

**CCGS Henry Larsen  
Statement of Work for  
Propulsion Motors, Generators  
And Transformers**

**Condition Survey**

Date: June 7, 2013

Prepared by Marine Engineering

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## 1.0 GENERAL NOTES

### 1.0 GENERAL NOTES

#### 1.1 Identification

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

#### 1.2 References

1.2.1 Applicable regulations and documentation:

<b>FSSM Procedures</b>	<b>Title</b>
7.B.2.	Fall Protection
7.B.3	Hazard Prevention Program
7.D.9	Entry Into Confined Spaces
7.D.11	Hotwork
7.D.19	Lockout and Tagout
7.F.6	Handling, Storage & Disposal of Hazardous Material
7.F.9	Paint and Other Coatings
7.F.10	Controlling Halocarbon Use Aboard Ships
10.A.2	Contractor Liability
Ship Specific	Vessel Specific - Asbestos Management Plan
<b>Publications</b>	
TP3177E	Standard for the Control of Gas Hazards in Vessels to be Repaired or Altered
T127E	Transport Canada Marine Safety Electrical Standard
IEEE 45	Recommended Practice for Electrical Installation on Ships
70-000-000-EU-JA-001	Specification for the Installation of Shipboard Electronic Equipment
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
<b>Acts</b>	
CSA	Canada Shipping Act
CLC	Canada Labour Code
<b>Regulations</b>	
MOHS	Maritime Occupational Health and Safety

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### **1.3 Occupational Health and Safety**

- 1.3.1 The Contractor and all sub-contractors shall follow 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.
- 1.3.2 The Contractor and the Contractor's employees, including any sub-contractors shall 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.
- 1.3.3 The Contractor shall 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 work involving the following;
- Hot Work;
  - Work Aloft;
  - Confined Space Entry;
  - Gas Freeing for Entry and Hot Work;
  - Lock Out/Tag Out;
  - Pre-Job Safety Assessments.
- 1.3.4 For the purpose of the Lock Out/Tag Out procedure the Contractor shall supply locks and locking devices for the Contractor's employees in addition to those provided by the Chief Engineer for the ship's crew.
- 1.3.5 The Contractor and Contractor's employees will not have access to the vessel's washrooms and crew mess facilities. The Contractor shall provide the necessary amenities for the Contractor's and sub-contractors employees as required.

### **1.4 Access to Worksite**

- 1.4.1 The Contractor shall ensure the TA and CG staff has unrestricted access to the worksite at all times during the contract period.

### **1.5 Workplace Hazardous Materials Information System (WHIMS)**

- 1.5.1 The Contractor must provide the TA with Material Safety Data Sheets (MSDS) for all Contractor supplied WHIMS controlled products.
- 1.5.2 The TA will provide the Contractor with access to MSD sheets for all controlled products on the ship for all specified work items.

### **1.6 Smoking in the Work Space**

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

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## **1.7 Clean and Hazard Free Worksite**

- 1.7.1 Before the Contractor starts any work on the vessel the Contractor's Quality Assurance Representative, the TA shall 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 specification. The Contractor's Quality Assurance Representative shall take digital pictures of each area showing the outfit therein and download the photos in JPG format onto a CD or DVD. Each picture shall be dated and labeled as to the location on the vessel. Copies of this CD or DVD are to be provided to the TA for reference purposes within 48 hours of the start of the contract.
- 1.7.2 The Contractor, during the work period shall maintain those areas of the vessel which Contractor personnel use to access those areas where work is to be undertaken, in a clean condition, free from debris and remove garbage daily.
- 1.7.3 Areas that pose a hazard as a result of the specification work are to 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.
- 1.7.4 Upon completion of this contract, the Contractor shall be responsible for the removal of all garbage generated from the work of this specification and for returning the vessel to the state of cleanliness in which the vessel was at the start of the contract period.
- 1.7.5 Once all known work and final clean-up has been completed the Contractor's QA Representative, the TA shall perform a 'walk through' of the vessel to view all areas where work was performed by the Contractor. Any deficiencies or damage noted shall 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 shall be repaired by the Contractor at no cost to the Coast Guard.

## **1.8 Fire Protection**

- 1.8.1 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. When the fire detection or fire suppression system is deactivated or disabled by the Contractor during the contract, 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.
- 1.8.2 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 sensors.
- 1.8.3 The Contractor must ensure 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:
- Disabling only one portion of a system at a time;
  - By maintaining system function using spares while work is in progress;
  - Other means acceptable to and approved by the TA.

- 1.8.4 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 at his cost, container(s) or systems that are discharged as a result of such work.

### **1.9 Touch-up / Disturbed Paint**

- 1.9.1 Unless stated otherwise, all new or disturbed steelwork is to have two coats of marine primer, compatible with the vessel's existing coating schedule.
- 1.9.2 The Contractor must prepare all new and disturbed steelwork to the paint manufacturer's standards prior to painting.

### **1.10 CCG Employees and Others on the Vessel**

- 1.10.1 CCG / DFO employees and other personnel such as manufacturer's representatives and/or TCMS or Class surveyors may carry-out other work including work items not included in this specification, 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 this work unless otherwise specified.

### **1.11 Regulatory Inspections and/or Class Surveys**

- 1.11.1 The Contractor shall contact, coordinate and schedule all regulatory inspections and/or class surveys by the applicable authority: i.e. TCMS, HC, Environment Canada or others as required by the specification.
- 1.11.2 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 .
- 1.11.3 The Contractor must not substitute inspection by the TA for the required regulatory inspections or class surveys.
- 1.11.4 The Contractor must provide timely advance notification (minimum of 24 hours) of scheduled regulatory inspections and/or class surveys to the TA so they may witness the inspection.

### **1.12 Test Results and Data Book**

- 1.12.1 The Contractor shall develop a Test and Trials Plan which shall include as a minimum, all tests and trials stated in the specification. This plan shall be provided for TA review 2 week(s) prior to the originally scheduled Tests and Trials commencement.
- 1.12.2 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, and TCMS.
- 1.12.3 Recorded dimensions shall be to a precision of three decimal places (unless otherwise stated) in the measuring system currently in use on the vessel.

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- 1.12.4 The Contractor shall provide to the TA 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.
  - 1.12.5 Hard copy reports shall be bound, type written on letter size paper and indexed by specification number. Electronic copies shall be in unprotected Adobe PDF format and provide on CD-ROM media. The Contractor shall provide 3 hard copies and 1 electronic copy of all reports.
  - 1.12.6 All documentation from the contract period shall be inserted in a data book and delivered to the TA on completion of the contract.

### **1.13 Contractor Supplied Materials and Tools**

- 1.13.1 The Contractor must ensure all materials are new and unused.
- 1.13.2 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.
- 1.13.3 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 prior to use.
- 1.13.4 The Contractor shall provide all equipment, devices, tools and machinery such as crane, staging, scaffolding and rigging necessary for the completion of the work in this specification.
- 1.13.5 The Contractor shall provide waste disposal services for any oil, oily waste or other hazardous or controlled waste generated by the work of this specification. The Contractor shall provide waste disposal certificates for all of the above generated waste and the disposal certificates shall indicate that the disposal was in accordance with Federal, Provincial and Municipal regulations in effect.

### **1.14 Government Supplied Materials & Tools**

- 1.14.1 All tools are Contractor supplied unless otherwise stated in the technical specifications.
- 1.14.2 Where tools are supplied by the TA they shall 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 return to the TA.
- 1.14.3 Any Government supplied material (GSM) shall 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.

### **1.15 Restricted Areas**

- 1.15.1 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.

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1.15.2 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.

### **1.16 Contractor Inspections and Protection of Equipment and the Worksite**

1.16.1 The Contractor must coordinate an inspection with the TA on the condition and location of items to be removed prior to carrying out the specified work or to gain access to a location to carry out the work.

1.16.2 The Contractor must repair or replace any item so damaged in this process. Materials used in any replacement or repairs must meet the criteria for Contractor supplied material noted above in section Contractor Supplied Materials and Tools.

1.16.3 The Contractor must protect all equipment and surrounding areas from damage. Work areas are to be protected from the ingress of water, welding and blasting grit etc. Temporary covers to work areas must be installed.

### **1.17 Recording of Work in Progress**

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

### **1.18 List of Confined Spaces**

1.18.1 The Contractor may request a list of the vessel's identified confined spaces at the Pre-Refit meeting.

### **1.19 Lead Paint and Paint Coatings**

1.19.1 The Contractor shall not use lead based paints.

1.19.2 CG 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 shall ensure that work areas are tested for lead content and that the work is performed in accordance with applicable regulations.

1.19.3 The Contractor must provide HC product approval for underwater hull surface paints controlled by HC and the Pest Management Regulatory Agency.

### **1.20 Asbestos Containing Materials**

1.20.1 The Contractor shall not use any asbestos containing materials.

1.20.2 Handling of any asbestos containing materials shall be performed 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 shall 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.

### **1.21 Removed Materials and Equipment**

1.21.1 All removed equipment as a result of this specification shall remain the property of the Coast Guard unless otherwise instructed in the specification sections.

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## **1.22 Welding Certification**

- 1.22.1 For any work requiring the application of fusion welding for steel structures the Contractor and/or the sub-contractor welders shall be certified by the Canadian Welding Bureau in accordance with CSA Standards W47.1-03, latest revision – Certification of Companies for Fusion Welding of Steel Division 2 Certification as a minimum. Current copies of certification shall be provided to the IA.

## **1.23 Electrical Installations**

- 1.23.1 All electrical installations and repairs shall 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.

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## 2.0 VESSEL PARTICULARS

Name: Henry Larsen  
Type: Medium Duty Ice Breaker  
Ice Class: Arctic Class 4  
Year Built: 1987

### Principal Dimensions:

Length: 99.8 meters  
Breadth, molded: 19.51 meters  
Loaded Draft: 7.2 meters  
Tonnage, displ: 6,166.5 Tons

Propulsion: Diesel Electric AC/AC

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### 3.0 SPECIFICATION ITEMS

#### 3.1 Identification

The intent of this specification is to perform a survey of main rotating electrical propulsion machinery and propulsion transformers on board the CCGS Henry Larsen. The context of this assessment is to highlight any deficiencies that may impact the intended lifespan to 2029.

Contractor is to perform a survey of the 3 Propulsion Generators, 2 Propulsion Motors and 4 propulsion transformers. The Contractor is to give a detailed report of the mechanical and electrical condition for each piece of machinery above, noting any defects or deficiencies. The Contractor is to provide recommendations as to maintenance required and the expected remaining service life of the above items. Contractor is to take into account replacement parts and service availability. Work is to be performed during the vessel's layup period October 23 - Dec11, 2013, while alongside the St Johns Coast Guard Base. Dates are pending operational requirements.

Contractor is to provide a detailed schedule of their intended work plan within (14) days of Contract Award. Contractor shall provide all labor, materials and equipment necessary for the performance of the work.

#### 3.2 References

##### Equipment Data

CGE Horizontal Synchronous Motor Part Number EN 139568, Serial # 1045148 and 1045149, Brushless Exciters EN-209015 Serial No 1045150 and 1045151 , Instruction manual PGEI-11604, 8046HP, 1900Volt

CGE Horizontal Generator Part Number EN 139584, Serial # 1045142 to 1045144, Brushless Exciters EN-209017 Serial No 1045145 to1045147 , Instruction manual PGEI-11539, 5MW, 4160Volt, 60HZ

FPE Dry type transformers 4270KVA at 4160 Primary, LV 3 x 1675KV a at 1200V .  
Serial/Instruction Manual T911294-1, T911294-2 Y connected, T911295-1 and T911195-2 Delta connected

##### Drawings

Drawing Number	Description	Electronic Number
M1307D0412	Transformer Dimensions	
M1339D1435	Transformer Connection Diagram	
M2112D0930-T91294	Transformer Nameplate Data	

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## Regulations

All work performed must be compliant with the latest Canada Shipping Act Regulations and in particular to the Marine Machinery Regulations. All work shall meet Transport Canada approved Class Regulations. (Lloyd's Register of Shipping, American Bureau of Shipping, Germanischer Lloyd, Det Norske Veritas or Bureau Veritas)

## Standards

The Contractor is to perform all of the following work and is to provide fully certified personnel acceptable to TCMS in accordance to latest revision of the Ship Safety Electrical Standards TP127E and IEEE Standard 45 Recommended Practice for Electrical Installation on Shipboard.

All work shall be completed in accordance with Canadian Coast Guard's Ship's ISM Fleet Safety and Security Manual concerning Hot Work, and Lock-Out and Tag Out Procedures.

### 3.3 Technical

All Canadian General Electric technical info, drawings and publications included in instruction manuals available

## Inspections

### Propulsion Motors :

- Prior to commencement of inspection existing Co2 bottle located next to each individual propulsion motor to be disconnected to prevent accidental discharge. System to be reconnected before any live testing is to be performed.
- Motor Circuit Evaluation test which includes insulation resistance, polarization Index, capacitance-to-ground, circuit inductance and winding resistance of stator, rotor and exciter windings. Procedures to be followed as per manufacturers recommendations as outlined in section 1-4 of the instruction manual. Insulation readings to be corrected as per insulation resistance temperature correction document Canadian General Electric TPP-8501
- Perform a visual inspection of the machine components, for the presence of contamination by dust, dirt, moisture and foreign matter. The condition of all gaskets and covers are to be noted. Check interior of machine for loose and worn objects as well as visual inspection for cracks/metal fatigue. Check all wedges and connections for tightness. Check for signs of overheating, both local and general. Video boroscope with high definition video or still shots, to be utilized for internal inspections. See section 5 of instruction manual for details.
- Air gap, fore and aft readings, refer to Canadian General Electric drawing 4005E1203DB for rotor (0.5") and exciter (0.1")

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- Thrust and Pedestal bearing wear for the propulsion motors were checked during drydocking in spring of 2013 as part of existing refit spec. All readings, pictures and reports from this earlier inspection will be supplied and will be re-used by the contractor for assessment of these components.
  - Inspect condition of Auxiliary gearbox on motors paying particular attention to bearing condition and oil pump operation. See Canadian General Electric PGEI 11663 instruction for details
  - All exciter Diodes, Silicon Controlled Rectifier's and crowbar circuits to be checked electrically and for signs of mechanical damage as per section 7 in instruction manual. Also see Canadian General Electric drawing 4004D1039AF and 4004D1041DA
  - All cooling and makeup fans to be inspected. See Canadian General Electric drawing 4004D1001SS
  - Water to Air coolers to be inspected and tested as per manufactures recommendations. Leak detectors to be tested for correct operation. See Canadian General Electric drawing 4004D1001SS and Unifin International 11400 publication
  - All Connection boxes to be inspected for electrical and mechanical soundness
  - Anti-condensation Heaters, insulation resistance, voltage and current readings to be obtained
  - All Resistive temperature detector's to be checked for correct operation
  - Vibration analysis readings of equipment and sub components to be recorded; Reference maximum values as per section 4 in instruction manual

## **Generators**

- Vibration analysis readings of generator to be recorded. Reference maximum values in section 4 of manual.
- Prior to commencement of inspection existing Co2 bottle located next to each individual generator to be disconnected to prevent accidental discharge. System to be reconnected before any live testing is to be performed
- Insulation and Polarization Index resistance of all windings, stators, rotors, exciters as per manufacturers recommendations as outlined in section 1-4 of the Instruction manuals. Winding resistances to also be recorded. Insulation readings to be corrected as per insulation resistance temperature correction document Canadian General Electric TPP-8501

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- Perform a visual inspection of the machine components, for the presence of contamination by dust, dirt, moisture and foreign matter. The condition of all gaskets and covers are to be noted. Check interior of machine for loose and worn objects as well as visual inspection for cracks/metal fatigue. Check all wedges and connections for tightness. Check for signs of overheating, both local and general. Boroscope with high definition video or still shots, to be utilized for internal inspections. See section 5 of instruction manual for details
  - Air gap readings fore and aft. Refer to the Instruction manual page 3-2, section 13 for procedure and acceptable readings.
  - Pedestal bearing wear down reading to be taken using Canadian Coast Guard supplied gauge . Rotor and exciter airgap readings to be taken fore and aft .
  - All exciter Diodes, SCR's and crowbar circuits to be checked as per section 7 of instruction manual
  - Unifin water to air coolers to be inspected and tested as per manufactures recommendations in section 8 of instruction manual. Leak detectors to be tested for correct operation.
  - All Connection boxes to be inspected for electrical and mechanical soundness
  - Anti-condensation Heaters, insulation resistance, voltage and current readings to be obtained
  - All Resistance Temperature Detectors's to be checked for correct operation
  - All Current Transformer's to be checked for correct operation/mechanical damage

### **Propulsion Transformers Test**

- Insulation Resistance Measurement
- Winding Resistance Measurement
- Magnetic Current Test
- Magnetic Balance Test

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- Cooler Circuits – 6 cooling motors per transformer. Motors to be inspected. Check temperature fan activation, alarm and trip circuits Canadian General Electric drawing M1339D1435 for detail
  - Check Resistance Temperature Detector's and analog temperature gauges for correct operation
  - Visual inspection of insulation and bolted connections/fasteners. Boroscope with high definition video or still shots, to be utilized for internal inspections.

### **3.4 Proof of Performance**

#### **Testing/Trials**

Live testing is to be conducted before and after Contractor inspections and assessments to ensure no damage has occurred. Chief Engineer must be given 48 hours notice prior to live testing. Vessel staff will be available to run up machinery to permit Contractor observations

#### **Machinery Lock Out, Open Up and Close Up for Access**

Contractor shall provide lock out of machinery per Regulations. Contractor is responsible for disassembly and reassembly of machinery and equipment, as necessary for the performance of the work.

### **3.5 Deliverables**

#### **Documentation (Reports/Drawings/Manuals)**

The Contractor shall supply the Canadian Coast Guard Technical authority with (3) hardcopies and (1) electronic copy (pdf) of all readings, videos(electronic only), photos, tests, defects, recommendations per section 3.1 above and work performed. These deliverables shall be provided within (14) calendar days of completion of on site work.

Receipt of the above documentation shall signify completion of the Work for Acceptance purposes .