263-001	Foundation ME Starting Air Receivers
5659-263-002	Foundation ME Silencers
5659-263-003	Foundation FO Cooler
5659-263-005	Foundation Preheater Units
	Outfitting Machinery
5659-452-001	Travelling crane w/ Lifting Equipment in engine room
	Class Drawings, Piping Diagram, Ship System
5659-703-001	Fuel oil supply system
5659-711-001	Lubricating oil system
5659-720-001	Cooling systems heat balance
5659-722-001	FW cooling system
5659-731-001	Starting air piping diagram
5659-740-001	Exhaust Gas Arrangement in ER and Casing
5659-743-001	Exhaust diagram
	Basic Drawings, Electrical System
5659-85051-01	Single Line Diagram
5659-85051-03	Electrical Load Analysis - AC
	Basic Drawings, Electrical System
5659-57452-01	Ventilation and Heating – Cable Diagram
5659-60152-01	Diesel engines/ME for propulsion - Cable Diagram
5659-71152-01	Lube Oil System - Cable Diagram
5659-72252-01	FW Cooling Systems - Cable Diagram
5659-73152-01	Compressed Air Systems - Cable Diagram
5659-79252-02	IAS I/O List
5659-85052-01	Cable List, including termination details
5659-87152-02	600V Main Switchboard - Feeder Diagram
5659-87452-01	Motor and Starter List
	Basic Drawings, Auxiliary Systems
5659-574-001	Ventilation arrangement in Engine room
	Piping Material
5659-789-001	Piping Material list
	Isometric Drawings (Guidance) – Folders (Multiple Files in Each)
5659-7432-001	ISO Draw Exhaust Gas system folder
5659-7032-001	ISO Draw FO system folder
5659-7222-001	ISO Draw FW Cooling system folder
5659-7112-001	ISO Draw Lub Oil system folder
5659-7312-001	ISO Draw Starting Air system folder

Original George R. Pearkes Drawings	
Drawing Number	Description
555-H-0023 - 0025	General Arrangement, 3 sheets
	Lay Out Arrangements, Machinery Compartments
50-00-01_01 & 02	Machinery Arrangements, 2 sheets
50-00-03_01 & 02	Machinery Arrangement Sections, 2 sheets
62-10-01_01-04	Machinery Space Ventilation, 4 sheets
	Main Structure
H-3_1 & 2	Profiles & Decks – ER/Tanktop and Main Deck, 2 sheets
H-2_1 - 3	Construction Sections, 3 sheets
555-H-0002	Framing Expansion
555-H-0003	Tank Top and Double Bottom Fr 70-106
555-H-0004	Engine Room Flats
555-H-0006	WT Bulkheads Below Main Deck
70-06-01 – 01- 03	Funnel, 3 Sheets
H-01-41	Prop Motor Seating
	Stability Documentation
555-H-0022	Docking Plan
H-0029_01 &_02	Lines Plans Fore & Aft
G-009-Stability Book	Trim and Stability Booklet
	Piping Diagrams
74-00-01_01 & 02	Fuel Oil Service/Transfer Diagrams, 2 sheets
73-00-01	Lube Oil Diagram
71-10-01	Central Cooling Diagram
76-00-01	Compressed Air Diagram
65-30-01	Domestic Fresh Water Diagram
65-30-01_01-04	Domestic & Fresh Water Sanitary Arrangements, 4 Sheets
	Electrical System
80-01 – 80-41	Electrical System One Line and Power Deck Plans
80-02-00	Electrical Load Analysis, 21 Sheets
86-01 - 86-20	Electrical Wireway Plans & Electrical Equipment Arrt's
19-166-100 – Generator Access Platforms	Poseidon Marine - Catwalk Platform Technical Drawings

2.4 Government Furnished Equipment

- 2.4.1 Refer to Wartsila Installation Planning Instructions (IPI) DMCA00048815 Section 1.5 - Wartsila scope of supply (where component details and drawings, following in subsequent subsections 2 to 9) and Section 10.8 - Component Data (automation system, Wartsila scope of supply, then followed by subsequent drawings and component datasheets)

- 2.4.2 Unless specifically noted within this specification, the contractor is responsible for supplying all labour, materials and equipment required to carry out the replacements of these new propulsion generator units.

3.0 TECHNICAL

3.1 General

- 3.1.1 The vessel must be re-powered by replacing the three (3) original main generator sets, based on ALCO-engines with three (3) new main generator sets based on Wärtsilä 8L26 diesel engines.
- 3.1.2 To support the new generator sets, auxiliary systems including cooling water, fuel oil, lube oil, start air, exhaust gas system and control system must be upgraded to fit the new generator sets. Main foundations must be replaced with new to fit the new generator sets, which will come on a common base frame.
- 3.1.3 Due to the scope of work needed for the CCGS George R. Pearkes, it is necessary for the Canadian Coast Guard and Wartsila to ensure that the Wartsila supervisory staff are in place to monitor the Contractor's work, provide guidance on the Wartsila Installation Planning Instructions, and provide Canada with additional Quality Assurance monitoring. In order to facilitate these goals, Canada will provide the Contractor with a Wartsila Site Manager to be on site for the duration of the project under the existing Wartsila Propulsion Generator Replacement contract. The Site Manager is not considered to be one of the FSR's required in 3.1.4 below. The contract and amendments can be found at <https://buyandsell.gc.ca>.
- 3.1.4 The Contractor is responsible for obtaining the services of accredited Wartsila FSRs to provide support in performing the work undertaken in this specification section in accordance with the manufacturer's specifications, drawings, instructions and these specifications. The FSR team must include the following personnel:

- Three (3) Commissioning / Controls Engineers

These engineers must be accredited by Wartsila Canada as being a person competent to perform this work. The three FSR's must be on site for a total of 6 weeks, including the dock and sea trail periods. The total cost of those services, travel and living expenses must be included as a line item in the Contractor's financial proposal.

- 3.1.5 Canada has provided a DNVGL Class approved design package for this project. Prior to starting work, as per SOW Part A 8.1, the Contractor must physically verify all affected items and all dimensions necessary for the work. The Contractor must not deviate from the Class approved drawings except, where deviation from the Class approved package is required, the Contractor must provide the TA and ABS

with all necessary engineering validation of the deviation and once approved by the TA, obtain ABS Class approval following the direction provided in Section 8.1 – Drawings – of this SOW item at the Contractor's expense.

3.1.6 Within 5 days of Contract Award, the Contractor must schedule a meeting with the following parties:

- a) ABS, who will be inspecting the work on behalf of ABS and Canada as the Delegated Statutory Inspection Program's (DSIP) Recognized Organization (RO) for the CCGS Pearkes;
- b) Wartsila Canada, who will provide the FSR technical support and project management for the Propulsion Generator Replacement;
- c) Technical Authority;
- d) Contracting Authority.

The purpose of the meeting will be to define the hold points for inspections for each party using the ITP and a tentative Commissioning Plan provided by Canada as a basis. The contractor must include pricing for a minimum of 2 yard representatives to attend this meeting in St. John's, NL.

3.1.7 Inspections must be completed by ABS (on behalf of Transport Canada), the TA and the manufacturer's representatives throughout the entire removal and installation process.

3.1.8 As this SOW item must be carried out while the vessel is in drydock, the Contractor must make the necessary arrangements to drydock the vessel in such a way that all steps and aspects of this installation can be effectively carried out. The contractor must reference drawings/documents:

- 5659-144-001 – Docking Plan
- 5659-101-002 – Temporary Accessibility Plan
- 555-H-0022 – Pearkes Original Docking Plan
- Pearkes Trim & Stability Booklet

The contractor must be responsible for all deviations and any associated costs must be included in their firm pricing. This includes any design and engineering work and all ABS class approvals.

3.1.9 Details in design, fabrication, installation and workmanship, not covered by the Specification and approval plans, must be in accordance with the shipbuilding standards noted above in section 2.2 of this SOW item and with ABS Classification Society Rules and Regulations. The Contractor must produce final as-fitted drawings for the auxiliary systems in this SOW item.

3.1.10 All hazardous materials must be disposed of in accordance with all Federal, Provincial and Municipal regulations and certificates provided to the CCG TA.

3.1.11 International System of Units (SI) must be used for designing and constructing of hull, machinery and equipment unless specifically stated in this SOW item. If metric

materials are not available, the Contractor must submit proposed materials to the TA for approval prior to purchase.

- 3.1.12 All welding and welding inspections must be executed in accordance with the requirements of drawing 5659-209-002 - Class Approved Welding Table, Welding Procedures required and approved by ABS, or the Canadian Coast Guard Welding Specification, document IDEKME#3049715V4, the most stringent requirements must apply.
- 3.1.13 Back gouging must be carried out with arc air, where necessary. Welding earth must be arranged close to the welding point. Excessive distortion of hull structures due to welding, which does not comply with standards, must be cured by means of cold press, line heating, or spot heating, as the case may call for. Double continuous welding must be applied to all fillet joints, except for dry spaces in superstructure and deckhouse, where intermittent or one side welding may be applied, unless the specific documentation states otherwise.
- 3.1.14 Lifting lugs, staging pieces or other temporary pieces fitted to the hull structures for construction must be removed to about 10mm from the base plate and ground smooth. In critical and highly stressed areas, lifting lugs must be removed and ground smooth, in accordance with the Contractor's procedures. All installed pieces to be used for lifting must be of engineered design for the expected loads and sufficient safety factor.
- 3.1.15 The edges of structural members of the Vessel must be treated in accordance with the Contractor's standard, provided it complies with coatings specifications. All paint work must be performed in compliance with the requirements of Coast Guard's "Paints and Coatings Standard", document No. 18-080-000-SG-003, and with paint manufacturer's recommendations. All machinery space internal structure and bilge areas must be prepped and coated as detailed in SOW item H-04 – Bilge Cleaning and Coating.
- 3.1.16 All required paint and materials must be provided by the Contractor, and be applied according to the recommendation of the paint manufacturer. Hull coatings after the completion of this specification item must be applied in accordance with SOW item H-03 – Hull Cleaning and Coating.
- 3.1.17 As described in the Hazardous Material Assessment documents "C1R6482V1 – Lead Assessment Engine Room and Stack" and "George R. Pearkes Lead Paint Assessments 2020 & 2021", there are some coatings throughout the engine room and stack area that contain high levels of lead. In order to remove and replace the exhaust piping and silencers detailed in this SOW item, a temporary insert will have to be cut in the stack area with potentially high levels of lead coatings. The contractor must follow all provincial and federal guidelines while removing and disposing of all lead coatings as required to successfully carry out this work. All removals and disposals of lead coatings necessary in order for the Contractor to remove and re-install this insert must be included in the contractor's firm pricing for this SOW item.

- 3.1.18 Upon arrival of the gensets to the Contractor's facility, the contractor must carry out unit inspections and pay close attention to necessary actions required as detailed in sections 1 and 2 of the Wartsila Installation Planning Instruction (IPI), document - DMCA00048815 IPI a3. The contractor must provide and maintain effective storage of the gensets and all related parts and equipment which includes, at a minimum, a dry space maintained at minimum 10°C and maximum 70%RH. Engines must be stored with sufficient space in all directions (minimum of 3ft.) to allow regularly scheduled full inspections of the engines. In addition, the alternator anti condensation heaters must also be provided with power (600V/1300W each) for the duration until supplied by the ship's power. This storage space must be separate from the space provided in section 3.5 of SOW item 3.0 - General Notes.
- 3.1.19 From the time the new propulsion units arrive at the Contractor's facility until they are successfully installed on the vessel, the Contractor is responsible for all crange, forklifts, rigging, labour and all other related equipment and mechanical requirements necessary for the successful installation of the new gensets. This includes all movements around the contractor's facility, on/off trucks, in/out of storage and on/off the vessel. These requirements also apply to the existing main engines which must be removed from the vessel and disposed of by the Contractor as per provincial and federal disposal guidelines.
- 3.1.20 As noted above, all necessary details for a successful installation of the new gensets are presented in the Installation Planning Instruction (IPI), document DMCA00048815 IPI. The Contractor must follow the requirements and recommendations of this document except where superseded in this SOW.
- 3.2 Preparations for Removals and Disconnections
- 3.2.1 The Contractor is responsible for all aspects of the machinery and equipment removals and installation of the three (3) PGSs with associated auxiliary machinery including commissioning and performance trials. All manufacturer's recommendations and requirements must be followed for each stage of the removal and installation. All manufacturers' documentation must be submitted to the TA prior to contract end. The Contractor must supply all materials, equipment, and parts required to perform the specified work unless otherwise stated.
- 3.2.2 The baseline drawings for the vessels affected machinery areas are detailed in the following documents:
- 50-00-01_01 & 2 – Machinery Arrangements
 - 50-00-03_01 & 2 – Machinery Arrangements Sectional
 - 555-H-0003 – Tank Top & Double Bottom
 - H-004 – Engine Room Flats
 - 555-H-0006 – WT Bulkheads Below Main Deck
 - 555-H-0026 – Capacity Plan

- 3.2.3 The Contractor must drain and dispose of all engine system fluids in accordance with all applicable Federal, Provincial and Municipal regulations. This includes the central cooling system of approximately 7m³ and all other oils and residue. These costs must be included in the contractor's firm pricing for this specification item and must remain separate from the bilge disposal allowance detailed in SOW item H-01 – Services.
- 3.2.4 It is the responsibility of the Contractor to carry out all safe work requirements necessary in order to carry out the work detailed in this specification. This includes opening, cleaning and gas-freeing all corresponding tanks in the engine room and machinery areas as required to carry out hot work detailed in this SOW item. All regular tank inspections and tank watch requirements as required to carry out these installations will be the responsibility of the contractor. The contractor must reference document 555-H-0026 – Capacity Plan - for additional details on required tank cleaning, gas freeing and watch requirements.
- 3.2.5 Any tanks or confined spaces affected in way of hot work in this SOW item must be inspected and pneumatically tested to the satisfaction of the ABS surveyor and the CCG TA.
- 3.2.6 The Contractor must dismantle the three (3) gensets with the view to preserving the engines as spares for reuse. The Contractor must ensure the engines have all openings blanked to prevent ingress of dirt, and any components and fittings removed are marked, packaged and prepared for shipment.
- 3.2.7 The Contractor must dismantle the three (3) alternators with the view to preserving the coolers as spares for reuse. The Contractor must ensure the alternator coolers have all openings blanked to prevent ingress of dirt, and any components and fittings removed are marked, packaged and prepared for shipment.
- 3.2.8 The Contractor must determine if the genset can be removed and crated as one unit, or separated prior to removal and packaging. If the genset components are separated, the Contractor must ensure the free end of the alternator is supported to prevent the rotor from dropping or rotating while in transit.
- 3.2.9 The Contractor must dismantle the engine's external components such as filters and coolers for all three (3) engines with the view to preserving the filters and coolers as spares for reuse. The Contractor must ensure the filters and coolers have all openings blanked to prevent ingress of dirt, and any components and fittings removed are marked, packaged and prepared for shipment.
- 3.2.10 Prior to making the cut out, an inspection of the affected area must be performed by the Contractor. Piping and electrical cables in the area to be identified and all nearby equipment to be covered and protected from hot cutting and welding work. Pipes, equipment and other installations that need to be removed while bringing the new gensets to their final position, must be identified, properly marked, temporarily removed and stored as Category B equipment. All Category B piping must have the ends tightly sealed off after disconnection to prevent contamination.
- 3.2.11 As a minimum, the following need to be temporarily removed:

- a) All floors and its supporting structure on tank top between Centre Line (CL) and 5000 mm off CL Port and Starboard from frame #71 to frame #96;
- b) All piping and cabling on tank top between CL and 5000 mm off CL Port and Starboard from frame #71 to frame #96;
- c) All piping, cabling, cable ladders, lights and other installation below engine room flat between CL and 5000 mm off CL Port and Starboard from frame #71 to frame #79;
- d) All piping, cabling, lights and other installation below engine room flat between CL and 5000 mm off CL Port and Starboard from frame #94 to frame #96;
- e) All piping, cabling etc. between engine room flat and tank top between CL and 5000 mm off CL Port and Starboard from frame #71 to frame #96;
- f) Stairs from tank top to engine room flat between of engines 1 and 2;
- g) Stairs between tank top and engine room flat between engines 2 and 3;
- h) Supply air distribution boxes between engines 1 and 2 and between engines 2 and 3;
- i) Supply air distribution ducts for distribution of air below engine room flat in front of engines;
- j) Pillars on frame #76, 1400 mm off CL Port and Starboard;
- k) The Contractor must take into consideration what temporary removals, if any, are required in way of the engine room flat structure on the starboard side, based on how the Gensets are brought into the Engine room. Impact on the main cable runs below the Starboard engine room flat must be avoided.

3.2.12 The Contractor must install temporary support posts during the refit period while the permanent pillars at frame #76 are removed to prevent sagging of the Engine Room Flat deck. The temporary support posts must only be removed to facilitate machinery movement, with additional temporary support posts used on either side of the gensets during the skidding of the gensets into their final positions.

3.2.13 The Contractor must determine whether equipment and other installations can remain on the removed section during the installation, or whether they must be fixed to the ships side above the cut and the engine room flat, and thereafter disconnected from the tank top prior to doing the cut for section removal, or temporarily removed and stored together with items listed above.

3.2.14 Piping and other installations on the tank top subject to removal, if considered beneficial, can be disconnected from their systems and remain on the tank top during the installation work. All disconnected pipe ends must then be properly blanked off to prevent ingress of water and impurities and all cables labelled, coiled together and their ends properly insulated and sealed. It is the responsibility of the

contractor to ensure that any piping or other installations removed must be properly re-installed and tested upon completion of primary work.

3.3 Temporary Hull Opening and Rigging Requirements

3.3.1 The existing generator sets' associated equipment must be removed and new main generator sets with associated equipment must be installed through temporary access cut out in the tank top structure. The vessel's hull must be supported with temporary supports as shown in reference Drawing - 5659-101-002 - Temporary Accessibility Plan, sheet 2 to prevent any deformation of the vessel's hull while the Module is removed. Any deviation by the Contractor from the designed temporary supports must be engineered and approved by ABS and the CGTA after review by CCG naval architects. The Contractor must cover all costs for the engineering and approvals for any change from the supplied design.

3.3.2 The identification, removal, storage and re-installation of all interference items required for this temporary hull opening is the responsibility of the contractor. After the installation of the new gensets are complete, the vessel must be returned to CCG in "as new" condition.

3.3.3 The Contractor must reference Drawings - 5659-101-002 - Temporary Accessibility Plan and 5659-220-001 – Sections in Engine Room - for the installation route for the generator sets. The baseline drawings for the vessels areas affected by this temporary opening are:

- H-0002 – Framing Expansion
- H-2_1-3 – Construction Sections
- H-3_1-2 – Profiles and Decks – ER and Main Deck
- 555-H-0003 – Tank Top & Double Bottom
- H-004 – Engine Room Flats
- 555-H-0005 – Main Deck
- 555-H-0006 – WT Bulkheads Below Main Deck
- 50-00-01_01 & 2 – Machinery Arrangements
- 50-00-03_01 & 2 – Machinery Arrangements Sectional

The reference drawings for the new installations are:

- 5659-106-001 – Layout Arrangement in Engine Room
- 5659.ebm – 3D model for Cadmatic e browser
- 5659 installations 3D – 3D AutoCad file
- 5659-452-001 - Travelling crane with lifting equipment in engine room

3.3.4 Other openings found necessary for the convenience of access, communication or ventilation for workers during the construction, must be provided in accordance with the Contractor's procedures and approved by the CCGTA and ABS.

3.3.5 The Contractor must note that this temporary insert will also be used for the installation requirements as detailed in SOW item E-03 – Auxiliary Generator

Replacement. It is the responsibility of the Contractor for all engineering, planning and coordinating activities involved in all removal, rigging and installation requirements necessary to carry out both of these SOW items.

- 3.3.6 The access cut-outs must not be made parallel, but with a small angle on cutting lines to ensure easy removal and installation of the tank top section that is temporarily removed.
- 3.3.7 The Contractor is responsible to ensure the safety of personnel operating in the area of temporary openings and provisional lifting equipment, and must secure the affected areas by necessary fences, safety bars, rails, solid platforms and scaffolding during the conversion stage in accordance with the Contractor's procedures.
- 3.3.8 The estimated weight of the temporary removed tank top section including the genset fitted onto it is approximately 75-80 MT. The Contractor must ensure the lifting equipment, trailer or hydraulic jacks are rated and designed to accommodate the estimated weight with safety margins. The Contractor must engineer any final hoisting, lifting, sliding, jacking or pulling arrangements of the Module or generator sets to accommodate the Contractor's preferred methods, equipment and any Occupational Safety requirements or considerations.
- 3.3.9 The contractor must suitably cover over/hoard in the temporary access hole when rigging operations are not being carried out in order to protect the engine room area from weather and debris and to maintain appropriate heating in the machinery areas. Any damage caused to the vessel from weather, debris or low temperatures will be repaired at the contractor's expense. As further detailed in SOW items 3.0 – General Notes and H-01 – Services, the contractor will be fully responsible for heating the vessel and carrying out all necessary winterization requirements.
- 3.3.10 The Contractor must support all loads from lifting or skidding of the engines either by the four lifting points on the engine, or through the mounting brackets for the resilient mounting. If the mounting brackets are used, the load must, to the extent possible, be evenly distributed between them.
- 3.3.11 The Contractor must supply a skidding frame for the engine which extends below the common base frame of the engine. The Contractor is responsible for engineering the specific methods and procedures of lifting, jacking and skidding the gensets taking into account dry dock configuration.
- 3.3.12 The engines must be skidded in position below the vessel, and lifted with hydraulic jacks or other lifting equipment. A lifting arrangement as indicated in the drawing 5659-101-002, "Temporary Accessibility Plan" must be used. The Contractor must ensure that the position of lifting lugs and the extent of the lifting frame allows for sufficient clearance through the opening, and that the spread out of the lifting chains/wires are in accordance with the requirements presented in the Installation Planning Instruction (IPI), Section 2.5.1. The cut out planned for in the engine room flat on starboard side from frame #91 - #95 must be executed prior to starting the lifting operation, see drawing No. 5659-220-001, Sections in Engine Room.

- 3.3.13 For new equipment installations, the Contractor must refer to drawing 5659-452-001 - Travelling crane with lifting equipment in engine room, the existing chain hoists must be re-used.
- 3.3.14 The existing trolley beams above the engines must be removed and new beams must be installed in accordance with the new propulsion generator's cylinder configuration and Wärtsilä recommendation regarding engine overhauling as presented in the IPI.
- 3.3.15 Lifting eyes specifically for turbocharger and charge air cooler maintenance must be fitted by the Contractor in locations according to drawing 5659-452-001 and with the guidance of the Wartsila Site Manager. The Contractor must provide a total of 12 lifting eyes with 1 tonne SWL to be supplied, installed and certified, with a unit price for adjustment for additional lifting eyes by PWGSC 1379 action.
- 3.3.16 The engines must be kept horizontal during all stages of the lifting operation.
- 3.3.17 If the brackets for resilient mounting are used for lifting, then the loads are to be distributed evenly on the twelve connections for the resilient mounting on the engine.
- 3.3.18 Once the engine is above tank top level, transverse skidding beams can be positioned below the engine. The engine can be skidded sideways by attaching pulleys on the shipside web frames at frame #76 and #88.
- 3.3.19 The weight of one generator set is approximately 41.5 MT. The Contractor must ensure the skidding pad eyes are rated and designed to accommodate the estimated weight with safety margins. Skidding sideways with steel on steel, the friction force will be approx. 10-20% of the engine weight.
- 3.3.20 For the cut out as shown on 5659-101-002, the Temporary Accessibility Plan, the skidding beam must be supported on the port side with temporary support going down to the dock floor.
- 3.3.21 Other equipment related to the engine replacement that must be transported in and out of the engine room can be handled by using the monorail arranged above existing engine No. 3. This monorail is dimensioned for a lifting capacity of 1 MT. Please see the Machinery Arrangement Plans as noted above for reference.
- 3.3.22 In case more heavy units must be lifted, necessary pad eyes and lifting arrangements must be engineered, installed and tested by the Contractor at the proper locations as required.
- 3.3.23 Removal of the funnel structure is one option for removal of structure and equipment from upper part of casing. Required lifting capacity for lifting the funnel structure located above stringer, at 4100mm above the Bridge Deck is approx. 7.5MT. The Contractor may submit alternative removal routes to CCGTA for approval with engineering as required.
- 3.3.24 Temporary openings must be closed back after completion of the conversion work with full penetration welding of hull and all strength/structural members by

approved CWB welding procedures. Non-destructive testing must be carried out to the weld joints by an inspector qualified to the Canadian General Standards Board (CGSB) Standard CAN/CGSB-48.9712-2014 at Level 2 or higher. The tests must include:

- a) All new welds must be 100% visually inspected by the weld inspector;
- b) Full penetration hull, deck, and strength/structural members welds must be tested by 100% Ultrasonic by the weld inspector;
- c) All other welds must be tested by 100% Magnetic Particle by the weld inspector;
- d) CCGTA/IA and ABS inspector must be notified 48 hours in advance of testing and given the opportunity to witness testing;
- e) An NDT schedule must be submitted to CCGTA/IA and ABS inspector for approval prior to cutting of temporary openings.

3.3.25 Preparation and painting of the jointing area must be according to the Coast Guard's "Paints and Coatings Standard", document No. 18-080-000-SG-003 and in accordance with the paint manufacturer's instructions. The external hull area must be prepped and coated as per SOW item H-03 – Hull Cleaning and Coating - and the internals must receive, at a minimum two coats of marine grade primer with a suitable matching compartment top coat.

3.3.26 Existing equipment, such as electrical cables, lighting fixtures, signal cables and piping under deck which are cut or removed during the conversion, must be returned to original condition and tested prior to vessel commissioning.

3.3.27 The IACS recommendations "Shipbuilding and Repair Quality Standard" should be used as guideline for the inspection of the workmanship.

3.3.29 Temporary pieces, such as staging pieces or lifting lugs and their reinforcements located in a fatigue sensitive area, high stressed area or passage way must be removed without leaving notches prior to any coatings being applied.

3.4 Installations

3.4.1 Vessel baseline drawings of areas affected in way of this work are detailed in the following:

- H-2_1-3 – Construction Sections
- H-3_1-2 – Profiles and Decks – ER and Main Deck
- H-0029_01 & 2 – Construction Sections Fore and Aft
- 555-H-0023 – 25 – GA's
- 555-H-0003 – Tank Top & Double Bottom
- H-004 – Engine Room Flats
- 555-H-0005 – Main Deck
- 555-H-0006 – WT Bulkheads Below Main Deck
- 50-00-01_01 & 2 – Machinery Arrangements
- 50-00-03_01 & 2 – Machinery Arrangements Sectional
- 63-10-01 – Diesel and Boiler Exhaust Piping

- 70-06-01 - Funnel Piping

3.4.1.2 Reference drawings for the new installations:

- 5659-223-001 – Main Engine Foundation
- 5659-220-001 – Sections in Engine Room
- 5659-202-001 – Material List
- 5659-209-002 – Welding Table
- 5659-101-001 – General Arrangement
- 5659-106-001 – Layout Arrangement in Engine Room
- 5659.ebm – 3D Model for Cadmatic e Browser
- 5659 installations 3D – 3D AutoCad File
- 19-166-100 – Generator Access Platforms

3.4.2 *Decks, Platforms and Supports*

3.4.2.1 New inserted steel structure in engine room area must ensure structural integrity and necessary support and integration of main and auxiliary equipment foundations. The Contractor must ensure continuity of longitudinal structural elements to ensure longitudinal global strength as well as ensuring necessary access and maintenance space to equipment is maintained. The weight of the structure must be kept low, weight increase to be avoided or minimized.

3.4.2.2 Due to the removed and new installed equipment, the Contractor must replace all existing Engine Room deck plates with new ¼" steel checkered deck plates. The contractor must also supply and install all new underlying supports, brackets, gratings, hand rails, ladders and stairways required. The new deck plates must be supplied by the contractor and are to have all cut outs and access holes fitted and supported as well as being fastened securely in place when complete with Brass countersunk screws. The Contractor must have the deck plates on one level above the tank top, maintain safe access to all areas of the new gensets, while leaving room for the gensets to move on the flexible vibration mounts. During installation of the deck plates around the PGSs, the Contractor must consult with the on-site Wartsila representative for acceptable distances to install deck and supports around the PGSs. The new steel deck plates, supports and brackets must be coated with 2 coats of marine grade primer prior to final installation on the vessel.

3.4.2.3 As per reference drawing 5659-220-001 - Sections in Engine Room, a recess must be arranged in the engine room flat between frames 91 and 95 to provide sufficient clearance for the turbo charger outlet on the Starboard propulsion generator.

3.4.2.4 After the installation of new deck plates, brackets and deck support system, the contractor must fabricate and install a new catwalk system around the three main engines as detailed in the attached Poseidon Marine technical drawing package 19-166-100 – Generator Access Platforms.

3.4.3 *Engine Foundations*

3.4.3.1 The new gensets are delivered assembled on a common base frame for flexible mount installation on the genset foundation. Foundations for existing generators must be replaced with foundations for the new generators.

3.4.3.2 The existing foundations for the three (3) existing propulsion gensets must be removed in their entirety and ground flush to the tank top.

3.4.3.3 The contractor must fabricate and add additional foundation structure as per the drawing 5659-223-001 - Main Engine Foundation.

3.4.4 *Auxiliary Equipment Foundations*

3.4.4.1 Baseline vessel drawings of the affected areas:

- 555-H-0023 – 25 – GA's
- 50-00-01_01 & 2 – Machinery Arrangements
- 50-00-03_01 & 2 – Machinery Arrangements Sectional
- 63-10-01 – Diesel and Boiler Exhaust Piping
- 70-06-01 - Funnel Piping

3.4.4.2 The contractor must reference documents 5659-106-001 –Machinery Arrangement and 5659.ebm -3D model for use in Cadmatic eBrowser - for the fabrication and installation of the new auxiliary foundations.

3.4.4.3 The contractor must remove the existing foundations for the engine control panels, motor control cabinets for redundant machinery and proceed to fabricate and install the following:

- New starting air vessels, 2 pieces, reference IPI, Section 5.4.1, located on engine room flat, on starboard side. Foundation for existing starting air vessels must be modified, see drawing 5659-263-001, "Foundation ME Starting Air Receivers";
- New starting air compressors, 2 pieces, reference IPI, Section 5.4.2, located on tank top, starboard side (existing foundations must be adapted to fit the new compressors);
- Fuel oil cooler, 1 piece, reference IPI, Section 3.4.1, located on tank top, inboard of the starboard Propulsion Generator. The foundation must be arranged with a drip tray. See drawing 5659-263-003, "Foundation Fuel Oil Cooler";
- CO2 bottles for fire extinguishing inside generator housings, 3 pieces, reference IPI, Section 2.8, drawing DMCA00001389, located adjacent to generators. The foundation must be designed, supplied and installed by the Contractor;
- Preheating units for the new engines, 3 pieces, reference IPI, Section 6.4.2, located on tank top in the area of the new engines, see drawing 5659-263-005, "Foundation Preheater Units"

- New fixed points and supports for exhaust piping and silencer (9 pieces of silencers), please reference document DSCA00255833, "Technical Offer Specification" in section 8.5 of the IPI and drawing 5659-263-002, "Foundation ME Silencers". Attachment points for anchoring vibration mounts must be designed, supplied and installed by the Contractor.

3.4.4.4 The Contractor must design, supply and install new foundations for all electronic boxes, motor starters and power units noted to be mounted.

3.4.4.5 All new foundations and disturbed areas in way of the foundations must be primed and painted in accordance with the vessel's paint scheme and further detailed in SOW item H-04 – Bilge Cleaning and Coating.

3.4.4.6 The Fuel Oil Cooler and Preheater Unit foundations require additional stiffeners to be installed under the tank top (in the double bottom tanks) in way of the new foundations. The Contractor must comply with section 3.2.4 and the General Notes for Confined Spaces when performing this work.

3.4.5 *Engine Room Ventilation System*

3.4.5.1 The current ER ventilation arrangement is detailed as per the following vessel original drawings:

- 70-06-01 1-3 – Funnels
- 50-00-03_01 & 2 – Machinery Arrangements Sectional
- 62-10-01 1-4 – Machinery Space Ventilation

3.4.5.2 The existing ventilation system for the engine room must be maintained to the maximum possible extent. The following must be removed from the system:

- a) Silencer at the air inlets, 2 pieces;
- b) Fire damper at the inlet, 2 pieces
- c) Existing two (2) ventilation fans with flexible mounts;
- d) Starters for existing engine room supply fans, two (2) pieces;
- e) Transition duct from supply fans to main ducting.
- f) Parts of duct leading below the engine room flat in front of the main engines to facilitate the removal of the original gensets and installation of the new gensets.

3.4.5.3 As per document 5659-574-001 – Ventilation in Engine Spaces - the contractor must re-build the engine room ventilation system.

3.4.5.4 The following GSM must be installed by the contractor:

- GSM: Air supply fans, Ø 1000 mm, axial type, 68.000 m³/h, frequency controlled, two (2) pieces, reference IPI, Section 7.4.1 and drawing DBAF355755 “Air Supply Fan and Silencer on page 7-6 of the IPI;
 - GSM: Frequency control units for the ventilation fans, two (2) pieces, reference IPI, Section 10.8.7 and drawing DMCA00014866 “Fan Control” on page 10-78 of the IPI;
 - GSM: Engine room pressure control units, two (2) pieces, reference IPI, Section 10.8.5 and drawing DMCA00011541 “Pressure sensor” on page 10.70 of the IPI;
 - GSM: Flexible supports for air supply fan, four (4) pieces, reference IPI, Section 7.4.3;
 - GSM: Silencers, Inner diameter Ø 1000 mm, two (2) pieces , reference IPI, Section 7.4.4;
 - GSM: Fire dampers, 1000x1000 mm, two (2) pcs, ref. IPI, Section 7.4.5;
- 3.4.5.5 As referenced in document 5659-574-001 – Ventilation in Engine Spaces - suction air ducts, wire screens and ventilation louvres are to be fabricated and installed by the Contractor. The Contractor must engineer, design, supply and install the surrounding structure above the Officer Deck level.
- 3.4.5.6 The new ventilation fans must be installed on top of the duct transition above the boat deck. Flexible mounts and necessary counter flanges are delivered together with the fans for installation by the Contractor.
- 3.4.5.7 The new fans must be provided with frequency control based on the actual pressure in engine room, and with possibility for manual override. Control of ventilation fan speed must be provided by control unit sensing the actual pressure in engine room and the reference pressure in open air.
- 3.4.5.8 Tube for pressure reference must be drawn from the pressure control unit to a position in open air, protected from water ingress and physical damage, the final location to be determined by the Wartsila FSR and the CCG TA.
- 3.4.5.9 The fan speed control system must allow for manual setting of requested overpressure and manual setting of fan speed. Fan controllers are to be tied in to fire alarm system as per originally set up.
- 3.4.5.10 New suction air ducting must be installed between flexible mounts on top of the new fans and the officer's deck according to the design presented in drawing 5659-574-001, “Ventilation in Engine Spaces”. The duct must be painted on internal and external surfaces. If painting is difficult to access, galvanized pipe must be used.
- 3.4.5.11 The penetration through the officer's deck must be modified to a square penetration according to the dimensions of the mounting flanges of the new fire dampers, ref. IPI, Section 7.4.5.

- 3.4.5.12 Ducting for air distribution in the engine room must be modified above engine room flat in front of centre main genset, to provide space for the exhaust outlet from the new genset. For reference refer to drawing 5659-574-001 - Ventilation in Engine Spaces.
- 3.4.5.13 Air supply ducts must be coated and insulated by Contractor supplied 50 mm insulation and lined according to current, Class approved standards.
- 3.4.6 *Propulsion Generators*
- 3.4.6.1 The current ER layout is detailed as per the following vessel original drawings:
- 50-00-01_01 & 2 – Machinery Arrangements
 - 50-00-03_01 & 2 – Machinery Arrangements Sectional
 - 555-H-0023 – 25 – GA's
- 3.4.6.2 The existing three (3) main Gensets must be removed and the Contractor must install three (3) GSM Wärtsilä Gensets through the temporary access hole as detailed above in section 3.3 – Temporary Hull Opening and Rigging Requirements - of this SOW item. The contractor must also reference the Wartsila IPI Manual for more specific unit information and installation details.
- 3.4.6.3 After the removals of the existing units are complete and prior to the installation of the new gensets, the contractor must proceed to clean, prep and coat the mechanical space bilge areas as detailed in SOW item H-04 – Bilge Cleaning & Coating to the satisfaction of the CCG TA and the CCG supplied NACE inspector.
- 3.4.6.4 As noted in section 3.3 – Temporary Hull Opening and Rigging Requirements, the installation of the new Auxiliary Generator as detailed in SOW item E-03 of this work package will be carried out simultaneously with this SOW item. It is the responsibility of the contractor to effectively coordinate and plan both of these installations so as to limit any possible interferences.
- 3.4.6.5 Hold Point - It is the responsibility of the contractor to cover and protect all of the vessel's equipment, parts and spares in the engine room and machinery areas from any potential damage during this installation. Any damage caused to the vessel will be corrected at the contractor's expense. The Contractor must make every effort to isolate the cyclo converter room and transformer room from the Engine room while steelwork and painting is ongoing. If any amount of dust/dirt/debris enters the Transformers, all electrical components and structures in the Transformer Room must be cleaned by a professional company trained to do so at the contractor's expense before commissioning commences. Inspections must be carried out by the CCGTA and CE and the contractor must receive approvals to proceed.
- 3.4.6.6 The engine and alternator are installed on a common base frame which the Contractor must mount using the flexible mounts on the foundation, reference drawing 5659-203-001 - ME Foundation. Prior to mounting, foundations must

be made flat per document DAAE027798 - - Installation of WÄRTSILÄ 26 generating sets in the IPI.

3.4.7 Piping

- 3.4.7.1 The Contractor is responsible for all necessary piping, electrical and automation systems to be connected to the engines. All connections between engine and piping must be through flexible pipe connections provided by Wärtsilä, reference IPI Section 2.7.1, and noted in the Table 11-1 below.

Table 11-1 – GSM Pipe Connections

Code	Pipe Connection	Connection Size	Qty/Engine	Drawing Reference
101	Fuel inlet	DN32/PN40	1	DBAA841528
102	Fuel outlet	DN32/PN40	1	DBAA841528
103	Leak fuel drain, clean fuel	OD22	1	DAAB761468
104	Leak fuel drain, dirty fuel	OD22	1	DAAB761468
104	Leak fuel drain, dirty fuel	OD22	1	DAAB761468
213	Lube oil from separator and filling	DN40/PN40	1	DAAB740705
214	Lube oil to separator and drain	DN50/PN40	1	DAAB740705
301	Starting air inlet	DN40/PN40	1	DAAF034374
401	HT-water inlet	DN80/PN16	1	DAAB761661
402	HT-water outlet	DN80/PN16	1	DAAB761661
404	HT-water air vent	OD12	1	DAAB761457
404	HT-water air vent	OD12	1	DAAB761457
406	Water from preheater to HT-circuit	DN80/PN16	1	DAAB761661
451	LT-water inlet	DN100/PN16	1	DAAB761664
452	LT-water outlet	DN80/PN16	1	DAAB761661
454	LT-water air vent	OD10	1	DAAB761452
483	LT water air vent	OD10	1	DAAB761452
607	Condensate after air cooler	OD8	1	DAAB761446
701	Crankcase air vent	DN80/PN16	1	DAAB740720

- 3.4.7.2 All fabricated piping must be seamless pipe and chemically pickled following the procedures in the IPI. After installation of piping, each of the systems must be

flushed in their entirety following procedures in IPI 9.10 Cleaning and Flushing Instructions to a minimum of ISO 4406 class 21/19/16 (NAS 1638 class 10) cleanliness for all piping systems other than fuel and oil which are specified in sections below.

3.4.7.3 A Wartsila Bill of Materials is attached with each Auxiliary System P&ID/Diagram in the TDP, various indicated components are GSM supplied (i.e. those specifically indicated on the BOM as being supplied by Wartsila). The supply of all other BOM listed items are CFM.

3.4.7.4 In addition to the fabrication and installation of new piping as detailed in the following sections of this SOW item (A – E) and supporting documents, the contractor must also modify some existing piping. As detailed and highlighted in the Wartsila 3D models, a significant portion of the existing engine room piping must be modified by the contractor after removal for the installation of the new gen sets, and prior to re-installation on the vessel, in order to properly tie into the new units.

3.4.8 A) Fuel Oil System

A)3.4.8.1 The Contractor must modify the fuel oil treatment and service system according to the requirements of the new engines.

A)3.4.8.2 On completion, the system must be inspected and tested in accordance with the requirements of applicable ABS rules, with the presence of class surveyor.

A)3.4.8.3 The contractor must use the following documentation as reference:

- 5659-106-001 Machinery Arrangement
- 5659-703-001 Fuel Oil Service Diagram – including list of new valves and list of components removed/added
- 5659-7032-001 Fuel oil system – isometric drawings
- 5659-789-001 Piping material list
- DMCA00048815 Installation Planning Instructions (IPI), Section 3 “Fuel Oil System” and section 9 “Piping Arrangements
- DAAF446589 DG Set GA with Pipe connection drawing

A)3.4.8.4 All piping less than 2” diameter has not been included in the 3D model, the Piping Materials List or the Isometric drawings. The Contractor must supply, design and install all piping of less than 2” in diameter accordance with system diagrams. The Contractor must include an allowance of \$20,000.00 to cover the design, material supply, pickling and installation of all fuel oil piping less than 2”. This includes any flushing, purging, testing of these small pipes and supports/brackets as required.

A)3.4.8.5 This allowance must be tracked between Canada and yard representatives based on actual yard labour timesheets and material invoice costs. The total

cost will be adjusted by PWGSC 1379 based on final material invoices and direct labour associated with this work as agreed upon by the CCG TA and the yard representatives.

A)3.4.8.6 The existing fuel oil purifiers meet the requirement of the new propulsion genset, and their arrangement, functionality and system connections must remain unaffected by the refit operation.

A)3.4.8.7 The fuel oil feed and circulation system must be converted according to principles presented in drawing 5659-703-001 - Fuel oil supply system.

A)3.4.8.8 The baseline for the system modifications are presented in the following documents:

- 5659-106-001 - Layout Arrangement in Engine Room
- 74-00-01-01 & 02 - Fuel Oil Service Diagrams

A)3.4.8.9 The Contractor must remove the following installations:

- a) Existing fuel oil supply piping between the fuel oil supply header and the main engines, No pipe references in existing diagram.
- b) Existing fuel oil return piping from the engines and all the way to the day tank, No pipe references in existing diagram.
- c) Existing fuel oil flowmeters arranged in the supply and return lines to each engine, no identification tag.

NOTE - It is the responsibility of the contractor to clean up and dispose of any oil leakage or spillage that occurs during the removal/installation of piping or any part of the gen set system. The contractor must clean up and dispose of any fuel or oil spillage or leakage of any kind that occurs in a timely fashion, so not to delay work, and as per provincial and federal guidelines.

A)3.4.8.10 The Contractor must install the following:

- a) GSM W8L26 Gen set with built on:
 - a. fuel injection pumps
 - b. injection valves
 - c. engine driven fuel feed pump
 - d. duplex fine filter
 - e. pressure relief valve in the outlet pipe
- b) Flexible pipe connections (noted in Table 11-1) (GSM);
- c) One (1) new fuel oil cooler, equipment ID 703.008.010 (GSM);
- d) Six (6) new fuel oil flowmeters, component ID FO33 (GSM);

- e) New Contractor supplied fuel oil supply piping from the fuel oil supply header to the new engines;
- f) New Contractor supplied fuel oil return piping from the new engines to the fuel oil day tank;
- g) New Contractor supplied Clean fuel leak piping;
- h) New Contractor supplied Dirty fuel leak piping.

A)3.4.8.11 Fuel oil supply piping to the fuel oil supply to the new engines must be connected to the existing fuel oil supply line, no pipe tag number, leading to the front of the engines along the cut out in engine room flat.

A)3.4.8.12 Fuel oil return lines from each engine must be joined together to a common return line leading through the new fuel oil cooler (equipment ID 703.008.010) and back to the fuel oil day tank.

A)3.4.8.13 All connections between engine and piping must be through flexible pipe connections provided by Owner, please refer IPI, Section 2.7.1. and Table 11-1.

A)3.4.8.14 Fuel oil flowmeters (component ID FO33), with a bypass arrangement, must be installed in the supply and return line to each engine. This new arrangement must be made with 32mm pipe to match the new Wartsila design.

A)3.4.8.15 Clean leakage fuel oil pipeline from the clean fuel drain on the new engines must be installed and connected to the fuel drains tank.

A)3.4.8.16 Dirty fuel drain pipes from the engines dirty drain connections on the engines must be installed leading to the sludge tank in separator room. Pipe can be joined before entering the sludge tank. Connection to tank must be through non-return valve.

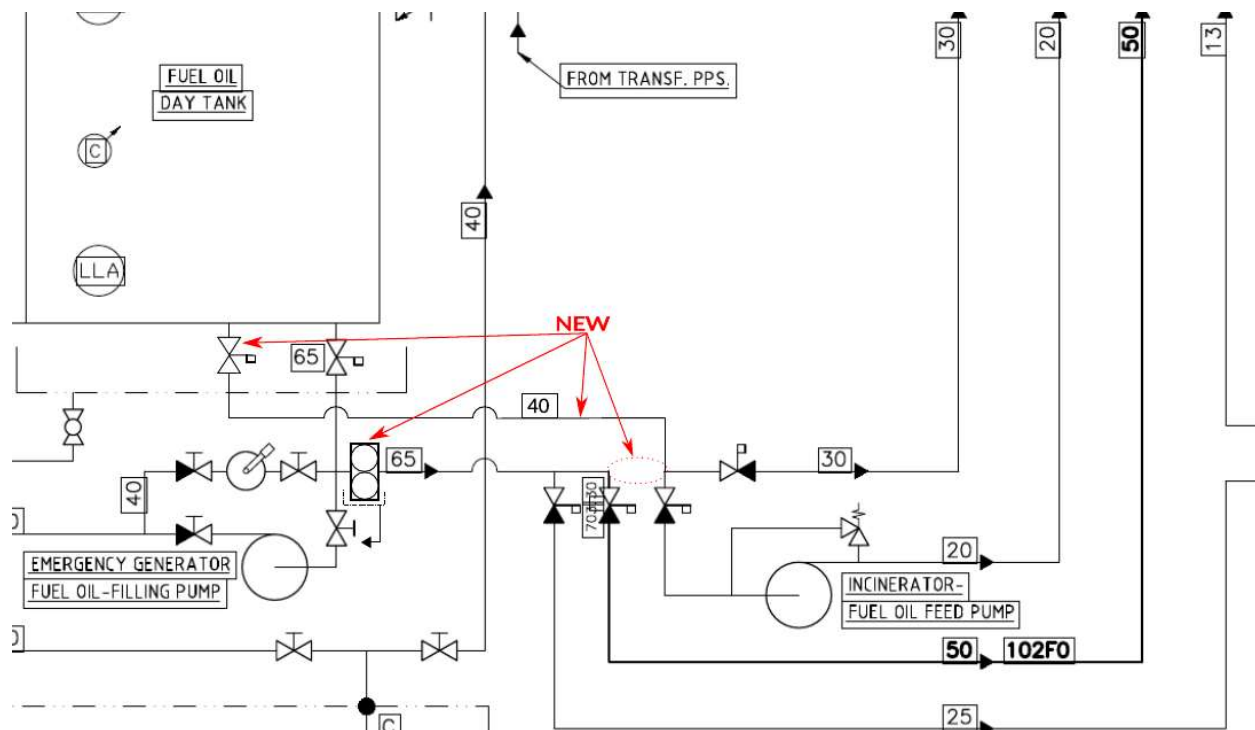
Table 12-2 GSM Fuel System Components

Item	Model	Quantity	Drawing
Fuel Oil Cooler	KS12-ACV-413	1	KS12-ACV-13B Rev D
Fuel Oil Meters	Kral OMP32	6	
Fitting List for Fuel Supply System			5659-703-001.xls

A)3.4.8.17 The contractor must make further modifications to the fuel oil supply piping at the day tank in addition to those specified above – these drawings are not shown in the 3D model, the Piping Materials List or the Isometric drawings. The contractor must use the fuel oil piping allowance as detailed above in section 3.4.7.4 of this SOW item to cover the design, material, fabrication and installation of the fuel oil piping for this additional work. All fittings must be welded or flanged with gaskets suitable for fuel oil. All piping must be flushed as per the IPI to meet ISO 4406 class 15/13/10 (NAS 1638 class 4) cleanliness.

Schematic changes are included in DWG 5659-703-001_Add'l_Mods and highlighted in red below.

DWG 5659-703-001_Add'l_Mods



A)3.4.8.18 The Contractor must isolate the boiler and incinerator fuel supplies from the propulsion generator and auxiliary generator supply, and install a new day tank supply for the boiler and incinerator - pipe to be 40mm, schedule 40, seamless pipe. A new, leak-free penetration with flange must be made into the day tank, and a new CSM quick-close gate valve must be installed (Young & Cunningham DN40 Bronze Quick-close Gate valve flanged, or fully certified marine grade equivalent). The penetration and valve location must permit access to and operation of the valve - final location to be agreed upon by CCGTA. The valve hydraulics must be tee'd into the tubing for the existing day tank isolation quick-close valve. The piping must tie into the existing boiler and incinerator piping. Contractor must supply and install new brass tags at the quick-closing valves: "F/O Supply fr Day Tk to Gen's" "F/O Supply fr Day Tk to Incin & Blr's" in English and French. Quick-close valves must be commissioned per manufacturer instructions and/or CCGTA and proven operational after modifications. Modifications to the day tank are to be completed prior to obtaining survey credit per SOW item: E-09 FUEL OIL, WASTE OIL AND D/G TANK SURVEY.

A)3.4.8.19 The Contractor must supply and install a duplex fuel oil strainer (Eaton Model 53 BTX 2 ½" flanged supplied with three (3) 100 mesh stainless steel baskets - one (1) is a spare – or fully certified marine grade equivalent) at the day tank propulsion/auxiliary generator fuel oil supply. The Contractor must mount the strainer on a suitable seat with a save-all around (if not fitted in existing save-all). Strainer location must be accessible for operation/cleaning - final location to be agreed upon by CCGTA.

3.4.8 B) Lube Oil System

B)3.4.8.1 The Contractor must modify the lube oil treatment and service system according to the requirements of the new engines.

B)3.4.8.2 On completion, the system must be inspected and tested in accordance with the requirements of ABS class rules, in the presence of class surveyor.

B)3.4.8.3 The contractor must use the following documentation for reference:

- 5659-711-001 -Lube Oil Diagram including list of new valves and list of components removed/added (CFM)
- 5659-7112-001 -Lubricating oil system – isometric drawings
- 5659-789-001 - Piping material list
- DMCA00048815 - Installation Planning Instructions" (IPI), Sections 4 Lubrication oil and Crankcase Ventilation System & 9 – Piping Arrangements
- DAAF446589 - DG Set GA with Pipe connection drawing

B)3.4.8.4 The current arrangement is referenced in

- 73-00-01- Lube Oil Diagram
- 5659-106-001 – Engine Room Arrangement

B)3.4.8.5 All piping less than 2" diameter has not been included in the 3D model, the Piping Materials List or the Isometric drawings. The Contractor must supply, design and install all piping of less than 2" diameter in accordance with system diagrams. The Contractor must include an allowance of \$5,000 to cover the design, material supply, pickling and installation of all lube oil piping less than 2". This includes any flushing, purging, testing of these small pipes and supports/brackets as required to meet ISO 4406 class 18/16/13 (NAS 1638 class 7) cleanliness.

B)3.4.8.6 This allowance must be tracked between the Canada and the yard representatives based on actual yard labour timesheets and material invoice costs. The total cost will be adjusted by PWGSC 1379 based on final material invoices and direct labour associated with this work as agreed upon by the CCG TA and the yard representatives.

- B)3.4.8.7 Presently there are installed two (2) lube oil purifiers serving the three (3) main gensets. The Contractor must leave these purifiers in place and must make them functional with the new system.
- B)3.4.8.8 Existing pipe lines without pipe tagging must be connected to the new gensets as shown in drawing No. 5659-711-001, "Lube oil diagram".
- B)3.4.8.9 All connections between engine and piping must be through flexible pipe connections (GSM), please refer to IPI, Section 2.7.1. and Table 11-1 (presented in item 3.4.7.1).
- B)3.4.8.10 For information about oil quality, please refer IPI, Section 4.2.1. The Contractor is responsible for the supply and installation of new engine oil into the new propulsion generators. The contractor must provide approximately 1,800L of Petro-Can MHP 154oil per generator unit (5,400L Total).
- B)3.4.8.11 The Contractor must convert the lubricating oil system according to principles presented in drawing No. 5659-711-001, "Lube oil diagram".
- B)3.4.8.12 The following equipment will have been removed together with the existing engines:
- a) Lube oil coolers, three (3) pcs
 - b) Pre-lubrication pumps, three (3) pcs
 - c) Hand pumps, three (3) pcs
- B)3.4.8.13 The discharge lines leading from pre-lubrication pumps to waste oil tank must be blanked off in the engine room close to the engines for future use.
- B)3.4.8.14 The new GSM engines, please ref IPI, Section 2.8, will be delivered with built on:
- a) engine driven lubricating oil pump
 - b) electric motor driven pre-lubrication pump
 - c) lubrication oil cooler
 - d) thermostatic valve
 - e) automatic filter
 - f) centrifugal filter
 - g) pressure control valve
 - h) wet sump
- B)3.4.8.15 A branch connection with closing valve (valve reference 711.02, 711.05 and 711.08 in the drawing No. 5659-711-001, "Lube oil system") followed by a blank flange must be arranged in the separator suction line from each engine to allow from emptying of the engine by portable pump or suction hose from truck.
- B)3.4.8.16 The engine crankcase ventilation must be connected to existing piping. The lower end of the piping must be slightly shortened and a new Contractor supplied condensate trap, built according to the recommendations in IPI, section 4.3.2 must be installed in each crankcase ventilation pipe line. Reference drawing 5659-711-001– Fitting List for Lubrication Oil System for further detail.

3.4.8 C) Cooling System

C)3.4.8.1 The Contractor must modify the central cooling system according to the requirements of the new gensets. The sea water system must remain unchanged.

C)3.4.8.2 On completion, the system must be inspected and tested in accordance with the requirements of ABS class rules, in the presence of class surveyor.

C)3.4.8.3 The contractor must use the following documentation for reference:

- 5659-106-001 - Machinery Arrangement
- 5659-720-001 - Cooling Systems Heat Balance
- 5659-722-001 - Central Cooling Diagram” including list of new valves and list of components removed/added (CFM)
- 5659-7222-001 - FW cooling system” – isometric drawings
- 5659-789-001 - Piping material list
- DMCA00048815 - Installation Planning Instructions” (IPI), Sections 6 “Cooling Water System and 9 –“Piping Arrangement”
- DAAF446589 - DG Set GA with Pipe connection drawing

C)3.4.8.4 The heat rejection data for the redesigned cooling water system is presented in drawing No. 5659-720-001, “Cooling Systems Heat Balance”.

C)3.4.8.5 All piping less than 2” diameter has not been included in the 3D model, the Piping Materials List or the Isometric drawings. The Contractor must supply, design and install all piping of less than 2” diameter in accordance with system diagrams. The Contractor must include an allowance of \$25,000 to cover the design, material supply, pickling and installation of all cooling water piping less than 2”, including vent tubing. This includes any flushing, purging, testing of these small pipes and supports/brackets as required to meet ISO 4406 class 18/16/13 (NAS 1638 class 7) cleanliness.

C)3.4.8.6 This allowance must be tracked between Canada and yard representatives based on actual yard labour timesheets and material invoice costs. The total cost will be adjusted by PWGSC 1379 based on final material invoices and direct labour associated with this work as agreed upon by the CCG TA and the yard representatives.

C)3.4.8.7 New plates must be added to the existing central coolers, equipment identification 722.001.010 and 722.001.020. Existing plates must be cleaned within 24 hours of draining, per Sondex Operation and Maintenance Manual with care to preserve gaskets, prior to reuse as directed by FSR. New plates, gaskets and necessary spare parts and instructions will be GSM, please refer to the IPI, Section 6.4.

C)3.4.8.8 Flow control valves after the cooling water pumps must be re-tuned to secure the flow rate specified for each pump in drawing 5659-722-001, "Central Cooling Diagram".

C)3.4.8.9 The Contractor must convert the fresh water cooling system according to principles presented in drawing No. 5659-722-001, "Central Cooling Diagram."

C)3.4.8.10 The current vessel baseline arrangement is referenced in:

- 5659-106-001 – Engine Room Layout
- 71-10-01 – Central Cooling Diagram

C)3.4.8.11 The Contractor must remove the following from the existing gensets:

- a) Lube oil coolers, three (3) pcs
- b) Main LT temperature control valve
- c) Heat recovery temperature control valve
- d) Common cooling water pipes
- e) All cooling water piping leading to engines
- f) All cooling water piping between engines and common return pipe

C)3.4.8.12 The following equipment must be installed and connected to the system:

- a) GSM W8L26 gensets, ref IPI, Section 6.1, with built on:
 - 1) engine driven HT circulating pump
 - 2) engine driven LT circulating pump
 - 3) HT thermostatic valve of self-actuating type for controlling the outlet temperature from the engine
 - 4) charge air cooler
- b) GSM One (1) Fuel Oil Cooler, tag No. 703.008.010, refer to IPI, section 3.4.1.
- c) GSM Three (3) new engine preheaters units, tag No. 722.011.010, 722.011.020 and 722.011.030, refer to IPI, section 6.4.4.
- d) GSM One (1) HT temperature control valve, valve ID 722.64, refer to IPI, section 6.4.2.
- e) GSM Three (3) LT electronic temperature control valves, valve ID 722.13, 722.29 and 722.45, in the LT circuit for each engine refer to IPI, section 6.4.1.
- f) GSM Two sets of replacement Plates for Central Coolers.

C)3.4.8.13 Fresh water cooling system outside the engine room and outboard of the engines on port side and aft in the engine room must remain unaffected by the conversion.

C)3.4.8.14 Existing pipe between cooling water system expansion tank and the suction side of cooling water pumps must remain unaffected by the conversion to the position in front of engine room at the elevation of engine room flat, where a

new pipe must be installed to the suction side of pumps in the redesigned LT and HT cooling circuits.

- C)3.4.8.15 Existing alternators must be disconnected from the electric machinery cooling water circuit, and the new alternators adapted to the system. New piping must be arranged between the alternator cooling connections and the closing valves.
- C)3.4.8.16 The fresh water cooling circuit connected to the Electric Machinery C.W. Pumps must be re-tuned to ensure the water flow stated for the components in drawing No. 5659-722-001, "Central Cooling Diagram" is obtained through all existing components and the new alternators.
- C)3.4.8.17 Fresh water pipes in front of the heat exchanger must not be rebuilt as these are required to use the existing LT control valve.
- C)3.4.8.18 The cooling water supply to the new engines must be branched off from the new common cooling water pipe.
- C)3.4.8.19 The cooling water system for the new engines must be arranged as a mixing system, where the LT circuit is connected to the central cooling water system, and the common external HT cooling water system is exchanging water with the LT system.
- C)3.4.8.20 Temperature control in the common external HT system is maintained by one (1) temperature control valve (valve tag 722.64), refer to IPI, Section 6.4.2.
- C) 3.4.8.21 Hot water supply to the water makers must be arranged from the hot side of the engines common external HT system according to the central cooling diagram.
- C) 3.4.8.22 One (1) preheating unit must be integrated in the HT cooling circuit of each engine, total of three (3) units. Each preheater unit comprises one (1) electrical heating element, one (1) electrically driven circulation pump and one (1) control cabinet.
- C) 3.4.8.23 De-aeration units (2 pieces) must be Contractor supplied and installed in the common return lines from the engines, one in the HT circuit and one in the LT circuit. Please see IPI, Section 6.3.3 and drawing No. V60D0343, "Recommended cooling water circuit deaerator".
- C) 3.4.8.24 Bleed pipes must be arranged between the deaeration units and vent pipe connections on the engines and the cooling water system expansion tank according to the recommendations in the IPI section 6.3.3. The pipes must be provided with orifices and closing valve as specified in the system diagram and the valve list following the diagram.
- C) 3.4.8.25 As noted in the initial Section 3.4.7 – Piping introduction, All connection between engines and piping must be through flexible pipe connections (GSM), please refer to IPI, Section 2.7.1. and Table 11-1.
- C) 3.4.8.26 The cooling water piping to the fuel oil cooler must be branched off the common cooling water return line and the return piping must be connected to

the common return water line, with an added flow regulating valve to regulate the water flow into the fuel oil cooler and common return water line.

Table 12-4:GSM Cooling Components

Item	Model	Quantity	Drawing
Temperature control valve (LT)	04GGSDBS32EBBCA-AA	3	04GGS_1
Thermostatic valve	5BRDB17007-00-AZA	1	DMCA00014835
Plates for Central Cooler		2 sets	DMCA00014831
Preheating Unit	KVE8-30	3	33968_KVE8W-30
Fitting List for FW Cooling System			5659-722-001.xls

3.4.8 D) Compressed Air System

D)3.4.8.1 The Contractor must modify the compressed air system according to the requirements of the new engines.

D)3.4.8.2 On completion, the system must be inspected and tested in accordance with the requirements of applicable ABS class rules, in the presence of class surveyor.

D)3.4.8.3 The contractor must use the following documentation as reference:

- 5659-106-001 - Machinery Arrangement
- 5659-731-001 - Start air diagram" including list of new valves and list of components removed/added (CFM)
- 5659-7312-001 - Starting air system" – isometric drawings
- 5659-789-001 - Piping material list
- DMCA00048815 - Installation Planning Instructions" (IPI), Sections 5, "Compressed Air System" and 9, "Piping Arrangements"
- DAAF446589 - DG Set GA with Pipe connection drawing

D)3.4.8.4 The existing baseline reference drawings are:

- 5659-106-001 - Layout Arrangement in Engine Room
- 76-00-01 - Compressed Air Diagram

D)3.4.8.5 The following items must be removed:

- a) Starting air compressors, two (2) pieces
- b) Starting air receivers, two (2) pieces
- c) Pipelines between starting air compressor and receivers

- d) Pipelines between starting air receivers and pressure reduction stations

D)3.4.8.6 The following equipment must be installed and connected to the system, refer to IPI, Section 1.5:

- a) GSM W8L26, refer to IPI, Section 10.4.1, with built on pneumatic starting arrangement;
- b) GSM Two (2) starting air receivers, tag No 731.010.010 and 731.010.020, capacity 900 l each @ 30,0 bar, refer to IPI, Section 5.4.1;
- c) GSM Two (2) starting air compressors, tag No 731.001.010 and 731.001.020, capacity 55,0 m³/h each @ 30,0 bar, refer to IPI, Section 5.4.2;
- d) GSM Two (2) sets of valves, including pressure reducers, for pressure reduction stations, 30-17.6 bar, refer to IPI, Section 5.4 and valve list following drawing No 5659-731-001, "Start air diagram";

D)3.4.8.7 The Contractor must convert the starting air system and then new engines connected to the system according to principles presented in drawing No. 5659-731-001, "Start air diagram". Necessary flexible pipe connections are provided by Wärtsilä, please refer to IPI, Section 2.7.1 and Table 12-1.

D)3.4.8.8 All piping less than 2" diameter has not been included in the 3D model, the Piping Materials List or the Isometric drawings. The Contractor must supply, design and install all piping of less than 2" diameter in accordance with system diagrams. The Contractor must include an allowance of \$50,000.00 to cover the design, material supply, pickling and installation of all compressed air piping less than 2". This includes any flushing, purging, testing of these small pipes and supports/brackets as required.

D)3.4.8.9 This allowance must be tracked between Canada and the yard representatives based on actual yard labour timesheets and material invoice costs. The total cost will be adjusted by PWGSC 1379 based on final material invoices and direct labour associated with this work as agreed upon by the CCG TA and the yard representatives.

D)3.4.8.10 Two (2) sets of valves for pressure reduction station, 30-17.6 bar, must be installed in the starting air supply to the existing auxiliary generator and other existing equipment.

Table 12-5: GSM Compressed Air System Components

Item	Model	Quantity	Drawing
Starting Air Vessels	900L/DN50	2	Db_30752
Starting air compressor unit	HL2/77-90-105	2	G02-0157
Air Filter	FIG34	3	DAAB726284
Pressure Reduction Valve	Niezgodka Typ 71.2 1-1/2" 600RF	2	07-2-2-KO38-A112L-K-001
Safety Valve	Type 30.1 BG II, Head C	1	030-1-2-025wd-A112L-A112L-C-001
Glove Valve	1.5"	4	GD89-01
Strainer	1.5" Class 600	2	F9A000PJ0A8040
Fitting List for Starting Air Piping			5659-731-001.xls

3.4.8 E) Exhaust System

E)3.4.8.1 The Contractor must replace the exhaust piping system according to the requirements of the new engines.

E)3.4.8.2 The Contractor must use the following document references:

- 5659-263-002 - Foundation ME Silencers
- 5659-740-001 - Exhaust Gas Arrangement in ER and Casing
- 5659-743-001 - Exhaust piping system" including list of components removed/added (Valves CFM)
- 5659-7432-001 - Exhaust pipe system" – isometric drawings
- 5659-789-001 - Piping material list
- DMCA00048815 Installation Planning Instructions" (IPI), Section 8 - Exhaust Gas System
- DAAF446589 - Pipe connection drawing
- DBAE702029 - Technical Offer Specification

E)3.4.8.3 The entire existing main engine exhaust piping system must be replaced. The contractor must reference the existing baseline vessel drawings:

- 63-10-01 – Diesel and Boiler Exhaust
- 70-06-01 – Funnel Piping
- 50-00-03 1 & 2 – Machinery Arrangements Sectional

E)3.4.8.4 Following components of the system must be removed:

- a) Existing main engine exhaust silencers (3 pieces);
- b) Existing main engine exhaust piping and mounting arrangements.

E)3.4.8.5 Following components must be installed, refer to IPI, Section 8:

- a) GSM - Three (3) exhaust gas bellows for turbo charger outlets, one per engine, refer to IPI, section 8.4.2.
- b) GSM - Twelve (12) exhaust gas bellows for installation in the exhaust lines, four (4) bellows in each pipe line, refer to IPI, section 8., Document DSCA00255833.
- c) GSM - Three (3) sets of Wärtsilä Compact Silencer System, each system consist of three (3) separate silencer units, refer to IPI, sections 8.4.3 to 8.4.5.
- d) GSM - New set of flexible support and suspensions, refer to IPI, section 8.4.6, Document DSCA00255833.

E)3.4.8.6 The exhaust gas piping system must be engineered, designed and modified by the contractor according to the principles presented in drawing No. 5659-743-001, Exhaust Diagram System, and the drawing 5659-740-001, Exhaust Gas Arrangement in ER and Casing. The contractor is responsible for identifying and carrying out any temporary removals/re-installations in the stack area as required to suitably accommodate the new propulsion generator exhaust piping system.

E)3.4.8.7 All piping less than 2" diameter has not been included in the 3D model, the Piping Materials List or the Isometric drawings. The Contractor must supply, design and install all piping of less than 2" diameter in accordance with system diagrams. The Contractor must include an allowance of \$5,000 to cover the design, material supply, pickling and installation of all exhaust piping less than 2". This includes any flushing, purging, testing of these small pipes and supports/brackets as required.

E)3.4.8.8 This allowance must be tracked between Canada and the yard representatives based on actual yard labour timesheets and material invoice costs. The total cost will be adjusted by PWGSC 1379 based on final material invoices and direct labour associated with this work as agreed upon by the CCG TA and the yard representatives.

E)3.4.8.9 The Contractor must supply and install new Corten steel pipes as required between the top of the funnel and the engines turbo charger outlets. Please pay attention to the installation instructions included in IPI, Section 8.3.

E)3.4.8.10 Drain pots must be arranged in the exhaust pipes according to drawings. The piping must be arranged with connection for back pressure measurement and with sampling point for gaseous emissions according to IPI, Section 8.2.2. and 8.2.4.

E)3.4.8.11 After all new piping has been installed, the Contractor must supply and install all new insulation on the entire exhaust piping with a doubled padded, flexible insulation system as per the following:

- The inner pad must be fabricated using stainless steel mesh and 2” Morgan Thermal Ceramic FireMaster Marine Blanket Insulation
- The outer pad must be fabricated using stainless steel mesh on the inside and Auburn Manufacturing Silicone Cloth, AMI-TUF, Style SGL 1700 Grey as the outside finish. The insulation must be 2” Morgan Thermal Ceramic FireMaster Marine Blanket
- Blanket layers must be arranged to overlap seams where possible.
- All Standard Specifications for the Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service-ASTM Designation: C 1695-10 must be followed
- The most recent version of the Specification Guidelines for the use of Soft Cover Insulation on Exhaust Systems must be followed

E)3.4.8.12 Supports and suspensions for the existing and new piping and components must be renewed and installed new according to the provided documentation, refer to IPI, section 8.4.5. All fasteners and gaskets required in the exhaust rebuild, and not supplied as GSM, must be new. Material for Bolts is ANSI/ASTM A193-79A GR B16 and suitable for high temperature operations, such as exhaust. Material for Hex HSF Nuts is ANSI/ASTM A194-79A GR7. Exhaust gaskets are asbestos-free with a solid insert of galvanized iron mesh, NBR/NR binders, rolled-on graphite layer for anti-stick.

E)3.4.8.13 Foundations for the new silencers must be built according to the drawing 5659-263-002, “Foundation ME Silencers.”

E)3.4.8.14 Necessary structure for supporting the exhaust stack must be engineered, designed, supplied and installed in place by the Contractor. New fixed points and supports for exhaust piping and silencer (9 pcs of silencers), please ref document DSCA00255833, “Technical Offer Specification” and dwg 5659-263-002, “Foundation ME Silencers”. Final attachment points for anchoring vibration mounts must be arranged and confirmed on site by the Contractor.

Table 12-6: GSM Exhaust System Components

Item	Model	Quantity	Drawing
Exhaust Gas Bellows	NS350	3	DAAB761852
Exhaust Gas Bellows	SBF	12	
Compact Silencer System		3	DBAE624944
Flexible Support System		3	
Fitting List for Exhaust Piping			5659-743-001.xls

Note: Only new bolts/fasteners are provided for the new GSM supplied sections (silencers/bellows). The contractor must supply and install all remaining new bolts and fasteners required for the new exhaust piping systems.

3.4.9 *Automation and Instrumentation*

- 3.4.9.1 The Contractor must update and expand the existing control and instrumentation Automation system to allow for new I/Os. Spare points will be used and banks of Analog/digital signal cards may be added.
- 3.4.9.2 The information related to I/Os are detailed and specified in the following documents:
- 5659-79252-02-IAS I/O list
 - 5659-85052-01-Cable list, including termination details
 - 5659-87452-01 Motor and Starter List
 - DMCA00047751-Block InterConnection Diagram
 - DMCA00001974-MODBUS Serial List
 - DMCA00048815-Installation Planning Instructions” (IPI), Section 10 - Automation System
 - 80-05 to 80-16-Electrical System One Line (existing document)
 - 80-02 – Electrical Load Analysis
- 3.4.9.3 The engines are equipped with a distributed, built-on engine management system. The main control cabinet handles all strategic functionality such as engine start, stop, and speed control and engine safety. It communicates with Main Switch Board (MSB)/ Power Management System (PMS) and IAS. Refer to IPI section 10 for more details.
- 3.4.9.4 The main interface with the ships alarm and monitoring system is a bus communication through which all measured values, alarm and status indication are transmitted. For details see drawing DMCA00001974 - “Modbus List”. One (1) communication box for each engine to be installed to assist communication between the main control cabinet and existing ship alarm system.
- 3.4.9.5 The existing MSB/PMS is interfaced to new gensets via hardwired signals to the new control I/Os.
- 3.4.9.6 One (1) power unit for each engine operates at 120VAC and 24VDC. The 120VAC is taken from existing 120VAC power distribution board in Engine Room. The 24VDC is taken from existing 24VDC Engine UPS.
- 3.4.9.7 One (1) communication box for each engine is fed by 24VDC. It is taken from existing 24VDC Engine UPS.

3.4.10 *Electrical Distribution System*

- 3.4.10.1 Some of the major items that must be replaced and cabling/connection which must be modified by Contractor are listed below. This list is non-exhaustive. Further details can be found in the respective electrical documents (An overview showing the equipment below, except item l, is provided on DMCA00047751 on page 10-17 of the IPI).
- a) Wärtsilä 8L26 (3 units)
 - b) Starting air compressor, 600VAC (2 units)
 - c) Preheating unit, 600VAC (3 units)
 - d) Engine Pre-lubricating oil pump, 600VAC (3 units)
 - e) Engine Turning Gear, 600VAC (3 units)
 - f) Generator Lube Oil pump, 600VAC (6 units)
 - g) Power Unit 120VAC + 24VDC (3 units)
 - h) Starter for starting air compressor, (2 units)
 - i) Starter for Engine turning gear (3 units)
 - j) Starter for Generator lube oil pumps (3 units)
 - k) LT electronic thermostatic valves (for arctic operations) in the LT circuit for each engine, 120VAC (3 units)
 - l) Central cooler valve, 120VAC (1 unit)
 - m) Communication Box, 24VDC
 - n) Engine Room Ventilation fans, 600V (2 unit)
 - o) Frequency drive for Engine Room Ventilation fans (2 Units)
- 3.4.10.2 The main switchboard will be fed by three Wärtsilä 8L26 diesel generator sets (2100kW, 600V, 60Hz). Refer to IPI, document No.: DMCA00048815.
- 3.4.10.3 Following the installation of the new engines the electrical equipment serving existing gensets must either be replaced or modified to meet the requirement for the new gensets and associated equipment.
- 3.4.10.4 The MCC No.1, MCC No.2, MCC No.3, MCC No.4, Port and Stbd Vital MCCs are responsible for the power supply of 600V/60Hz new electrical equipment.
- 3.4.10.5 120VAC must be supplied from existing 120VAC power distribution board in Engine room and 24VDC must be supplied from existing Engine UPS.
- 3.4.10.6 The two (2) existing Starting air compressors must be replaced. The two (2) new starting air compressors must be fed by the same feeders located at Port and Stbd Vital MCCs. Refer to IPI section 5.4.2.

- 3.4.10.7 The existing three (3) pre-lube oil pumps will be replaced by three (3) sets of new engine pre-lube oil pumps, and the power must be supplied from MCC No.3. Refer to IPI section 4.
- 3.4.10.8 Three (3) new engine preheaters units must be fed from MCC No.1 and No.2. Refer to IPI section 6.
- 3.4.10.9 Three (3) pcs of LT electronic thermostatic valves in the LT circuit and one (1) Central cooler valve must be provided 120VAC power which is from existing 120VAC power distribution board in Engine room. Refer to IPI section 6.
- 3.4.10.10 Three (3) turning gear for new Gensets must be added and fed from Port Vital and Stbd Vital MCCs. Refer to IPI section 10.8
- 3.4.10.11 Two (2) bearing pre-lube pump for each alternator (total six (6) pumps) must be added. The power must be supplied from MCC No.3. One starter is supplied per pump set of two.
- 3.4.10.12 Two (2) ventilation fans frequency converters for engine room with must be connected to MCC No.4 to replace the old supply fans in the engine room.
- 3.4.10.13 Some existing MCC feeder/breaker with starters must be modified to feeder/breaker to connect with the local starters (GSM). Refer to drawing 5659-85051-01 Electrical AC System - Single Line Diagram (updated with new consumers) and 5659-87152-02 600V_Main Switchboard-feeder for details. The Contractor must include an allowance of \$20,000.00 for the circuit breaker parts and components required to rebuild or reconfigure the various MCC breakers in this section. All labour required to perform these modifications must be separately provided and costed. The actual amount will be adjusted up or down via PWGSC 1379 action based on final invoice.
- 3.4.10.14 The Contractor must install new feeder circuit breakers and relevant cables must be replaced. Detailed information regarding the extent of changes can be found in the following documents:
- 5659-85051-01 - Electrical AC System - Single Line Diagram.
 - 5659-85051-03 - Electrical Load analysis - AC (for new consumers)
 - 5659-57452-01 - Ventilation System – Cable Diagram
 - 5659-60152-01 - Diesel engines/ME for propulsion - Cable Diagram
 - 5659-71152-01 - Lube Oil System - Cable Diagram
 - 5659-72252-01 - FW Cooling Systems - Cable Diagram
 - 5659-73152-01 - Compressed Air Systems - Cable Diagram
 - 5659-85052-01 - Cable list, including termination details
 - 5659-87152-02 - 600V Main Switchboard - Feeder Diagram
 - 5659-87452-01 - Motor and Starter List
 - 80-05 to 80-16 - Electrical One Line (existing document)
 - 80-02 - Electrical Load Analysis (existing document)
 - DMCA00048815 - Installation Planning Instructions (IPI)

3.4.10.15 The Contractor is provided the following non-exhaustive list of system modifications for the Electrical Distribution System. All redundant wiring for the following systems must be removed and the Contractor must supply and install new wiring as indicated below. The length of cables noted in the 5659-85052-01 Cable List are estimates based on a sister ship, the Contractor must confirm all cable lengths once the Contractor has determined final placement of equipment and routing of the cables. For bidding purposes, the contractor must include pricing for the supply and installation of all listed cabling lengths plus an additional 20 percent to account for any additional lengths deemed necessary on site. The Contractor must supply and install all material required to mount the GSM electrical boxes.

a) Wärtsilä 8L26 (3 units):

- 1) Mounting of three (3) new Power Unit boxes with 120v and 24VDC power supplies;
- 2) Mounting of three (3) new Wartsila Communication Boxes with 120v and 24VDC power supplies;
- 3) Replacement of all generator cables, including armoured main power (note cable schedule only states screened) , preheater and control cables to Main Switchboard and Power Management System;
- 4) Run new power supply cables to Engine Controls and Communication Boxes;
- 5) Run new communication cables from Gensets to Communication Boxes and Alarm and Monitoring System;
- 6) Run new cables to ECR Console Mimic Panel;
- 7) Run new cables to Woodward Communication Box in the Engine Room and AVR in Main Switchboard.

b) Starting air compressor, 600VAC (2 units):

- 1) Mounting of two (2) new starter boxes for the air compressors;
- 2) Run new power cables from new compressors to starter panels on MCC's;
- 3) Run new control cables from compressor to starter panel on MCC's.

d) Preheating unit, 600VAC (3 units):

- 1) Replace the existing breaker current trips;
- 2) Modify the breaker buckets for the new preheater control configuration;

- 3) Run new power cables to each of the new Preheating units. Generator #1 and #2 preheaters are from MCC1, Generator #3 is from MCC2;
 - 4) Run new control cables from main engines to Preheating units.
- e) Engine Pre-lubricating oil pump, 600VAC (3 units):
- 1) Mount three (3) new Pre-lubricating pump starter boxes and emerg. shutdown;
 - 2) Run new power and control cables from engines to starter and shutdown;
 - 3) Run all new power cables, all Generators are from MCC3.
- f) Engine Turning Gear, 600VAC (3 units):
- 1) Modify the breaker buckets for the new equipment configuration with three (3) new locally mounted starter boxes;
 - 2) Run new power cables to each of the new Engine Turning Gear starters, Generator #1 and #2 from the Port Vital MCC and Generator #3 from the Stbd Vital MCC, and from the starters to the Engine Turning Gears.
- g) Generator Lube Oil pump, 600VAC (6 units)
- 1) Mount three (3) new Pre-lubricating pump starter boxes;
 - 2) Run new power and control cables from generators to starter;
 - 3) Run new power cables from Generator Lube Oil Pump starters to MCC3.
- h) LT electronic thermostatic valves (for arctic operations) in the LT circuit for each engine, 120VAC (3 units):
- 1) Run new power cables from 120V panel to thermostatic valves;
 - 2) Run new control cables from engines to LT thermostatic valves.
- i) Central cooler valve, 120VAC (1 unit)
- 1) Run new power cables from 120V Power Supply to thermostatic valve controller;
 - 2) Run new control cables from engines and Central Cooler thermostatic valve to thermostatic valve controller.
- j) Engine Room Ventilation fans, 600V (2 units)

- 1) Two (2) VFD displays to be mounted in the control room;
- 2) Two (2) VFDs to be mounted in the engine room above Port Main Engine at the Engine Room Flat;
- 3) Mount new pressure control sensors and shutdowns and proceed to run cables to the VFDs and the ECR Console Mimic Panel;
- 4) Run new power cables from MCC4 to the VFDs;
- 5) Run new power cables from the VFDs to the fans;
- 6) Run new communication cables from the VFDs to the Alarm and Monitoring System.

- k) Mount and install CO2 bottles and piping for each of the generators per DMCA00001389 in the IPI.

3.4.11 *Electrical Cable Installation*

- 3.4.11.1 The Contractor must install all cables according to TP127E and in compliance with the requirements of ABS.
- 3.4.11.2 Systems which are disturbed must be tested before and after the conversion (fire detection, Public Address, lighting, emergency lighting and engine room alarm system) to confirm operation. The Contractor is responsible to isolate, tag, remove, store and reinstall all electrical components removed for this specification. The contractor must confirm all systems with shut downs are functioning upon re-installation.
- 3.4.11.3 Before any electrical works are started, all lock out and tag out procedures to ensure that power distribution is switched off must be followed.
- 3.4.11.4 Properly sized, certified marine approved cables must be supplied by the contractor and installed for all new electrical equipment, including all power cables. Details of the cable sizes are specified in the following documents:
- 5659-85051-01 - Electrical AC System - Single Line Diagram.
 - 5659-57452-01 - Ventilation System - Cable Diagram
 - 5659-60152-01 - Diesel engines/ME for propulsion - Cable Diagram
 - 5659-71152-01 - Lube Oil System - Cable Diagram
 - 5659-72252-01 - FW Cooling Systems - Cable Diagram
 - 5659-73152-01 - Compressed Air Systems - Cable Diagram
 - 5659-85052-01 - Cable list, including termination details
 - 5659-87152-02 - 600V Main Switchboard - Feeder Diagram
 - 5659-87452-01 – Motor and Starter List

- 3.4.11.5 In general, cables running in group must be fixed on steel hangers or trays and fastened as per ABS guidelines. Cable trays on weather deck to be of stainless steel. Section 4 of this specification must be followed with regards to cable terminations, cable marking and termination labels.
- 3.4.11.6 The contractor must follow existing cable routing wherever possible. The contractor must provide and include the cost for the supply, installation, packing and testing of ten (10) new S8x4, welded, complete Roxtec transit kits (Complete with frame, blocks, wedge kit, stay plate, lubricant etc.) as part of this specification item. The contractor must also provide a unit price per transit for adjustment purposes. The actual value will be adjusted by PWGSC 1379 based on the final installation requirements.
- 3.4.11.7 The Contractor must make necessary modifications to the lighting in engine room and casing to ensure proper light for safe operation, inspection, service and maintenance of all installations in the area is maintained after the conversion.
- 3.4.11.8 After the installation of the new Propulsion Generators, Auxiliary Generator & Cycloconverter units are complete, and prior to carrying out SOW item L-02 – Thermography Inspections – of this SOW, the contractor must supply and install new Fluke CLKT, Type: 3, 12 indoor/outdoor infrared windows, or approved marine grade equivalents, on these new units and on the transformers in the transformer room. The location of these installations on the new Propulsion Generator, Auxiliary Generator, Cycloconverter and transformer units must be confirmed with the Wartsila, CAT and ABB FSR's along with the ABS surveyor and the CCGTA/CE. The Contractor must include pricing for the complete supply and installation of 100 infrared windows to be installed on these units and provide a unit price per window. This final cost will be adjusted by PWGSC 1379 based on the final requirement.
- 3.4.11.9 After all of the electrical installations are complete, the contractor is responsible for carrying out all additional testing requirements and supplying all equipment, including load banks, necessary for testing the new system per DBAE591721 - 1100 Commissioning Manual. All testing and commissioning must be carried out under the supervision of the FSR and to the satisfaction of the CCG TA.
- 3.4.11.10 The contractor must supply all labour, equipment and materials required for load testing including cabling, connections and hardware (i.e. Belleville washers) needed to connect a suitable load bank (2 Mega Watt Resistive) to the load side of the Propulsion Breaker. The contractor must provide certified technicians to run all cabling and to remove the existing propulsion transformer leads from the propulsion breaker, connect the load bank to the breaker and return the propulsion transformer connections upon completion. The technicians must adjust the propulsion breaker instantaneous, long time, and slow time settings to match the load bank characteristics & return to "as found" settings once testing is completed. All rigging, crantage and labour required to successfully complete these testing requirements are the responsibility of the contractor and must be included in their pricing. This load bank requirement is based on a 7

day, continuous, testing period including 1 day for set up and 1 day for tear down. A unit price per day must be provided and the final cost will be adjusted by PWGSC 1379 based on the actual requirement.

4.0 PROOF OF PERFORMANCE

4.1 Inspection and Tests

- 4.1.1 Inspection, tests and trials of the Vessel, including the hull, machinery, equipment and outfits must be carried out by the Contractor in the presence of ABS, and the TA, throughout the construction period of the Vessel. The Contractor's inspection, tests and trial plans must comply with the requirements of ABS Rules and Regulations, the Wartsila IPI and Commissioning Plan.
- 4.1.2 The TA must be advised in advance of all inspections, tests and trials of the Vessel.
- 4.1.3 The Contractor must submit for approval to the TA and ABS the detailed schedule of the Inspection and Test Plan within 21 days of contract award, using document DBAE850131 - George R. Pearkes ITP as a basis.
- 4.1.4 Wärtsilä will have technical advisory personnel on site to provide technical assistance during the pre-commissioning, testing and commissioning of the equipment. Before start-up of any equipment, the Wärtsilä personnel will inspect the correctness of installation to ensure the safe start-up of the equipment. The Wärtsilä personnel will work in close cooperation with the Contractor and in liaison with the Owner's personnel prior to the start-up of the installation.

4.2 Test and Trials

- 4.2.1 Radiographic test, ultrasonic test or magnetic particle inspection for welds must be carried out in compliance with the requirements of the Classification Society and as detailed in this specification. The location and number of non-destructive testing (NDT) must be in compliance with the requirements of the Classification Society, or the CCG Welding Standard, whichever is more stringent. The NDT plan must be prepared by the Contractor and submitted to the TA and ABS for approval prior to starting removals. The TA must be notified when testing is complete. The inspectors must be qualified to the Canadian General Standards Board (CGSB) Standard CAN/CGSB-48.9712-2014 (Qualification and Certification of Non-Destructive Testing Personnel), at Level 2 or higher.
- 4.2.2 As detailed in Section 11.0 – Inclining Experiment, Trim and Stability Booklet – of this SOW item, an Inclining Experiment must be performed after the conversion in accordance with Section 12.0 – Commissioning - of this SOW item.
- 4.2.3 When the Vessels conversion is completed, sea trials must be carried out by the Contractor in accordance with the sea trial procedure, in order to demonstrate the full functionality of the newly installed system.

- Reference document - DBAE850131 George R Pearkes ITP

- 4.2.4 Sea Trial Plans must be prepared by the Contractor and must be submitted to the TA for approval, at least three weeks before the sea trials. The measurements must be conducted at defined conditions in terms of weather, draught and trim in accordance with the SNAME Guide for Sea Trials. These conditions must be recorded.
- 4.2.5 Any hull/propeller condition variation to the one recorded as stated in the previous paragraph (due to Owner's works during conversion process) must be recorded and noted prior to sea trials (for example hull polishing or painting).
- 4.2.6 The Contractor must confirm the fuel oil grade and quality to be used in the new Gensets with Wartsila and the TA, and the fuel must be analyzed prior to use in engines and report provided to the TA.
- 4.2.7 If any basic faults are found during the trials, the Contractor is obliged to repeat the trials in case of necessity within a reasonable period of time.
- 4.3 Commissioning
 - 4.3.1 The Contractor must perform the Commissioning in accordance with the Wartsila Commissioning Plan, and section 12.0 - Vessel Commissioning - of this SOW item.

5.0 Deliverables

5.1 Reports

- 5.1.1 The temporary openings in the hull must be inspected using Non-destructive testing on all weld joints of the vessel structure. The Contractor must deliver a report to the TA with the results of the NDT testing prior to the application of any hull coatings.
- 5.1.2 The Contractor must provide the TA and Wartsila Site Manager with a copy of the fuel analysis report for approval prior to the loading of fuel aboard the vessel.
- 5.1.3 Contractor must prepare a binder for the documentation of all Tests, Trials and Inspection Records performed pertaining to the installation of the propulsion generators. The binder must be indexed for each test, trial and inspection performed and any alterations / repairs made prior to the acceptance of this item. The records must include all relevant documentation, test procedures, associated test sheets, including shop test data, and test, trial and inspection data and observation results.
- 5.1.4 All original records of the test, trial and inspections must be signed by ABS, Contractor and where necessary by the sub-Contractor and FSR who witnessed the tests.
- 5.1.5 The Contractor must generate new "As-Fitted" drawings affected by the installation of the new propulsion generator system. At a minimum, this includes all ship's drawings detailed in section 2.3 – Drawings – of this SOW item. These drawings

must be provided in both electronic and hardcopy format. Electronic copies must be supplied in AutoCAD 2017 format – or later edition. Final versions for the drawings must be delivered to the TA and ABS. Copies of all ABS approved drawings must be delivered to the TA prior to completion of the contract. These drawings include, but are not limited to, all machinery space arrangements, mechanical deck layout drawings and all electrical and piping related drawings/documentation.

- 5.1.6 All drawings must be standard ANSI paper size and must be in, at minimum, AutoCAD 2017 DWG format, and conform to the CCG National CAD Standard [MECTS-#2860606- v1-National_CAD_Standards.
- 5.1.7 All electronic versions of drawings must be given a name such that the user does not have to open the drawing to establish the purpose of the drawing.
- 5.1.8 Copies of all disposal certificates detailing disposal of the oil are to be supplied to the TA.
- 5.1.9 The Contractor must supply a report indicating the cleanliness results after the oil system flushing process and present to the TA prior to the final system connections being made.
- 5.2 Spares
 - 5.2.1 All spares which have been supplied with this item and have not been used in the installation must be returned to the Owner prior to the acceptance of this item.
- 5.3 Certificates
 - 5.3.1 All original Class approval certificates for all system components supplied by the Contractor must be submitted to the TA prior to the acceptance of this SOW item.
 - 5.3.2 All original Class and mill certificates for all steel used must be submitted to the TA prior to the start of work on this SOW item.
 - 5.3.3 The Contractor must supply the following certification to the TA prior to the start of work on this SOW item:
 - a) CWB certification
 - b) Certification of the Marine Chemist
 - c) Certification for any technician conducting NDT testing.

E-02 CYCLOCONVERTER REPLACEMENT

1.0 SCOPE

- 1.1 All the T1100 vessels use cycloconverters to obtain the power conversion necessary to control the propulsion motors. A contract was awarded in 2016 to ABB Inc. to provide 12 “turn-key” cycloconverter systems complete with propulsion control levers (telegraphs), and generator Automatic Voltage Regulators (AVRs) for the six vessels. These systems were originally planned to be installed while the vessel was alongside at Canadian Coast Guard facilities.
- 1.2 Due to the scope of work being completed on the George R. Pearkes, it is necessary for the Canadian Coast Guard and ABB to deviate from the alongside turn-key installation and complete the Cycloconverter installation while the vessel is docked in a shipyard. The bulk of the technical work involved with the systems must be completed by ABB. The Shipyard must contract directly with ABB for their services.
- 1.3 A simplified break down of the division of work can be seen in the table below:

Shipyard	ABB On-site Team
Manage Dry Dock sequencing with ABB	Onsite planning
Supply Personnel Trailers	Equipment Supply
Supply Storage	Cable Supply including termination crimping
All Rigging, fitting, mounting and installation of new equipment in the Cycloconverter room tank top and propulsion motor room areas	Cable terminations
All Rigging and removals of existing equipment and all related disposals or packing of removed equipment	Equipment construction after mounting
Large Steelwork and Paint Restoration of the hull opening and tanktop/bulkhead areas	Regulatory Approvals for System Design
Tank Cleaning, Gas-freeing, Entry & Coatings	Equipment Programming and Commissioning
Confined Space Entry	Integration Engineering Support
All Piping system modifications	Remove Existing Cables
Area cleaning and garbage removal	Pull and label all cables (Power and Field Wiring)
Regulatory Approvals for Construction	MCC Modifications and Integration wiring
Small Steelwork (supply and installation of brackets, cable trays etc.)	AVR, Propulsion Control Levers and RCS System, Automation Enclosures Installs
Cable Transit Supply and Installation	
Modifications to MCR and Wheelhouse consoles/faceplates	
Identification, temporary removal, storage and re-installation of interference items (i.e. ductwork, sheathing, lighting etc.)	

- 1.4 This work must be carried out in conjunction with the following SOW items:

- 12.0 – Vessel Commissioning
- H-03 – Hull Cleaning and Coating

- H-04 – Bilge Cleaning and Coating
- E-01 – Propulsion Generator Replacement
- E-03 – Auxiliary Generator Replacement
- L-02 – Thermography Inspections

- 1.5 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 REFERENCES

2.1 Regulations

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

2.2 Standards

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

2.3 ABB Information

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2.4 Guidance Drawings and Manuals

Drawing/Document Number	Name
	ABB Technical Drawings/Manuals
3AFV0362131000820	Technical Cycloconverter Modernization Package
3AFV6105984	Cycloconverter System Integration Plan
3AFV0362132000001	Cycloconverter Drawings
3AFV0362132000101	Scope of Supply
3AFV0362132000401	One Line Diagram
3AFV0362132090200	Cabling Diagram
3AFV0362138000001	Control Units Diagrams and Drawings
3AFV0362138000201	Control System Functional Description
3AFV0362138000401	Control Topology
3AFV1162138100001	Control Layout Drawings
3AFV0362132000530	Dock Trial Specification Report
3AFV0362132000540	Sea Trial Specification Report
3AFV6077841	Cabling Instruction Guidelines
3BHS244888_E01 / ACS6000C Technical Description	Water Cooling System Manual & Technical Description
80 Packing Transportation Storage	Packing, Transportation & Storage Manual
ACS6000C Installation Manual_B	Installation Manual
ACS6000C Marine Cycloconverter Assembly Instructions	Assembly Instructions
3ADU170021W1000 (3 sheets)	Internal Connection Drawings (Including Cooling)
	Poseidon Marine Installation Drawings
21-085-001	Poseidon Marine Technical Drawing – New Cycloconverter Layout Arrangement
21-085-002	Poseidon Marine Technical Drawing – Temporary Hull Cutout for Cycloconverter Compartment
21-085-003	Poseidon Marine Technical Drawing – New Foundation/Seating Arrangement
	Vessel Drawings
555-H-0023 - 0025	General Arrangements, 3 sheets
555-H-0026	Capacity Plan
	Lay Out Arrangements, Machinery Compartments
50-00-01_01 & 02	Machinery Arrangements, 2 sheets
50-00-03_01 & 02	Machinery Arrangement Sections, 2 sheets
71-01-10	Central Cooling Diagram
	Main Structure

H-3_1 & 2	Profiles & Decks – ER/Tanktop and Main Deck, 2 sheets
H-2_1 - 3	Construction Sections, 3 sheets
H-0002	Framing Expansion
555-H-0003	Tank Top and Double Bottom Fr 70-106
555-H-0004	Engine Room Flats
555-H-0006	WT Bulkheads Below Main Deck
	Stability Documentation
555-H-0022	Docking Plan
H-0029_01 & _02	Lines Plans Fore & Aft
G009-Stability Book	Trim & Stability Booklet
	Electrical
81-01 – 81-05	Propulsion Power Block & Connections
86-01 - 86-20	Wireways and Electrical Layouts
E4064-E-12 (1-7) & E4064-E-22 (1-3)	ECR & Wheelhouse Elementary Wiring diagrams
80-01-01 – 80-57	Electrical One line Drawings and Fault Current Calculations

2.5 Government Furnished Equipment

2.5.1 Unless specifically noted within this SOW item, the contractor is responsible for supplying all labour, materials and equipment required to carry out the work detailed in this SOW item.

3.0 TECHNICAL

3.1 General

3.1.1 The following SOW item describes the specific roles and responsibilities of the shipyard for the cycloconverter systems, control levers, and AVR's installation. Unless otherwise noted, The Contractor must supply all documents, materials, equipment, and parts required to perform the specified work unless otherwise stated.

3.1.2 ABB Services - The Contractor must contract ABB directly for the installation of the Cycloconverters, Automatic Voltage Regulators, and Propulsion Control Lever (Telegraph) system. ABB will have up to 15 people on site during the installation. For a complete explanation of ABB's roles and responsibilities, excluding tasks mentioned below, please refer to <https://buyandsell.gc.ca> or contact the FSR as detailed in section 2.3 above. All costs for the services of ABB, including all

commissioning and testing requirements, must be included in the contractor's firm pricing along with an allowance for the technicians reasonably incurred travel and living expenses. Further details regarding the ABB FSR costs are detailed in Part A – General Information - of the SOW, Section 12.3.3.

- 3.1.3 The Contractor must provide and cost two (2) mobile office trailers along with a toilet facility with cleaning station for the ABB team and their sub-contractors for the duration of the Cycloconverter installation. The lockable trailers must have access to uninterrupted WIFI. Each trailer must be equipped with:
- a) 7 office work stations;
 - b) 7 chairs;
 - c) one office copier/printer/scanner;
 - d) a four (4) drawer filing cabinet, and;
 - e) HVAC systems for heating and cooling.

Note: Additional office requirements are detailed in the attached ABB Technical Cycloconverter Modernization Package

- 3.1.4 The trailers must have sufficient power supply for the equipment noted in this section, assuming one laptop powered at each work station, and be located no further than 150 meters from the vessel. Contractor facilities may be used in lieu of the trailers if the facility allows 24 hour access and is within 150 meters from the vessel.
- 3.1.5 The Contractor must include the cost of providing storage, in addition to that provided in section 3.5 of Specification item 3.0 - General Notes – of this SOW, for all equipment supplied by ABB. The total storage volume must be 150m³. If sea containers are used, 60m³ must be "High Cube" as the shipped cycloconverter cabinets are taller than the standard 2.59m container height. All storage must have lighting and the storage space environment must be maintained at a minimum of 15 Celsius and at a maximum relative humidity of 70 percent for the duration of the contract period. The Contractor must allow for uninterrupted access for ABB and CCG to these storage areas during the contract period. The contractor must reference the attached Packing, Transportation & Storage Manual titled "80 Packing Transportation Storage" for further details on the equipment storage requirements.
- 3.1.6 The Contractor must provide all required labour, materials, rigging, crantage, forklift and trucking requirements required for the ABB equipment and cabling once it has entered the shipyard until it is all installed on the vessel. This includes all requirements for the moving of parts and equipment around the contractor's facility, in/out of storage and on/off trucks. A complete equipment list and associated dry weights are included in the ABB Technical Cycloconverter Modernization Package. The contractor must note that there are approximately 30 spools of cable required to be stored and rigged aboard the vessel for installation.

- 3.1.7 The Contractor must provide and include pricing for all required labour, rigging, crantage, forklift and trucking requirements necessary for the removal and disposal of existing ship's equipment and cabling classified to be as Category C.
- 3.1.8 The Contractor must provide and include pricing in their bid for all required labour, crantage, rigging, forklift and trucking requirements necessary for the removal, temporary storage and final loading for transport off-site of existing ship's equipment classified as Category A.
- 3.1.9 The Contractor must include in their pricing for the cost of supply, installation, packing and testing of the following:
- Fourteen (14) new S8x1, welded Roxtec transit kits (Complete with frame, blocks, wedge kit, stay plate, lubricant etc.), or certified equivalent, complete with the compatible blocking systems.
 - Twelve (12) new S6x1, welded Roxtec transits kits (Complete with frame, blocks, wedge kit, stay plate, lubricant etc.), or certified equivalent, complete with the compatible blocking systems.
 - Eight (8) new S4x1, welded Roxtec transit kits (Complete with frame, blocks, wedge kit, stay plate, lubricant etc.), or certified equivalent, complete with the compatible blocking systems.

These transits will be installed in the converter room bulkheads, deckhead, foundations, motor room, control room, engine room, through the upper deck cable trunking and in the bridge/crawlspace areas. A unit price for the supply and installation of each of these transit kits (complete with all the necessary hardware for blocking) must be included for the purpose of adjusting the final price by PWGSC1379 action based on the actual requirement. Further detail on the electrical requirements are detailed in the ABB Technical Cycloconverter Modernization Package, Installation Manual, Integration Plan, electrical drawings 3AFV0362132000401, 3AFV0362132088201, 3AFV0362132090200, 3AFV0362138000001 and in the attached Poseidon Marine Technical Drawings.

3.2 Existing Cycloconverter Removals

- 3.2.1 The Contractor must include and provide pricing for the removal of the following equipment from the vessel and their disposal according to applicable by-laws:
- a) Port and Stbd Cycloconverters – as Category “C” equipment;
 - b) Dynamic Brake Resistor and GE Test Cabinet– as Category “C” equipment;
 - c) Harmonic Filters – as Category “C” equipment;

- d) All water piping, supports and brackets in the cycloconverter compartment– as Category “C” equipment. New cooling water piping from the aft to forward compartment bulkhead penetrations must be fabricated, installed and tested as detailed in section 3.4.8 of this SOW item.
- e) Checkered plating and framing/brackets
- f) Mounting brackets and supports for tools located on the aft bulkhead of the cycloconverter compartment.

- 3.2.2 The CCG will remove specific components from the cycloconverter cabinets to save as spare parts upon arrival at the Contractor's facility. Once these items are removed, all remaining cycloconverter parts become Category “C” as noted above. The Contractor must confirm with the CCGTA before commencing the cycloconverter removal process.
- 3.2.3 The contractor reference the attached ABB Cycloconverter Modernization Package, System Integration Plan, Installation Manual and the Poseidon Marine Technical Drawings for more specific details regarding preparation, removals and stripout requirements. All removals must be carried out under the direction of the CCGTA and ABB FSR.
- 3.2.4 The existing foundation seats must be removed in their entirety and ground flush to the tanktop. All existing deck plates, framing and unused supports and brackets, etc. must be removed and disposed of in their entirety and ground flush to the tanktop.
- 3.2.5 The Contractor must prepare and perform 100 NDT shots of the tank top in the cycloconverter room to assess the condition of the tank top plate and a minimum of 14 NDT shots of every frame bracket just above the tank top from frame 55 to 69, as directed by the CCGTA. A unit price per NDT shot including surface preparation must be included for adjustment purposes up or down via PWGSC 1379 action. The results of the NDT tests must be presented to the TA for evaluation at least four (4) weeks prior to the installation of the cycloconverter foundations in the event any material requires replacement.
- 3.2.6 In addition to the permanent removals of existing category “C” equipment, it is the responsibility of the contractor to identify all temporary interference items under the direction of the ABB FSR, categorized as “B” equipment. This includes but is not limited to the following:
- Armoured insulation, wall panels and deckhead panels
 - Existing piping – This includes all overhead piping and piping located under the deck plates below the cycloconverter units in the cycloconverter compartment
 - Re-usable electrical cabling and electrical equipment

- Ductwork and related ventilation trunking in the cycloconverter compartment, transformer/control rooms and landing, motor room and wheelhouse/crawlspace areas.
- Mechanical equipment

This equipment must all be temporarily removed, stored, labelled, re-installed and tested on the vessel at a later date in order to carry out the work detailed in this SOW item.

- 3.2.7 The requirement for any new ventilation or piping fabrication or modifications based on temporary removals must be confirmed on site. If new sections are required to be fabricated and installed or permanently modified, this will be covered by PWGSC 1379.
- 3.2.8 The Contractor must repair all damages and test all equipment that is disturbed and all equipment dependent on disturbed piping and wiring in accordance with the vessel's standard operating procedures for the specific equipment.
- 3.2.9 All vessel equipment, parts and spaces must be properly protected from all work debris. Any damage to the vessel, parts or equipment due to the contractor will be repaired or replaced at the contractor's expense.
- 3.2.10 After all removals are complete, the ABB FSR will review the room structure and layout to confirm the final routing of the new cabling and location of transits.

3.3 Temporary Hull Access Insert

- 3.3.1 The contractor must cut a temporary access hole insert in the port side hull of the cycloconverter compartment for the installation of the new cycloconverter cabinets and related equipment as per the attached Poseidon Marine technical drawing # 21-085-002. The engine room access hole for the Propulsion generators and Auxiliary generator installations must not be used for work on this specification item.
- 3.3.2 The contractor is responsible for all safe work requirements to be carried out prior to beginning any hot work in or around the cycloconverter area. This includes the opening, cleaning and gas freeing of any tanks or bilge areas around where hot work is required. This includes, but is not limited to, the #3 Bilge retention tank, Stbd DB WB tank and pipe tunnel located under the cycloconverter compartment and the port side tanks where the temporary insert will be required. The contractor must reference the attached Poseidon drawing # 21-085-002 and ships drawing 555-H-0026 – Capacity Plan for reference.
- 3.3.3 Any tanks or confined spaces affected in way of steelwork in this specification must be inspected and pneumatically tested to the satisfaction of the ABS surveyor and the CCG TA.

- 3.3.4 The contractor must proceed to temporarily remove, store and replace all interference items in way of this insert as detailed above in section 3.2.6. The contractor must pay close attention to the temporary removal of electrical equipment required for this hull insert. All removed insulation must be replaced with new, marine grade equivalent as per the vessel's insulation plan and all disturbed equipment and related systems must be fully tested after re-installation in accordance with the vessels standard operating procedures for the specific equipment.
 - 3.3.5 The contractor is responsible to effectively cover over/hoard in this insert when rigging operations are not being carried out; it is the responsibility of the contractor to protect the vessel, equipment and parts from ingress of potential weather or debris and provide all necessary heating requirements. Any damage to vessel parts or equipment will be repaired or replaced at the contractor's expense.
 - 3.3.6 The temporary opening must be closed back after completion of the conversion work with full penetration welding and approved CWB welding procedures. Non-destructive testing must be carried out to the weld joints of the insert panels to the vessel structure by an inspector qualified to the Canadian General Standards Board (CGSB) Standard CAN/CGSB-48.9712-2014 at Level 2 or higher.
 - 3.3.7 All welds must have 100% visual inspection. All Hull plating and all strength and structural members must be tested with 100% UT and all remaining welds are to have 100% MPI in accordance with the Rules and Regulations of ABS prior to any coatings being applied.
 - 3.3.8 Preparation and painting of the jointing area must be according to the Coast Guard's "Paints and Coatings Standard", document No. 18-080-000-SG-003 and in accordance with the paint manufacturer's instructions. The external hull area must be prepped and coated as per SOW item H-03 – Hull Cleaning and Coating - and the internals must receive, at a minimum, two coats of marine grade primer with a suitable top coat matching existing. Tank Coating repairs must be carried out as detailed in SOW item H-11 – Void and Ballast Tank Surveys.
- 3.4 Installation of the New Cycloconverter Units
- 3.4.1 The Contractor must include the provision to rig, install/mount the new cycloconverter cabinets and related system equipment in the vessel as referenced in Poseidon Marine Drawing # 21-085-001 and detailed in The ABB Cyclo Modernization Package, System Integration Plan and Installation Manual. The installation route must be through an access cut through the ship's port side (outboard of the cycloconverter room) as described in the attached Poseidon Marine technical drawing # 21-085-002. The hole in the vessel's side for the Main

Engine and Auxiliary Generator must not be used for the cycloconverter or associated equipment.

- 3.4.2 Hold Point – Prior to any work starting on the Cycloconverter foundation, the Converter room floor/tank top must be inspected by the CCG TA and/or the ABB representative) and assessed for stiffness. NDT must be carried out as noted in section 3.2.5 above. If new stiffening or additional steel repairs are required, it must be carried out by the contractor and addressed by way of PWGSC 1379 action.
- 3.4.3 After all tanks in way of the cycloconverter compartment area have been opened, cleaned and gas freed as noted previously in section 3.2, the contractor must proceed to construct permanent foundation seats for the new cycloconverter cabinets and permanently mount these new seats to the tank top of the double bottom tank as per the attached Poseidon Marine Drawings # 21-085-003. The contractor must reference the attached ABB Installation Manual and Cycloconverter Modernization Package for further details on the seat foundation and equipment installation requirements.
- 3.4.4 The foundation must completely seal off the bottom of the cabinets to the surrounding area as they form part of the Ingress Protection rating for the cabinets. The contractor must supply all required equipment and materials for this fabrication and installation and must adhere to the tight tolerances required for the foundation top plate.
- 3.4.5 Hold Point - After the new foundation seats have been installed on the tank top, the entire tank top of the cycloconverter compartment, bilge well, brackets, foundations, framing, seating and bulkheads from the tank top to 24" up from the tank top, or as directed by the CCGTA, must be suitably degreased, pressure wash cleaned, prepared and coated as per the bilge coating requirements described in SOW item H-04 – Bilge Cleaning and Coating – prior to the installation of the new cycloconverter units. This application must be carried out to the satisfaction of the CCGTA and NACE inspector.
- 3.4.6 After all coating work is cured and complete, the contractor must proceed to mount each cabinet into place on the foundations and fasten in place under the direction of ABB and the CCG TA. The cycloconverter cabinets, including the auxiliary transformers, UPS, harmonic filters and all other related equipment must reference the attached Poseidon Marine Technical Drawing # 21-085-001 for installation requirements. All equipment and system components must be suitably mounted and supported in place by the contractor. Seating and foundation arrangements must be fabricated or modified for each unit prior to installation, as further detailed in section 3.5.6 of this specification. This must all be carried out under the guidance of the on-site ABB team and is further detailed in the attached Installation Manual and ABB Cycloconverter Modernization Package. All equipment must be installed and mounted to the satisfaction of the CCGTA and ABB FSR.

- 3.4.7 After the cabinets and all related system equipment have been fastened in place, the contractor must supply and install marine rated, ABB approved anti-vibration mounts for the top connections of each cabinet and proceed to fasten each converter top of to the deck head. These mounts must be securely installed and fastened by the contractor to the satisfaction of the ABB FSR and CCGTA.
- 3.4.8 The contractor is responsible for fabricating and installing new cooling piping in the cycloconverter compartment to allow for the bottom cable entry of the new units and to connect the freshwater cooling lines. The Contractor must supply, fabricate and install new cooling lines that run from the existing cooling piping into each of the cycloconverter bases as referenced in the attached Poseidon Marine technical drawings. The contractor must also reference “Chapter 2 – Mechanical Installation” of the Installation Manual, the ABB Cycloconverter Modernization Package, Installation/Integration manuals and Cooling Water system documents 3BHS244888_E01 / ACS6000C Technical Description for further detail on the system cooling requirements. Further details on the existing vessel cooling piping arrangement is provided in drawing 71-10-01 – Central Cooling Diagram.
- 3.4.9 All new piping must be suitably supported to the satisfaction of the CG TA and ABB FSR with new brackets/hangars/supports. For estimating purposes, the contractor must include pricing for the supply, fabrication, installation and testing of the following cooling pipe in the cycloconverter compartment:

- 100 ft. – 2” sched. 80 black iron pipe, including all elbows, flanges, fittings, brackets and hardware/fasteners.
- 3 - 2” SDNR valves
- 3 – 2” flanged, lockable gate valves
- 4 – ½” threaded Brass gate valves
- 4 – 9” dual reading adjustable angle thermometers and thermometer wells
- 8 – 2 ½” pipe flanges for socket weld
- 4 – 2” piping for socket weld to fit ABB flanges on flex lines from coolers.
- 4 - Flexible pipe pieces, PN16, each 8 feet long, with NS32 PN16 flanges at both ends
- 4 – New flow switches. 2 Required at the propulsion motors.

Note: These lengths and sizes are estimates based on similar installations. Actual piping/fitting requirements must be confirmed by the contractor on site. The contractor must provide a unit price per ft. for the supply/installation of 2” pipe and fittings for adjustment by PWGSC 1379 based on the actual requirement.

- 3.4.10 All new cooling piping must be pneumatically tested to the satisfaction of the CCGTA and the ABB surveyor prior to installation on the vessel. After the successful installation on the vessel, the entire piping system must be flushed to be checked for leaks. All welds to receive 100% visual inspection and to be tested

with 100% MPI. Any deficiencies or repairs detected are to be corrected at the contractor's expense.

- 3.4.11 The contractor must fabricate, mount and install 2 leakage trays for under the cycloconverter pumps as detailed in "Chapter 2 – Mechanical Installation" of the Installation Manual.
- 3.4.12 After all piping is installed, it must all be leak tested to the satisfaction of the CCG TA and ABB on site team. All areas of paint disruption due to hot work and modifications must receive, at a minimum, 2 coats of marine grade primer and 1 topcoat to match existing colour scheme.

3.5 Electrical

- 3.5.1 The Contractor must construct and install new cable wire ways as detailed in the "Chapter 3 – Electrical Installation" of the ABB Installation Manual and the Integration Plan. Further details regarding the cabling/electrical installations are included in the ABB drawing documents 3AFV0362132000401, 3AFV0362132088201, 3AFV0362132090200 and 3AFV0362138000001. As the exact layout of the new cable trays and cable routing is not entirely known due to interference items and the new design of the converter doors, the contractor must include an allowance of 160 hours for all labour regarding re-routing assistance, cable tray and new cable support installations under the guidance of the ABB on-site team. This allowance is for labour assistance with cable routing only, as the cable tray supply must be included in the contractor's pricing as per section 3.5.3 of this specification. These hours must be tracked and agreed upon by the CCG TA and yard representatives and will be adjusted by PWGSC 1379 based on the actual hours required.
- 3.5.2 The Contractor must include the provision to construct and install new cable wire ways, complete with bracing, down the inboard ends of the cycloconverter compartment. All metal needed to support the cable trays must be supplied by the Contractor and coated upon completion.
- 3.5.3 The contractor must supply all angle iron, flat bar, misc. brackets and welding materials and equipment required for the installation of all cabling supports. The following is a list of Thomas and Betts material that the Contractor must supply and install for the cable trays:

Cat. No	Quantity needed
SH1309V-3	22pcs
SH1312V-3	24pcs
SH3418L06-3	10pcs
SH3424L06-3	12pcs
SH3742S-3	4pcs
SHF418LHB9012	6pcs
PREFIX-6-SB SHW	8pcs
PREFIX-3-ESP SHW	34pcs
PREFIX-4-ESP SHW	24pcs

- 3.5.4 The Neutral Ground Resistor, Dynamic Brake, DCT880 Drive Module, Harmonic Filters, and Excitation Transformers and all other related system equipment must be installed as per the attached Poseidon Marine Equipment Layout drawing # 21-085-001 and the ABB Cycloconverter Modernization package.
- 3.5.5 The Contractor must provide all rigging and labour required to transport, rig and install the two (2) Harmonic Filters, one (1) dynamic brake module, (2) neutral ground resistors, (1) DCT880 drive module, two (2) excitation transformers and associated system equipment in the cycloconverter and propulsion motor room areas.
- 3.5.6 The checkered deck plates and related supports in front of the harmonic filter cabinets must be lowered and modified by the contractor to allow proper opening/closing of the new harmonic filter doors. There is an additional pipe above the starboard side harmonic filter that must be temporarily removed and modified by the contractor prior to re-installation to allow for the new, higher harmonic filter cabinets (They are approx. 2300 mm in height). The contractor must modify the existing bedding/seating arrangements to suit the new harmonic filter units on both the port and starboard sides of the propulsion motor room. The Contractor must work with ABB to fabricate and install new steel beddings/seats and mounting arrangements for the neutral ground resistors, dynamic brake, DCT880 drive, and excitation transformers. All unused foundations, bracketing, etc. to be removed, disposed of and ground flush prior to coatings. These locations are further detailed in the attached Poseidon Marine Drawing # 21-085-001 and the ABB Installation Manual.
- 3.5.7 There are two (2) valve handles, one located in front of each of the harmonic filter units, that the contractor must modify in way of the new, lowered deck plates that must be installed to accommodate the new harmonic filter installations.
- 3.5.8 All of the seats/mounting assemblies must be fabricated, installed and properly coated with two coats of primer and white top coats prior to the installation of these units. Any additional preparatory work required for these units must also be completed prior to rigging any of the equipment into the room or mounting them to their seats.

3.6 New Deck and Lighting Requirements

- 3.6.1 Upon completion of the Cycloconverter cabinet installations, the Contractor must supply and install four (4) new lighting fixtures above the center corridor of the converters. These fixtures must be Glamox certified, Marine grade, explosion proof lighting for mechanical areas or CCG/ABS approved equivalent. All new cabling, breakers and mounting support requirements must be supplied, mounted and installed by the Contractor. A new circuit must be supplied, installed and tested using the existing panels and breakers in the cycloconverter/engine room compartments. Due to interference issues, the Contractor must also provide and cost out relocating five (5) existing lights to nearby locations with new brackets and removal of existing brackets, as determined by CCGTA.
- 3.6.2 Upon completion of work in the cycloconverter compartment and the re-installation and testing of all temporarily removed and stored items, the contractor must supply, cut, fit and install all new aluminum checkered deck plating and related supports/brackets for the entire cycloconverter compartment and alleyway area. All new steel supports, brackets and angles must be coated as detailed in section 3.4.5 of this SOW item.
- 3.6.3 Under the direction of the CCGTA, the contractor must proceed to re-install all removed tool mounting support brackets on the cyclo converter compartments aft bulkhead. These are made up of steel flatbar, angle iron and roundstock. Upon completion of welding, these brackets and all disrupted coatings must be cleaned, loose edges prepped and coated with 2 coats of marine primer and two top coats of corresponding marine grade white paint.
- 3.6.4 The contractor must also supply and install all new IEC 61111:2009 (Or North American Equivalent) High Voltage Isolations mats for the entire room. These mats must be class approved.

3.7 Wheelhouse and MCR Consoles/Controls

- 3.7.1 The contractor must make modifications to the consoles in both the MCR and in the wheelhouse areas to accommodate the new propulsion console desktop controls. The contractor must reference attached ABB drawings 3AFV1162138100001, 3AFV0362138000001 and the installation/integration plan/manual for further specific details regarding the new controls and mounting arrangement requirements.
- 3.7.2 The contractor is responsible for the identification, removal, temporary storage, re-installation and testing of any interference items, specifically electronics, cabling and equipment inside of the consoles and underneath the wheelhouse in the crawlspace under the direction of the ABB FSR and CCGTA. The contractor must suitably protect all equipment and parts from any potential damage caused from

any work being detailed in this SOW item. As new transits and cable trays will be required in the crawlspace below the wheelhouse, the contractor must take extra caution to suitably protect all electronics and related equipment prior to starting any hot work activities. Any damage to existing or new vessel parts or equipment must be repaired or replaced at the expense of the contractor.

- 3.7.3 In the Wheelhouse, the contractor must remove of the existing propulsion controls/faceplates from the centre, port and starboard wing console locations to accommodate the installation of the new units.
- 3.7.4 The contractor must fabricate and install 3 black anodized aluminum desktop plates, complete with cutouts, for the installation of the new controls into the consoles under the direction of the ABB FSR and CGTA.
- 3.7.5 In the MCR, the contractor must remove the existing controls/faceplates to accommodate the installation of new units.
- 3.7.6 The contractor must fabricate and install new black anodized aluminum desktop plates, complete with cutouts, for the installation of the new controls into the console under the direction of the ABB FSR and CGTA.
- 3.7.7 All new controls and related equipment must be mounted and installed under the direction of the ABB FSR. The contractor must reference documents 3AFV1162138100001 – Control Layout Drawings, 3AFV6105984 – System Integration Plan and the Installation Manual for all new GSM supplied equipment/controls being mounted. All work must be carried out to the satisfaction of the ABB FSR and CGTA.

4.0 PROOF OF PERFORMANCE

4.1 Inspections

- 4.1.1 All work must be witnessed by the Technical Authority and the attending ABS surveyor.
- 4.1.2 All stages of the prep work and coating application must be inspected and approved by the CCGTA and NACE inspector.

4.2 Testing

- 4.2.1 The Contractor must provide NDT testing report/certificate on the hull cut out once reinstalled along with NDT reports for any other steel work that arises.
- 4.2.2 The Contractor must provide a water test of the Vessel's Fresh Water cooling system at 125% working pressure, highlighting the changes made with the

cycloconverter connections. Any leaks must be corrected at the Contractor's expense.

- 4.2.3 The Contractor must provide an air pressure tests of all affected tanks and confined spaces affected by the work in this specification.
- 4.2.4 Thickness measurements must be taken between coatings to ensure manufactures recommended DFT readings are being obtained. The Contractor must also be responsible for providing batch numbers and recording the environmental conditions and temperatures (both ambient as well as steel surface temperature) to ensure that the paint application(s) is being applied in accordance with the manufacturer's requirements for the type of paint being used.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 One copy of gas free certificates for each tank must be given to the CCGTA prior to workers entering the tank and a copy of each certificate must be posted in close proximity to the entry point for each tank.
- 5.1.2 The Contractor must generate new "As-Fitted" drawings for all documents affected by the installation of the new cycloconverter system. At a minimum, this includes all affected drawings detailed in section 2.4 – Guidance Drawings – of this SOW item. These drawings must be provided in both electronic and hardcopy format. Electronic copies must be supplied in AutoCAD 2017 format – or later edition. Final versions for the drawings must be delivered to the TA and ABS. Copies of all ABS approved drawings must be delivered to the TA prior to completion of the contract. These drawings include, but are not limited to, all machinery space arrangements, mechanical deck layout drawings and all electrical and piping related drawings/documentation.
- 5.1.3 All drawings must be standard ANSI paper size and must be in, at minimum, AutoCAD 2017 DWG format, and conform to the CCG National CAD Standard [MECTS-#2860606- v1-National_CAD_Standards.
- 5.1.4 All electronic versions of drawings must be given a name such that the user does not have to open the drawing to establish the purpose of the drawing.
- 5.1.5 The Contractor must provide a Quality Assurance (QA) type written report recording the humidity and air/surface temperatures pre-coating and during coatings cure time as well as the DFT of each paint coating application.

E-03 AUXILIARY GENERATOR REPLACEMENT

1.0 SCOPE

- 1.1 The intent of this SOW item must be to remove the existing Caterpillar 3508 marine generator set located on the starboard tweendeck of the engine room and to replace it with an Owner-supplied Caterpillar C32 marine generator set. This specification includes reference drawings from Poseidon Marine Consultants to go along with this SOW item.
- 1.2 This work must be carried out in conjunction with the following SOW items:
- 12.0 – Vessel Commissioning
 - H-03 – Hull Cleaning and Painting
 - H-04 – Bilge Cleaning and Painting
 - E-01 – Propulsion Generator Replacement
 - E-02 – Cycloconverter Replacement
 - L-02 – Thermography Inspections
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this specification item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 REFERENCES

2.1 Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Canada Shipping Act - Tackle Regulations
- c) Canada Shipping Act – Marine Machinery Regulations
- d) Canada Shipping Act - Hull Inspection Regulations
- e) Canada Shipping Act – Safe Working Practices Regulations
- f) Maritime Occupational Health and Safety Regulations
- g) ABS Rules and Regulations

2.2 Standards

- a) CCG Fleet Safety Manual (DFO/5737)
 - b) IACS No. 47 - Shipbuilding and Repair Quality Standard
 - c) TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
 - d) IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
 - e) IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
 - f) IEC 60092-504-Electrical Installations in Ships – Part 504: Special Features – Control and Instrumentation
 - g) IEC 60533 – Electrical and Electronic Installations in Ships – Electromagnetic compatibility
 - h) CSA W59-08 (R2008) - Welded Steel Construction
 - i) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
 - j) Society for Protective Coatings (SSPC) Standards
 - k) CCG Welding Specification (CT-043-eq-eg-001-E)
- Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Drawings

- Ref. Doc No.1-6,10-16 (Note: this document is a package which includes George R. Pearkes as fitted drawings, C32 manual and a dimensional drawing for the existing Cat 3508).

2.3.1 Poseidon Marine Drawings:

- 21-172-001 – Rigging/Installation Technical Specification
- 21-172-100 – Lifting Arrangement
- 21-172-101 – New Seating Arrangement

2.3.2 Madsen Documentation:

- TR408828 - Pre-Work Package CCGS George R. Pearkes
- 407790 - Kopit Hopson-C32 CABLE PLAN REV 1.1 – This document is to be used as a guide and reference only as it details a similar cable layout on a sister ship

2.3.3 The contractor Must reference the following vessel baseline drawings:

Drawing Name	Drawing Number
Ship ser switchboard 600v.1600a 3ph.3w. 5 sect.indoor s	30300.0D02-1

Ship ser switchboard 600v.1600a.3ph.3w. 5 sect. indoor s	30300.0D02-2
Ship ser switchboard 600v.1600a.3ph.3w. 5 sec. indoor s	30300.0D02-3
Fault Current Calculation	80-01
Electrical load analysis	80-02
Circuit breaker coordination curve	80-03
Ship service switchboard one line diagram	80-06
Power deck plan engine room flat	80-29
P-106 & P-621 Ant condensation heaters	80-54
Automation control diagrams (Aux Gen Connection Diagram)	81-06 Sheet 9
Monitoring control diagram (Aux Gen Control Panel)	81-07 Sheet 21
Schematic diagram for Ships Service. switch. 600v 1600A;3 Phase 3 Wire 52-AG	SW-02-30300-D501
Machinery arrangement	50-00-01
Diesel and Boiler Exhaust Piping	63-10-01
Funnel (3 sheets) Sheet 1 of 3 – Piping, Sheet 2 of 3 Ventilation, Sheet 3 of 3 Ladders and gratings.	70-06-01
Central cooling. Includes emergency sea water cooling	71-10-01
Change over auxiliary generator cooling water supply	71-10-sk46
Fuel Oil Service	74-00-01
Compressed Air System	76- 00-01
General Arrangements	555-H-0023-0025

2.4 Government Supplied Materials

2.4.1 The Owner will supply (x1) Cat C32 SCAC Package Generator Set - 500kW,600V, 60Hz.

2.4.2 The Owner will supply expansion joints for the initial section of exhaust piping coming from the new unit.

2.4.3 Unless specifically noted within this specification, the contractor is responsible for supplying all labour, materials and equipment required to carry out the work detailed in this SOW item

2.5 FSR Info

- **FSR – Toromont CAT** – To serve as the primary FSR contact to oversee the installation, testing and commissioning of the new auxiliary generator.

Atilla Szilagyi
 Project Manager, Toromont Power Systems Cat
 Telephone: 905-488-2573
 Mobile: 416-435-3426
 Email: ASzilagy@toromont.com

- **FSR – Madsen** – To serve as the primary FSR to oversee and assist the contractor in carrying out the integration and configuration of the new unit into the vessel's Woodward engine control system and assist with the upgrading and integration of the Trihedral alarm and monitoring system (AMS). Additional details regarding commissioning requirements is included in Part A Section 12.0 – Commissioning - of this SOW.

Donald Bradley - Manager, Controls and Engineering, Madsen Diesel and Turbine
141 Glencoe Drive
Mount Pearl (St. John's), NL A1N 4S7
Canada
T: (709) 726-6774
C: (709) 697-0201
E: Donald.Bradley@madsen.ca

3.0 TECHNICAL DESCRIPTION

3.1 General

- 3.1.1 The Contractor must supply the services of a Toromont FSR for guidance and supervision in overseeing the installation, testing, and commissioning of the new C32 auxiliary generator set. The Contractor must include an allowance of \$50,000.00 to cover the services, authorized travel and living expenses reasonably and properly incurred in the performance of the work, of a Toromont FSR. This allowance will be adjusted by PWGSC 1379 based on final invoice.
- 3.1.2 Madsen FSR's will be required to oversee and carry out the terminations and integration of the new C32 into the vessels Woodward engine controls and alarm and monitoring system. Full details regarding Madsen's scope of work is detailed in the attached document "TR408828 - Pre Work Package CCGS George R. Pearkes." All costs for the services of the Madsen FSR's, including all commissioning and testing requirements, must be included in the contractor's firm pricing and travel and living allowance as detailed further in SOW Part A, Section 12.3.4.
- 3.1.3 Any FSR allowances, as detailed in the General Section of this SOW item, will be adjusted by PWGSC 1379 based on final contractor invoicing. It is the responsibility of the contractor to organize and arrange FSR visits/inspections as required. Any excess costs due to planning or coordinating issues will be paid at the contractor's expense. If there are delays as a result of Contractor's scheduling

of work or extra costs due to excess FSR down time, then the Contractor must be responsible for covering any additional costs associated with retaining the required FSR's.

- 3.1.4 The Contractor must include their firm pricing for the complete disconnection, removal and disposal of the existing main power cables and for the supply and installation of new power cables for the new Auxiliary Generator unit. These new cables must be 300x500 MCM, or compatible approved equivalent, Marine Grade, Class Approved, Armoured, multi-conductor cables. These cables must be, at a minimum, 0.6/1kV 110c of a low smoke zero halogen (LSZH) designation and must follow the existing cabling route from the Auxiliary Generator into the Auxiliary Switchboard located in the Main Control Room. This cabling must be properly installed and secured with all new, contractor supplied class approved securing straps, stainless steel cable trays and metal glands. These cables must be terminated as referenced in Marine Electrical Standards and Regulations detailed in item 3.3.2 of Section 3.0 – General Notes – of this SOW. Any transits that are opened/disrupted from this cabling must be re-packed with new class approved, compatible blocking system. The contractor is to include pricing for 3 runs of this power cabling at approximately 50 metres of length each (150 metres total). These lengths are estimates and must be confirmed by the contractor prior to ordering/installing. The contractor must include a unit price per metre for the supply and installation of these cables and the total cost will be adjusted by PWGSC 1379 based on the actual requirement. All work must be carried out by the contractor under the direction of the Madsen and CAT FSR's and the CCG TA.
- 3.1.5 In addition to the supply and installation of new power cabling, the Contractor must include a separate \$30,000.00 allowance for the supply and installation of any other new miscellaneous wiring, glands or securing straps required as part of this installation. This allowance will be adjusted using form PWGSC 1379 (see Annex F for procedure) and must be included in the overall bid price. Costs against this allowance must be tracked regularly and agreed upon by the CCG TA and the yard representatives based on actual hours worked and material invoices. Any new control cables, supplied by Contractor, must be 0.6/1kV 110c of a low smoke zero halogen (LSZH) designation, and must also be braided/armored unless otherwise identified in the wiring specification. Glands utilized to secure cables must be of a metal construction. Fiber or composite glands are not acceptable. Routing of cables must be identified by the Technical Authority and FSR in conjunction with the Contractor. The Contractor must test all power and motor feeds insulation to ground and record readings with the Technical Authority present.
- 3.1.6 The Contractor must include a \$25,000.00 allowance for modifications to the existing piping systems that are currently unknown and will be required as part of

the new Auxiliary Generator installation. It is intended the Contractor will perform the modifications and connections in consultation with and to the satisfaction of the Technical Authority and Caterpillar FSR. This allowance must include chemical pickling, gaskets, brackets, fasteners as well as the application of 2 coats of primer and 2 topcoats. This allowance is for the fabrication/modification of new piping sections to tie directly into the new C32 unit only. This allowance does not include temporary piping removals and re-installations or any other work detailed in this SOW item. These costs must form part of the contractor's firm pricing for this specification item. All costs against this allowance must be tracked regularly and agreed upon by the CCG TA and the yard representatives. The final cost for this item will be adjusted by PWGSC 1379 based on actual agreed upon hours worked and material invoices.

- 3.1.7 As noted, the allowances in items 3.1.5 and 3.1.6 will be adjusted by PWGSC 1379 (See Annex F) based on actual hours worked and material invoicing.
- 3.1.8 The Contractor must supply all equipment, enclosures, ventilations, staging, chain falls, craneage, slings and shackles necessary to perform the work. All lifting equipment must be appropriate for the expected duties and be accompanied by current certifications indicating, or be permanently marked as to being, of an adequate safe working load for the expected duties. Any brackets or other welded attachments required in the performance of this specification must be welded into place by CWB certified welders certified to the above-noted welding standards.
- 3.1.9 The contractor must carry out all safe-work requirements for this SOW item. Prior to any hot work taking place, the Contractor must ensure that the area of work and any adjacent space is certified as gas free and suitable for hot work. All tanks, bilges and spaces affected by this installation must all be opened, cleaned, gas-freed and tested again each day that personnel are required entry in the space. The Contractor is responsible for maintaining an adequate fire watch during the course of all hot work. This must include providing various applicable extinguishers and extinguishing mediums as necessary. The Contractor must follow the hotwork requirements under DFO/5737.
- 3.1.10 The contractor must suitably protect all areas of the vessel, equipment and parts while carrying out this installation. This includes protection against any physical damage or contamination due to generated smoke or debris from coating activities. This will include the provision of suitable extraction fans as well as suitable coverings for decks, decking, deckheads, bulkheads and outfit as required to

prevent damages. Any damages resulting from the performance of this SOW item will be repaired at the Contractor's expense.

- 3.1.11 The Contractor must be responsible to protect the genset and associated equipment throughout the duration of the installation work and up to commissioning of the genset. Upon GSM equipment arrival at the contractor's facility, the contractor must carry out a full inspection of all parts and equipment along with the CAT FSR and CCG TA. The contractor must then provide heated, indoor storage as per section 3.5 of SOW item 3.0 – General Notes –until the units are being rigged aboard for installation. Any damage to the vessel, equipment or parts caused by the contractor must be repaired or replace at their expense.
- 3.1.12 From the time the new auxiliary generator unit arrives at the contractor's facility until it is successfully installed on the vessel, the contractor is responsible for all crantage, forklifts, rigging, labour and all other related equipment and mechanical requirements necessary for the successful installation of the new unit. This includes all movements around the contractor's facility, on/off trucks, in/out of storage and on/off the vessel. These requirements also apply to the existing auxiliary generator which must be removed from the vessel and disposed of as per Federal and Provincial guidelines.
- 3.1.13 The Contractor must be responsible to ensure that all areas have been thoroughly cleaned and free of any debris resulting from welding prior to the acceptance of this SOW item.
- 3.1.14 The Contractor must electrically and mechanically isolate the existing 3508 Generator Set to allow the removal of the components. All electrical and mechanical lock-out and tag-out tasks must be carried out to the satisfaction of the TA, as per the DFO/5737 Fleet Safety Manual, 7.B.5-Lock-Out and Tag-Out. The Contractor must install / remove locks and tags accordingly during the scope of work. The Coast Guard will assist the Contractor in identifying the location to perform the lock-outs, but will not perform the actual lock-out. The Contractor must supply and install their own locking devices and retain all keys during the scope of this work. Upon completion of all work, the Canadian Coast Guard must be in attendance when all locks/tags are removed.
- 3.1.15 The Contractor must implement a fall restraint system for all workers, working in areas where a system is required, while removing/installing the generator sets. This must be at least equal to or in excess of the Canadian Coast Guard ISM

System, 7.B.2.M.S36- 01and 02. The Contractor must supply all necessary and currently certified fall restraint equipment and devices for the Contractor's workers.

3.1.16 The Contractor must use suitable blanks, caps and plugs on any open pipes remaining on the vessel after sections have been removed, and there may be a possibility of oil/water/air leaking passed locked valves.

3.1.17 As described in the Hazardous Material Assessment documents "C1R6482V1 – Lead Assessment Engine Room and Stack" and "George R. Pearkes Lead Paint Assessments 2020 & 2021," there are coatings throughout the engine room area that contain high levels of lead. As referenced in these documents, the deck area under and around the Auxiliary Generator seating, foundation and chocks contains coatings with potentially high levels of lead. The contractor must follow all provincial and federal guidelines while removing and disposing of all lead coatings as required to successfully carry out the work detailed in this SOW item. All required removal and disposal of lead coatings necessary on and around this deck area surrounding the Auxiliary Generator on the upper starboard engine room landing must be included in the contractor's firm pricing for this specification item.

3.2 Identification and Removal of all Interference Items

3.2.1 The Contractor is responsible for the identification of interference items, their temporary removal, storage and refitting to the vessel. The following list of interferences has been identified which the Contractor must temporarily remove and store for re-installation upon completion of the work scope. This includes but is not limited to; Coverings, insulation, wiring, lighting, piping, ventilation ducts/trunking, railings, stairwell, brackets and lifting beams. This is not an all-inclusive list, the Contractor is responsible for the identification of all removals and reinstallation of removals to complete this SOW item.

3.2.2 All removed insulation must be replaced with new, equivalent marine grade insulation and any areas affected by hotwork must be cleaned, edges feathered back and coated with 2 coats of marine grade primer and a matching top coat.

3.2.3 All work must follow the International Association of Classification Societies (IACS) No. 47 - Shipbuilding and Repair Quality Standard and all materials used must be in accordance with TCMS or equivalent Classification Society.

3.2.4 All removed items must be re-installed with new hardware and gaskets where required. All welding must be tested with 100% Visual inspection and 100% MPI at a minimum and re-installed as per CCG TA and ABS approval.

3.3 Rigging Requirements and Removal of Existing Unit

- 3.3.1 The contractor must use the existing temporary hull insert as described in SOW item E-01 – Propulsion Generator Replacement – for the removal of the existing and the installation of the new Auxiliary Generator. As previously noted, it is the responsibility of the contractor to coordinate the rigging, removal and installation requirements of both specification items due to their close proximity.
- 3.3.2 The contractor is responsible for supplying all required labour, craneage, materials, equipment and rigging requirements necessary to carry out the work detailed in this specification. The Contractor must reference the attached Poseidon Marine Specification/Drawings # 21-172-001, 21-172-100 & 21-172-101 for the effective removal of the existing Auxiliary Generator unit and installation of the new unit. The contractor must engineer, supply, install and test all lugs/pad eyes as required and provide all equipment and labour necessary to perform all removal, rigging and installation activities to the satisfaction of the CGTA and the ABS surveyor.
- 3.3.3 Prior to the genset removal, the contractor must be responsible for draining and disposing of all engine fluids, oils, lock out, tag out and disconnecting and properly labelling all piping systems, wiring and cables associated with the existing Caterpillar genset. The contractor is responsible for all costs associated with these removals and disposals which must be carried out as per provincial and federal guidelines. All remaining piping and openings on the genset must be suitably plugged/blanked upon disconnection and draining.
- 3.3.4 The contractor must lockout/tag out the following electrical circuits connected to the existing auxiliary generator set:
- Alternator terminal box. (600 VAC 3 phase)
 - All transducer circuits to actuator, final resource connections alarm, monitoring and instrumentation. (24VDC)
 - Jacket water heating circuits.(230 VAC)
 - Pre-lube pump(600 VAC 3 phase)
 - The removal of above noted existing cables and the complete replacement cable list will be determined at the time of installation in consultation with the Technical Authority. The document 407790 - Kopit Hopson-C32 CABLE PLAN REV 1.1 is attached for reference only. This is a cable layout drawing recently used for a similar C32 installation on a sister vessel.

3.3.5 The contractor is responsible for the disconnection and tear down of the existing Auxiliary Generator and engine assembly in order to rig it off of the vessel. This includes, but is not limited to, the following:

- Exhaust piping to be removed up to and including the expansion joint.
- Cooling water piping, supply and return
- Fuel piping, supply and return
- Compressed air piping for air start
- Disconnect, tag and secure generator cables
- Electrical disconnections to include alternator terminal box, all transducer circuits to alarm, monitoring and instrumentation, 24 VDC final resource connections to engine, jacket water heaters, anti-condensation heaters and actuator. All disconnections and removals will be labelled, stowed and protected.

NOTE - *It is the responsibility of the contractor to clean up and dispose of any oil leakage or spillage that occurs during the removal/installation of piping or any part of the auxiliary gen system. The contractor must clean up and dispose of any fuel or oil spillage or leakage of any kind that occurs in a timely fashion, so not to delay work, and as per provincial and federal guidelines.*

3.3.6 In conjunction with SOW item E-01 – Propulsion Generator Replacements - the contractor must re-route sections of the existing Auxiliary Generator exhaust uptakes in order to successfully install the new exhaust piping/silencers for the Propulsion Generators. The contractor must reference the Wartsila supplied exhaust diagrams, IPI document and vessel's drawing 63-10-01 - Diesel and Boiler Exhaust Piping – to confirm spacing/arrangements in the engine room stack and to determine modifications required to install/secure the new exhausts for the propulsion generator units with the existing exhausts in the engine room stack. Any Auxiliary Generator exhaust piping that is affected must be completely engineered, designed and re-secured with new brackets and hardware as per the existing arrangement. All exhaust piping must be completely re-insulated upon the successful installation and modification of all exhaust piping as detailed further in section 3.4.6 of this SOW item. Any engineering/design work must be carried out by a certified Naval Arch./Engineer.

3.3.7 All accessory equipment and piping that will not be reused must be carefully removed from the engine room and disposed of by the contractor. This will include items such as:

- Air intake, turbo charger, charge air cooler and associated piping.
- Lube oil cooler and associated piping

- Cooling water pump, expansion tank, fresh water cooler and associated piping.
- Gauge cluster
- Control/signal wiring/boxes

3.3.8 The Contractor will disconnect the engine from the generator and both pieces of equipment must be unbolted from the genset foundation. The contractor must remove the existing genset from the engine room through the existing temporary insert already removed in the engine room hull area as described in SOW item E-01 – Propulsion Generator Replacement - and as noted above in section 3.3.1.

3.3.9 After blanks/caps have been installed on the remaining piping on the vessel, the contractor must lift and move each piece using only approved lifting gear with a safe working load in excess of the weight to be lifted. All lifting lugs and/or pad eye rigging points whether contractor installed or existing are to be proven prior to their use.

3.3.10 The approximate weights of each genset component are as follows:

- 3508 TA Engine - 14,300 lb (6,486 Kg)
- Generator - 4,900 lb (2,222 Kg)
- Steel Base & Isolators - 4,100 lb (1,860 Kg)

The listed engine weight is a total weight with no components removed.

3.3.11 The Contractor must remove existing genset foundation mounts and collision chocks from the deck and grind flush. The deck area must be cleaned and coated with 2 coats of marine grade, weld able primer and 2 top coats. As noted in section 3.1.17 of this specification, the deck areas may contain coatings with high lead content and must be properly abated by third party, licensed abatement professionals. These costs must be included in the contractor's firm pricing for this specification item.

3.4 Installation of New Auxiliary Generator

3.4.1 The Contractor will be responsible for the movement of genset from their storage facility to the upper engine room tween deck flat through the existing opening in the engine room side shell. As previously noted, the contractor must reference the attached Poseidon Marine drawings for the installation of the new units. The contractor must supply all required labour, craneage, equipment and rigging requirements necessary to carry out the work detailed in this SOW item. This

includes the installation and appropriate testing of all lugs/pad eyes and any additional engineering/design requirements as necessary.

3.4.2 The new genset foundation has six weld plates associated with the isolation mounts which must be welded to the E. R. tween deck on the upper engine room flat as shown on the supplied Poseidon Marine Drawing. The contractor must also fabricate and install new collision chocks located at the forward and aft ends as well as the inboard and outboard sides of the new genset foundation as identified on the Poseidon Marine Drawing. All new steel to receive 2 coats of marine primer and welds to be inspected/tested with 100% Visual and 100% MPI.

3.4.3 The Cat C32 genset will be installed in its existing location on the upper ER tween deck as a complete unit having the following weight:

- Cat C32 Genset (complete) – Approximately 17,500 lbs (7,938 KG)
- The contractor must proceed to securely mount the new unit in place to the satisfaction of the FSR and CCGTA.

3.4.4 The Contractor must be responsible for connection of the new genset to the existing vessels piping and electrical systems. This will include connection to:

- Genset exhaust piping – The contractor must include in their firm pricing for the supply, fabrication and installation of a wye section of piping and elbow to directly connect the new C32 unit to the new GSM expansion joint section. These sections are to be 8" seamless, Class approved corten steel, flanged sections and must be chemically pickled, coated with marine certified hi-temperature coatings and installed with all new high temperature gaskets and hardware. Welds must be tested by a certified third party with 100% MPI. The contractor must reference drawing 63-10-01 – Diesel and Boiler Exhaust Arrangements and Ref. Doc No.1-6,10-16 for further details.
- Cooling water piping (supply and return)
- Fuel oil piping (supply and return)
- Compressed air piping
- Crank case vent piping
- Lube Oil piping
- Electrical connections to engine and alternator

****There will be minor modifications to the existing piping and electrical systems that is currently unknown. It is intended the contractor will perform the modifications and connections in consultation with the Chief Engineer. These will*

be covered off on the allowances described in line items 3.1.5 and 3.1.6 of this SOW item.

- 3.4.5 The contractor is responsible for the supply and installation of all new brackets, supports, gaskets, stainless fasteners etc. as required for the installation of all piping and ventilation ductwork. The contractor must also carry out all new piping coatings as per the existing paint scheme.
- 3.4.6 The contractor must completely renew the Auxiliary Generator Exhaust insulation in its entirety. This includes removing and disposing of all existing insulation and lagging and installing the following double padded, flexible insulation system from the top of the new unit to the top of the engine stack:
- The inner pad must be fabricated using stainless steel mesh and 2" Morgan Thermal Ceramic FireMaster Marine Blanket Insulation
 - The outer pad must be fabricated using stainless steel mesh on the inside and Auburn Manufacturing Silicone Cloth, AMI-TUF, Style SGL 1700 Grey as the outside finish. The insulation must be 2" Morgan Thermal Ceramic FireMaster Marine Blanket
 - Blanket layers must be arranged to overlap seams where possible.
 - All Standard Specifications for the Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service-ASTM Designation: C 1695-10 must be followed.
 - The most recent version of the Specification Guidelines for the use of Soft Cover Insulation on Exhaust Systems must be followed.
- 3.4.7 The contractor must supply and install a new "fast oil change system (FLOCS)" pump unit, or certified equivalent, that must be connected/installed in a similar fashion to the existing 3508 gen-set pre-lube pump. This must be a 3 phase, 0.5 HP, 60Hz, 575V, close coupled, marine grade WEG pump/motor set, or certified equivalent. A new CSM, larger capacity pre-lube pump with motor must be also be supplied and installed by the Contractor under the guidance of the FSR and CGTA, to replace the "As-Fitted" unit. All mounting and installations of the new units must be carried out by the contractor to the satisfaction of the CGTA and FSR.
- 3.4.8 The Contractor must fabricate, supply and install a set of manifold valves to allow the operator the ability to pre-lube the new generator set, and to pump out the engine sump to the ship waste oil tank and fill the engine with new oil from the ship auxiliary engine oil storage tank. The new manifold must be clearly marked indicating the position the valve handles must be located for each function). The

Contractor must supply, install, and flush clean all new hoses and valves units, suitable for oil service.

- 3.4.9 The Contractor must supply and install a 24VDC backup power supply unit, complete with 2x12VDC gel-cell storage batteries, 24 VDC battery charger and associated power cables and vented battery storage box. The battery unit must be a 185 A.H, Non Gassing 4D gel, Lead acid, 970 CCA, non-spillable, marine rated deep cycle battery unit. The charger must be a La Marche A46F-20-24-120-1, 24 VDC, 20A output, marine rated, class approved charger, or certified approved equivalent. The contractor must supply and install the required cabling and fabricate and install/mount an aluminum, vented battery box. The location for the battery charger, and the storage cells with battery box will be determined by the Technical Authority and FSR during the installation of the new generator set. All items supplied by the Contractor must be approved by the Technical Authority and FSR.
- 3.4.10 The Contractor must install the new GSM instrumentation panels in suitable locations in consultation with the Technical Authority. Various electrical, signal and pressure lines must be extended or replaced accordingly. All lines, and controls associated with the various panels must be tested and confirmed working, and connected to the right gauge – all to the satisfaction of the Technical Authority.
- 3.4.11 In case of cable re-routing requirements deemed necessary on-site during installation, the contractor must include pricing for the supply, installation, packing and testing of six (6) new S8x4, welded, complete Roxtec transit kits (Complete with frame, blocks, wedge kit, stay plate etc.) as part of this SOW item. The contractor must also provide a unit price per transit for adjustment purposes. The actual value will be adjusted by PWGSC 1379 based on the final installation requirements.
- 3.4.12 The removed 3508 genset, associated equipment, fittings and fasteners must be stored, protected and crated in a sheltered location designated by the Technical Authority until the time of final disposal is determined. The Contractor must be responsible for the disposal of the old genset and its associated piping and ancillary components including accessory equipment that will not be reused. Disposal must be done in accordance with provincial and federal regulations. The final disposal of must be done in consultation with the Technical Authority.
- 3.4.13 Upon completion of the new Auxiliary Generator installation, the contractor must clean up the entire area, carry out touch up paint repairs and re-install all interference items. The entire auxiliary flat and engine room area must be delivered back to CCG in “as delivered” condition.
- 3.4.14 The contractor must supply all labour, equipment and materials required for load testing including cabling, connections and hardware (i.e. Belleville washers)

needed to connect a suitable load bank (500 KW Resistive) for testing. The contractor must provide certified technicians to run all cabling and to remove the existing transformer leads from the breaker, connect the load bank to the breaker and return connections upon completion. The technicians must adjust the breaker instantaneous, long time, and slow time settings to match the load bank characteristics & return to "as found" settings once testing is completed. All rigging, craneage and labour required to successfully complete these testing requirements are the responsibility of the contractor and must be included in their pricing. This load bank requirement is based on a 7 day, continuous, testing period including 1 day for set up and 1 day for tear down. This requirement is completely independent and separate from the load bank requirements detailed in SOW item E-01 – Propulsion Generator Replacements.

4.0 PROOF OF PERFORMANCE

4.1 Inspection

- 4.1.1 All work must be subject to witness by the Chief Engineer or delegate and the attending ABS/TCMS surveyor.

4.2 Testing

- 4.2.1 All welding must be 100% visually inspected by the welding foreman after welding is completed. All full penetration welds are to receive 100% UT and all fillet welding must receive 100% MPI. Weld inspections must be only completed by approved testing personnel and be carried out in the presence of the attending ABS/TCMS surveyor and owner's representative. NDT reports from the certified, third party organization must be supplied to the CCG TA. All costs associated with the inspection to be included in the contractor's price for known steel work. The Contractor is responsible for all air quality testing that may be necessary to ensure hot work and entry is permitted.
- 4.2.2 The Contractor must supply and post hot work permits in a noticeable location. During all hot work, the contractor must maintain a fire watch as per CCG Fleet Safety Manual. The work must be completed and acceptable to the attending ABS/TCMS inspector and the owner's representative. Only CWB approved welders are to complete the welding and completed as per approved CWB weld procedures. Documentation as listed below stating welder qualifications and weld procedures must be supplied to the Owner.
- 4.2.3 New Auxiliary Generator Testing – The following tests must be carried out after the new unit is commissioned under the direction of the FSR:

- Complete set of insulation readings of the generator and the ship board conductor connected to the new generator, inducing the generator, pre-lube pump, and jacket water heaters;
- Simulated over speed test;
- High jacket water cooling temperature shut down;
- Low oil pressure shut down;
- Low voltage/breaker open testing;
- Emergency shut down;
- Remote starting and stopping of the generator set;
- Local operation, starting and stopping of the generator set;
- Testing of all non-shutdown alarms (low sump level, low jacket water level etc.);
- Testing of primary and secondary 24 VDC system automatic change over;
- Take a complete set of local panel readings and compare to readings listed on alarm system. Any inconsistencies must be investigated and corrected.
- The Contractor must supply a report indicating the cleanliness results after the oil system flushing process and present to the Technical Authority prior to the final system connections being made.

4.2.4 Load testing requirements must be carried out to the satisfaction of the FSR and CCGTA as detailed in Section 3.4.14 of this SOW item.

5.0 DELIVERABLES

5.1 Reports

5.1.1 The Contractor must provide the Chief Engineer with a typewritten report in both electronic and hardcopy formats outlining the details of the inspection and any alterations/repairs made prior to the acceptance of this SOW item.

5.1.2 The Contractor must document all test results in a report form.

5.1.3 The Contractor must ensure that the following documents are included in the final report for this SOW item:

- Material Certs for new supplied plate, sections, piping, cabling
- CWB Certificates for Welders
- CWB Certificates for Welding Supervisors
- CWB Weld Procedures
- CWB Weld Data Sheets
- UTM/NDT Testing Documentation
- Lead Coating abatement certification

5.2 Drawings

- 5.2.1 The contractor must develop new “as-fitted” drawings for vessel drawings that have been affected by the installation of the new C32 Auxiliary Generator unit in AutoCAD 2017 DWG format, or later edition. All affected ships drawing must be updated by the contractor as referenced in the General section of this SOW item. At a minimum, the following affected drawings must be modified:

Drawing Name	Drawing Number	Sheet	Rev
Ship ser switchboard 600v.1600a 3ph.3w. 5 sect.indoor s	30300.0D02-1	01/01	4
Ship ser switchboard 600v.1600a.3ph.3w. 5 sect. indoor s	30300.0D02-2	01/01	5
Ship ser switchboard 600v.1600a.3ph.3w. 5 sec. indoor s	30300.0D02-3	01/01	5
Fault Current Calculation	80-01		
Electrical load analysis	80-02	21/21	1
Circuit breaker coordination curve	80-03	25/25	3
Ship service switchboard one line diagram	80-06	01/01	8
Power deck plan engine room flat	80-29	01/01	13
P-106 & P-621 Ant condensation heaters	80-54	01/01	6
Automation control diagrams (Aux Gen Connection Diagram)	81-06 Sheet 9	13/13	2
Monitoring control diagram (Aux Gen Control Panel)	81-07 Sheet 21	21/21	0
Schematic diagram for Ships Service. switch. 600v 1600A;3 Phase 3 Wire 52-AG	SW-02-30301-D502	1/1	3
Machinery arrangement	50-00-01	All	
Funnel (3 sheets) Sheet 1 of 3 – Piping, Sheet 2 of 3 Ventilation, Sheet 3 of 3 Ladders and gratings.	70-06-01	All	
Central cooling. Includes emergency sea water cooling	71-10-01	All	
Change over auxiliary generator cooling water supply	71-10-sk46	All	
Fuel Oil Service	74-00-01	All	
Compressed Air System	76- 00-01	All	
General Arrangement, Tank Top, E/R Flat and Main Deck	555-H-0025	All	

- 5.2.2 The Contractor must provide 2 type-written copies and 2 electronic copies of the drawings on USB flash drive format
- 5.2.3 All drawings must be standard ANSI paper size and must be in, at minimum, AutoCAD 2017 DWG format – or later edition, and conform to the CCG National CAD Standard (MECTS #2860606-v1-National_CAD_Standards.
- 5.2.4 All electronic versions of drawings must be given a name such that the user does not have to open the drawing to establish the purpose of the drawing.

5.3 Spares

N/A

5.4 Training

5.4.1 The Contractor must provide 2 sets of training courses to be held onboard the vessel after commissioning of the auxiliary generator set. Each course must be for up to 8 students for 8 hours. These courses must be conducted by the Caterpillar technical representative and must as a minimum provide:

- Overview of generator sets
- Overview of generator set functionality and capability
- Routine maintenance
- Troubleshooting methods
- Test procedures for simulating emergency shut-down functions
- The Contractor must provide a video of the provided training course to the RT for future reference.

E-04 STERN TUBE BEARING WEARDOWNS

1.0 Scope

- 1.1 The intent of this SOW item must be for the contractor to measure and record the bearing wear down of both Port and Stbd stern tube bearings and present readings to class and owners. This SOW item must be carried out in conjunction with SOW item E-06 – Port and Stbd Tailshaft, Bearing and Seal Survey.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- 2.1.1 The following list of Guidance Drawings are provided as references for the Contractor, when performing the following SOW items:
 - 61-00-01_03 - Shafting Arrangement
 - 61-10-01_01 – Stern Tube Arrangement
 - 61-00-SK-6_01 – Shaft Support
 - 61-10-02_01 – Shaft Inspection Ports
 - 50-00-01_01 – Machinery Arrangement 1
 - 50-00-03_01 – Machinery Arrangement Sections 1

3.0 Technical Description

- 3.1 Port and starboard rope guards must be removed to gain access to the after end of each stern tube.

- 3.2 The Contractor must supply and erect staging or man lifts and lifting gear as required to access both sterntubes to carry out the readings. The staging must also be used by the TA to inspect the propellers and rudder. Upon completion of all work, staging must be removed.
- 3.3 Wear-down readings must be taken on the port and starboard stern tube bearings within eight hours of dry-docking the vessel. The Contractor may use the Owner-supplied poker gauge on the port side, but, as the bracket is damaged on the starboard side, feeler gauges will be required on that side.
- 3.4 The TA must be notified prior to the wear down in the event the TA or designate wishes to witness the measurement. The contractor to provide an electronic copy of these readings within 24 hours.
- 3.5 The Contractor must quote on fabrication of new rope guards for both port and stbd shafts, as well as coating the new rope guards as per vessel hull paint spec. Rope guards are made from ABS approved ASTM A-36 steel. Approximate material sizes are as follows:
- a)A-36 steel 1635 mm length x 200 mm width x 20 mm thick, quantity four (4);
 - b)A-36 steel 1635 mm length x 160 mm width x 20 mm thick, quantity four (4);
 - c)Backing bar, A-36 steel, 1534 mm length x 60 mm width x 3 mm thick, quantity four (4);
 - d)Backing bar, A-36 steel, 250 mm length x 60 mm width x 3 mm thick, quantity four (4).
- Note: This pricing will be a separate line item on the Price and Data sheet and will be credited back to Canada by means of PWGSC 1379 if deemed necessary on site.
- 3.6 Actual sizes of rope guards must be measured and confirmed by the Contractor and adjusted to allow proper fitting of rope guards.

4.0 Proof of Performance

- 4.1 Upon completion of all work, both rope guards must be reinstalled. Poker gauge plugs must be installed and locked in place with the TA or designate witnessing the locking arrangement. All work must be inspected by the CCG TA.
- 4.2 All disturbed paintwork must be mechanically cleaned to bare metal, primed, and coated as per SOW item for Hull Cleaning and Coating on completion of the mechanical work.

5.0 Deliverables

- 5.1 Three typewritten copies of the readings must be provided to the Owner's representative.
- 5.2 Material certificates for the new plate being used and CWB welding tickets and welding procedures must be provided to the CCG TA
- 5.3 All survey items are to receive full credit from ABS.

NOTE:

Shaft turning gear must be locked out as per contractor lock out tag out procedures while work is done in way of propellers, rudders and shafting. Engaging and operation of turning gear must be considered a safe work permit required job.

Steering gear must be locked out as per contractor lock out tag out procedures while work is done in way of propellers, rudders and shafting. Operation of steering gear must be considered a safe work permit required job.

E-05 PORT AND STBD PROPELLER SURVEYS

1.0 Scope

- 1.1 The intent of this SOW item must be to remove and inspect the port and starboard propellers for credit as carried out by ABS. This work will be in conjunction with SOW items E-06 – Tailshaft, Bearing and Seal Inspections and E-04 – Sterntube Bearing Wear-downs.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Propeller particulars:

- Diameter: 3600 mm
- No. of Blades: 4
- Weight: 7200 Kg
- Outboard Turning

2.2 Reference Drawings

- 61-00-01_03 - Shafting Arrangement
- 61-10-01_01 – Stern Tube Arrangement
- 61-00-SK-6_01 – Shaft Support
- 61-10-02_01 – Shaft Inspection Ports
- 50-00-01_01 – Machinery Arrangement 1
- 50-00-03_01 – Machinery Arrangement Sections 1

3.0 Technical Description

- 3.1 The Contractor must install sufficient lifting arrangements on the hull of the vessel to remove the propeller tail cones, propeller nuts and propellers. It is the responsibility of the contractor to ensure all arrangements are properly installed, tested and capable of all rigging required for the removal and re-installation of both the complete port and starboard tailshaft and blade assemblies. Upon completion of all work the lifting arrangements must be removed and areas ground flush and recoated as per the SOW item H-03 – Hull Cleaning and Coating specification.
- 3.2 Jacking plates, studs, hydraulic power pack, and associated removal equipment is available on board the vessel; access is through the flush deck hatch on the Helicopter (Boat) Deck. Vessel's crew will retract the Hangar and open and close the hatch. The propellers are secured with a Pilgram nuts, with the necessary tools available on board the vessel for the contractor to use in order to operate them. The contractor will have access to the specialty tools and will be responsible for safe operation and return of the tools in good working order to the TA, any damage or loss will be rectified by the contractor at their expense
- 3.3 The Contractor must mark both shafts with the location of the propellers prior to any removals The TA or designate must witness the proof marks prior to the Contractor moving the propeller. The Contractor must first remove the propeller tail cone, the forward propeller gland seal rings and seals, the propeller nut locking key, propeller nuts and propellers. Rope guards will be removed/installed as part of SOW item E-04, Stern tube Bearing Wear down.
- 3.4 The contractor shall follow Pilgrim nut manufacturer's instructions so as not to over extend travel limits and cause damage to the nut. Contractor shall observe and record maximum pressures for the Pilgrim nut hydraulic pump.
- 3.5 The propeller and cone must be thoroughly cleaned and examined for defects; any defects are to be recorded on the provided Propeller Inspection Report form, available from the Technical Authority. The Contractor must verify each key and propeller keyway with dye penetrant crack detection, the dye penetrant testing must be carried out by a certified, third party, technician acceptable to the TA and ABS. The Contractor must measure the keys and keyways in the shafts and propellers in 3 locations, measuring width and thickness and depth of keyways. This must be witnessed by ABS, the Technical Authority and the Inspection Authority.
- 3.6 The contractor is to include an allowance of \$25,000.00 for potential repairs to the propellers to be carried out by a certified blade repair specialist. This allowance must be adjusted with PWGSC 1379 action based on final invoice.

- 3.7 The Contractor must include the cost for three separate fits of the propeller on the tail shaft. The Contractor must provide a unit cost for each additional fit and proof/witnessing of each fit must be carried out by the TA or their designate.
- 3.8 The Contractor must install the propellers and harden up the propeller nuts in accordance with manufacturer's instructions. The Contractor must advise the Technical Authority when this must be carried out. The Technical Authority and the Attending Inspection Authority are to witness the final installation of the propeller on the shaft to ensure that the propeller is properly aligned with the original proof marks and that the travel is equivalent.
- 3.9 Propeller nuts are to be locked in place. Stainless steel locking wire must be used on compression bolts.
- 3.10 The tail cones and the back of the propeller nuts must be filled with tallow. The tail cone nuts must be secured with stainless locking wire, the nut recesses filled with cement and faired to the contour of the cones.
- 3.11 The Contractor must supply and install new rubber seal rings to the front of the propellers prior to fitting the glands. The gland nuts must be secured with stainless steel locking.
- 3.12 The Contractor is responsible for the identification of any interference items, their temporary removal and storage and refitting to the vessel.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 The Contractor is to be responsible for all inspections and is to consult with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the Technical Authority, in advance, to allow his/her attendance.

5.0 Deliverables

5.1 Reports

- 5.1.1 The contractor must supply a copy of the NDT test reports and a report of all measurements taken.
- 5.1.2 Full credit from the attending Inspection Authority (ABS) is to be delivered on completion of the work for all applicable survey items.

- 5.1.3 If blade repairs are required, the contractor must provide a complete, detailed report describing the scope of repairs, including photographs, from the certified third party repair facility.

E-06 PORT AND STBD TAILSHAFT, BEARING AND SEAL SURVEY

1.0 Scope

- 1.1 The intent of this SOW item must be to remove both tail shafts for cleaning, overhaul and inspection for ABS credit. This inspection must include shaft bearings and all associated fittings. The stern tube Bushings on both the port and stbd sides must be thoroughly examined and replaced with new GSM bushings if deemed necessary on site.
- 1.2 This work must be completed in conjunction with the following SOW items:
 - 12.0 – Vessel Commissioning.
 - H-03 – Hull Cleaning and Painting
 - E-04 – Sterntube Bearing Wearabouts
 - E-05 – Port and Stbd Propeller Surveys
 - E-07 – Rudder and Rudder Stock Survey
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 Reference Particulars
LOA 14.513 meters.
Diameter: 510 mm.
Weight: 24644 Kg.

2.2 Reference Drawings

- 61-00-01_03 - Shafting Arrangement
- 61-10-01_01 – Stern Tube Arrangement
- 61-00-SK-6_01 – Shaft Support
- 61-10-02_01 – Shaft Inspection Ports
- 50-00-01_01 – Machinery Arrangement 1

- 50-00-03_01 – Machinery Arrangement Sections 1

3.0 Technical Description

- 3.1 The contractor must supply the services of a certified Thordon Marine FSR and must follow his direction and expertise. The contractor is to provide an allowance of \$10,000.00 for the travel, living and services of this FSR which must be adjusted by PWGSC 1379 based on final invoicing.
- 3.2 The contractor must supply the services of a Wartsila FSR to attend the disassembly and reassembly of the port and starboard Shaft Seals. The contractor must include in their bid price an allowance of \$20,000.00 for the Wartsila FSR. This value must be adjusted by PWGSC 1379 based on final invoicing.
- 3.3 In conjunction with SOW item E-05 – Port and Starboard Propeller Surveys, the Contractor must remove both propellers. The Contractor must scribe proof marks on each propeller and tail shaft and remove the propellers to the dock floor.
- 3.4 As noted in the SOW item E-05, it is the responsibility of the contractor to ensure all lifting lugs and arrangements are properly installed, tested and capable of all rigging required for the removal and re-installation of both the complete port and starboard tailshaft and blade assemblies. Upon completion of all work the lifting arrangements must be removed and areas ground flush and recoated as per the SOW item H-03 – Hull Cleaning and Coating.
- 3.5 The tail shafts must be let go at the shaft coupling at the propulsion motor end. All shaft coupling flanges, nuts, and fitted-bolts must be proof marked to ensure replacement in their original positions. The Contractor must provide a unit cost for supplying of fitted bolt and nut set in the event there needs to be renewals. The Contractor must also provide a unit cost to ream the shaft and coupling bolt holes for new fitted bolts, should they be required.
- 3.6 The turning gears and brake assemblies located on the tail shaft in the Propulsion Motor Room must be removed to gain access to the Pilgrim nut to permit shaft removal. The Pilgrim nut must be removed and the coupling must be jacked from the shaft. The Contractor must put scribe marks on the shaft for the coupling position prior to removal. The Contractor must notify the Chief Engineer or CCG TA prior to removal to allow their attendance. The Contractor must record the hydraulic pressures required to remove the shaft coupling so they can be compared to previous readings and used when re-installing the coupling. The Contractor must provide electronic copies of these readings within 24 hrs to the CCG TA. The Contractor must ensure the coupling and tail shaft are properly supported at all times. Care must be taken to ensure no damage is done to the shaft protective coatings, damage done to the coating will be repaired at the contractors cost to the satisfaction of the TA and Attending ABS surveyor

- 3.7 The Wartsila mechanical stern tube seals must be disassembled prior to removal of the shafts to prevent damage to the seal components. A Wartsila FSR must be present during the removal, disassembly and reassembly of the shaft seals. All components must be cleaned, checked for wear and defects as per manufacturer's recommendations, and laid out for inspection in an area that preserves the items from potential damage. Any components found to be defective to be replaced under PWGSC 1379 action.
- 3.8 Upon completion of the seal removal, the tail shafts must be withdrawn and removed ashore to the Contractor's shop with proper support at all times during removal and transport, care must be taken to not damage the protective coatings at any time.
- 3.9 In the Contractor's shop, the tail shaft must be properly supported at all times. The shafts must be thoroughly cleaned and checked for wear and defects. Particular attention to be paid 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 in way of staves and condition of staves,
 - Fwd end of fwd liner in way of "SEALOL" seal.
 - Rematek coating between liners.
- 3.10 Inspection of the keyways and tapers are to include non-destructive crack detection (dye penetrant) by a certified technician as accepted by the attending ABS inspector and TA. All materials for testing must be supplied by the Contractor; a report, detailing the results of this testing, is to be provided to the Technical Authority within 3 days of completion.
- 3.11 Inspection of the liners must consist of thoroughly cleaning the "Rematek" coating in way of the joint, but is not to include any cutting, peeling, or otherwise disturbing the coating.
- 3.12 The contractor must conduct a Hi-Pot Test (Voltage of Hi Pot or "Holiday" test must be tested as per coating manufacturer's recommendation) on the tail shaft to ensure that the "Rematek" coating is sound. The Contractor's must include an allowance of \$10,000 for repairs to the "Rematek" coating – the actual cost for replacing the coating will be adjusted up or down using PWGSC 1379 action.
- 3.13 The tail shafts must be set in a lathe and checked for trueness. The Contractor must provide 4 copies of the 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 is not to be located so as to interfere with the shaft surface in way of the mechanical seal. Every effort must be made to prevent the lathe steady-rest from grooving the shaft

or damaging the protective coating, damage will be repaired at the contractor's expense.

- 3.14 Shaft bearing (stern tube) bushings on both the port and starboard sides must be cleaned; inspected for wear and defects. Internal measurements must be taken at 4 positions over the length of the stern tube bushings.
- 3.15 The contractor must measure the port and stbd sterntubes and shafting in way of the bushings. The Contractor is to consult with the Thordon representative, CCG and ABS to inspect the condition of the current bushings and check for wear.
- 3.16 After inspections of the bushings, if required, the contractor must remove existing and machine the new sections of bushings to the proper dimensions as recommended by the Thordon FSR. All bushings will have water passages machined the length of the bushings as per the Thordon representatives recommendations. The contractor must provide a unit cost for the machining and installation of one (1) GSM Thordon bushing. This will be included in the Contractor's firm pricing and will be adjusted by PWGSC 1379 based on the actual requirement determined on site.
- 3.17 The Contractor to "freeze fit" the new bushings to allow proper installation. The Contractor is to supply all materials, including dry ice, and carry out all fitting, rigging and installation requirements.
- 3.18 Upon completion contractor is to take new clearance measurements to ensure the proper clearances have been achieved.
- 3.19 Cooling water lines to the sterntube must be proven clear and water flow to the sterntube to be proven adequate.
- 3.20 The area of the stern tubes (Port and Starboard) stern tube housings between the Thordon full form bearings must be mechanically cleaned (SSPC-SP-3, contractor to first clean to SSPC-SP1 and carry out chloride test if required by coating manufacturer) and coated with two coats of Amercoat 238 Abrasion Resistant Epoxy @ 10 mils DFT to coating manufacturer's application procedure recommendations prior to the bearings installation. The Contractor must supply all materials and tools and inspections must be carried out by the CCGTA and NACE inspector.
- 3.21 Contractor must dress the 18 fitted coupling bolts as required prior to reinstallation to ensure a proper fit. The contractor is to quote unit cost of chasing threads of the bolt nut set threads per each. If bolts require dressing (chasing Threads) then the charges will be handled as work arising and addressed with PWGSC 1379 action.
- 3.22 Upon completion of inspection and repairs, the Contractor must assemble the shafting, turning gear, brake, propeller, mechanical seals and couplings and

propeller as per manufacturer's recommendations and in good running order. The Contractor must notify the Chief Engineer and TA prior to bolting up the coupling so they can witness the fit up pressures. The Wartsila FSR must be present for the reinstallation and set up of the mechanical seals.

- 3.23 The Contractor must supply all equipment, such as chain falls, slings and shackles; all 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 installed by CWB-certified welders; upon completion of all work, they must be removed, the affected area ground flush, and a surface treatment to match the existing must be applied.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 The Contractor is to be responsible for all inspections and is to consult with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the Technical Authority, in advance, to allow his/her attendance.

- 4.1.2 All coatings must be inspected by the CCGTA and the NACE inspector.

4.2 Testing/Trials

- 4.2.1 Upon undocking of the vessel, a dock trial must be conducted. The shafting system must be test run for 2 hours (at the best safe RPM possible) to check for overheating or vibration; the Contractor must have personnel in attendance to observe this testing and recording bearing and seal temperatures where possible. Any sensors (local and remote) or alarms are to be tested as fully functional, any failing are to be repaired or replaced by the contractor at their cost.
- 4.2.2 Upon completion of all refit work, but prior to Acceptance, an 8 hour sea trial must be conducted; various revolutions must be undertaken to test the ship's equipment. The ship will be gradually worked up to full speed; the Contractor must have personnel in attendance to monitor the shafting system on a continual basis. Any overheating or vibration will be remedied at no expense to the Crown.

5.0 Deliverables

5.1 Reports/Certifications

- 5.1.1 Three typewritten copies of the readings must be provided to the Owner's representative.
- 5.1.2 Full QA report including weather conditions/temperatures/moisture/dew points, coating film thicknesses, dates and batch numbers must be provided for all coating work detailed in this specification.
- 5.1.3 Full credit for all survey items must be obtained from ABS.

E-07 RUDDER AND RUDDER STOCK INSPECTION

1.0 Scope

- 1.1 The intent of this specification item must be to open up the rudder system for inspection, cleaning and quinquennial inspection for ABS credit.
- 1.2 This work must be carried out in conjunction with the following SOW items :
- 12.0 – Vessel Commissioning
 - H-03 – Hull Cleaning and Painting
 - H-12 – Ballast Tank Coatings
 - E-06 – Port and Starboard Tailshaft, Bearing and Seal Surveys
 - E-12 – Steering Upgrades
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 The Steering Gear must be locked out except when required to move the rudder; at these times, the Steering Gear must be operated under the supervision of a designated member of the ship's crew. The vessel's Electrical Officer will ensure that all circuits have been isolated prior to the commencement of any work. The Main Steering Pumps will be locked out at breakers P-618, located in the MCR, and P-619, located in the Transformer Room; the Emergency will be locked out at breaker EP-601, located in Emergency Generator Room. Steering gear operation must be considered a safe work permit required job while work is ongoing on or around the stern of the vessel
- 2.2 Reference Drawings
- H-2620 – Rudder Arrangement
 - H-2640 – Rudder Stock

- 68-30-02 – Steering Arrangement

3.0 TECHNICAL DESCRIPTION

- 3.1 The Contractor must gain access to the steady bearing by way of the rudder trunk manhole covers, located in the Aft Void space. The Aft Void space is to be considered as a confined space under the Canadian Coast Guard's Safety Management System and must be certified "Gas Free", safe for personnel to enter and safe for hot work prior to entry. The original certificates must be provided to the Chief Engineer and a copy must be posted in a conspicuous location near the entrance to each tank. Certificates must be updated each day.
- 3.2 Rudderstock steady bearing clearances must be measured and recorded. Bearing clearances must be taken and recorded when the rudder is in each of the following positions:
- hard to Port
 - hard to Starboard
 - midships

The clearance between the jumping collar and the vessel must be measured at four equal distances around the collar.

- 3.3 Rudder fairwater plates must be removed to gain access to the rudder pintles and reinstalled upon completion of work. The clearances between the bearings and the pintles must be recorded. Also, the clearances between the rudder arms and the machined pads above each gudgeon must be recorded. Clearances must be taken with rudder in each of the positions as noted above. Copies of the clearances are to be provided to Chief Engineer.
- 3.4 Rudder drain plug must be removed to verify that the rudder is dry and tight. The Contractor must block the rudder in position. Clean, number stamp (for identification purposes), and disconnect rudder coupling bolts and nuts. Note that the palm bolts are of the MorGrip TYPE and require to be hydraulically pressurized to remove (<https://www.pilgrim-international.co.uk/product-range/bolts/morgrip/>) Any repairs to the rudder if required will be considered work arising and carried out through the PWGSC 1379 process
- 3.5 The three rudder pintle pilgrim nuts must be removed. The pintles must be removed from the rudder, cleaned, and measured (Pintles and nuts are to be marked to ensure they go back together as they came out and return to the same position as original). The rudder must be lifted and lowered to the dock bottom. The rudder gudgeon bushings must be cleaned and measured. Measurements for the pintles and bushings must be taken forward and aft, port and starboard, and at three locations over the length. In the event bushings are to be replaced this will be treated as work

arising and completed through the PWGSC 1379 process. The contractor must provide a unit price of supplying and fitting one new Thordon bushing.

- 3.6 Due to past wastage, the welds on the forward and aft rudder lifting pipes must be gouged and re-welded around the attachment & ground flush. The plugs must be reinstalled, using new $\frac{1}{8}$ " nylon washers (contractor supplied). The rudder must then be hydrostatically tested as detailed in attached "General Notes" from Drwg H-2620, drained and then float coated with contractor supplied Marine Ship-2-Shore (<https://ship-2-shore.com/marine-products/>). Drain plugs must be reinstalled and locked.
- 3.7 Upon successful completion of the hydrostatic test, and after grit blasting, but prior to hull coating, any slot welds in the rudder requiring fairing are to be filled flush with Inerta putty. The rudder drain plug must be refitted on completion of testing and locking tabs fitted.
- 3.8 Quadrant and bearing must be opened for inspection. Tiller nut must be removed and the quadrant lifted and laid aside. This will entail disconnection of the two rams and proper supporting of them during the course of the work. Any hydraulic conductor connections that are removed are to be sealed to prevent ingress of contaminants.
- 3.9 Keyways in the rudder stock and quadrant must be inspected and key clearance to be measured and recorded. Carrier bearing and gland housings must be unbolted and lifted aside. Carrier bearing must be inspected for wear and measurements of the same must be taken and recorded in both radial and axial directions. Dye penetrant crack testing to be carried out on key and keyway by certified personnel
- 3.10 Within the rudder trunk, apply and tighten ring clamps above and below the steady bearing. Unbolt the steady bearing housing from the stern frame. Lower the rudder stock gently to the dock bottom; turning as required to clear obstacles.
- 3.11 Rudder stock complete with the steady bearing must be transported to the Contractor's workshop. Steady bearing position on rudder stock must be marked and rudder stock and steady bearing housing surfaces to be cleaned of all corrosion, dirt and debris. Caution must be taken at all times to prevent debris from entering the steady bearing. The contractor must carry out complete alignment checks of the stern frame and rudder bearings with piano wire and provide the CE with results.
- 3.12 Rudder stock must be supported on its side; ring clamps removed aside and steady bearing assembly moved down the rudder stock clear of the normal bearing running area. Rudder stock in way of bearing running area must be inspected for corrosion or damage after cleaning.
- 3.13 Upon completion of repairs, if required, the rudder stock and steady bearing assembly must be transported back to the vessel and re-installed as per original. The shipyard must supply two temporary bolts to align both rudder and rudder stock. The

rudder must be assembled back on the vessel and fastened as per original; plugs with nylon washers are to be reinstalled in lifting pipes & locked in place. Repairs to the rudder are to be carried out as work arising and addressed under the PWGSC 1379 process.

- 3.14 The gland housing must be cleaned and re-installed as per original using new Contractor-supplied gland packing. 25 feet of 1" packing is required and is installed in 4 sections. Carrier bearing must be cleaned and greased and re-installed as per original. Prior to reassembly all grease passages are to be proven clear with the TA or designate witnessing free flow of grease when forced through. Quadrant must be re-installed as per original and tiller nut re-secured. Steering rams must be re-connected to the tiller.
- 3.15 Following the above work, all clearances must be measured and recorded again as detailed in section 3.2 prior the disassembly. Discrepancies from the initial readings must be rectified at no cost.
- 3.16 The steady bearing must be inspected by the Technical authority (or designate) and the attending ABS Surveyor prior to securing manhole covers. Two covers removed by the Contractor are to be fitted with new 1/4" neoprene gaskets prior to installation.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 The Contractor is to be responsible for all inspections and is to consult with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the Technical Authority, in advance, to allow his/her attendance.

4.2 Testing/Trials

- 4.2.1 Upon refloating the ship, the steering system must be tested in the presence of the Technical Authority (or designate) and the attending ABS surveyor. The rudder must be moved hard over to hard over, under the influence of first one pump, then the other, and finally both pumps together; times for each evolution are to be recorded. The accuracy of the rudder angle indicators must be verified to be "as found".

5.0 DELIVERABLES

5.1 Reports/Certifications

- 5.1.1 Three typewritten copies of the readings must be provided to the Owner's representative.

- 5.1.2 Full credit for all of the inspection items must be supplied by the attending ABS surveyor.

E-08 SEA CONNECTION VALVE INSPECTIONS

1.0 Scope

- 1.1 The intent of this SOW item must be to open up the sea connection valves for cleaning, overhaul and inspection for ABS credit.
- 1.2 This work must be carried out in conjunction with the following SOW items:
- H-03 – Hull Cleaning and Painting
 - H-04 – Bilge Cleaning and Coating
 - H-06 – Sea Chest and Seabay Inspections
 - H-07 – Sea Water Vent Lines
 - E-01 - Propulsion Generator Replacement
 - E-02 – Cycloconverter Replacement
 - E-03 – Auxiliary Generator Replacement
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Valve Listing

Location	Description	Application
Port sea chest Fr. 96 – 106	4" butterfly valve	Air vent high chest
Port sea chest Fr. 96 – 106	4" butterfly valve	Air vent low chest
Port sea chest Fr. 96 – 106	¾" SDNR globe	Air inj. high chest
Port sea chest Fr. 96 – 106	¾" SDNR globe	Air inj. low chest

Location	Description	Application
Port sea chest Fr. 96 – 106	1/2" SDNR globe	Steam inj. high chest
Port sea chest Fr. 96 – 106	1/2" SDNR globe	Steam inj. low chest
Port sea chest Fr. 96 – 106	8" butterfly valve	Recirc. high chest
Port sea chest Fr. 96 – 106	8" butterfly valve	Recirc. low chest
Port sea chest Fr. 96 – 106	16" butterfly valve	Sea inlet high chest
Port sea chest Fr. 96 – 106	16" butterfly valve	Sea inlet low chest
Stbd. sea chest Fr. 96 – 106	4" butterfly valve	Air vent high chest
Stbd. sea chest Fr. 96 – 106	4" butterfly valve	Air vent low chest
Stbd. sea chest Fr. 96 – 106	3/4" SDNR globe	Air inj. high chest
Stbd. sea chest Fr. 96 – 106	3/4" SDNR globe	Air inj. low chest
Stbd. sea chest Fr. 96 – 106	1/2" SDNR globe	Steam inj. high chest
Stbd. sea chest Fr. 96 – 106	1/2" SDNR globe	Steam inj. low chest
Stbd. sea chest Fr. 96 – 106	8" butterfly valve	Recirc. high chest
Stbd. sea chest Fr. 96 – 106	8" butterfly valve	Recirc. low chest
Stbd. sea chest Fr. 96 – 106	16" butterfly valve	Sea inlet high chest
Stbd. sea chest Fr. 96 – 106	16" butterfly valve	Sea inlet low chest
F/W gen. sea chest Fr. 102-106	4" butterfly valve	Air vent
F/W gen. sea chest Fr. 102-106	3" SL angle globe	F/W gen. Suction
F/W gen. sea chest Fr. 102-106	1 1/4" SL angle globe	R/O unit suction
F/W gen. sea chest Fr. 102-106	3/4" SDNR globe	Air injection

Location	Description	Application
F/W gen. sea chest Fr. 102-106	½" SDNR globe	Steam injection
Aft sea chest port Fr. 51-54	4" butterfly valve	Air vent
Aft sea chest port Fr. 51-54	3" SL angle globe	Sub. Fire pump
Aft sea chest port Fr. 51-54	2 1/2" SL angle globe	Stern tube pump
Aft sea chest port Fr. 51-54	¾" SDNR globe	Air injection
Aft sea chest port Fr. 51-54	½" SDNR globe	Steam injection
Sea Bay Fr. 96 – 102	16" butterfly valve	Sea inlet port
Sea Bay Fr. 96 – 102	16" butterfly valve	Sea inlet stbd.
Sea Bay Fr. 96 – 102	6" butterfly valve	Air vent port
Sea Bay Fr. 96 – 102	6" butterfly valve	Air vent stbd.
Sea Bay Fr. 96 – 102	5" SL angle globe	Fire pump suction
Sea Bay Fr. 96 – 102	3" SL angle globe	Aux. D/G. suction
Sea Bay Fr. 96 – 102	8" SL angle globe	Foam pump
Sea Bay Fr. 96 – 102	8" butterfly valve	Main S/W P/P aft
Sea Bay Fr. 96 – 102	8" butterfly valve	Main S/W P/P fwd
Sea Bay Fr. 96 – 102	8" butterfly valve	Main S/W P/P Stdbby
Sea Bay Fr. 96 – 102	4" SL angle globe	Ballast pumps
Sea Bay Fr. 96 – 102	4" SL angle globe	Distiller / RO unit

Location	Description	Application
Propulsion motor room Frame 35 stbd	2" SDNR globe	OW separator

Location	Description	Application
Propulsion motor room Frame 47 stbd.	3" SDNR globe	Sub fire pump
Generator room Frame 83 port.	2" right angle cock	Boiler blowdown
Generator room Frame 90 – 91port.	4" SDNR globe	Ballast pump
Generator room Frame 89 – 90 port.	4" SDNR globe	Ballast pump
Generator room Frame 101 – 102 port.	12" butterfly	Central cooler
Generator room Frame 90 – 91 stbd.	4" SDNR globe	F/W distiller
Generator room Frame 92 – 93 stbd.	3" SDNR globe	Aux. Generator
Engine room flat Frame 95 stbd.	3" SDNR globe	Galley drains
Engine room flat Frame 95 stbd	2" SDNR globe	Galley drains
Frame 29 in void tank # 6P	4" SDNR globe	Grey water drain
Frame 28 in void tank # 6P	3" SDNR globe	Sewage discharge
Frame 29 in void tank # 6S	3" SDNR globe	Grey water drain
Frame 169 port, fwd halon locker	2" SDNR globe	Fwd. Bilge pump
Frame 176 stbd. Fwd rope stores	2" SDNR globe	Chain locker
Frame 13 port, bosun stores	2"SDNR globe	Av. Cofferdam
Frame –4 port, engineer stores	2" SDNR globe	Bilge pump

Location	Description	Application
Frame 101	16" Butterfly	Sea Inlet S/W Pump
Frame 100-102	3/4" SDNR	Air Injection
Frame 100-102	1/2" SDNR	Steam Injection
Frame 99 Stbd	8" Butterfly	Recirc to Strainer
Frame 99 Port	8" Butterfly	Recirc to Port Strainer

3.0 Technical Description

- 3.1 All valves must be suitably tagged such that they may be reinstalled in their respective original locations.
- 3.2 The contractor must remove from the vessel and disassemble all valves listed. The globe valves must have their spindles removed, cleaned and laid out for inspection in the contractors shop. The internals of the valve bodies, valves, and sealing surfaces must be cleaned thoroughly cleaned, and laid out for inspection in the contractors shop. The butterfly valves must be removed, disassembled, cleaned and laid out for inspection in the contractors shop.
- 3.3 The butterfly valves must be carefully inspected, paying close attention to the seals. Any seal replacements will be with Contractor-supplied replacements; this cost must be covered in the material allowance detailed in this SOW item.
- 3.4 Metal-to-metal seated valves will be lapped to provide a watertight seal.
- 3.5 The Contractor must provide a test method to insure that a watertight seal is maintained between the valve and valve seat for the screw type valves. This test method must be determined to be acceptable to the attending ABS Surveyor.
- 3.6 The contractor must was and scrape clean all overboard sea water stub pipe sections while the associated valves are removed. All sections of this piping must be inspected by the CCGTA prior to re-installing connected valves. The contractor must include pricing for 300 UT shots to be taken on these sections of pipe. A unit price per 10 shots must be taken for adjustment by PWGSC 1739.
- 3.7 Following all inspections and satisfactory tests, all valves must be assembled with new gland packing and jointing, and installed in good order in their original respective locations. All Fasteners must receive a coating of anti-seize compound when reassembled, any fasteners replaced with new are to be of the same or better grade than the original ones replaced.

- 3.8 The Contractor must supply all material required to carry out the specified work. The Contractor must include a \$20,000.00 allowance for replacement valves, piping, parts and materials that are required based on valve and piping inspections. This final amount is to be adjusted by PWGSC 1379 based on final invoicing.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 The Contractor is to be responsible for all inspections and is to consult with ABS , prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the Technical Authority, in advance, to allow his/her attendance.

4.2 Testing

- 4.2.1 Upon the refloating of the vessel all valves are to be inspected for water tightness. Any leaks are to be repaired by the contractor at the contractor's expense.

5.0 Deliverables

5.1 Reports/Certifications

- 5.1.1 Full credit for all inspection items is to be received from ABS on completion of work.
- 5.1.2 The contractor must maintain a typewritten spreadsheet/valve report maintaining all work complete on the listed valves. This report must be updated throughout the refit and a final copy provided to the CCG TA.

E-09 FUEL OIL, WASTE OIL AND D/G TANK SURVEY

1.0 Scope

- 1.1 The intent of this SOW item must be to open up the listed tanks for cleaning, inspection, testing and to cover the continuous survey for ABS. These tanks are considered as confined spaces under the Canadian Coast Guard's Safety Management System.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Tank Listing

<u>Tank</u>	<u>Location</u>	<u>Capacity</u>	<u>Field #</u>
F.O. Tank #1	Fr 163-175 (P)	56.1 m ³	3L090
F.O. Tank #2	Fr 163-175 (S)	56.1 m ³	3L091
F.O. Tank #3	Fr 152-163 (P)	11 m ³	3L092
F.O. Tank #4	Fr 152-163 (S)	113 m ³	3L093
Upper Flume	Fr 117-126 (C)	118.3 m ³	3L100
Lower Flume	Fr 117-126 (C)	116.3 m ³	3L101
Fuel Coll. Tk	Fr 94-96 (C)	2 m ³	3L103
Fuel Overflow	Fr 106-110	8.5m ³	3L102
Fuel Day Tank	Fr 64-70	27.8 m ³	3L104

Fuel Settling Tank	Fr 57-64	32.5 m ³	3L105
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<u>Tank</u>	<u>Location</u>	<u>Capacity</u>	<u>Field #</u>
Waste Oil Tank	Port Fr 30 – 37	4.9 m ³	3L107
Oily Bilge Tank	Stbd Fr 30 – 37	4.9 m ³	3L108
Purifier Sludge Tank	Stbd Fr 55 – 64	2.5 m ³	3L106

<u>Tank</u>	<u>Location</u>	<u>Capacity</u>	<u>Field #</u>
Emergency Gen Tank	Fr 60-63.5 (S)	1.9 m ³	3L130

2.2 Reference Drawings

- Emergency Gen Tank Compartment Arrangement - 51-10-01-01
- Capacity Plan – 555-H-0026

3.0 Technical Description

- 3.1 The Contractor must have the tanks gas freed, and certified Gas Free, safe for personnel to enter and safe for hot work as per provincial and federal disposal guidelines. Certificates must be forwarded to the Owner's representative and a copy must be posted in a conspicuous location near the entrance to each tank. Certificates must be renewed every day.
- 3.2 The Contractor will be responsible for all environmental requirements for disposal of tank residues. The vessel's crew will pump the tanks down to the suction levels.
- 3.3 The Contractor must open up the tanks and dispose of the remaining waste oil residues. The Contractor must quote on a unit cost per m³ of for the disposal of waste oil/fuel water mixture. The Contractor must include an allowance of 15m³ disposal in their bid price, the final cost will be adjusted by PWGSC 1379 based on actual removals. Cleaning and wash water or spilled fluids are not part of this costing and any of the costs associated with the disposal of these fluids is to be the contractor's responsibility.
- 3.4 The tanks must be thoroughly cleaned and wiped down using lint free rags; all scale, dirt and debris must be removed ashore. Contractor to provide unit cost for

mechanical descaling on tank surfaces, an allowance of 5 m² to be provided based on quoted unit rate, adjustment of the actual m² area will be made by PWGSC 1379 based on the unit rate. Prior to work commencing the contractor and TA must agree on m² of area to be mechanically cleaned. The contractor must ensure that there is no rust or scale build up after cleaning, prior to re-filling these tanks. All vent, sounding and overflow pipes are to be proven clear.

- 3.5 Where tank drain plugs are fitted, and if removed for cleaning when refitting the plugs, the TA or designate must witness hardening up the plugs. The Contractor must provide a unit cost per each for renewal of tank plugs. If plugs are removed they are to be identified and given to the TA for safe keeping until ready to refit.
- 3.6 Following the cleaning of the tanks, the tanks and vents will then be inspected by the Owner's representative and the attending ABS Surveyor. The Contractor must include an allowance of \$7,500 for tank vent piping repairs. The Chief Engineer and Technical Authority must make the decision on which tank vent pipes need repair. This allowance must be adjusted by PWGSC 1379 based on the actual amount of vent repairs required.
- 3.7 The Owner's representative (or designate) will be present when the manhole covers are reinstalled. The Contractor must clean the sealing surfaces around the manhole and cover and install the cover using new ¼ inch thick Nitrile gaskets. Anti-seizing compound must be used on all threads. The Contractor must include pricing for the replacement of 10 studs and must include a unit cost per stud to replace any broken manhole securing studs. Any studs damaged by the contractor must be replaced at their expense.
- 3.8 The Contractor must provide pneumatic testing of each individual tank.. This pricing must include the installation and removal of blanks for suctions, overflow pipes and vent head removals, additional tank openings, HSE confined entry requirements and additional tank cleaning if required.
- 3.9 The attending ABS Surveyor solely must determine the test method. All tests must be witnessed by the attending ABS Surveyor and the Technical & Inspection Authorities.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 The Contractor must be responsible for all inspections and must consult with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor must advise the Owner's representative, in advance, to allow his/her attendance.

4.2 Testing

- 4.2.1 All tanks listed in this specification item must be pneumatically tested to the satisfaction of the ABS surveyor and CCG TA.

5.0 Deliverables

- 5.1 Upon completion of all repairs and testing, the Contractor and the Owner's representative (or designate) must conduct a final inspection and ensure all tanks, covers, vents and piping connections have been returned to operating conditions and the attending ABS Surveyor has completed all inspections and credit has been awarded for all survey items.

E-10 ANCHOR WINDLASS SURVEY

1.0 Scope

- 1.1 The intent of this SOW item must be to open up the Anchor Windlass for inspection, and survey as per ABS requirements.
- 1.2 This work must be carried out in conjunction with the following SOW items:
 - H-03 – Hull Cleaning and Painting
 - H-17 – Chain Locker Survey
 - H-18 – Anchors and Chains
 - H-21 – Kick Pipe/Wire Penetrations
 - H-30 – Bow Thruster Replacement
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Nameplate Data

- Pacific Winches
- Hydraulic double wildcat Windlass s/n 56/1-2

Note: The Anchor Windlass hydraulic power pack will be locked out by the vessel's Electrical Officer at breaker P-604-15-1, located in the Forward Winch Room.

2.2 Drawings

- Anchor Windlass Arrangement - H-3110
- General Arrangement Focsle Deck – H-0019

3.0 Technical Description

- 3.1 Anchor chains must be laid out and ranged in the dock bottom for survey under SOW item H-18 - Anchors and Chains.
- 3.2 The Contractor must drain the gear case; quote on disposal of 50 liters of 68-220 gear oil, as per applicable provincial government regulations. The top cover is to be removed from the gear case and must be protected from damage.
- 3.3 Both band brake assemblies and clutch operating assemblies must be marked as to their position and are to be disassembled; all parts are to be removed to the Contractor's facility for cleaning and ABS survey.
- 3.4 The four main bearing caps must be marked to their position and removed. The warping head covers and retainers must be removed; fasteners must be discarded. Warping heads must be pulled from the main shaft; keys are must be retained for reuse.
- 3.5 The main shaft and remaining fittings must be removed to the Contractor's facility for cleaning, disassembly and ABS survey; the main shaft must be suitably supported to prevent any damage. Clutch plates, wildcats and associated spacers are to be marked as to their position and are to be removed; all parts must be cleaned, examined for defects and laid out for inspection. Shaft seals must be removed and discarded. The contractor must label any shims/chocks upon removal of the windlass base securing hold down bolts.
- 3.6 After the windlass has been removed, the contractor must pressure wash clean and de-grease the entire deck area under and around the windlass base and the windlass seat itself. When dry, the contractor must proceed to remove all loose and flaky coatings from the deck and windlass seat area and feather back edges to existing adhered coatings by means of power tooling to SSPC SP3. The contractor must coat this entire area with two coats of marine grade primer and two coats of corresponding marine grade topcoat to match the existing deck and windlass seating colour schemes. The contractor must also include pricing for 75 UT shots to be taken on the deck area by a certified third party organization.
- 3.7 Both band brake assemblies and clutch operating assemblies are to be completely disassembled, cleaned, examined for defects and laid out for inspection. The Brake material must be renewed; the Contractor must quote on a unit cost per section to renew brake material and fasteners with non-asbestos friction material. Each brake requires approx. 72" of 6" x ½" material attached with copper rivets. Contractor to provide certification that the friction material is non asbestos. The Contractor must inspect threads on the brake band securing spindles and swivel connections for excessive wear, any repairs or replacements to these sections shall be covered by PWGSC 1379 adjustment.

- 3.8 Bearings are to be thoroughly cleaned of grease; all grease fittings are to be removed and discarded; grease passages are to be proven clear by mechanical cleaning and forcing new grease through the passages, the TA or designate must witness. New grease nipples will be contractor supply. The main shaft in way of the four bearings must be examined and any minor imperfections are to be corrected using crocus cloth or other fine abrasive. Contractor must note the location and orientation of each grease nipple and ensure they are returned in the correct position to enable access and proper greasing when the windlass is reassembled and installed.
- 3.9 Immediately prior to reassembly, the gear case, upper and lower portions, must be cleaned and de-greased to remove any traces of the emulsified oil.
- 3.10 After all ABS inspections, witnessed by the Technical Authority, are completed the Anchor Windlass must be reassembled; new Owner-supplied shaft seals are to be fitted. Gear oil and grease will also be Owner-supplied; all other parts will be Contractor-supplied.
- 3.11 The Contractor must check the windlass base for trueness. Upon installation of the windlass, the bolts shall be torqued to proper bolt size specification. The contractor must check the alignment of the windlass shaft (blueing on gear teeth) upon completion of its installation prior to connecting hydraulic lines and operating under load.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 The Contractor must be responsible for all inspections and is to consult with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor is to advise the Technical Authority, in advance, to allow his/her attendance. All coatings and prep work must also be inspected and approved by the CCG TA and the NACE inspector.

4.2 Testing

- 4.2.1 Upon completion of SOW item H-18, Anchors and Chains, the Anchor Windlass must be operationally and functionally tested as directed by the attending ABS Inspector; these tests must be witnessed by the Technical Authority. All tests must be approved by the ABS surveyor and the CCG TA.

5.0 Deliverables

- 5.1 A Full QA report including weather conditions/temperatures/moisture/dew points, coating film thicknesses, dates and batch numbers must be provided for all coating work detailed in this specification.
- 5.2 Full credit must be awarded for all survey items by ABS.
- 5.3 The contractor must provide the CGTA with a copy of the UT report.

E-11 RELIEF VALVE CERTIFICATION

1.0 Scope

- 1.1 There are 23 air, steam and fuel system safety relief valves which require recertification for ABS. The Contractor must remove these valves and transport them to a recognized facility for testing and recertification, certification must be accepted by ABS.
- 1.2 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this specification item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Valve Listing

VALVE	LOCATION	S/N	TYPE	SET POINT	SIZE
Auxiliary Craft Fuelling	E/R Casing (A) – Officers' Dk	N/V 2924	Kunkle 20-G01-MG	50 PSI	1½"
Whistle Air	E/R Casing (F) – Officers' Dk	N/V 2437	Aquatrol 88	112 PSI	½"
Emergency Air Receiver	Emergency D/G Rm	N/V 56051-1	Aquatrol 88	164 PSI	½"

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Main Air Receiver (upper)	D/G Room Flat (S)	84C2226	Consolidated 1990C	270 PSI	1"
Main Air Receiver (lower)	D/G Room Flat (S)	84C2227	Consolidated 1990C	270 PSI	1"
Ship Service Starting Air	D/G Room Flat (S)	N/V 2436	Aquatrol 88	115 PSI	3/4"
Whistle Air reducing stn	D/G Room Flat (S)	N/V 12V-03476	Kunkle	110 PSI	3/4"
Main Starting Air (upper)	D/G Room Flat (A)	31481D01	Kunkle 6010EEM01-KM0165	165 PSI	1"
Main Starting Air (lower)	D/G Room Flat (A)	N/V 2442	Aquatrol 88	165 PSI	1"
Control/Service Air reducing stn	Lwr D/G Room (S)	N/V 4424-14-2	Kunkle	112 PSI	1"
Control Air receiver	Lwr D/G Room (S)	6383E92	Kunkle 6010DD	115 PSI	3/4"
Seabay Air service	Lwr D/G Room (S)	N/V 56051	Aquatrol 88	55 PSI	1"
Auxiliary Steam	D/G Room Flat (A)	15428841LE	Apollo 19MGGK055	55 PSI	1 1/2"
Emergency Air Comp (2)	D/G Room Flat (A)	NV 5057	FIG 118CSS	100 psi	1/2"
		NV 3652	Kunkle 82.4	200 psi	1/2"
Stbd Boiler Feed Water	D/G Room Flat (A)	C7000157131085	Anderson Greenwood	600 psi	1/2"

Valve	Location	S/N	Type	Set Point	Size
Stbd Boiler Steam	D/G Room Flat (A)	NV30814	Apollo 19GFA125	125 psi	1-1/4"
Port Boiler Feed Water	D/G Room Flat (A)	NV B11-27343	Anderson Greenwood	600 psi	1/2"
Port Boiler Steam	D/G Room Flat (A)	NV 4395	Kunkle 6010HGM01-AM	125 psi	1-1/2"
#1 Air Compressor (2)	Lwr D/G Room (S)	NV-5067 NV-5069	Seetru Seetru	31.5 bar 9 bar	1/2"
#2 Air Compressor (2)	Lwr D/G Room (S)	NV-5068 NV-5070	Seetru Seetru	31.5 bar 9 bar	1/2"

3.0 Technical Description

- 3.1 The Contractor must be responsible for all inspections and must consult with ABS, prior to commencement of work, to determine an inspection schedule; at each inspection point, the Contractor must advise the Technical Authority, in advance, to allow his/her attendance.
- 3.2 Lock-out of air inlet valves must be on a case-by-case basis by TA approved personnel, with boilers being isolated at the respective circuit breaker/MCC by the vessel's Electrical Officer.
- 3.3 Suitable blanks/plugs are to be installed in the piping/receivers while the safety valves are removed; the Technical Authority (or designate) are to witness the removal of the blanks/plugs upon reinstallation of the relief valves.
- 3.4 Contractor-supplied thread sealant or new gasket material must be used on all re-installations; connections are to be proven leak-free, using the medium normally contained in the receiver/piping at operating pressure.

- 3.5 The Contractor must include a \$1,000.00 allowance in their pricing for any adjustments or repairs required as a result of the above recertification procedures; this value will be adjusted by PWGSC 1379 action. Any valves failing to operate as required will be replaced by ABS approved equivalent valves which will also be covered on this allowance.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 All work to be inspected and approved by ABS and the CCG TA.

5.0 Deliverables

5.1 Reports/Certificates

- 5.1.1 Original test certificates must be supplied to the Technical Authority within three working days of the completion of all work. Valves are to be sealed with tags or lead seals when returned from certification.

- 5.1.2 Full Credit must be awarded by ABS for all survey items.

E-12 STEERING UPGRADES

1.0 Scope

- 1.1 The intent of this SOW item is for the contractor to upgrade the existing steering system with new GSM Jastram hydraulic, mechanical and electrical components as described in the attached technical Installation and Service Manual # JQ 161379. The Contractor must also supply and install all new cabling as per the appended Jastram documentation. All work in this SOW item must be carried out by the contractor under the guidance of a Jastram FSR.
- 1.2 This work must be carried out in conjunction with the following SOW items:
- 12.0 – Vessel Commissioning
 - H-03 – Hull Cleaning and Painting
 - H-33 – Bridge Window and Steel Replacement
 - E-07 – Rudder and Stock Inspection
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Regulations

- a) Canada Shipping Act 2001 - Hull Construction Regulations
- b) Canada Shipping Act - Tackle Regulations
- c) Canada Shipping Act – Marine Machinery Regulations
- d) Canada Shipping Act - Hull Inspection Regulations
- e) Canada Shipping Act – Safe Working Practices Regulations
- f) Maritime Occupational Health and Safety Regulations
- g) ABS Rules and Regulations

2.2 Standards

- a) CCG Fleet Safety Manual (DFO/5737)
- b) IACS No. 47 - Shipbuilding and Repair Quality Standard
- c) TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- d) IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- e) IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- f) IEC 60092-504-Electrical Installations in Ships – Part 504: Special Features – Control and Instrumentation
- g) IEC 60533 – Electrical and Electronic Installations in Ships – Electromagnetic compatibility
- h) CSA W59-08 (R2008) - Welded Steel Construction
- i) CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- j) Society for Protective Coatings (SSPC) Standards
- k) CCG Welding Specification (CT-043-eq-eg-001-E)

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Drawings

- JQ 161379 – Jastram Installation and Service Manual
- F-7049-16-0331 – CCG Supplied Parts List 1
- F-7049-16-0331 – 2 – CCG Supplied Parts List 2
- 68-30-01 – Hydraulics for Steering Gear
- 68-30-02 – Steering Arrangement
- H-2620 – Rudder Arrangement
- H-2640 – Rudder Stock
- 84-4 – Steering Wiring
- 86-01 - 86-20 - Wireways and Electrical Layouts
- E4064-E-12 (1-7) & E4064-E-22 (1-3) - ECR & Wheelhouse Elementary Wiring diagrams
- 80-01-01 – 80-57 - Electrical One line Drawings and Fault Current Calculations

2.4 Government Supplied Materials

2.4.1 The CCG Supplied Jastram parts lists are listed in documents F-7049-16-0331 and F-7049-16-0331 – 2.

2.4.2 Unless specifically noted within this SOW item, the contractor is responsible for supplying all materials and equipment required to carry out the work detailed in this SOW item.

2.5 FSR

Val Korbut
Lead Service Engineer
Jastram Engineering Ltd.
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3.0 TECHNICAL DESCRIPTION

3.1 General

- 3.1.1 The contractor must include a \$50,000.00 allowance in their pricing for the services of a certified Jastram FSR to oversee this work. The Jastram FSR will also provide the services of a Sperry FSR to oversee the installation of the Autopilot portion of this specification item as detailed in section 3.4. This allowance will be adjusted by PWGSC 1379 upon the completion of work and receipt of final invoice.
- 3.1.2 The Contractor must supply all labour, equipment, enclosures, ventilation, staging, chain falls, crane usage, slings, and shackles necessary to perform the work. All lifting equipment must be appropriate for expected duties, and be accompanied by current certification indicating, or be permanently marked as being of an adequate safe working load for the expected duties. Any lugs/pad eyes, brackets or other welded attachments required in the performance of this SOW item must be welded into place by CWB certified welders certified to welding standard W47.1 Div.1 and tested as per safety regulations. All Hydraulic work must be carried out by Certified Hydraulic Technicians and any Electrical work must be carried out by Certified Electrical Technicians.
- 3.1.3 The contractor is responsible for all safe work requirements as detailed in this specification. Prior to any hot work taking place Contractor must ensure that the area of work and all equipment, wiring, transits, etc. have been sufficiently protected from any sparks or metal filings. The Contractor must also ensure that the area of work, the system, and any adjacent space is certified gas free and suitable for work as per the preamble. The Contractor is responsible for opening, cleaning, gas freeing all confined spaces/tanks as required to safely carry out the work detailed in this SOW item and is responsible for arranging a certified Marine Chemist to visit the vessel and carry out the necessary testing to obtain safe entry and safe for hot work certificates. A copy of a gas free/safe for hot work certificate must be given to the CCGTA prior to personnel entering the tank and a copy of each certificate must be posted in a conspicuous location in close proximity to the manhole cover for each tank. Spaces must be tested each day that personnel are required entry in the tanks.

- 3.1.4 The contractor is responsible for the identification and removal, storage and re-installation of any interference items in way of carrying out this upgrade. This includes but is not limited to; all wall/ceiling panels, flooring, piping, electrical, ductwork/trunking, insulation and equipment. All removed insulation is to be replaced with new, contractor supplied marine grade, ABS approved equivalent.
- 3.1.5 Any areas affected by hot work must be cleaned, edges feathered to SSPC-SP3 standards and coated with 2 coats of marine primer and 2 topcoats of the corresponding area colour. All welds must be power tool cleaned to SSPC-SP11 and painted with 2 coats of marine primer and 2 top coats of the corresponding area colour.
- 3.1.6 The Contractor must schedule all work in this specification and the attendance of the FSR so that no delays are incurred and there are no excess costs for additional down time. If there are delays as a result of Contractor's scheduling of work or extra costs due to excess FSR down time, then the Contractor must be responsible for covering any additional costs associated with retaining the Jastram FSR.
- 3.1.7 Prior to starting any strip out or removals, the Contractor must ensure that all identified piping isolations for the steering system are closed and are secured using the established lock-out / tag-out system as outlined in the General Notes. The Contractor must also ensure that all identified electrical supplies for the system have been isolated and secured using the established lockout / tag-out system as outlined in the General Notes.
- 3.1.8 The Contractor must be responsible to drain and dispose of the necessary hydraulic oil from the system to permit the work to be carried out on the system.
- 3.1.9 The contractor must carry out all work in this SOW item under the direction of the Jastram FSR and CCG TA. The document JQ 161379 – Jastram Installation and Service Manual – must be referenced and used for additional provision and guidance only. Drawings including all connections and placement of components and equipment must be approved by CCGTA and FSR before any work begins.
- 3.1.10 The contractor must also provide and maintain effective storage of all related parts and equipment as required for this upgrade prior to any installation on the vessel. This includes storage in an enclosed, heated and dry building storage facility safe from all outdoor weather and shipyard debris from the time the equipment arrives at the contractor's facility until it is successfully installed on the vessel. Further storage requirements are detailed in Section 3.5 – Storage Requirements - of this specification.
- 3.1.11 From the time the new steering parts and related equipment arrive at the contractor's facility until they are successfully installed on the vessel, the contractor is responsible for all cranes, forklifts, rigging, labour and all other related equipment and mechanical requirements necessary for the successful completion

of these upgrades. This includes all movements around the contractor's facility, on/off trucks, in/out of storage and on/off the vessel. These requirements also apply to the existing steering equipment which must be removed from the vessel and properly disposed of as per provincial and federal guidelines.

- 3.1.12 As described in the George R. Pearkes Lead Paint Assessments 2020 & 2021, the deck coatings in the steering flat area may contain high levels of lead. In order to modify the seating arrangements as detailed in this specification, the contractor must carry out the necessary lead coating abatement and disposals on the seating/foundations as required. The contractor must follow all provincial and federal guidelines while removing and disposing of all lead coatings as required to successfully carry out the work detailed in this SOW item. All removals and disposals necessary around the steering equipment seating and foundations must be included in the contractor's firm pricing for this specification item.

3.2 Electrical Cabling Removals and Installations

- 3.2.1 After the removal of interference items, draining of oils and lockout/tagouts are complete, the contractor must proceed to remove all electrical cabling from the present system with the exception of four (4) cables that must be retained for the autopilot portion of this install, which is detailed further in section 3.4 of this SOW item. The contractor must label and neatly store all temporarily removed ceiling/wall panels and interference items for future re-installation. The contractor must reference drawing D-752070 – Steering Control Cabling Diagram – for specific details on cabling requirements. The four (4) existing cables to retain are as follows:

- 2 x Speed Log Cables, cable label DL-SCU-1 & DL-SCU-2
- 2 x Gyrocompass Cables, cable label LC-SCU-1 & LC-SCU-2

- 3.2.2 The contractor must supply and install all new cables as described in the attached Jastram installation manual, Sections 4-6 and specifically detailed in drawing D-752 070 – Steering Control Cabling Diagram. The Contractor must use the Cabling Drawings referenced to determine all of the specifications of the cable and to ensure the proper cables are supplied. It is the responsibility of the contractor to confirm all cable lengths and technical requirements.

- 3.2.3 The Contractor must confirm final layout and components locations, as well as cable construction standards. Check the cabling/wiring diagram for the type of cable and number of conductors. For ease of installation the cable conductors must be colour coded.

- 3.2.4 Terminal blocks, disconnect switches and over-current protection on power supplies are CFM and must be provided as indicated on the cabling

drawings. Terminal Blocks, if fitted, must be housed in fire and water resistant enclosures.

- 3.2.5 The contractor must ensure that the cable ends can terminate to Jastram supplied components approximately as shown in the cabling diagrams in the Jastram installation manual, sections 4-6. To avoid damage, components and their cables must not be installed in unrelated machinery or work spaces and no cables or related electrical components must be placed in close proximity to high current or voltage devices.
- 3.2.6 All signal, line supply, and power cables must be routed away from each other as much as possible to minimize interference. Actual routing must be approved by the CCGTA and FSR.
- 3.2.7 All wiring must be labeled as per the Jastram Installation Package during this installation and must follow existing cable trays and routes throughout the vessel as detailed in the vessels electrical deck plans. Any existing cable transits that are opened up or disturbed must be suitably re-packed with compatible, class approved blocks. The contractor must include in their price to supply, install and pack eight (8) new S8x4, welded, multi-cable Rextec transit kits (Complete with frame, blocks, wedge kit, stay plate, lubricant etc.), or certified equivalent, as part of this specification item. The contractor must also provide a unit cost per transit. The final cost for this work will be adjusted by PWGSC 1379 based on the actual installation requirement.
- 3.2.8 All cabling must be terminated and secured as per the Jastram Installation package, section 4-6, and as per TP127E standards.
- 3.2.9 The Contractor is responsible for modifying the existing consoles and panels where required and is responsible for any reinforcement necessary. All modifications must return the console to a finish matching the panels or consoles previous "as delivered" state.
- 3.2.10 All temporarily removed interference items (i.e. wall and ceiling panels) are to be re-installed in good order upon completion of electrical work.

3.3 Mechanical and Hydraulic Removals and Installation

- 3.3.1 Installation of all components for the steering gear must follow the attached Jastram Installation and Service Manual and associated drawings. The associated hydraulic and mechanical drawings, instructions and documentation are in sections 1-3 of the manual.
- 3.3.2 The Contractor must be responsible to supply all seamless piping & tubing, fittings, and hoses required for the installation of the steering gear. Black iron pipe must

not be used. All new flexible lines must be pressure tested and cleaned to a preferred NAS 5 Standard, all pressure testing and cleanliness must be complete with certification stating the 1.5 times Working Pressure test and the NAS 5 Cleanliness. All new hard lines must be chemically pickled and cleaned to a preferred NAS 5 level and reference to the procedure and results must be supplied within a signed certificate. The Contractor must supply and install sufficient new pipe and tube hangers and supports as needed to prevent any movement of the pipe or tubing when under full operating pressure. The contractor must reference drawing D-601991 – for the new piping arrangement and installation.

3.3.3 The contractor must use the aft cargo hatch, forward of the steering flat area, for all rigging requirements in and out of the steering flat area. All rigging and installations must be carried out under the guidance of the Jastram FSR.

3.3.4 The contractor must proceed to disconnect piping and hydraulics from the following mechanical units and rig the following assemblies off the vessel through the aft hatch in their entirety:

- The existing HPU's complete with the steering manifolds

- The existing hydraulic steering cylinders, taking extra precaution to not disturb the tiller. These existing cylinders must not be disposed of and must be suitably protected, crated and returned to CCG stores.

- All existing hydraulic lines, including the draining and disposal of all related oils must be disposed of as per provincial and federal guidelines. Disposal certificates to be forwarded to CCGTA.

- All additional, redundant electrical components and equipment.

Note: *The contractor must obtain approval from the FSR and the CCG TA prior to the disposal of these items.*

3.3.5 The Contractor must remove the Emergency Manual Helm Pump from the Main Hydraulic Power Unit. This pump must be protected, laid aside and re-installed after the new components are installed. This pump must be connected to the new GSM header tank after installation. Connection ports must be capped/plugged to ensure no ingress of dirt while removed from the system.

3.3.6 Before installing the two (2) new Hydraulic Power Units (40 Hp), the Contractor must supply and install a ¾" NPT locking ball valve with cap into the bottom of the reservoir for the purpose of complete draining capability. The contractor must supply 2" NPT port c/w 2 " ball valve at the lower portion of the tank for use as a Balancing (Equalizing) line. The exact location must be determined by the Jastram FSR on site. The tank must be cleaned out so that it is free of any debris that has originated from the installation of this locking ball valve.

- 3.3.7 The Contractor must install the two (2) new Hydraulic Power Units, 40 Horsepower, in the location of the existing HPU's utilizing the existing base that the existing HPU is mounted to. CFM shock absorbing pads must be supplied and installed prior to securely mounting and fastening the new units. The Contractor must assume that existing 3 inch x 3 inch x 1.5 inch solid mounting pads must require removal and that new mounting pads, drilled to allow fitting to the shock absorber pads must be required and fabricated/supplied and welded to the existing frames, continuous full penetration welds are required (4 pads per HPU). The pads will require new framing to be fabricated, fitted and installed underneath by the contractor. The existing main HPU mount size is approximately 1270mm x 1170mm. The new HPU units mount size is 1372mm x 1220mm. The contractor must reference the Jastram installation manual and the Steering Flat Arrangement Diagram – 68-30-02 - for further details on the new equipment and mounting arrangements.
- 3.3.8 Prior to installing the one (1) new Hydraulic Power Units (7.5 Hp), the Contractor must supply and install a $\frac{3}{4}$ inch NPT locking ball valve with cap into the bottom of the reservoir for the purpose of complete draining capability. The tank must be cleaned out so that it is free of any debris that has originated from the installation of this locking ball valve.
- 3.3.9 The Contractor must install the one (1) Hydraulic Power Unit, 7.5 Horsepower, in the location of the existing HPU, utilizing the existing support base that the existing HPU is mounted to. The existing base must be enlarged forward and aft to accommodate the new HPU unit. The existing mount is approximately 710 mm x 710 mm and the new emergency HPU is 890mm x 610 mm. The Contractor must install new CFM shock absorbing pads between the HPU and the Contractor modified base prior to securely mounting and fastening the new unit. The existing angle frame requires modification and new mounting holes must be drilled for the new shock absorber pads securing fasteners. The contractor must reference the Jastram installation manual and the Steering Flat Arrangement Diagram – 68-30-02 - for further details on the new equipment and mounting arrangements.
- 3.3.10 The Contractor must supply and install all new hydraulic lines, hard and flexible units, except any lines listed as OEM supplied. These new lines must be new, clean and fully certified prior to installation on the vessel and are detailed in the attached Jastram installation manual, Sections 1-3. All new hydraulic piping must be chemically pickled prior to installation on the vessel. As previously noted, all hydraulic work must be carried out by fully certified hydraulic technicians.
- 3.3.11 The Contractor must install the two (2) new GSM supplied hydraulic cylinders complete with mounting pin, installation sleeve and tiller pin. The contractor must install/connect the associated new OEM GSM hydraulic flexible lines.

- 3.3.12 The Contractor must install the new DARB valve and 4 DARB isolation valves as described in sections 1-3 of the Jastram installation manual and as per drawing D-601991.
- 3.3.13 The contractor must confirm with the FSR and CCGTA for the final mounting arrangement and locations of any remaining miscellaneous items as detailed in the attached CCG Supplied Parts Lists.
- 3.3.14 The Contractor must remove all obsolete items from the Main Console and the Starboard and Port Wing Consoles using control/console drawings in section 5 of the Jastram installation manual for reference. The Contractor must design, fabricate and install new, console faceplate arrangements so that the new console assemblies and components are fitted and installed in a proper manner with a new, clean finish. This must all be carried out with approvals from the CCG TA and FSR.
- 3.3.15 The Contractor must install the Electric Wheel, the Control Panel, Unit Change Over Panel, Rudder Order Indicator, Rudder Angle Indicator, Dimmer and JO 100-2 JOG Lever.
- 3.3.16 The Contractor must install the two (2) MCP 100-22 Mode Control Processor and 2 x DSC 100-202 either under the existing steering console or, if not possible, in another approved location in the wheelhouse area.
- 3.3.17 The Contractor must install in each steering wing the LC 100-2 Lever Controller, JO100-2 Jog Lever, CP 375 Mode Control Panel, Jastram Dimmer and RAI 580. The Contractor must remove the existing overhead Rudder Angle Indicator and install the new RAI 3300 with RAI 330 Power Supply in the location to the satisfaction of the CCG TA. The contractor must reference drawing D-752070 – Steering Control Diagram – for further details on these console locations and installations.
- 3.3.18 As described in sections 4-6 of the Jastram installation manual and as referenced in drawing D-752070 – Steering Control Diagram - the contractor must proceed to mount and install the following units in the steering flat area in locations suitable and approved by the CCG TA and FSR:
- Two (2) RFU 2000-2410 units
 - (1) Emergency STN Junction Box
 - Two (2) of the four (4) AP 600 Alarm Panels
 - (1) JO 100-1 Jog Lever in the Steering Compartment at the Emergency Station Junction Box
 - Two (2) Motor Starter and Alarm Units for the two 40 HP HPU's
 - One (1) Motor Starter and Alarm Unit for the Emergency HPU
 - One (1) HLAP (Hydraulic Lock Alarm Processor)
 - One (1) High Flow Valve Controller

- 3.3.19 The Contractor must install the remaining two (2) of four (4) AP 600 Alarm Panels and one (1) AP 375 Alarm Panel in the Engine Control Room as per in a location suitable and approved by the CCG TA and FSR.
- 3.3.20 The Contractor must re-fill the system with CFM Petro Canada MV 36 Hydraulic oil (or certified equivalent if approved by CCG and FSR) passing the oil through a 3 micron filter cart as it enters into the system. The contractor must include pricing for the supply, filtering and installation of 900L of this hydraulic oil.

3.4 Auto Pilot Installation

- 3.4.1 The CGTA must supply one (1) Navinet 4000™ Auto Pilot system complete with a flush mounting kit for the Bridge Center Console, and Contractor must make consideration for this unit in the remaking of the Center Console and modifications to the Wing Steering Stations as well. This system must be installed as per the Manufacturer's Installation and Service Manual and with the direction of the Jastram FSR & Sperry FSR. The Contractor is responsible for supplying the necessary cables and terminations for the installation.
- 3.4.2 The Navinet 4000™ requires a bus backbone cable which is approved for compatibility with the requirements of the CAN bus according to IEC 611-3. Contractor must confirm that the wiring they supply meets this requirement as well, (note: Lapp 2705250 Unitronic Bus DeviceNet™ Trunk Cable, manufactured by U.I Lapp, Schultze-Delitsch Str. 25, D-70565 Stuttgart, Germany meets this requirement).
- 3.4.3 This work must be carried out by the contractor in conjunction with the CCG E&I team. As noted in section 3.2.1 of this SOW item, the contractor must retain four (4) existing cables for this portion of work.
- 3.4.4 The Jastram FSR will arrange the services of a Sperry Marine FSR to oversee the Autopilot portion of work. The costs for the services of this FSR will be included in the allowance specified in section 1.3 of this SOW item and will be adjusted by PWGSC 1379 based on the final invoice.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work must be subject to witness by the CCGTA, FSR and attending ABS Surveyor in order to obtain a survey credit.

4.2 Testing/Trials

- 4.2.1 The commissioning of the steering and control system must be done under the direction of the Jastram Engineering FSR & Jastram Field Engineer and in accordance with the manufacturer's practices.
- 4.2.2 Testing must be completed on the system to confirm that all systems aspects are in compliance with the requirements of Transport Canada and ABS. A report on all testing and findings must be submitted to the TA prior to the acceptance of this item.
- 4.2.3 Dock Trials must be conducted to verify the operation of all new components in a variety of operational conditions including the follow up, non-follow up, single pump operation, dual pump operation, and timed movements of the rudder in accordance with ABS/TCMSS.
- 4.2.4 Sea Trials must be conducted for a period of four (4) hours to verify the operation of the new components and the integration of the system with the Autopilot control.
- 4.2.5 Any fillet welding carried out in way of this specification item is to be tested with 100 % visual inspection by a weld inspector who is qualified to Level 2 or higher and 100% MPI.

5.0 DELIVERABLES

5.1 Reports/Manuals

- 5.1.1 All ABS approval certificates for all system components/inspections must be submitted to the CCGTA prior to the acceptance of this SOW item.
- 5.1.2 The Contractor must provide the CCGTA with the typewritten report of Contractors work in both electronic and hard-copy formats outlining the details of the inspection and any alterations / repairs prior to the acceptance of this SOW item.
- 5.1.3 The Contractor must ensure that all operation, maintenance, and installation manuals supplied with the new equipment are submitted to the CCGTA prior to the acceptance of this SOW item.

5.2 Drawings

- 5.2.1 The contractor must develop new "as-built" drawings for vessel drawings that have been affected by the installation of the new steering gear components in AutoCAD 2017 DWG format, or later edition. At a minimum, the contractor must develop new "as-built" drawings for all affected drawings referenced in section 2.3 – Drawings – of this SOW item.

- 5.2.2 The Contractor must provide 2 type-written copies and 2 electronic copies of the drawings on USB flash drive format.
- 5.2.3 All drawings must be standard ANSI paper size and must be in, at minimum, AutoCAD 2017 DWG format – or later edition, and conform to the CCG National CAD Standard (MECTS #2860606-v1-National_CAD_Standards).
- 5.2.4 All electronic versions of drawings must be given a name such that the user does not have to open the drawing to establish the purpose of the drawing.
- 5.3 Spares
 - 5.3.1 Contractor must return any items CCGTA supplied with this SOW item that have not been used prior to the acceptance of this SOW item.
 - 5.3.2 The re-conditioned cylinders must be suitably protected, wrapped, crated and returned to the vessel complete with certification from a certified hydraulic repair shop.
- 5.4 Training
 - 5.4.1 Contractor must provide one (1) training course of eight (8) hour duration must be held onboard after the final installation and commissioning of all new steering controls and governors. This training must be provided to applicable staff and be conducted by the OEM of the system. Training must encompass all items outlined in the operating and maintenance instructions as supplied by the OEM.

STATEMENT OF WORK

CCGS GEORGE R. PEARKES Vessel Life Extension



PART D – Electrical (“L”) Specifications

Prepared by:
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L-01 ELECTRICAL INSULATION SURVEY

1.0 Scope

- 1.1 The intent of this SOW item must be for the Contractor to perform the annual Megger survey of the ship as per Class ABS survey credit requirements.
- 1.2 This work must be carried out in conjunction with the following SOW items:
 - E-01 - Propulsion Generator Replacement
 - E-02 - Cycloconverter Replacement
 - E-03 - Auxiliary Generator Replacement
 - E-12 - Steering Upgrades
 - H-30 - Bow thruster Replacement
 - H-32 - Galley Upgrades
 - H-33 - Bridge Window and Steel Replacements
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Regulations

- Canada Shipping Act 2001 – Marine Machinery Regulations (SOR/90-264)
- Maritime Occupational Health and Safety Regulations (SOR/87-183)
- ABS Rules and Regulations

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- TP 127E, Transport Canada Marine Safety – Ship Electrical Standards

2.3 Documents

- CG Megger Template (MS Word Document)
- CG Electrical Panel Directory (MS Excel Document)

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must perform the annual insulation resistance megger testing of all electrical panels and breakers aboard the vessel, in accordance with the CCG supplied Megger Template and Electrical Panel Directory documents. The only circuits excluded from these testing requirements are those with either the navigation equipment or electronic components. NOTE: The generator breakers must have their electronic components isolated prior to testing as well.
- 3.1.2 The Contractor must be responsible for the identification of any interference items, their temporary removal and storage and refitting to the vessel. The Contractor is responsible for protecting surrounding area and equipment while carrying out this work.
- 3.1.3 Any readings below 1MΩ or defects must be brought to the attention of the TA as soon as possible for any remedial actions that may be required.
- 3.1.3 For 120V circuits, the Contractor must provide the vessels crew with reasonable notice of areas being tested, to ensure crew members have adequate time to unplug their belongings. The Contractor is responsible to ensure all 120V equipment is unplugged in public areas prior to testing, and then reconnected upon completion

3.2 Main (x3), Emergency and Auxiliary Diesel Generators

- 3.2.1 All motor circuits must be tested in a two-step manner.
- a) First step is to have each motor circuit tested between load side of circuit breaker and line side of motor starter; and
 - b) The second step is then to have each motor circuit tested, between the load side of starter and the motor.

3.3 Propulsion Motors

- 3.3.1 The two (2) propulsion motors must be isolated and have their winding(s) insulation to ground readings measured and recorded. All circuits with readings

below 1MΩ must be immediately identified to the CCG TA. Any repairs required must be done via PWGSC 1379 action.

3.4 Main, Emergency and Ship's Service Switchboards

- 3.4.1 All switchboards found aboard the vessel must have their insulation reading to ground measured and recorded. All circuits with readings below 1MΩ must be immediately identified to the CCG TA. Any repairs required must be done via PWGSC 1379 action.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 All work to be carried out to the satisfaction of the CCG TA and ABS inspector.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The Contractor must provide one electronic and two (2) typed copies of the Final Megger Survey Report to the CCG TA. The report is to include the deficiencies found, what circuits they involved and what remedial action was taken to correct the defect.
- 5.1.2 Note: It is important that the CCG TA receives this report immediately upon completion of the Work so it can be submitted to ABS for the required survey credit.

5.2 Certification

- 5.2.1 Once approved, the Contractor is to ensure that the attending ABS Surveyor signs off Megger Survey in Ship's Survey Record Book.

L-02 THERMOGRAPHY INSPECTIONS

1.0 Scope

- 1.1 As required by TP-127E, this specification requires the Contractor to arrange to address the necessary requirements to survey the vessel's electrical generators, switchboards and transformers (over 10 kVA) using infrared Thermography.
- 1.2 This work must be carried out in conjunction with the following SOW items:
 - E-01 - Propulsion Generator Replacement
 - E-02 - Cycloconverter Replacement
 - E-03 - Auxiliary Generator Replacement
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

- 2.1 Owner/Contractor Supplied Material
 - 2.1.1 The Contractor must supply all labour, materials, equipment, and parts required to perform the specified work unless otherwise stated.

3.0 Technical Description

- 3.1 Due to the requirement to have each of the below noted equipment and machinery under normal operating loads and temperatures it is suggested that this survey be performed during the sea trials vessel required as part of this Contract.
- 3.2 The Contractor is to retain the services of certified Infrared Thermographer who will, with the assistance of the vessel's Electrical Officer, survey the three(3) new Diesel Generators, the Auxiliary Diesel Generator, the Emergency Generator, the two (2) Propulsion Motors, Main, Emergency and Vessel's Service Switchboards, and the associated transformers.

- 3.3 To obtain sufficient electrical load to conduct a meaningful survey, it will be necessary to place the propulsion system “online” and conduct maneuvers; it will also be necessary to place the Auxiliary and Emergency Diesel Generators on their respective buses on hotel/emergency service.
- 3.4 Any repairs identified by the Contractor must be brought to the immediate attention of the CCG TA for remedial action. Once repairs have been made that Contractor must arrange to have the Thermography performed again on the affected equipment. Any repair action required will be done via PWGSC 1379 action (refer to Annex F).
- 3.5 As noted in Section 3.4.11.8 of SOW item E-01 – Propulsion Generator Replacement, the contractor must supply and install new infrared windows on the new Propulsion Generator, Auxiliary Generator and Cycloconverter units prior to carrying out the Thermography inspections.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 All work to be inspected and approved by the ABS surveyor and CCGTA.

5.0 Deliverables

5.1 Reports

- 5.1.1 The Contractor must be responsible for preparing a two (2) typed written reports, detailing any defects or deficiencies discovered and the corrective action(s) taken, Copies of these reports must be provided to the CCG TA for distribution.

L-03 SPEED LOG GATE VALVE AND & TRANSDUCER REPLACEMENT

1.0 Scope

- 1.1 The intent of this SOW item is to replace and relocate the existing gate valve and transducer for the Doppler Speed Log System.
- 1.2 The Contractor must supply all materials and parts required to perform the specified work unless otherwise stated.
- 1.3 This work must be carried out in conjunction with the following SOW items:
 - H-03 - Hull Cleaning & Coating
 - H-04 - Bilge Cleaning & Coating
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this specification item must take precedence.

2.0 References

2.1 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations (C.R.C., c. 1431)
- Canada Shipping Act - Tackle Regulations (C.R.C., c. 1494)
- Canada Shipping Act – Marine Machinery Regulations (SOR/90-264)
- Canada Shipping Act - Hull Inspection Regulations (C.R.C., c. 1432)
- Canada Shipping Act – Safe Working Practices Regulations (C.R.C., c. 1467)
- Maritime Occupational Health and Safety Regulations (SOR/2010-120)
- ABS Rules and Regulations

2.2 Standards

- CCG Fleet Safety Manual (DFO/5737)
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- TP 127E, Transport Canada Marine Safety – Ship Electrical Standards
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations

- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- IEC 60092-504-Electrical Installations in Ships – Part 504: Special Features – Control and Instrumentation
- IEC 60533 – Electrical and Electronic Installations in Ships – Electromagnetic compatibility
- CSA W59-08 (R2008) - Welded Steel Construction
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CCG Welding Specification (CT-043-eq-eg-001-E)
- SWA International Paint Specification CM600222

Note: In case of conflict between any of the standards, then the most stringent requirements will prevail.

2.3 Drawings and Documents

Drawing Number	Description	Electronic Number
84-5 REV C	CCGS George R. Pearkes Sperry Naviknot 450D Doppler Speed Log Wiring Diagram	
4983-0112-01	Doppler Speed Log Transducer and Sea Chest for Steel and Aluminum Vessels (Sheet 1 of 2)	
4983-0112-02	Doppler Speed Log Transducer and Sea Chest for Steel and Aluminum Vessels (Sheet 2 of 2)	
	Doppler Transducers, Gate Valve and Tank Mount and Preamplifier Type 5005 for Doppler Speed Log Systems Naviknot Operation, Installation and Service Manual	5005-0125-01 056800 Rev P Jan 2013

2.4 Government Supplied Material

- 2.4.1 GSM will include the new Naviknot Doppler Speed log valve and transducer assembly.

2.5 Contractor Supplied Material

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

3.0 Technical Description

- 3.1 The Contractor must supply all equipment, enclosures, ventilation, staging, chain falls, cramage, rigging, 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, or a safe working load for the expected duties. Any brackets, mounts, or any other welded attachments required in the performance of this specification must be welded into place by certified welders.
- 3.2 Prior to any hotwork taking place, the Contractor must ensure that the area of work and all equipment, wiring, transits, etc. have been sufficiently protected from any sparks or metal filings.
- 3.3 In addition to any hot work taking place, which includes grinding and welding, the Contractor must check the vessels' lead abatement documentation and follow proper lead abatement procedures. If any area is of any concern, it will be brought to the attention of the Chief Engineer and a lead abatement will be conducted.
- 3.4 Any lead testing will be covered by the existing allowance in Part A – General of this SOW.
- 3.5 All cabling, once installed, must be marked with a stamped stainless steel metal tag. The labels must be securely affixed to the cable at each end and through any deck, deck heads, and/or gland penetrations with the designation for each cable as provided in this SOW item.
- 3.6 The Contractor is responsible for the temporary removal and reinstallation of any deck heads, bulkheads, paneling, insulation, and any items that is deemed to be interfering to the running of any cables and mounting of any equipment.
- 3.7 All cabling must follow existing cable trays throughout the vessel where fitted. Once installed, all cabling must be secured as per TP127.
- 3.8 The Contractor must be responsible to ensure that all areas have been cleaned and free of any debris resulting from the performance of this SOW item.
- 3.9 The Contractor must follow the vessels requirements for any work completed to the underwater hull as follows:
 - 3.9.1 *Damaged coatings must be abrasive grit blasted to SSPC-SP-10 (Near White) standard or power tooled and feathered back to intact coating. If oxidation occurs between blasting and application of the coating, the surface must be re-blasted to the specified surface preparation standard.*
 - 3.9.2 *The Contractor must apply first coat of Intershield 163 Inerta 160 Black, 20 mils DFT minimum.*
 - 3.9.2 *The Contractor must then apply second coat of Intershield 163 Inerta 160 Black, 10 mils DFT minimum.*

3.10 Prior to the commencement of any electrical work, the Contractor must ensure that all electrical supplies feeding the systems have been isolated at the source following an established lockout/tag out procedure. The Contractor must ensure that Chief Engineer or Senior Electrical Officer is notified of any lockout/tag out completed.

3.11 Electrical Isolations for AC power are as follows:

3.11.1 IC-101-7 Speed Log Navigation Bridge Nav. Console

3.12 Upon final installation, testing must be carried out as per Section 4.2 of this specification item.

3.13 The Contractor must work in conjunction with a Coast Guard Electronic Technician to oversee the installation. Terminations of all equipment must be completed by CCG technicians.

3.14 The Contractor must disconnect and remove the following equipment listed below in table.

3.14.1 – Equipment Removal

Equipment	Location
Gate Valve	Between Frames 161 & 162 Pipe Tunnel Forward 450 mm off centerline
Speed Log Transducer and Cabling (DL-1)	Within Gate Valve Between Frames 161 & 162 Pipe Tunnel
Transducer Junction Box	Frame 110 Pipe Tunnel
Speed Log Pre-Amplifier	Tank Top Deck Button of stairwell on bulkhead prior to entering MCR (Engine Control Room)

3.15 The Contractor must remove the existing hull spool piece, attachment collar, from the vessels hull between frames 161 and 162 at 450 mm off centerline.

- 3.16 The Contractor must supply and weld in place a new piece of steel material of the same grade and thickness of the hull from the removal of the spool piece for the old gate valve.
- 3.17 The Contractor must disconnect and remove the following cables listed below in table. Take note that cable DL-1 is sealed within the transducer.

3.17.1 - Cable Removal

Cable Label	Cable Type	From	To	Signal	Length (m)
DL-1	Factory	Between Frames 161 & 162 Transducer	Junction Box Piped Tunnel Frame 110	Data	18
DL-2	6C 18AWG	Transducer Junction Box Frame 110 Pipe Tunnel Aft	Speed Log Pre-Amplifier 5003 Bottom of Stairwell to MCR	Data	20
DL-3	2 C 14 AWG	Speed Log Pre-Amplifier 5003 Bottom of Stairwell to MCR	Nav. Bridge Nav. Console Port Side Speed Log Electronics Unit	Power	30
DL-4	4 PR 18 AWG	Speed Log Pre-Amplifier 5003 Bottom of Stairwell to MCR	Nav. Bridge Nav. Console Port Side Speed Log Electronics Unit	Data	30

- 3.18 The Contractor must mount the following owner supplied equipment listed in table below. The Contractor must reference the Installation, Maintenance, and Service Instructions 005005-0125-001/F Section 3 and adhere to the procedures to properly install the new Gate Valve and Transducer.

3.18.1 – Equipment List

Equipment	Location
Gate Valve	Between Frames 150 & 151 Pipe Tunnel Forward
Speed Log Transducer	Within Gate Valve Between Frames 150 & 151

	Pipe Tunnel Forward
Pre-Amplifier 5029	Engine Room Forward Above Fuel Manifold On new mounting plate

- 3.19 The Contractor must install the new owner supplied gate valve at a location determined by the Chief Engineer in the area of frame 150. The new valve must be mounted at 450 mm off centerline to the port as was the original gate valve. The included spool piece must be welded to the vessels bottom flush with the outer skin of the hull and mounted horizontally. The new spool piece must be oriented that when the gate valve is attached, the hand wheel is conveniently accessible between the frames.
- 3.20 The Contractor must ground flush all welding seams flush with the hull.
- 3.21 The Contractor must supply and install new mounting plate for the new owner supplied pre-amplifier unit that will mount to the existing cable tray above the fuel manifold at a location that is easily accessible.
- 3.22 The Contractor must supply and install all the following cables listed below unless stated. All cables must be marine and shipboard approved by classification societies. Take note that cable DL-1 is sealed within the new transducer.

3.22.1 – Cable List

Cable Label	Cable Type	From	To	Signal	Length (m)
DL-1	Factory Cable (SWE)	Transducer (Gate Valve) Between Frames 150 & 151	Pre-Amplifier 5029 Engine Room Forward Above Fuel Manifold	Data	30
DL-2	3 PR 18 AWG	Pre-Amplifier 5029 Engine Room Forward Above Fuel Manifold	Nav. Bridge Nav. Console Port Side Speed Log Electronics Unit	Data	30
IC-101-7-A	3 C 14 AWG	Pre-Amplifier 5029	Nav. Bridge Nav. Console	AC Power	30

		Engine Room Forward Above Fuel Manifold	Port Side Speed Log Electronics Unit		
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- 3.23 This work will be carried out externally on the hull of the vessel as well as internally in the Bridge, Engine Room and Pipe Tunnel areas. The Contractor is responsible for the identification of interference items, their temporary removal, storage, and refitting to vessel.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work must be subject to witness and to be to the satisfaction both the CCG TA and the attending ABS surveyor.

4.2 Testing

- 4.2.1 All cables must be checked for continuity after installation to ensure operational capability. Should any cable run fail to pass testing as a result of installation, the cable must be replaced at the Contractor's expense
- 4.2.2 All cable testing is to be performed by the Contractor and witnessed by a Coast Guard Electronics Technician.
- 4.2.3 Electronic equipment which has been removed for the performance of this specification item must be returned to operational condition as it will be used as spares for similar equipment used in CCG fleet.
- 4.2.4 All hull and structural welding must receive 100% visual inspection by a level 2 (or higher) CWB certified welding inspector and 100% UT testing.

5.0 Deliverables

5.1 Reports/Drawings

- 5.1.1 The Contractor must provide to the CCG TA a typed written report, both electronic and hardcopy formats, outlining the details of the work performed, any alterations and or repairs made, the inspections performed and copies of all readings and calibrations made.
- 5.1.2 Any affected vessel drawings must be updated by the contractor as referenced in section 8.1 – Drawings - of this SOW item.

5.1.3 The contractor must provide NDT reports, CWB tickets and procedures to the CCGTA

5.2 Certification

5.2.1 Two (2) copies as well as the original Class approval certificates for all system components must be submitted to the CCG TA. All original Class approval certificates for all system components must be submitted to the owner prior to acceptance of this SOW item.

5.2.2 The Contractor must provide all material certificates including Class approval documents of the transits, cables and other electrical components.

5.3 Spares

5.3.1 All owner supplied cable which has not been used must be returned to the owner prior to the acceptance of the SOW item.

5.4 Training – Not Used

5.5 Manuals

5.5.1 The Contractor must ensure that any manuals or VFI that has been borrowed to assist the Contractor with this installation must be returned to the CCG TA.

L-04 Integrated Communication System (ICS) Replacement

1.0 Scope

- 1.1 The intent of this SOW item must be to completely remove the existing Integrated Communications System (ICS) components and cabling (which consists of the Public Address (PA) System, the Talkback (TB) System and the Public Branch Exchange (PBX) System) and replace with a new class approved, Contractor supplied, fully Integrated Communications System (ICS). This new system must incorporate the redundant Public Address Systems, Public Branch Exchange Internet Protocol (IP) Telephone System and an Internet Protocol (IP) Intercom System that interfaces with the existing vessels alarm and monitoring system, General Alarm System, and the audio entertainment systems within the vessel.
- 1.2 The Contractor must supply and install all equipment as indicated by the manufacturer's documentation package.
- 1.3 The Contractor must supply and install all required cabling as indicated by the manufacturer's documentation package. All cabling must be approved by the applicable classification society.
- 1.4 The Contractor must terminate all cabling as indicated by manufacturer's documentation package.
- 1.5 The Contractor must procure and supply the owner with the manufacturer's recommended spare equipment for the Integrated Communications System (ICS) as indicated in the new systems documentation package.
- 1.6 The Contractor must supply all materials and parts required to perform the specified work that meets or exceeds classification societies and Transport Canada requirements. The Contractor is responsible for the identification, temporary removal, storage and re-installation of all interference items.
- 1.7 This work must be carried out in conjunction with the following SOW items:
 - E-01 – Propulsion Generator Replacement
 - E-02 – Cycloconverter Replacement
 - E-03 – Auxiliary Generator Replacement
 - E-12 – Steering Upgrades
 - H-33 – Bridge Window Replacement & Steel Renewals
 - L-06 – TV Distribution Upgrade
 - L-07 – Master Clock Upgrade
- 1.8 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1

to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings/Nameplate Data

Section	Description	Drawing/Reference Number (#)
2.1.1	CCGS George R. Pearkes General Arrangement Drawing Vessel Overview View from Front and Aft	555-H-0023
2.1.2	CCGS George R. Pearkes General Arrangement Drawing Wheelhouse Top Navigation Bridge Deck Officers Deck Boat Deck Upper Deck	555-H-0024
2.1.3	CCGS George R. Pearkes General Arrangement Drawing Main Deck Lower Deck Double Bottom Tank Top	555-H-0025
2.1.4	CCGS George R. Pearkes Public Address & Talkback System Diagram	LM639-615-SS (Sheet 1/4)
2.1.5	CCGS George R. Pearkes	LM639-615-SS

	Public Address & Talkback System Diagram	(Sheet 2/4)
2.1.6	CCGS George R. Pearkes Public Address & Talkback System Diagram	LM639-615-SS (Sheet 3/4)
2.1.7	CCGS George R. Pearkes Public Address & Talkback System Diagram	LM639-615-SS (Sheet 4/4)
2.1.8	CCGS George R. Pearkes Telephone System and Telephone Distribution Wiring	LM639-612-SS (Sheet 1/3)
2.1.9	CCGS George R. Pearkes Telephone System and Telephone Distribution Wiring	LM639-612-SS (Sheet 2/3)
2.1.10	CCGS George R. Pearkes Telephone System and Telephone Distribution Wiring	LM639-612-SS (Sheet 3/3)
2.1.11	CCGS George R. Pearkes Integrated Communications System Block Diagram	82-01
2.1.12	CCGS George R. Pearkes Integrated Communications System Deck Plan Bridge Deck and Wheelhouse Top	82-02
2.1.13	CCGS George R. Pearkes Integrated Communications System Deck Plan Boat Deck and Officers Deck	82-03
2.1.14	CCGS George R. Pearkes Integrated Communications System Deck Plan Upper Deck and Foc'sle Deck	82-04
2.1.15	CCGS George R. Pearkes Integrated Communications System Deck Plan Main Deck	82-05
2.1.16	CCGS George R. Pearkes Integrated Communications System Deck Plan Engine Room Flats	82-06
2.1.17	CCGS George R. Pearkes Integrated Communications System Deck Plan Tank Top	82-07

2.1.18	CCGS George R. Pearkes Integrated Communications System Connection Diagrams	82-28 (3 Sheets)

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- TP127E – Ships Electrical Standards
- IEEE 45:2002 – Recommended Practice for Electrical Installations on Ships
- Specification for the Installation of Shipboard Electronic Equipment (70-000-000-EU-JA-001)
- TCMS recognized, Classification Society Approval
- Rules and Regulations for the Classification of Ships
- Standard Technical Architecture for Shipboard Computer Systems

2.3 Regulations

- Canada Shipping Act, 2001
- Canadian Supplement to the SOLAS Convention TP15221E paragraph 3.7.1.1
- SOLAS Chapter II-2 Part D Regulation 12.3
- SOLAS Chapter III Part B Regulation 6.5.1
- SOLAS Chapter III Part B Regulation 6.5.2
- SOLAS Chapter III Part B Regulation 6.5.3
- SOLAS Chapter II-1 Part D Regulation 43.2.4.1
- SOLAS Chapter III Part B Regulation 6.5.4

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must remove and dispose of all cabling from the original Integrated Communications System (ICS) throughout the vessel that is referenced within the drawings provided with this SOW item. This includes the Public Address (PA) and Talkback (TB) Systems and the Public Branch Exchange (PBX) System. The majority of the cabling originates from the Boat Deck Port Side Electronics Equipment Room 308 Frames 87 and 91. The majority of the existing 120 VAC power feeds will be reused. Any power sources not reused must be placed into a marine suitable junction box and labelled accordingly. Refer to drawing numbers LM639-615-SS (4 Sheets) and 82-01 to 82-07.

- 3.1.2 The Contractor must remove and dispose of all the existing equipment and equipment components as part of the Integrated Communications System (ICS) throughout the vessel that is referenced within the provided drawings for this specification. This includes the Public Address (PA) and Talkback (TB) Systems and the Public Branch Exchange (PBX) System. Exception to the disposal of the amplifier units within Equipment Control Panel Cabinet #1 (ECP #1). These units must be stored and returned to owner, CCG, to be used as spare parts for existing systems within the fleet. Refer to drawing numbers LM639-615-SS (4 Sheets) and 82-01 to 82-07.
- 3.1.3 The Contractor must supply and install a fully commissioned and operable, type approved Integrated Communications System (ICS) that is developed and designed by a recognized manufacturer and recognized by the applicable classification society. All equipment and equipment components must be type approved by the applicable classification societies.
- 3.1.4 The Contractor must, along with the manufacturer and vendor, work in conjunction with the applicable classification society to seek class approval of the new Integrated Communications System (ICS) prior to any work associated with this SOW item.
- 3.1.5 The Contractor must supply and install all cables associated with the new Integrated Communications System (ICS) that is recommended by the manufacturer and stated within the documentation package. All cabling must be marine shipboard approved and approved by applicable classification society.
- 3.1.6 The Contractor must supply and install all materials required by the manufacturer to provide a fully commissioned and operable ICS. This will be indicated within the documentation package provided by the manufacturer and stated as yard supply.
- 3.1.7 The Integrated Communications System (ICS) must be comprised of the following integrated systems, an Internet Protocol (IP) based Telephone and Intercom System and a Conventional Public Address (PA) System. Requirements are listed in the statements below.
- 3.1.8 The supplied ICS system must meet the following requirements:
- Must be comprised of two controllers in a Loop A and Loop B type of configuration that includes the system controls and monitoring functions
 - Must have system redundancy through the Loop A and Loop B configuration
 - Each system controller from the Loop A and Loop B system must be able to take control of each other system if either system controller fails automatically
 - Must have a separate cabinet or rack for each Loop system, Loop A and telephone assembled in one and Loop B assembled within the other

- Must have sufficient amplifiers to drive the conventional speakers throughout the vessel
- Must have redundant network interfaces for the system controllers, amplifiers, and call panels
- All equipment must be able to be powered by 120 VAC sources
- Must have automatic changeover facility from the main and emergency power sources for the integrated systems
- Must have uninterruptible power supplies (UPS) to provide clean and conditioned power to the integrated system cabinets during blackout conditions during the switch over from main and emergency power sources
- The UPS must be able to provide, at the minimum, 30 minutes of run time
- Must provide the vessels alarm system with indication of power failures or alerts of the main and emergency power and UPS units
- Must have the system controllers crossed connected for redundancy
- Must provide routine and emergency broadcast public address facilities
- Must include a loudspeaker installation.
- Must broadcast to all areas of the ship.
- Must be audible in all areas of the ship.
- Must provide the option to broadcast to selected areas, broadcast zones, of the ship
- Must be clearly audible above the ambient noise in all spaces as prescribed in paragraphs 7.2.2.1 and 7.2.2.2 of the International Life-Saving Appliances (LSA) Code.
- Must be audible over the loudest ambient noise level occurring during ice transiting, icebreaking or ramming.
- Must provide the following two options for creating PA messages
 - A handset with dedicated selection push-buttons and
 - Specifically programmed telephone stations.
- Must be arranged into the following selectable groups
 - (1) Engineering Work Group
 - (2) Cabin Group
 - (3) General and Recreation Group
 - (4) Outer Deck Group
 - (5) All Call Group (Excludes Cabin Group)
 - (6) Emergency All Call Group (All Groups)
- Must have separate call panels within the Navigation Bridge area and Engine Control Room that has the broadcast groups selectable
- Must have the broadcast groups selectable via the telephone and intercom system
- Must have the ability of point-to-point communications that are easily accessible and the means of programming these lines between the configured stations
- Must be a separate dedicated selection push button on each Master Control Panel for each PA system broadcast zone.

- Each dedicated selection push-button must be configured to broadcast PA messages to a separate broadcast zone on the ship.
- Must broadcast PA messages to the broadcast zones corresponding to the selected push-button.
- The telephone system access to the PA system broadcast zones must be configurable
- Must be able to mute the local speakers within the area of the PA announcement is being made from
- Must have a Control and Monitoring element that is accessible from a web browser running on a PC
- The amplifiers must be continuously rated for the maximum power they are required to deliver into the system for audio and for alarm tone signals.
- The system amplifiers and loudspeakers must be selected and arranged to prevent feedback and other interference.
- Must have the facilities to mute the general alarm and fire alarm during PA announcements and to unmute after PA announcements has concluded
- Must be available throughout the accommodation areas, washroom/bathroom facilities, the services spaces, the control stations, the open decks, the muster station, the embarkation stations and the machinery spaces.
- Loudspeakers must be strategically located throughout the ship so that PA and Alarm messages are broadcasted to and audible in all areas of the ship.
- Must have an emergency override function that is accessible from the PA master control panels.
- The emergency override function must broadcast emergency messages over the PA system, including: the broadcast over any loudspeaker in the spaces concerned that is switched off, the broadcast over any loudspeaker in the spaces concerned for which the volume is turned down, and the broadcast over any loudspeaker that is being used for other purposes.
- Must have telephones with built-in speakers that are approved for the PA system
- Must allow the audio output from the entertainment system to be broadcasted to via telephones
- Must automatically mute the audio input from the audio entertainment systems during PA transmissions.
- The broadcast of audio output from the audio entertainment system must be automatically returned to normal service at the conclusion of any PA transmission.
- Must have the ability to control the different audio entertainment systems via telephone within the accommodation areas and also control the volume output

- The system must automatically mute all the audio output from the entertainment systems when the general alarm is activated.
- The system must provide discrete signals to mute the entertainment distribution system.
- The system must to interface to the vessels following systems,
 - Vessels Alarm Monitoring System
 - General Alarm System
 - Fire Detection and Alarm System
- The speakers included within the system must have, at the minimum, an Ingress Protection (IPxx) indicated as follows below,
 - Ceiling Loudspeaker, for cabins and common areas IP44 or better
 - Ceiling Loudspeaker for Washroom/Bathroom areas IP55 or better
 - Horn type loudspeaker for machinery space areas IP66 or better
 - Horn type loudspeaker for outside space areas IP66 or better
 - speakers for outside spaces area with talkback functionality IP66 or better
 - Loudhailers for wheelhouse top area IP66 or better

3.1.9 The telephone and intercom system must meet the following requirements:

- The system must provide operator free dialing and communication for incoming and outgoing calls between all spaces identified.
- Must be approved as part of the Integrated Communications System (ICS)
- Must be an Internet Protocol (IP) based system
- Must be power via Power Over Ethernet (PoE)
- All telephones must have a built-in speaker that is approved as part of the PA system
- All telephones must be able to be part of the PA groups
- Must be able to access the PA system for PA broadcasts
- System must have the following features
 - Self-contained unit
 - Caller ID
 - Programmable from Web Interface
 - Call forwarding
 - Call transfer
 - Call park
 - 3-way conferencing
 - Wake up system
 - Exterior Communication Access – Programmable (Shoreline, Satellite, Cellular)
 - Incoming call routing
 - Public Address Interface
 - Remote Diagnostics/Maintenance
 - Night Bells

- Must have the ability to select the different audio inputs via telephone within the accommodation areas and also control the volume.
- Must be able to mute the local speakers if a PA announcement is made from the local telephone to eliminate any feedback
- Must be able to activate the PA system via the telephone and intercom system through pre-recorded messages to reduce the amount of feedback
- Must interface to the existing cellular and satellite terminals
- All IP telephones must be able to dial all other telephones on board and access shore trunks and other external communication via programming. The list of who must have access to what trunks will be provided by CCG Technical Authority during commissioning. IP telephones must be suitable for marine use, suitable for bulkhead or desk mount, and be either drip-proof or waterproof type depending on location. In high noise areas and machinery spaces auxiliary visual signaling via rotating blue beacons must be supplied and installed to indicate an incoming call. These beacons must be able to use the existing power source of 120 VAC. In high noise areas and machinery spaces a headset must be supplied and include a push to talk microphone that can interface to the telephone and stored within a waterproof box.
- Telephones and intercom equipment in noisy environments must have a built-in relay for the blue strobe light and powered via local 120 VAC emergency power
- Telephones and intercom equipment that are located within noisy environments must be able to connect to a headset that has a push to talk microphone. The headset must provide ear protection as well as these areas may be over the acceptable limit.
- Telephone and intercom equipment that are located within an area of fuel bunkering must be explosive proof
- Intercom stations must be suitable for industrial environments with an IP66 or better rating
- Must have the ability to provide a minimum of 36 traditional intercom stations
- Must have the ability to provide a minimum of 72 analogue telephones
- Must have the ability to provide a minimum of 552 IP telephones that consist of IP telephones, intercoms, and DECT handsets
- Must have an auto attendant function to provide a means of selecting certain individuals throughout the vessel, provide recall functions, and have the ability to have prerecorded messages via the interfaced communication systems
- The telephones must be equipped with special marine handset retainers.
- The telephones on the bridge must have a call pick-up capability
- The telephones on the bridge must have a forward on busy capability to other user terminal on the bridge.

- A list of extension numbers must be provided with each user terminal and configurable after the fact to match the existing ships telephone directory.
- The telephone user terminals installed outside must be an industrial type that is waterproof with an ingress protection rating of IP66 or better and contain an audible or visual signal upon a call to the terminal and approved with a built-in speaker for the PA system
- Telephone system user terminals installed outside may be installed inside a weatherproof cabinet with IP rating of IP66 or better.
- Telephone system user terminals installed in machinery spaces, mechanical spaces, and operational spaces must include hands-free communications with an option for headset and push to talk, have IP66 rating or better, bulkhead mountable, and have a built-in relay for the interface of an external auxiliary visual signaling blue strobe light.
- The signaling strobe for a user terminal must be turned on when a call is received (on the user terminal).
- The signaling strobe for a user terminal which is turned on as a result of an incoming call, must be turned off when; the call is answered or the call is terminated.
- The telephone system must interface to the PA system and be approved as part of the PA system.
- The telephone system must interface to the vessels existing satellite communications systems.
- The telephone system must interface to the vessels cellular communication system.
- Equipment for telephone and intercom system must be provided with Ingress Protection (IPxx) indicated as follows:
 - IP telephone, bulkhead or desk mountable, must be IP42 or better
 - IP industrial telephone for machinery/mechanical spaces, complete with headset jack, strobe blue beacon, and suitable headset, bulkhead mountable, built-in speaker, and must be IP66 or better
 - IP telephone for outside location must be IP66 or better

3.1.10 The Audio Entertainment System must meet the following requirements:

- The Integrated Communications System (ICS) must be capable of accepting four (4) line level audio inputs for Ship's Recreational Entertainment. Distribution of the entertainment audio for cabins and offices must be programmable via system configuration software. Control of audio source and volume in accommodations must be via local telephone. Entertainment audio must be over-ridden and volume level selected for entertainment will be automatically bypassed in the event of an alarm or PA announcement. The audio inputs are only selectable through the telephone and intercom system.

3.1.11 The Digital Enhanced Cordless Telecommunications (DECT) Telephone must meet the following requirements:

- An IP based DECT Telephone System must be provided for operation on the Navigation Bridge Deck and within the Lower and Double Bottom Tank Top Decks. The system will operate in conjunction with the telephone and intercom system, which in turn is integrated with the PA system. The base controllers will connect to the telephone system via Cat6A or Cat7 cable.
- The system must consist of:
 - One (1) DECT base unit within the Navigation Bridge area.
 - Three (3) DECT portable telephones with single chargers for Navigation Bridge Deck area
 - Two (2) DECT base units within the Lower Deck area
 - Three (3) DECT portable telephones with single chargers for the Lower Deck area

3.1.12 The Equipment Cabinets must meet the following requirements:

- Each cabinet must contain only one (1) Public Address (PA) System. In this case, Loop A PA system in one cabinet and Loop B PA System in the other cabinet to provide a fully redundant and separate integrated PA system.
- One (1) cabinet must contain the Public Address (PA) System Loop A, along with the Telephone and Intercom System, and all equipment and materials for the end device connectivity and termination. This includes, but not limited to, the 120 VAC power sources, speakers, telephones, intercoms, strobe lights, audio inputs, etc.
- The other cabinet must contain the Public Address (PA) System Loop B, along with all equipment and materials for the end device connectivity and termination. This includes, but not limited to, the 120 VAC power sources, speakers, telephones, intercoms, strobe lights, audio inputs, etc.
- The cabinets must be installed in the space vacated by the old cabinets located on the Boat Deck Port Side Electronics Equipment Room 308 and must have the clearance as recommended by manufacturer.
- The cabinets must be delivered pre-assembled and must have the following dimensions of 800 mm x 1335 mm x 600 mm (Width x Height x Depth) to be able fit through the exterior doors, interior doors, and hallways to final location within the Electronics Equipment Room
- Must have an internal 19 inch fixed frame for a maximum of 24 head units
- Must have a Ingress Protection of IP22
- Must be of steel material
- Must be floor mountable
- Must come prepared with proper ventilation to allow sufficient air flow for the cooling of equipment

- Must come prepared with chassis ground
- Must have cable access available through the bottom of the cabinet

3.1.13 The Equipment Package supply must satisfy all of the requirements needed for a functional system, including; equipment, materials, cabling, installation, design, drawings, cable type and layout, ICS deck and cable layout, component layout on Ships General Arrangement, junction boxes, enclosures, terminal blocks, and piping requirements.

3.1.14 The Contractor must indicate the make and model. The successful Contractor must provide the following details; manufacturer, subcomponent list, design installation drawings, component layout on ships general arrangement, single line diagrams for each deck on general arrangement, vendor furnished information, operator, installation, and service manuals, no later than three (3) weeks after contract award for a complete review process. This will involve approval from the CCG Technical Authority and the applicable Classification Society surveyor.

3.1.15 The Contractor must arrange for an authorized field service representative, FSR, to conduct the set to work, site acceptance testing and commissioning of the ICS system. A testing procedure must be obtained and followed as per manufacturer's practices. The contractor must include in their pricing a \$20,000.00 allowance for the services, travel and living expenses of a certified system FSR. This will be adjusted by PWGSC 1379 based on final invoicing. It is the responsibility of the contractor to effectively coordinate this FSR, any additional costs incurred due to excessive FSR downtime or planning/coordinating issues will be paid for at the contractor's expense.

3.1.16 The Contractor must install the provided quantity and type of speakers as indicated by the manufacturer throughout the vessel as indicated on the new drawings provided by the manufacturer. There will be a total of 170 speakers to be installed. All speakers will be mounted in the space vacated by the old speakers. Contractor must supply the material and fabricate all mounting plates and brackets.

3.1.17 The Contractor must install the ceiling type speakers in the space vacated by the old ceiling type speakers by flush mounting the new speakers into 12-1/2" x 12-1/2" x 1/16" thick sheet metal plate with rounded edges. The plates must be painted to match the existing paint color of the deck heads. This speaker will now occupy the larger space left behind by the speakers that were removed. The new washroom/bathroom ceiling type speakers must be flush mounted in the washroom/bathroom facilities as indicated in reference drawings to be obtained from manufacturer. The deck head panels must be modified to accommodate the new speakers.

3.1.18 The Contractor must follow all recommendations for mounting of all the speaker types by manufacturer and must meet the applicable classification society's

guidelines. The locations of new speakers will be at the existing locations and must be indicated within the manufacturer's documentation package.

3.2 Location of Speakers

Wheelhouse Top

Install a total of five (5) new speakers at the following locations;

- 2 – 100 W loud hailer at the port and starboard searchlight locations forward
- 2 – 15 W horn speakers mounted on the port and starboard side of the A/C hut facing port and starboard
- 1 – 15 W horn speaker mounted on the forward bulkhead of the A/C Hut

Bridge Deck

Install a total of four (4) new speakers at the following location;

- 3 – 10 W IP ceiling loudspeakers, 1 on the port side, 1 on the starboard side, and the other at the top or the stairwell, entrance to bridge deck
- 1 – 6 W ceiling loudspeaker intended for bathroom/washroom and humid areas

Officers Deck

Install eight (8) new speakers in the following locations;

- 2 – 10 W ceiling loudspeakers, 1 mounted within the center of the passage way, space vacated by old speaker, and the other mounted within the staircase
- 3 – 6 W ceiling loudspeakers intended for bathroom/washroom and humid areas
- 3 – 15 W horn speaker mounted outside, 1 on the port side outer deck frame 94, 1 on the starboard outer deck frame 94, and the other on the aft facing side on the engine casing frame 65 centerline

Boat Deck

Install 18 new speakers in the following locations;

- 6 – 6 W ceiling speakers, 5 throughout passageway in locations vacated by the old speakers, and 1 located within the staircase
- 3 – 6 W ceiling loud speakers intended for bathroom/washroom and humid areas

- 3 – 15 W explosive proof speakers, 1 located within the helicopter hanger, 1 within the helicopter workshop, and the other at helicopter extension platform
- 4 – 15 W horn speakers outer decks, 1 located at frame 26 port side in area of stairwell, 1 located at frame 26 starboard side in area of stairwell, 1 located at frame 60 port side walkway, and the other located at frame 70 starboard side walkway
- 2 - 15 W horn speakers, 2 located in Room 328, 1 in Room 316, and 1 in Room 317

Upper Deck

Install 47 new speakers in the following locations;

- 12 – 6 W ceiling speakers within the passage ways around the deck
- 12 – 6 W ceiling speakers intended for bathroom/washroom and humid areas
- 2 – 6 W ceiling speakers within the stairwell
- 2 – 6 W ceiling speakers in Officers Mess Room 202
- 2 – 6 W ceiling speakers in Gymnasium Room 248
- 1 – 6 W ceiling speaker in Officer's Pantry Room 201
- 1 – 6 W ceiling speaker in Engineer's Office Room 226
- 1 – 6 W ceiling speaker in Deck Office Room 225
- 2 – 6 W ceiling speakers in Ships Office Room 218
- 1 – 6 W ceiling speaker in Logistics Office Room 224
- 2 – 15 W horn speakers located in the Engine Casing Section 249
- 3 – 15 W horn speakers located along the port side walkway outer deck
- 3 – 15 W horn speakers located along the starboard side walkway outer deck
- 3 – 15 W horn speakers located in the area of the Aft Mooring and Towing winches

Forecastle Deck

Install three (3) new speakers in the following locations;

- 3 – 15 W horn speakers, 1 on the port side, 1 on the starboard side, and 1 forward centerline

Main Deck

Install 53 new speakers in the following locations;

- 10 – 6 W ceiling speakers within the passage ways around the deck

- 11 – 6 W ceiling speakers intended for bathroom/washroom and humid areas
- 2 – 6 W ceiling speakers in stairwell
- 3 – 6 W ceiling speakers within the Galley Room 113
- 2 – 6 W ceiling speakers within the Crew's Mess Room 123
- 2 – 6 W ceiling speakers within the Crew's Lounge Room 154
- 1 – 6 W ceiling speaker within Canteen Room 161
- 1 – 6 W ceiling speaker within Refrigerated Room 108
- 1 – 6 W ceiling speaker within Main Deck Accommodation Area 106
- 1 – 15 W horn speaker within Stores handling Area Room 141
- 2 – 15 W horn speakers within the Steering Gear Compartment Room 151
- 1 – 15 W horn speaker within Rope Store Room 166
- 1 – 15 W horn speaker within Store Room 140
- 2 – 15 W horn speakers within Engine Casing Area 167
- 1 – 15 W horn speaker within the Incinerator Flat Area 125
- 1 – 15 W horn speaker within the Halon/CO2 Room 102
- 2 – 15 W horn speakers within the Winch Power Room 101
- 1 – 15 W horn speaker within Paint Locker Room 103
- 2 – 15 W horn speakers within Rope Stores Room 100
- 6 – 15 W horn speakers within the Cargo Deck Handling Area
 - 2 mounted forward bulkhead
 - 2 mounted aft bulkhead
 - 2 mounted on port and starboard sides

Lower Deck

Install 20 new speakers in the following locations;

- 2 – 6 W ceiling speakers within the Machinery Control Room 52
- 1 – 15 W horn speaker within the Engineer's Workshop Room 51
- 1 – 15 W horn speaker within the Electricians Workshop Room 53
- 1 – 15 W horn speaker within the Bow Thruster Compartment Room 3
- 4 – 15 W horn speakers within the Engine Room Flats Area
- 2 – 15 W horn speakers within the Winch Compartment Area
- 2 – 15 W horn speakers within the Transformer Room Area
- 1 – 15 W horn speaker within the area of the Lobby Area
- 2 – 15 W horn speaker within the Propulsion Room Area
- 2 – 15 W horn speakers within the Central Stores Area
- 2 – 15 W horn speakers within the Cargo Hold Area

Double Bottom Tank Top Deck

Install 11 new speakers in the following locations;

- 4 – 15 W horn speakers within the Main Generator Compartment
 - 1 – 15 W horn speaker within the Purifier Room
 - 2 – 15 W horn speakers within the Converter Room
 - 2 – 15 W horn speakers within the Propulsion Room
 - 2 – 15 W horn speakers within the Sewage Compartment Area
- 3.3 The Contractor must install eight (8) new blue strobe lights at the locations of the old rotating blue beacons and will reuse the existing 120 VAC power.
- 3.4 The Contractor must install seven (7) new IP Master Stations with expansion complete with handsets, three (3) mounted within the space vacated by the old stations throughout the vessel and four (4) new stations (two (2) new stations will be located within the Bridge Wing Consoles and the other two (2) new stations at the Quarter Masters Stations). The control stations for these locations must be installed using adapter plates with the control heads and handsets fitted in the adapting plates. These plates must be of the same paint scheme as the location they are being installed.
- 3.5 The Contractor must install approximately 71 new IP telephone, 26 new IP intercom stations, and 7 new IP master stations as indicated in the original deck plan ICS reference drawings and those to be obtained from manufacturer.
- 3.6 Location of IP Telephones and Intercom Stations

Bridge Deck

Install 1 new IP telephone and 3 master stations, and DECT IP telephones in the following locations

- 1 desk phone on navigation bridge
- 1 DECT base station with 3 handsets and chargers
- 3 master stations
 - Forward Center Console
 - Port Wing Console
 - Starboard Wing Console

Officers Deck

Install 6 new IP telephones in the following locations

- 1 desk telephone within the Commanding Officers Day Cabin Room 405
- 1 desk telephone within the Commanding Officers Night Cabin Room 403
- 1 desk telephone within the Chief Officers Day Cabin Room 404
- 1 desk telephone within the Chief Officers Night Cabin Room 408
- 1 desk telephone within the Second Officers Cabin Room 400
- 1 desk telephone within the Third Officers Cabin Room 401

Boat Deck

Install 4 new IP telephones, 1 new IP master station, and 8 IP rugged type intercom stations in the following locations

- 1 new master station within the Electronics Equipment Room 308 in one of the existing racks
- 1 new desk telephone within the SAR/SERVER Room 312
- 1 new desk telephone within the Officials Night Cabin Room 304
- 1 new desk telephone within the Officials Day Cabin 300
- 1 new desk telephone within the Officers Lounge Room 305
- 1 new industrial rugged intercom station with built-in relay within the Emergency Generator Room 317 complete with blue strobe light and headset
- 1 new industrial rugged intercom station with built-in relay within the A/C Unit Room 328 complete with blue strobe light and headset
- 1 new explosive proof industrial rugged telephone within the Helicopter Workshop Area 318
- 1 new explosive proof industrial rugged station within the Helicopter Hanger Area 318
- 1 new explosive proof industrial rugged station within the Helicopter Fuel Bunking Station Port Side Aft in the area of the Helicopter Workshop
- 1 new industrial rugged intercom station within the Port FRC Launch Area
- 1 new industrial rugged intercom station within the Starboard Lifeboat Launch Area
- 1 new industrial rugged intercom station within the Starboard Barge Launch Area
- 1 new industrial rugged intercom station within the Derrick Control Room 302

Upper Deck

Install 25 new IP telephones, 2 new IP master stations, and 2 IP intercom stations in the following locations

- 1 new IP Master Station at the Port Quarter Master Station Room 204
- 1 new IP Master Station at the Starboard Quarter Master Station Room 205
- 1 new telephone within the Pantry Room 201
- 1 new telephone within the Officers Mess Room 202

- 1 new telephone within the Sick Bay Room 203
- 1 new telephone within Cabin Room 208
- 1 new telephone within Cabin Room 212
- 1 new telephone within Cabin Room 216
- 1 new telephone within Cabin Room 222
- 1 new telephone within Cabin Room 228
- 1 new telephone within Cabin Room 234
- 1 new telephone within Cabin Room 240
- 1 new telephone within Cabin Room 244
- 1 new telephone within the Gymnasium Room 248
- 1 new telephone within Cabin Room 232
- 1 new telephone within the Engineer's Office Room 226
- 1 new telephone within the Deck Office Room 225
- 1 new telephone within the Ship's Office Room 218
- 1 new telephone within the Logistics Office Room 224
- 1 new telephone within Cabin Room 245
- 1 new telephone within Cabin Room 241
- 1 new telephone within Cabin Room 235
- 1 new telephone within Cabin Room 229
- 1 new telephone within the Senior Engineer Day Cabin Room 217
- 1 new telephone within the Senior Engineer Night Cabin Room 223
- 1 new telephone within the Chief Engineer Day Cabin Room 213
- 1 new telephone within the Chief Engineer Night Cabin Room 209
- 1 new industrial rugged intercom telephone within a waterproof box within the forward Forecastle Deck Mooring Area
- 1 new industrial rugged intercom telephone within a waterproof box within the Aft Mooring Area

Main Deck

Install 23 new telephones and 7 IP intercom stations in the following locations

- 1 new industrial rugged intercom telephone within the Bosum's Locker and Rope Storage forward Room 100
- 1 new industrial rugged intercom telephone within the Winch Power Room 101
- 1 new explosive proof industrial rugged intercom telephone within the Port Fuel Bunkering Station 104
- 1 new explosive proof industrial rugged intercom telephone within the Starboard Fuel Bunkering Station 105
- 1 new industrial rugged intercom telephone within Main Deck Accommodation Area 106
- 1 new telephone within the Galley Room 113
- 1 new telephone within the Crew's Mess Room 123
- 1 new telephone within Cabin Room 129

- 1 new telephone within Cabin Room 135
- 1 new telephone within Cabin Room 139
- 1 new telephone within Cabin Room 147
- 1 new telephone within Cabin Room 149
- 1 new telephone within Cabin Room 157
- 1 new telephone within Cabin Room 163
- 1 new telephone within the Store's Handling Room 141
- 1 new telephone within the Canteen Room 161
- 1 new telephone within the Stores Room 140
- 1 new industrial rugged intercom telephone within the Workshop and Rope Store Room 166
- 1 new industrial rugged intercom telephone with built-in relay that activates a blue strobe light and headset within the Steering Gear Compartment Room 151
- 1 new telephone within Cabin Room 156
- 1 new telephone within Cabin Room 148
- 1 new telephone within Cabin Room 146
- 1 new telephone within Cabin Room 138
- 1 new telephone within Cabin Room 134
- 1 new telephone within Cabin Room 128
- 1 new telephone within Cabin Room 126
- 1 new telephone within Cabin Room 120
- 1 new telephone within Cabin Room 112
- 1 new telephone within the Crew's Lounge Room 154
- 1 new telephone within Laundry Room 143

Lower Deck

Install 1 new IP telephone, 1 new IP master station, 4 IP intercom stations, and 1 DECT telephone within the following locations:

- 1 new telephone within Central Stores
- 1 new master station within the Machinery Control Room (MCR) Room 52
- 2 DECT base stations
- 1 new industrial rugged intercom telephone with built-in relay within the Winch Compartment complete with blue strobe light and headset
- 1 industrial rugged intercom telephone within the Transformer Room
- 1 industrial rugged intercom telephone within the Engineer's Workshop Room 51
- 1 industrial rugged intercom telephone within the Electrician's Workshop Room 53

Double Bottom Tank Top

Install 8 new IP intercom stations within the following locations:

- 1 new industrial rugged intercom telephone with built-in relay within the Bow Thruster Compartment Room 3 complete with blue strobe light and headset
- 1 new industrial rugged intercom telephone with built-in relay within the Cargo Hold3 complete with blue strobe light and headset
- 1 new industrial rugged intercom telephone with built-in relay within the Forward Main Generator Compartment complete with blue strobe light and headset
- 1 new industrial rugged intercom telephone with built-in relay within the Aft Main Generator Compartment complete with blue strobe light and headset
- 1 new industrial rugged intercom telephone with built-in relay within the Purifier Room complete with blue strobe light and headset
- 1 new industrial rugged intercom telephone with built-in relay within the Converter Room complete with blue strobe light and headset
- 1 new industrial rugged intercom telephone with built-in relay within the Propulsion Motor Room complete with blue strobe light and headset
- 1 new industrial rugged intercom telephone with built-in relay within the Sewage Compartment complete with blue strobe light and headset

- 3.7 The Contractor must remove the main Equipment Control Panels ECP #1 and ECP #2 complete with the Telephone Exchange (PBX) equipment within the Electronics Equipment Room on the Boat Deck Port Side. ECP Cabinets are blue in color and located on the aft bulkhead. The PBX equipment is located within Rack #1 as you enter the room.
- 3.8 The Contractor must completely remove all cabling associated with the systems. Refer to applicable drawings listed above.
- 3.9 The Contractor must supply all equipment, enclosures, ventilation, staging, scaffolding, chain falls, carnage, crane, slings, and shackles necessary to perform the work. All lifting equipment must be appropriate for the expected duties, and be accompanied by current certification indicating, or be permanently marked as to being, or a safe working load for the expected duties. Any brackets, mounts, or any other welded attachments required in the performance of this specification must be welded into place by certified welders.
- 3.10 Prior to any hot work taking place, the Contractor must ensure that the area of work and all equipment must have be sufficiently protected from any sparks or metal filings.

- 3.11 In addition to any hot work taking place, which includes grinding and welding, the Contractor must check the vessels lead abatement documents and follow proper lead abatement procedures. If any area is of any concern, it will be brought to the attention of the Chief Engineer and a lead abatement will be conducted.
- 3.12 Any lead testing will be covered by the allowance listed in Part A – General of this SOW.
- 3.13 The Contractor must ensure that all areas have been cleaned and free of any debris resulting from the performance of this SOW item.
- 3.14 The Contractor must be responsible for the temporary removal and reinstallation of any deck heads, bulkheads, paneling, insulation, and any items that is deemed to be interfering to the running of any cables and mounting of any equipment.
- 3.15 The Contractor must reseal all deck penetrations, kick pipes, transits, etc. that are left following the removal and relocation of all equipment specified within this SOW item.
- 3.16 The Contractor must follow existing cable trays throughout the vessel where fitted for all cable installation. Once installed, all cabling must be secured as per TP127. The Contractor must re-use existing cable penetrations and repack with classification society approved products. Any cable penetrations that are deemed not reusable by the Contractor will be replaced and installed with new glands and dealt with by PWGSC 1379 form and process. The Contractor must supply and install all required materials.
- 3.17 The Contractor must identify each installed cable with a marked stamped stainless steel metal tag. The labels are to be securely affixed to each cable at each termination end and through any deck, deck heads, and gland penetrations with the designation for each cable, as provided in this SOW item.
- 3.18 The Contractor must follow the cable labelled scheme provided by the manufacturer's documentation package. AC power sources must be labelled with the applicable power panel along with the breaker number.
- 3.19 The Contractor must ensure that all identified electrical supplies for the system and system components have been isolated and secured using the established lock-out / tag-out system as outlined in the preamble. A list is provided below with some of the power sources but there may be other sources of power not identified.
- 3.20 Electrical Power Sources
 - EP-104-8 (C-MC) Integrated Communications System (ICS) ECP #1 Cabinet Electronics Equipment Room 308 Boat Deck feed from Emergency Bus 120 VAC EP-104 Panel located in Emergency Generator Room Boat Deck.

-IC-101-10 Public Branch Exchange (PBX) Electronics Equipment Room 308 Boat Deck feed from IC-101 Panel located on the Bridge Deck on forward side on Nav. Console.

-The following power sources feed the stations that have a rotating beacon light in the area. There may be additional sources throughout the vessel as they are feed from the Emergency Lighting Panels that are within the area.

- EP-101-11
- EL-104-1
- EL-101-9
- EL-101-1
- EL-101-3
- EL-101-2
- EL-104-1

- 3.21 The Contractor must reuse the existing Emergency Bus 120 VAC source EP-104-8 (C-MC) to feed the new ICS system. The Contractor must determine, with the assistance of the Chief Engineer and Electrical Officer, three additional 120 VAC power sources for the new ICS system. A total of four (4) 120 VAC feeds are required for the new system (Two (2) Emergency 120 VAC feeds and two (2) Main 120 VAC feeds, one of each to the new cabinets).
- Another Emergency Bus 120 VAC feed
 - Main Bus 120 VAC feed
 - Main Bus 120 VAC feed
- 3.22 The Contractor must supply and install four (4) new 120 VAC AC breakers that are required for the new ICS system with the applicable ratings as indicated by the manufacturer and wire sizes. These breakers must be suitable and fit the existing power panels.
- 3.23 The Contractor must relabel and update all electrical supply feeds on electrical panels within this SOW item.
- 3.24 The Contractor must provide a grounding lug/stub for all the new equipment. Lugs/stubs to be attached to the vessels hull within close proximity to the equipment.
- 3.25 The Contractor must dispose of all cables that have been identified for removal below and in the reference drawings at their own expense.
- 3.26 The Contractor must repack all glands and transits that will be reused as per this SOW item and the method must meet or exceed TCMS or classification society requirements.

- 3.27 The Contractor must supply all required mounting hardware, unless supplied with equipment, and all hardware must be all stainless steel grade.
- 3.28 The Contractor must work in conjunction with a Canadian Coast Guard Electronics Technician to oversee the installation of the new ICS system to ensure compliance with the applicable Canadian Coast Guard standards and to determine the final installation location of additional components as supplied with the system.
- 3.29 The Contractor must be responsible to ensure that all areas have been thoroughly cleaned and free of any debris resulting from the performance of this SOW item.
- 3.30 Upon final installation, testing must be carried out as per Section 4.2 of this SOW item.
- 3.31 The Contractor must temporarily remove and store all deck heads and bulkhead paneling as required for this SOW item. Once all work is completed, the Contractor must retrieve and reinstall all deck heads and bulkhead paneling.
- 3.32 The Contractor must note that there are a total of four (4) junction/terminal boxes located throughout the vessel, ICS-1, ICS-2, ICS-3, and ICS-4, that must be reused within the new system. These junction/terminal boxes will be reused for the speaker connections and utilized as part of the Loop A or Loop B PA system and included within the manufacturer's documentation package.
- 3.33 The Contractor must remove all equipment as indicated on drawing number LM639-615-SS (4 Sheets). The Contractor must verify the exact number to be removed.
 - 182 different speaker units throughout the vessel. This includes, loudhailers, ceiling, submersible, horns, talkback speakers, and explosion proof.
 - Seven (7) volume control knobs throughout the vessel.
 - Nine (9) rotating blue light beacons throughout the vessel.
 - Nine (9) relay boxes throughout the vessel which is part of the rotating blue light beacons throughout the vessel. Ensure that the power is isolated before equipment removal as this is feed from the emergency lighting system. This power will be reused for the new blue strobe lights in these areas.
 - 13 talkback outlet jacks throughout the vessel.
 - Four (4) talkback push button boxes throughout the vessel.
- 3.34 Contractor must remove all equipment as indicated on drawing number LM639-612-SS (3 Sheets). The Contractor must verify the exact number to be removed.

- 80 telephones complete with cable back to originating locations along with the telephone jack boxes. Reference drawing LM639-612-SS (3 Sheets) or the Telephone System Wiring.
 - Four (4) talkback telephones complete with cable back to originating locations along with the telephone jack boxes.
 - Five (5) existing IDCH-7200 control heads complete with cabling throughout the vessel. Units are located on the Bridge Deck, Boat Deck, and Machinery Control Room.
- 3.35 The Contractor must supply, install, and terminate a new relay in the vicinity of the General Alarm System for connection of the ICS system to this panel for muting and unmuting the General alarm during a PA announcement.
- 3.36 The Contractor must supply and install two (2) cable runs of 50 meters of a 2 x 2 x 0.75mm² screened shipboard approved cable from the new ICS cabinets within the Electronics Equipment Room Boat Deck Port Side to the Emergency Generator Room General Alarm System.
- 3.37 The Contractor must install the new equipment cabinets that are pre-assembled and provided by the manufacturer, in the Electronics Equipment Room Boat Deck Port Side. If the maximum cable length exceeds the allowable 100 meter limit for Power over Ethernet (PoE), one of the cabinets may need to be decentralized that includes the Internet Protocol (IP) telephones and intercoms. The cabinets must be mounted to allow access to components inside. A type approved marine UPS with conditioning must be mounted beneath each equipment rack and off the deck. Exact locations and mounting to be determined on site.
- 3.38 The Contractor must supply the material to fabricate new boxes, complete with gland cables, to flush mount the new IP master stations at the Quarter Master Stations Room 204 and 205 and install them on the bulkheads.
- 3.39 The Contractor must supply and install all material required for the fabrication of any required brackets and mounts as recommended by the manufacturer to properly install all the required speakers, telephones, intercoms, strobe lights, junction boxes, etc.
- 3.40 The Contractor must modify the existing mounting arrangement of the old cabinets in the Electronics Equipment Room to be able to house the new cabinets supplied by the manufacturer.
- 3.41 The Contractor must supply the material to fabricate and install new mounting arrangements for the new UPS for each cabinet. Location to be in the vicinity of the new cabinets within the Electronics Equipment Room.

- 3.42 Unless supplied or stated, the Contractor must use all 316 stainless steel hardware for the installation of all equipment within this specification.
- 3.43 The Contractor must be aware that each cable run for IP telephones and intercom stations must not exceed 100 m as the system components are powered over Ethernet and this is the standard for PoE.
- 3.44 For the purpose of deck and bulkhead penetrations the Contractor must use existing where possible.
- 3.45 The Contractor must supply and install sixteen (16) S 4x1 ROXTEC primed frames complete with 36 RM20 Roxtec modules per frame, one wedge kit stainless steel per frame and six (6) stainless steel stay plates per frame. Contractor may substitute RM20's with RM15's or any mixture of.
- 3.46 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install for one (1) S 4x1 Roxtec primed frame complete with 36 RM20 Roxtec modules per frame, one wedge kit stainless steel and stainless steel stay plates per frame.
- 3.47 The Contractor must allow for the supply and install of approximately 10 000 meters of Bergen BC-10-021 DNV GL Maritime LAN S/FTP Cat6A cable (Category 6A Shipboard Marine Type Approved) according to manufacturer's recommendations for the connection of IP telephones and IP intercom stations, and other devices, and accessories as detailed in the manufacturer's reference drawings.
- 3.48 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install for 10 meters of listed Cat6A cable.
- 3.49 The Contractor must allow for approximately 100 cable runs of Cat6A between each IP telephone and intercom stations to equipment cabinets as outlined in the reference drawings once obtained from manufacturer.
- 3.50 The Contractor must allow for the supply and install of approximately 5 000 meters of marine shipboard approved 2 x 2 x 0.75mm² shielded twisted pair cabling to be obtained from manufacturer for the system to be installed. It must be the Contractor's responsibility to determine the cable routing.
- 3.51 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install for 10 meters of the 2 x 2 x 0.75mm² as applicable.
- 3.52 The Contractor must supply and install approximately 300 meters of 6x2x0.75mm² screened shipboard approved cables for the connection between the junction boxes as part of the manufacturers documentation package for the Loop A and Loop B PA Systems.

- 3.53 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install for 10 meters of the 6x2x0.75mm² as applicable.
- 3.54 The Contractor must supply and install the recommended cabling by the manufacturer to interface the following systems to the ICS system
- Cellular Telephone Terminal
 - Satellite Telephone Terminal #1 (Iridium Satellite Phone)
 - Satellite Telephone Terminal #2 (Vessel Link Satellite Phone)
 - Satellite Radio
 - AM/FM Radio
 - Vessels (Ships) Alarm Monitoring System
 - General Alarm System
 - Fire Monitoring System
- 3.55 For the IP desk telephones, the Contractor must supply and install one hundred (100) RJ45 wall boxes for each desk phone installed in cabins and offices on the vessel, and in the space vacated by the old phones removed and in new locations as identified in drawings to be provided by manufacturer. Cable runs behind bulkhead panels must be suitably protected and secured. All desk phones must be bulkhead mounted.
- 3.56 The Contractor must replace all applicable outside cable hangers and mounting bases associated with the ICS system that are not suitable for further use. The Contractor must ensure that the new Cat6A and 2 x 2 x 0.75 mm² STP cable is properly secured from the exit of each outside gland to the termination point at each speaker. Spacing between these clips must not exceed 300mm, if this is the case new stainless steel hangers are to be added.
- 3.57 The Contractor must give a unit cost for the supply and installation of 10 stainless steel cable hangers.
- 3.58 The Contractor must recoat all disturbed metal surfaces with two (2) coats of primer and two (2) coats of paint that is applicable to the vessels requirements. Each coating must have a minimum of 2 mils each. All surfaces must be abrasive blasted to SSPC-SP-10. All edges of existing coatings must be feathered back using blasting or suitable mechanical means to allow a sound surface to accept the new coatings.
- 3.59 The Contractor must remove and replace approximately 40 exterior cable glands that are used for the exterior speakers and intercom units. Cable glands must be shipboard approved and approved by applicable classification society.

- 3.60 The Contractor must allow for the supply and install of approximately 100 meters of 10/3 AWG marine shipboard cable for the purpose of connecting the 4 - 120 VAC power sources to each cabinet.
- 3.61 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install for 10 meters of this cable type.
- 3.62 The Contractor must allow for the supply and install 100 meters of 14/3 AWG marine shipboard cable for the connection of additional signaling devices.
- 3.63 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install for 10 meters of this cable type.
- 3.64 The Contractor must allow for the supply and install of 100 meters of 14/3 AWG marine shipboard cable for any device requiring 120 VAC if applicable.
- 3.65 For the purpose of adjustments, the Contractor must include a unit cost for the supply and install of 10 meters of this cable type.
- 3.66 The system must be a Loop A/Loop B redundant system and must provide the following discrete alarm outputs to be interfaced to the vessels alarm and monitoring system.
 - Main/Emergency failure system A
 - Main/Emergency failure system B
 - UPS failure system A
 - UPS system failure B
 - PA system fault system A
 - PA system fault system B
 - Telephone System fault
- 3.67 The Contractor must provide the services of an FSR to perform and configure the alarm interfaces within the vessel alarm and monitoring system.
- 3.68 The Contractor must supply and install approximately 100 meters of 4 x 2 x 0.75 mm² shielded cable vessel board approved from each ICS equipment cabinet to the vessels alarm and monitoring system.
- 3.69 For the purpose of adjustments, the Contractor must provide a unit cost for the supply and installation of this cable type.
- 3.70 The ICS system is in locations all over the vessel including the wheelhouse top, officer's deck, boat deck, upper deck/focsle deck, main deck lower deck and tank top areas. The Contractor is responsible for the identification of interference items,

their temporary removal, storage, and refitting to vessel. Interferences will be available for viewing during the on-site vessel visit.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work must be subject to witness by chief engineer of delegate and the attending surveyor.

4.2 Testing

- 4.2.1 The commissioning/site acceptance testing of the new ICS system must be done by of an approved FSR and in accordance with the manufacturers approved procedures.
- 4.2.2 The Contractor must include an allowance of \$20,000 for the services of the FSR for this SOW item. This cost is to include all services (including programming, commissioning, training, etc.), accommodations, meals, and transportation.
- 4.2.3 Testing must be completed on the system to confirm that all system aspects are in accordance with the requirements of Transport Canada and the relevant Classification Society to ensure a class approved installation. A report on all testing and findings must be submitted to the Owner prior to the acceptance of this item.
- 4.2.4 Programming of the system must be carried out by the FSR at time of installation.
- 4.2.5 All cables must be checked for continuity after installation to ensure operational capability. Should any cable run fail to pass testing, the cable must be replaced at the Contractor's expense.

4.3 Certifications

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

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The Contractor must provide the Technical Authority with a report of the Contractors work in both electronic (MS Word 2010) and hardcopy formats outlining the details of the inspections and any alterations / repairs completed prior to the acceptance of this item.

5.1.2 The Contractor must provide the complete documentation package that is designed and developed by the manufacturer. This will include, at minimum, the following:

- All datasheets for all equipment in electronic format
- Equipment dimensional drawings
- Single block diagrams with cable type indication
- Connection and terminal drawings
- Power consumption and heat dissipation information
- Equipment disposition on the General Arrangement Drawings
- All as-built documentation that is ready for class approval

5.1.3 Any affected vessel drawings must be updated by the contractor as referenced in section 8.1 – Drawings - of this SOW.

5.1.4 The Contractor must provide an itemized list (packing slip) with details and serial numbers for all replaceable items used in this install to CCG. This is required for CCG to be able to enter all items in AMS (Asset Management System).

5.1.5 The contractor must provide the As built Programming/Configuration File ON A Flash Drive or CD.

5.2 Spares

5.2.1 Spares must include 4 of each type speaker used in the system, 4 of each type phone used in the system as well as the manufacturers recommended list of spares.

5.2.2 The list of recommended spares provided must be returned to the Chief Engineer prior to acceptance of this item.

5.3 Training

5.3.1 The Contractor must provide two (2) training courses of eight (8) hours in duration for each crew shift to be held onboard after the final installation and commissioning of all new system components. This training must be provided to the ship's personnel involved in the operation of the system (both crews) and to the CCG Technicians responsible for the maintenance on the system. The training must be provided by the manufacturer's technical representative (FSR). Training must encompass all items outlined in the operating and maintenance instructions as supplied by the manufacturer. This may have to be provided on completion of the Vessel Life Extension based on access to the vessel during the VLE.

5.4 Manuals

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

L-05 SECTION NOT REQUIRED

1.0 SCOPE

- 1.1 This specification item has been deleted in its entirety.

L-06 TV DISTRIBUTION UPGRADE

1.0 Scope

- 1.1 The intent of this SOW item is to completely remove the existing TV/FM Radio Distribution Equipment and cabling throughout the vessel and install all new owner supplied TV/FM Radio Distribution Equipment as per Drawing # 18146-540-E-001 Rev 0.
- 1.2 The Contractor must supply and install approximately 8000 feet of Belden 1694SB (RG-6) cable.
- 1.3 The Contractor must supply all materials and parts required to perform the specified work unless otherwise stated.
- 1.4 This work must be carried out in conjunction with the following SOW items:
 - L-04 – ICS Replacement
 - L-07 – Master Clock Replacement
 - H-33 – Bridge Window Replacement & Steel Renewals
 - E-12 – Steering Upgrades
- 1.5 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Drawings

Drawing Number	Description	Electronic Number
83-08	CCGS George R. Pearkes Crew Common Antenna System	

LM639-640-SS Rev C 2001/11	CCGS George R. Pearkes Signal TV/FM Distribution System	
18146-540-E-001 Rev 0	CCGS George R. Pearkes TV/Radio Distribution Wiring Diagram	

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- TP127E – Ships Electrical Standards
- IEEE 45:2002 – Recommended Practice for Electrical Installations on Ships
- Specification for the Installation of Shipboard Electronic Equipment (70-000-000-EU-JA-001)
- General Information for the Rules and Regulations for the Classification of Vessels.

2.3 Regulations

- Canada Shipping Act, 2001

2.4 Government Supplied Materials

Quantity	Description	Specification
55	Diplexer	Blonder Tongue LUV-2150
60	2-Way Splitter	Blonder Tongue SXRS-2
16	3-Way Splitter	Blonder Tongue SXRS-3
5	4-Way Splitter	Blonder Tongue SXRS-4
1	Amplifier	Blonder Tongue BIDA 75A-43
1	Fixed Attenuator	Blonder Tongue FAM (5dB)
600	Connector	Belden FS6U Male RG-6
54	Outlet Boxes and Accessories	Assortment
1	Tools (Set)	Compression and Preparation Tool
1	Shelf	1 Rack Unit Shelf

3.0 Technical

3.1 General

- 3.1.1 The Contractor must supply all equipment, enclosures, ventilation, staging, 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 specification must be welded into place by CWB-certified welders certified to welding Std. W47.1, Div. 1 and 2.
- 3.1.2 Prior to any hot work taking place, the Contractor must ensure that the area of work and all equipment, wiring, transits, etc. have been sufficiently protected from any sparks or metal filings. The Contractor must also ensure that the area of work, the system, and the adjacent space is certified as gas free and suitable for hot work as per the Fleet Safety and Security Manual.
- 3.1.3 In addition to any hot work taking place, which includes grinding and welding, the Contractor must check the vessels lead abatement documents and follow proper lead abatement procedures. If any area is of any concern, it will be brought to the attention of the Chief Engineer and a lead abatement will be conducted.
- 3.1.4 For the purpose of adjustments, the Contractor must provide a unit cost for the testing of lead. Any lead testing or abatement required will be covered by the allowance detailed in Section 4.2.8 – Lead Paint - of the General Technical portion of this SOW item.
- 3.1.5 The Contractor must follow existing cable trays throughout the vessel where fitted. Once installed, all cabling must be secured as per TP127.
- 3.1.6 The Contractor must repack all glands and transits that will be reused as per this SOW item and the method must meet or exceed TCMS or classification society requirements.
- 3.1.7 The Contractor must be responsible for the temporary removal and reinstallation of any deck heads, bulkheads, paneling, insulation, and any items that is deemed to be interfering to the running of any cables and mounting of any equipment.
- 3.1.8 The Contractor must identify each cable, once installed, with a marked stamped stainless steel metal tag. The labels are to be securely affixed to the cable at each end and through any deck, deck heads, and gland penetrations with the designation for each cable as provided within the applicable drawings.

- 3.1.9 The Contractor must use, at a minimum, 316 grade stainless steel hardware for the mounting of all equipment.
- 3.1.10 The Contractor must dispose of all cables that have been identified for removal indicated below at their expense.
- 3.1.11 The Contractor must be responsible to ensure that all areas have been thoroughly cleaned and free of any debris resulting from the performance of this SOW item.
- 3.1.12 The Contractor must relabel and update all electrical supply feeds on electrical panels within this SOW item.
- 3.1.13 Prior to the commencement of any electrical work, the Contractor must ensure that all electrical supplies feeding the systems have been isolated at the source following an established lockout/tag out procedure, and as per ISM fleet safety manual. The Contractor must check with Chief Engineer or Senior Electrical Officer.
- 3.1.14 Electrical Isolations for AC power listed below:
- RR-101-14 – Panel located in Server/Computer Room 312 Boat Deck Port Side
- 3.1.15 The Contractor must work in conjunction with a Canadian Coast Guard Electronic Technician to oversee the work to ensure compliance with applicable Canadian Coast Guard standards.
- 3.1.16 Upon final installation, testing must be carried out as per Section 4.2 of this SOW item.
- 3.1.17 Contractor take note that there is labelling on the deck heads throughout the vessel indicating where the existing TV Distribution System equipment is located. It's referred to as the Crew's Common Antenna.
- 3.1.18 The Contractor must disconnect and remove all of the existing equipment and cabling associated within the systems as detailed in reference drawings 83-08 and LM639-640-SS and equipment accompanied in the Equipment Removal List table below. It would be recommended to start the cable removal from the equipment side in the Electronics Equipment Room to eliminate any discrepancies within the drawings.

3.1.19 Equipment Removal List

Equipment	Location
SOCOMAR TV Cabinet (Green) complete with all the internal equipment and the top plate containing the external equipment	Boat Deck Port Side Electronics Workshop Room 308

Equipment	Location
	Aft Bulkhead next to entrance to Room 312
TV Outlet Boxes Bridge Deck (x1) <ul style="list-style-type: none"> • Nav. Bridge Port Side Information Console 	Nav. Bridge Deck
TV Outlet Boxes Officers Deck (x7) <ul style="list-style-type: none"> • Commanding Officers Cabin Room 405 (x3) • Chief Officers Cabin Room 404 (x2) • Second Officer Cabin Room 400 (x1) • Third Officers Cabin Room 401 (x1) 	Officers Deck
TV Outlet Boxes Boat Deck (x6) <ul style="list-style-type: none"> • Electronics Equipment Room 308 (x2) • Radio Room 312 (x1) • Officers Lounge Room 305 (x1) • Officials Cabin Room 300 (x2) 	Boat Deck
TV Outlet Boxes Upper Deck (x25) <ul style="list-style-type: none"> • Quarter Master Station Port Room 204 (x1) • Quarter Master Station Starboard Room 205 (x1) • Officers Mess Room 202 (x1) • Third Engineer Room 208 (x1) • Second Engineer Room 212 (x1) • Logistics Officer Cabin Room 216 (x1) • Logistics Officer Office Room 224 (x1) • Ice Observer Cabin Room 222 (x1) • Leading Seaman Cabin Room 228 (x1) • Leading Seaman Cabin Room 234 (x1) • Clerk/Storekeeper Cabin Room 240 (x1) • Passengers Cabin Room 244 (x1) • Engineer's Office Room 226 (x1) • Passengers Cabin Room 232 (x1) • Gymnasium Room 248 (x2) • Sick Bay Room 203 (x1) • Chief Engineer Room 213 (x2) • Senior Engineer Room 217 (x2) • Electrical Officer Cabin Room 229 (x1) • Helicopter Pilot Cabin Room 235 (x1) • Helicopter Engineer Cabin Room 241 (x1) • Smoking Lounge Room 245 (x1) 	Upper Deck
TV Outlet Boxes Main Deck (x18) <ul style="list-style-type: none"> • Quarter Master Cabin Room 120 (x1) • Quarter Master Cabin Room 126 (x1) • Boatswain Cabin Room 128 (x1) • Boatswain Mate Cabin Room 134 (x1) • 2 Seaman Cabin Room 138 (x1) • 2 Seaman Cabin Room 145 (x1) • 2 Seaman Cabin Room 148 (x1) • 2 Seaman Cabin Room 156 (x1) 	Main Deck

Equipment	Location
<ul style="list-style-type: none"> Galley Room 113 (x1) Crew's Mess Room 123 (x1) Chief Cook Cabin Room 129 (x1) Assistant Cook Cabin Room 135 (x1) 2 Oilers Cabin Room 139 (x1) Crew's Lounge Room 154 (x1) 2 Oilers Cabin Room 147 (x1) 2 Oilers Cabin Room 149 (x1) 2 Stewarts Cabin Room 163 (x1) 2 Seaman Cabin Room 157 (x1) 	

- 57 - TV/Radio Outlet Boxes
- 12 - Various Splitters
- 4 - Line Amplifiers
- 1 – RR-101-14 AC Outlet Electronics Equipment Room
- 1 – RR-101-14 AC Junction Box just Outside EI

Picture: TV Distribution Equipment in Electronics Equipment Room 308



3.1.20 The Contractor must remove and dispose of approximately 1500 meters of RG-59, 150 meters of RG-11, and 150 meters of 2C 14 AWG AC Power cables at their own expense as per Cable Removal List below and using reference drawings. Recommended to start cable removal from old SOCOMAR TV Cabinet in Electronics Equipment Room 308. Refer to Drawing LM639-640-SS.

3.1.21 Cable Removal List

Cable Label	Cable Type	Equipment (From)	Equipment (To)
RR-101-14	AC Power Cable	120 VAC Panel RR-101 Boat Deck Port Side	RR-101-14 Junction Box

Cable Label	Cable Type	Equipment (From)	Equipment (To)
	2C 14 AWG	Room 312 Breaker #14	Electronics Equipment Room 308
RR-101-14-1	AC Power Cable 2C 14 AWG	RR-101-14 Junction Box Electronics Equipment Room 308	RR-101-14 AC Outlet Electronics Equipment Room Aft Bulkhead next to SOCOMAR TV Cabinet
RR-101-14-2	AC Power Cable 2C 14 AWG	RR-101-14 Junction Box Electronics Equipment Room 308	Line Amplifier Boat Deck
RR-101-14-3	AC Power Cable 2C 14 AWG	RR-101-14 Junction Box Electronics Equipment Room 308	RR-101-14 Junction Box Just outside Electronics Equipment Room 308
RR-101-14-4	AC Power Cable 2C 14 AWG	RR-101-14 Junction Box Just outside Electronics Equipment Room 308	Officers Lounge Old Antenna Rotator Control Unit
RR-101-14-5	AC Power Cable 2C 14 AWG	RR-101-14 Junction Box Just outside Electronics Equipment Room 308	Line Amplifier Officers Deck
RR-101-14-6	AC Power Cable 2C 14 AWG	RR-101-14 Junction Box Just outside Electronics Equipment Room 308	RR-101-14 AC Junction Box Upper Deck
RR-101-14-7	AC Power Cable 2C 14 AWG	RR-101-14 AC Junction Box Upper Deck	Line Amplifier Upper Deck
RR-101-14-8	AC Power Cable 2C 14 AWG	RR-101-14 AC Junction Box Upper Deck	Line Amplifier Main Deck
Cable TV	RG-59	Nav. Bridge Deck Electronics Workshop Room 308 SOCOMAR Cabinet (Green)	Officers Deck Shore Cable Junction Box
VCR OFF. LOUNGE	RG-59	Boat Deck Officers Lounge VCR	Boat Deck Electronics Equipment Room SOCOMAR TV Cabinet
VCR CREW LOUNGE	RG-59	Main Deck Crew's Lounge VCR	Boat Deck Electronics Equipment Room SOCOMAR TV Cabinet
UHF-ANT (ANT-TV ARR.2)	RG-11	Boat Deck Electronics Equipment Room SOCOMAR TV Cabinet	A/C Unit Aft Room 328 Junction Box
VHF-ANT (ANT TV AAR.1)	RG-11	Boat Deck Electronics Equipment Room SOCOMAR TV Cabinet	A/C Unit Aft Room 328 Junction Box
R-RB-6	RG-11	Boat Deck	Line Amplifier Upper Deck

Cable Label	Cable Type	Equipment (From)	Equipment (To)
		Electronics Equipment Room 308 SOCOMAR TV Cabinet	
R-RB-7	RG-11	Boat Deck Electronics Equipment Room 308 SOCOMAR TV Cabinet	Line Amplifier Main Deck
R-RB-1	Belden 9405	Officers Lounge Boat Deck	A/C Unit Aft Room 328 Junction Box
SRE	RG-59	Boat Deck Electronics Equipment Room 308 SOCOMAR TV Cabinet	Boat Deck Electronics Equipment Room Rack #3
VSCS	RG-6	Boat Deck Electronics Equipment Room 308 SOCOMAR TV Cabinet	Boat Deck Room 312 Rack #1 Combiner
R-RB-4	RG-59	Boat Deck Electronics Equipment Room 308 SOCOMAR TV Cabin	Officers Deck 2-Way Splitter Across from Room 400
R-RB-8	RG-59	Officers Deck 2-Way Splitter Across from Room 400	Nav. Bridge Port Information Console
R-RB-9	RG-59	Officers Deck 2-Way Splitter Across from Room 400	Commanding Officers Cabin Room 405 Officers Deck
R-RB-10	RG-59	Commanding Officers Cabin Room 405 Officers Deck	Commanding Officers Cabin Room 405 Officers Deck
R-RB-11	RG-59	Commanding Officers Cabin Room 405 Officers Deck	Third Officer Cabin Room 401 Officers Deck
R-RB-12	RG-59	Third Officer Cabin Room 401 Officers Deck	Second Officer Cabin Room 400 Officers Deck
R-RB-13	RG-59	Second Officer Cabin Room 400 Officers Deck	Chief Officers Cabin Room 404 Officers Deck
R-RB-14	RG-59	Chief Officers Cabin Room 404 Officers Deck	Chief Officers Cabin Room 404 Officers Deck
R-RB-15	RG-59	Boat Deck Electronics Equipment Room 308 SOCOMAR TV Cabin	Electronics Equipment Room 308 Above Workbench
R-RB-16	RG-59	Electronics Equipment Room 308 Boat Deck Above Workbench	Electronics Equipment Room 308 Boat Deck Above Workbench
R-RB-17	RG-59	Electronics Equipment Room 308 Boat Deck	Room 312 Boat Deck

Cable Label	Cable Type	Equipment (From)	Equipment (To)
		Above Workbench	
R-RB-18	RG-59	Boat Deck Electronics Equipment Room 308 SOCOMAR TV Cabin	Boat Deck Officials Cabin Room 300
R-RB-19	RG-59	Boat Deck Officials Cabin Room 300	Boat Deck Officials Cabin Room 300
R-RB-20	RG-59	Boat Deck Officials Cabin Room 300	Officers Lounge Room 305 Boat Deck
R-RB-21	RG-59	Officers Lounge Room 305 Boat Deck	Upper Deck Engineer's Office Room 226
R-RB-22	RG-59	Upper Deck Engineer's Office Room 226	2 Passengers Cabin Room 232 Upper Deck
R-RB-23	RG-59	2 Passengers Cabin Room 232 Upper Deck	2 Passengers Cabin Room 236 Upper Deck
R-RB-24	RG-59	2 Passengers Cabin Room 236 Upper Deck	Gymnasium Room 248 Upper Deck
R-RB-25	RG-59	Line Amplifier Upper Deck	Officer's Mess Room 202 Upper Deck
R-RB-26	RG-59	Officer's Mess Room 202 Upper Deck	Third Engineer Cabin Room 208 Upper Deck
R-RB-27	RG-59	Third Engineer Cabin Room 208 Upper Deck	Second Engineer Cabin Room 212 Upper Deck
R-RB-28	RG-59	Second Engineer Cabin Room 212 Upper Deck	Logistics Officer Cabin Room 216 Upper Deck
R-RB-29	RG-59	Logistics Officer Cabin Room 216 Upper Deck	Logistics Office Room 224 Upper Deck
R-RB-29	RG-59	Logistics Office Room 224 Upper Deck	Ice Observer Cabin Room 222 Upper Deck
R-RB-30	RG-59	Ice Observer Cabin Room 222 Upper Deck	Leading Seaman Cabin Room 228 Upper Deck
R-RB-31	RG-59	Leading Seaman Cabin Room 228 Upper Deck	Leading Seaman Cabin Room 234 Upper Deck
R-RB-32	RG-59	Leading Seaman Cabin Room 234 Upper Deck	Clerk/Storekeeper Cabin Room 240 Upper Deck
R-RB-33	RG-59	Clerk/Storekeeper Cabin Room 240 Upper Deck	2 Passengers Cabin Room 244 Upper Deck
R-RB-34	RG-59	Line Amplifier Upper Deck	Sick Bay Room 203

Cable Label	Cable Type	Equipment (From)	Equipment (To)
			Upper Deck
R-RB-35	RG-59	Sick Bay Room 203 Upper Deck	Chief Engineer Cabin Room 213 Upper Deck
R-RB-36	RG-59	Chief Engineer Cabin Room 213 Upper Deck	Chief Engineer Cabin Room 213 Upper Deck
R-RB-37	RG-59	Chief Engineer Cabin Room 213 Upper Deck	Senior Engineer Cabin Room 217 Upper Deck
R-RB-38	RG-59	Senior Engineer Cabin Room 217 Upper Deck	Senior Engineer Cabin Room 217 Upper Deck
R-RB-39	RG-59	Senior Engineer Cabin Room 217 Upper Deck	Electrical Officer Cabin Room 229 Upper Deck
R-RB-40	RG-59	Electrical Officer Cabin Room 229 Upper Deck	Helicopter Pilot Cabin Room 235 Upper Deck
R-RB-41	RG-59	Helicopter Pilot Cabin Room 235 Upper Deck	Helicopter Engineer Cabin Room 241 Upper Deck
R-RB-42	RG-59	Helicopter Engineer Cabin Room 241 Upper Deck	Smoking Lounge Room 245 Upper Deck
	RG-11	Line Amplifier Upper Deck	Line Amplifier Main Deck
	RG-11	Line Amplifier Upper Deck	Line Amplifier Main Deck
R-RB-43	RG-59	Line Amplifier Main Deck	Quarter Master Cabin Room 120 Main Deck
R-RB-44	RG-59	Quarter Master Cabin Room 120 Main Deck	Quarter Master Cabin Room 126 Main Deck
R-RB-45	RG-59	Quarter Master Cabin Room 126 Main Deck	Boatswain Cabin Room 128 Main Deck
R-RB-46	RG-59	Boatswain Cabin Room 128 Main Deck	Boatswain Mate Cabin Room 134 Main Deck
R-RB-47	RG-59	Boatswain Mate Cabin Room 134 Main Deck	2 Seaman Cabin Room 138 Main Deck
R-RB-48	RG-59	2 Seaman Cabin Room 138 Main Deck	2 Seaman Cabin Room 146 Main Deck
R-RB-49	RG-59	2 Seaman Cabin Room 146 Main Deck	2 Seaman Cabin Room 148 Main Deck
R-RB-50	RG-59	2 Seaman Cabin Room 148 Main Deck	2 Seaman Cabin Room 156 Main Deck

Cable Label	Cable Type	Equipment (From)	Equipment (To)
R-RB-51	RG-59	Line Amplifier Main Deck	2-Way Splitter Main Deck Galley
R-RB-51	RG-59	2-Way Splitter Main Deck Galley	Crew's Mess Room 123 Main Deck
R-RB-52	RG-59	Crew's Mess Room 123 Main Deck	Chief Cook Cabin Room 129 Main Deck
R-RB-53	RG-59	Chief Cook Cabin Room 129 Main Deck	Assistant Cook Cabin Room 135 Main Deck
R-RB-54	RG-59	Assistant Cook Cabin Room 135 Main Deck	2 Oilers Cabin Room 139 Main Deck
R-RB-55	RG-59	2 Oilers Cabin Room 139 Main Deck	Crew's Lounge Room 154 Main Deck
R-RB-56	RG-59	Crew's Lounge Room 154 Main Deck	2 Oilers Cabin Room 147 Main Deck
R-RB-57	RG-59	2 Oilers Cabin Room 147 Main Deck	2 Oilers Cabin Room 149 Main Deck
R-RB-58	RG-59	2 Oilers Cabin Room 149 Main Deck	2 Stewards Cabin Room 163 Main Deck
R-RB-59	RG-59	2 Stewards Cabin Room 163 Main Deck	2 Seaman Cabin Room 163 Main Deck

3.1.22 The Contractor must install all the equipment listed above in the Government Furnished Equipment as per CCGS George R. Pearkes TV/Radio Distribution Wiring Diagram Drawing # 18146-540-E-001 Rev 0.

3.1.23 The Contractor must install all the equipment located within the Electronics Equipment Room 308 Boat Deck on an owner supplied shelf within Rack #2 or as indicated by Technical Representative. This includes the following equipment:

- 1 Diplexer
- 2-Way Splitters
- 2 3-Way Splitters
- 1 Fixed Attenuator

3.1.24 The Contractor must supply and install five (5) ROXTEC S 6 x 1 Primed Frame Steel, or equal LRS approved transit, complete with all RM20 blocks, stainless

steel wedge kit, and stainless steel stay plates under Rack #2 located in the Electronics Equipment Room 308.

- 3.1.25 For the purpose of adjustment the Contractor must include a unit cost for the supply and install for one (1) ROXTEC S 6 x 1 Primed Frame Steel, or equal LRS approved transit, complete with all RM20 blocks, stainless steel wedge kit, and stainless steel stay plates.
- 3.1.26 The Contractor must install all splitters (2, 3, and 4-Way) on new fabricated 1/8" aluminum plates approximately 6" x 6" and mounted to the sides of the existing cable trays and must be as close as possible to the identified location as indicated in drawing.
- 3.1.27 The Contractor must install all the diplexers and 2-way splitters located at each outlet location on a new fabricated 1/8" thick by 6" x 6" aluminum plate and mounted just above the outlet location in the deck head either to the existing cable tray or onto the bulkhead panels.
- 3.1.28 Once all these items are installed at their final location, the Contractor must supply and install lamacoid labels and secure them directly to deck head panels to identify each items location.
Labeling as follows;
- TV/FM – 2-WAY SPLITTER
 - TV/FM – 3-WAY SPLITTER
 - TV/FM – 4-WAY SPLITTER
 - TV/FM – DIPLEXER
- 3.1.29 The Contractor must supply and install approximately 2500 meters of Belden 1694SB (RG-6) cable between all devices and all the way to new outlet boxes/faceplates as per CCGS George R Pearkes TV/Radio Distribution Wiring Diagram 18146-540-E-001 Rev 0.
- 3.1.30 For the purpose of adjustment the Contractor must include a unit cost for the installation of 10 meters of the listed cable type.
- 3.1.31 The Contractor must supply and install a new AC power feed from Panel RR-101 Breaker 14 (RR-101-14) Room 312 at the location of new amplifier within Rack #2 in the Electronics Equipment Room 308. The Contractor must supply and install new AC Outlet within Rack #2 to supply the new TV Distribution System.
- 3.1.32 The Contractor must supply and install a new Belden 1694SB cable run from the new Diplexer located within Rack #2 in the Electronics Equipment Room 308 to Rack #1 located within Room 312 to interface to the existing Satellite TV System Combiner.

- 3.1.33 The Contractor must label each cable, once installed, with marked with a stamped stainless steel metal tag. The labels are to be securely affixed to the cable at each end and through any deck, deck heads, and gland penetrations with the designation for each cable as provided in this SOW item.
- 3.1.34 The Contractor must replace the 2-Way Splitter located on the Main Deck at Frame 96 as indicted on the new TV/Radio Distribution Wiring Diagram 18146-540-E-001 with an owner supplied 3-Way Splitter and run a new cable run to the Galley Room 113 at location of old TV Outlet Box. Contractor must also install new TV Outlet box supplied by owner as indicated above.
- 3.1.35 The Contractor must terminate all cable runs between devices using supplied FS6U connectors with crimp tool CPLCCT-SLM and tip LMTIP-S, and cable preparation tool PS59/6
- 3.1.36 The Contractor must terminate all runs at the outlet boxes using supplied FS6U connectors with the same tools as above. These are to be mounted using wall plates, inserts, and modules at each location. The cable connected to the diplexer port label 950 – 2050 MHz must be connected to the unlabeled port on the faceplate. The cable from the diplexer port labeled 40- 862 MHz will be split to feed the other two inserts which must be labeled TV and FM Radio by the Contractor.
- 3.1.37 All new outlets will occupy the space vacated by the old outlets.
- 3.1.38 All unused ports on the splitters must be terminated using LTF 2150 75 Ohm terminator.
- 3.1.39 The Contractor must be responsible for sealing all cable glands.
- 3.1.40 The Contractor is responsible for the identification of interference items, their temporary removal, storage, and refitting to vessel.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work must be subject to witness by the CCG TA, Chief Engineer or delegate and the attending ABS surveyor.

4.2 Testing

- 4.2.1 All cables are to be checked for continuity after installation to ensure operational capability. Should any cable run fail to pass testing, the cable must be replaced at the Contractor's expense.

4.2.2 All cable testing must be verified by a Canadian Coast Guard Technician.

4.2.3 New AC/DC circuits must be proven operational

4.2.4 Electronic equipment which has been removed for the performance of this SOW item must be returned to operational condition.

4.2.5 The TV Distribution system must be tested by a CCG Technical Representative to ensure all drops are balanced to within +/- 3dB from each other. A signal must be injected at the head end diplexer in Room # 406 Electronics Workshop at the port labeled 40 – 860MHz, the frequency must be set at 221.25MHz and the level must be set at 0dB, measure signal dB level at each outlet labeled TV only. The outlets should all be within +/- 3dB of each other and the results must be entered in the table below.

Room #	Compartment (Location)	Test Level Injected Signal at Head End	Signal Level at Output (Result)
400	Second Officer Cabin	221.25 MHz @ 0 dB	
401	Third Officer Cabin		
403	Commanding Officer Night Cabin		
404	Chief Officers Day Cabin		
405	Commanding Officer Day Cabin		
408	Chief Officer Night Cabin		
300	Officials Day Cabin		
304	Officials Night Cabin		
308	Electronics Equipment Room		
312	Computer/Server Room		
305	Officers Lounge		
202	Officers Mess Room		
203	Sick Bay		
204	Quarter Master Station Port		

Room #	Compartment (Location)	Test Level Injected Signal at Head End	Signal Level at Output (Result)
205	Quarter Master Station Starboard		
208	Third Engineer Cabin		
209	Chief Engineer Night Cabin		
212	Second Engineer Cabin		
213	Chief Engineer Day Cabin		
216	Logistics Officer Cabin		
217	Senior Engineer Day Cabin		
218	Ship's Office		
222	Ice Observer Cabin		
223	Senior Engineer Night Cabin		
224	Logistics Office		
226	Engineer's Office		
228	Leading Seaman Cabin		
229	Electrical Officer Cabin		
232	2 Passengers Cabin		
234	Leading Seaman Cabin		
235	Helicopter Pilot Cabin		
240	Clerk/Storekeeper Cabin		
241	Helicopter Engineer Cabin		
244	2 Passengers Cabin		
245	Smoking Lounge		
248	Gymnasium		
113	Galley		

Room #	Compartment (Location)	Test Level Injected Signal at Head End	Signal Level at Output (Result)
120	Quarter Master Cabin		
123	Crew's Mess Room		
126	Quarter Master Cabin		
128	Boatswain Cabin		
129	Chief Cook Cabin		
134	Boatswain Mate Cabin		
135	Second (Assistant) Cook Cabin		
138	2 Seaman Cabin		
139	2 Oilers Cabin		
141	Stores Handling Room		
146	2 Seaman Cabin		
147	2 Oilers Cabin		
148	2 Seaman Cabin		
149	2 Oilers Cabin		
154	Crew's Lounge		
156	2 Seaman Cabin		
157	2 Seaman Cabin		
163	2 Stewards Cabin		
53	Electrical Workshop		

5.0 Deliverables

5.1 Report

- 5.1.1 The Contractor must provide the Chief Engineer a report of the Contractor's work in both electronic and hardcopy formats outlining the details of the inspections and any alterations/repairs prior to the acceptance of this SOW item.

5.2 Spares

- 5.2.1 All owner supplied equipment and materials which has not been used must be returned to the owner prior to the acceptance of the SOW item.

5.3 Drawings

- 5.3.1 Any affected vessel drawings must be updated by the contractor as referenced in section 8.1 – Drawings - of this SOW item.

L-07 MASTERCLOCK INSTALLATION

1.0 Scope

- 1.1 The intent of this SOW item is for the complete removal of the existing Electric Clock System and for the installation of a new owner supplied Master Clock system.
- 1.2 The Contractor must supply all materials, and parts required to perform the specified work unless otherwise stated.
- 1.3 This work must be carried out in conjunction with the following SOW items:
- L-04 – ICS Replacement
 - L-06 – TV Distribution Upgrade
 - H-33 – Bridge Window Replacement & Steel Renewals
 - E-12 – Steering Upgrades
- 1.4 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Documentation

Drawing Number	Description	Electronic Number
82-25	CCGS George R. Pearkes Electric Clock System "As Fitted" Diagram	
G9_GRP MSTR CLCK BD 202007 REV B	CCGS George R. Pearkes Master Clock Block Diagram	

G9_GRP MSTR CLCK EQ LAYOUT	CCGS George R. Pearkes Master Clock Equipment Layout	
LM639-010-AL REV J	CCGS George R. Pearkes Antenna Arrangement	
LM639-101-AL REV K	CCGS George R. Pearkes Antenna Arrangement	

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- TP127E – Ships Electrical Standards
- IEEE 45:2002 – Recommended Practice for Electrical Installations on Ships
- Specification for the Installation of Shipboard Electronic Equipment (70-000-000-EU-JA-001)
- General Information for the Rules and Regulations for the Classification of Ships.
- CWB, Welding Procedures

2.3 Regulations

- Canada Shipping Act, 2001

2.4 Government Supplied Materials

Item	Equipment Description	Part Number	Quantity
1	Fabricated Small Masts		2
2	Master Clock Unit	GMR 5000	1
3	Digital Displays	NTDS24	15
4	Master Clock GPS Antenna		1
5	Satellite Radio Antenna		1
6	DGPS Antenna (Existing)	GPA-021	2
7	AIS GPS Antenna (Existing)		1
8	AIS VHF Antenna (Existing)		1

Item	Equipment Description	Part Number	Quantity
9	Antenna Clamps		2

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must supply all equipment, enclosures, ventilation, staging, chain falls, crane, crane, slings, and shackles necessary to perform the work. All lifting equipment must be appropriate for the expected duties, and be accompanied by current certification indicating, or be permanently marked as to being, or a safe working load for the expected duties.
- 3.1.2 The Contractor responsible for the temporary removal and reinstallation of any deck heads, bulkheads, paneling, insulation, and any items that is deemed to be interfering to the running of any cables and mounting of any equipment.
- 3.1.3 The Contractor must be responsible to ensure that all areas have been cleaned and free of any debris resulting from the performance of this SOW item.
- 3.1.4 The Contractor must dispose of all cabling and equipment removed within this SOW item at their own expense.
- 3.1.5 All new metal structure and fittings added must be primed and painted to match existing structure finish.
- 3.1.6 Existing structure finish that is disturbed due to installation of equipment as outlined in this SOW item must be restored to original finish.
- 3.1.7 The Contractor must use at minimum a 316 grade stainless steel hardware for mounting equipment, plates, and panels listed within this SOW item.
- 3.1.8 All cabling, once installed, must be marked with a stamped stainless steel metal tag. The labels must be securely affixed to the cable at each end and through any deck, deck heads, and/or gland penetrations with the designation for each cable as provided in this SOW item.
- 3.1.9 All cabling must follow existing cable trays throughout the vessel where fitted. Once installed, all cabling must be secured as per TP127.
- 3.1.10 For all cables, the Contractor must supply and install transits, glands and grommets required at bulkhead penetrations, deck penetrations and equipment entry points to provide cable protection and fastening. Where required, the Contractor must remove bulkhead and decking material to accommodate transit and gland installation.
- 3.1.11 Prior to the commencement of any electrical work, the Contractor must ensure that all electrical supplies feeding the systems have been isolated at the source

following an established lockout/tag out procedure, and as per ISM fleet safety manual. The Contractor must check with Chief Engineer or Senior Electrical Officer.

3.1.12 Electrical Isolations for AC power listed below:

-IC-101-12 – Panel located on Nav. Bridge forward side of Nav. Chart Console

3.1.13 The Contractor must work in conjunction with a Canadian Coast Guard Electronic Technician to oversee the installation of the new system to ensure compliance with applicable Canadian Coast Guard standards. Terminations of all equipment must be completed by CCG technicians with the exception of those for electrical supply which must be the Contractor's responsibility as well as any grounding requirements.

3.1.14 The Contractor must fabricate and install brackets for all equipment.

3.1.15 The Contractor must supply and install an AC outlet for the existing IC-101-12 power feed.

3.1.16 The Contractor must supply and install approximately 2000 feet of Belden 1300SB cable throughout the vessel. This cable is shipboard and class approved.

3.1.17 The Contractor must supply and install approximately 1000 feet of LMR-400 ultra-flex and fire retardant cable (LMR-400-UF-FR).

3.1.18 The Contractor must install the owner supplied equipment as shown in **Error! Reference source not found.** above. All equipment locations will be finalized prior to mounting by Commanding Officer, Chief Engineer or Technical Representative.

3.1.19 Upon final installation, testing must be carried out as per Section 4.2 of this SOW item.

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

3.2 Equipment and Cable Removals

3.2.1 The Contractor must remove the following equipment listed below and reference drawing number 82-25.

Equipment	Location
Master Clock Unit MIC-10	Boat Deck Port Side Electronics Equipment Room 308 Rack #2 (Middle)
Junction/Terminal Box CE-JB1	Boat Deck Port Side Electronics Equipment Room 308 Port Bulkhead above shelf
Junction/Terminal Box CE-JB2	Upper Deck Passage Way Deck head within the area of the cable trunk
Junction/Terminal Box CE-JB3	Main Deck Passage Way Deck head within the area of the cable trunk
Clock	Nav. Bridge Nav. Chart Table Center
Clock	Officers Deck Commanding Officers Day Cabin Room 405
Clock	Boat Deck Computer/Server Room 312
Clock	Boat Deck Officer's Lounge Room 305
Clock	Upper Deck Quarter Masters Station Port Room 204
Clock	Upper Deck Quarter Masters Station Starboard Room 205
Clock	Upper Deck Officer's Mess Room 202

Clock	Upper Deck Chief Engineer's Day Cabin Room 213
Clock	Main Deck Crew's Mess Room 123
Clock	Main Deck Crew's Lounge Room 154
Clock	Engine Room Flats Motor/Engine Control Room Room 52

3.2.2 Contractor must remove the following cabling listed below and referenced in drawing number 82-25.

Cable Label	Cable Type	Equipment (From)	Equipment (To)
CE-1	4 PR 16 AWG	Master Clock Unit Rack #2 Electronics Equipment Room 308 Boat Deck	CE-JB1 Junction Box Electronics Equipment Room 308 Port bulkhead above shelf Boat Deck
CE-2	1 PR 16 AWG	CE-JB1 Junction Box Electronics Equipment Room 308 Port bulkhead above shelf	Boat Deck Computer/Server Room 312
CE-3	4 PR 16 AWG	CE-JB1 Junction Box Electronics Equipment Room 308 Port bulkhead above shelf	Nav. Bridge Nav. Chart Console Center Terminal Blocks

Cable Label	Cable Type	Equipment (From)	Equipment (To)
CE-3	6 C 16 AWG	Nav. Bridge Nav. Chart Console Center Terminal Blocks	Nav. Bridge Nav. Chart Console Center Clock
CE-4	2 PR 16 AWG	CE-JB1 Junction Box Electronics Equipment Room 308 Port bulkhead above shelf Boat Deck	Officers Deck Commanding Officers Cabin Room 405
CE-5	2 PR 16 AWG	CE-JB1 Junction Box Electronics Equipment Room 308 Port bulkhead above shelf Boat Deck	Boat Deck Officer's Lounge Room 305
CE-6	2 PR 16 AWG	CE-JB1 Junction Box Electronics Equipment Room 308 Port bulkhead above shelf Boat Deck	CE-JB2 Junction Box Upper Deck Passage Way Deck head in area of cable trunk
CE-7	2 PR 16 AWG	CE-JB2 Junction Box Upper Deck Passage Way Deck head in area of cable trunk	Upper Deck Quarter Master Station Port Room 204
CE-7	2 PR 16 AWG	Upper Deck Quarter Master Station Port Room 204	Upper Deck Officer's Mess Room 202
CE-7	2 PR	Upper Deck	Upper Deck

Cable Label	Cable Type	Equipment (From)	Equipment (To)
	16 AWG	Officer's Mess Room 202	Quarter Master Station Starboard Room 205
CE-7	2 PR 16 AWG	Upper Deck Quarter Master Station Starboard Room 205	Upper Deck Chief Engineers Day Cabin Room 213
CE-8	2 PR 16 AWG	CE-JB2 Junction Box Upper Deck Passage Way Deck head in area of cable trunk	CE-JB3 Junction Box Main Deck Passage Way Deck head in area of cable trunk
CE-9	2 PR 16 AWG	CE-JB3 Junction Box Main Deck Passage Way Deck head in area of cable trunk	Main Deck Crew's Mess Room 123
CE-9	2 PR 16 AWG	Main Deck Crew's Mess Room 123	Main Deck Crew's Lounge Room 154
CE-10	2 PR 16 AWG	Main Deck Crew's Lounge Room 154	Engine Room Flats Motor/Engine Control Room Room 52
GPS1-ANT	LMR-400	Nav. Bridge Nav. Chart Console Center DGPS #1 Display	Wheelhouse Top Forward Center Platform
GPS2-ANT	LMR-400	Nav. Bridge Nav. Chart Console Center DGPS #2 Display	Wheelhouse Top Forward Center Platform
AIS-GPS	LMR-400	Nav. Bridge Nav. Chart Console	Wheelhouse Top Forward Center

Cable Label	Cable Type	Equipment (From)	Equipment (To)
		AIS R4 Transponder	Platform
AIS-VHF	LMR-400	Nav. Bridge Nav. Chart Console AIS R4 Transponder	Wheelhouse Top Forward Center Platform

3.3 Equipment Installation

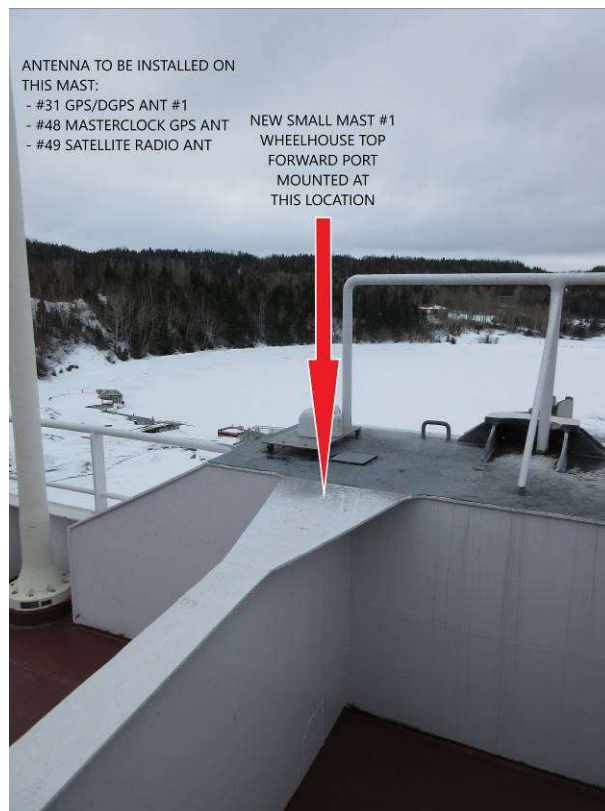
- 3.3.1 The Contractor must install the owner supplied small mast's using, at a minimum, 316 stainless steel bolts and hardware to fit a 19 mm hole at the bottom of the mast.
- 3.3.2 The Contractor must supply and install a new ROXTEC R125 AISI 316 transit complete with RM20 blocks and suitable size piping in a gooseneck form on the Wheelhouse Top Forward Center under the existing platform. The location will be determined prior to installation.
- 3.3.3 The Contractor must supply and install cable hangers from the new transit location to each new small mast location.
- 3.3.4 The Contractor must relocate the existing antennae, GPS/DGPS #1 (#31), GPS/DGPS #2 (#39), AIS VHF (#1), and AIS GPS (#31) to the new locations as indicated on antenna arrangement drawings. The Contractor must reference the CCGS George R. Pearkes Antenna Arrangement Drawing LM639-101-AL REV J and K for the locations of the existing antennae and the new antennae locations.
- 3.3.5 The Contractor must install the owner supplied equipment listed above in Equipment List at locations listed in table below. Locations will be determined prior to installation by Technical Representative but will likely be mounted in the area vacated by the removed equipment.

Equipment	Mounting Location
New Small Mast #1 Port	Wheelhouse Top Port Forward. See picture below.
New Small Mast #2 Starboard	Wheelhouse Top Starboard Forward. See picture below.
Master Clock Unit (GMR 5000)	Boat Deck Electronics Equipment Room 308 Rack #2 Top
Master Clock GPS Antenna (#48)	Wheelhouse Top New Small Mast #1 Port Inner Arm

Equipment	Mounting Location
DGPS #1 Antenna (Existing #31)	Wheelhouse Top New Small Mast #1 Port Outer Arm
Satellite Radio Antenna (#49)	Wheelhouse Top New Small Mast #1 Port Top Middle
DGPS #2 Antenna (Existing #39)	Wheelhouse Top New Small Mast #2 Starboard Outer Arm
AIS VHF Antenna (Existing #1)	Wheelhouse Top New Small Mast #2 Starboard Top Middle
AIS GPS Antenna (Existing #38)	Wheelhouse Top New Small Mast #2 Starboard Inner Arm
Digital Clock NTDS24	Nav. Bridge Aft Bulkhead Center
Digital Clock NTDS24	Nav. Bridge Nav. Chart Console Center
Digital Clock NTDS24	Officers Deck Commanding Officers Day Cabin Forward Bulkhead Starboard
Digital Clock NTDS24	Boat Deck Officer's Lounge
Digital Clock NTDS24	Upper Deck Officers Pantry Room 201
Digital Clock NTDS24	Upper Deck Officer's Mess Room 202
Digital Clock NTDS24	Upper Deck Quarter Masters Station Port Room 204
Digital Clock NTDS24	Upper Deck Quarter Masters Station Starboard Room 205
Digital Clock NTDS24	Upper Deck Chief Engineer's Day Cabin Room 213
Digital Clock NTDS24	Main Deck Galley Room 113
Digital Clock NTDS24	Main Deck

Equipment	Mounting Location
	Crew's Mess Room 123
Digital Clock NTDS24	Main Deck Crew's Lounge Room 154
Digital Clock NTDS24	Engine Room Flats Motor/Engine Control Room (MCR) 52
Digital Clock NTDS24	Engine Room Flats Winch Compartment
Digital Clock NTDS24	Engine Room Flats Engine Room Top Middle

Picture: Wheelhouse Top Port Forward Small Mast #1 Location



Picture: Wheelhouse Top Starboard Forward Small Mast #2 Location



3.4 Cabling

- 3.4.1 The Contractor must supply and install approximately 2000 feet of Belden 1300SB cable.
- 3.4.2 The Contractor must supply and install approximately 1000 feet of LMR-400 Ultra-Flex Fire Retardant cable.
- 3.4.3 The Contractor must install the cables in accordance with the table below and reference drawing CCGS George R. Pearkes Master Clock Block Diagram.

Cable #	From Location	To Location	Cable Type
MC-1	Wheel House, STBD Wing Console, POE Switch	Wheel House, AFT Bulkhead	Belden 1300SB
MC-2	Wheel House, STBD Wing Console, POE Switch	Wheel House, Nav. Chart Console, Clock	Belden 1300SB
MC-3	Wheel House, STBD Wing Console, POE Switch	Officers Deck, RM405 – Commanding Officers Cabin, Clock	Belden 1300SB
MC-4	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Boat Deck, RM 305 – Officers Lounge, Clock	Belden 1300SB
MC-5	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Upper Deck, RM 201 – Officers Pantry, Clock	Belden 1300SB

Cable #	From Location	To Location	Cable Type
MC-6	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Upper Deck, RM 202 – Officers Mess Room, Clock	Belden 1300SB
MC-7	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Upper Deck, RM 204 – Quarter Master Station Port, Clock	Belden 1300SB
MC-8	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Upper Deck, RM 205 – Quarter Master Station Starboard, Clock	Belden 1300SB
MC-9	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Upper Deck, RM 213 – Chief Engineer Day Cabin, Clock	Belden 1300SB
MC-10	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Main Deck, RM 113 – Galley, Clock	Belden 1300SB
MC-11	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Main Deck, RM 123 – Crew's Mess Room, Clock	Belden 1300SB
MC-12	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Main Deck, RM 154 – Crew's Lounge, Clock	Belden 1300SB
MC-13	Engine Room Flats, RM 52 –MCR, CONSOLE, POE Switch	Engine Room Flats, RM 52 –MCR, Clock	Belden 1300SB
MC-14	Engine Room Flats, RM 52 –MCR, CONSOLE, POE Switch	Engine Room Flats, Winch Compartment, Clock	Belden 1300SB
MC-15	Engine Room Flats, RM 52 –MCR, CONSOLE, POE Switch	Engine Room Flats, Engine Room, Clock	Belden 1300SB
MC-17	Boat Deck, RM 306 – Electronic Equipment, Rack 3, Master Clock	Wheelhouse Top Forward Port Small Mast #1 Inner Arm Antenna #48 Master Clock Antenna	LMR-400 UF-FR
MC-18	Boat Deck, RM 306 – Electronic Equipment, Rack 3, POE Switch	Boat Deck Room 312 – Computer Server Room Rack #1	Belden 1300SB
MC-19	Boat Deck, Electronics Equipment Room 308 Master Clock Unit GMR 5000	Wheelhouse, Nav. Bridge Nav. Chart Console GPS Distribution	Belden 1300SB
GPS1-ANT	Wheelhouse, Nav. Bridge Nav. Chart Console GPS/DGPS #1 Display	Wheelhouse Top Forward Port Small Mast #1 Outer Arm Antenna #31 GPS/DGPS #1 Antenna	LMR-400 UF-FR

Cable #	From Location	To Location	Cable Type
GPS2-ANT	Wheelhouse, Nav. Bridge Nav. Chart Console GPS/DGPS #2 Display	Wheelhouse Top Forward Starboard Small Mast #2 Outer Arm Antenna #39 GPS/DGPS #2 Antenna	LMR-400 UF-FR
AIS-GPS	Wheelhouse, Nav. Bridge Nav. Chart Console Starboard AIS R4 Transponder	Wheelhouse Top Forward Starboard Small Mast #2 Inner Arm Antenna #38 AIS GPS Antenna	LMR-400 UF-FR
AIS-VHF	Wheelhouse, Nav. Bridge Nav. Chart Console Starboard AIS R4 Transponder	Wheelhouse Top Forward Starboard Small Mast #2 Middle Antenna #39 AIS VHF Antenna	LMR-400 UF-FR
SAT-ANT	Boat Deck, Electronics Equipment Room 308 Rack #3 Satellite Radio	Wheelhouse Top Forward Port Small Mast #1 Middle Antenna #49 Satellite Radio Antenna	LMR-400 UF-FR

4.0 Proof of Performance

4.1 Inspection

4.1.1 All work must be subject to witness by the Chief Engineer of delegate and the attending surveyor.

4.2 Testing

4.2.1 All cables are to be checked for continuity after installation to ensure operational capability. Should any cable run fail to pass testing, the cable must be replaced at the Contractor's expense.

4.2.2 All cable testing must be verified by a Canadian Coast Guard Technician.

4.2.3 New AC/DC circuits must be proven operational.

- 4.2.4 Electronic equipment which has been removed for the performance of this specification item must be returned to operational condition as it will be used as spares for similar equipment used in CCG fleet.

4.3 Certifications

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

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 The Contractor must provide the Chief Engineer with a typewritten report of the Contractors work in both electronic and hardcopy formats outlining the details of the inspections and any alterations / repairs to the acceptance of this SOW item.
- 5.1.2 Any affected vessel drawings must be updated by the contractor as referenced in section 8.1 – Drawings - of this SOW item.

L-08 BREAKER INSPECTION AND TESTING

1.0 Scope

- 1.1 A number of circuit breakers require inspection and testing for ABS and Transport Canada/Marine Safety requirements. The intent of this SOW item is to describe the work required for the complete overhaul, including injection testing, on the attached list of circuit breakers.
- 1.2 This work must be carried out in conjunction with the following SOW items:
- E-01 – Propulsion Generator Replacement
 - E-02 – Cycloconverter Replacement
 - E-03 – Auxiliary Generator Replacement
 - E-12 – Steering Upgrades
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Affected Circuit Breakers

Main Generator #1 (Port)

TC/MS Field # 3E048

Circuit P-0601

Location: Transformer Room

Manu: Merlin Gerin

Type Masterpact

3 Pole, 600 VAC, 60 HZ

Control 48 VDC/120 VAC

Ser #TB9145 100 06

Main Generator #2 (Centre)

TC/MS Field # 3E049

Circuit P-602

Location: Transformer Room

Manu: Merlin Gerin

Type: Masterpact

3 Pole, 600 VAC, 60 HZ

Control 48 VDC/120 VAC

Serial #TB9145 100 07

Main Generator #3 (Starboard)

Propulsion E.(Port)

TC/MS Field # 3E050

Circuit: P-0603
 Location: Transformer Room
 Manu: Merlin Gerin
 Type: Masterpact
 3 Pole, 600 VAC, 60 HZ
 Control 48 VDC/120 VAC
 Ser #BH28091-84

TC/MS Field # 3E051

Circuit: PP-601
 Location: Transformer Room
 Manu: Merlin Gerin
 Type: Masterpact
 3 Pole, 600 VAC, 60 HZ
 Control 48 VDC/120 VAC
 Ser #BH28089-84

Propulsion E (Starboard)

TC/MS Field # 3E052

Circuit: PP-602
 Location: Transformer Room
 Manu: Merlin Gerin
 Type: Masterpact
 3 Pole, 600 VAC, 60 HZ
 Control 48 VDC/120 VAC
 Ser #TB9145 100 10

Propulsion Excitation and Control (Starboard)

TC/MS Field # 3E061

Circuit: PP-604
 Location: Transformer Room
 Manu: FPE Moulded Case
 Type: TB-43225AF-14 Tri-Break
 3 Pole, 600 VAC, 60 HZ
 Fr. Size 400
 Motor Operated (120VAC)
 TJKMOMA1

Propulsion Excitation and Control (Port)

TC/MS Field # 3E060

Circuit: PP-603
 Location: Transformer Room
 Manu: FPE Moulded Case
 Type: TB-43225AF-14 Tri-Break
 Fr. Size 400
 Motor Operated (120VAC)
 TJKMOMA1

Transformer Breaker

Circuit P-606
 Location: Transformer Room
 Manu: FPE
 Type 30HL-3
 3 Pole, 600 VAC, 60 HZ
 Fr. Size 800
 Relay 800
 Int. Cap. 200kA
 Contact I.C. 30kA
 Control 48 VDC/120 VAC
 Ser# BH28367-84

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- TP127E – Ships Electrical Standards
- IEEE 45:2002 – Recommended Practice for Electrical Installations on Ships
- Specification for the Installation of Shipboard Electronic Equipment (70-000-000-EU-JA-001)
- General Information for the Rules and Regulations for the Classification of Ships.

2.3 Regulations

- Canada Shipping Act, 2001

3.0 Technical Description

- 3.1 All work detailed in this SOW item must be carried out by certified, electrical contractors.
- 3.2 The Contractor is to determine, in consultation with the ABS Electrical Surveyor and the vessel's electrical officer, a schedule of any required ABS inspections and advise the Technical Authority at each inspection point, in advance, to allow his/her attendance.
- 3.3 The contractor must include an allowance of \$10,000.00 in their pricing for the disassembly and supply of new components, if required. This total value will be adjusted by PWGSC 1379 based on final material/equipment invoicing.

4.0 Proof of Performance

- 4.1 Testing
 - 4.1.1 Secondary injection testing shall be performed and shall be witnessed by ABS and the Technical Authority.
- 4.2 Inspection
 - 4.2.1 All work must be carried out to the satisfaction of the ABS surveyor and CCGTA. The contractor must arrange for all inspections by the ABS surveyor and CCGTA.

5.0 Deliverables

- 5.1 Report
 - 5.1.1 A final report containing all testing data and results must be developed by the contractor and given to the CCGTA. Full survey credit must be given by ABS.

STATEMENT OF WORK

CCGS GEORGE R. PEARKES Vessel Life Extension



PART E – Optional Specifications

Prepared by:
Vessel Life Extension Program
200 Kent Street
Ottawa, ON K1A 0E6

TABLE OF CONTENTS – OPTIONAL ITEMS

H-35	COMMON AREA FLOORING & WALL COVERING RENEWALS.....	3
H-36	WASHROOM UPGRADES	9

H-35 COMMON AREA FLOORING AND WALL COVERING RENEWALS

1.0 Scope

- 1.1 The intent of this SOW item must be to remove and replace the flooring on the Main and Upper Deck alleyways, mess rooms (excluding crew's mess - covered in SOW item H-32), quarter master's stations, and entrance ways. All flooring must be supplied and installed by fully certified marine flooring installers.
- 1.2 This work must be carried out in conjunction with the following SOW items:
 - H-20 - Interior Scupper Drain Replacements
 - H-22 - Grey Water Piping Replacement
 - H-32 - Galley Upgrades
 - H-36 - Washroom Upgrades
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this specification item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Standards

- Fleet Safety and Security Manual (DFO/5737)
- CSA W47.1 1983 – Canadian Welding Bureau Standards for the fusion welding of steel
- CSA W47.2 – M1987(R1998) – Canadian Welding Bureau Standard for the fusion welding of aluminum and aluminum alloys
- Society for Protective Coatings (SSPC) Standards
 - SP1 – Solvent Cleaning
 - SP3 – Power Tool Cleaning

2.2 Regulations

- Canada Shipping Act 2001 – Marine Machinery Regulations
- MOSH Regulations

2.3 Documents

- H-3510 Deck Coverings Plan
- H-0016 General Arrangement - Main Deck
- H-0017 General Arrangement- Main Deck Forward
- H-0018 General Arrangement Upper Deck
- H-0019 General Arrangement- Focsle Deck (Page 1/1)
- H-0020 General Arrangement - Boat Deck
- H-0021 General Arrangement - Officers Deck and Wheelhouse
- H-0025 -General Arrangement- Main Deck, Engine Room Flat, and Tank Top
- <https://dexotexmarine.com/uploads/files/file170405170315.pdf>
- Transport Canada Approved Products Catalogue, <https://www.tc.gc.ca/eng/marinesafety/oep-navigation-safety-apci-2298.htm>

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must arrange for the services of a certified marine flooring installer to complete the flooring renewals including application of underlayment, flooring and wall bases.

- 3.1.2 The **Upper Deck flooring** renewals must include the following areas:

- Port and Starboard Gangway entrances and Port and Starboard Aft Entrances **(72 square feet)**
- Port and Starboard Quartermaster Stations **(56 sq feet)**
- The complete alleyways running the length of the accommodation spaces and athwartship. **(798 Square Feet)**
- Officers Mess **(336 sq feet)**

- 3.1.3 The **Main Deck** flooring renewals must include the following areas:

- The complete alleyways running the length of the accommodation spaces and athwartship. **(728 square Feet)**

- Forward Entrance (**102 square feet**)

3.1.4 The **Boat Deck** flooring renewals must include the following areas:

- The complete alleyways running the length of the accommodation spaces and athwartship. **(260 square Feet)**

3.1.5 The **Officers Deck** flooring renewals must include the following areas:

- The complete alleyways running the length of the accommodation spaces and athwartship. **(85 square Feet)**

3.1.6 The **Stair Wells** flooring renewals must include the following areas:

- All stairs and landings. **(120 square Feet)**

Note: All measurements are approximate, the contractor is responsible for verifying and confirming all measurements.

3.1.7 Contractor must remove the existing deck covering system including wall base, existing flooring systems are as follows. ***NOTE: The contractor must include the replacement of complete underlayment systems as listed in section 3.1.2-3.1.6 above. The contractor must also include a unit cost per SQ meter for the removal/installation of each deck system in case there are changes to the actual flooring replacements required. Inspections on the underlayment must be made by chief engineer and certified Dexotex installer to determine the actual areas to be replaced. Costing must be adjusted using PWGSC 1379 process as required.***

- Officers Deck – 3mm Vinyl Tile and 10mm Dexotex
- Boat Deck – 3mm Vinyl Tile and 10mm Dexotex
- Stair Wells - 3mm Vinyl Tile and 10mm Dexotex
- Upper Deck – 3mm Vinyl Tile and 10mm Dexotex
- Main Deck – 3mm Vinyl Tile and 70mm Raeco Floating Floor
- Main Deck Entrance – Dexotex approx 15mm

3.1.8 The entire steel deck must be power tooled clean to bare metal SSPC-SP-11. Contractor must ensure all cabins and compartment doors in-way of the renewals are closed and taped to prevent debris/dirt from contaminating adjacent areas. Contractor must provide, fit and install barriers where spaces cannot be closed off from the work area. These temporary barriers must be secured and must include fitted openings that can open/close to allow access with continued containment.

3.1.9 Forced air extraction fans must be used to remove airborne debris during removals vented to the exterior of the vessel.

3.1.10 The bulkhead panels must be reused unless CG advises otherwise. The CE must inspect the bulkhead panels/track with the Contractor and advise if any bulkhead panels/track must be replaced. The Contractor must include the pricing for the

- supply, fitting and installation of 50 marine rated, joiner or equivalent bulkhead panels including related tracks. This will include the removal/re-installation of any related interference items. A unit cost per panel must be included for this work for final adjustment by PWGSC 1379 process.
- 3.1.11 The Contractor must include pricing for 300 UT shots to be taken on the bare steel deck by a certified, third party NDT Technician in areas directed by the CCG TA. A unit cost per shot will be provided by the contractor for final adjustment by PWGSC 1379.
- 3.1.12 The Contractor must include pricing for the replacement of 10 m² of steel deck. Removals of all interference items including (but not limited to) deck head/bulkhead panels, sheathing, insulation, electrical cables, piping, ductwork etc, must be included in the bid with re-installation upon completion of steel renewals. All welding must be subjected to 100% MPI and 100% Visual inspection. Steel must be Class approved, grade 44W or equivalent. All repairs to follow IACS No. 47 Shipbuilding and Repair Quality Standard.
- 3.1.13 The Contractor must provide a unit cost per square meter of steel deck replacement as per 3.1.13 to be adjusted via PWGSC 1379 process.
- 3.1.14 The steel deck must be cleaned of all loose debris upon completion of power tooling. The steel deck must be coated with 2 coats of Amercoat Primer 5105, or certified equivalent, upon completion to Manufacturer standards.
- 3.1.15 The Contractor must supply and install Transport Canada approved dex-o-tex underlayment or equivalent as per manufacturer guidelines. Dex-O-Tex approved products can be found on the following link with TC approval certificate numbers, <https://dexotexmarine.com/uploads/files/file170405170315.pdf>. The Dexotex underlayment and flooring must be applied in manner to maintain original flooring thicknesses as per original installation. Underlayment must meet fire rating and sound dampening requirements for the installed area.
- 3.1.16 The Contractor must supply, fit and install continuous robust marine Gerflor Streamo Seacrosser, or fully certified marine grade equivalent, flooring in color/pattern agreed upon by the CCG representatives in the alleyways, Quartermaster stations, and mess rooms with approved adhesive.
- 3.1.17 The vinyl flooring must be fitted with as few seams as possible and must be welded together for continuous seam as per manufacturers guidelines for installation.
- 3.1.18 The 5 outside entrances between the weathertight and inside accommodation doors on the Upper Deck and Main Deck must be fitted with a marine Dex-O-Tex Décor Epoxy continuous system including integral cove base along perimeters. The flooring system must be slip resistant. The color scheme of the Dex-O-Tex Décor Epoxy continuous system must be determined with the aid of contractor

supplied color charts to choose from at the time of application including color flakes. All coatings must be applied in accordance with Manufacturer guidelines.

- 3.1.19 The Contractor is responsible for the removal and re-installation of all shelving, counters, desks, and appliances needed to gain access to the deck areas below.
- 3.1.20 The Contractor must re-finish the bulkhead panels in all the areas noted in 3.1.2, 3.1.3, 3.1.4, 3.1.5, and 3.1.6 excluding the crews mess and main deck entrance with Gislaved Folie flame retardant, marine rated covering foil. Fully certified, marine grade equivalents may be accepted if approved by the CCG TA. All hand-rails, lights, switches, outlets, instruction decals, pictures, vanities, mirrors, mounted equipment, etc. must be removed and re-installed upon application. The Contractor must take note of the location of all interference items prior to removal by digital picture to allow for re-locating upon installation of new foil finish. The Contractor must allow for dressing up 3 screw holes per bulkhead panels prior to fitting the new foil to allow for a smooth finish with no visible defects. The foil must be installed as per manufacturer directions following the layout of the individual bulkhead panels.
- 3.1.21 For the purposes of supply the Contractor must allow for enough foil for the covering of 200 standard bulkheads for the main deck, 280 for the upper deck, 64 for the boat deck, 20 the officers deck, and 82 for the stairwells. Color scheme must be #1320-026-F25A.
- 3.1.22 Contractor must supply and fit new 6" 22 GA stainless steel base moldings with kick at bottom matching the profile of the removed vinyl wall base moldings. The moldings must be mounted direct to the base of the bulkhead panels using pan head stainless screws.
- 3.1.23 The bulkhead panels and spaces must be cleaned upon completion of all the above noted work. All new flooring must be completely covered over by Masonite board or equivalent and must be duct taped at all seams for protection of the flooring upon completion.
- 3.1.24 All areas must be professionally cleaned upon completion of work and signed off by a Vessel Designate.
- 3.1.25 The Contractor must be responsible for the identification of interference items, their temporary removal, storage, and refitting to vessel.

4.0 Proof of Performance

4.1 Inspections

- 4.1.1 All work must be carried out with the approval of the CCG TA, CE and ABS inspector.

4.2 Testing

- 4.2.1 All welds to be tested with 100% MPI and to receive 100 % Visual inspection.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 Full NDT and UT report carried out by a certified, third party organization must be submitted to the CCG TA.
- 5.1.2 The contractor must develop new “as built” drawings for all ships drawings that are affected by the work detailed in this specification item. At a minimum, this includes GA's, deck plans and the deck covering plan, H-3510. Both electronic and paper copies must be provided.

5.2 Certifications

- 5.2.1 All Transport Canada recognized approval certificates for materials being installed must be supplied to the Chief Engineer prior to installation of product and must be approved by the attending ABS surveyor prior to purchase.
- 5.2.2 Flooring certifications for the installers must be provided to the CCGTA .
- 5.2.3 Certified CWB tickets for welders and welding procedures must be provided to the CCG TA for steelwork as required.

H-36 WASHROOM UPGRADES

1.0 Scope

- 1.1 The intent of this SOW item is to complete the planned upgrades to the vessels washrooms. This work must include removal and replacement of shower stalls walls, flooring, upgrades to water mixing valves, and replacement of deck head panels, and bulkhead panel covering.
- 1.2 The work must be completed in conjunction with the following SOW items:
 - H-14 - Domestic Water Piping Replacement
 - H-24 - Sewage Vacuum Piping and System Replacement
 - H-25 - Grey Water Piping Replacement
 - H-35 - Common Area Flooring & Wall Covering Renewal
- 1.3 It is the responsibility of the Contractor to ensure that all requirements specified in PART A of this Statement of Work, i.e. the General Sections (including sections 1 to 12) are taken into consideration and applied to this SOW item's defined work requirements. This SOW item may mention certain specific requirements from PART A. However, this does not exempt the Contractor from considering and including any other references from PART A that should also be applied and included for this SOW item's work. ALL requirements must be assessed and included, when applicable, for the work described in this SOW item. In cases of discrepancy between content sources, the content in this SOW item must take precedence.

2.0 References

2.1 Guidance Drawings

- H-0016 - General Arrangement (1:50 Accommodation Layout)- Main Deck
- H-0017 - General Arrangement- Main Deck Forward
- H-0018 - General Arrangement (1:50 Accommodation Layout)- Upper Deck
- H-0019 - General Arrangement- Foc'sle Deck (Page 1/1)
- H-0020 - General Arrangement (1:50 Accommodation Layout)- Boat Deck
- H-0021- General Arrangement (1:50 Accommodation Layout)- Officers Deck and Wheelhouse
- H-0025 - General Arrangement- Main Deck, Engine Room Flat, and Tank Top

2.2 Standards

- Fleet Safety and Security Manual (DFO/5737)
- Coast Guard ISM Confined Space Entry Procedures
- Coast Guard ISM Hotwork Procedures

- Coast Guard ISM Lock out Tag out Procedures
- Coast Guard ISM Fall Protection Procedures
- IACS No. 47 - Shipbuilding and Repair Quality Standard
- CSA W59-08 (R2008) - Welded Steel Construction
- TC TP 127e
- IEC 60092-504,60332-3, 60364-5-52, 60533,60754-0,1,2
- IEEE 60332-3
- IEEE STD 45– Recommended Practice for Shipboard Electrical Installations
- IEEE STD 45.8-2016 Recommended Practice for Electrical Installations on Shipboard--Cable Systems
- CCG Welding Specification (CT-043-eq-eg-001-E)
- CSA W47.1-09 - Certification of Companies for Fusion Welding of Steel
- Society for Protective Coatings (SSPC) Standards
- CWB CSA 47.1 latest revision Division I, II or III

2.3 Regulations

- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act 2001 - Marine Machinery Regulations
- Canada Shipping Act 2001 - Hull Construction Regulations
- Canada Shipping Act - Tackle Regulations
- Canada Shipping Act - Hull Inspection Regulations
- Canada Shipping Act – Safe Working Practices Regulations
- Maritime Occupational Health and Safety Regulations
- ABS Rules and Regulations

2.4 Owner/Contractor Furnished Equipment

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

3.0 Technical Description

3.1 General

- 3.1.1 The Contractor must take detailed pictures of each washroom prior to starting any work to ensure any equipment is returned to original locations. Any damaged fixtures or appliances must be noted and a list defects as well as copies of the photos must be provided to the CCG TA. Items requiring replacement will be corrected via 1379 action. An equipment damaged during the removal process as a result of inappropriate handling by the Contractors must be replaced at the Contractor's expense.

3.1.2 There are twenty-one (21) affected washrooms. Typical dimensions of each washroom is 78 inches x 62 inches but vary slightly throughout the vessel. Contractor must be responsible for exact measurements for determining material requirements for each washroom.

3.2 Shower Stalls

3.2.1 The shower stalls are corner units with two open sides. Shower stall dimensions are typically 29 inches x 29 inches by 76 inches high but vary slightly throughout the vessel. NOTE: The shower stall panels do not need to be replaced in the Chief Engineers Cabin.

3.2.2 The Contractor must remove existing shower stall wall coverings, curtain rods, soap dishes, handrails, and plumbing fixtures. All hardware excluding shower stall walls must be clearly labeled for their location and retained for future reuse.

3.2.3 The Contractor must fabricate and install new brushed stainless steel shower stall enclosures similar to that used in the Chief Engineers cabin. Measurements must be verified for each shower arrangement to ensure proper fitment.

3.2.4 A one piece shower fabrication is preferred but, if not possible, multiple piece designs similar to the Chief Engineers cabin can be used. Any joints must be sealed with caulking on the back side of the overlapped joints. All sheeting must be riveted to the existing bulkhead at joints and edges.

3.2.5 Sheet metal used must 20 gauge stainless steel with edges smoothed and rounded to prevent sharp edges.

3.2.6 Exterior edges of the shower stall arrangement must be fitted with a four (4) inch wide splash guards running the entire vertical height of the shower. Drip guards must be fitted at the bottom of the shower walls to direct water flow over the shower base edges.

3.2.7 The Contractor must supply and install one stainless steel hand grab rail in each newly installed shower stall located on the shower wall adjacent to faucets in a similar orientation to that found in the Chief Engineers cabin.

3.2.8 The Contractor must also supply and install in each shower stall, one wall mounted stainless steel shower shelf and soap dish, design and location to be approved by the CCG TA.

3.2.9 The Contractor must replace the existing shower mixing valve/faucet assemblies in each shower stall with new Contractor supplied external mounted stainless steel Moen assemblies that must have a lifetime warranty. Fully certified equivalents may be accepted if approved by the CCG TA.

- 3.2.10 The Contractor must reinstall the existing shower head assemblies and piping in each shower stall. The Contractor must notify the CCG TA of any piping assemblies that are not stainless steel or chrome plated and these must be replaced via PWGSC 1379 action.
- 3.2.11 The Contractor must re-install existing shower curtain assemblies in each shower stall.
- 3.2.12 All piping must be tested for leaks and water temperature regulation; any defects must be repaired at the Contractor's expense.

3.3 Deck Head Panels

- 3.3.1 The Contractor must remove existing deck head panels and dispose ashore as per federal and provincial regulations.
- 3.3.2 The Contractor must remove and secure all ventilation(s) equipment, and lighting removed from the panels to prevent damage and for later re-installation/reuse.
- 3.3.3 The Contractor must supply and install new solid deck head panels, white in colour. New panels must be same type and dimensions as original to ensure fitment to existing mounting tracks.
- 3.3.4 The longest panels available must be used where possible. Where panel ends are cut to length, the edges must be folded in to give a finished appearance. Panels must be cut out to fit the fixtures that were removed during the strip out, lights, vents, etc. New Panels must be certified, marine grade, Trident Marine Systems provided panels or certified equivalent.

3.4 Floor and Shower Coatings

- 3.4.1 The Contractor must resurface all twenty-one (21) washrooms fitted with shower stalls.
- 3.4.2 The Contractor must remove existing toilets including Teflon seats and if required vanities and associated plumbing. Items must be clearly labeled and stored for future re-installation.
- 3.4.3 The Contractor must prep the existing floor coating including washroom floor and shower stall bases for resurfacing. The existing flooring is a Dex-O-Tex application covered with a top layer of paint within the main washroom area, the shower stalls consist of Dex-O-Tex with a top layer of textured stone effects.
- 3.4.4 The current top layers must be removed and surfaces prepped as per Dex-O-Tex requirements for recovering. Before any prep work begins the Contractor must ensure the washroom is encapsulated and suitable dust extraction is available to

contain the debris within the space and extract and dust and fumes to external decks.

- 3.4.5 The existing deck drains must be covered and protected to prevent the ingress of dust and debris during the work.
- 3.4.6 Upon the removal of top coatings the Contractor must notify the CG IA of any cracks and structural defects in the Dex-O-Tex base. Repairs must be dealt with via PWGSC 1379 action.
- 3.4.7 The deck, perimeters and shower base areas in each shower stall must be thoroughly cleaned and a finish coat of Dexotex Décor Epoxy applied as a continuous system with a light texture, must be applied to the both the deck and shower base area. Care must be taken to ensure that the topcoat does not interfere with re-install of shower and deck drain scupper grates.
- 3.4.8 The color scheme of the Décor Epoxy system must be determined by the CG TA. All coatings must be applied in accordance with manufacturer's application instructions with particular attention to curing times.

3.5 Bulkhead Covering(s)

- 3.5.1 The Contractor must remove all bulkhead mounted equipment including Vanities, Mirrors, Lights, Switches, Soap, Towel Racks, ventilation diffusers, etc. and clearly label and store. Any wall mounted air fresher cabinets and handmade shelving must be disposed of.
- 3.5.2 The Contractor must remove any protruding screws and objects from the bulkheads and patch any minor holes.
- 3.5.3 The bulkheads in each washroom must then be covered with Contractor supplied marine approved, fire retardant *Gislaved Foil type 1320-026-F25A*. Fully certified, marine grade equivalents may be accepted if approved by the CGTA. Material must be applied as per manufactures instructions and care must be taken to ensure proper adhesion and neat seamless joints. The new covering must be cut for existing penetrations.
- 3.5.4 Upon completions of flooring and bulkhead covering the Contractor must re-install all previously removed equipment to their original locations. Note: The existing toilet paper holders must be replaced new Contractor supplied units, approval for type used must be given by the CCG TA.

4.0 Proof of Performance

4.1 Inspection

- 4.1.1 All work to be completed to the satisfaction of the CCG TA and IA.
- 4.1.2 All systems must fully tested and proven fully functional to the satisfaction of the CCG TA. All defects found as a result of inappropriate or incorrect installation must be rectified by the Contractor and to their account.
- 4.1.3 Area where work was carried out to be inspected to ensure all debris has been removed.

4.2 Testing

- 4.2.1 All piping must be operationally tested for leaks, and mixing valves operation checked for temperature regulation.

4.3 Certification

- 4.3.1 Welders must be CWB Certified for the type of welding needed to perform this SOW item.

5.0 Deliverables

5.1 Drawings/Reports

- 5.1.1 Contractor must provide to the CCG TA copies of all certificates related to showing the products used and that they are approved for marine usage in Canada.
- 5.1.2 The contractor must develop new “as built” drawings for all ships drawings that are affected by the work detailed in this specification item. At a minimum, this includes GA's, deck plans and the deck covering plan, H-3510. Both electronic and paper copies must be provided.

5.2 Certifications

- 5.2.1 All Transport Canada recognized approval certificates for materials being installed must be supplied to the Chief Engineer prior to installation of product and must be approved by the attending ABS surveyor prior to purchase.
- 5.2.2 Flooring certifications for the installers must be provided to the CCGTA .