CCGS Griffon
Alongside Summer Refit 2018

Statement of Work: #864.17

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Prepared Marine Engineering
520 rue Exmouth
Sarnia, ON
N7T 8B1

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1.0 LIST OF ACRONYMS

AC	Alternating Current
AHU	Air Handling Unit
ASME	American Society of Mechanical Engineers
AWG	American Wire Gauge
CA	Contract Authority (PSPC)
CCG	Canadian Coast Guard
CCGS	Canadian Coast Guard Ship
CLC	Canada Labour Code
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DC	Direct Current
DFO	Department of Fisheries and Oceans
FSSM	Fleet Safety & Security Manual (CCG) (DFO 5737 – Latest Version)
FSR	Field Service Representative
GSM	Government Supplied Materials
GFM	Government Furnished Materials
HC	Health Canada
HMI	Human Machine Interface
HVAC	Heating Ventilation and Air Conditioning
IA	Inspection Authority
IACS	International Association of Classification Societies
IEEE	Institute of Electrical and Electronic Engineers
ISM	International Safety Management
LOA	Length Overall
MCR	Machinery Control Room
MSDS	Material Safety Data Sheet
NEMA	National Electrical Manufacturer Association Standards
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
PSPC	Public Services and Procurement Canada
SIRS	Ship Inspection Reporting System
SOW	Statement of Work
TA	Technical Authority – Owner's Representative (CCG)
TBS	Treasury Board of Canada Secretariat
TCMS	Transport Canada Marine Safety
UPS	Uninterruptible Power Supply
VPI	Vacuum Pressure Impregnation
WHMIS	Workplace Hazardous Material Information System

2.0 GENERAL NOTES

2.1 Introduction

2.1.1 These General Notes describe the CCG requirements applicable to all accompanying Technical Specifications.

2.1.2 It is the Contractor's responsibility to ensure that:

a) The execution of the work specified herein meets the requirements described and those of any Regulatory Bodies;
b) All items and equipment supplied are deemed necessary to ensure the seaworthiness and safe operation of the vessel, as required for a vessel of this class.

2.1.3 Sections 5 through 24 of this SOW define the individual work items for which the Contractor must address as part of the Alongside refit for the CCGS Griffon.

2.1.4 The requirements presented in sections 1 through 4 of this SOW must apply to sections 5 through 24. It is possible that the Specifications, in sections 5 through 24, do not directly refer to sections 1 to 4; however, they must still apply.

2.2 Work Period

2.2.1 The work period for this contract will be from July 3, 2018 to October 17th, 2018.

2.2.2 The work must take place at the Contractor's facilities. The vessel must remain habitable for the duration of the work period. The vessel will be manned throughout the work period and CCG personnel will be conducting work onboard the vessel. The number of CCG personnel onboard will vary throughout the work period.

2.3 Official language and Documentation

2.3.1 Canada must comply with the requirements of the Official Languages Act and related policies and directives issued by Treasury Board Secretariat. This vessel operates in a bilingual region; however its employees occupy unilingual English positions and many are unilingual English. The vessel will manage the work in this SOW in the language of choice agreed upon at the contract start meeting however; all documentation that must be dealt with on the vessel must be in the working language of the ship.

2.3.2 For the purposes of safety and efficiency, all documentation that is a deliverable for this contract must be in the English working language of the ship.

2.4 References

2.4.1 Applicable regulations and documentation:

FSSM Procedures	Title	Included Yes/No
7.A.1	Assessing Risk	FSMv4_Manual_eng.pdf
7.B.2	Fall Protection/Working Aloft	
7.B.3	Entry Into Confined Spaces	
7.B.4	Hotwork	
7.B.5	Lockout and Tagout	
7.B.6	Electrical Safety Working on Energized Electrical Conductors or Circuit Parts	
7.E.5	Handling, Storage & Disposal of Hazardous Material	
10.A.6	Paint and Other Coatings	
10.A.7	Contractor Safety and Security	
Ship Specific	Vessel Specific - Asbestos Survey Report	CCGS Griffon - Asbestos Survey Report (September 2016).pdf
Publications		
70-000-000-EU-JA-001	Specification for the Installation of Shipboard Electronic Equipment	Specification for Installation of Shipboard Electronic Equip_EN.pdf
ASHRAE Standard 52.2	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size	
CSA W47.1	Certification of Companies for Fusion Welding of Steel Structures Division 2 Certification	
CSA W47.2	Certification of Companies for Fusion Welding of Aluminum	
CSA W59	Welded Steel Construction – Metal Arc Welding	
CSA W59.2	Welded Aluminum Construction	
CSA Z462-15	Workplace Electrical Safety	
CSA-Z431-12(R2016)	Basic Safety Procedures for man-Machine Interface – Marking and Identification	
CT-043-eq-eg-001	Canadian Coast Guard Welding Specification	Canadian Coast Guard Welding Specification-eng.pdf

IACS No. 47	International Association of Classification Societies No. 47: Shipbuilding and Repair Quality Standard	
IEC 60092	IEC Electrical Installations in Ships	
IEEE 1531-2003	IEEE Guide for Application and Specification of Harmonic Filters	
IEEE 1584	Recommended Practice and Requirements for Harmonic Control in Electric Power Systems	
IEEE 45	IEEE Recommended Practice for Electrical Installation on Ships	
IEEE 519-2014	IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems	
IP	International Electro Technical Commission Ingress Protection Standards	
NEMA	National Electrical Manufacturer Association Standards	
TP11469E	Guide to Structural Fire Protection	
TP127E	Transport Canada Marine Safety Electrical Standard	
TP3177E	Standard for the Control of Gas Hazards in Vessels to be Repaired or Altered	
Acts		
CSA	Canada Shipping Act	
CLC	Canada Labour Code	
Regulations		
MOHS	Maritime Occupational Health and Safety	

2.5 Occupational Health and Safety

2.5.1 General

2.5.1.1 The Contractor and all its Subcontractors must comply with Occupational Health and Safety (OHS) procedures in accordance with applicable federal and provincial OHS regulations ensuring that Contractor activities are carried out in a safe manner and do not endanger the safety of any personnel.

2.5.1.2 The Contractor and its employees, including any Subcontractors must attend a safety orientation meeting of the vessel prior to the commencement of any work in order to familiarize the Contractor's

employees with ship specific hazards and permit systems for work protocols as well as procedures for Security, Hazard Prevention, Hazard Intervention and Pre-Job Safety Assessments. The Contractor will have access to an uncontrolled copy of the Fleet Safety and Security Manual. The familiarization meeting will be led by the crew and will take place prior to the Contractor starting any work.

2.5.1.3 The Contractor must comply with the Fleet Safety and Security Manual, DFO/5737 and shipboard work instructions in addition to the applicable Canada Labour Code regulations while performing all work on board including the following:

- Pre-Job Safety Assessments
- Lock Out/Tag Out
- Confined Space Entry
- Hot Work
- Gas Freeing for Safe For Entry and Hotwork
- Working Aloft
- Electrical work on energized circuits

2.5.2 Hotwork

2.5.2.1 The following precautions must be taken where hotwork is to be conducted:

a) The compartment(s) affected must be certified gas free by a certified marine chemist or other qualified person. The Contractor must keep copies of all active and expired hot work certificates in a central location on the vessel for viewing. Certificates must specify, "Safe for persons" and/or "safe for hot work" as appropriate. The Contractor must post a copy of all certificates at the entrance to the affected spaces;

b) Protective material must be used to prevent the spread of sparks, protecting electrical cables and other services;

c) Fire sentries must be provided in each space and in all adjacent spaces, if welding, grinding and burning is being carried out. Fire sentries must be provided with an appropriate fire extinguisher and must be trained in its use. The fire sentry must maintain a watch in his designated area for at least 30 minutes after any hot work has been completed.

d) The Contractor must provide sufficient suitable fire extinguishers and a fire watch during any such heating and until the work has cooled. Ship's extinguishers must not be used unless in the case of an emergency.

2.5.2.2 The Contractor must abide by the CCG Hotwork Policy. This policy is listed in section 7.B.4 of the Fleet Safety and Security Manual. It is the responsibility of the Contractor to ensure that its personnel, including all Subcontractors, comply with the policy.

2.5.2.3 The Contractor must also comply with the work requirements as outlined in the Canada Labour Code, Marine Occupational Health and Safety Regulations, and all applicable provincial regulations.

2.5.3 Confined Space Entry

2.5.3.1 The Contractor must supply a copy of a certified marine chemist or other qualified person's gas free certificate to the IA where any work must be carried out in tanks or bilge areas prior to commencing work. The certificates must specify, "Safe for persons" or "Safe for Hot Work" as appropriate. All certificates must be posted in full view and adjacent to the opening of the compartment.

2.5.3.2 The Contractor must abide by the CCG Policy for Entry into Confined Spaces. This policy is listed in section 7.B.3 of the Fleet Safety and Security Manual. It`s the responsibility of the Contractor to ensure that its personnel, including all subcontractors follow the policy.

2.5.3.3 The Contractor may request a list of the vessel's identified confined spaces at the contract start meeting.

2.5.3.4 All tanks and void spaces (pipe tunnels, cofferdams, etc.) which have been opened to carry out work or for inspection must be cleaned and submitted for a final inspection by the IA prior to the closing of the space/tank.

2.5.4 Lock-out/Tagout

2.5.4.1 The Contractor must ensure that persons working on board the vessel on systems and equipment, or in proximity, are protected from accidental exposure of:

- Electrical currents
- Hydraulic
- Pneumatic
- Gas or steam pressure and vacuum
- High temperatures
- Cryogenic temperatures
- Radio frequency emissions
- Potentially reactive chemicals
- Stored mechanical energy
- Equipment actuation

2.5.4.2 The Contractor must abide by the CCG Policy for Lockout and Tagout. This policy is listed in section 7.B.5 of the Fleet Safety and Security Manual. It`s the responsibility of the Contractor to ensure that its personnel, including all subcontractors follow the policy. The Contractor, under the supervision of the IA or delegate, must be responsible for the Lockout and Tagout of equipment and systems listed in the SOW. The Contractor must supply and install all locks and tags and must complete the Lockout Tagout Log sheet provided by the Vessel.

2.5.4.3 The Contractor must also comply with the work requirements as outlined in the Canada Labour Code, Marine Occupational Health and Safety Regulations, and all applicable provincial regulations.

2.5.4.4 For the purpose of the Lock Out/Tag Out procedures the Contractor must supply locks and locking devices for the Contractor's employees in addition to those provided by the IA for the ship's crew.

2.5.5 Working Aloft

2.5.5.1 The Contractor must abide by the Canadian Coast Guard Policy for Fall Protection. This policy is listed in section 7.B.2 of the Fleet Safety and Security Manual. It's the responsibility of the Contractor to ensure that the Contractor's personnel and any Subontractors follow the policy.

2.5.5.2 The Contractor must also comply with the work requirements as outlined in the Canada Labour Code, Marine Occupational Health and Safety Regulations, and all applicable provincial regulations.

2.5.6 Smoking in the Workplace

2.5.6.1 The Contractor must comply with the Non-Smokers' Health Act. The Contractor must ensure that every employee, and any person acting on behalf of an employer, must ensure that persons refrain from smoking in any work space under the control of the employer. The Contractor must ensure that there is absolutely no smoking onboard the vessel.

2.6 Hazardous Material

2.6.1 General

2.6.1.1 The Contractor must provide the TA with Material Safety Data Sheets (MSDS) for all Contractor supplied WHIMS controlled products.

2.6.1.2 The TA will provide the Contractor with access to MSD sheets for all controlled products on the ship for all specified work items.

2.6.2 Lead Paint and Paint Coatings

2.6.2.1 The Contractor must not use lead based paints.

2.6.2.2 CCG ships 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 may release this lead from the coatings. The Contractor must ensure that coatings in the affected work areas are tested for lead content and that the work is performed in accordance with applicable Federal and Provincial regulations. Results of any lead testing must be provided to the TA.

2.6.3 Asbestos Containing Materials

2.6.3.1 The Contractor must not use any asbestos containing materials.

2.6.3.2 Handling of any asbestos containing materials must be performed and supervised by personnel trained and certified in the removal of asbestos in accordance with Federal, Provincial and Municipal regulations in effect and in accordance with the Fleet Safety and Security Manual. The Contractor must provide the TA with disposal certificates for all asbestos containing material removed from the vessel indicating that the disposal was in accordance with Federal, Provincial and Municipal regulations in effect.

2.7 Clean and Hazard Free Worksite

2.7.1 Before the Contractor starts any work on the vessel the Contractor's Quality Assurance Representative and the TA or delegate must walk through each space and area where work is to take place, including access and removal routes and areas adjacent to those where the work is to be done as a result of this SOW. The Contractor's Quality Assurance Representative must take digital pictures of each area showing the outfit therein and download the photos in JPG format onto a USB Flash Drive. Each picture must be dated and labeled as to the location on the vessel. Copies of the pictures are to be provided to the TA and IA for reference purposes within 48 hours of the start of the work period.

2.7.2 During the work period, the Contractor must maintain those areas of the vessel which Contractor personnel (including subcontractors) use to access those areas where work is to be undertaken, in a clean condition, free from debris and remove garbage daily. The Contractor is responsible for storage in a Contractor supplied container and disposal of all debris and garbage related to this contract.

2.7.3 Areas that pose a hazard as a result of the specified work must be secured and clearly identified by the Contractor with signage to advise and protect all personnel from the hazard in accordance with applicable Canada Labour Code requirements.

2.7.4 At the end of the work period, the Contractor must ensure that all waste generated from the work of this SOW is disposed of and that the vessel is returned to its original state of cleanliness before the start of the work period.

2.7.5 Once all known work and final clean-up has been completed the Contractor's QA Representative and the TA must perform a 'walk through' of the vessel to view all areas where work was performed by the Contractor. Any deficiencies or damage noted must be recorded and compared to the photos and if deemed to have been caused by the Contractor as a result of the work the damage must be repaired by the Contractor at no cost to the Coast Guard.

2.8 Fire Protection

2.8.1 The Contractor must ensure the isolation, removal and installation of fire detection and suppression systems or any components thereof, is performed by a qualified technician.

2.8.2 When the fire detection or fire suppression system is deactivated or disabled by the Contractor during the work period, the system(s) must be recertified by a qualified technician as fully functional. A signed and dated original copy of the certificate must be delivered to the TA before the end of the contract.

2.8.3 The Contractor must notify the TA and obtain written approval from the TA prior to disturbing, removing, isolating, deactivating / disabling or locking out any part of the fire detection or suppression systems, including heat and smoke detectors.

2.8.4 The Contractor must provide protection against fire at all times including when working on the ship's fire detection and / or suppression system(s). This may be accomplished as suggested below and only with the written permission of the TA:

1. Disabling only one portion of a system at a time;
2. By maintaining system function using spares while work is in progress;
3. Other means acceptable to and approved by the TA.

2.8.5 The Contractor must note that failure to take the necessary precautions while performing work on the vessel's fire suppression system(s) could result in the accidental discharge of the fire suppression agent(s). The Contractor must recharge and certify its expense, container(s) or systems that are discharged as a result of such work.

2.9 Project Management

2.9.1 Planning / Scheduling

2.9.1.1 The Contractor must provide an overall project organizational chart identifying all key personnel and Subcontractors. Further, the

Contractor must identify the contract related work each Subcontractor is responsible for.

2.9.1.2 The Contractor must provide a draft of a Gantt bar chart that comply with the deadlines specified in the contract, in a MS Project 2013 or equivalent file.

2.9.1.3 The Contractor must update the schedules before each progress meeting and present the updates to the CA, and the TA.

2.9.2 Project Reporting

2.9.2.1 The Contractor must provide a monthly Progress Report describing the status of the project timeline, cost, and performance as an introduction. Time, cost, and performance must then be addressed in detail. The report must identify significant risks to the project and the actions taken to resolve these risks.

2.9.2.2 The risk analysis must identify any impact upon project completion and actions taken to recover any slippage that may affect the work completion date.

2.9.2.3 This report must be delivered in hard copy and electronic format, 3 business days prior to the progress review meetings to the CA, the TA.

2.9.3 Regulatory Inspections and/or Class Surveys

2.9.3.1 The Contractor must schedule and coordinate all regulatory inspections and classification surveys in collaboration with the authority concerned, e.g., Transport Canada Marine Safety, Classification Society, Health Canada, Environment Canada and others, on the basis of this SOW.

2.9.3.2 The Contractor must convene a meeting of the Contractors Project Manager for the work of this specification, the attending TCMS surveyor, and the TA, no less than one week before the scheduled start date of this project. The purpose of this meeting is to confer with all parties and determine the inspection and testing requirements of TCMS for the work of this specification.

2.9.3.3 Any documentation generated by the above inspections and/or surveys to show that the inspections and/or surveys were conducted (i.e. original signed and dated certificates) must be provided to the TA.

2.9.3.4 The Contractor must not substitute the TA's or IA's inspection for regulatory inspections by the TCMS or classification surveys.

2.9.3.5 The Contractor must give prior notice (of at least 48 hours) to the TA/IA and to the before the TCMS regulatory inspections or classification surveys planned so that the TA/IA can be present for the inspection.

2.9.3.6 The Contractor must ensure the TCMS inspector has the opportunity to inspect all materials to be installed on the vessel prior to the commencement of work. The Contractor must ensure all materials have

their associated heat numbers and mill test reports available to the TCMS inspector.

2.9.4 Test Results and Data Book

2.9.4.1 The Contractor must develop a Test and Trials Plan which must include as a minimum, all tests and trials stated in the SOW. This plan must be provided for TA and the IA review two weeks prior to the originally scheduled Tests and Trials commencement.

2.9.4.2 Upon completion of all work in this SOW, sea trials must be carried out. The Contractor must plan for a minimum of 8 hours to carry out the sea trials to be carried out over the course of one day. The Contractor must provide the necessary personnel required for the sea trials, including one supervisor to make the necessary adjustments. The Contractor must provide the necessary resources required for the handling of the ship's mooring lines and any tugs required for the ship's departure from and return to the dock.

2.9.4.3 Should extra or new work be added during the contract period, the Test and Trials Plan must be updated by the Contractor to reflect the additional inspection, testing and trials of the extra/new work has taken place.

2.9.4.4 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 Subcontractors' 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.

2.9.4.5 All originals of the test, trial and inspections records must be signed by TCMS, the Contractor and where necessary by the Subcontractors and/or FSR who witnessed the tests.

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

2.9.4.7 All tests, measurements, calibrations and readings must be recorded, signed by the person taking the measurements, dated and provided in report format both in hard copy and electronic format, to the TA, the IA and TCMS.

2.9.4.8 Recorded dimensions must be to a precision of three decimal places (unless otherwise stated) in the measuring system currently in use on the vessel.

2.9.4.9 The Contractor must provide to the IA current and valid calibration certificates for all instrumentation used in the Test and Trials Plan showing that the instruments have been calibrated in accordance with the manufacturer's instructions.

2.9.4.10 Hard copy reports must be bound in standard 3-ring binders, type written on letter size paper and indexed by specification number. Electronic copies must be in unprotected Adobe PDF format; provided on USB-KEY media and indexed by specification number. The Contractor must provide 1 hard copy and 1 electronic copy of all reports.

2.9.4.11 All documentation from the contract period must be inserted in a data book and delivered to the IA on completion of the contract.

2.9.4.12 For any drawings requested, the drawings must be plotted on standard ANSI paper size paper – minimum ANSI B (11" x 17"). Three copies must be provided.

2.9.4.13 Also the drawings must be provided in AutoCAD 2010 DWG format (as a minimum – more recent versions are acceptable) and must be on USB-KEY media. The drawings must not be password protected. One (1) copy must be provided.

2.9.5 Additional Work

2.9.5.1 All additional work not described herein but arising from this SOW and inspections must be negotiated by the CA with a PWGSC 1379 form, in accordance with the procedures described in the contract at Annex F.

2.9.5.2 Canada reserves the right to cancel, in part or in full, any item of this SOW if, on the TCSM inspector's advice, it is no longer necessary to carry out an inspection due to the good condition of the component.

2.10 Access to the Worksite

2.10.1 The Contractor must ensure the TA and all vessel staff has unrestricted access to the worksite at all times during the contract period.

2.11 Restricted Areas

2.11.1 The Contractor must not enter the following areas except to perform work as required by the specifications: all cabins, offices, workshops, Engineers' office, Wheelhouse, Control Room, all washrooms, Galley, Mess Rooms, Lounge areas and any other areas restricted by signage.

2.11.2 The Contractor must give the TA 24 hours advance notice prior to working in any accommodation areas or office spaces. This will allow CCG adequate time to move personnel and secure the areas.

2.11.3 The Contractor must provide toilets and eating areas for its employees, its subcontractor and the subcontractor's employees. The use of the ship's washrooms and dining areas will not be permitted.

2.12 CCG Employees and Others on the Vessel

2.12.1 CCG / DFO employees and other personnel such as other contractors, manufacturer's representatives and/or TCMS or Class surveyors may carry-out other work, including work items not included in this SOW, onboard the vessel during this work period. Every effort will be made by the TA to ensure this work and the associated inspections and/or surveys do not interfere with the Contractor's work. The Contractor will not be responsible for coordinating the related inspections or payment of inspection fees for the ship's crew's or other contractor's work unless otherwise specified.

2.12.2 The CCG is in contract (F2599-175088) with Hawboldt Industries and their Subcontractors for the installation of a Windlass Drive System on the CCGS Griffon during the period of this Contract. The Contractor must allow Hawboldt Industries and their Subcontractors to complete all work and testing related to the Windlass Drive System at the same time as the Contractor's work specified in this SOW. The Contractor must provide Hawboldt Industries and their Subcontractors unlimited access to the ship to perform the work of the Windlass Drive System Installation and Testing.

2.12.3 Under contract F2599-175125, there is the possibility that Group Ocean will be installing new windows on the Bridge during the work period. The Contractor must provide Group Ocean unlimited access to the vessel to complete all work pertaining to the above mentioned contract.

2.12.4 CCG personnel from the Electronic and Informatics department plan on carrying out some work onboard the vessel during work period. This work includes:

1. Replacement of rack enclosures in the communications room. This work involves the removal of all equipment in the existing racks, installation of new racks and reinstallation of the existing equipment. All work to take place in the Communications Room.
2. Complete Electronic Chart Display and Information System installation (ECDIS). This work includes the installation of a 3rd radar processor and display in the wheelhouse. Most of the work taking place in the Wheelhouse.
3. Replace Global Maritime Distress and Safety System (GMDSS) equipment. This work involves the removal of the GMDSS system to be replaced with a Sailor 6000 series system. Work will take place in the Wheelhouse and in the Communications Room.

2.12.5 The Contractor is not responsible for the supervision or the completion of work associated with the above mentioned contracts, nor is the Contractor responsible for the supervision of any subcontractors associated with those contracts. However, the TA may require all

contractors to attend daily or weekly meetings in order to ensure a good coordination of work between all ongoing projects.

2.13 Contractor Inspections and Protection of Equipment and the Worksite

2.13.1 In collaboration with the TA or delegate, the Contractor must coordinate an inspection of the condition and location of items to be removed before performing the work specified or accessing a location to work on it.

2.13.2 The Contractor must obtain and follow instructions from its Subcontractors for any special protection required for Subcontractor furnished equipment during the project work. Such instructions must be made available to the TA.

2.13.3 Materials used in any replacement or repairs must meet the criteria for Contractor supplied material noted below in section 2.14.

2.13.4 The Contractor must protect all equipment and surrounding areas from damage. Work areas must be protected from the ingress of water, dirt, contamination, welding by-products and blasting grit etc.

2.13.5 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, hotwork, adverse temperature or other environmental conditions.

2.13.6 Temporary covers to work areas must be installed.

2.13.7 Any damage incurred as a result of the Contractor’s work and that is attributable to the Contractor’s work performance must be repaired by the Contractor at its expense.

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

2.13.9 Vessel cleanliness must extend to the bilge areas which must be maintained free of oil, water, and debris for the duration of the project.

2.14 Contractor Supplied Materials and Tools

2.14.1 The Contractor must ensure all materials are new and unused. Canada will not accept equipment refurbished, reworked or rebuilt.

2.14.2 The Contractor must ensure replacement material such as jointing, packing, insulation, small hardware, oils, lubricants, cleaning solvents, preservatives, paints, coatings etc. are in accordance with the equipment manufacturer’s drawings, manuals and/or instructions.

2.14.3 Where no particular item is specified or where substitution must be made, the TA must approve the substituted item in writing. The Contractor must provide information about materials used, certificate of grade and quality of various materials to the TA and IA prior to use.

2.14.4 The Contractor supply all staging/scaffolding, cranes, rigging, lifting appliances, tools, ventilation, lighting, machinery and any other equipment required to carry out the work in this SOW.

2.14.5 The Contractor must provide waste disposal services for any oil, oily waste or other hazardous or controlled waste generated by the work of this specification. The Contractor must provide waste disposal certificates for all of the above generated waste and the disposal certificates must indicate that the disposal was in accordance with Federal, Provincial and Municipal regulations in effect.

2.15 Government Supplied Materials & Tools

2.15.1 All tools must be Contractor supplied unless otherwise stated in the technical specifications.

2.15.2 Where tools are supplied by the CCG they must be returned by the Contractor in the same condition as when they were borrowed. Borrowed tools must be inventoried and signed for by the Contractor on receipt and upon return to the IA.

2.15.3 Any Government furnished material (GFM) must be received by the Contractor and stored in a secure warehouse or storeroom having a controlled environment appropriate for the equipment as per manufacturer's instructions.

2.16 Removed Materials and Equipment

2.16.1 All removed equipment as a result of this SOW must remain the property of the CCG unless stated otherwise.

2.17 Recording of Work in Progress

2.17.1 The TA and the IA, or delegate, may record any work in progress using various means including, but not limited to photography and video, digital or film.

2.18 Coatings and Paint Work

2.18.1 General

2.18.1.1 Unless otherwise indicated, the Contractor must provide and apply two coats of marine primer paint compatible with the vessel's paint system on all new and/or disturbed surfaces.

2.18.1.2 Before applying the first coat, the Contractor must prepare all new steel structures and those that require retouching in accordance with the paint manufacturer's directions.

2.18.1.3 Unless otherwise stated in the individual specification item, the primer is to Interprime 234 primer or equivalent.

2.18.1.4 The Contractor must apply a minimum of two coats of primer. The Contractor must apply each coat of primer in accordance with the manufacturer's recommendations.

2.18.1.5 All paint must be for marine application and must meet CAN/CGSB 1.61-99 for exterior marine alkyd enamels and CAN/CGSB 1.193-99 for marine epoxy paints. Paint, varnish and other finishes used on interior surfaces must be listed in the TCMS list of approved products, TP-438.

2.18.1.6 The final topcoats must be protected from soiling or damage until the custody of the vessel is returned to Canada. Care must be taken in the application of paint to ensure that furnishings, and equipment liable to more serious damage due to excess spray, must be adequately protected.

2.18.1.7 The following items must not be painted:

- Screw threads;
- Grease fittings;
- Bronze pins;
- Door screens;
- Nameplates;
- Gaskets;
- Stainless steel or Monel metal fittings;
- Machined surfaces;
- Instrumentation;
- Interior gratings;
- Electrical wires, insulation and fittings;
- Electrical panels;
- Rubber seals of watertight doors and hatches;
- Fire door seals; and, in general, all working parts.

2.18.2 Heavy Metal Based Coating

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

2.19 Welding

2.19.1 For any work requiring the application of fusion welding for steel structures the Contractor and/or the Subcontractor's welders must be certified by the Canadian Welding Bureau in accordance with CSA

Standards W47.1, latest revision – Certification of Companies for Fusion Welding of Steel Division 2 Certification as a minimum.

2.19.2 For any item requiring the application of fusion welding for stainless steel structures, the Contractor or the Subcontractors must be certified in accordance with the Canadian Welding Bureau, CSA\ACNOR AWS; Division 1.6 certification – latest revision.

2.19.3 For any item requiring the application of fusion welding to aluminum structures, the Contractor or the Subcontractors must be certified in accordance with the Canadian Welding Bureau, CSA\ACNOR W47.2; Division 3 certification – latest revision.

2.19.4 The Contractor must provide documentation to the TA clearly identifying the welding certification of all employees performing any welding included in this specification prior to the commencement of any welding.

2.19.5 For all items requiring the application of fusion welding for work in this SOW the Contractor must comply with the latest revision of the Canadian Coast Guard Welding Specification CT-043-eq-eg-001.

2.19.6 The Contractor must submit CWB stamped welding specifications and weld procedure data sheets to TCMS where required. Welding procedures for joining pipe connections must be recorded and approved by CWB in accordance with ASME section IX.

2.19.7 The size, length, and details of all welds must be approved by TCMS or an approved Classification Society.

2.20 Electrical Installations

2.20.1 All electrical installations and repairs must be carried out in accordance with the latest revisions of Transport Canada Marine Safety Electrical Standard TP127E and IEEE Standard 45 Recommended Practice for Electrical Installation on Ships.

2.20.2 All installations of electronic equipment must be carried out in accordance with Canadian Coast Guard Telecommunications and Electronics publication CGTS-3(E) entitled “General Specification for the Installation of Shipboard Electronic Equipment”.

3.0 GENERAL PARTICULARS OF VESSEL

Name: CCGS Griffon

Type: Twin Screw, Medium Icebreaker/Navaids Tender

Class of Voyage: Inland Waters, Class I Fire Extinguishing and Lifesaving Appliances for a vessel of Class X

Year Built: 1970

Ship Builder: Davie Shipbuilding Ltd., Lauzon, Québec

Principal Dimensions:

Length Overall:	234'–0" (71.32 m)
Length between Perpendiculars:	214'–0" (65.23m)
Breadth, molded:	49'–0" (14.94 m)
Depth, molded:	21'–6" (6.55 m)
Draft (Mld. Design):	15'- 6 1/4" (4.73 m)

Tonnages:

Gross:	2211.87 LT (2252 Metric Tonnes)
Reg. Net:	751.90 LT (765.56 Metric Tonnes)
Displacement 15' – 6 ¼"	2944 LT (2991 Metric Tonnes)
Deadweight Max:	744 LT (757.5 Metric Tonnes)

Propulsion: Twin screw, fixed pitch, diesel electric, total power 2 x 2000 SHP.

Main Machinery: Four Fairbanks Morse 38D8-1/8" diesel engines driving four Westinghouse DC, two wire single armature, non-reversing variable voltage generators.

4.0 SERVICES

4.1 General

4.1.1 The Contractor must supply the following services to the vessel for the entire work period and disconnect upon completion of the work period. The Contractor must be responsible for the re-establishment of services if the vessel is moved during the work period.

4.1.2 Each of the services noted below must be separately priced in the Contractor's submitted bid.

4.1.3 The Contractor must be responsible for supplying all material, hoses, cables etc. and labour required to connect and disconnect the services to the vessel. Unless otherwise stated these services must be available 24 hours a day 7 days a week for the entire contract period.

4.1.4 The Contractor must be available at all times to correct outages should they occur.

4.2 Berthing

4.2.1 The berthing and mooring facilities must be suitable for a vessel of this size in local weather / tide / sea conditions. Fenders must be supplied by the Contractor to prevent the vessel from contacting the wharf in local weather / tide / sea conditions.

4.2.2 The length of the dock must be a minimum of 90% of the length of the vessel (LOA).

4.2.3 During the contract period, the ship must be berthed at the Contractor's wharf at a safe and secure location with a minimum clearance of 2 meters under the vessel at extreme low water to ensure the vessel will not touch bottom.

4.2.4 The Contractor must be responsible for all movements of the vessel, including berthing and mooring of the vessel for the duration of the work period and arrangements, including costs for line handlers, tugs and pilots.

4.3 Mooring Lines

4.3.1 The Contractor must provide the necessary mooring lines and labour required to secure the vessel alongside the facilities. The Ship's mooring lines are not to be used.

4.4 Gangways

4.4.1 The Contractor must supply the labour and services required for the installation and removal of two gangways, complete with handrails, safety nets and lighting for the duration of the work period. The Contractor must supply and maintain the gangways.

4.4.2 Any movement of the gangways required by the Contractor will be at the expense of the Contractor.

4.4.3 Gangways must be at separate locations to facilitate fire evacuation.

4.4.4 Any damage occurring to structure of the vessel caused by the movement, installation or removal of the Contractor's gangway must be repaired at the Contractor's expense.

4.5 Electrical Power

4.5.1 The Contractor must supply 600 Volt Alternating Current, 60 Hertz, 3 Phase, 300 Ampere service electrical power for the duration of the work period. The Contractor must be available at all times to correct outages should they occur.

4.5.2 The Contractor must supply and connect the necessary shore cable to the ship's shore power connection.

4.5.3 The Contractor must ensure that the correct phase rotation on a 3 – phase system is established prior to energizing the ship's distribution system. Any changes to the ship's power system to accommodate the Contractor supplied shore power connections must be returned to the original setup by the Contractor upon the disconnection at the end of the work period. All work must be carried out by certified electricians.

4.5.4 The Contractor must supply all power to the vessel through a Contractor supplied kilowatt-hour meter. The Contractor must read the kilowatt-hour meter when the connection is made and once again when the power is disconnected. Both readings of the meter must be witnessed by the IA. The Contractor must provide a calibration certificate for the kilowatt-hour meter.

4.5.5 The Contractor must provide a unit price per kilowatt hour which the Contractor must use in its bid to determine a price for a block of 150 000 kilowatt hours. This unit price will also be used to adjust (up/down) the ship's total consumption at the end of the work period. This power supply must only be used by the ship and its personnel.

4.5.6 Final price for this item must be determined at the end of the contract once the meter has been read. The final power consumption total must be adjusted up or down using the 1379 form.

4.6 Potable Water Supply

4.6.1 The Contractor must provide a 2 inch diameter sized hose, disinfected and certified for use for potable water only, to supply potable water to the vessel. Water must be supplied through a calibrated pressure regulator and calibrated water meter, complete with pressure gauge and isolation valve. Potable water pressure must be capable of being regulated between 40 to 100 psig. The hose must be connected on the

shore supply connection at Frame 34, Port side Poop Deck bulwarks. The dock connection must be flushed for at least 5 minutes before connecting the supplied hose to the ship to ensure standing water in the system has been cleared from the pipe.

4.6.2 The Contractor must read the water meter at the beginning of the work period and again at the end. The readings must be taken in the presence of the IA and must be used to calculate the total water usage.

4.6.3 The water must be supplied through a suitable backflow prevention device from an approved municipal drinking water supply system that has been certified safe for consumption. (Reference CCG FSSM 7A12 Potable Water Quality paragraphs 3.2 Shore Supply, 3.6 Potable Water Testing, and 3.7 Connections to the Potable Water System).

4.6.4 At the start of the contract the Contractor must immediately provide the TA with a copy of recent water test results for the potable water being supplied to the vessel showing the following parameters from the current Guidelines for Canadian Drinking Water Quality.

4.6.5 Health-Based Objectives:

1. Antimony 0.006 mg/L
2. Barium 1.0 mg/L
3. Benzene 0.005 mg/L
4. Boron 5.0 mg/L
5. Cadmium 0.005 mg/L
6. Chromium 0.05 mg/L
7. E. Coli 0 per 100ml
8. Ethylbenzene 0.14mg/L
9. Fluoride 1.5 mg/L
10. Lead 0.01 mg/L
11. Mercury 0.001 mg/L
12. Nitrate/Nitrite 45 mg/L
13. Selenium 0.05 mg/L
14. Total Coliform 0 per 100ml
15. Turbidity 1 NTU
16. Uranium 0.02 mg/L
17. Xylenes 0.9 mg/L

4.6.6 Aesthetic Objectives

1. Chloride 250 mg/L
2. Colour 15 TCU
3. Copper 1.0 mg/L
4. Iron 0.3 mg/L
5. Manganese 0.05 mg/L
6. pH 6.5 – 8.5 pH Units

7. Sodium 200 mg/L
8. Sulphates 500 mg/L
9. Toluene 0.024mg/L
10. Total Dissolved Solids 500 mg/L
11. Zinc 5 mg/L

4.6.7 The test results must have been taken within 3 month of the start of the contract date.

4.6.8 Provisions must be made by the Contractor to ensure that the potable water supply does not freeze during cold weather.

4.6.9 The Contractor must supply a price quote per cubic meter of potable water. The Contractor must also quote on supplying 10 cubic meter of potable water per day for the duration of the work period (approximately 108 days).

4.6.10 The final amount of potable water used must be calculated from the calibrated water meter and adjusted up or down using a 1379 form.

4.7 Compressed Air Supply

4.7.1 The Contractor must quote on supplying compressed air at a daily rate through a reducing station set to deliver 150 psig, at 36 cubic feet per minute at a constant pressure for the duration of the work period. This air supply must be connected to the ship's service air system. The Contractor must quote on a unit price for compressed air supply including installation and all the necessary hoses and fittings. This air is only to be used for the requirements of the ship's crew and must not be used by the Contractor to complete work covered in this SOW.

4.7.2 One possible option for connecting to the ship's compressed air system is to disconnect the flexible connection at the discharge of the emergency air compressor. This will be completed by the ship's crew. The Contractor must supply compressed air hose long enough to reach this point. The hose must not interfere with ongoing work or present a hazard. The Contractor must provide a shut-off valve on the main deck that can be quickly and safely closed should the hose become damaged over its length. The end of the hose must be connected to a 1" 300 lb flange by the Contractor. The Contractor must connect the hose end fitting to the inlet valve. The Contractor must supply and install new locking fasteners and gaskets. The Contractor must perform a functional pressure test of the supply hose and connection before supplying air to the ship's system. The test must be witnessed by the IA.

4.8 Cranage

4.8.1 The Contractor must quote on the general services of a crane, including an operator and a rigger, for the support of the vessel's day-to-day activities, i.e. the moving of stores from the vessel to the Contractor's facilities ashore. The Contractor must quote on providing this service for 80 hours over the duration of the contract. This must not include transit or assembly of the crane prior to commencing lifts.

4.8.2 For adjustment purposes (up/down) the Contractor must provide an hourly rate for this service. The Contractor must keep a record of the crane usage and it must be signed weekly by the IA.

4.8.3 This time is not inclusive of the requirements for a crane by the Contractor to perform any of the work specified in the SOW.

4.9 Garbage Removal

4.9.1 A garbage container or dumpster of 5 cubic meters must be located adjacent to the vessel. The garbage container must be emptied as required if full or at a minimum every four days.

4.9.2 Ship's personnel must comply with any recycling programs that the Contractor has in place. The Contractor must provide the appropriate containers for managing the waste. These containers must be located adjacent to the vessel and emptied daily, or as needed.

4.9.3 If required by the Contractor, the Contractor must also supply a green bin for food waste. The green bin must also be located adjacent to the vessel and emptied daily.

4.10 Temporary Deck Covering

4.10.1 Temporary deck coverings of new material must be installed prior to the Contractor beginning work on the vessel.

4.10.2 To protect the alleyway flooring the contractor must supply and install 1/8" MDF sheeting over all deck surfaces on the main, poop, flight, boat and bridge decks.

4.10.3 The wheelhouse carpet must be covered with 1/8" MDF sheets.

4.10.4 In alleyways, the seams and edge joints of the MDF are to be taped to secure the covering and prevent dirt ingress.

4.10.5 In the wheelhouse the sheet to sheet joints are to be taped. The MDF must not to be taped to the carpet.

4.10.6 Upon completion of the refit, the Contractor must remove and dispose of all protective coverings installed. Any tape residue remaining must be removed from decks by the Contractor.

4.11 Parking at the Contractor's Facility

4.11.1 The Contractor must provide 6 parking spaces for the exclusive use of the TA and the project team for the duration of the contract.

5.0 BILGE CLEANING

5.1 Identification

5.1.1 The Contractor must clean all of the bilge area of the vessel's main engine room, propulsion motor room, and shaft compartment at the beginning of the work period.

5.2 References

5.2.1 Drawings

Drawing Number	Description	Electronic Number
CMG05-111-GA Sheets 1 & 2	General Arrangement	G05111ga1.dwg G05111ga2.dwg
664-4200-1	Bilge and Ballast Diagram	G05181pl1.dwg

5.3 Technical Description

5.3.1 Bilge Cleaning

5.3.1.1 The Contractor must clean all bilge areas such that they can be certified safe for man entry and safe for hot work in the following locations:

- Engine Room Bilge.
- Propulsion Motor Room Bilge
- Shaft Compartment Bilge

5.3.1.2 This certification must be maintained for the duration of the work period. In order to maintain the hot work certification valid, the Contractor must perform localized cleaning as required.

5.3.1.3 All bilge cleaning must be completed before any hot work commences, or any equipment is opened and exposed in the following sections:

- Refurbishment of Propulsion Generators
- Propulsion Generator Removal Route
- Survey of Propulsion Motors
- Overhaul of Propulsion Motor and Generator Coolers
- Overhaul of Propulsion Motor Blowers
- Replacement of Propulsion Motor Tacho-Generators
- Ship Service Generator Overhauls
- Watertight Door Refurbishment

5.3.1.4 The Contractor must quote on removing and disposing of twenty cubic meters of oily waste from the bilges prior to the start of the cleaning operation. Based on the volume of oily water removed, the cost of removing/disposing oily water from the bilges will be adjusted up or down using PWGSC 1379 form by prorating the quoted amount.

5.3.1.5 The Contractor must maintain the cleanliness of all bilge areas throughout the duration of the work period.

5.3.1.6 As an option, the Contractor must also provide a quote for a second bilge cleaning at the end of the work period, should it be required only as a result of work performed by CCG employees or its representatives via additional contracts.

5.3.2 Disposal of Liquid and Waste from the Bilges

5.3.2.1 All material from the bilges must be removed and disposed of ashore in accordance with Federal, Provincial and Municipal regulations in effect at the time of the contract. The Contractor must provide copies of waste oil manifests showing that the materials removed from the bilges were disposed of in accordance with Federal, Provincial and Municipal regulations in effect at the time.

5.3.2.2 Where water, oil or any foreign materials are allowed to ingress into the bilge as a result of subsequent work performed by the Contractor or its Subcontractors; this material must be removed from the bilge areas at the Contractor's expense.

5.4 Proof of Performance

5.4.1 Inspection

5.4.1.1 The Contractor must have the IA inspect the bilges for cleanliness once the work is considered to be completed.

5.4.1.2 The bilge cleaning must be done to the satisfaction of the IA.

5.4.1.3 The bilge cleaning must be done to a standard to procure an issuance of, "Safe for Hotwork" certificates for that space.

5.4.1.4 Prior to the end of the work period, the Contractor must complete an inspection of all bilge areas with the IA to determine if a second bilge cleaning is required.

5.5 Deliverables

5.5.1 Documentation

5.5.1.1 The Contractor must provide the IA with all copies of waste oil manifests showing the disposal of the materials removed from the vessel's bilges.

5.5.1.2 The Contractor must provide the IA with all copies “Safe for Entry” and “Safe for Hotwork” certificates for the Engine room, Motor room and Shaft space bilge areas.

6.0 PROPULSION GENERATOR REMOVAL ROUTE

6.1 Identification

6.1.1 This section of the SOW identifies the proposed removal route for the removal and installation of the propulsion generators and their respective components. This section also outlines the work to be completed onboard in order to remove/install the generator components, as well as structural strip-out required to prepare the shipping route.

6.1.2 This work also includes testing of existing lifting eyes and rails within the engine room.

6.2 References

6.2.1 Drawings

Drawing Number	Description	Electronic Number
J17080-A01 Rev. A	Propulsion Generator Shipping Route of Armature Assembly	J17080-A01_rA Generator Removal Route.pdf
J17080-S01 Rev. B	Structural Removal Details	J17080-S01_rB Structural Removal Details.pdf
J17080-S02 Rev. B	Transverse Lifting Bean	J17080-S02_rB Transverse Lifting Beam.pdf
J17080-S03 Rev. B	Additional Lifting Lug Details	J17080-S03_rB Additional Lifting Lug details.pdf
J17080-S04 Rev. A	Rigging Beam for Armature Assembly	J17080-S04_rA Rigging Beam for Armature.pdf
GRI-PRP-GEN-2018-01-08-A1	Propulsion Generator Stator Assembly Approximate Dimensions for Removal Route	gri-prp-gen-2018-01-08-A1a.pdf
GRI-PRP-GEN-2018-01-08-B1	Propulsion Generator Armature Assembly Approximate Dimensions for Removal Route.	gri-prp-gen-2018-01-08-B1a.pdf
664-120-11	Lower Deck and ER Flat Layout	664-120-11.tif
664-120-12	Upper Deck Plating	664-120-12.dwg

6.2.2 Documents

Name	Electronic File Name
Photos Depicting some of the required Removals and Interference Items	Required removals and interference items.pdf
ER Lifting Points 2011 Pull Test	ER Lifting Points.pdf
ER Lifting Points Location Guide	ER Lifting Points – 1.pdf

6.2.3 Regulations / Standards

- CSA W47.1-03, Certification of Companies for Fusion Welding of Steel
- CSA W59-03, Welded Steel Construction (Metal Arc Welding)
- Canada Shipping Act – Cargo, Fumigation and Tackle Regulations
- Canada Shipping Act – Tackle Regulations (C.R.C., c. 1494)
- Canada Shipping Act - Hull Construction Regulations
- Canada Shipping Act – Marine Machinery Regulations
- Canada Shipping Act - Hull Inspection Regulations
- 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 – 1998 Recommended Practice for Shipboard Electrical Installations
- IACS No. 47, Shipbuilding and Repair Quality Standard (1996)
- IACS No. 20, Non-destructive testing of ship hull steel welds
- CT-043-EQ-EG-001, Canadian Coast Guard Welding Specification
- Fleet Safety Manual Section 10.B.1 – Maintenance of Lifting Appliances and Cargo handling Gear.

6.2.4 Description of Stator and Armature Assembly

6.2.4.1 The armature assembly and stator can be seen guidance drawings GRI-PRP-GEN-2018-01-08-AI and GRI-PRP-GEN-2018-01-08-BI. All dimensions on these guidance drawings are approximate and must be verified by the Contractor. The assembly is composed of the following components, listed in order based on longitudinal location while in situ (aft to forward):

1) Flywheel – positioned at the aft end of the rotor and bolted to the ring gear. The flywheel is approximately 28.5” in diameter and is also bolted to the 16.75” flange on the rotor via twelve 1” bolts (accessible once armature assembly has been removed).
2) Rotor – overall length (approximate) of 96.51”, bolted to the flywheel on the aft end.
3) Armature Winding – overall length of approx. 36” and a diameter of 32”. Longitudinal location is not centered on the length of the rotor.
4) Stator – 62” outer diameter and a length of 31” at the extrusion of the pole windings. The stator is assembled in two halves.
5) Commutator – Positioned forward of the armature winding with a diameter of approx. 23” and a length of approx. 10”

6.2.4.2 The estimated weights of the each component are as follows:

- Armature Assembly – 6,500lbs
- Stator – 14,100lbs (2 @ ~7,050lbs)

6.3 Technical Description

6.3.1 General

6.3.1.1 If the Contractor wishes to propose an alternate removal route as to the one specified in this section, the Contractor must submit a plan to the TA for review and approval prior to commencing work.

6.3.1.2 The Contractor must supply all tools, lighting, ventilation, staging, materials, lifting appliances, carnage, rigging and equipment required to carry out the work in this section of the SOW. All Contractor supplied material and equipment must installed, maintained in safe working condition by the Contractor and removed upon completion of the work.

6.3.1.3 The Contractor is responsible for identifying all interference items, temporarily removing them, temporarily storing them and re-installing them in their original locations upon completion of the work.

6.3.1.4 The Contractor must protect all equipment and machinery located in work area from damage, contamination, dirt, and hotwork by-products. Upon completion of the Contractor must remove and dispose of all protective coverings. The Westinghouse electrical cabinets in the engine room along bulkhead 62 must be properly shielded from any collision with the armature or stator during extraction. The equipment within these cabinets is considered extremely fragile and not easily replaced.

6.3.1.5 The Contractor must take proper precautions to maintain in a proper state of preservation any machinery, equipment, fittings, stores or items of outfit which might become damaged by exposure, movement of materials, paint, sand, grit or shot blasting, airborne particles from sand, grit or shot blasting, welding, grinding, burning, gouging and painting.

6.3.1.6 When any work is being carried out involving a ship's firefighting or fire detecting system, it must be done in such a way as to leave the vessel and any persons aboard with adequate protection against fire at all times. This may be so accomplished by the removal or disarming of only a portion of the system at a time, by replacement with spares while work is in progress or by other reasonable means acceptable to the TA. All work carried out on fire detection or extinguishing systems, but must be carried out by certified technicians.

6.3.1.7 The Contractor must supply the TA with Marine Chemist's Certificates in accordance with TCMS TP 3177E before any cleaning, painting or hot work is commenced in confined spaces or machinery compartments.

Certificates must clearly state the type of work permitted and must be renewed as required by the regulations.

6.3.1.8 Upon completion of work, the Contractor must return all work area to their original state of cleanliness and working order.

6.3.2 Proposed Removal Route

6.3.2.1 The selected removal route utilized the shortest distance while minimizing modifications and removals to the existing vessel structure and systems. The main steps regarding the removal route of each component are:

1) Lift vertically above the Lower deck
2) Move forward above the walkway aft of the bulkhead at frame 62
3) Move to starboard side to align with structural removals in bulkhead at frame 62
4) Move forward through bulkhead cut-out at frame 62
5) Position below cut-out in Upper Deck on starboard side
6) Hoist through Upper Deck cut-out

6.3.2.2 A more detailed view of the removal route can be found in drawing J17080-A01. The referenced drawing indicates the necessary orientation of each component as it is navigated through the removal route. Details pertaining to adjustments in rigging and step by step maneuvers required to navigate the removal route are left up to the discretion of the Contractor.

6.3.3 Removals

6.3.3.1 General

6.3.3.1.1 The following is an overview of the key mechanical, electrical and structural items must to be temporarily removed. This list may not be complete and must be verified at ship by the Contractor prior to submitting a bid. The Contractor must allow for the temporary removal of miscellaneous small mechanical, structural and electrical items and their associated components. This entire section must be read in conjunction with the document called “Photos Depicting some of the Required Removals and Interference Items” (Required Removals and Interference Items.pdf)

6.3.3.2 Structural

6.3.3.2.1 All structural removals are to be completed as per the referenced drawings. Any material required to replace temporarily removed items that have been damaged must be to the same grade as the original.

The Contractor must supply all material required, including any material required to complete the work which is not explicitly identified in this specification.

6.3.3.3 Piping

6.3.3.3.1 The removed sections of piping must be carefully retained and protected from damage. All remaining piping in way of the removed pipe sections must be blanked off with bolted blank flanges sufficient to manage the particular system pressure. Piping systems that are affected by spool removals must be bypassed, or temporarily rerouted to ensure normal ship functions are not interrupted. The Contractor must liaise with, and obtain approval from, the IA to ensure that systems are bypassed correctly.

6.3.3.3.2 Prior to removing any piping the Contractor must confirm with the IA, that the system has been properly isolated.

6.3.3.4 Electrical

6.3.3.4.1 Light and power cabling in the way of the access route are to be disconnected and either: pulled back to their “next” point of connection, or coiled back to an area outside of the access route.

6.3.3.4.2 Fire detection cabling in way of the shipping route must be disconnected under the supervision of the system installer and reconnected with a temporary cabling system, meeting the installer’s approval. At no time must the fire detection system be inoperative during the non-working hours of the vessel.

6.3.3.5 Engine and Generator Disassembly/Removals

6.3.3.5.1 In order to access the generators, the following engine and generator components must be disassembled, removed from the engine and generator and stowed in a location clear of the generator where they will not interfere with remaining generator removals, nor other work in this SOW. All removals must be retained for re-installation. The removals required for all 4 generators being serviced are:

1. Fire Extinguishing System: Each generator is fitted with a fire suppressant system and its associated plumbing. The system is to be shut off as per the manufacturer’s requirements prior to any work on the generator taking place. The plumbing for the system is to be removed as required during the disassembly of the generator.
2. Each generator air box is fitted with a heat probe (detector). The probes must be made safe, removed and wires pulled back. These probes must be reinstalled in their respective generators upon

completion of the work. This work must be carried out by a certified company.

3. Engine Scavenge Air Blower and intake: The engine blower (~1.270m x 1.016m x 1067m, 1.037MT) is located on the forward end of the main engine, directly above the generator. The intake for the blower is fitted to the top of the blower housing. Crankcase vacuum blower piping must be removed. Wiring and pneumatic for the Blower bypass system must also be removed.
4. Generator Air Filter housing and associated filters: The filter housing is a fiberglass box located on the forward end of the generator.
5. Generator Cooler, Cooler Cover and Piping: The generator cooler assembling consists of a brass piping assembly and fiberglass covers and is located directly aft of the filter housing. The cooling system is plumbed to various short piping spools and a temperature regulating valve assembly (with capillary and sensing bulb) which also will require disassembly and removal. Spools and flexible piping must be removed to the supply isolating valves. These valves must be locked out and blanked for the duration of the work.
6. Fiberglass ducting: Located immediately aft of the cooler assembly a large fiberglass ducting, which is the same width as the generator, is located directly above the generator stator assembly.
7. Frame Assembly: The rotor and stator assembly are housed in a steel housing which surrounds and protects the assembly. The housing consists of numerous components which have been bolted together, which will require disassembly for removal.
8. Brush Assembly: All components associated with the brush assembly, which is located forward of the stator, must be disassembled and removed. Prior to disassembly, all components must be identified as to their exact location and orientation. These components must be stored in a location where they will not be damaged. These components must be reinstalled in their exact location and orientation upon completion of the work.
9. Forward end pedestal and bearing assembly: The forward end bearing pedestal, which is located forward of the generator is to be sufficiently disassembled such that the rotor can be lifted free. All hydraulic hoses must be clearly identified, disconnected and capped to prevent the ingress of dirt or contaminants. Bearing oil supply piping is to be blanked at the nearest point clear of the removal route. Bearing oil drain lines have a flexible joint. These joints must be identified, labelled, removed, and the openings must be blanked with flanges. Opened bearings must not be left open to contamination and must be covered at the first opportunity. Bearing caps are to be identified and labelled with orientation, and must be store in a clean and secure area.

10. Tachogenerator: The tachogenerator which is fitted on the fore end of the rotor, forward of the bearing pedestal is to be removed. Electrical leads must be clearly identified, disconnected, and pulled back. Shim packs located under the tachogenerator feet must be identified as to total thickness and location, labelled and retained for reinstallation. The coupling inserts and associated components are to be identified and retained for reinstallation.
11. Generators: On the port side of each generator, 4 of 800 MCM power cables are to be clearly identified, disconnected, terminating lugs removed and retained, and the cables pulled back from the junction box. On the starboard side of each engine, electrical connections for generator heaters, internal lighting, field excitation, and temperature sensors must be electrically isolated, clearly identified, disconnected and pulled back from the junction box.
12. An incandescent light is fixed to each of the air filter cover plates and must be unbolted and pulled back.
13. Miscellaneous Removal: All other components not previously discussed which would inhibit or impede the removal of the rotor and stator assembly must be disassembled and removed.

6.3.3.5.2 It must be noted that modifications have been made to each generator since its initial installation. As such, each generator component must be assumed to be unique to the generator on which it is currently fitted. Care must be taken during the removal process to clearly label what generator each component belongs to, and to keep the components from each generator separate, to ensure that all items are re-installed on the proper generator.

6.3.3.6 Piping and Structural Removals in way of each Generator

6.3.3.6.1 Each generator requires unique structural and piping removals directly in way of the generator in order to create sufficient clear space around the generator to remove all the necessary components and to allow the lifting lugs, located on the upper deck, to be utilized. The following is a list of removals required which are unique to the generator being described.

6.3.3.6.2 **Main Engine #1 – Port Side Outboard**

1. Engine Room Lower Deck. 2 bolted lower deck structural members, 1 longitudinal 1 transverse, located directly above generator must be removed along with associated deck grating. The handrails located on the aft end of the lower deck directly above the generator must be removed.
2. Sea Water Cooling piping spool, located directly over generator and connected to generator cooling system.

3. Fire suppression plumbing for this generator and others must be removed in areas where it will cause interference.
4. A fluorescent light and its associated wiring located directly above generator must be removed.

6.3.3.6.3 **Main Engine #2 – Port Side Inboard**

1. Engine Room Lower Deck. 2 bolted lower deck structural members, 1 longitudinal 1 transverse, located directly above generator are to be removed along with associated deck grating. The handrails located on the aft end of the lower deck directly above the generator are to be removed.
2. Sea Water Cooling piping spool, located directly over generator and connected to generator cooling system.
3. Fire suppression plumbing for this generator and others must be removed in areas where it will cause interference.
4. A fluorescent light and its associated wiring located directly above generator must be removed.
5. 4 fuel oil pipe spools located above the outboard side of the generators.
6. Port bearing oil spool pipe must be removed and blanked.

6.3.3.6.4 **Main Engine #3 – Starboard Side Inboard**

1. Engine Room Lower Deck. 2 bolted lower deck structural members, 1 longitudinal 1 transverse, located directly above generator must be removed along with associated deck grating. The handrails located on the aft end of the lower deck directly above the generator must be removed.
2. Fire suppression plumbing for this generator and others must be removed in areas where it will cause interference.
3. A fluorescent light and its associated wiring located directly above generator must be removed.
4. Fuel Oil Drains tank vent pipe spool located directly above generator must be removed and a blank installed on the remaining pipe.
5. 1 pipe cableway containing 2 cables must be removed or temporarily relocated. This pipe contains two multi-strand communication cables, which must be isolated, identified and pulled back.
6. 2 fuel oil pipe spools located above the starboard side of the generator must be removed.

6.3.3.6.5 **Main Engine #4 – Starboard Outboard**

1. Engine Room Lower Deck. 2 bolted lower deck structural members, 1 longitudinal 1 transverse, located directly above generator are must be removed along with associated deck grating. The handrails located

on the aft end of the lower deck directly above the generator must be removed.

2. Sea Water Cooling piping spool, located directly over generator and connected to generator cooling system must be removed.
3. Fire suppression plumbing is to must be removed in areas where it will cause interference.
4. A fluorescent light, and an incandescent light and their associated wiring located directly above generator must be removed.
5. Fuel Oil Drains tank vent pipe spool located directly above generator must be removed and remaining pipe blanked.
6. Cableway containing 3-wires attached to bolted transverse structure. These wires are multi-strand communication cables which must be isolated, identified and pulled back.

6.3.4 Mechanical, Electrical and Equipment Removals Required to Establish Shipping Route

6.3.4.1 In order to establish a clear and efficient shipping route for the propulsion generator components, the following equipment as well as mechanical and electrical components will need to be temporarily removed. These components being removed must be stowed in a location that will not interfere with the shipping route.

1. Miscellaneous piping in way of Frame 59, 60 and 61 may need to be removed in order to install lifting appliances for the propulsion generator components. Where the removal of potable water lines (or any other piping that cannot be taken out of service for extended periods of time) be deemed necessary, temporary rerouting of these lines will be required. See Figures 6, 7, 8 and 9 of the document “Photos Depicting some of the Required Removals and Interference Items”.

2. Aft Side of Bulkhead at Frame 62, Starboard:
   a. 2-Off grey consumable cabinets inboard of “Starting Air Receiver” tanks on starboard side.
   b. 1-½” Lube oil pipe to be removed in way of proposed cut out in bulkhead.
   c. HVAC ducting must be removed from the bulkhead at frame 62 as far aft as the lifting beam above the propulsion generator. Ducting must be sealed to prevent contamination for the duration of the work.
   d. 3 flexible extended spindles for fuel tanks may need to be removed and must be confirmed onboard the vessel.
   e. Steam and Condensate in way of the bulkhead opening must be removed and blanked.

3. Forward Side of Bulkhead at Frame 62, Starboard:
   a. 2-Off large red tool boxes must be temporarily relocated.
   b. Tool storage board must be removed from bulkhead.
   c. Speaker hanging from deck head must be temporarily removed.
   d. Manual starter for steam heater fan and associated wiring outboard of tool storage board will have to be temporarily removed.

4. Forward End of Workshop
   a. Workbench in forward starboard corner of workshop must be temporarily removed as well as the tool box under the workbench.
   b. Miscellaneous tools and equipment in this area should be temporarily removed (ex: 2 bench grinders, welding rod oven, welding gas bottles). Gas bottles must be stored and secured in an upright position.

5. Under Deck Removals in way of cut out in Upper Deck
   a. The starboard fuel bunker pipe will need to be closed off and removed between bulkheads 62 and 67.
   b. The lube oil pipe will need to be removed and capped outside the removal route.
   c. The freshwater fill pipe must be removed by disconnecting its flanged connection at the deck head and at the groove lock fitting. The freshwater pipe must be capped to prevent contamination.
   d. The fuel tank vent pipe will have to be cropped to the lower deck.
   e. The two florescent lights will have to be removed in way of the cut out in the deck head.
   f. Cable transit in way of existing lifting lug on frame 65 must be moved.

6. Removals above Upper Deck
   a. Entirety of the fuel bunker piping, including fuel strainer and bypass valve above the Upper Deck. Orientation of the valves must be marked for reinstallation.
   b. Fuel tank vent must be temporarily removed and capped.
   c. Fresh water fill pipe and valve must be removed at flange and retained for reinstallation. All freshwater piping must be capped to prevent contamination.
   d. Stairway extending from the Upper Deck to the Poop Deck may need to be removed. This must be confirmed on the vessel.

6.3.5 Structural Removals Required to Establish Shipping Route

6.3.5.1 In order to establish a clear and efficient shipping route for the propulsion Generator components, several structural sections must be temporarily removed. The structural sections being removed must be stowed in a location that will not interfere with the shipping route of the rotor and stator nor any other work in this SOW (i.e. port side of work shop or on the Upper Deck). Drawing J17080-S01 illustrates in detail, the required structural removals. The steel removed must be stowed, cleaned and edges prepped as it must be reinstalled after the overhaul of the rotor and stator assemblies are complete. Note that structural removals may require the use of new lifting points described in Section 6.3.6.3 below.

6.3.5.2 Upper Deck

6.3.5.2.1 The Upper Deck cut-out will need to be removed prior to removal of the bulkhead section on frame 62. The deck and supporting angles must be cut via torch. Note that the angle bar should be cut back short of the deck plate for ease of reinstallation and to prevent the section from falling. As the deck is being cut, additional precautions must be taken to avoid the plate from falling or dislodging (i.e. welded stops or leave crane connected to lifting lugs). Lugs must be welded to Upper Deck and utilized as lifting points for the crane. The lug must be constructed as per drawing J17080-S01. The weight of the Upper Deck section to be removed is estimated at 600lbs.

6.3.5.3 Frame 62 Bulkhead

6.3.5.3.1 The bulkhead at frame 62 will require a square cut out on starboard side at 16’-8¼” off centerline. The bulkhead section and supporting angles must be cut via torch. Note that the angle bar should be cut back further than the bulkhead plate for ease of reinstallation. As the bulkhead is being cut, precautions must be taken to avoid the plate from falling or dislodging. Once the cut-out is complete and dislodged from its original position, one lifting lug is to be welded to the forward side of the bulkhead, such that it is lapped over the center stiffener at 16’-8¾” off center line and protruding above the sniped stiffener. The bulkhead must be routed forward and up through the opening in the Upper Deck or stowed in the port side of the workshop. The weight of the Bulkhead section is estimated at 700lbs.

6.3.6 Required Lifting Points

6.3.6.1 In order to optimize the efficiency of removing the rotor and stator assembly, multiple lifting points must be installed. This section will highlight the main lifting points to be utilized. This section must be read

in correlation with drawings J17080-S02 Transverse Lifting Beam and J17080-S03 New Lifting Lug Details.

6.3.6.2 Existing Lifting Points to be used

6.3.6.2.1 The existing lifting points that will need to be utilized are listed below:

1. Longitudinal Lifting Beams – Above each engine is a 4Ton lifting beam that extends from frame 50 to frame 58. The ship is equipped with two 4 Ton geared trolleys and two 4 Ton hand hoists. The bottoms of these lifting beams are approximately 5'3" from the lower deck plating.
2. Lifting Lug in Workshop – Located at frame 65 on the starboard side of the workshop. This lug is positioned slightly aft of the existing cut lines in the Upper Deck plating. Note: this lug is not certified and must be certified by the Contractor prior to use.

6.3.6.3 New Lifting Points

6.3.6.3.1 In order to establish an efficient removal route, the following new lifting points must be fabricated and installed:

i. Transverse Lifting Beams – two transverse lifting beams will be installed on frame 59. In order to get the beams into the engine room, each beam will have to be cut into two pieces. Once the beams are in the engine room, they must be welded back together and the welds ground flush such that it does not interfere with the trolley. Fabrication details for the lifting beams are illustrated in drawing J17080-S02.

Note that these lifting beams will have to be equipped with a minimum 4 ton trolley and hand hoist. The clearance allowed for the rigging equipment is 20" below the underside of the transverse lifting beam. The transverse lifting beam indicated in drawing J17080-S02 can be altered to accommodate the existing rigging equipment but the alternate I-beam must have equivalent or greater section modulus. Note that increasing the depth of the I-beam will directly deduct from the clearance currently allotted for the rigging equipment.

As indicated on the referenced drawing, multiple bracing options have been provided to minimize onsite removals. Each lifting beam must be supported via six vertical braces along the length of the beam that lap onto the aft side of the transverse angle on frame 59. The inboard and outboard most vertical supports at each end of the lifting beam must be supported via two diagonal braces, one spanning to frame 58 and one spanning to frame 60. The remaining vertical supports require only a single diagonal brace to either frame 60 or frame 58.

ii. These bracing options must be reviewed on site to determine the least removals required. A series of piping spools run the length of frame 60 and should be avoided as much as possible utilizing the various bracing options.

iii. New Lifting Lug Frame 61 – This lug is to be fabricated as per drawing J17080-S03. The lug is to be positioned approximately 15'-8" off center line to starboard.

iv. New Lifting Lug Frame 61 – This lug is to be fabricated as per drawing J17080-S03. The lug is to be positioned approximately 17'-8" off center line to starboard.

v. New Lifting Lug Frame 63 - This lug is to be fabricated as per drawing J17080-S03. The lug is to be positioned approximately 15'-8" off center line to starboard.

vi. New Lifting Lug Frame 63 - This lug is to be fabricated as per drawing J17080-S03. The lug is to be positioned approximately 17'-8" off center line to starboard.

vii. New Lifting Lug Frame 65 - This lug is to be fabricated as per drawing J17080-S03. The lug is to be positioned approximately 2' inboard of the existing lifting lug on frame 65.

viii. New Lifting Lug Frame 65 - This lug is to be fabricated as per drawing J17080-S03. The lug is to be positioned approximately 15" outboard of the existing lifting lug on frame 65.

6.3.6.3.2 Each new lifting lug has a SWL of 2.5mT. Provided that each stator half is heavier than the SWL of any individual lug, all components must be supported via two lugs at all times during shipping.

6.3.7 Lifting Point Certification

6.3.7.1 The CCGS Griffon has a requirement to test and re-certify all travel rails and lifting anchors in the Upper Engine Room, Lower Engine Room and Engine Room Workshop listed in Tables 6.3.7.6 and 6.3.7.7 prior to the start of the Propulsion Generator Refurbishment work.

6.3.7.2 The Contractor must install and Proof test all additional anchors identified in the Lengkeek Vessel Engineering Transport Canada approved Propulsion Generator Transit Route plans.

6.3.7.3 The Contractor must provide the services of a competent person to perform a Pull Proof Test and NDT on all lifting equipment listed in Table 6.3.7.6, Table 6.3.7.7, and section 6.3.6.3 and provide test certificates for each point tested. A competent person is defined in paragraph 300(2)(a) or (b) of the Cargo, Fumigation, and Tackle Regulations.

6.3.7.4 For bidding purposes, the Contractor must quote on testing and certifying all equipment listed under Table 6.3.7.6, as well as provide a price per lifting anchor for any additional anchor. The final amount of

lifting anchors to be tested and certified will be adjusted using the PWGSC 1379 form.

6.3.7.5 The Contractor must provide a price per anchor for the replacement of worn or damaged existing anchor. The Contractor must bid on the replacement of 5 anchors. The final amount of lifting anchors to be replaced will be adjusted using the PWGSC 1379 form.

6.3.7.6 List of Existing Lifting Points:

Point ID Number	Location	Frames	SWL	Last Test Date
1	OB ME#1	59-60	1.5 ton	N/A
2	OB ME #4	57	1.5 ton	02/12/11
3	OB ME #4	55-56	1.5 ton	14/12/11
4	ME #4	60	1.5 ton	14/12/11
5	ME #4	59	1.5 ton	02/12/11
6	8’ Stbd of CL	55	1.5 ton	02/12/11
7	ME #3	57	1.5 ton	N/A
8	ME #3	59-60	1.5 ton	02/12/11
9	OB ME #3	59	1.5 ton	02/12/11
10	ME #3	59-60	1.5 ton	02/12/11
11	ME #3	59	1.5 ton	02/12/11
12	ME #3	57	1.5 ton	02/12/11
13	ME #3	57	1.5 ton	N/A
14	IB ME #3	59	1.5 ton	14/12/11
15	IB ME #2	59	1.5 ton	14/12/11
16	IB ME #2	57	1.5 ton	14/12/11
17	IB ME #2	59-60	N/A	N/A
18	IB ME #3	59-60	1.5 ton	14/12/11
19	IB ME #2	59-60	1.5 ton	02/12/11
20	ME #2	59	1.5 ton	14/12/11
20A	ME #2	59	1.5 ton	02/12/11
21	OB ME #2	57	1.5 ton	02/12/11
22	OB ME #2	54	1.5 ton	14/12/11
23	Workshop door	60	N/A	N/A
24	Workshop door	61-62	1.5 ton	14/12/11
25	OB ME #2	58-59	1.5 ton	02/12/11
26	OB ME #2	59-60	1.5 ton	14/12/11
27	ME #1	59	1.5 ton	14/12/11
28	IB Prt Air Rec.	59-60	1.5 ton	14/12/11
29	OB ME #1	57-58	1.5 ton	14/12/11
30	OB ME #1	56-57	1.5 ton	14/12/11
31	OB ME #1	55-56	1.5 ton	14/12/11

32	OB ME #1	57-58	1.5 ton	14/12/11
33	Centerline	54	1.5 ton	14/12/11
34	SOG exciter	60	1.5 ton	14/12/11
35	Centerline	49	1.5 ton	14/12/11
36	ME #4	58	1.5 ton	14/12/11
37	Port Side	52-53	1.5 ton	14/12/11
38	Stbd Side	52-53	1.5 ton	14/12/11
	Workshop Rail		1 ton	
	ME #1 Rail		4 ton	
	ME #2 Rail		4 ton	
	ME #3 Rail		4 ton	
	ME #4 Rail		4 ton	

6.3.7.7 Existing uncertified Lifting points to be tested:

Point ID Number	**Location**	**Frames**	**SWL**	**Last Test Date**
N/A	OB ME#1	54	1.5 ton	N/A
N/A	OB ME#1	54	1.5 ton	N/A
N/A	OB ME #1	53	1.5 ton	N/A
N/A	Port Side	52	1.5 ton	N/A
N/A	Side Side	61	2.5 ton	N/A
N/A	Stbd Workshop	65	2.5 ton	N/A

6.3.7.8 In December 2011, most of the engine room lifting eyes were pull tested using a hydraulic ram and a calibrated pressure gauge. The calculated pull for each point was >6000 lbs. After the pull test they were inspected and certified for 1.5 ton straight lift.

6.3.7.9 The Contractor must develop a method to test, inspect and certify all existing and new lifting eyes and travel rails in the Upper Engine Room, Lower Engine Room, and Workshop. The method of testing must be approved by TCMS or a naval architect.

6.3.7.10 The Contractor must identify and label each lifting point, perform a proof load test of 2 times SWL, perform a Non-destructive Test (NDT) post-test analysis of the lifting eye and welds, and provide a test certified for each point tested.

6.3.7.11 Identification of the lifting point must include, at a minimum, a unique identifying number, a general description of its location, frame reference, a description of the lifting point (i.e. plate, ring), and a sketch showing construction and dimensions to 0.010”.

6.3.7.12 NDT analysis must include, at a minimum, inspection and crack detection of the welds, deformation/elongation of the lifting eye, and

deformation/distortion of the beam or plate the lifting point is secured to.

6.3.7.13 The Certificate must include, at a minimum, the name of the tester, date of test, name of inspector, date of NDT testing and inspection, results of NDT inspection, unique identifier of the lifting point, description of its location, a description of the lifting point, the method of test, determination of SWL, and a stamp approval by TCMS for the lifting point.

6.3.8 Rigging and Lifting Arrangement

6.3.8.1 Stator

6.3.8.1.1 Rigging of the stator must be established utilizing a lifting saddle with three lifting lugs. This will optimize maneuverability during the removal process. A similar arrangement was used during the previous removal, as shown below in figure.

Figure 1: Stator Rigging Arrangement

6.3.8.2 Armature Assembly

6.3.8.2.1 The armature assembly must be rigged utilizing a fixed lifting beam. The lifting I-beam is to be shorter than the rotor so that it does not affect navigating the proposed route. The minimum length is 60 inches and the maximum length is 90 inches. The I-beam is to be rigidly anchored to the armature assembly such that it does not slide or rotate independently of the armature assembly.

6.3.8.2.2 The I-beam is to be equipped with a series of lugs. On the top of the I-beam, at the center of its span, a plate must be welded with three lifting holes. On the bottom of the I-beam at each end, one lug should be installed with a single lifting hole. A drawing detailing the fixed lifting beam can be found in drawing J17080-S04.

6.3.8.2.3 The securing of the armature assembly to the fixed lifting beam must be done using a shackle and wire rope connected to the single lifting points at each end of the beam. The wire rope must be wrapped around the circumference of the rotor at least twice, as to create a choke to prevent the rotor from sliding independently from the beam. A similar arrangement was used during the previous removal as shown below.

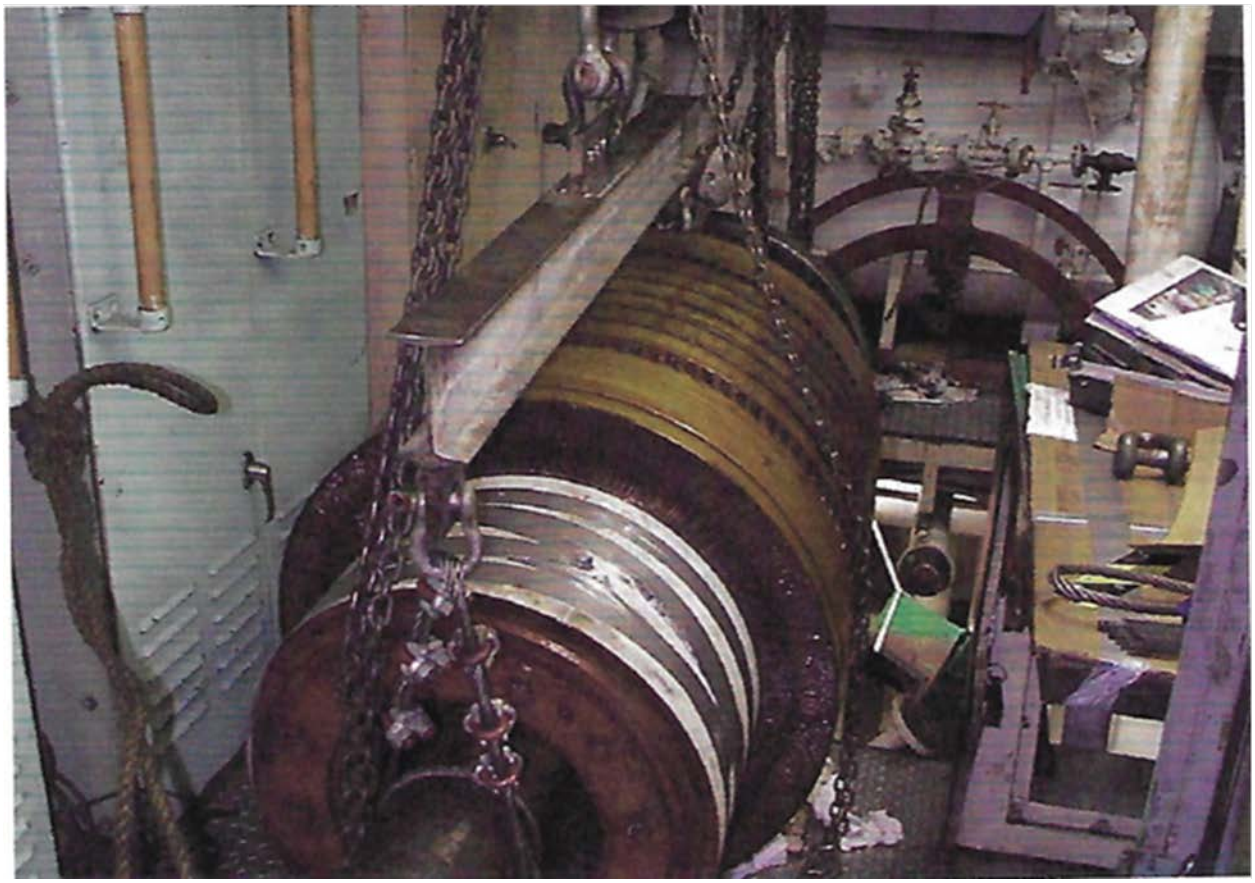

Figure 2: Rigging Arrangement of Armature Assembly

6.3.9 Temporary Closing of Access Hole in Upper Deck

6.3.9.1 The Contractor must provide temporary closing of the access hole in the Upper Deck. The temporary closure must be weather tight and suitable for the duration of the work period, until the opening is permanently closed. The closure must prevent any objects or material from being dropped in through the opening. The temporary closure must utilize

hand rails or a comparable structure to prevent personnel from working too close to the opening.

6.3.9.2 One option is to re-install the Upper Deck panel and weld a series of stops/lugs around the perimeter to vertically support it. In order to ensure weather tightness, a shelter would have to be built around the panel or silicone would have to be used to seal the seam. Temporary handrails or barricade would also be required.

6.3.10 Re-Installation of Structural Removals

6.3.10.1 General

6.3.10.1.1 The Contractor must re-install all of the items temporarily stripped out under Sections 6.3.3, 6.3.4 and 6.3.5 above. The Contractor must ensure that in way of these reinstalled items the vessel is returned to its original configuration and condition.

6.3.10.1.2 The Contractor must respect CCG and CWB specified welding standards, and must ensure that appropriate QA procedures are in place to address such issues as correct welding sequence, correct edge preparation, correct alignment of structure, and NDE requirements. If it is found that the Contractor has removed too much material during the strip-out, the Owner must specify that new material is to be used for the re-installation. The work must not be considered complete until it has met the acceptance of attending TCMS inspector and the IA.

6.3.10.1.3 Maneuvering of all structural components that were removed must be accomplished utilizing the same methods that were used for handling during the removal stage. Temporary stops and lugs may need to be installed on insert plates to secure positions prior to welding. The Contractor must removal all temporary lugs upon final installation. All surfaces must be ground smooth prior to apply any coatings. All coatings must be compatible with the vessel's existing paint system.

6.3.10.1.4 Unless otherwise stated, the Contractor must remove the lifting beam installed at frame 59, including all supporting structure upon completion of the work. All piping that was affected by the installation of this lifting beam must be returned to its original configuration.

6.3.10.2 Welding Inspections

6.3.10.2.1 A physical/visual inspection of all structural welds, including temporary structural installations, must be conducted by the Contractor and the IA to ensure the quality of the welds and contain no visible deficiencies.

6.3.10.2.2 Non-destructive examinations of all structural welds must be carried out by the Contractor. All non-destructive testing must be carried out by a certified Level II technician as per Natural Resources Canada certification CAN/CGSB-48.9712 standard. The Contractor must

provide a copy of the technician's certificate to the TA. All tests results, calibrations, measurements, trials and readings must be properly tabulated, compiled and copies must be provided to the IA with the technician's original handwritten notes.

6.3.10.2.3 The full extent of any weld defect must be ascertained by applying additional non-destructive examinations where required. Unacceptable defects must be completely removed and where necessary, re-welded. The repair must be examined after re-welding.

6.3.10.2.4 In addition to 100% visual inspection, all fillet welds on structural stiffeners must require 50% MT. All lifting eyes and lifting beam welds must be 100% MT. All full penetration welds (ie. deck and bulkhead inserts) must require 100% UT. The work must be inspected as outlined unless otherwise directed by the attending surveyor or TCMS inspector.

6.3.10.3 Reinstallation of Mechanical Systems

6.3.10.3.1 The Contractor must re-install all of the piping and ducting items temporarily stripped out under Section 6.3.3, 6.3.4 and 6.3.5 above. The Contractor must ensure that in way of these reinstalled items the vessel is returned to its original configuration and condition.

6.3.10.3.2 All removed propulsion generator and main engine components that were removed to permit the removal of the generator components must be reinstalled in their original locations and working order.

6.3.10.3.3 All piping systems and ducting must be reinstalled with new fasteners and gaskets. All flange fasteners must be of appropriate size and grade for the flange size and rating, in accordance with ANSI standards. All flange fasteners must be fitted with flat washers, lock washers and nuts. Never-seize must be applied to all bolt threads.

6.3.10.3.4 All potable water piping removed to carry out the work must be re-installed. Upon re-installation, the piping must be super-chlorinated to mg/L for a period of 24 hours. After 24 hours the piping must be drained and flushed prior to being returned to service.

6.3.10.3.5 All work must be consistent with good shipbuilding practice where. The work must be completed to the satisfaction of the attending TCMS inspector and the IA.

6.3.10.3.6 All disturbed insulation, linings, ceilings, sheathings, and coatings must be seamlessly replaced with new material of at least the equivalent quality to that of the existing materials. All new installations must be finished to the same standard as similar existing installations.

6.3.10.3.7 The Contractor must conduct operating tests at system pressures for all disturbed piping, and ducting. The tests must confirm that the pipe and duct spools have been re-installed without leakages. All tests must be

witnessed by the TCMS and the IA. All leaks must be repaired by the Contractor, at its expense.

6.3.10.3.8 All affected CO2 system must be reinstalled to their original configuration and proven functional by a company certified to carry out work on these types of systems. The Contractor must provide the original certificate to the IA.

6.3.10.4 Reinstallation of Electrical Systems

6.3.10.4.1 The Contractor must re-install all of the electrical items temporarily stripped out under Section 6.3.3, 6.3.4 and 6.3.5 above. The Contractor must ensure that in way of these reinstalled items the vessel is returned to its original configuration and condition. The Contractor must respect TP 127E.

6.3.10.4.2 The Contractor must conduct electrical insulation testing on all disturbed cabling, with exception of the fire detection cabling. A copy of the results must be given to the TA. The Contractor must also demonstrate to the TA that each circuit is functioning correctly.

6.3.10.4.3 Upon completion of the work, the fire detection systems must be tested, devices identified as to type and location being correct, and the system certified operational by the installer's representative.

6.3.10.4.4 All work must be to the satisfaction of the attending TCMS inspector and the IA.

6.4 Proof of Performance

6.4.1 Inspection

6.4.1.1 All work must be completed to the satisfaction of the attending TCMS inspector and the IA.

6.4.1.2 All work must be inspected on a regular basis by both the IA and Contractor.

6.4.1.3 The load testing of the lifting points must be witnessed by the IA.

6.4.2 Testing

6.4.2.1 The Contractor must carry out NDT testing as described above for all lifting points, rails, and steelwork.

6.4.2.2 The Contractor must demonstrate to the IA that all mechanical and electrical systems have been returned to service. All piping must undergo a pressure test to prove there are no leaks. All electrical systems must undergo an electrical insulation test.

6.4.2.3 Functional test of the main engine blowers and affected systems must be carried out by the Contractor and coordinated with section 7.0 of the SOW.

6.4.3 Certification

6.4.3.1 The Contractor must certify all lifting eyes and rails as identified above.

6.4.3.2 The Contractor must demonstrate that all testing equipment used to proof load the lifting anchors and travel rails has been calibrated less than 12 months prior to the inspection being completed. The Contractor must provide the IA with a copy of all calibration certificates for this section prior to the Contractor using any lifting anchors or travel rails.

6.4.3.3 The Contractor must demonstrate to the IA how the lifting appliance tester is qualified to certify the lifting anchors and travel rails.

6.4.3.4 The Contractor must demonstrate to the IA the qualification of the NDT inspector. The Contractor must provide the TA with a copy of the technician's certificate indicating a Level 2 inspector.

6.4.3.5 All fire detection and suppression systems must be certified operation and certificates provided to the IA.

6.5 Deliverables

6.5.1 Documentation

6.5.1.1 The Contractor must provide TCMS and the IA and the TA with production/fabrication drawings for all steelwork. These drawings must include a minimum of the welding procedures to be used, welding specifications indicating the types of welds to be used, the weld sizes, welding sequence, correct edge preparation, correct alignment of structure and the materials to be used.

6.5.1.2 The Contractor must supply a report including all NDT testing, electrical insulation testing, details of all new materials used, and system testing pressures.

6.5.1.3 The Contractor must provide a report containing a copy of the SWL certificate for each lifting anchor and travel rail certified. The report must include a colour photograph of each tested point showing evidence of post load test NDT inspection. The Contractor may use the 2011 report "ER Lifting Points" as a guideline. The Contractor must provide the TA with 3 printed copies of the report - 1 original with each certificate signed and stamped, and 2 other printed colour photocopies. The Contractor must provide the TA with 1 electronic copy (PDF) of the report. The stamped original copy must be provided to the IA before any lifting anchors or travel rails are used by the Contractor.

7.0 OVERHAUL OF PROPULSION GENERATORS

7.1 Identification

7.1.1 The Contractor must perform the initial inspection, disassembly, removal, shipping (to and from), final assembly and the operational testing of all four propulsion generators and their respective components. This must include all electrical, mechanical, and technical phases of the work.

7.1.2 The propulsion generators must be removed from the vessel to carry out the specified work. The Contractor must include in its bid proposal, the facility to be used for the specified work on the propulsion generators. The proposed facility must have significant experience overhauling DC generators of this size and type.

7.1.3 TCMS must witness the final testing and trials of the propulsion generators and must issue an inspection and compliance certificate as per the Division 3 Report (5 year survey).

7.1.4 Final acceptance of completed contractual work/tasks must be to the standards prescribed by:

- Transport Canada Marine Safety;
- CCG Inspection Authority;
- CCG Technical Authority.

7.1.5 Each generator must be aligned with its respective diesel engine. The babbitt bearings of each generators must be renewed, fitted, and aligned to the shaft.

7.2 References

7.2.1 Equipment Data

Manufacturer: Westinghouse Canada, Hamilton Plant, year 1968.

Ratings as per generator nameplates:

- Continuous - 1032 kW, 833 V, 1238 A, 750 RPM,
- 2 Hour - 1290 kW, 900 V, 1432 A, 750 RPM, 85°C Rise
- Wound: Shunt Stabilized
- Excitation: Separate
- Excitation Volts: 206
- Original Insulation Class: B
- Serial Numbers:
  - #1, Port Outboard, SN 4-1S5108
  - #2, Port Inboard, SN 3-1S5108
  - #3, Starboard Inboard, SN 2-5S108

#4, Starboard Outboard, SN 1-5S108

7.2.1.1 Each generator is separately excited by a General Electric GF 2000 unit.

7.2.1.2 The forward end (non-drive end) of the armature is supported by a Michell babbitted plain bearing. The bearing has a separate lube oil system.

7.2.1.3 The aft end of the armature is supported by the propulsion diesel engine crankshaft.

7.2.1.4 Each generator is equipped with heaters for humidity control and fitted lights.

7.2.1.5 A tachogenerator mounted to the forward end of the armature shaft is used to provide a speed signal to the propulsion system.

7.2.1.6 The generator stator/magnet frame can be split into lower and upper halves (sometimes called yokes).

7.2.2 Drawings

Drawing Number	Drawing Title	Electronic Number
664-M1 sh1	Machinery Arrangement Plan at Lower Level	G05319me1.dwg
664-M1 sh2	Machinery Arrangement Plan View at Lower Deck	G05135ma2.dwg
664-M1 sh3	Machinery Arrangement Elevations	G05138ma3.dwg
664-M1 sh4	Machinery Arrangement Sections	G05138ma4.dwg
664-M6 sh1	Location of Connections on Sea Bay & Sea Chest	G05133pl1.dwg
664-M7 sh2	Installation of Flexible Connections at Propulsion Motors & Generators, air compr.	G05132pl2.dwg
664-5-1	Seats for Thrustblock, Turning Gear, Shaft Brake, Propulsion Motor, Diesel Engine, Propulsion and Service Generators	G05117de1.dwg
664-120-10	Oil Stabilization Tanks, Oiltight & Watertight Bulkheads Forward	G05129as1.dwg
664-120-11	Lower Deck & Engineroom Flat Plating	664-120-11.tif
664-120-12	Upper Deck Plating	664-120-12.dwg
664-1215-10 sh1	Machinery Space Ventilation	G05185hv1.dwg
664-1215-10 sh2	Machinery Space Ventilation	G05185hv2.dwg
664-1215-10 sh3	Machinery Space Ventilation	G05185hv3.dwg
664-1215-10 sh4	Machinery Space Ventilation	G05185hv4.dwg
664-3221-1 sh1	Floor Plates, Ladders & Gratings	G05177st1.dwg
664-3221-1 sh2	Floor Plates, Ladders & Gratings	G05177st2.dwg

664-4200-1	Bilge and Ballast Diagram	G05181pl1.dwg
664-4200-2 sh1	Bilge and Ballast Piping Arrangement	G05A0461.DWG
664-4202-10 sh1	Fuel Oil Filling, Transfer & Service Piping Arrg't	G05147pl1.dwg
664-4207-1	Raw Water Circulating Diagram	G05159pl1.dwg
664-4207-10 sh1	Raw & Fresh Water Circulating Piping Arrg't	G05200pl1.dwg
664-4207-10 sh2	Raw & Fresh Water Circulating Piping Arrg't	G05200pl2.dwg
664-4210-1	Propulsion Motor & Generator Bearing Lube Oil System Diagram	G05166pl1.dwg
664-4210-10 sh1	Main Engine & Bearing Lube Oil Piping Arrg't	G05168pl1.dwg
C-AC-1636AFB-16	Assembly Crankshaft Flexible Coupling to Westinghouse Generator	C-AC-1636AFB-16.tif
37305/38074/2	Generator Michell Bearing/ Pedestal Assembly	37305.tif
169D571	Original DC Machine Type QL FRCC 216.5 Shaft and Bar Assembly	169D571.tif
529F075	D.C. Generator Assembly/ Outline Drawing	529F075.TIF
549A428	D.C. Machine Frame Armature Stacking and Armature Banding	549A428.TIF
640J771 shts 1 & 2	D.C. Machine Type QL CC 216.5 General Assembly	640J771.TIF 640J771-2.TIF
735D861	D.C. Generator Type QL CC 216.5 Stator Wiring Around Magnet Frame	735D861.TIF
736D088	D.C. Generator Type Q FR CC 216.5 Devices & Connections	736D088.TIF
6192C88	CCGS Griffon Modified/Updated Typical Generator Shaft Spider Assembly Drawing	6192C88.pdf

7.2.3 Regulations

- TP 127E Ships Electrical Standards, latest edition
- IEEE 45 Recommended Practice for Electrical Installations on Shipboard;
- Lloyd's Classification Society Rules;
- Westinghouse Propulsion Equipment Manual (February 1969) Note: Westinghouse Manual contains all information relevant to the propulsion generators.

7.3 Technical Description

7.3.1 General

7.3.1.1 The Contractor must perform the following work on the four DC propulsion generators. The procedures outlined below must be followed and the Contractor must keep clear and precise records of all measurements, photographs and observations recorded. These must be presented to the TA and the IA.

7.3.1.2 The Contractor, in conjunction with ship personnel, must lockout the diesel engines and generators.

7.3.1.3 The Contractor must mark and remove the generator housings from the generators. This must include all casings, ventilation shrouds, air coolers, sea water cooling pipes, oil supply and drain pipes, CO2 piping, alarm and monitoring wiring for temperature sensors and all other associated equipment that will interfere with the work to be performed on the propulsion generators.

7.3.1.4 The Contractor must provide the services of a licensed Kidde Company representative for the securing, disconnection, and removal of the CO2 equipment fitted to the propulsion generators. This same representative is to be on-site for the reconnection, restoration and functional testing of the propulsion generator CO2 system upon completion of the specified work herein.

7.3.1.5 The Contractor must remove the engine blower from each main engine, set it aside and cover the openings. The engine blowers must be stored on the Lower Deck (upper level of the engine room) as indicated by the IA. Blowers must be supported on wooden blocks and secured by chain fall. Wooden blocks and chain falls must be supplied by the Contractor. The blowers must be protected from damage and contamination (infiltration of debris, dust, dirt, etc.) for the duration of the work. The blowers must be situated in a location that will not impede the removal/reinstallation of the generator components, nor other work being carried out by the Contractor.

7.3.1.6 All work being carried out on the Main Engines and their components (ex: blowers, flywheel, crankshaft deflections) must be carried out under the supervision of a Fairbanks Morse technician, having significant (5 years or more) experience working on this particular type of engine. The Contractor must include an allowance of $50 000 in its bid to cover the costs of services for a Fairbanks Morse FSR, including living expenses accommodations, meals and transportation). The Contractor must provide the representative's final invoice along with copies of all supporting documentation attesting to actual costs. This documentation will be used to increase or decrease the $50 000 allowance via a 1379 form.

7.3.1.7 The Contractor must secure and blank off all sea-water connections and oil supply and drain pipes for the duration of the work. These systems must be flushed with service liquid and proven clear prior to reconnection to the remaining system.

7.3.1.8 The Contractor must remove four sea-water temperature regulating valves from the propulsion generator cooling water circuits. These valves must be set aside as they will be re-used. The valves are to be re-installed and fitted with new gaskets at all flanges. Final set-up and adjustment of the valves is to be carried out in conjunction with the operational tests of the propulsion generators.

7.3.1.9 The Contractor must remove the four air/water heat exchangers from the propulsion generator cooling water circuits and must clean both the exterior and interior of the tube bundle and header assemblies (see section 13.0 of the SOW).

7.3.1.10 The Contractor must remove the top generator air filter casing, front to back air casings and rig to allow easy removal from ship.

7.3.1.11 The Contractor must remove the lower air casings from the generator and rig to allow easy removal from ship.

7.3.1.12 The Contractor must disconnect the generator shaft flange from the engine flywheel coupling prior to moving the generator armature. Feeler gauge and dial indicator readings must be taken to determine the horizontal and vertical alignment of the generator armature shaft flange to the engine coupling. These measurements must be witnessed by the IA. All readings must be recorded and provided to the TA and the IA. All fitted bolts must be clearly identified as to the location from which they were removed in the couplings.

7.3.1.13 The Contractor must take engine crankshaft deflections prior to disassembly and upon final installation of the generators. These readings must be recorded and provided to the IA and the TA. Generator armature and flywheel coupling components must be match marked by permanent means. This must be done for all generators.

7.3.1.14 The removal route from the vessel for the generators must be planned out in advance and the Contractor must remove deck plates, lighting fixtures and other interference items in preparation for the generator removal (see section 6.0 of the SOW for the proposed removal route).

7.3.2 On-Ship Disassembly of Stator/Field and Armature

7.3.2.1 General Procedures and Instructions

7.3.2.1.1 The Contractor must mark all parts prior to disassembly, (i.e., brackets, frame, covers, brush holders, and fitted bolts).

7.3.2.1.2 The Contractor must identify brackets, housing and bearings in pairs where two are fitted. Identifying marks must be recorded.

7.3.2.1.3 The Contractor must measure and record all airgaps at the forward and aft end of the generator. Main poles and interpoles, airgap measurements for alignment purposes should be taken at the centre of the pole tip to a reference mark on the armature which is rotated between measurements.

7.3.2.1.4 The Contractor must identify and record all frame-mounted devices and their identification marks.

7.3.2.1.5 The Contractor must identify, mark and record all wiring before disconnection. (For internal and external connections).

7.3.2.1.6 The Contractor must verify alignment after installation by calibrated laser type equipment.

7.3.2.1.7 The Contractor must photograph and report all special markings, and/or damage.

7.3.2.2 Detailed Mechanical and Electrical Inspections

7.3.2.2.1 The onboard inspection of the propulsion generators must consist of two sections, a mechanical and electrical inspection as detailed below. A final report with recommendations of all findings must be submitted to the TA and the IA prior to any overhaul work on the propulsion generators.

7.3.2.3 Mechanical Generator Inspection, On-Ship

7.3.2.3.1 The mechanical generator inspection (on-ship) must include a minimum of the following:

7.3.2.3.2 The Contractor must perform a general inspection of all connections, bus and bar joints, “V” rings, windings, keyways, threaded fits, all pole pieces, etc. and record all defects or missing parts.

7.3.2.3.3 The Contractor must measure and record dimensions of the following:

a) Shaft run-out;
b) Journal and bearing fits;
c) Shaft seal fits;
d) Commutator diameter, concentricity, radial run-out, appearance of the film;
e) Brush location, size, type, quantity, and spring tension;
f) Air gap measurements – main, and commutating (interpole) poles,
g) Armature end play,
h) Visually inspect all armature core, commutating, and field pole laminations, leads, mounting blocks, welds, machined fits, etc.
i) Visually inspect all anti-condensation heaters, tachometer- speed devices, tachometer coupling, thermostats, lighting fixtures, etc.

j) Marine pedestal sleeve bearings:
k) Condition of lubricant; dirt, rust, or moisture;
l) Fretting corrosion;
m) Thermal discoloration;
n) Pitting or spalling of liners;
o) Scoring or wiping of babbitt;
p) Integrity of any insulation furnished to block passage of bearing current (50 Megohms minimum Insulation Resistance is recommended; no temperature correction is needed; use megohmmeter with less than 500V output);
q) Oil leakage, oil disk and oil scraper wear. Check forced-oil lubrication systems for blockage inside piping, presence of proper metering orifices in the system, proper pump operation.
r) Shaft - Straightness (NEMA MG 1-2003, Section 1, Part 4 Par 4.9.7 and 4.07.1); cracks, corrosion; scoring or galling. The Contractor must be responsible for obtaining this specification).
s) Seals - Rubbing or wear; leakage; glazing or hardening of felt or elastomeric materials.
t) Gaskets - Indications of hardened, broken, or shifted parts; missing gaskets.
u) Evidence of lubricant or contaminant leakage past a gasket.
v) Fasteners, hardware and dowels - Loose, missing, defective or broken parts.
w) Frame or housing - Corrosion; structural weld integrity; blocked drains, breathers, or ventilating air passages; paralleling of feet.

7.3.2.3.4 The Contractor must replace the defective anti-condensation heaters on the Starboard Inboard Generator. These heaters will be GFM.

7.3.2.4 Electrical Inspection, On-Ship

7.3.2.4.1 The electrical inspection (on-ship) must include a minimum of the following:

7.3.2.4.2 On main field, compensating and commutating windings and armature observe and record the following:

a) Insulation that is loose, damaged, or has shifted in position.
b) Ties, lashings, banding or blocking that are found loose or broken.
c) Excessive dirt, oil, or moisture deposited on coil surfaces.
d) Coil winding or insulation physical damage.
e) On lead cables, straps, and bus work, look for cracked, overheated, or frayed insulation; and loose or burned terminal lugs.
f) On auxiliary devices, wiring that is cracked, overheated, or frayed.
g) Terminal blocks that are damaged.

h) When a winding/ coil shows clear evidence of destructive arcing or overheating, observe and record carefully the location and nature of the damage. If possible, pictures must be taken showing the connecting parts between poles and must should be identified and recorded on the drawing.
i) Inspection for physical damage to the armature winding.
j) Label and record all buswork, power cable, control wiring, field coil inter- connections. Labels must be of the type to ensure positive adherence and legibility. Number identification system must correspond to existing diagrams.
k) Megger test (insulation resistance) the main power cables to the main DC switchgear. The cables must be isolated at each end for the test. Test must be performed individually (five minute at 1000 volts DC, record @ every one minute).

7.3.2.5 Electrical Testing of Generators, On-Ship

7.3.2.5.1 Each generator must be given the following tests and results documented:

7.3.2.5.2 A 10 minute insulation resistance (megger) test recorded at every minute of the following, also recording temperature and humidity and corrected to 20°C:

- Shunt field winding at 500V DC
- Differential Series winding at 500 V DC
- Interpoles and compensating winding together at 1000 V DC
- Brushgear only at 1000 V DC
- Armature winding only at 1000 V DC

7.3.2.6 Shipping Precautions, Methods & Means

7.3.2.6.1 For transportation, armature/shaft assemblies of sleeve-bearing generators must be blocked for shipment. Shafts must be restrained against endwise, sidewise, and up-and-down movement caused by impact. Screws, clamps, plates, or other blocking means must be clearly identified for removal before the generator is re-assembled. The rotor shafts must be protected from damage especially at the machined bearing locations. The Contractor must fabricate a steel shipping cradle to support each of the four generator armatures. Reference drawings of the armature are included in the specification. Weight of each armature is approximately 6,000 lbs.

7.3.2.6.2 The armatures must be totally wrapped with a drying agent or moisture absorbing material placed inside the wrap prior to shipment.

7.3.2.6.3 The upper and lower magnet frames must be individually wrapped with a drying agent or moisture absorbing material placed inside the wrap.

The frames must be secured against movement and damage during shipment.

7.3.2.6.4 The commutating (interpoles) poles at the frame split must be individually wrapped with a drying agent or moisture absorbing material placed inside the wrap. The coils must be secured against movement and damage during shipment.

7.3.2.7 Inspection of Generators and Generator Components after removal from Vessel

7.3.2.7.1 The Contractor must notify the TA and IA of the date of the initial inspection of the generator components after removal from the vessel.

7.3.2.7.2 The Contractor must provide the TA and the IA with a detailed schedule for the overhaul and reconditioning of the generator armatures and generator components.

7.3.2.7.3 The Contractor must perform a thorough inspection of the generator armatures and generator components to determine if there are any further defects not originally detected during the on-ship inspection and to diagnose the cause and effect of these defects (if any) so as to prevent a recurrence. The Contractor must provide the TA and the IA with a condition report for each propulsion generator including photographs and recommendations. The condition reports must include but not be limited to the following for each part of the generators:

- General cleanliness, insulation, mechanical and electrical checks;
- Cracked or broken welds or castings (spiders) from rotor to armature;
- Missing hardware, wear or rub marks, including fretting on shaft;
- Discoloration, charring, overheating, spurring of the commutator;
- Carbon, corrosion, moisture, or oil inside or on the armature winding.

7.3.2.7.4 The Contractor must make the condition report available at the earliest possible time, particularly if there are issues that could have a potential impact on the completion schedule of the generator overhauls.

7.3.2.7.5 The Contractor must examine # 4 armature closely for shaft /spider weld cracks using NDT, as this shaft was not replaced in 1999. If cracks are found the Contractor must notify the TA immediately to determine if repairs can be made or if a new shaft/spider assembly must be installed.

7.3.3 Scope of Work for Generator Armatures

7.3.3.1 The Contractor must perform the following work on each of the generator armatures:

- Steam clean and dry, apply insulating varnish and cure.
- Apply a finish coat of Thermo epoxy insulating paint to the windings once the varnish is oven cured.
- Machine, undercut and bevel commutator. Undercut to be a minimum of 0.06" deep, bevel the corners of the commutator bars with a 0.02” X 45° bevel. Surface of the commutator to be polished to a 32 micro-inch finish or better. No emery cloth to be used to polish the commutator. No mica insulation to protrude above the undercut. Undercut to extend the full length of the commutator bar. Maximum bar to bar variation not to exceed to 0.0001”.
- Dynamically balance armature/rotor; to ISO standard 1940/1 G 2.5 or lower.
- Clean main generator blower and NDT all vane welds.
- Paint fan with an epoxy paint
- Dynamically balance blower to ISO standard 1940/1 G 2.5 or lower.
- If required chrome the shaft in at the bearing journal and finish to original size as per drawing 169D571, surface finish, 15 micro-inches.
- Paint complete armature with a thermal epoxy insulating enamel;
- Prepare armature for shipment as per same instructions when generator was removed from vessel.
- Place armature in shipping cradle, taking care not to rest armature on core bands.

7.3.3.2 Electrical Testing of Armatures

7.3.3.2.1 Finished armatures must be given the following electrical tests, all test results to be recorded in the final test document:

7.3.3.3 Commutator, before installation

7.3.3.3.1 Test between adjacent commutator bars at 300 volts AC momentary (3 seconds).

7.3.3.3.2 Ground test commutator at 6000 volts AC momentary (3 seconds).

7.3.3.4 Test armature windings as follows:

7.3.3.4.1 Test between conductors of finished coil at 1000 volts DC momentary (3 seconds) before winding.

7.3.3.4.2 After winding coils, but before banding at 5500 volts AC momentary.

7.3.3.4.3 After banding VPI treatment and curing of armature at 4000 volts AC momentary.

7.3.3.4.4 Ductor - bar to bar test.

7.3.3.4.5 Measure winding insulation resistance to ground at 1000 volts DC, record insulation resistance every minute for 10 minutes, and calculate the polarization index. Minimum insulation resistance to be 500 megohms or better.

7.3.3.4.6 Final high potential test at 3500 volts AC for 1 minute, record leakage current.

7.3.3.4.7 Repeat winding insulation resistance to ground test (megger) after high potential test.

7.3.3.5 Optional Armature Work

7.3.3.5.1 The Contractor must provide a price in its bid for the refurbishment of all armature components that are affected by deterioration from heat, wear and time. All components/wiring etc. of the generator must be removed down to bare metal and replaced or renewed as follows. Silicone based compounds must not be used in rewinding of the generator. This is optional work and must include the above mentioned work as well as the following:

a) Core-loss test the armature core and continuously check for hotspots with an infrared camera, any temperature variation greater than 10°C. After energization of core at rated flux density for 30 minutes must be marked, inspected and repaired after coils are removed.
b) Mark the position of the commutator with respect to the armature slots, and cut the coils close to the risers and remove the commutator.
c) Strip the armature winding without damaging core iron, acquire and confirm winding data required for rewind. If a cold strip of the armature winding is possible; by heating the individual coils with a welder to soften the insulation this is the preferred method of removing the coils. If this is not possible, the exposed ends of the shaft extension must be wrapped securely with a fire resistant insulation and the rotor put in a charring oven to char the insulation for easy removal of the coils. The oven temperature must exceed 650°F., and must have a water suppression system to prevent any flare ups.
d) After the coils are removed, the slots cleaned and any lamination hotspot repairs made, perform a second coreloss test and recheck for hotspots with an infrared camera, maximum temperature variation not to exceed 10°C. after energization of core at rated flux density for 30 minutes.
e) Inspect each slot visually to see that edges of iron are rounded and free from dirt high laminations, torn iron and burrs. Run a slot gauge down each slot to check for high laminations. Inspect vent fingers and end fingers for tightness and straightness.
f) Supply a new commutator or refill the existing commutator using new silver bearing copper, and new mica for Vee rings and new mica between commutator bars. Finished commutator to be seasoned, turned, undercut

and beveled. Final runout not to exceed 0.003" with generator assembled on vessel.

g) Manufacture one set of class F or higher armature coils suitable for VPI impregnation. 2 spare coils are to be supplied and processed through VPI tank and oven cured, along with armature for dissection and inspection after processing.
h) Manufacture one set of rear equalizer connections.
i) Insert slot liners in all armature slots. Slot liners are to extend a minimum of 3/8” past the laminations at each end of the core.
j) Install armature coils, the maximum allowable clearance between the coil and the slot is 0.015". If clearance is excessive between the coil and the slot, increase the thickness of the slot liner to reduce the coil clearance to 0.015”
k) Connect equalizers, all connections to cleaned and free of dirt varnish or oxides prior to TIG welding, use a sil-phos brazing rod (minimum 15% silver), no soldering allowed.
l) Band armature iron; front and rear coil extensions and riser connections. Place temporary bands on the coil extensions prior to banding armature iron. Ensure the core bands apply positive pressure to coils in slot, and no gaps exist between bands and coils after curing.
m) Glass polyester tape, used for banding must be properly stored and inspected to ensure expiry date has not been exceeded. Banding tape to be properly thawed prior to use.
n) Armature to be processed through a VPI system containing class F or higher resin. Armature is to be oven cured. 2 complete VPI and oven cure cycles are to be provided for each armature.
o) VPI process. Pull a vacuum down to an absolute pressure of less than 5 torr, maintain dry vacuum for 1 hour. Fill tank with resin while maintaining a vacuum of 5 torr. Break vacuum and pressurize with dry compressed air until 90 psi is reached. Hold this pressure for 1 hour per layer of tape plus one full hour. Repeat this process for the other generator components that require a VPI treatment
p) Rotor to be properly dried out and preheated before the start of the VPI process. Rotor temperature to be a minimum of 40°C., before the start of the VPI process. Record vacuum, pressure and cycle time for each VPI cycle.
q) Oven bake for 4 hours after iron temperature has reached 155°C. to cure resin.

Note: Generator # 3 suffered a bearing failure and non-drive end shaft journal was machined undersize, shaft seal areas were also damaged. The recommended repair is to weld the journal and damaged seal areas, chroming is not recommended. The journal area and damaged seal areas must first be under cut in the lathe. The shaft area to be repaired, must be preheat to 400°F to 450°F, and using a CWB certified welder, weld using an E7018 low hydrogen rod 3/32" diameter, placing weld passes

on opposite sides of the shaft to prevent localized heating. Clean, and peen each weld pass to remove all welding slag, with the next weld pass having a 50% overlap over the previous weld. Maintain the preheat while welding. After welding is complete cover with an insulating blanket to prevent rapid cooling of the shaft. Stress relieve the portion of the shaft that was welded by slowly heating the shaft to 1175°F +/- 25 °F and holding the temperature for 4 hours using Cooper Heat ceramic blankets or equivalent and slowly cooling the shaft. Finish machine the shaft to Westinghouse drawing 169D571. Protect the armature core from excessive heat.

7.3.3.6 Information on the Generator Armatures for Quotation Purposes

7.3.3.6.1 Commutator contains 372 commutator bars, with a commutator diameter of 32.5". Commutator bar length is 12.24" including risers. Commutator bars are to be Vee bound, with a front and rear Vee ring to secure the commutator bars. Commutator bars to contain silver bearing copper. New mica insulation is to be used between the commutator bars and for the Vee ring insulation. Commutators are to be properly pressed and seasoned to prevent bar movement during operation.

7.3.3.6.2 Armature consists of 93 slots, 32.0" diameter with a gross core length 16.5", overall coil length 25.12". Original bare wire size was 0.085" x 0.30", 4 conductors wide by 3 conductors deep. Coils lie in slots 1 and 16, with 2 coils per slot. Slot size is 0.480" wide by 2.030" deep. Coil insulation to be class F or better, composed of mica tape insulation. Manufacture one set of armature coils suitable for VPI resin impregnation. Resin to have a minimum of a Class F rating. Supply 2 spare coils, which are to be also impregnated and cured and later inspected to ensure proper impregnation of resin through all the coil insulation. Sample coils are to be sandwiched between steel plates to simulate the slot section while being processed.

7.3.3.6.3 New rear equalizers are to be supplied and installed. Equalizers consist of 3 pieces of 0.020" by 0.50" with a total length of approximately 29.45" long, before shaping. 49 Armature coils contain equalizers.

7.3.3.6.4 Armature coils are held in the slot with glass bands (no slot wedges). There are 6 glass bands on the armature core to hold coils in place, 2.0" wide. Refer to drawing 549A475 for placement of glass bands. In addition there are front and rear armature coil bands to secure the coils. Armature coils are to be properly supported and packed to prevent glass bands from crushing coils. There is also a glass band over the risers to armature coil connections.

7.3.4 Generator Brush Gear

7.3.4.1 The Contractor must remove all brush holders and insulating brackets from each generator. The Contractor must clean the rocker ring, positive and negative bus rings to bare copper along with associated parts.

7.3.4.2 The Contractor must replace all hardware and insulating brackets with new assemblies.

7.3.4.3 The Contractor must replace all brush holders with new assemblies.

7.3.4.4 The Contractor must replace all brushes with new brushes and seat all brushes.

7.3.4.5 The Contractor must verify brush pressure is 2.5 lbs per square inch on assembly.

7.3.4.6 The Contractor must replace the glastic brush arm insulators with new units.

7.3.4.7 The Contractor must coat the assembly of the Positive and Negative bus rings to brush arms and all exposed copper with a thermal epoxy insulating enamel.

7.3.4.8 Information on the Brush Gear for Quotation Purposes

7.3.4.8.1 There are 5 brush holders per arms and 6 arms per generator. For a total of 30 brush holders per unit. Westinghouse brush holder # 683D269H01;

7.3.4.8.2 Brush size 0.6" by 1.75" by 2.94" long, split brush. 30 double brushes per generator. Original grade EG 236, current grade to be confirmed upon brush removal;

7.3.4.8.3 6 Glastic "T" shaped brush arm insulators per generator.

7.3.4.8.4 The existing brushes currently installed in the propulsion generators are from Mersen Canada DN Ltd:

- Y6013 assembly: BAR03/Brush complete with PD90-202 Reaction Box
- Y6012R.1: grade EG98P, bevels 60/50, 74.61 x 44.45 x 12.7 mm

7.3.4.8.5 The Contractor will require 120 of each of the above mentioned items to complete the work on the 4 propulsion generators.

7.3.5 Magnetic Frames (Stators)

7.3.5.1 The Contractor must perform the following work on the generator magnet frames by unbrazing all the jumpers from the compensating winding (there are 144 joints that will have to be unbrazed). If no damage is found to the compensating bars and jumpers, they can be reused. The Contractor must remove all insulation from the

compensating bars and clean the bars and jumpers. All compensating bars must be free of nicks and burrs after cleaning;

7.3.5.2 The Contractor must remove the field and interpole iron from the magnet frame by marking and recording the placement of all shims and shim packs behind poles with respect to their orientation, order and shim material. The Contractor must secure all shim packs individually and replace them in exactly the same orientation and order when reassembling the magnet frame. Absolutely no interchanging of shim packs is allowed;

7.3.5.3 The Contractor must confirm the winding data of field coils, (which contains a shunt and indirect series winding on the same pole);

7.3.5.4 The Contractor must remove both field coils from the pole ensuring the pole iron is clean and straight, with no nicks or burrs, before applying ground wall insulation;

7.3.5.5 The Contractor must wind both coils using new class H insulated copper, new Class H ground wall insulation and new Class H glastic insulating washers. When winding field coils a thermally conductive epoxy must be applied between layers of conductors. Any gaps between washers and ground wall insulation must be sealed.

7.3.5.6 The Contractor must install newly insulated compensating bars. The compensating bars must be insulated with a Dacron Mica Dacron based wrapper and an outer layer of armour glass tape. Insulated bars must fit tightly in slots. A masking/ release compound must be applied to the ends of bars where the brazed connections are to be made;

7.3.5.7 The Contractor must remove the interpole coils from the iron, remove the insulation from the coils and the pole iron. All copper conductors must be inspected for cracks and copper fatigue. If no damage is found to the copper, they can be reused;

7.3.5.8 The Contractor must reinsulate the interpole iron with new Class H Nomex paper and must reinsulate the interpole coils with Class H blocks and spacers and install new hardware.

7.3.5.9 The Contractor must use 2 VPI and oven cure cycles for the field coils and interpole coils as previously described.

7.3.5.10 The Contractor must replace diverter resistors;

7.3.5.11 The Contractor must clean, inspect and repair any damage to all fiberglass covers. The covers must be painted with an epoxy enamel paint.

7.3.6 Assembly for Magnet Frame Coils and Poles

7.3.6.1 The Contractor must install field poles and interpoles using the same shims that were removed in the same order and orientation. All shims must be cleaned prior to installation.

7.3.6.2 The Contractor must braze the compensating bars to jumpers with sil-phos brazing rods (minimum 15% silver). Ensure mating surfaces are clean down to bare copper and that there is no air gap between components to be brazed together.

7.3.6.3 The Contractor must join the compensating jumper bar at frame splits using new insulators and hardware.

7.3.6.4 The Contractor must assemble the top and lower magnet frames and measure and record the diameter between diametrically opposite pole pairs (fields and interpoles) at forward and aft ends

7.3.6.5 The Contractor must paint the finished magnet frame and coils with thermal epoxy insulating enamel.

7.3.7 Electrical Testing of Magnet Frame Winding

7.3.7.1 Field Coils

7.3.7.1.1 The Contractor must check each coil for shorted turns by means of resistance and impedance test before and after VPI impregnation and curing. The Contractor must perform a surge comparison test between pairs of coils. The following parameters must be achieved:

- Resistance must be plus or minus 5% of the average.

7.3.7.1.2 The Contractor must megger each coil to ground at 1000 volts before the high potential test.

7.3.7.1.3 The Contractor must perform a high potential test each field coil to ground at 3500 volts AC momentary.

7.3.7.2 Compensating Bars

7.3.7.2.1 The Contractor must megger each compensating bar to ground at 1000 volts before the high potential test and record all readings.

7.3.7.2.2 The Contractor must perform a high potential test each at 4200 volts AC momentary.

7.3.7.3 Interpoles

7.3.7.3.1 The Contractor must check each coil for shorted turns by means of resistance and impedance test before and after VPI and curing. A surge comparison test must be performed between pairs of coils after curing.

7.3.7.3.2 The Contractor must megger each coil to ground at 1000 volts before the high potential test

7.3.7.3.3 The Contractor must perform a High potential test each at 4200 volts AC momentary.

7.3.7.3.4 All the above mentioned must be included in the Contractor's final report to be provided to both the IA and the TA.

7.3.7.4 Information on the Magnet Frame for Quotation Purposes

7.3.7.4.1 There are 12 compensating bars per field pole and 6 field poles. Compensating bars are approximately 0.22" wide by 2.0"high;

7.3.7.4.2 The shunt field coil contains 700 turns of #9 (0.1144" diameter) copper wire that is insulated. Approximate overall coil size is 14.0" wide by 21.12" long.

7.3.7.4.3 The indirect series field coil contains 28 turns of 0.080" by 0300" insulated rectangular copper.

7.3.7.4.4 There are 6 interpole coils, each consisting of 0.375" by 1.0" flat copper, 2 conductors in parallel and 7 turns per coil. Approximate overall coil size is 4.88" wide by 22.12" long.

7.3.7.4.5 There are 3 heaters, Chromolox Finstrip Element Cat # SEF-190 rated115volts and 1000 watts each.

7.3.8 Generator Auxiliaries

7.3.8.1 The Contractor must perform the following work on the generator auxiliaries:

- Clean all terminal boxes and replace any insulating dividers;
- Replace all space heaters;
- Replace all wiring to auxiliaries, including all terminal blocks and rails;
- Replace all lighting fixtures if any signs of deterioration is observed;
- Replace all temperature sensors.

7.3.9 Generator Bearing Overhauls

7.3.9.1 The Contractor must remove the pedestal bearings, dismantle and clean them.

7.3.9.2 The Contractor must replace or re-babbitt the bearing shells and provide a report detailing the bonding of the babbitt to the bearing shell.

7.3.9.3 The Contractor must fit the shells to the armature shafts and must obtain a minimum 85% contact area between the shaft and the bearing shell.

7.3.9.4 The Contractor must re-insulate the pedestals and machine the bearing hold down bolts.

7.3.9.5 The Contractor must replace all insulating shims and/or materials with new material.

7.3.9.6 The Contractor must re-install the bearings and align them using a laser alignment method. All “As-left” bearing clearances must be recorded.

7.3.10 Installation and Generator Assembly

7.3.10.1 The Contractor must be responsible for the handling of the armature, magnet frames, brush gear and interpole coil assemblies to the area of the ship for assembly of the DC generators. The Contractor must provide all necessary rigging apparatus, support members, protective materials, Safety Engineering and personnel to ensure proper and safe movement of the armature/rotors and field coils.

7.3.10.2 The Contractor must provide the services of a qualified Field Service Representatives to assist with the assembly of the DC Generators.

7.3.10.3 The Contractor must supply all required materials (gaskets, fasteners, and other mounting hardware) as required for the assembly of the propulsion generators.

7.3.10.4 The Contractor must provide new terminal blocks, new wiring and splices for the internal generator component connections.

7.3.10.5 The Contractor must provide new brushes and springs. In addition the Contractor must supply two complete sets of spare brushes.

7.3.10.6 The Contractor must repair, repaint, apply new hardware and reseal the DC generator fiberglass housings and access doors. Note numerous threaded cover securing bolt threads are stripped. All hardware to be minimum Grade 5 zinc plated.

7.3.10.7 The Contractor must be responsible for the final generator assembly and for the alignment of the generator shaft to the flywheel coupling of each generator. Final crankshaft deflections must be taken and recorded.

7.3.10.8 The Contractor must perform final Megger testing of all components, following the same procedure as when generator was disassembled, prior to connection of power cables and the insertion of the brushes into brush holders.

7.4 Proof of Performance

7.4.1 Inspection

7.4.1.1 The Contractor must prepare a final condition report of the equipment after placement onboard the vessel and prior to final installation and closing up of the equipment. This condition report must include but not be limited to the following:

- Final alignment readings of the generator armature shaft flanges to engine flywheel.
- Final alignment readings of each generator journal bearing;

- Final air gap readings between generator armatures and stators;
- Final Megger results for each generator component tested;
- Final brush spring tension reading for each brush location.

7.4.2 Testing, Commissioning, and Trials

7.4.2.1 The Contractor must provide both the TA and the IA with a list of all systems and services disturbed or dismantled during the propulsion generator overhaul. The Contractor must develop operational test and calibration procedures for the disturbed services to prove them fully functional after the completion of the generator overhaul work. The operational test and calibration procedures must be submitted for review by the TA prior to any testing and calibration of the affected services.

7.4.2.2 The propulsion generators must meet or exceed the performance specifications set out on the original generator test certificates. The Contractor must make reference to IB 3500-50A D.C. Generators and Generators Instruction book from Westinghouse Canada (Part 2, Section 5 of the Propulsion Control Manual – attached in electronic PDF format) when performing final set up of the DC propulsion generators.

7.4.2.3 DC Propulsion Generator Tests

7.4.2.3.1 The Contractor must develop specific trial procedures in order to test the full functionality of the propulsion generators and associated systems. The tests described below may be incorporated into the ship's sea trials requirements after the propulsion motor and affected systems have been proven fully functional. The Propulsion Generator test and trials must include but not be limited to the following tests:

7.4.2.3.2 For Each DC Propulsion Generator:

- Initial rotation of the propulsion generator via the turning gear to ensure the armature and shaft rotate freely;
- One generator connected to each motor bus:
- Initial minimum application of power to the generator field to cause the motor to rotate in the ahead direction;
- Initial minimum application of power to the generator field to cause the motor to rotate in the astern direction;

- Ahead Direction
    - Application of power for ¼ shaft speed for 30 minutes;
    - Application of power for ½ shaft speed for 30 minutes;
    - Application of power for ¾ shaft speed for 30 minutes;
    - Application of power for full shaft speed for 30 minutes;

- Two generators connected to each motor bus to determine load sharing:

- Ahead Direction
  - Application of power for ¼ shaft speed for 5 minutes;
  - Application of power for ½ shaft speed for 5 minutes;
  - Application of power for ¾ shaft speed for 5 minutes;
  - Application of power for full shaft speed for 30 minutes;

- Astern Direction
  - Application of power for ¼ shaft speed for 5 minutes;
  - Application of power for ½ shaft speed for 5 minutes;
  - Application of power for ¾ shaft speed for 5 minutes;
  - Application of power for full shaft speed for 5 minutes;

7.4.2.3.3 During each phase of the testing the following data must be recorded for each generator:

- Diesel Speed;
- Field Current;
- Field Voltage;
- Armature Current;
- Armature Voltage;
- Cooling Water Temperature In;
- Cooling Water Temperature Out;
- Cooling Air Temperature;
- Winding Temperature;
- Bearing Temperature.

7.4.2.4 Crash Stops

- One (1) generator connected to each motor bus:
  - Full Speed Ahead to Stop;
  - Full Speed Astern to Stop;
  - Full Speed Ahead to Full Astern:
  - Full Seed Astern to Full Speed Ahead.

- Two (2) generators connected to each motor bus:
  - Full Speed Ahead to Stop;
  - Full Speed Astern to Stop;
  - Full Speed Ahead to Full Astern;
  - Full Speed Astern to Full Speed Ahead.

7.4.2.4.1 Each of the above tests must be performed satisfactorily a minimum of two times. In addition to the above listed data, the following must also be recorded for the crash stops:

- Wind Speed
- Wind Direction
- Vessel Speed at start of test
- Vessel Speed at completion of test
- Time required to complete test (especially full ahead and full astern to stop)
- Time required to stop the vessel under full crash reversal (full ahead to full astern and vice versa).

7.4.2.5 Heat Run

7.4.2.5.1 One generator must be connected to one motor. After the successful completion of the above tests, the generators must be subjected to an 8 hour heat run at 100% rated load. This is to be followed immediately by a 2 hour run at 110% rated load to determine the temperature rise within the motor windings. The following data must be recorded at ½ hour intervals and the winding temperatures immediately upon shut down at the completion of the heat run.

- Shaft Speed;
- Field Current;
- Field Voltage;
- Armature Current;
- Armature Voltage;
- Cooling Water Temperature In;
- Cooling Water Temperature Out;
- Cooling Air Temperature;
- Bearing Temperature;
- Winding Temperature;

7.4.2.5.2 The Contractor must make reference to the original generator trial certificates as documented in the Westinghouse Certificates Book for the Griffon (Electronic copy in PDF format attached).

7.4.3 Final Acceptance after Testing

7.4.3.1 The generator armatures and field coils must meet the following minimum requirements:

- Minimum Insulation Resistance Values at 25deg C/1000 Volts DC
- Armature and Interpole/ Compensating Winding : 1000 Megohms
- Field Coils: 500 Megohms

7.4.4 Certification

7.4.4.1 Provide details for certification of equipment items – i.e. TCMS sign offs, Classification certifications etc.

7.5 Deliverables

7.5.1 Documentation

7.5.1.1 The Contractor must provide the documentation in the following format:

- All calculations, readings, and reports must be provided in electronic format in either MS WORD or MS Excel format. These must also not be password protected and must be provided on USB key media.
- All drawings must be provided in electronic format in AutoCAD 2005 or later DWG format. Drawings must not be password protected and must be provided on USB key media. Paper format must standard ANSI format in C, D, or E size format.

8.0 PROPULSION SYSTEM SURVEY

8.1 Identification

8.1.1 The Griffon's propulsion system is due for TCMS survey. In addition there are some control issues to be investigated.

8.1.2 The survey must involve the various propulsion control system components and all 8 exciters (drives).

8.1.3 The Contractor must perform routine maintenance and conduct a condition assessment of the propulsion system components in order to obtain this TCMS survey credit.

8.1.4 As part of the work, the Contractor must inspect and calibrate all fitted system shunt SVIA current/voltage isolators (6) and SVAA voltage attenuators (6).

8.1.5 This work must be done concurrent with SOW Items 10.0: Replacement of Propulsion Motor Tacho-Generators and Specification Item 9.0: Survey of Propulsion Overcurrent Protection System.

8.1.6 The Contractor must also calibrate the voltage speed signal from the new tachogenerators into the propulsion control system.

8.2 References

8.2.1 Drawings

Drawing Number	Drawing Title	Electronic File Name
	GE Propulsion System Drawings	Griffon Propulsion Drawings.pdf
	Drive System Propulsion Audit – by GE 2013	2013 Prop System Report by GE.pdf
GE-100027	Application and Replacement Instructions for SVIA Shunt Isolator Board	GE SVIA Shunt Isolator Board.pdf
GE-100187	Replacement Procedure for SVAA Voltage Attenuator Board	GE SVAA Attenuator Board.pdf
03-D84702084-1 shts 0-13	Griffon Propulsion Exciters Interconnect Diagram	03D84702084-1.pdf

8.2.2 Standards

- TP 127, Ships Electrical Standards, Latest Edition

8.2.3 FSR Contact Information

Lyne Gloutnay
Coordonnatrice – Field Service Coordinator
GE Énergie
Solutions Industrielles
ECRA/ESA Lic 7010935
T: 450-688-8690 ext :222
C: 514-604-6479
F: 450-688-4730
lyne.gloutnay1@ge.com
3060, rue Peugeot
Laval, Québec H7L 5C5
Générale Électrique du Canada International Inc

8.3 Technical Description

8.3.1 Propulsion Control System

8.3.1.1 The Contractor must provide the services of a General Electric Controls Technician to aid in the testing of the propulsion control system and circuitry. This must include the inspection and verification of the mechanical and electrical condition of the following propulsion system components such that a TCMS Survey credit can be obtained:

- Item 3E022 Port Outboard Propulsion Generator Exciter GF 2000.
- Item 3E023 Port Inboard Propulsion Generator Exciter GF 2000.
- Item 3E024 Starboard Inboard Propulsion Generator Exciter GF 2000.
- Item 3E025 Starboard Outboard Propulsion Generator Exciter GF 2000.
- Item 3E026 (duplicate 3E030) Propulsion Generator Spare Exciter GF 2000.
- Item 3E031 Port Propulsion Motor Exciter GM 2000.
- Item 3E032 Starboard Propulsion Motor Exciter GM 2000.
- Item 3E033 Propulsion Motor Spare Exciter GM 2000.

8.3.1.2 The Contractor must perform the following work:

a) All exciter cabinets and fitted components must be cleaned of all visible dust;
b) The GF/GM 2000 drives must be cleaned of all visible dust.
c) All electrical connections to the exciter must be verified as being secure. In the event of broken connections, the entire ribbon cable must be replaced and will be negotiated with a 1379 form. All

connections must have Nyogel electrical lubricant and protection grease applied. All connections must be potted secure to resist vibration.

d) The cooling fan must be replaced on each exciter drive unit except the two spare units. The cooling fan model to be as fitted on board.
e) All exciter units to be tested for correct operation.
f) Spare propulsion generator exciter unit must be shown fully functional in parallel operation with each propulsion generator. Load balance between all units and the spare exciter must be equal.
g) Spare propulsion motor exciter to be shown fully functional in operation with each motor.
h) Correct operation of the cross-connection capability of both the starboard engines on both propulsion motors and port engines on both propulsion motors must be proven during dock trials and sea trials.
i) Contractor to verify software installed on GF/GM drives backed up to ship's laptop computer.
j) A report of all findings on each exciter to be prepared and provided to the IA and the TA.
k) A survey credit for each exciter must be obtained from TCMS for the Division III continuous survey. The Contractor is responsible for coordinating all TCMS inspections.

8.3.1.3 The Contractor must perform the following work on the Port and Starboard propulsion control systems (TC Survey Item 3E029 Propulsion Control System):

a) Port and Starboard UC 2000 units to be cleaned of visible dust.
b) All electrical connections to the UC units unit verified secure.
c) The cooling fan to be replaced on each UC.
d) All UC units to be tested for correct operation.
e) The redundancy of the UC 2000 communication must be tested by operation of the system on only one UC. This must be verified on both the Port and Starboard UC. The cable to connect for this redundancy option is laying loose at the bottom of the exciter cabinets containing the UC’s cabinets.
f) All electrical connections to be GE90-30 PLCs and I/O modules verified secure.
g) Batteries of the two GE90-30 PLCs to be replaced. All batteries must have a recent date code. The Contractor must supply 2 spare batteries to the IA.
h) Contractor to verify software installed on UCs and PLCs backed up to ship's laptop computer.

i) A report of all findings on the Propulsion Control System must be prepared and provided to the IA and the TA.
j) Propulsion control system must be presented to TCMS for survey credit.

8.3.1.4 The Contractor must connect the new Port and Starboard Propulsion Motor Tacho-Generators to the Propulsion Control System. This must include verification of the voltage signal polarity and calibration of the voltage output signal with respect to propulsion shaft speed and direction.

8.3.1.5 The inspection of the Propulsion Control System must also include the verification and calibration, as required, of any circuit protective devices within the system. Upon completion of the inspection, the General Electric Technician must provide a written statement indicating that the propulsion control system is fully functional, calibrated and operating within its parameters as designed such that the attending TCMS survey can sign off the continuous survey requirements for the propulsion control system.

8.3.2 Propulsion System Current Isolators and Voltage Attenuators

8.3.2.1 The location of the isolators and attenuators are in the Propulsion Motor Room breaker cabinets - port and starboard side.

8.3.2.2 The Contractor must verify the calibration of the six SVIA Shunt Isolator Boards. The SVIA boards are GE Cat #336A348G2.

8.3.2.3 The six current shunts are being renewed as part of Section 9.0 Inspection of Propulsion Overcurrent Protection System. Calibration of the SVIA Shunt Isolator board is must be done with the new shunts installed.

8.3.2.4 The isolators are must be verified functional and properly calibrated as per the reference documentation (note that the reference document is from 2003).

8.3.2.5 The Contractor must verify the accuracy of the six SVAA Voltage Attenuators as per reference documentation. The SVAA boards are GE Cat #336A3459G2.

8.3.2.6 The attenuators are to be verified functional and providing the rated attenuation. The actual attenuation of each unit must be noted and adjustments made at the respective exciter DCFB boards to accommodate for attenuation inaccuracy. If the attenuation error is outside of the specification for the unit, the attenuator must be replaced by a Contractor supplied new unit on 1379.

8.4 Proof of Performance

8.4.1 Inspection

8.4.1.1 All work must be inspected by both the attending TCMS inspector and the AI.

8.4.1.2 The Contractor must prove that the propulsion control system is functional. This must include a sea trial. This sea trial must demonstrate the following conditions functional (for acronyms see supplied GE propulsion system audit report):

- POG alone
- POG master PIG slave
- PIG alone (port side)
- PIG master POG slave
- PIG alone (cross connected to starboard side)
- SOG alone
- SOG master SIG slave
- SIG alone (starboard side)
- SIG master SOG slave
- SIG alone (cross connected to port side)
- AXG on single POG on motor @1/2 ahead
- AXG on single PIG on motor @1/2 ahead
- AXG on single SIG on motor @1/2 ahead
- AXG on single SOG on motor @1/2 ahead
- AXG on POG, 4 engines @ full speed
- AXG on PIG, 4 engines @ full speed
- AXG on SIG, 4 engines @ full speed
- AXG on SOG, 4 engines @ full speed
- PME on line
- SME on line
- AME as PME on motor @1/2 ahead
- AME as SME on motor @1/2 ahead

8.4.1.3 For each condition, the Contractor must record:

a) Generator voltage, current, and field current
b) Motor voltage, current, field current, and RPM.

8.4.1.4 This functional demonstration is to be done in the presence of the IA and the TCMS Inspector.

8.5 Deliverables

8.5.1 Documentation

8.5.1.1 The Contactor must provide 3 paper copies and one electronic (PDF) copy of the GE Representative's report which must include a minimum of:

- The condition, findings and settings of the propulsion control system for the Griffon.
- The results and settings of the current isolator and voltage attenuator calibration.
- The propulsion readings recorded during sea trials.
- All miscellaneous repairs made.

8.5.1.2 This report must be provided to the IA and the TA prior to sea trials.

9.0 PROPULSION OVERCURRENT PROTECTION SYSTEM

9.1 Identification

9.1.1 The overcurrent protection system for the main propulsion system is due for TCMS survey. As such the Contractor must obtain a TCMS survey credit for the six main circuit breakers fitted as part of the system protection.

9.1.2 TCMS also requires calibrated shunts to test the circuit breakers using secondary injection. The Westrip DC2000 trip units fitted to each breaker require accurate and calibrated signals to satisfy TC requirements. New calibrated shunts will be GFM and must be installed at this time.

9.1.3 Additionally, the propulsion motor current shunts have not been replaced since 2003. They must be replaced with new GFM calibrated shunts.

9.2 References

9.2.1 Drawings

Drawing Number	Drawing Title	Electronic File Name
	GE Propulsion System Drawings	Griffon Propulsion Drawings.pdf
	20133 Report on the DC Circuit Breaker overhaul	2013 DC Breaker Report.pdf
PRE-314	Shunt (Prop. Gen.)	PRE-314.pdf
90000-1277	3000 AMP 50 MV Shunt (Prop Mtr)	9-1277.pdf

9.2.2 Standards

- TP 127, Ships Electrical Standards, Latest Edition

9.2.3 Main Circuit Breaker Details

- Manufacturer: ITE
- Type: FB-20
- Frame Size: RMV-1000VDC, 2000A
- Serial Numbers: 20-302 through 20-307
- Westrip DC-2000 trip units, S/N: 22015 through 22020

9.2.4 TCMS Division 3 Report Items

- 3E028 – Propulsion Overcurrent System
- 3E034 – Starboard Inboard Prop Generator Circuit Breaker
- 3E035 – Starboard Inboard Propulsion Generator Circuit Breaker (X Conn)

- 3E036 – Starboard Outboard Propulsion Generator Circuit Breaker
- 3E037 – Port Inboard Propulsion Generator Circuit Breaker (X Conn)
- 3E038 – Port Inboard Propulsion Generator Circuit Breaker
- 3E039 – Port Outboard Propulsion Generator Circuit Breaker

9.3 Technical Description

9.3.1 Main Circuit Breaker Testing and Inspection

9.3.1.1 Prior to removal, the Contractor must clearly mark and label all primary and secondary circuits connected to the circuit breakers. All circuit breakers must be returned to the same location from which they were removed.

9.3.1.2 The Contractor must remove all 6 circuit breakers from the breaker cabinets for inspection.

9.3.1.3 The Contractor must perform a visual check of the 6 fitted circuit breakers. This inspection must include:

- Bus bar connections - condition and tightness.
- Main contact condition. Identify and record any hotspots.
- Cleanliness - clean as required.
- Arc chute condition.
- Wiring connection tightness.
- Condition of wiring (note we have had issues with breaking of wires to the moving holding coil).
- Condition of insulation components.
- Megger testing of electrical components.

9.3.1.4 The Contractor must immediately report any defects to the IA and to the TA. Any agreed to repairs will be negotiated via the 1379 process.

9.3.1.5 The Contractor must lubricate all moving parts of the circuit breaker as required.

9.3.1.6 The Contractor must test the six main circuit breakers fitted to the Griffon's propulsion system. The testing may be done in situ, on board the Griffon, or at the Contractor's facility.

9.3.1.7 The Contractor will be responsible for removal and installation of the breakers as required.

9.3.1.8 If the Contractor removes the circuit breakers from the ship, the Contractor is responsible for all transportation to / from the Contractor's facility, including all associated costs. All circuit breakers must be protected from any damage during the time that they are in the care and custody of the Contractor for this portion of the specification. All damage must be repaired by the Contractor at its expense.

9.3.1.9 The Contractor must provide calibration certificates for all test equipment.

9.3.1.10 The circuit breaker trip setting must be verified and tested in the presence of the IA and a TCMS surveyor.

9.3.1.11 Secondary injection must be used to verify the setting and working of all breaker trip mechanisms.

9.3.1.12 Circuit breaker testing must be done to the satisfaction of the attending TCMS surveyor. The Contractor is responsible for coordinating all TCMS inspections.

9.3.1.13 For each breaker, a minimum testing will consist of:

- The circuit breakers must be inspected for any mechanical and electrical defects. Any defects noted must be brought to the immediate attention of the IA and the TA. Any approved repairs will be negotiated using the 1379 process.
- Long time, short time, and instantaneous trip functions must be tested. Test results and breaker trip relay indications must be recorded.
- Contact resistance of the two poles must be measured and recorded.
- Megger testing of all breakers: phase to ground, phase to phase when the breaker is closed, and line to load when the breaker is open.

9.3.2 Propulsion Generator Shunt Replacement

9.3.2.1 This must be done in conjunction with the survey of the GE Propulsion Control System as the outputs to these shunts also feed into the propulsion generator current/voltage isolators for generator current feedback. The calibration of the current/voltage isolators must be done after the new shunts have been installed.

9.3.2.2 The Contractor must install four new shunts in the propulsion system. These shunts are GFM and will be direct replacements for the four shunts which provide input to the trip units of the circuit breakers.

9.3.3 Propulsion Motor Shunt Replacement

9.3.3.1 This must be done in conjunction with the survey of the GE Propulsion Control System as the outputs to these shunts feed into the propulsion motor current/voltage isolators for current feedback. The calibration of the current/voltage isolators must be done after the new shunts have been installed.

9.3.3.2 The Contractor must install two new shunts in the propulsion system. These shunts are GFM.

9.4 Proof of Performance

9.4.1 Inspection

9.4.1.1 The Contractor must prove that the propulsion control system is functioning properly upon re-installation of the main circuit breakers and that all circuit breaker controls and interlock functions work. This must be done in the presence of the TCMS Surveyor and the IA.

9.5 Deliverables

9.5.1 Documentation

9.5.1.1 The Contractor must provide a written report of all circuit breaker inspections and test reports detailing the condition of the circuit breakers and any faults found with the circuit breakers. The report must also detail any repairs made or parts replaced.

9.5.1.2 The Contractor must provide a detailed report of the electrical testing of the circuit breakers. This report must also include the calibration documentation for the test equipment.

9.5.1.3 The Contractor must provide details of the propulsion control system adjustments made after the installation of the generator and motor shunts.

9.5.1.4 The Contractor must provide 3 paper copies of the report as well as an electronic copy in PDF format (unprotected). Copies of the report must be provided to the IA and the TA prior to sea trials.

10.0 PROPULSION MOTOR TACHOGENERATOR REPLACEMENT

10.1 Identification

10.1.1 The Contractor must replace the tachogenerator units fitted to the forward end of the Port and Starboard Propulsion Motors with new GFM units and gearboxes. These units provide an RPM feedback signal to the propulsion control system and the services of a GE Service Technician will be required to perform the calibration of the new units and the existing propulsion control system.

10.1.2 The work includes removal of the existing equipment, modification to base and mounting arrangements to accept the new equipment, installation of 2 new tacho/gearbox assemblies, laser alignment of gearboxes to their respective propulsion motor, laser alignment of tacho shaft to gearbox, modification to covers and trials and calibration of connected equipment.

10.2 References

10.2.1 Drawings/Documentation

Drawing Number	Description	Electronic Number
359B7019CA shts 0C1, 4HA, 7HA	Griffon Propulsion Control Drawings – Propulsion Control System Block Diagram	Griffon Propulsion Drawings.pdf
759C556	D.C. Motor Speed Sensing Device Assy	759C556.TIF
	BG Series Shear Type Shaft Coupling	p-1930-bg pg 103.pdf
	R100 Spiral Bevel Gears	p-1485-bg section M.pdf
	BG R131-B outline drawing	R131-B line dwg.pdf
X7A006Z	Baldor Electric Co. Ly, Tach XC46 100VDC/1000 RPM w/Base	X7A006Z.pdf

10.2.2 Standards

- TP 127E, Ships Electrical Standards, latest version.

10.2.3 Equipment Data

10.2.3.1 The tachogenerators are small direct current (D.C.) generators that produce a D.C. voltage signal proportional to speed and direction of rotation. They are driven by the propulsion motor shaft through a 90-

degree angle speed reducer (gearbox) via elastomeric flexible shear-type couplings. The tacho-generator, gearbox, and couplings are original to the propulsion system and are no longer supported.

10.2.3.2 The tachogenerators provide RPM feedback to the following pieces of equipment on each side of the propulsion system:

- MCR Motor Tachometer
- Bridge Center Console Shaft Tachometer
- Bridge Port Wing Shaft Tachometer
- Bridge Stbd Wing Shaft Tachometer
- Outboard Generator Exciter (Speed Feedback)
- Inboard Generator Exciter (Speed Feedback)
- Standby Generator Exciter (Speed Feedback) when connected into the system.

10.2.3.3 These pieces of equipment will require calibration once the new tacho-generators are fitted. This can only be done during sea trials. Therefore, all calibration in this specification must be done concurrently with the sea trials of the vessel.

10.2.3.4 Existing Equipment:

Permanent Magnet DC Tacho-Generator:
Mfg: Associated Electrical Industries Ltd
Type: BD2510B
O.C.V./RPM: 0.1 V
Max. RPM: 4000
Max. Amp: 0.25
No: FM8736/15 TPL

Coupling:
Dynaflex Shear-Type Coupling: Model #J1211-5 (Lord Corp., Erie ,PA)
(.625” shaft in - .500” shaft out)

Angled Gearbox:
Mfg: Boston Gear Work, Quincy, Mass.
Cat. No. 131-J19
MTG: BOM1
Ratio 1:1
Input: 1750 RPM
Max. H.P. 3.6
3 shafts all .500” OD

Zero Speed Switch:
Cat No. 2220 111CC1B

300V
Mfg: Euclid Electric Manufatcuring Co., Madison, Ohio.

Drive shaft from propulsion motor:
Shaft O.D.: 0.500”
Drive Coupling: Dynaflex Shear-Type Coupling: Model #J1211-5-3 (Lord Corp., Erie ,PA) (.500” shaft in - .500” shaft out)

10.2.3.5 New Equipment:

Permanent Magnet Generator, 2 ea:
Mfg: Baldor
Model: X7A006Z
Duty: Cont.
Max. Amb.: 65 deg.C
100V per 1000 RPM
Amps 1.0
Shaft size: 0.625”

Drive Coupling, 2 ea:
Mfg: Boston Gear, Charlotte, N.C.
Type:BG Series Shear-type
Model: BG-11-5-8-10
Bore: Shaft In 0.500” – Shaft Out 0.625”

Angled Gearbox, 2 ea:
Mfg: Boston Gear, Charlotte, N.C.
Cat. No.: R131 BOM1
Ratio 1:1
Input 1750 RPM
Max. H.P. 4.2
3 shafts, all OD 0.500”

Drive shaft from propulsion motor:
Shaft O.D.: 0.500”

Drive Coupling, 2ea:
Mfg: Boston Gear, Charlotte, N.C.
Type:BG Series Shear-type
Model: BG-11-5-8-8
Bore: Shaft In 0.500” – Shaft Out 0.500”

10.3 Technical Description

10.3.1 General

10.3.1.1 These specifications apply to the tachogenerator installations of the Port and the Starboard Propulsion Motors.

10.3.1.2 All work must be completed in accordance with the manufacturer`s recommendations.

10.3.1.3 All new and disturbed metal must be coated with 2 coats of Interprime 198 marine primer and 2 coats of Interlac 665 Light Grey Marine enamel Primer and paint must be applied according to the manufacturers recommended practice including surface preparation, application thickness, and drying time between applications.

10.3.2 Removals

10.3.2.1 The Contractor must remove and discard of the existing tachogenerator covers.

10.3.2.2 The Contractor must observe the polarity of the tachogenerator with reference to rotation and wire marking. For clockwise rotation, one wire must be marked positive and the other wire marked negative. The same polarity in relation to direction of rotation must be observed when installing the new units. This information must be recorded and submitted in a work report at the completion of work.

10.3.2.3 The Contractor must disconnect the wiring from the tachogenerator and remove the cables from the wire way to secure them out of the way of the hot work. These cables must be reused.

10.3.2.4 The Contractor must disconnect the zero speed switch and remove and discard all cabling associated with this circuit back to the propulsion motor connection box.

10.3.2.5 The Contractor must release and remove the zero speed switch, tachogenerator and angled gearbox. The removed tachogenerators and angled gearboxes must be returned to the IA. The removed zero speed switch must be disposed of by the Contractor once final testing of the equipment has been accepted.

10.3.3 Installation

10.3.3.1 The Contractor must modify the mounting arrangement for the tachogenerator/angled gearbox to the propulsion motor as required to maintain the driveline on center with the center of the propulsion shaft.

10.3.3.2 The Contractor must modify the existing tachogenerator base such that the new angled gearbox aligns with the center point of the propulsion motor shaft.

10.3.3.3 The Contractor must ensure the modified base is such that the new tachogenerator aligns with the angled gearbox.

10.3.3.4 The Contractor must fabricate a stainless steel protective cover that bolts over the new installation. The cover must have open ends and must have a ¼" thick bolted plexiglass window built over the tachogenerator coupling thus allowing the watch keepers to easily inspect the coupling.

10.3.3.5 The Contractor must apply primer and marine enamel coatings to all new and disturbed metal.

10.3.3.6 The Contractor must install the new tachogenerators and angled gearboxes onto the modified mount.

10.3.3.7 The Contractor must laser align the gearbox shaft to the motor drive shaft and the gearbox shaft to the new tachogenerator shaft. The Contractor must be responsible for all shimming required to achieve proper alignment. Results of the final alignment must be recorded and included in the final work report.

10.3.3.8 After alignment has been approved by the IA, the gearboxes and tachogenerators must be secured with 2 dowel pins each.

10.3.3.9 The Contractor must fill the gearboxes to the appropriate working level with GFM Klubersynth UH1-6-460 gear oil prior to trials.

10.3.3.10 The Contractor must reconnect the tachogenerator wires to the new unit using new metal watertight cable glands at the junction boxes. The glands will be Contractor supplied.

10.3.3.11 The Contractor must co-ordinate this SOW item with SOW Item 8.0: Propulsion System Survey. The GE Controls Technician performing the Propulsion Control Survey must ensure that the tachogenerator signals are properly calibrated into the Propulsion Control System.

10.4 Proof of Performance

10.4.1 Inspection

10.4.1.1 The Contractor must demonstrate to the IA the correct polarity of the wiring connection prior to completing the installation.

10.4.1.2 The Contractor must submit the completed work to inspection by the IA and TCMS prior to installing the cover.

10.4.2 Testing

10.4.2.1 The Contractor must demonstrate to the IA and attending TCMS inspector that all propulsion equipment mentioned in section 10.2.3 above has been properly calibrated with the new tachogenerators.

10.4.2.2 The Contractor must test the proper operation of the tachogenerators during sea trials and make all necessary adjustments.

10.5 Deliverables

10.5.1 Documentation

10.5.1.1 The Contractor must provide a report detailing all work carried out, all measurements/readings taken, alignment results including the thickness of shims used and polarity documentation. This report must also include all adjustments made to the propulsion system. The Contractor must provide three paper copies of the report and 1 electronic version (PDF).

10.5.1.2 The Contractor must submit all certificates for materials used.

10.5.1.3 The Contract must submit proof of calibration for the laser alignment tool used.

10.5.1.4 All manuals for installation and operation of the GFM components must be returned to the IA after the installation and testing is complete.

11.0 PROPULSION MOTOR SURVEY

11.1 Identification

11.1.1 The Griffon's two propulsion motors are due for Transport Canada Marine Safety survey.

11.1.2 Both machines must be inspected by a certified electrical contractor and their condition assessed. The electrical contractor must be able to demonstrate previous experience in the assessment and survey of D.C. Propulsion Motors greater than 1000kW to TCMS standards.

11.1.3 This work must be done concurrently with the Propulsion Motor Blower Inspection work (Section 12.0).

11.2 References

11.2.1 Drawings

Drawing Number	Drawing Title	Electronic File Name
749C089-1	Re-Drawn Westinghouse Elementary Diagrams	749C089-1.pdf
	Griffon Propulsion Drawings	Griffon Propulsion Drawings.pdf
03-D84702084-1	GE – Engineering Services Interconnect Diagrams for CCG Project Griffon	03-D8470284-1.pdf
529F077	2000 S.H.P. Propulsion Motor Main Assembly	529F077.TIF
640J774	DC Machine Type Q FR EE 626-6 General Assembly	640J774.tif 640J774 -2.tif
169D046	D.C. Motor Stator	169D046.TIF
169D655	D.C. Motor Devices and Connections	169D655.TIF
38068-3	Michell Horizontal Journal Bearing (Motor)	38068-3.TIF
38069-4	"Certified for Construction" Michell Horizontal Journal Bearing (Motor)	38069-4.TIF

11.2.2 Documents

Document Title	Electronic File Name
Westinghouse Instr. Book No CD-4530, Part II, Sect. I, Propulsion Motors	Part II - Section 1 - Propulsion Motors.pdf

11.2.3 Standards

- TP 127, Ships Electrical Standards, Latest Edition

11.2.4 Propulsion Motor Details

- Westinghouse 2000/2500HP, 833/900 VDC, 1910/2220 Amps.

11.2.5 TCMS Division 3 Report Item

- 3E002 Port Propulsion Motor
- 3E007 Starboard Propulsion Motor

11.3 Technical Description

11.3.1 General

11.3.1.1 All readings must be taken before and after cleaning to indicate the “as found/existing” condition of the machine and the “as left/post-cleaning” condition of the machine.

11.3.2 Propulsion Motor Inspection Items

11.3.2.1 The Contractor must perform the following described work to obtain a TCMS Division 3 survey credit for the Propulsion Motors. The Contractor is responsible for coordinating all TCMS inspections.

11.3.2.2 The Contractor must perform a visual inspection of each machine and must inspect the following points:

- Commutator surface condition;
- Armature winding condition - mechanical and insulation condition;
- Armature core and spider condition;
- Stator frame and structure;
- Brushes and brush gear - brush length and spring tension to be measured;
- Field poles and connections;
- Shaft bearings;
- All sandwich connections condition;
- Lighting circuit condition;
- Heating circuit condition;
- Sensors and wire lead condition.

11.3.2.3 The Contractor must take and record a megger reading of each machine’s armature, stator windings and main supply cabling to the propulsion switch gear. During the cable check, both line to line and line to ground reading must be taken for all cables. Megger readings must be corrected to 20ºC. PI readings are to be corrected to 20°C.

11.3.2.4 The Contractor must take and record the Polarization Index (PI) insulation readings of each machine's armature winding, stator windings and the main supply cabling to the propulsion switchgear.

11.3.2.5 The Contractor must note that access to the lower brushes of the propulsion motors is challenging and dexterity is required.

11.3.2.6 The Contractor must report all defects or abnormal results to the AI and the TA within 24 hrs of the inspection.

11.3.2.7 The Contractor must prepare a technical report for each machine detailing the findings and readings recorded for each machine.

11.3.3 Cleaning

11.3.3.1 The Contractor must remove and dispose of all filter media from each propulsion motor filter cage.

11.3.3.2 The Contractor must provide for all materials, equipment and preparatory work to either contain the carbon dust in a filter box or exhaust it to an appropriate area exterior to the vessel. No carbon dust must be exhausted into the engine room spaces or accommodations.

11.3.3.3 The Contractor must use clean and dry compressed air to remove all loose carbon dust from all propulsion motor components. The compressed air must be dry and contain no oil vapor. The Contractor must use appropriate compressed air filters/driers to remove any contaminants in the air

11.3.3.4 Upon completion of compressed air cleaning, all accessible motor components must be wiped down, by the Contractor, to remove any remaining carbon dust with rags soaked with an electrical cleaning solvent acceptable to the IA. The Contractor must demonstrate to the IA that the electrical cleaning solvent to be used is a product recommended for the cleaning of electric motor windings. It must be suitable for removing grease and carbon deposits. It must have a high dielectric resistance, be non-conductive, and non-corrosive. It must not corrode or damage cables, insulation, protective varnishes, fiberglass, plexiglass, or rubber parts. It must evaporate cleanly, leaving no greasy deposits.

11.3.3.5 Post cleaning, the Contractor must take another set of megger readings of the armature and stator circuits for each motor. This is to ascertain that the cleaning action has not degraded the megger readings. Where megger readings are lower than when performed in the as found condition, the Contractor must carry out a subsequent inspection ensuring that in fact all areas are clean and report any findings to the IA/TA.

11.3.3.6 The Contractor must replace the filter media for each propulsion motor with new GFM filter media.

11.4 Proof of Performance

11.4.1 Inspection

11.4.1.1 All work must be inspected and completed to the satisfaction of TCMS and the IA.

11.4.1.2 The Contractor must submit the cleaned motors for a final inspection by the IA prior to closing up the units.

11.4.2 Testing

11.4.2.1 The propulsion motors must be tested in accordance with the test and trials plan for the complete propulsion system.

11.5 Deliverables

11.5.1 Documentation

11.5.1.1 The Contractor must provide a written report of the survey of the propulsion motors, including the “As-found” condition of each motor, initial megger readings, PI readings, any photographs taken during the cleaning and inspection process, any abnormalities found, and the final “As-left” megger readings for the armature and stator circuits. A copy of the Division 3 Survey Credit must be provided with the report as well as the calibration certificates for the test instrumentation used during the work. The reported Megger and PI readings must include the tested component’s temperature, measured insulation values, insulation values corrected to 20ºC, ambient temperature and relative humidity during the testing.

11.5.1.2 The Contactor must provide 3 paper copies and one electronic copy (PDF, unprotected) of the condition report for each propulsion motors prior to end of the work period and sea trials.

12.0 OVERHAUL OF PROPULSION MOTOR BLOWERS

12.1 Identification

12.1.1 There are two blower assemblies fitted to each propulsion motor that must be disassembled by the Contractor and then the 4 blower assemblies and their electric motors must be transported to the Contractor's facility for cleaning, overhaul, testing and reassembly prior to re-installation in their original locations on the propulsion motors.

12.1.2 The Contractor must trial the blower assemblies in the presence of the IA and the attending TCMS surveyor as these are survey items, requiring a Division III sign-off from TCMS. The Contractor is responsible for arranging all TCMS inspections.

12.1.3 This specification item must be completed in conjunction with SOW items for Propulsion Motor Survey (11.0), Propulsion System Inspection (8.0) Survey, and Propulsion Overcurrent Protection System (9.0). Additionally, ship's crew will be surveying both Main Air Compressors that are located in the aft, port side of the Upper Propulsion Motor Room.

12.2 References

12.2.1 Drawings

Drawing Number	Drawing Title	Electronic File Name
529F077	2000 S.H.P. Propulsion Motor Main Assembly	529F077.TIF
640J774	DC Machine Type Q FR EE 626-6 General Assembly	640J774.tif 640J774 -2.tif
766401 Rev. A11	Electrical Plant Schematic Wiring Diagram	766401_2016.dwg
	Griffon Propulsion Drawings	Griffon Propulsion Drawings.pdf

12.2.2 Documents

Document Title	Electronic File Name
Westinghouse Instr. Book No CD-4530, Part II, Sect. I, Propulsion Motors	Part II - Section 1 - Propulsion Motors.pdf

12.2.3 Standards

- TP 127, Ships Electrical Standards, Latest Edition

12.2.4 Blower Details

Manufacturer: Westinghouse Centrifugal Fan, Sturtevant Div., Galt, Ont.
Model: 3022 Special Blower
Styles: 717D805 Fig. 1 and Fig. 5
Ser. No.:

- Port Outboard – 60-12645-2,
- Port Inboard – 60-12645-1.
- Starboard Inboard – 60-12645-2
- Starboard Outboard – 60-12645-1

12.2.5 Electric Motor Details

Manufacturer: General Electric Induction Motor, Peterborough, Ontario.
Model: 117121
Power: 10 HP
Volts: 440, 3 Phase, 60 Hz
Amps: 14.5
Speed: 1750 RPM
Service Factor: 1.0
600C Rise Cont.
CEMA Design: B, Type K, Frame 254DZ
DE Bearing: 40BC03J
ODE Bearing: 35BC02J
Marine Class B Insulation
Original Motors; last overhauled in 2013
Serial No:

- Port Outboard – 966867
- Port Inboard – 966869
- Starboard Inboard – 966868
- Starboard Outboard – 966870

12.2.6 TCMS Division 3 Report Items

- 3E005 – Port Prop Motor Blower No. 1
- 3E006 – Port Prop Motor Blower No. 2
- 3E010 – Stbd Prop Motor Blower No. 1
- 3E011 – Stbd Prop Motor Blower No. 2

12.3 Technical Description

12.3.1 General

12.3.1.1 The Contractor must supply all labor, material and equipment to complete the, work including all rigging required to remove and re-mount the blowers.

12.3.1.2 The Contractor must remove all interference items to complete the work. Where items are removed they must be clearly tagged as to their location. Upon completion of the work, the Contractor must reinstall all interference items in their original locations and working order.

12.3.1.3 All replacement blower parts must be Contractor supplied.

12.3.1.4 All meggering must be performed at 1000 Volts.

12.3.1.5 All components of the blower assemblies must be thoroughly de-greased and cleaned using an approved electrical cleaning solvent prior to reassembly.

12.3.1.6 The Contractor must demonstrate to the TA that the electrical cleaning solvent to be used is a product recommended for the cleaning of electric motor windings. It must be suitable for removing grease and carbon deposits. It must have a high dielectric resistance, be non-conductive, and non-corrosive. It must not corrode or damage cables, insulation, or rubber parts. It must evaporate cleanly, leaving no greasy deposits.

12.3.1.7 All measuring devices, including megger, must have been calibrated within the last 12 months. Proof of valid and current calibration must be a deliverable for this specification item.

12.3.2 Removals

12.3.2.1 The Contractor must electrically isolate, disconnect and remove each of the blowers from the propulsion motors to facilitate cleaning and inspection of the blower, blower shrouds and ducting. Isolation and disconnection must be done through a proper lock out tag out system.

12.3.2.2 The Contractor must disassemble each blower assembly for transportation, cleaning and inspection.

12.3.2.3 The Contractor must transport the electric motors to the Contractor's facility for overhaul. The Contractor must ensure the electric motors and blower assemblies are protected from damage during the manipulation and transportation of these components. Any damage resulting from the work/transportation must be repaired at the Contractor's expense.

12.3.3 Motor Inspection and Overhaul

12.3.3.1 The blower motors are to be dismantled, meggered, cleaned, and new bearings installed.

12.3.3.2 The Contractor must provide a photographic record of each electric motor showing the condition of the motor after disassembly, after cleaning, and upon reassembly. The photos must be linked to the serial numbers of each motor.

12.3.3.3 The Contractor must megger the field windings of each motor before disassembly and after reassembly.

12.3.3.4 The Contractor must dynamically balance each blower after cleaning to ensure that it will run true and not induce vibrations into the motor shaft.

12.3.3.5 Upon reassembly, the Contractor must bench test each motor with the fan blades installed. The motor must be run for 1 hour. Motor current, DE and ODE casing temperatures must be recorded every 15 minutes.

12.3.4 Installation

12.3.4.1 All components must be cleaned prior to reassembly. The Contractor must check the cleanliness and condition of each component prior to reassembly.

12.3.4.2 The Contractor must reinstall all components removed in good order.

12.3.4.3 The motor casing must be reinstalled with new solid neoprene rubber gaskets.

12.3.4.4 The Contractor must reconnect the electrical supply to each motor with new connectors approved for marine applications. With the exception of the thread cutting type of connector, twist-on type connectors must not be used for making joints in cables.

12.3.4.5 The Contractor must verify that the 3 phase supply is correctly connected giving the correct rotation for each blower motor before testing.

12.4 Proof of Performance

12.4.1 Inspection

12.4.1.1 The Contractor must submit the electric motor components to inspection by the IA and TCMS prior to reassembly. The Contractor must afford the IA the opportunity to witness the bench test of the electric motor.

12.4.1.2 The Contractor must submit the cleaned and overhauled components to inspection by the IA prior to reassembly onto the propulsion motors.

12.4.2 Testing

12.4.2.1 The Contractor must perform an operational test of each Propulsion Motor Blower once all blowers have been reinstalled on the propulsion

motors and once all other concurrent survey items have been completed on the propulsion motors.

12.4.2.2 The operational test must be of 4 hours duration and must be separate from the sea trial of the propulsion system. Motor current, DE and ODE casing temperatures must be recorded every hour.

12.4.2.3 This specification item must be included on the tests and trials plan.

12.5 Deliverables

12.5.1 Documentation

12.5.1.1 The Contractor must submit a report to the TA and the IA for each blower assembly. The report must contain detailed information on the work performed, the readings taken, photographs of the equipment in various stages of disassembly/reassembly, calibration certificates of all measuring devices used, bill of materials for all parts used including part numbers, and who performed the work. The report must also detail all parts replaces, any deficiencies and corrective measures taken. The Contractor must supply one electronic (PDF) copy and three paper copies of the report to the IA. A work order is not considered acceptable.

12.5.1.2 The Contractor must provide the IA with the specification and product sheets for the electric motor degreaser used.

12.5.1.3 The Contractor must obtain a TC Division 3 survey credit for each blower assembly.

13.0 OVERHAUL OF PROPULSION MOTOR & GENERATOR COOLERS

13.1 Identification

13.1.1 The Contractor must overhaul the two propulsion motor and four propulsion generator coolers, for a total of six units to be overhauled. The coolers are of the air/water heat exchanger type. This is also a TCMS Division III survey item.

13.1.2 Removal and installation of the propulsion motor coolers must be done concurrent with SOW item 12.0 (Overhaul of Propulsion Motor Blowers)

13.1.3 Removal and installation of the propulsion generator coolers must done concurrent with SOW item 7.0 (Overhaul of Propulsion Generators).

13.2 References

13.2.1 Drawings

Drawing Number	Drawing Title	Electronic File Name
529F075	D.C. Generator – Type QL Main Assembly	529F075.TIF
529F077	2000 S.H.P. Propulsion Motor Main Assembly	529F077.TIF
640J771 shts 1-3	D.C. Generator – Type QL FR. CC. 216.5 General Assembly	
640J774 shts 1-2	DC Machine Type Q FR EE 626-6 General Assembly	640J774.tif 640J774 -2.tif
664-4207-1	Raw Water Circulating Diagram	G05159pl1.dwg
664-4207-10 sh1&2	Raw & Fresh Water Circulating Piping Arrg.	G05200pl1.dwg G05200pl2.dwg

13.2.2 Propulsion Motor Heat Exchanger Description

13.2.2.1 The Motor Heat Exchangers (Unifin) are of the air/water, double wall marine, leak detecting water tube type, with internal provision for preventing air pockets. The headers are interchangeable, and water connections are on the outboard side of each unit. The leak indicators are on the right side when viewed from the propulsion shaft coupling.

13.2.2.2 The units are constructed of 70/30 Cupro-nickel tubes and tube sheets, bronze headers, zinc anti-corrosion rods, and with connections to space between double wall tubing fitted with leak indicators and drains.

13.2.2.3 Each Motor Cooler has approximately 114 tubes, arranged in a staggered pattern of 6 columns by 18/19 rows.

13.2.2.4 The water side is a four pass system. Inlet and outlet water connections terminate at nominal 2” bronze flanged pipe fittings. The bronze flanges are flat faced.

13.2.2.5 Approximate dimensions of the assembled unit are 96” x 36” x 13”.

13.2.3 Propulsion Generator Heat Exchanger Description

13.2.3.1 The Generator Heat Exchangers (Unifin) are of the air/water, double wall marine, with internal provision for preventing air pockets. The headers are interchangeable, and water connections are on the right side of each unit as viewed from the generator coupling.

13.2.3.2 Each Generator Cooler has approximately 74 tubes, arranged in a staggered pattern of 7 columns by 10/11 rows.

13.2.3.3 The water side is a four pass system. Inlet and outlet water connections terminate at nominal 1-1/2” bronze flanged pipe fittings. The bronze flanges are flat faced.

13.2.3.4 Approximate dimensions of the assembled units are 86” x 19” x 13”.

13.2.4 TCMS Division 3 Report Items

- 3E003 – Port Prop Motor Cooler
- 3E008 – Stbd Prop Motor Cooler
- 3E015 – Port Outbd Prop Gen Cooler
- 3E017 – Port Inbd Prop Gen Cooler
- 3E019 – Stbd Inbd Prop Gen Cooler
- 3E021 – Stbd Outbd Prop Gen Cooler

13.3 Technical Description

13.3.1 General

13.3.1.1 The dimensions provided are considered approximate. It is the Contractor’s responsibility to verify all dimensions before removing the cooler units from the vessel.

13.3.1.2 The Contractor must supply all labor, material and equipment to complete the work including all rigging required to remove and remount the heat exchangers.

13.3.1.3 The Contractor must remove all interference items for the completion of this work. Upon completion of the work, the Contractor must reinstall all interference items in the original location and working order.

13.3.1.4 The Contractor must pressure test each of the coolers. Testing must be must be performed at 20 PSI.

13.3.1.5 The Contractor must thoroughly clean all components of the heat exchangers to the satisfaction of the IA.

13.3.1.6 The Contractor must demonstrate to the AI that any chemicals used for cleaning the coolers are non-acid, non-caustic, and will not harm or damage the coolers and their different components.

13.3.1.7 The Contractor must follow the recommended manufacturer's procedures for any cleaning chemicals, including preparation, use, removal, and disposal.

13.3.1.8 The Contractor must not use high pressure methods for cleaning the air side of the cooler, as this may damage the cooler's fins.

13.3.1.9 Any damage to the tubes, tube sheets, fins, headers, flanges, water regulator, piping and flexible hose connections that occurs while the unit is in the custody of the Contractor must be repaired to the satisfaction of the IA at the Contractor's expense.

13.3.1.10 All measuring devices, including the pressure gauge used for the pressure test, must have been calibrated within the 12 months prior to testing. Proof of valid and current calibration must be a deliverable for this specification item.

13.3.2 Removals

13.3.2.1 The Contractor must isolate the inlet and outlet raw water valves for each of the 6 heat exchangers.

13.3.2.2 The Contractor must drain and contain the water from the isolated systems to prevent re-contamination of the previously cleaned bilges. The Contractor must dispose of the water in the ship's grey water system. As work on the Propulsion Motor Blowers, Propulsion Motors and Propulsion Generators may be concurrent; the Contractor must be responsible for any water contamination of those systems and their auxiliaries.

13.3.2.3 The electrical connection boxes mounted on the side of the Motors and Generators have old gaskets and may not be water tight. They are located below the heat exchangers, and are open to the inside of the Propulsion Motors and Propulsion Generators. The Contractor must ensure that no water enters the Motors or Generators during removals, installation, or trials of the coolers. The Contractor must be responsible for any water contamination of those systems and their auxiliaries.

13.3.2.4 The Contractor must clearly identify, by means of a punch stamp, each of the six coolers. The Contractor must use the following codes:

- P-MOT - port motor
- S-MOT - starboard motor
- POG - port outboard generator
- PIG - port inboard generator
- SIG - starboard inboard generator
- SOG - starboard outboard generator to represent.

13.3.2.5 The Contractor must use this coding to identify all the components and pieces of the cooling systems.

13.3.2.6 The Contractor must clearly identify each water-regulating valve before removal. The valves must be identified with respect to location, orientation, and temperature set point. The Contractor must release the thermostatic water-regulating valve and its capillary tube and place it safely aside for reuse. Any and all securing items are to be bagged, identified, and kept with the associated valve. The Contractor must take care not to damage or kink the capillaries during removal, storage, or installation. Any loss of or damage to the thermostatic water-regulating valves and their auxiliaries must be repaired or replaced at the Contractors expense.

13.3.2.7 The Contractor must identify and remove heat exchange inlet and outlet piping back to the most convenient flange. The Contractor must blank the flange with Contractor supplied blank flanges and new gaskets. The Contractor must be responsible for determining how much piping to remove, as some of the piping is an interference item for other sections of the specification. Upon installation of each cooler, the Contractor must install new gaskets at all flanged connects. The gasket material used must be suitable for its application.

13.3.2.8 The Contractor must release each Propulsion Motor Cooler from its blower inlet cover, air filter housing, and the vent assembly support. The bolts and washers are to be retained for reuse. Any bolts showing damage or corrosion must be replaced with identical units supplied by the Contractor.

13.3.2.9 The Contractor must rig and remove each Propulsion Motor Cooler from the vessel, and transport them to a Contractor's facility for servicing. The Contractor must ensure the coolers are protected from damage during the manipulation and transportation of these components. Any damage resulting from the work/transportation must be repaired at the Contractor's expense.

13.3.2.10 The Contractor must release each Propulsion Motor Cooler from its duct work, air filter housing, and front end bell top. The bolts and washers are to be retained for reuse. Any bolts showing damage or corrosion must be replaced with identical units by the Contractor.

13.3.2.11 The Contractor must rig and remove each Propulsion Generator Cooler from the vessel, and transport them to a Contractor's facility for servicing.

13.3.3 Cleaning and Testing

13.3.3.1 Prior to disassembly, each of the cooler headers must be clearly marked for position and alignment.

13.3.3.2 Each of the coolers must be opened and inspected.

13.3.3.3 The Contractor must clean both the exterior and interior of the tube bundle and header assemblies. Any deficiencies must be brought to the attention of the IA.

13.3.3.4 After disassembly and cleaning, the coolers must be made available for inspection by the IA. If approved, any work arising from the noted deficiencies or inspection will be negotiated using the 1379 process.

13.3.3.5 The Contractor must assemble the coolers with new Contractor supplied gaskets, brass drain plugs, zinc anodes and brass anode holders.

13.3.3.6 The Contractor must pressure test each cooler. The pressure test must consist of filling the water side with fresh water, applying a pressure of 20 psi for 8 hours, and observing air side and sealing surfaces for leaks. Any deficiencies must be brought to the attention of the IA. If approved, any work arising from the noted deficiencies will be negotiated using the 1379 process.

13.3.3.7 Upon the successful completion of the pressure tests, the Contractor must empty the water from each cooler.

13.3.3.8 The Contractor must prepare a condition report for each of the 6 coolers. It should be noted that in certain cases the attending TCMS Inspector may wish to witness the pressure tests and thus the Contractor must communicate with TCMS as to the exact requirements for the inspection and pressure testing of the cooler assemblies.

13.3.4 Installation

13.3.4.1 The Contractor must transport from the Contractor's test facility, securely rig, and move each of the coolers into the vessel. The Contractor must land each cooler on its respective Motor or Generator mount.

13.3.4.2 The Contractor must demonstrate to the TA that the air side of each cooler is thoroughly dry before installation.

13.3.4.3 The Contractor must secure each cooler in place. Securing fasteners that have been deemed unsuitable for reuse by the TA will be disposed of by the Contractor. Replacement fasteners must be Contractor supplied.

13.4 Proof of Performance

13.4.1 Inspection

13.4.1.1 The Contractor must submit the completed work for inspection by the IA and TCMS.

13.4.2 Testing

13.4.2.1 The Contractor must perform a full flow test of the cooling water through the coolers once the coolers have been re-installed on the vessel. The Contractor must repair any leaks resulting from the work at its own expense.

13.5 Deliverables

13.5.1 Documentation

13.5.1.1 The Contractor must provide a report detailing the work performed on each of the coolers and their overall condition from the “AS-found” condition to the “As-left” condition. The must also detail all parts replaces, any deficiencies and corrective measures taken. The Contractor must supply one electronic (PDF) copy and three paper copies of the report to the IA and on electronic copy to the TA.

14.0 SURVEY OF SHIP'S CIRCUIT BREAKERS

14.1 Identification

14.1.1 There are five ITE 600 Amp Frame circuit breakers (Shore Power, Emergency Generator, Ship Service Generator #1, #2 and #3) that must be serviced by an authorized ITE service center to be inspected, tested and calibrated such that they can receive their TCMS Div III certification.

14.1.2 Additionally, Ship Service Breaker #1 has a loud 60 Hz buzzing noise emanating from a component in the bottom linkages that cannot be located while the breaker is in service. The source of the buzzing must be located and the defective component replaced with a new unit.

14.2 References

14.2.1 Drawings

Drawing Number	Title	Electronic File Name
10204806-1	2013 SHORE PWR TRIP CURVE & GE REPORT	2013 SHORE PWR TRIP CURVE & GE REPORT.pdf
	CCG GRIFFON EMERGENCY GENERATOR CIRCUIT BREAKER TRIPPING CURVES	CCGS Griffon - EG CB Trip Curve.pdf
5210822-001A	CCGS GRIFFON - VLE PROJECT GENERATOR CIRCUIT BREAKERS TRIPPING CURVE	CCGS Griffon SSG CB Trip Curve.pdf

14.2.2 Standards

- TP 127, Ships Electrical Standards, Latest Edition, 29.2 and 34.11

14.2.3 Breaker Details

Manufacturer: ITE
Type: K-600
Frame Size: 600 Amp
Breaker Type: Air/Draw-Out

14.2.4 ITE Serial Numbers and Trip Units Fitted

- SSG #1 - 93186, Westrip RMS-2000
- SSG #2 - 93179, Suretrip RMS2007AF(1)
- SSG #3 - 93177, Digitrip RMS/R500
- Shore Power Breaker - 93180, Suretrip RMS 2007AF(1)
- Emergency Generator - 46732-M12-1-7A, Suretrip RMS- 2007AF

14.2.5 TCMS Division 3 Report Items

- 3E040 – Emergency Alternator Circuit Breaker
- 3E043 – SSG #1 Circuit Breaker
- 3E044 – SSG #2 Circuit Breaker
- 3E045 – SSG #3 Ct Breaker
- 3E046 – Shore Power Circuit Breaker

14.3 Technical Description

14.3.1 General

14.3.1.1 All labor, equipment, rigging, cranage and materials required to perform the work must be Contractor supplied.

14.3.1.2 All replacement parts must be Contractor supplied.

14.3.1.3 The Contractor must remove the five circuit breakers from the switchboards of the vessel and reinstall them upon completion of work.

14.3.1.4 The Contractor must install the vessel's two spare circuit breakers in the switchboard to maintain the shore supply and the emergency generator. The Contractor must set the spare breaker digital trip units to match the two breakers removed.

14.3.1.5 The Contractor is responsible for removal/installation of the breakers from the vessel and transportation to/from the Contractor's test facility. The breakers must be protected from weather and damage prior to transport from the vessel and while in the care of the Contractor.

14.3.1.6 Any damage to the circuit breakers incurred while handling and transporting the breakers must be repaired at the Contractor's expense.

14.3.2 Inspection and Testing

14.3.2.1 The Contractor must remove the five circuit breakers from the switchboards of the vessel.

14.3.2.2 The Contractor must install the vessel's two spare circuit breakers in the switchboard to maintain the shore supply and the emergency generator. The Contractor must set the spare breaker digital trip units to match the two breakers removed.

14.3.2.3 The Contractor is responsible for removal/installation of the breakers from the vessel and transportation to/from the Contractor's test facility. The breakers must be protected from weather and damage prior to transport from the vessel and while in the care of the Contractor.

14.3.2.4 Any damage to the circuit breakers incurred while handling and transporting the breakers must be repaired at the Contractor's expense.

14.3.2.5 The Contractor must inspect the referenced circuit breakers for proper mechanical and electrical operation.

14.3.2.6 The Contractor must megger the control circuit insulation and measure the primary contact resistance. All readings must be recorded and referenced to a breaker serial number.

14.3.2.7 The Contractor must inspect the circuit breakers and provide a report as to the physical condition of the circuit breakers.

14.3.2.8 All damaged or worn parts that have been identified must be replaced and negotiated through 1379 form.

14.4 Proof of Performance

14.4.1 Inspection

14.4.1.1 All work must be completed to the satisfaction of the TCMS inspector and the TA.

14.4.2 Testing

14.4.2.1 The Contractor must perform the primary injection test in the presence of a TCMS and the IA. The Contractor must coordinate all TCMS inspections.

14.5 Deliverables

14.5.1 Documentation

14.5.1.1 The Contractor must affix a sticker on the inside panel of each breaker cubicle detailing the date and the Instantaneous, Short and Long Time trip setting for each breaker respectively as per the requirements of TP 127E 34.11.

14.5.1.2 The Contractor must provide a report of all inspections, megger readings, parts found worn or out of tolerance, all adjustments made and a certificate of final inspection.

14.5.1.3 The Contractor must provide 3 paper copies of all documentation and one electronic copy (PDF) of the documentation.

14.5.1.4 All documentation must be provided to the IA and the TA prior to end of the work period.

15.0 MEGGER TESTING OF ELECTRICAL CIRCUITS

15.1 Identification

15.1.1 The Contractor must perform a complete Megger survey as per TCMS requirements for all electrical circuits onboard the vessel.

15.2 References

15.2.1 Drawings

Drawing Number	Description	Electronic Number
766401 Rev. A11	Electrical Plant Schematic Wiring Diagram	766401.dwg

15.2.2 Documents

- Megger Report – CCGS Griffon – 2017 Megger Results, July 24_2017.xls

15.2.3 Standards

- TP 127, Ships Electrical Standards, Latest Edition

15.3 Technical Description

15.3.1 General

15.3.1.1 The Contractor must Megger test all the electrical circuits on the vessel and must record the readings obtained. The Contractor must update the vessel's 2017 electronic copy of the Megger report file. This report will be provided to the Contractor at the commencement of the work and will be in Excel format.

15.3.1.2 Testing must be from power leads to ground and lead to lead. All motor circuits must be tested from the main distribution panel to the motor starter and from the motor starter to the motor. The test voltage required for the circuit must be as per the requirements of TP 127.

15.3.1.3 The Contractor must submit a copy of the updated Megger Report to the IA/TA within twenty four hours of completion of the work and within two weeks prior to the end of the work period.

15.4 Proof of Performance

15.4.1 Inspection

15.4.1.1 All work must be inspected and completed to the satisfaction of the IA.

15.5 Deliverables

15.5.1 Documentation

15.5.1.1 The Contractor must provide the IA with an updated copy of the ship's electronic Megger Report in MS Excel format on USB-KEY media. The Excel report must not be locked or password protected. The Contractor must also provide three paper copies of the report on 8.5 by 11 inch paper.

15.5.1.2 The updated document must include the dates of the test period, name of the tester(s), name of the supervisor, the type of instruments used, including their serial numbers and calibration dates.

15.5.1.3 The Contractor must provide the valid calibration certificate for the Megger instrument(s) used to carry out the work. The certificate will be considered valid if calibration has occurred within the last 12 months.

16.0 HULL CONDITION SURVEY

16.1 Identification

16.1.1 The Contractor must provide the services of a TCMS delegated Classification Society to perform a hull and structural survey of the vessel CCGS Griffon. The hull and structural survey must be performed in accordance with the Classification Society's survey requirements for the vessel of this type and age and with the particular additional requirements of this specification.

16.1.2 The Contractor must provide for the services of a Class certified NDT (ultrasonic thickness testing) firm to determine the shell plating and structural thickness as indicated by the Classification Society and as described herein.

16.1.3 The NDT firm must use equipment as required by their Class certification.

16.1.4 The Classification Society must prepare a detailed condition report of the hull and structure of the vessel.

16.1.5 The Canadian Coast Guard is undertaking an extensive renewal program of its existing fleet. The aim of this program (Vessel Life Extension, Mid-Life Modernization) is to ensure that its current fleet of ships provides continued service for at least 15 more years. As part of this program of investment and to ensure that budgetary constraints are realized, detailed assessments of the ships' existing hull condition are required. The aim of this document is to ensure that the expectations of the CCG are recognized by the Classification Societies.

16.1.6 The ships require a Hull Condition Assessment to be undertaken by a Classification Society. The deliverables from this survey will identify all areas onboard the vessel where renewal of plating, stiffening, coatings and other structural components are recommended for replacement/ repairs to ensure continued un-interrupted service for at least 15 years.

16.1.7 The reporting of the results by the Classification Society must include all recommended repairs/renewals as required to meet the intent of this specification, which is to achieve the equivalent of a 2nd Special Survey status for the vessel.

16.2 References

16.2.1 Equipment Data

16.2.1.1 Classification Society will be provided any additional structural drawings, as may be required.

16.2.2 Drawings

Drawing Number	Description	Electronic Number
CMG05-111-GA Sheets 1 & 2	General Arrangement	G05111ga1.dwg G05111ga2.dwg
664-120-2	Shell Expansion & Bulwark Detail	G05A0462.dwg
664-120-11	Lower Deck & Engineroom Flat Plating	664-120-11.tif
664-120-12	Upper Deck Plating	664-120-12.dwg
664-130-2	Forecastle Deck Plating & Partition Bulkheads Under	664-130-2.tif
CMG05-229-DE	Profile & Bulkheads Scantlings	G05229de1.dwg
CMG05-108-ST	Steel Profile & Bulkheads & Scantlings Steel Profile & Bulkheads & Scantlings Profile & Bulkhead Scantlings Steel Profile & Bulkhead Scantlings Steel Profile & Bulkhead Scantlings Tank Top, Lower, Upper Forcastle & Poop Deck Scantlings Tank Top, Lower, Upper Forcastle & Poop Deck Scantlings Flight & Boat, Bridge Nav. Bridge Decks & Wheelhouse Top	G05108st1.dwg G05108st2.dwg G05108st3.dwg G05108st4.dwg G05108st5.dwg G05108st6.dwg G05108st7.dwg G05108st8.dwg
CMG05-123-AS	Double Bottom Plan	G05123as1.dwg
CMG05-124-AS	Framing Plan	G05124as1.dwg
CMG05-125-AS	Web Frames & Strong Beams	G05125as1.dwg
CMG05-126-AS	Shell Side Stringers	G05126as1.dwg
CMG05-128-AS	WT & NWT Bulkheads Aft & Floors	G05128as1.dwg
CMG05-129-AS	Oil & Stabilization Tanks, OT & WT Bulkheads Forward	G05129as1.dwg
CMG05-140-SE	Construction Sections	G05140se1.dwg
CMG05-231-ST	Poop Deck Plating & Minor Bulkheads Under	G05231st1.dwg
521-375-001	Thruster Tunnel Installation and Thruster Compartment Steelwork	521-375-001-1.tif 521-375-001-2.tif
CMG05-220-MI	Thermal Insulation	G05220mi1.dwg G05220mi2.dwg
CMG05-250-MI	Fire Insulation Plan	G05250mi1.dwg
732931	Boat, Bridge & Nav. Bridge Deck – Joiner Bulkhead and Linings	732931-1.tif
732941	Poop Deck- Joiner Bulkheads and Linings	732941-1.tif
732951	Upper Deck- Joiner Bulkheads and Linings	732951-1.tif

732934	Ceiling Plan – Boat, Bridge and Nav. Bridge Decks	732934-1.tif
732944	Ceiling Plan – Poop Deck	732944-1.tif
732954	Ceiling Plan – Lower & Upper Decks	732954-1.tif
732400	Deck Coverings	732400_1.dwg 732400_2.dwg
J18021	List of Compartments, 3 pages	J18021-HullConditionSurveySpecAppendixA-RevC.pdf
J18021-SK01	Thickness Measurement Survey sketches, 5 pages	J18021-SK01 HullConditionSurveySpecAppendixASketches-RevC.pdf

16.2.2.1 Classification Society will be provided any additional structural drawings, as may be required.

16.2.3 Tanks and Spaces for Survey

16.2.3.1 J18021 and J18021-SK01 Appendix “A” includes all tanks, voids and spaces which must be included in the survey. All work required to open and prepare each compartment for entry must be carried out by the Contractor as per the respective specification item identified.

16.2.4 Regulations

- Canada Shipping Act 2001, Hull Construction Regulations;
- Canada Shipping Act 2001, Hull Inspection Regulations;
- Arctic Waters Pollution Prevention Act;
- Arctic Shipping Pollution Prevention Regulations;
- TP 12260 Equivalent Standards for the Construction of Arctic Class Ships.
- Canada Labour Code Part II
- Maritime Occupational Health and Safety Regulations
- Safe Working Practices Regulations

16.2.5 Standards

- Canadian Coast Guard Fleet Safety Manual DFO5737 and site-specific work instructions, applicable to the vessel during a CCG manned refit period.
- Classification Society Standards (Rules and Regulations) for vessel construction for vessels of the same type as the vessel.

- Classification Society Standards for the inspection of vessels for vessels of the same type and age as the vessel.
- Classification Society Hull Condition Assessment Program or Scheme
- Classification Society Thickness Measurement and Close-Up Survey Guidance
- CAN/CGSB 48.9712 – latest edition. Ultrasound Technician Certification.
- IACS Recommendation 82 (July 2003) Surveyor's Glossary Hull Terms & Hull Survey Terms
- IACS Requirements concerning Survey and Certification (2012)

16.2.6 Definitions

16.2.6.1 Close up Survey (CUS) must consist of visual inspection of the vessel structure, including hull envelope, all water ballast tanks and a selection of other tanks or spaces as defined in J18021 and J18021-SK01 Appendix "A". The aim of the survey is to assess general condition of the structure, including presence of deformations, corrosion as well as the condition of the coating. The survey findings are also used to guide the thickness measurement (TM): the surveyor must ensure denser measurement grid for areas with pronounced corrosion. Close up survey infers that the surveyor will be within an arm's length of the item under examination.

16.2.6.2 Transverse Section includes all longitudinal members such as plating, longitudinals and girders at the deck, side, bottom and iner bottom.

16.2.6.3 Suspect Areas are locations showing substantial corrosion and/or are considered by the Surveyor to be prone to rapid wastage.

16.2.6.4 Substantial Corrosion is an extent of corrosion such that assessment of corrosion pattern indicates a material wastage in excess of 75% of allowable margins , but within acceptable limits.

16.2.6.5 Critical Structural Areas are locations which have been identified from calculations to require monitoring or from service history of the subject ship or similar ships or sister ships, if applicable to be sensitive to cracking, buckling or corrosion which would impair structural integrity of the ship.

16.2.6.6 Coating Condition is defined as: Good (minor spot rusting), Fair (local breakdown at stiffener edges and weld connections and/or light rusting over 20% of areas considered), and Poor (general breakdown over 20% or more, or hard scale over 10% or more of areas considered

16.3 Technical Description

16.3.1 General

16.3.1.1 The Contractor must engage the services of a TCMS approved Classification Society capable of performing the work. The Contractor and its sub-contractors must hold all data derived from the work of this survey in strictest confidence and must not divulge this data and conclusions to any other third party.

16.3.1.2 The Contractor must include an allowance of $10,000 to cover the travel of the Classification Society. Travel and living expenses must be billed at cost without added overhead or profit. The $10,000 allowance must form part of the overall bid and must be adjusted by Work Arising action upon receipt of the final FSR invoice supported by copies of all related documentation to verify actual expenses.

16.3.1.3 The work of this survey must be in compliance with the latest edition of the selected Classification Society thickness measurement and close-up survey guidelines for a vessel of this type and age.

16.3.1.4 The Contractor must provide all necessary materials and labor to assist the Classification Society to gain the necessary access to the exterior and interior portions of the hull and vessel's structure required to be surveyed, including removing and reinstalling interference items. Gas freeing and certification of tanks as safe to enter must be included.

16.3.1.5 The Classification Society surveyor will be responsible to direct the location for all of the Ultra-sonic thickness measurements. All measurements taken must be recorded in detail on ship's drawings and sketches including but not limited to: shell expansion, profile and decks, sections and bulkheads.

16.3.1.6 The Contractor must provide any staging or certified man-lifts required to enable the Classification Society and NDT firm to perform a detailed examination and inspection of the hull and internal structure and for the ultrasonic thickness testing. The Contractor must quote on the provision of a certified man-lift including operator for a period of 100 hours and provide unit cost per hour for the use of the man-lift and operator for adjustment by PWGSC 1379 action if required.

16.3.1.7 If the vessel is manned with CCG Crew, the Contractor and the Classification Society must adhere to the requirements of the Fleet Safety and Security Manual (DFO 5737) with regards to Confined Space Entry and Working Aloft procedures.

16.3.2 Survey Planning

16.3.2.1 The Contractor must arrange for a meeting between the TA and the Classification Society, 2 weeks prior to commencement of the scheduled docking work period, to establish the detailed survey plan for the hull

and structural survey. At this time the Classification Society must have established the preliminary inspection requirements, including the number of ultrasound shots to be taken and where these will be taken.

16.3.2.2 The Contractor must co-ordinate the Hull Structural Survey requirements of this section with the TCMS Regulatory Survey requirements for the vessel to avoid duplication of work, specifically for hull ultrasound readings and tank surveys. The Contractor must arrange the attendance of a local TCMS Surveyor at the meeting described in 16.3.2.1 above.

16.3.2.3 The Contractor must provide a detailed survey schedule that integrates the Condition Survey requirements into the general work being performed outside of the Condition Survey. The preliminary schedule must be presented at the start of the contract and must be updated at no greater intervals than bi-weekly showing the progress of the survey work.

16.3.3 Extent of Overall and Close-Up Survey

16.3.3.1 The Classification Society must conduct an overall and Close-Up Survey of the hull and superstructure envelope (since the Griffon work will be conducted alongside, the hull envelope can only be surveyed from the inside) and ALL spaces within the hull and superstructure including all integral tanks and voids as per their survey standard, and as per the particularized requirements included in this specification. Linings, ceilings, wood sheathing or other coverings on steel decks, and linings in way of galley/washrooms and beneath port lights and windows are to be removed and reinstalled as indicated in J18021 and J18021-SK01 Appendix “A” and as additionally required by the Class Surveyor. The Close-Up Survey will pay particular attention to the following structural elements:

Item	Structure Requiring Particular Attention During CUS
1	All shell frames in all cargo holds and ‘tween deck spaces, including their upper and lower end attachments and adjacent shell plating.
2	All cargo hold transverse bulkheads, including stiffening system.
3	All transverse bulkheads in ballast tanks, including stiffening system.
4	All transverse webs with associated plating and framing in each water ballast tank.
5	All cargo hold hatch covers and coamings (plating and stiffeners).
6	All deck plating and underdeck structure inside the line of hatch openings between cargo hold hatches.
7	All areas of inner bottom plating.
8	Grooving corrosion in way of welds, particularly butt welds

9	Under bellmouths in water ballast tanks

16.3.3.2 The Classification Society must determine the required locations and extent of the examination of the hull and structure in the Areas of Special Concern as noted in Section 1.3.6 and J18021 and J18021-SK01 Appendix "A", including any additional areas considered suspect or critical as required by the Classification Society.

16.3.3.3 The Classification Society is to perform close-up surveys of all respective locations including a visual examination of the structure and coating.

16.3.4 Extent of Hull Thickness Measurements

16.3.4.1 The Contractor must perform thickness measurements such that the TCMS requirements for hull thickness measurement survey are met in addition to the specific requirements of the Classification Society and the work of this Specification. Thickness measurements must be carried out at all points that adequately represent the nature and extent of any corrosion or wastage of the representative structure (plate, web, longitudinal, etc.)

16.3.4.2 Ultrasonic Thickness Measurements of representative hull structure must be taken under the direction of the attending Surveyor. The measurements must be conducted concurrently with any other Special Survey to avoid redundant surveys. The extent of the thickness measurements must include the following requirements as a minimum:

Item	Description	Notes
1	Within 0.5L amidships; a minimum of 3 transverse sections > 90m or 2 transverse sections <90m; one of which must be located to represent the cargo hold region (see Note 1 below). **(since the Griffon work will be conducted alongside, the hull plating TM must be taken from the inside)**	Typical Class Requirement
2	All cargo hold hatch covers and coamings (plating and stiffeners)	Typical Class Requirement
3	All exposed main deck plating over full length of ship, including plating in way of wood deck planking or sheathing (see Note 2 below)	Typical Class Requirement
4	All wind and water strakes over the full length of the ship, port and starboard (see Note 2 below) **(since the Griffon work will be conducted alongside, the hull plating TM must be taken from the inside)**	Typical Class Requirement

5	Representative exposed superstructure deck plating (i.e. poop, bridge and forecastle decks)	Typical Class Requirement
6	Lowest strake, and strakes in way of 'tween deck, all transverse bulkheads in cargo spaces, together with internals	Typical Class Requirement
7	All transverse webs with associated plating and longitudinals, and the transverse bulkhead complete in the fore peak tank and aft peak tank	Typical Class Requirement
8	All keel plates over the full length of the ship **(since the Griffon work will be conducted alongside, the keel plating TM must be taken from the inside)**	Typical Class Requirement
9	Additional bottom plates in way of cofferdams, machinery space and aft end of tanks; including under bellmouths	Typical Class Requirement
10	Plating of sea chests and side shell plating in way of overboard discharges	Typical Class Requirement
11	Suspect or Critical areas, as considered necessary by the Surveyor including areas where coatings are found to be other than in GOOD condition	Typical Class Requirement
12	Shell and tank top plating immediately adjacent to tank top margins	CCG Requirement
13	Bottom shell in way of any cement, asphalt or other composition	CCG Requirement
14	Shell plating (internal) below port lights and windows	CCG Requirement
15	Tank top plating below ceiling and cabin soles;	CCG Requirement
16	Deck plating and side shell plating in way of galleys, washrooms and refrigerated store spaces	CCG Requirement
17	Structure in way of integral sanitary tanks	CCG Requirement
18	Ballast tank Sounding and vent pipes; seabay vent pipes	CCG Requirement
19	Tunnel under cargo hold	CCG Requirement

Note 1 – a transverse section includes all longitudinal members such as plating, longitudinals and girders at the deck, sides, bottom, inner bottom, and longitudinal bulkheads. For transversely framed vessels, a transverse section includes adjacent frames and their end connections in way of transverse sections.
Note 2 – a plate or strake is considered to be each plate field that is bounded by longitudinal and transverse members.

16.3.4.3 The Contractor must provide the services of a Class certified NDT (ultrasonic thickness testing) firm to determine the shell plating and structural thickness as indicated by the Classification Society. The specialist firm is to be a certified independent contractor using methods and equipment prescribed by the Classification Society. The Contractor will bid on 4000 shots (including proper surface preparation) including reporting, drawings, and sketches as prescribed by the Classification Society. The Contractor must provide a unit cost for each additional group of shots (groups of 10) to be adjusted up or down by PWGSC 1379 action.

16.3.4.4 The Contractor must include an allowance of $10,000 to cover the cost of travel of the NDT specialist. Travel and living expenses must be billed at cost without added overhead or profit. The $10,000 allowance must form part of the overall bid and will be adjusted by PWGSC 1379 action upon receipt of the final FSR invoice supported by copies of all related documentation to verify actual expenses.

16.3.5 Support

16.3.5.1 The Contractor must remove and reinstall, to as found condition, all bulkhead, ceiling, deck panel coverings, furnishings, fixtures, planking, insulation etc. that are required to gain access for surveying and thickness measuring (see J18021 and J18021-SK01 Appendix “A”). Areas that are too badly corroded, fouled, or otherwise unfit for survey and measurement are to be cleaned and/or blasted and primed to facilitate the survey and measurement work. The Contractor will repair any damage caused during removal and installations. Areas where coatings have been removed will be repaired by the application of 2 coats of approved primer as per coating manufacturer’s recommendations.

16.3.5.2 The Contractor must bid on removal and reinstallation of panels, liners, deck coverings, furnishings, fixtures, planking, insulation etc. (see J18021 and J18021-SK01 Appendix “A” for a breakdown of insulation and deck covering area, and the number of liner panels to be removed). The Contractor must provide a unit cost for removal and reinstallation of each additional m2 of insulation and deck coverings removed, and for each additional panel removed, to be adjusted by PWGSC 1379 action as required. The Contractor must provide a unit cost for removal and reinstallation of fan housings, lights, speakers, smoke detectors, and other similar components. An allowance of 50 additional items must be bid to be adjusted by PWGSC 1379 action as required.

16.3.5.3 The Contractor must supply all other materials needed to reinstall and restore the bulkhead, ceiling and deck panel coverings and insulation to the “As-found” condition.

16.3.5.4 Support services must include the opening and closing of all tanks and other spaces, including cleaning, preparation for safe entry, maintaining spaces for safe entry for duration of survey period and closing out. Confined spaces required for entry, for the purposes of the Condition Survey, that are not indicated on J18021 and J18021-SK01 Appendix A will be addressed through PWGSC 1379 action.

16.3.5.5 Support services must include the provision of all staging, man lifts, ladders, fall-arrest, and all other services required to provide access to carry out the work of this specification.

16.3.6 Areas of Special Concern

16.3.6.1 Special consideration must be given to the following areas onboard:

- Areas onboard where large changes in hull section modulus or areas where high shear loads occur during icebreaking operations (interface of accommodation blocks and decks, etc.)

16.3.7 Extent of Survey and Measurement – J18021 and J18021-SK01 Appendix A

16.3.7.1 A detailed list of the areas, locations, spaces, and tanks that are required to have a Close Up Survey and Thickness Measurements is identified in J18021 and J18021-SK01 Appendix A. This list is meant to expand upon the typical survey and measurement requirements of Class by providing CCG's program requirements and particularized vessel requirements.

16.3.7.2 The appendix includes an estimate of the areas of deck and bulkhead coverings, and the number of liners that need to be removed and reinstated in order to gain access for the CUS and TM.

16.3.7.3 The appendix includes notes that identify particular requirements and instructions for each area, location, space and tank.

16.4 Proof of Performance

16.4.1 Inspections

16.4.1.1 The Contractor must supply the survey plan and schedule, as prepared by the Classification Society, at the opening pre-refit meeting.

16.4.1.2 During the survey the Classification Society must complete a Close-up Survey Report for each location to record and assess the condition of the following items:

- Actual or latent defects, the presence of deficiencies relating to structural damage, fractures, buckling and ice damage, pitting and corrosion and weld grooving;

- Coating condition, both breakdown and representative measurements of remaining thickness;
- Condition of other anti-corrosion protective systems and devices (anodes).

16.4.1.3 During the survey the Contractor must provide a minimum of 48 hour notice to the TA and IA of the work items pertaining to the Condition Survey such that the TA and IA may make arrangements to have fluids moved from tanks etc., if required.

16.4.1.4 The Classification Society must notify the TA and IA immediately of any findings which in their opinion requires immediate remediation for the safety of the vessel.

16.4.1.5 The Contractor and the Classification Society surveyor must meet with the TA and IA at the end of each working day such that a summary of work and inspection results can be presented to the TA and IA.

16.4.2 Testing / Trials

16.4.2.1 The Contractor must restore all spaces and areas opened or exposed for the Condition Survey to serviceable condition. Materials used for the restorations must meet the requirements of the Canada Shipping Act and associated regulations. New gaskets will be fitted.

16.4.3 Certification

16.4.3.1 The Contractor must supply Classification Society certifications for the Thickness Measurement Service Company and Thickness Measurement equipment operators to the Contracting Authority and TA before commencement of the work.

16.5 Deliverables

16.5.1 Documentation

16.5.1.1 The Classification Society must prepare and present a Condition Survey report of their findings and assessment of the condition of the vessel. Reporting must include positive reporting results of where found onboard (Not just poor conditions). The report must include the following:

- A narrative section detailing their findings;
- Detailed thickness measurements for the hull. These must be presented in the Society's standard format and must include original, actual and limit values of structure under consideration. Measurements must also be recorded on a shell plate expansion drawing. Additional ship's drawings must be used to detail the conditions of the structural members not found on the shell

expansion plan (if these are unavailable, then sketches of the structure under consideration must be prepared;

- Close-up survey reports for each compartment, hull envelope and structure detailing of the findings for the various areas surveyed with respective photographs. Where necessary these detailed findings must be supported by drawings and detailed photographs showing the condition and state of the hull and structure;
- For the assessment reports, the condition of the structural components is to be rated as one of the following; Good, Satisfactory, Unsatisfactory or Poor. The Classification Society is to provide their specific definition for each of these terms.
- For the assessment reports, the condition of the protective coatings is to be rated as one of the following; Good, Fair or Poor. The Classification Society is to provide their specific definitions for each of these terms.

16.5.1.2 The report must also incorporate all deficiencies that have been identified. Where critical items have been identified the Classification Society must provide details for the required remediation work and the time line for when the work will need to be addressed to maintain the vessel's certification and reliability. The report must include all recommended repairs/renewals as required to achieve the equivalent of a 2nd Special Survey status for the vessel.

16.5.1.3 With respect to the hull coating, the report must identify any areas of concern and overall condition assessment of the hull coating. Where necessary, the areas of concern must be identified on a hull expansion plan and the report must provide details for the necessary remediation and the time frame being considered to address these issues.

16.5.1.4 The Contractor must provide to the TA one week after survey data is taken, 3 paper copies and 1 electronic copy, in MS Word 2003 or later format on a memory stick, of the full raw data file of the NDT Thickness measurements identified by location, frame space, compartment and component.

16.5.1.5 The Contractor must supply 3 paper copies of the Classification Society report to the TA within 12 weeks of the conclusion of the docking work period. The report must type written on standard letter size paper and must be bound.

16.5.1.6 The Contractor must supply 1 unprotected electronic copy of the Classification Society report in MS Word 2003 or later format on a memory stick that is not password protected to the TA within 12 weeks of the conclusion of the docking work period.

16.5.1.7 The Contractor must supply 3 paper copies of all amended and/or marked-up drawings to the TA within 12 weeks of the conclusion of the

docking work period. The drawings must be on standard ANSI D size paper.

16.5.1.8 The Contractor must supply 1 unprotected electronic copy of all drawings in AutoCAD 2007 DWG format or later on a memory stick that is not password protected to the TA within 12 weeks of the conclusion of the docking work period.

16.5.1.9 The Contractor must provide the initial schedule as indicated in 16.3.2.3 and provide copies of the updated schedule on a bi-weekly basis. Where possible the schedules and updates will be provided in MS Project 2007 or later revisions.

J18021 and J18021-SK01 - APPENDIX A

See List of Compartments and Sketches Attached

17.0 SHIP SERVICE GENERATORS MAINTENANCE AND OVERHAULS

17.1 Identification

17.1.1 The Contractor must provide the services of a manufacturer's representative to perform a 5 year survey (TCMS required survey) on the three Caterpillar 3406C ship service generators. This work includes the in-frame overhaul and survey of ship service diesels #2 and #3 as well as the dismantling, cleaning and inspection of all 3 alternators.

17.1.2 Additionally, the automatic voltage regulators must be set-up to achieve optimum load sharing, reactive power, stability and response to load variances both in parallel and alone on the bus.

17.2 References

17.2.1 Equipment Data

	SSG#1	**SSG#2**	**SSG#3**
Engine Manufacturer	Caterpillar		
Diesel Engine Model	3406C	3406C	3406C
Serial Number	#1SS01190	#1SS01191	#1SS01188
Arr. No.	177-8876	177-8876	177-8876
Speed	1800 RPM	1800 RPM	1800 RPM
Forecasted Total Operating Hours			
Generator Model	SR4B - 450S Frame 10 wire, Wye, Series	SR4B - 450S Frame 10 wire, Wye, Series	SR4B - 450S Frame 10 wire, Wye, Series
Arr. No.	231-2734	231-2734	231-2734
Year	2003	2003	2003
Serial Number	9FF03187	9FF03188	9FF03186
Voltage	460V	460V	460V
Amps	502A	502A	502A
Excitation	29 V, 5.6 A	29 V, 5.6 A	29 V, 5.6 A
Insulation	Class H	Class H	Class H
Phase/ Freq./P.F.	3 phase/60 Hz/0.8	3 phase/60 Hz/0.8	3 phase/60 Hz/0.8
KVA	400 KVA	400 KVA	400 KVA
Kilowatts	320 KW	320 KW	320 KW
Hours since last survey			
AVR Model	VR6	VR3	VR6

17.2.2 OEM Contact Information

Toromont Power Systems
Mike Duchesne
Marine Products Support Manager
mduchesne@toromont.com
1-289-219-2100

17.3 Technical Description

17.3.1 General

17.3.1.1 The Contractor must provide the services of ship service generators' OEM representative to carry out all the work on both the diesel engines and the three alternators.

17.3.1.2 The Contractor must provide an allowance of $90 000 in its bid to cover the cost of the OEM technician(s), including any living expenses (accommodations, meals, transportation, ect.) The Contractor must submit the OEM's final invoice, along with copies of all supporting documentation attesting to actual costs in accordance with Article 7.47 of the Contract. The $90 000 allowance will be increased or decreased using a 1379 form.

17.3.1.3 Prior to working on the diesel engines and the alternators, the Contractor must use proper lock-out/tag-out procedures (Fleet Safety Manual) to ensure that all equipment and systems are properly isolated.

17.3.1.4 All maintenance carried out on the diesel engines and alternators must be in accordance the manufacturer's recommendations and procedures.

17.3.2 Ship Service Generators #2 and #3 Diesel Engines

17.3.2.1 The Contractor must supply all labor, equipment and materials to complete an in-frame overhaul of both diesel engines. The Coast Guard will be able to provide a marine engineer to assist as required.

17.3.2.2 The Contractor must dismantle the diesel engines and inspect all components. The as found condition is to be included in the overhaul report.

17.3.2.3 Once each engine has been dismantled and the condition assessed, the Contractor must arrange for survey of the diesel engine components by a TCMS Surveyor and the IA.

17.3.2.4 Following the TCMS inspection, the Contractor must rebuild each diesel engine. The Contractor must supply all parts required for the in-frame overhaul. All parts must be OEM parts and provided using Toromont's core exchange program. All pistons, cylinder liners and connecting rods must be new components and included in the original bid price.

17.3.2.5 The Contractor must provide the TA and the IA with the complete listing of all remaining parts required to overhaul each engine. The Contractor must use the manufacturer's core exchange program for the parts and final cost will be negotiated using the 1379 process.

17.3.2.6 The Contractor must supervise the run up and break in of each diesel engine in accordance with the engine manufacturer's recommendations. The Contractor must provide a report of all operating parameters (pressures, temperatures, alarm points, shut downs).

17.3.3 Ship Service Alternators #1, #2, and #3

17.3.3.1 The Contractor must supply all labor, equipment and materials to complete the required work. The Coast Guard will be able to provide a marine engineer to assist as required. Any work arising in excess of that listed below or as a result of assessments will be negotiated using the 1379 process.

17.3.3.2 Where insulation resistance assessments are performed, the assessment must consist of a megger test for 1 min at 500 V, a polarization test for 10 minutes at 500 V and a dielectric discharge test for 30 minutes at 500 V.

17.3.3.3 The Contractor must perform an insulation resistance assessment on all windings of each machine prior to disassembly, before and after cleaning and after reassembly.

17.3.3.4 The Contractor must carry out a preliminary assessment of each machine. The assessment must include, but not be restricted to, a visual inspection of all alternator components, electrical testing and data acquisition while in operation, insulation resistance assessment prior to being disassembled. The Contractor must report all abnormalities to the TA and IA once preliminary assessments are complete.

17.3.3.5 The Contractor must disconnect electrically the alternator of each unit. All wiring must be properly identified and recorded for reference for reassembly.

17.3.3.6 The Contractor must ensure the rotor of each machine is adequately and rigidly supported during performance of this work.

17.3.3.7 Note the Griffon has rails and an armature support pipe aboard which were used by the Toromont technicians in 2013 to perform this work.

17.3.3.8 The Contractor must dismantle the alternator as required to perform inspection, cleaning, maintenance and testing of all rotor and stator components. In the event the rotor is uncoupled from the drive, alignment readings must be taken and recorded prior to uncoupling and after reconnecting the drive. The alignment readings must be presented to the IA prior to putting the unit in operation.

17.3.3.9 The Contractor must replace the rotor bearing of each machine. The bearings must be supplied by the Contractor.

17.3.3.10 The Contractor must clean the rotor and stator components using an accepted electrical solvent and spray wash method. The cleaner is to be Contractor supply. The Contractor must contain and dispose of all products used in the cleaning process. The Contractor must provide documentation that the waste products are disposed of according to all provincial and federal and municipal regulations in effect.

17.3.3.11 The Contractor must dry all windings after cleaning until acceptable insulation readings are obtained. No coatings must be applied to the windings until acceptable insulation readings have been obtained. All leads and windings must be inspected for damage and reported to the IA for possible repair where necessary.

17.3.3.12 The Contractor must arrange an inspection with TCMS and the IA of the alternator components prior to applying any coatings to the windings.

17.3.3.13 The Contractor must supply and apply a fast drying, synthetic resin type electrical insulating and finishing varnish suitable for oil, acid, moisture and salt water resistance to all windings prior to reassembly. The Contractor must ensure the manufacturer's recommendations for application, drying and curing time are followed. The Contractor must be responsible for all containment, ventilation and cleanup required to complete the work.

17.3.3.14 The Contractor must reassemble the alternator as per manufacturer's standards. All wiring and cables must be reconnected and tightened to manufacturer's requirements.

17.3.3.15 The Contractor must fit new GFM filter media on the air inlet of the alternator.

17.3.4 Adjustment of Automatic Voltage Regulators and Voltage Trim Pots

17.3.4.1 The Contractor must use calibrated test equipment to perform the following adjustments. The Contractor must not rely on the accuracy of the vessel's panel meter to perform the adjustments.

17.3.4.2 The Contractor must adjust the open circuit voltage of each machine using the trim pots fitted to the panels.

17.3.4.3 The Contractor must adjust the automatic voltage regulators of each machine to optimize the load sharing, stability and knee frequency of each machine. The Contractor must adjust for a voltage droop to the maximum allowable with the fitted AVR's to achieve good stability and reaction time. Sharing of KW load and KVAR load must be balanced in all combinations of generators operating in parallel. Reaction to heavy loads must be optimized for each machine using the start-up current of

the Bow Thruster as the test load. The vessel's engineering staff will assist in start-up of onboard vessel loads to obtain the necessary generator loading.

17.4 Proof of Performance

17.4.1 Inspection

17.4.1.1 All work must be completed to the satisfaction the TCMS inspector and the IA.

17.4.1.2 The Contractor must supervise the run up of each ship service generator.

17.4.2 Testing

17.4.2.1 The Contractor must submit each machine to a 2 hour loaded test at 210 kW (the largest hotel load the Griffon can supply). All operating data must be recorded and included in the final report to the IA and the TA.

17.4.2.2 The final testing must be submitted to the IA and TCMS for inspection.

17.5 Deliverables

17.5.1 Documentation

17.5.1.1 The Contractor must submit a detailed inspection report for each diesel and alternator to the IA. The Contractor must submit 3 paper copies and one electronic copy (PDF) of the report.

17.5.1.2 The report must include, but not be restricted to, observations and data from initial inspection, record of work performed and data (measurements, readings, ect.) collected during the work, final commissioning data, record of adjustments performed and record of all parts used.

17.5.1.3 The Contractor must work with CCG personnel to obtain a TCMS Division III credit for each ship service alternator (3) and each diesel engine (2).

17.5.1.4 The Contractor must provide copies of the invoices for the engine parts as per the OEM's core exchange program to the TA and the CA.

17.5.1.5 The Contractor must provide all MSDS sheets for all cleaning products used

17.5.1.6 The Contractor must provide proof of valid and current calibration for all measuring instruments used.

18.0 HVAC SOFTWARE AND CONTROL REPLACEMENT

18.1 Identification

18.1.1 The Contractor must upgrade the HVAC software and controls for the existing Carrier Comfortview Network. This consists of providing a new stand-alone laptop computer, new software, new hardware and interface connections and programming the software to control the system along with the associated testing and commissioning of the system.

18.2 References

18.2.1 Drawings

Drawing Number	Description	Electronic Filename
521-822-010 sh1 of 9	HVAC Modernization Layout & Details	521-822-010 S1.pdf
521-822-010 sh2 of 9	HVAC Modernization Equipment Control Strategy	521-822-010 S2.pdf
521-822-010 sh3 of 9	HVAC Modernization Block Diagram	521-822-010 S3.pdf
521-822-010 sh4 of 9	HVAC Modernization Electrical Conn. Diagram	521-822-010 S4.pdf
521-822-010 sh5 of 9	HVAC Modernization Fan Room Safety Panel	521-822-010 S5.pdf
521-822-010 sh6 of 9	HVAC Modernization Reheater Panel #1, Boat Dk.	521-822-010 S6.pdf
521-822-010 sh7 of 9	HVAC Modernization Reheater Panel #2, Poop Dk.	521-822-010 S7.pdf
521-822-010 sh8 of 9	HVAC Modernization Reheater Panel #3, Upper Dk. Stbd	521-822-010 S8.pdf
521-822-010 sh9 of 9	HVAC Modernization Reheater Panel #4, Upper Dk Port	521-822-010 S9.pdf
CMG05-111-GA sheets 1-2	General Arrangement, as fitted	G05111ga1.dwg G05111ga2.dwg

18.2.2 Graphic Files

Name	Description	Electronic Filename
Menu	Cover Page with selections	MAIN PAGE.pdf
SF-1	Upper Air Handler	GRIFFON SF-1.pdf
SF-2	Lower Air Handler	GRIFFON SF-2.pdf
Upper Deck	Cabin & Work Area Temps Upper Deck	GRIFFON UPPER DECK REV.1.pdf
Poop Deck	Cabin & Work Area Temps Poop Deck	GRIFFON POOP DECK REV.1.pdf

Boat Deck	Cabin & Work Area Temps Boat Deck	GRIFFON BOAT DECK REV.1.pdf
Bridge Deck	Cabin & Work Area Temps Bridge Deck	GRIFFON BRIDGE DECK REV.1.pdf

18.2.3 Manuals

Name	Electronic Filename
CCGS Griffon H.V.A.C System	Griffon HVAC Manual.pdf

18.2.4 Standards

- ANSI/ASHRAE Standard 135-2016 - Data Communication Protocol for Building Automation and Control Networks, latest revision and all related addendums;
- ANSI/ASHRAE Standard 15-2016 (packaged w/ Standard 34-2016) - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants, latest revision and all related addendums;
- TP 127 Latest Edition, Ship's Electrical Standards.

18.2.5 Background

18.2.5.1 The vessel's accommodation HVAC system is comprised of a circa 2003 Carrier Comfortview Ver. 3.0 Network which supervises and controls via a standalone laptop and RS232/486 Converter.

18.2.5.2 The system is split into Upper and Lower Units. The Upper System (SF-1) is comprised of a Carrier Model 39M size 08, 3500 CFM air handling unit and condenser for air conditioning. The Lower System (SF-2) is comprised of a Carrier Model 39M size 06 air handling unit and condenser unit for air conditioning.

18.2.5.3 Each system uses two 6400 CCN Controllers – one for communication and control of the air handling equipment and air conditioning and one for communication and control inside the accommodations for local control of the reheaters and temperature feedbacks.

18.2.5.4 Both systems are equipped to provide:

1. Central steam heat via steam to air heating coil in air handler,
2. Air handler equipment status indication,
3. Local zone heating control via electrical reheaters and thermostats, and safety shutdown circuits,
4. Nortec Humidification,
5. Carrier Transicold Sea Horse 90Y Central Air conditioning,
6. Belimo Outside/Recirc. damper control to control fresh air input and modulation according to temperature and humidity

conditions inside and out. This includes freeze protection of the steam coil during extreme cold conditions,

7. All temperature monitoring required providing data acquisition at each stage of the system, exterior temperature, with override in each cabin and accommodation workspaces.
8. The NO2 sensors and CO sensors have been disconnected, removed and are not required in the new system and all references in the programming have been deleted.
9. The refrigerant sensors are Vulcain Model VA-201T-Q2 and there is one fitted in each fan room.

18.2.6 Components to be Removed and Replaced

1. Carrier Comfortview Ver. 3.0 software;
2. Chief Engineer's HVAC standalone laptop (cabin);
3. RS232/485 Converter;
4. 4 – 6400 CCN controllers Part # CEPL130201 on the network:
   a) CC_64_12: SF-1 Reheats #1, Address 0.12;
   b) CC_64_10: SF-1 Air Handler, Address 0.10;
   c) CC_64_11: SF-2 Air Handler, Address 0.11;
   d) CC_64_13: SF-2 Reheats #2, Address 0.13.
5. 12 - I/O Extenders, Part # CEPL130203 are fitted to handle the additional I/O in the system;
6. 407C refrigerant sensors.

18.2.7 Components Remaining and to Adapt New System to

18.2.7.1 The Contractor must keep and adapt to the existing components fitted to the vessel's HVAC system, except where otherwise specified in this statement of work.

18.2.7.2 Remaining components include:

1. Upper HVAC unit;
2. Lower HVAC unit;
3. Nortec Humidifiers, NH Electric Steam Humidifier;
4. Kele steam valves actuators, model KAS-142;
5. Local re-heaters solid state power controllers Chromalox PDS SCR 4001, and associated re-heaters thermostats, safety shut downs;
6. In cabins and accommodations Carrier T55 space temperature sensors with override;
7. Exterior temperature thermistors, Carrier #HH79NZ017Carrier Transicold Sea Horse Central Air conditioning;
8. Belimo Outside/Recirc. damper control, including freeze protection of the steam coil during extreme cold conditions;
9. All power and control wires, unless otherwise specified.

18.3 Technical Description

18.3.1 General

18.3.1.1 The Contractor must plan for one day at the beginning of the design and programming phase of the work to collect all database information from the existing system required for the design and programming phase.

18.3.1.2 The Contractor must supply and install the latest version i-Vu software or equivalent, new user laptop, controllers and I/O extenders compatible with the new software and existing remaining system components.

18.3.1.3 The contractor must have the capability and experience to read, interpret and program the existing Carrier CCN software and integrate the new hardware and software into the existing system.

18.3.1.4 All peripheral equipment including wiring to and from the new controls must remain. All system peripherals must be retained and put to work in the new system. All electrical enclosure must remain. All new hardware must fit neatly in the existing enclosures. All communication backbones must remain.

18.3.1.5 The Contractor must program into the new software all existing system functionalities and control algorithms.

18.3.1.6 The Contractor must program into the new Contractor supplied laptop detailed interactive graphic representations of each deck of the ship as per the as fitted general arrangement drawing provided.

18.3.1.7 The Contractor must replace the existing refrigerant sensors in both Upper Fan Room and Lower Fan Room with new sensors compatible with 407C refrigerant.

18.3.1.8 The system must be set to work and all functions tested. All errors to programming encountered during commissioning must be repaired by Contractor.

18.3.1.9 The Contractor must provide training on the new system's operation, maintenance and troubleshooting.

18.3.1.10 All programming, drawings and documentation specific to the installation onboard the CCGS Griffon must become the intellectual property of Canada once the system has been commissioned. All historical data generated by the system must become the intellectual property of Canada throughout the life of the equipment.

18.3.1.11 The Contractor must provide the IA and the TA with documentation of the proposed system for review and acceptance prior to installation.

18.3.1.12 The Contactor must install and commission the new HVAC software controls onboard the CCGS Griffon.

18.3.2 Performance Requirements

18.3.2.1 Control System Supply

18.3.2.1.1 The control system must consist of a laptop that communicates with a high-speed, standalone BACNET network or equivalent consisting of 4 controllers and required I/O modules.

18.3.2.1.2 The new controllers must have the same power requirements as the existing units and must connect to the existing power supplies with a minimum of modifications.

18.3.2.1.3 The steam heating boiler and air conditioning systems will not be available to operate at the same time. The new control system must be designed to operate independently of those systems being operational or powered.

18.3.2.1.4 The new control system must be impervious to power outages. Upon the return of power, the system must return to operation at its last set operating parameters. Should the contractor choose to design the new system in such a way that it uses UPS protection to meet this requirement, the Contractor must be responsible for supplying and installing the equipment.

18.3.2.1.5 The new system must have fail safes built into the control system algorithms to prevent the steam coils from freezing should the system lose power or during periods of extreme cold weather. The designed fail safes must override any manual settings that may cause such freezing. The new system must have safety shutdowns programmed to control the dampers, reheater controls, and A/C compressors. Upon shutdown of a fan. The outside air dampers must close, power to the reheaters must be isolated, the A/C compressors must operate safely with overload or coil freezing, and the steam actuator must prevent the heating coil from both freezing and overheating.

18.3.2.1.6 The Contractor must supply and install in the Chief Engineer's cabin a new laptop to monitor and make program changes to the entire system.

18.3.2.1.7 The Contractor supplied lap-top must have at minimum the following specifications:

1. Fully compatible with the new system.
2. Dual Core Processor.
3. At least 1.5 GB RAM.
4. 10Mbps or higher LAN communications capability.
5. Windows 10 latest version.
6. Supports Edge, IE, Google Chrome, Mozilla Firefox, Safari browsers.
7. Have a maximum footprint measuring 15 inches wide by 12 inches deep.

18.3.2.1.8 The supplied laptop must be provided with all software configured as a portable operator's terminal. The Operator must be able to connect the configured terminal to the system network or directly to each controller for programming, set-up, and troubleshooting.

18.3.2.1.9 The operators must have access to all operational information in the control system via the supplied laptop computer utilizing web browser. The operator must also be able to connect locally to communicate with each controller separately when required.

18.3.2.1.10 Any installation or commissioning software used to operate, program, troubleshoot and modify the system, graphics and program must be pre-installed on the laptop.

18.3.2.1.11 Any tools required for making graphic changes must be provided with interface.

18.3.2.1.12 The computer and network must be completely separate from ship's DFO LAN. The computer must be connected via USB converter to the BACNET or equivalent network.

18.3.2.1.13 The interface must gather data from this system and generate web pages accessible through a conventional web browser on the Chief Engineer's new Contractor supplied HVAC laptop

18.3.2.1.14 Interface and controllers must communicate using BACNET or equivalent protocol. The interface and control network backbone must communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACNET/IP addressing as specified in ANSI/ASHRAE 135, BACNET Annex J.

18.3.2.2 Program Minimum User Requirements

18.3.2.2.1 The user interface program must allow the user to execute the following functions as a minimum, through the web browser interface:

1. The interface must contain navigation links that allow the operator to quickly navigate from the home screen to any piece of equipment in the system, and then return to the home screen. The present system is arranged in a hierarchical fashion, such as navigating from the home screen to a system data point, then to a specific feature in the configuration, and then to a specific cabin or piece of equipment, a similar arrangement is preferred.
2. Users must be able to download memory from the system database to each controller.
3. Log In and Log Out. The new system must have a user and password authentication system that requires an operator to log in before viewing or editing any data, and which can be configured to limit the privileges of an individual operator. The Contractor must create and provide to the Chief Engineer an administrator user and

password with unlimited access for modifications to the program, including all system parameters and configuration programming.

4. Point-and-click Navigation. Operator interface must be graphically based and must allow operators to access graphics for equipment and physical areas throughout the vessel using point-and-click navigation.
5. View and Adjust Equipment Properties. Operators must be able to view controlled equipment status and to adjust operating parameters such as set points, PID gains, on and off controls, and sensor calibration.
6. View and Respond to Alarms. Users must be able to view a list of currently active system alarms, to acknowledge each alarm, and to manually clear alarms as needed. Alarms or links to alarms must be provided on a contiguous list so the operator can quickly view all alarms. The list must have a defined capacity for a typical alarm retention of one month.
7. View and Configure Trends. Users must be able to view a trend graph of each trended point and to edit graph configuration to display a specific time period or data range. The user must be able to create custom trend graphs to display on the same page data from multiple trended points.
8. View and Configure Reports. Users must be able to run preconfigured reports, to view report results, and to customize report configuration to show data of interest. The Contractor must pre-program a report consisting of the list of all programmed parameters values at the time of printing.
9. Manage Control System Hardware. Users must be able to view controller status, to restart (reboot) each controller, and to download new control software to each controller.
10. The program must have the capability built into it to control the heating mode and cooling mode automatically and manually.
11. The program must have the capability to operate in “Fan Only” mode where the dampers are modulated to control the air temperature within the ship in conjunction with the ship’s reheaters. The air handlers must operate normally if both heating and cooling mode are manually turned off.
12. The Contractor must program and provide a summary page link for each piece of equipment in the system. This page must include the current values of all critical I/O points and must allow the operator to force binary points on or off and to force analog points to any value within their range.

18.3.2.3 Graphics Minimum User Requirements

18.3.2.3.1 The interface must depict each mechanical system and vessel deck plan by multiple point-and-click graphics. All existing and new components of the system must be represented and all control points must be interactive and represented in their physical location. The existing graphics in GIF format are the property of the Coast Guard and can be modified to display the new arrangement.

18.3.2.3.2 The system graphics must provide the minimum features:

1. User interface must be graphical and must include at least one graphic per piece of equipment or occupied zone, graphics for A/C condenser units and air handling units, and graphics that summarize conditions on each deck of the ship. Indicate thermal comfort on deck plan summary graphics using dynamic colors to represent zone temperature relative to zone setpoint.
2. Functionality: User graphics must allow operator to monitor system status, to view a summary of the most important data as shown in the reference graphics supplied for each controlled zone or piece of equipment, to use point-and-click navigation between zones or equipment, and to edit set points and other specified parameters.
3. Animation: User graphics must be able to animate by displaying different image files for changed object status.
4. Alarm Indication: Indicate areas or equipment in an alarm condition using color or other visual indicator.
5. Format: Graphics must be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics must be viewable on browsers compatible with supported browsers. Web graphic format must require no plug-in (such as HTML and JavaScript) or must only require widely available no-cost plug-ins.

18.3.2.4 Hardware Requirements

18.3.2.4.1 All hardware must be approved by TCMS or TCMS Approved Recognized Organization for installation aboard ships in Canada, such as CSA and UL.

18.3.2.4.2 The Contractor must supply all hardware for the upgrade of the HVAC control system. This must include controllers, I/O modules, new fusing, mounting hardware, additional wiring, terminations and plugs.

18.3.2.4.3 Space in the controller cabinets is limited. The hardware must fit in the existing controller cabinets such that there is adequate room for maintenance and troubleshooting.

18.3.2.4.4 The available space in the reheat panels is approximately 10 inches high by 14 inches wide by 5-3/4 inches deep. The available space in the A/C and Air Handler Panels is approximately 14 inches high by 6

inches wide by 8 inches deep. It is the Contractor's responsibility to ensure all new and existing hardware fits in the available space within the existing panels.

18.3.2.4.5 The hardware must be mounted on the back of the controller panels.

18.3.2.5 Refrigerant Sensors

18.3.2.5.1 The Contractor must supply two new Honeywell Vulcain or equivalent quality, manufactured within the last 2 years, refrigerant sensors compatible with 407C refrigerant and the new control system.

18.3.2.5.2 The sensors must utilize the existing power wiring and must output a digital signal to the control system when the refrigerant reaches threshold levels established under ANSI/ASHRAE Standard 15-2016, Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants, within the space.

18.3.2.5.3 The sensors must be installed in a way that allows removal and re-installation by a person working alone.

18.3.2.5.4 The sensors must be supplied with a current calibration certificate valid for a minimum of one year and a user's manual.

18.3.3 Removals

18.3.3.1 Software Backup

18.3.3.1.1 The Contractor must create an accurate backup of all existing Carrier programs and associated software onboard the Griffon prior to commencing removals. The backup programming must be used as the reference for the development of the functionalities and graphics interface of new programming.

18.3.3.1.2 The Contractor must record the configuration and addressing of all controllers in the network prior to disassembly.

18.3.3.2 Hardware Removals

18.3.3.2.1 The Contractor must isolate and lock out all electrical supplies prior to commencing work. The Contractor must consult the supplied reference drawings for sources to isolate and lock out and a proper lock-out, tag-out system shall be utilized.

18.3.3.2.2 The Contractor must identify and label all wires to all peripheral equipment identified to be disconnected. Unless otherwise specified, the original wiring to the existing equipment must be reused in the new installation where practicable.

18.3.3.2.3 The Contractor must disconnect, release from the back of the panel and remove all controllers and I/O extenders. All removed controllers and extenders must be returned to CG.

18.3.3.2.4 The Contractor must disconnect and remove the refrigerant sensors located in the Upper and Lower Fan Rooms. They must be discarded as electronic waste. This work must be done by a certified refrigeration technician and the Halocarbon log must be completed as required under the Federal Halocarbon Regulations. The Contractor must provide a disposal certificate that proves compliance with Federal, Provincial and municipal regulations.

18.3.3.2.5 All other removals required to complete the work in this specification is the responsibility of the Contractor.

18.3.4 Installation

18.3.4.1 The Contractor must install the new controllers and I/O modules using new zinc plated lockable machine screws. The units must be mounted on the back of each panel.

18.3.4.2 The Contractor must connect power to the new controller and I/O modules using new wires originating from the original terminals in the panels. New wires must be compliant with the original equipment manufacturer's requirement for the equipment and TP-127.

18.3.4.3 The Contractor must connect the controllers and I/O modules to the network utilizing the existing #18 AWG shielded communication cables.

18.3.4.4 The Contractor must reconnect all I/O using the existing wiring. Where existing wiring is too short for the new components installed, the Contractor must replace the wires with longer ones of the same capacity as the existing wire.

18.3.4.5 All new wires must be labelled with their origin and function and in accordance with TP 127E.

18.3.4.6 The Contractor must connect the existing communication network to the new user laptop via new Contractor supplied USB Converter. The converter must be mounted on the bulkhead close to the laptop in the Chief Engineer's cabin and be easily accessible for troubleshooting and maintenance.

18.3.4.7 The Contractor must mount and connect the new laptop to the USB converter using Contractor supplied cables. The laptop must be supplied with all required programming and software already installed.

18.3.4.8 The Contractor must install the new refrigerant sensors in place of the existing ones using the existing wiring and new corrosion resistant locking fasteners.

18.3.4.9 The Contractor must commission and test the new system in the presence of the Chief Engineer. The Contractor must tune all PID controls for stable operation.

18.3.4.10 The Contractor must backup and copy the new program once all modifications have been tested.

18.4 Proof of Performance

18.4.1 Inspection

18.4.1.1 The Contractor must afford the IA to inspect the final wiring in each panel prior to closing the panels.

18.4.2 Testing

18.4.2.1 The Contractor must develop a commissioning and test plan for the entire system to prove the correct communication and operation of all peripheral equipment. The system must be operated and tested in both heating and air conditioning modes. The commissioning and test plan must be submitted to the IA and the TA prior to commencing removal of any equipment.

18.4.2.2 Upon completion of the installation, the Contractor must test the new 407C refrigerant detection sensors in the upper and lower fan rooms to the threshold value in the presence of the IA to prove compliance with ANSI/ASHRAE Standard 15-2016, Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants.

18.4.2.3 The Contractor must test all program functions and modifications in the presence of the IA to prove their correct operation and adjust all system settings to the satisfaction of the IA.

18.4.2.4 After satisfactory review of the result, the Contractor must backup the modified programming using a unique file name incorporating the date it was modified and the name GRIFFONHVAC.

18.5 Deliverables

18.5.1 Intellectual Property

18.5.1.1 The terms of Intellectual Property rights are set out in SACC Supplemental General Conditions 4007 – Canada to Own Intellectual Property Rights in Foreground Information.

18.5.1.2 For clarity, Foreground Information includes, but is not limited to, all HVAC control system as fitted drawings; software foreground programming; and operation, maintenance, parts and training manuals produced or developed for this work specification and the installation onboard the CCGS Griffon. This information will be used in the operation, maintenance, servicing, set points adjustments, and future programming and upgrades to the HVAC control system.

18.5.2 Documentation

18.5.2.1 The Contractor must provide one electronic copy and one paper copy of a summary report to the IA prior to the end of the contract including the following:

1. Work done and any outstanding issues the programmer encountered;
2. Detailed description of the new system functions, including operation, maintenance and troubleshooting procedures;
3. A copy of the backup of the program after all testing and commissioning has been completed, including all graphic files must be supplied to the Chief Engineer in USB-Key format;
4. Updated as fitted schematics of all wiring modifications for the install of the new equipment;
5. OEM operation and maintenance manuals of all new equipment supplied;
6. Calibration certificates for the new refrigerant sensors valid for minimum of one year;
7. Disposal certificates for the old refrigerant sensors;
8. Completed log books for the work completed on the refrigerant systems by the certified technician, this shall include the licnence number and name of the technician who did the work;
9. Bill of materials including make, model and part numbers of all new components.

18.5.3 Training

18.5.3.1 The Contractor must provide two separate non-consecutive days (8 hours) of onboard training, one for each crew, for 2-4 people per crew on the HVAC software operation, maintenance and troubleshooting.

18.5.3.2 Crew training must be completed after HVAC system has been fully tested by the Contractor and is deemed to be operational.

18.5.3.3 One training day must occur immediately after commissioning. The Contractor must coordinate a second training day with the TA, for the other crew.

18.5.3.4 The training must cover all knowledge required to perform all tasks listed in 18.3.2.

19.0 MIRANDA DAVIT MAINTENANCE

19.1 Identification

19.1.1 The purpose of this section is to complete an annual inspection of the vessel's Miranda davit as well as carry out maintenance to the manual brake and the manually operated hydraulic directional control valve which controls the raising/lowering of the vessel's fast rescue craft.

19.1.2 The control valve work includes removing the valve to the Contractor's facility for overhaul, complete disassembly and inspection all components of the valve including relief valve, replacement of all seals with Contactor supplied OEM parts, reassembly, bench testing, reinstallation and testing of the Miranda davit.

19.1.3 The annual inspection work includes replacement of the brake shaft, a complete inspection as per Palfinger recommendations, and a functional load test of the Davit upon completion of all work.

19.1.4 All work in this section must be completed under the supervision of an FSR from Palfinger Marine Canada Inc.

19.2 References

19.2.1 Drawings

Drawing Number	Description	Electronic Filename
35117	General Arrangement MRT 3900 (Stbd Side)	35117.pdf
711742	Schematic Circuit Diagram	711742.pdf
S711550 Rev A	Sectional Arrgt of Winch Type BHY 5300	S711550A.pdf
902624	Gen Arrgt BHY 5300 MK XR	902624.pdf
711776	Pict. Pipe Arrg't & Fittings List Panel to Pumps	711776.pdf
407029 Rev. B	Sectional Arrangement of Brake Unit	407029B.tif

19.2.2 Regulations

- Cargo, Fumigation, and Tackle Regulations, (SOR/2007-128).

19.2.3 Davit Details

Manufacturer: Schat-Harding
Davit Type: MRT 3900

Winch #: 2922
Winch Type: BHY.5300

Mark: XR
SWL: 5300 KGS
Static Test: 5660 KGS
Lower Load: 4150 KGS
Speed of Barrel: 83.6 M/MIN
Date 29.01.03
Directional Valve Data: D50-5A51-5M1-5E526S-5D1-5Z52, manual lever operated, self-centering, open-center

Davit Arms (Fore and Aft similar)
O/No: 12703
HGA 146
STL: 5280 kg
SWL: 2400 kg

Cradle
O/No: 12703
HGA 146
STL: 9750 kg
SWL 3900 kg

Lifeboat
Zodiac Hurricane Model: H749
Weight: 5620 lbs
Max complement weight: 3275 lbs
Total Max weight: 8895 lbs

19.2.4 Field Service Representative

19.2.4.1 The OEM accredited field service representatives for the Miranda davit is:

Palfinger Marine Canada Ltd.
120 - 20575 Langley By-Pass
Langley, V3A 5E8
Tel: 1-604-530-0814

19.3 Technical Description

19.3.1 General

19.3.1.1 The Contractor must supply all labor, parts, materials and equipment required to carry out the work described below, unless indicated otherwise.

19.3.1.2 All work on the Miranda davit must be carried out under the supervision of a Palfinger Marine Canada FSR. All work carried out on the davit must be in accordance with the manufacturer's recommendations and practices.

19.3.1.3 The Contractor must include a $10 000 allowance in its bid to cover the cost of the services of a Palfinger representative, including living expenses (accommodations, meals and transportation) in accordance with Article 7.47 of the Contract. The $10 000 allowance will be adjusted (increased/decreased) using a 1379 form upon receipt of the representative's final invoice, along with all supporting documentation attesting to actual costs.

19.3.1.4 The vessel will be secured so that the davit is accessible from the dock.

19.3.1.5 The Contractor must use a proper lock out tag out system to electrically isolate the Miranda Davit electrical power supply.

19.3.1.6 Prior to completing any work on the davit, the Contractor must ensure that the zodiac has been removed and that the cradle is properly secured.

19.3.1.7 The Contractor is responsible for coordinating at TCMS inspections.

19.3.2 Directional Control Valve

19.3.2.1 The Contractor must supply all labor, materials and equipment to drain the system and hoses of hydraulic oil, remove the valve, isolate and contain leakage, transport the valve to/from the contractor's facility, overhaul the valve with GFM supplied repair kit, reinstall the valve and testing of the davit.

19.3.2.2 The Contractor must drain the system and hoses of hydraulic oil, remove the valve, isolate and contain leakage. The Contractor is responsible for disposing of all oil in accordance with all provincial and federal regulations.

19.3.2.3 All hose connections are flanged SAE 3000 PSI. All hoses are SAE 100R2AT. All hose ends removed from the valve must be deadheaded to prevent leakage using appropriately sized blanks.

19.3.2.4 The Contractor must release and deadhead the following seven connections at the directional valve:

1. P1 at block 5A51, 1 – 1" hose;
2. A1 & B1 at block 5M1, 2 – 1" hoses;
3. P2 at block 5E526S, 1 – 1" hose;
4. A2 & B2 at block 5D1, 2 – 1" hoses;
5. T2 at block 5Z52, 1 – 1-1/4" hose.

19.3.2.5 The Contractor must release the valve from the control stand and transport it to the Contractor's facility for inspection and overhaul. The Contractor is responsible for the valve and must ensure that the valve is protected against all damage and contamination while in the Contractor's care.

19.3.2.6 Prior to disassembly of the valve, the Contractor must bench test the valve to determine the existing relief valve setting. This value must be recorded and detailed on the overhaul report.

19.3.2.7 The Contractor must disassemble, clean and inspect all components for wear. Any defective components other than seals must be brought to the immediate attention of the IA for corrective action.

19.3.2.8 The Contractor must install the GFM supplied seal kit and reassemble the valve in good working order.

19.3.2.9 The Contractor must bench test the valve upon reassembly and set the relief valve pressure of 5M1 and 5D1 to manufacturer's recommended settings. The valve relief settings must be submitted to the IA and TCMS for inspection at the Contractor's facility.

19.3.2.10 The Contractor must reinstall the valve in the control stand using new non-corrosive locking fasteners.

19.3.2.11 The Contractor must reinstall the hose connections to the valve assembly using new Contractor supplied flange O-ring seals and 316 stainless steel Allen head bolts.

19.3.2.12 Prior to testing the davit, the Contractor must fill the hydraulic system to its operational oil level. The oil must be Contractor supplied Hydrex AW 32. Oil cost to be negotiated using 1379 process.

19.3.3 Davit Maintenance

19.3.3.1 The Contractor must complete an annual inspection of the davit as per Palfinger Marine recommendations and must include a minimum of:

1. A general inspection of the davit and its components for damage and good working order;
2. Carry out a full functional test of the davit and its controls, including emergency stop;
3. Disassembly and inspection of the manual and centrifugal brake sections;
4. Replacement of the brake shaft (GFM);
5. Brakes components must be cleaned, pads deglazed and components lubricated as necessary before reassembly;
6. Inspection of the winch gearbox, including oil change;
7. Cleaning and inspection of hydraulic oil reservoir, including oil and filter change;

8. Inspection of all limit switches and their proper operation, adjusting as necessary;
9. Inspection of all cable sheaves, pins and lower blocks.

19.3.3.2 The Contractor must drain the winch gear box and dispose of the oil. The Contractor must fill the gear box with new Contractor supplied oil. The type oil used in the winch gearbox is Enduratex EP-68, approximately 11 Litres.

19.3.3.3 The Contractor must drain the hydraulic system and its tank. The Contractor must dispose of this oil. The tank must be cleaned and inspected. The Contractor must replace the hydraulic filter and the desiccant breather filter. These items will be GFM. The Contractor must supply new oil to fill the system. The type of oil used in the hydraulic system is Hydrex AW 32, approximate capacity of the hydraulic reservoir is 225 litres.

19.3.3.4 The Contractor must replace the disc brake shaft (ref: drawing 407029 Rev. B, item B), including all bearings and seals on this shaft. These parts will be GFM.

19.3.3.5 All components must be replaced according to the manufacturer's recommendations and procedures.

19.3.3.6 Upon completing of work, the Contractor must carry out a load test of the davit and demonstrate the proper operation of the brake. The load test must be carried out as per manufacturer's recommendations.

19.4 Proof of Performance

19.4.1 Inspection

19.4.1.1 All work must be completed to the satisfaction of the TCMS inspector, the IA and the Palfinger FSR.

19.4.2 Testing

19.4.2.1 The Contractor must put the system in operation and demonstrate the proper functioning of the davit while both lower and raising. The davit must be loaded as per manufacturer's recommendations to test the system. The manufacturer's recommendations must conform to SOLAS requirements for lifeboat launching appliances. The ship's crew will be available to operate the davit. The Contractor must verify the system is free of leaks and all pressures and temperatures are within the design parameters for the system.

19.4.2.2 The Contractor must demonstrate the proper functioning of the centrifugal and manual brakes as per manufacturer's specifications.

19.5 Deliverables

19.5.1 Documentation

19.5.1.1 The Contractor must provide a detailed report of all the work carried out on the davit, the brakes, and the control valve. This report must include all measurements taken, pressures recorded, relief valve settings, all deficiencies found, all corrective measures taken and any recommendations for future maintenance.

19.5.1.2 The Contractor must provide a certificate indicating that the davit is fit for service.

20.0 HIAB SEA CRANE INSPECTION (QUINQUENNIAL)

20.1 Identification

20.1.1 The Hiab Stores Crane onboard the CCGS Griffon requires a 5 year survey inspection that must be carried out in accordance with the Canada Shipping Act Cargo, Fumigation and Tackle Regulations. The Contractor must provide a T2 certificate "Certificate of Test and Thorough Examination of Lifting Appliances".

20.2 References

20.2.1 Documents

Description	Electronic File
Hiab Sea Crane 200 Instruction Manual	Sea Crane 200 manual.pdf
Polar 2100B Manual for Remote Control	Polar 2100B manual.pdf
Polar 2100B Marine Part Manual	

20.2.2 Regulations

- Cargo, Fumigation, and Tackle Regulations, (SOR/2007-128).

20.2.3 Equipment Data

Hiab Seacrane:
Model: 200SC
Manuf. Date: 1994
Manuf.: # 610
Last Inspected: 25/06/2013, Atlas Polar

Hydraulic Pump:
2PL090

Electric Motor:
Hansen 30HP, 3Ph, 460VAC, 60Hz
Cat No. 2424215H-00M
Frame: HLF286TC
Nr. A447564 JC502-002

20.2.4 Field Service Representative

20.2.4.1 The accredited field service representatives for this crane is:

Atlas Polar
60 Northline Rd.
Toronto, Ontario.
M4B 3E5
Tel: 1-416-751-7740

20.3 Technical Description

20.3.1 General

20.3.1.1 The Contractor must supply all labor, tools and materials to perform the work as well as the test weights required for the load tests.

20.3.1.2 The goal of this inspection is to receive a Form T2, Certificate of Test and Thorough Examination of Lifting Appliances signed by a “competent person” under the regulations. In this case a competent person is “a person engaged in the manufacture and repair of the gear” (paragraph 300 (2) of the regulations) and the Contractor must engage the services of the OEM of the equipment.

20.3.1.3 The Contractor must provide an allowance of $10 000 in its bid to cover the cost of the OEM technician(s), including any living expenses (accommodations, meals, transportation, ect.) The Contractor must submit the OEM’s final invoice, along with copies of all supporting documentation attesting to actual costs in accordance with Article 7.47 of the Contract. The $10 000 allowance will be increased or decreased using a 1379 form.

20.3.1.4 The crane underwent NDT testing in 2013 and according to manufacturer’s recommendations this is not required again until 2023.

20.3.1.5 The Contractor must perform a load test of the crane prior to commencing any work on the crane. The load test must at a minimum meet the requirements of Schedule 4 of the Cargo, Fumigation, and Tackle Regulations, (SOR/2007-128) regulations. The test weight (dead load only) must be slewed for the full slewing range of the crane. This test must be witnessed by the IA. Upon completion of all work, the Contractor must complete another load test.

20.3.1.6 The load test must be done with the boom fully extended and the test load suspended from the end of the boom. A test load of 125% of the safe working load (SWL) must be used and the boom angle must not to exceed 15 degrees above the horizontal. The test load must be as follows:

- Fully extended - 9.9 m, 1850kg SWL x 125% = 2313 kg

20.3.1.7 The Contractor must note that this test load exceeds the SWL of the winch wire and thus the Contractor supplied test load must be attached to the end of the boom via a Contractor supplied shore side mobile crane and attachment devices.

20.3.2 Hydraulic Reservoir, Pumps and Motors

20.3.2.1 The Contractor must electrically isolate and secure the power supplies to the two hydraulic pumping units, the hydraulic reservoir tank heater, the hydraulic tank by-pass filter, and the hydraulic control unit.

20.3.2.2 The Contractor must drain and dispose of the Hiab crane's hydraulic reservoir tank oil. The Contractor must open, clean, and inspect the hydraulic reservoir tank. Access into the reservoir tank is through a 12" hand hole. All filters (breather and hydraulic return) must be renewed and will be GFM. The hydraulic tank hatch gasket must be renewed by the Contractor with and OEM gasket (Vescor 5801 Buna-N).

20.3.2.3 The Contractor must disconnect the two hydraulic pumps from the hydraulic lines, uncouple them from their electric motors, and remove them from their mounts. The pumps must be taken to a Contractors facility, opened, cleaned, and inspected by the FSR. The Contractor must take a photographic record of the pump overhaul including a photograph that clearly shows all the components cleaned and laid out for inspection. A condition report containing descriptions of the equipment conditions, all measurements taken, and photographs of the components for each pump must be prepared by the OEM and presented to the IA and the TA within 48 hours of completing the inspection.

20.3.2.4 The Contractor must identify, label, and disconnect the power leads at each hydraulic pump motor. Care must be taken to note and record the direction of rotation for each motor prior to electrically disconnecting them. The motors must be removed to a Contractors facility to be Meggered, opened, inspected, cleaned, and have new bearings installed. Megger testing must be between phases and ground, and the megger instrument must have a valid calibration certificate.

20.3.2.5 The Contractor must take a photographic record of the motor components. The motors must be presented to the IA for inspection before reassembly.

20.3.2.6 The motors must be reassembled with new OEM Contractor supplied bearings.

20.3.2.7 The Contractor must provide a condition report of each motor to the IA and the TA within 48 hours of the inspection. The report must include descriptions of the equipment and their condition, photographs of the disassembled components, measurements, and calibration certificates for all measuring devices used.

20.3.3 Hydraulic Crane

20.3.3.1 The Contractor must clean and inspect the crane and its various components according to manufacturer's recommendations and all components must be examined for evidence of permanent deformation,

wear and general overall condition. To facilitate this thorough inspection, it is recommended that either the crane or its components be removed from the ship and that the inspections of the components are performed indoors.

20.3.3.2 The Contractor must seal all opened hydraulic components, including hoses with plugs, seals and covers to prevent contamination of any part of the hydraulic system after disassembly. The Contractor must clean up all hydraulic oil leakage and spillage that occurs during the course of the work of this specification section. The Contractor must dispose of all oil and oily waste generated during the work of this specification section. Disposal certificates for oil and oily waste shall be provided as proof that the Contractor disposed of the generated waste in accordance with regulations in effect.

20.3.3.3 The Contractor must ensure inspection of the crane includes the following items:

1. Hydraulic reservoir oil level;
2. Slewing housing oil level;
3. Pivot pins and lockings;
4. Linkages;
5. Hold-down bolts and nuts;
6. Hoses/connections;
7. Pins/connections;
8. Swivels;
9. Valve assembly and additional valves;
10. Swing cylinder;
11. Inner boom cylinder;
12. Outer boom cylinder;
13. Extension cylinder;
14. Crane Base;
15. Crane Post;
16. Inner boom;
17. Outer boom;
18. Extension boom;
19. Winch, snatch block, and hoist wire;
20. Load plate;
21. Lever symbols;
22. Hose reels;
23. Check main relief valve;
24. Hydraulic pumps/shaft;
25. Hook and safety latch;
26. Marine controller, 3 of.

20.3.3.4 The Contractor must take and record all measurements required by the OEM to ascertain that individual components of the crane are within the OEM recommended tolerances. These measurements must be available for inspection by the attending TCMS surveyor and the IA.

20.3.3.5 The Contractor must inspect the hook and block assembly for corrosion and wear of the threads. The hook nut must be marked with the date of inspection.

20.3.3.6 The Contractor must replace any worn or deformed parts under 1379 action. All replacement parts must be Contractor supplied and must be OEM parts.

20.3.3.7 As this is a 5 year inspection, the Contractor must replace all hydraulic hoses of the crane with OEM replacement parts. The Contractor must flush all new hoses with hydraulic oil prior to installation.

20.3.3.8 Once the inspection of all components has been completed the Contractor must reassemble the crane, re-install the crane on the vessel and perform a full functional test proofing that the crane functions as designed.

20.3.3.9 The Contractor must provide the necessary hydraulic oil quantity to fill the oil reservoirs on the crane to their working levels (approximately 250 L). Currently Hydrex AW 32 hydraulic oil is used onboard the vessel for this crane.

20.3.3.10 The Contractor must provide the necessary gear oil quantity to fill the winch and slewing housing on the crane to their working levels (approximately 1 L for the winch and 20 L for the gearbox). Currently Traxxon 80W90 gear oil is used onboard the vessel for this crane.

20.4 Proof of Performance

20.4.1 Inspection

20.4.1.1 The Contractor must present the components of the crane for inspection to the attending TCMS inspector and the IA. Any defects must be pointed out to the IA so that corrective action can be taken.

20.4.2 Testing

20.4.2.1 Prior to testing the crane after the dismantling and component inspections the Contractor must verify that the hydraulic oil pressure circuits are oil tight.

20.4.2.2 Prior to testing the crane after installation of the hydraulic pumps and motors, the Contractor must perform a bump test of each motor to ensure direction of rotation is correct. The Contractor must not run the hydraulic pumps without sufficient oil.

20.4.2.3 The functionality of the crane must be proven to the IA. The functional test must include all articulations possible with the crane with the SWL attached from remote control and locally. Winch operation and braking must be verified. All Stop buttons must be tested. All safety systems must be proven functional. Testing must be conducted through a minimum of one hour and must include a varied range of lifting weights through a range of heights and extensions from the maximum upper and lower limits of the operation of the crane within the restraints of the ship. The Contractor must supply load weights for the load tests. Any leaks that develop during the testing must be repaired by the Contractor.

20.4.2.4 The Contractor must perform a load test to 1.25 times the SWL after the reassembly of the crane as required by the Regulations. This load test must be done in the presence of the person signing the T2 Certificate. All test loads required for this test must be supplied by the Contractor.

20.5 Deliverables

20.5.1 Documentation

20.5.1.1 As a competent person under the Cargo, Fumigation, and Tackle Regulations, (SOR/2007-128) the Contractor must issue a completed Form T2 to the Coast Guard after completion of the inspection and testing of the Hiab crane.

20.5.1.2 The Contractor must generate an inspection report documenting the overall condition of the structure and its components. The report must also detail the work completed, parts replaced, all readings/measurement taken, results of final tests and inspection as well as any recommendations. The Contractor must provide three hard copies of the report and one electronic copy (PDF).

20.5.1.3 The Contractor must provide the IA with all disposal certificates for the oil and oily waste generated during the work of this specification item.

21.0 WATERTIGHT DOOR REFURBISHMENT

21.1 Identification

21.1.1 The Contractor must upgrade the watertight door hydraulic system for 3 watertight doors by installing new GFM pump sets, pressure switches and tubing kits, replacing existing pressure switches and pumps, as well as overhauling the hydraulic rams and valve blocks.

21.1.2 An example of a previously completed door/system refurbishment exists at door position #2 – Fwd Motor Room, Lower Bulkhead.

21.2 References

21.2.1 Drawings

Drawing Number	Description	Electronic Filename
	WT Door Electrical – Sheet 1	WT Door Electrical Schematic (1).pdf
	WT Door Electrical – Sheet 2	WT Door Electrical Schematic (2).pdf
	WT Door Electrical – Sheet 3	WT Door Electrical Schematic (3).pdf
A-WK-406-57	Hyd. Graphical Dia. For Power-Operated W.T. Door	A-WK-406-57.pdf
A-WK-4A	Pressure Switch A-WK-4A	A-WK-4A.pdf
B-WK-471-9D	Hydraulic Arrangement Power Operated Door	B-WK-471-9D.pdf
B-WK-406-C-1-B	Cylinder Assembly 2-3/4” Bore 3-3/8” OD	B-WK-406-C-1-B.pdf
C-WK-852-69	Tube details for sliding door Motor, pump, and valve assy.	C-WK-852-69.pdf
D-WK-852-48	Motor, Pump, Valve Assembly HSWT Door	D-WK-852-48.pdf
C-WK437-37	Local Hand Pump	C-WK437-37pdf
DWK-406CK	Hand Cranks	DWK-406CK.pdf
A-WK-471-1A	Quad Check Valve A-WK-2A & Single Check Valve A-WK-5A	A-WK-471-1A.pdf
AWK-471-2A	Shuttle Unit A-WK-3A	A-WK-471-2A.pdf
A-WK-471-3A	Dual Relief Valve A-WK-1A	A-WK-471-3Apdf
A-WK-471-4A	Single Check Valve A-WK-5A	A-WK-471-4Apdf

21.2.2 Standards

- TP 127, Ships Electrical Standards, Latest Edition

21.2.3 Watertight Door System Data

- Electrical Supply: 460 Emergency Distribution Breaker EP-3, Emergency Switchboard.
- Watertight Door System Data:
- Manufacturer: Walz & Krenzer Inc., Rochester, N.Y.
- Type: Horizontal Sliding Door 30” X 72”
  Serial # 1084 - Door #3, location: Control Room
  Serial # 1085 - Door #4, location: ER Workshop
  Serial # 1086 - Door #1, location: Sewage Compt.

- Inspection Dates: 25 Sept, 1968.
- Pumpset Data: Pump: Gerotor, Model: B1.5P30A1. 1.6 GPM @1800 RPM
- Motor: Baldor, Model: 35-4252-2124, 440V, 2.2A.
- Pressure Switch Data: Micro, Model: BZ-7RT04
- Ram Cups: Bitan – Type A 2.770” X 1-1/2” X ¾” X 3/16”
- Cylinder Chevron Packing: Chevron 8452, 1-5/8” X 2-3/8” (homogeneous Nitrile elastomer)
- Oil Seal: Klozure Garlock #63 X 760

- **New Pumpset:**
  Pump: Marzocchi
  Model #ALP1A-R-6-E2
  Motor: Baldor, Model # 350057Y153G1, 6HP, 208-230/460V, 2.1, 1675 RPM.

21.3 Technical Description

21.3.1 General

21.3.1.1 The Contractor must subcontract the services of an experienced hydraulic technician who has experience in marine sector, to perform all hydraulic work on the watertight door systems.

21.3.1.2 All electrical work must be performed by a certified electrician having experience in the marine sector.

21.3.1.3 All parts and material must be Contractor supply unless otherwise stated.

21.3.1.4 The Contractor must dispose of all waste oil ashore in accordance with regulations in effect. The Contractor must provide the disposal certificates for the oil disposal. The Contractor must control all oil leakage from the opened systems by using containment systems to prevent oil leakage into the bilge. All oil leakage into the bilges must be cleaned up at the Contractor’s expense.

21.3.1.5 Upon completion of work, the Contractor must return all old equipment to the CCG.

21.3.1.6 The Contractor must notify the IA 24 hours in advance of its intention to commence work on this specification item.

21.3.1.7 The Contractor is responsible for coordinating all TCMS inspections.

21.3.2 Removals

21.3.2.1 The Contractor must isolate and lock out the electrical and hydraulic supply for each system using a proper lock out tag out system.

21.3.2.2 The Contractor must drain and remove the hydraulic oil from each system.

21.3.2.3 The Contractor must disconnect the pump set and pressure switches electrically for each door. The cables must be pulled back to their connections inside the control box and removed from the circuit. The Contractor must mark these connections for re-installation of new cabling.

21.3.2.4 The Contractor must release and remove the following equipment:

1. The pump set;
2. The valve block in its entirety inclusive of the pressure switch;
3. The local hand pump at each door.

21.3.2.5 The Contractor must remove the hydraulic ram from its mount on the door. The unit must be overhauled at the Contractor's facility.

21.3.3 Installation

21.3.3.1 The Contractor must overhaul the valve blocks with new Contractor supplied Viton "O" rings. The pressure switch assembly (quad check 2A with pressure switch) must be installed into the existing valve block assembly. New "O" rings for the pressure switches are GFM and will be supplied by the Chief Engineer.

21.3.3.2 The Contractor must overhaul the ram with new cups. The ram must be rebuilt with new chevron packing and oil seals that are Contractor supplied material.

21.3.3.3 The Contractor must reinstall the ram cylinder onto the existing mounts using the existing fasteners.

21.3.3.4 The Contractor must install the new pump sets onto the existing mounting brackets. The new motors must be reconnected to their supplies using new TC approved cabling. New galvanized steel cable glands with watertight seal washers must be installed at either end. These items must be Contractor supplied.

21.3.3.5 The Contractor must reinstall the valve blocks and reconnect the electrical wiring using new TC approved cables and new galvanized steel cable glands with watertight seal washers at either end.

21.3.3.6 The Contractor must fit and install the new hydraulic piping from the pumps to the suction and discharge ports on the valve blocks.

21.3.3.7 The Contractor must reconnect the inlet and outlet connections at the top of the valve blocks.

21.3.3.8 The Contractor must replace the oil seals on both sides of each of the local hand pumps. The Contractor must reinstall the hand pumps in their original orientation and reinstall the handles with new Contractor supplied pins.

21.3.3.9 The Contractor must return each system back to operation using GFM hydraulic oil to bleed and top up the system. The GFM oil supplied will be Petrocan Hydrex MV 22.

21.4 Proof of Performance

21.4.1 Inspection

21.4.1.1 All work must be completed to the satisfaction of the IA and the attending TCMS inspector.

21.4.2 Testing

21.4.2.1 The Contractor must test run each unit in the presence of the TCMS Inspector and the IA. All functions of each system are to be tested and proven to work correctly. All leaks resulting from the work performed must be repaired by the Contractor at their expense. The Contractor must connect a pressure gauge to demonstrate the operating pressure of each system and the pressure at which the motors shut off.

21.4.2.2 The Contractor must operate the local hand pump from both sides of the door in the presence of the TCMS Inspector and the IA. All leaks resulting from the work performed must be repaired by the Contractor at their expense.

21.4.2.3 The Contractor must also operate each door from the remote operating station located on the bridge.

21.4.2.4 The Contractor must verify the proper operation of all door limit switches and door status indicator lights at the remote operating station.

21.5 Deliverables

21.5.1 Documentation

21.5.1.1 The Contractor must submit a report to the IA and the TA detailing the work performed on each door, the operating parameters of the system, and any adjustments made. The report must clearly identify the work completed on each watertight door system and each system must be referenced by location of the watertight doors.

21.5.1.2 The Contractor must also provide a detailed report of the work carried out on each hydraulic ram, including all parts replaced, all measurements taken, the cause of any defects and corrective measures taken.

21.5.1.3 The Contractor must supply a copy of all material specifications for all Contractor supplied material used to complete the work described above (cabling, glands, o-rings, seals ect.).

22.0 POOP DECK CARPET REPLACEMENT

22.1 Identification

22.1.1 The Contractor must replace the carpeting in eight cabins located on the Poop Deck.

22.1.2 The Contractor must employ the services of a commercial flooring company specialized in the installation of flooring systems onboard ships to perform the work, and that the on-site supervisor has at least 5 years of experience installing marine commercial carpeting.

22.2 References

22.2.1 Drawings

Drawing Number	Description	Electronic Number
732400 sh 1	Deck Coverings	732400_1.dwg

22.2.2 Existing Carpeting

- Kraus Congress Elite 28 oz. level loop carpet
- Color: 2232/08 – Grey Flannel; direct glued
- Matching carpet skirting board

22.2.3 Cabins to be carpeted

Item #	Cabin Identification	Approximate square footage
1	Cabin #6, Spare Cabin	90.9
2	Cabin #8, 1st Engineer's Cabin	106.6
3	Cabin #9, 2nd Engineer's Cabin	108.3
4	Cabin #10, 3rd Engineer's Cabin	108.3
5	Cabin #11, Electrical Officer Cabin	103.5
6	Cabin #12, 2 Passengers Cabin	96.2
7	Cabin #13, 2 Passengers Cabin	94.7
8	Cabin #14, 2 Passengers Cabin	113.4

22.2.4 Standards

- Canadian Labor Code, latest revision.
- Marine Occupational Health and Safety Regulations, latest revision.
- Canadian Coast Guard Fleet Safety Manual
- Vessel Fire Safety Regulations, SOR/2017-14

22.3 Technical Description

22.3.1 General

22.3.1.1 The Contractor must inspect each cabin and verify dimensions of carpet required for each cabin prior to commencing the work in this specification item.

22.3.1.2 The Contractor must note that some cabins will be occupied as the vessel is partially staffed during the work period. The Contractor must notify the IA 24 hours prior to commencing the work to permit vacating the cabins. The Contractor must schedule the work in groups so as not to take all the cabins out of service at the same time and for a prolonged period.

22.3.1.3 The Contractor must supply all materials, labour and equipment required to complete the work of this specification item including removals, surface preparations, clean-up, dust and debris containment and disposal of removed items.

22.3.1.4 All carpeting and flooring products used for the installation of the new carpeting must be installed in accordance with the manufacturer's instructions and recommendations.

22.3.1.5 Upon completion of each cabin, the Contractor must clean it to an "as found" condition suitable for immediate occupancy.

22.3.2 Removals

22.3.2.1 The Contractor must remove all interference items to perform the work unless otherwise stated and includes the existing skirting boards, carpeting and carpet bases in each cabin.

22.3.2.2 The subfloor must be scraped clean and prepared for new carpet. All old adhesives must be removed and/or leveled to provide a smooth surface for the new carpet. The bulkhead paneling where the skirting board was removed must be scraped clean and prepared for new skirting board. Care must be taken not to damage the surface of the bulkhead panels that will remain visible after the new skirting board is installed. The Contractor must repair, at their own expense, any visible damage to the bulkhead panels caused by the Contractor.

22.3.3 Installation

22.3.3.1 In the event the subfloor requires repair, the Contractor must repair the existing subfloor. This will be considered extra work and will be negotiated in accordance with the 1379 process.

22.3.3.2 The cabin vanities were recently replaced in all of the cabins. The vanities have adjustable legs so that carpet can be installed beneath. The Contractor must ensure the vanities are not damaged during this work. All damage must be repaired at the Contractor's expense. The

carpet must extend to the bulkhead underneath each vanity. All vanity legs must be restored to their original length once the work is completed.

22.3.3.3 The Contractor must direct-glue the new carpeting and cut, bind and install new carpet skirting boards (baseboards) in each cabin. The carpet must be KRAUS Congress Elite 28 oz. level loop carpet – colour #2232/08 grey flannel, or an equivalent or better, commercial grade carpet product. The skirting boards must be made of the same carpet as the floor covering, be no less than 4 inches and no more than 5 inches in height, and must have the top edge hemmed. Prior to the purchase and installation of an equivalent product (or better), the Contractor must provide all technical specifications of the proposed product to the TA and the IA for approval.

22.3.3.4 The Contractor must install matching carpet floor mats in each cabin. The floor mats must be hemmed and measure 32” x 23”.

22.3.3.5 Upon completion of work, the Contractor must reinstall all removed interference items in their original location and working order.

22.4 Proof of Performance

22.4.1 Inspection

22.4.1.1 The Contractor must submit the completed work for inspection by the IA. All defects must be repaired by the Contractor.

22.5 Deliverables

22.5.1 Documentation

22.5.1.1 The Contractor must provide the carpet specifications indicating the materials low flame-spread and low smoke production data to the IA and the TA before the end of the work period.

22.5.1.2 The Contractor must provide a report of all the work completed including all products used.

23.0 ANNUAL FIREFIGHTING SYSTEMS INSPECTION

23.1 Identification

23.1.1 The Contractor must retain the services of a certified Kidde and Notifier FSR for the inspection and certification of all of the fire detection and prevention equipment on board the vessel, including those of the small boats (barge and FRC). This is a TCMS required survey for the certification of the vessel.

23.1.2 The forward Paint Locker CO2 system control head has been cross-threaded at some point. The Contractor must install a new GFM control head on this system.

23.2 References

23.2.1 Documentation

- 2017 Griffon Annual Fire Inspection – compiled

23.2.2 Regulations

- SOR/2017-14 Vessel Fire Safety Regulations

23.3 Technical Description

23.3.1 General

23.3.1.1 The Contractor must supply all materials, labor and equipment required to carry out all the work described below.

23.3.1.2 The Contractor must ensure that all inspections and maintenance are performed by technicians who are certified to work on the firefighting systems and equipment mentioned below. Prior to starting work, the Contractor must provide the IA with a valid copy of the technician's certification.

23.3.1.3 For scheduling purposes, the Contractor must ensure that all inspections and maintenance are completed towards the end of the work period and prior to sea trials. The Contractor must coordinate the inspections and maintenance with the TA and the IA once the work period has started.

23.3.1.4 The Contractor must give the IA at least 24 hours in advance prior to working on fire suppression system. The work must be completed in such as manner as to ensure adequate protection of the ship in case of an emergency.

23.3.1.5 Upon completion of work, the Contractor must return all spaces affected by the work to their original functional state and cleanliness.

23.3.2 Paint Locker CO2 System

23.3.2.1 The forward Paint Locker CO2 system control head has been cross-threaded at some point. The Contractor must replace the control head on this system.

23.3.2.2 The Contractor must make safe the Paint Locker CO2 system.

23.3.2.3 The Contractor must remove and return the old control head to the IA.

23.3.2.4 The Contractor must install the GFM control head on the Paint Locker CO2 system.

23.3.2.5 The Contractor must reuse the existing pull cable during installation.

23.3.2.6 Any modifications to the pull cable conduit are to be made at the Contractor's expense, with Contractor supplied materials.

23.3.2.7 This repair must be completed prior to testing and certification of the Paint Locker CO2 system.

23.3.3 Fire Systems

23.3.3.1 The Contractor must provide the services of a certified Kidde and Notifier FSR and materials to perform the work in this section of the SOW.

23.3.3.2 The Contractor must inspect, test and certify the Notifier NFS-640 Fire Detection System.

23.3.3.3 The Contractor must inspect, test, and certify the work barge and Fast Rescue Craft FM-200 fire suppression systems (4 of).

23.3.3.4 The Contractor must inspect, test, and certify the CCGS Griffon's fixed CO2 Suppression systems. The last hydrostatic test date was 2008.

23.3.3.5 The Contractor must inspect, test, and certify all the CCGS Griffon's portable fire extinguishers.

23.3.3.6 The Contractor must have the following fire extinguishers hydrostatically tested:

Ext. #	Location	Size	Type
2	Wheelhouse – Starboard	5 lbs	CO_2
3	Wheelhouse – Port	5 lbs	CO_2
5	Alleyway – By Comm. Centre	5 lbs	CO_2
6	Communication Centre – Starboard	5 lbs	CO_2
38	Galley Aft	10 lbs	CO_2
71	Engine Room, Lower Aft Starboard – By watertight door	10 lbs	CO_2

23.3.3.7 The Contractor must carry out a 6 year inspection on the following extinguishers:

Ext. #	Location	Size	Type
67	Buoy Workship	5 lbs	Dry Chemical ABC
N/A	Boat Deck by Helicopter Locker	300 lbs	Purple K

23.3.3.8 The Contractor must inspect, test, and certify the CCGS Griffon's fixed sprinkler system and all associated components.

23.3.3.9 The Contractor must inspect, test and certify the galley WHDR 260 Wet Chemical Fire Suppression system and all systems connected to it including:

- Fire Door Holdback System
- Gaylord Ventilator Range Hood System
- Fire Alarm System
- Remote Manual Pull
- Galley Equipment Panel NP-31

23.3.3.10 The Contractor must also inspect, test, and certify the Range Hood System.

23.3.3.11 The Contractor must coordinate the work on the galley fire suppression system and the range hood with the IA in order to respect the operational needs of the galley.

23.4 Proof of Performance

23.4.1 Inspection

23.4.1.1 The Contractor must demonstrate to the IA that all work has been completed as describe above and that all systems have been returned to operation.

23.4.1.2 All inspected fire extinguishers and systems must bare labels showing the name of the Company who conducted the inspection/maintenance, the date and the initials of the person who performed the inspection.

23.5 Deliverables

23.5.1 Documentation

23.5.1.1 The Contractor must provide the IA and the TA with written reports detailing:

- The condition of each system or component based upon the inspections.
- The test results of each component or system based upon the testing.

- The next due date for testing for each component or system based on current regulations.
- Any defects found on any component or system.
- All repairs made to any component or system.

23.5.1.2 The reports must be similar to the referenced reports from 2017.

23.5.1.3 The reports must be acceptable to the TCMS surveyor and demonstrate that all systems are in full working order as required for the CCGS Griffon's annual TCMS Safety Inspection.

23.5.1.4 The Contractor must provide inspection certificates for all systems inspected onboard the CCGS Griffon. These must be provided to the IA prior to the completion of the contract.

24.0 ANNUAL REFRIGERATION MAINTENANCE AND DAIRY ROOM EVAPORATOR

24.1 Identification

24.1.1 As per the Federal Halocarbon Regulations (2003), the Contractor must perform an annual inspection and leak test of the refrigeration system fitted onboard the vessel by a certified refrigeration technician.

24.1.2 The work in this section also includes the replacement of the existing Dairy Room evaporator.

24.2 References

24.2.1 Drawings

Drawing Number	Description	Electronic Number
521-822-009 sh1	Domestic Refrigeration Block & Connection Diagram	521-822-009.tif
EK050-06	RefPlus EKA1800,2100 – EK(E,R,T) 1700,2000	EK060-06.pdf
	EKE1700-5-SP data tag	RJ134629-TAG.pdf
	EKE 1700-5 General Information	EKE1.png

24.2.2 Regulations

- SOR/2003-289; Federal Halocarbon Regulations, 2003

24.2.3 Standards

- Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

24.2.4 Equipment Data

- **Main Refrigeration Plant:**
  Manufacturer: RefPlus
  Model: MCS-100-1L7-9,
  Serial Numbers: C 2003080221 and C 2003080220
  Refrigerant: 407C – 34 lbs

- **Existing Dairy Room Evaporator:**
  Manufacturer: RefPlus Model: EKE1700-5
  Serial Number: D2009110110, stainless steel housing.

- **New GFM Dairy Room Evaporator:**
  RefPlus model EKE1700-5-SP, ser.# D 2017120082, aluminum housing.

24.3 Technical Description

24.3.1 General

24.3.1.1 The Contractor must supply all labor, equipment and materials to complete the work described below.

24.3.1.2 All work must be completed by certified refrigeration technicians and a copy of their certification must be provided to the IA prior to commencing work.

24.3.1.3 The vessel will be manned during the work period and the refrigeration system will be in operation. The Contractor must coordinate with the IA to ensure minimum impact on the walk-in freezer and the walk-n vegetable cold room.

24.3.2 Annual Inspection

24.3.2.1 This work required to each of the above mentioned systems must include a minimum of:

a. A refrigerant leak test of all piping and system components.
b. Replace of all filter driers.
c. Clean all evaporators and check their defrost systems (where fitted).
d. Verify all system operating parameters and adjust as required, in accordance with the manufacturer's recommendations.

24.3.2.2 If a system is low on refrigerant the Contractor must determine the source of the leak and repair it prior to charging the system. Any repairs must be negotiated with a 1379 form. The Contractor must advise the IA of any required repairs prior to carrying out any work.

24.3.2.3 All refrigerant required to return a system to its proper charge must be supplied by the Contractor and must be negotiated with a 1379 form.

24.3.3 Dairy Room Evaporator

24.3.3.1 The Contractor must decommission the Dairy Room Evaporator in accordance with the Environmental Code of Practice. Proper lock-out tag outs must be used.

24.3.3.2 The Contractor must provide a minimum of 48 hours notice to the IA before commencing work on the Dairy Room Evaporator.

24.3.3.3 Once the IA has received this notice, the Ship's Crew will remove any interference items from the Dairy Room.

24.3.3.4 The Contractor must pump down and isolate the Dairy Room Evaporator. The Contractor must certify the Evaporator to be gas-free. The certificate must include the date, Contractors name, and the Contractors Ozone Depletion Prevention (ODP) card number. The evaporator must be clearly labelled as being gas-freed. A copy of the gas-free certificate must immediately be presented to the IA. This certificate will act as a Chain of Custody for the removed unit.

24.3.3.5 The Contractor must disconnect and save the copper drain line at the evaporator drain pan. This line will be reinstalled on the new GFM supplied evaporator.

24.3.3.6 The Contractor must isolate the electrical power supply to the Dairy Room evaporator. The power wires for the evaporator fan and evaporator solenoid valve must be disconnected and pulled back to be reused.

24.3.3.7 The Contractor must disconnect the evaporator from the high pressure and low pressure copper piping as close to the evaporator as possible. The Contractor must use a refrigerant leak detector and test the open pipe ends for signs of refrigerant leaking by the isolation valves.

24.3.3.8 The thermostatic expansion valve (TEV) must be de-soldered from the old evaporator and kept for installation on the new evaporator. The TEV body must be protected from heat damage from the de-soldering practice.

24.3.3.9 The Contractor must remove the old evaporator from its hangars, and dispose of the old evaporator in accordance with federal regulations.

24.3.3.10 The Contractor must install the new evaporator using the same hangers. The units are the same model, and there should be no requirement to modify the mounting arrangement.

24.3.3.11 The Contractor must reconnect wiring and re-solder the piping connections with sil-fos.

24.3.3.12 Following reconnection, the Contractor must evacuate the system of all air and leave the system under a 20” vacuum for a minimum of 8 hours. Following this, the Contractor must change the filter drier in the system and then proceed to re-commission the system.

24.3.4 Pressure Regulating Valves – Dairy Room and Vegetable Cooler

24.3.4.1 The Contractor must replace the Pressure Regulating Valves (PRV) for the Vegetable Room and Dairy Cooler. This work also includes the installation of a ball valve in parallel with the Dairy Room PVR.

24.3.4.2 The ball valve and PVRs will be GFM. The Contractor must provide the necessary piping for the installation of the ball valve. Valves to be installed are:

- ORIT611830: Sporlan Pressure Regulator, evaporator, 1-1/8 in. ODF, 30-100 psi, 9.75 in.
- ORIT1013830: Sporlan Pressure Regulator, evaporator, 1-3/8 in. ODF, 30-100 psi, 11.19 in.
- 591WA11ST: Superior, Ball Valve, shut off, refrigeration.

24.3.4.3 The Contractor must dispose of the existing PVRs in accordance with federal regulations.

24.3.4.4 Following the installation, the must evacuate the system of all air and contamination and leave the system under a 20” vacuum for a minimum of 8 hours. Following this, the Contractor must change the filter in the system and then proceed to re-commission the system. The Contractor must make all adjustments necessary to ensure optimal operation of the system.

24.4 Proof of Performance

24.4.1 Inspection

24.4.1.1 The Contractor must demonstrate to the IA that all systems have been returned to service and are correctly adjusted to the manufacturer’s recommendations.

24.5 Deliverables

24.5.1 Documentation

24.5.1.1 The Contractor must provide the IA with a copy of the certification/Ozone Depletion Prevention Card for each technician that works on any of the above mentioned systems.

24.5.1.2 The Contractor must provide a detailed report describing all work carried out, the cause of any defects (if any), any corrective measures taken and any parts replaced, for all of the above mentioned systems. The Contractor must provide the IA with three paper copies of this report and one electronic copy prior to the end of the work period.