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Gatineau
Québec
K1A 0S5
Bid Fax: (819) 997-9776

LETTER OF INTEREST
LETTRE D'INTÉRÊT

Comments - Commentaires

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Issuing Office - Bureau de distribution
Marine Machinery and Services / Machineries et services
maritimes
11 Laurier St. / 11, rue Laurier
6C2, Place du Portage
Gatineau
Québec
K1A 0S5

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|---|--|
| Title - Sujet Refrigeration System | |
| Solicitation No. - N° de l'invitation W8483-127092/A | Date 2012-05-09 |
| Client Reference No. - N° de référence du client W8483-127092 | GETS Ref. No. - N° de réf. de SEAG PW-\$\$ML-005-22751 |
| File No. - N° de dossier 005ml.W8483-127092 | CCC No./N° CCC - FMS No./N° VME |
| Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2012-05-22 | |
| Time Zone Fuseau horaire Eastern Daylight Saving Time EDT | |
| F.O.B. - F.A.B. Specified Herein - Précisé dans les présentes Plant-Usine: <input type="checkbox"/> Destination: <input type="checkbox"/> Other-Autre: <input checked="" type="checkbox"/> | |
| Address Enquiries to: - Adresser toutes questions à: Burns, Robert | Buyer Id - Id de l'acheteur 005ml |
| Telephone No. - N° de téléphone (819) 956-1199 () | FAX No. - N° de FAX (819) 956-0897 |
| Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: Specified Herein Précisé dans les présentes | |

Instructions: See Herein

Instructions: Voir aux présentes

| | |
|---|--|
| Delivery Required - Livraison exigée See Herein | Delivery Offered - Livraison proposée |
| Vendor/Firm Name and Address Raison sociale et adresse du fournisseur/de l'entrepreneur | |
| Telephone No. - N° de téléphone Facsimile No. - N° de télécopieur | |
| Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie) | |
| Signature | Date |

Letter of Interest (LOI)
Request For Information (RFI)
File Number: 005ML.W8483-127092
for the
Victoria Class Submarine
Provisional Stores Refrigeration System

Introduction

THIS IS A REQUEST FOR INFORMATION (RFI). THIS IS NOT A BID SOLICITATION.

Respondents are requested to provide feedback on the enclosed draft documents pertaining to a planned procurement for the replacement of the combined (cool and cold room) Provisional Stores Refrigeration System on board each of Canada's four (4) Victoria Class submarines, HMCS CHICOUTIMI, HMCS CORNER BROOK, HMCS WINDSOR AND HMCS VICTORIA.

The purpose of the RFI is to inform potential Bidders concerning the upcoming requirement and to obtain Industry input and feedback regarding the development of the RFP. All responses concerning this process will be considered prior to posting the RFP document on MERX. It will be at the sole discretion of Canada, which feedback provided by the Respondents will be incorporated into the RFP.

It is anticipated that the RFP will be released in the Spring of 2012.

Background

The Victoria Class submarines were designed and built in the 1980's when the refrigerant of choice was Freon -12. For a variety of reasons, including equipment obsolescence and the need to change refrigerants, the Department of National Defence (DND) plans to replace the Provisional Stores Refrigeration System in its submarines.

RFP Documents

The draft RFP document is provided for Industry review and input as well as the following annexes:

- Annex A Statement of Work
- Annex B Technical Statement of Requirement
- Annex C Security Requirements Check List (SRCL) - Not included.

RFI Submission Instructions

Canada awaits potential Bidders to provide substantive written feedback on the attached draft document as well as to the questions listed herein. These responses will then enable Canada to consider industry perspectives which may be further discussed in an interactive confidential one-on-one consultation session via teleconference or meeting with potential Bidders as part of the process to finalize the RFP.

Requested Input

Comments from industry should include, but need not be limited to, the following questions:

1. Are there any requirements in the attached documents that would preclude your organization from responding to the upcoming RFP? If so, please explain.
2. Does your organization have any concerns or suggested improvements with respect to the project approaches reflected in the attached documents? If so, please explain.
3. Can you offer any other suggestions for improvement of the attached documents prior to posting of the final RFP? If so, please explain.

Format of Response

Responses should clearly identify any requests for additional information or clarification to be incorporated into the final RFP. Confidential or proprietary information contained with the response should be marked as such. Marketing or promotional information submitted as part of the responses will not be reviewed.

Submission of Responses

Written responses to this RFI should be submitted on or before the closing date to the address below. The respondent's name, return address, RFI solicitation number and closing date should be clearly visible on the response. Responses to this RFI will not be returned.

Robert Burns, Contracting Authority
Telephone: (819) 956-1199
Fax: (819) 956-0897
robert.burns@tpsgc-pwgsc.gc.ca

Solicitation No. - N° de l'invitation

W8483-127092/A

Amd. No. - N° de la modif.

File No. - N° du dossier

005mlW8483-127092

Buyer ID - Id de l'acheteur

005ml

CCC No./N° CCC - FMS No/ N° VME

W8483-127092

Other Information

Responses to this RFI will not be used to pre-qualify or otherwise restrict participation in any future RFP. Notice of any resulting RFP will be posted on MERX in accordance with government policies.

Canada will not reimburse expenditures incurred in participating in this RFP development process.

ANNEX A

**STATEMENT OF WORK
FOR THE
VICTORIA CLASS SUBMARINE
PROVISIONAL STORES REFRIGERATION SYSTEM**

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1 Scope

1.1 Purpose

This Statement of Work (SOW) specifies the work requirements for training of DND staff and the replacement of the combined (cool and cold room) Provisional Stores Refrigeration System on board each of Canada's four (4) Victoria Class submarines, HMCS CHICOUTIMI, HMCS CORNER BROOK, HMCS WINDSOR AND HMCS VICTORIA.

1.2 Background

The Victoria Class submarines were designed and built in the 1980's when the refrigerant of choice was Freon-12. For a variety of reasons, including equipment obsolescence and the need to change refrigerants, the Department of National Defence (DND) plans to replace the Provisional Stores Refrigeration System in its submarines.

1.3 Functional Overview of Current System

1.3.1 The refrigeration system is comprised of four main units: compressor unit, unit coolers (cool and cold rooms), valve board, and control/starter panel.

1.3.2 The compressing unit assembly includes two circuits with a common suction and liquid line connection. Each circuit comprises a two cylinder reciprocating semi hermetic compressor, liquid receiver vessel and condenser. The two circuits share a common dehydrator cartridge and gauge board. Each circuit of the condensing unit is capable of meeting the entire cool and cold room refrigeration load while the other is manually isolated as standby.

1.3.3 The compressor assemblies have been specially modified to include a remote, deep oil sump arrangement to allow them to operate at the inclinations experienced on board operational submarines.

1.3.4 The condensers employed are tube-in-tube arrangements, cooled by water fed from the ships chilled water circuit.

1.3.5 The valve board arrangement includes a suction/liquid line heat exchanger, solenoid isolation valve, manual isolation valves, crankcase pressure regulating valve and one thermal expansion valve. The other thermal expansion valve is fitted adjacent to its respective unit cooler (evaporator). Unit coolers are mounted from the ceiling in each of the cool and cold rooms.

1.3.6 Each evaporator coil block is manufactured from copper tubes with aluminum fins. A fractional horsepower motor fitted with a fan blade circulates air over the coil block. Both coolers are fitted with coil block and drip tray defrosts heaters in addition to condensate drain line heaters.

1.4 Objectives of the Provisional Stores Refrigeration System Replacement

The fundamental objectives are to replace the current Provisional Stores Refrigeration System with a modern and fully supportable system that shall:

- a. Utilize R134a or an equivalent refrigerant, as agreed by DND, that does not contradict the Federal Halocarbon Regulations 2003 or any related regulation;
- b. Utilize the same space envelope currently occupied by the existing system;
- c. Utilize the same power source and consumption as the current system;
- d. Utilize the same water source as the current system;
- e. Meet the noise, shock and vibration requirements; and
- f. Ensure a maximum life expectancy with regards to engineering and spare part support for a minimum of ten (10) years from installation.

1.5 Acronyms and Terminology

Throughout this Statement of Work, the following Acronyms and Terminology shall apply:

| | |
|------|--------------------------------|
| ATP | Acceptance Test Procedures |
| CDR | Critical Design Review |
| DND | Department of National Defence |
| FAT | Factory Acceptance Test |
| HMCS | Her Majesty's Canadian Ship |
| ILS | Integrated Logistic Support |
| MCC | Machinery Control Console |
| MI | Magnetic Indicator |
| MSDS | Material Safety Data Sheet |
| PDR | Preliminary Design Review |
| PM | Project Manager |
| PMP | Project Management Plan |
| PS | Project Schedule |
| SOW | Statement of Work |
| STW | Set-to-Work |
| TA | Technical Authority |
| TDP | Technical Data Package |
| WBS | Work Breakdown Structure |

Provisional Stores Refrigeration System: A combination of equipment such as starter/motor/compressor/condenser/controller, with other ancillary equipment to provide cooling requirement for the VICTORIA Class Submarines Provisional Stores.

One Day: Shall be any day of the week from Sunday through Saturday.

Combat Forces: Shock or vibration that a military vessel may be subjected to.

2 Provisional Stores Refrigeration System and Project Requirements

2.1 General

2.1.1 The Contractor shall obtain, manufacture, customize, integrate, test and deliver all equipment, spares and tools to satisfy the requirements of this SOW.

2.1.2 The Contractor shall clearly demonstrate that their refrigeration system will meet all the requirements that are outlined in this Statement of Work (SOW).

2.2 System Technical Requirements

The System Technical Requirements are identified in TSOR 3.2.3.1 to 3.2.3.4.

2.3 Refrigeration System Capabilities

The Refrigeration System Capabilities are identified in TSOR Para 3.2.3.12 to 3.2.3.16 and 3.3.

2.4 System Design Life and Support Requirements

2.4.1 The Provisional Stores Refrigeration System shall have a life expectancy of no less than ten (10) years from the date of installation.

2.4.2 The Contractor shall be available to provide Technical Advice or respond to Technical queries on an "as required basis" to support equipment.

2.5 Accessibility and Assembly Requirements

- 2.5.1 Provisional Stores Refrigeration System shall be designed for easy access to routinely serviceable items within space constraints listed in the TSOR.
- 2.5.2 Provisional Stores Refrigeration System shall be designed with the intent to be assembled in pieces to accommodate flexible installation schedules.

2.6 Project Work Requirements

2.6.1 Design Work

The Contractor shall design, build and supply four (4) complete Provisional Stores Refrigeration Systems as detailed in the Technical Statement of Requirements.

2.6.2 Deliverables

2.6.2.1 Preliminary Design Review (PDR)

The Contractor shall conduct a Preliminary Design Review (PDR) meeting at the Contractor's facilities within (30) days after contract award. The Contractor shall provide the TA with a Preliminary Design Review Data Package (PDRDP) which shall provide all of the review materials required for the PDR review meeting. The PDRDP shall include the following:

- a. Hardware Design and including Special Purpose Test Equipment (SPTATE) Document;
- b. Interface Control Documents;
- c. Software Interface Design Description;
- d. Provisional Stores Refrigeration System User's Manual;
- e. Approach for initial training and steady state training;
- f. Identification, Tracking and Maintenance of Supporting Hardware and Non-Deliverable Software Plan;
- g. Quality Testing Plan (if not included as part of the Project Management Plan);
- h. Acceptance Test Plan (if not included as part of the Project Management Plan);
- i. Acceptance Test Procedure (if not included as part of the Project Management Plan).

2.6.2.2 Critical Design Review (CDR)

Within thirty (30) days after the TA's approval of the Preliminary Design, the Contractor shall provide a Detailed Design, Weight and Material Lists for a Critical Design Review (CDR) by the TA or its designated Authority. The Contractor shall also provide a Critical Design Review Data Package that will contain all of the review materials required for the Critical Design Review meeting and shall include but is not limited to:

- a. detailed and scaled drawings;
- b. detailed (system) description;
- c. performance of the proposed solution; and
- d. dimensions of the proposed Refrigeration System.
- e. Hardware Design and including Special Purpose Test Equipment (SPTATE) Document;
- f. Interface Control Documents;
- g. Software Interface Design Description;
- h. Preliminary Engineering Change specifications for submarines and the trainers;
- i. Provisional Stores Refrigeration System Operations Manual;
- j. Approach for initial training;
- k. Identification, Tracking and Maintenance of Supporting Hardware and Non-Deliverable Software Plan
- l. Set To Work Test Plan; and
- m. Quality Testing Plan (if not included as part of the Master Test Plan).

2.6.2.3 Material

To address submarine material safety requirements, the Contractor shall supply the following information for all the material that constitutes the Provisional Stores Refrigeration System. The Contractor shall submit this information along with its Detailed Design for it to be reviewed by the TA or its designated Authority:

- a. a list of all materials;
- b. technical specifications; and
- c. Material Safety Data Sheets (MSDS)

2.6.2.4 Test Plans

The Contractor shall produce and deliver to the TA an Acceptance Test Plan for the Factory Acceptance Test (FAT) and the Set to Work (STW) that provides an overall outline of the entire spectrum of test activities of the Provisional Stores Refrigeration System. The Contractor shall provide the TA two copies of these plans thirty (30) days prior to the conduct of the FAT and thirty days (30) prior to the STW.

2.6.2.5 Acceptance Test Procedure

The Contractor shall produce and deliver an Acceptance Test Procedure (ATP) for the FAT and the STW. The ATP shall contain all conditions, precautions, adjustments, expected test results, tolerances, and a list of the tools and test equipment required to verify the correct operation of the entire Provisional Stores Refrigeration System. The Contractor shall provide the TA two copies of these procedures thirty (30) days prior to the conduct of the FAT and thirty days (30) prior to the STW.

2.7 Factory Acceptance Test (FAT)

2.7.1 The Contractor shall perform factory acceptance testing on each of the Provisional Stores Refrigeration System for the submarines.

2.7.2 The conduct of the FAT shall be witnessed and approved by the TA or its designated Authority.

2.7.3 The Technical Authority (TA) or designated alternate shall be given no less than thirty (30) days notice prior to conducting the FAT.

2.7.4 Following the factory acceptance of each refrigeration system, the Contractor shall be responsible for the preservation, packaging, packing and marking in accordance with the Contractor's standard domestic commercial practice to ensure safe storage and delivery at destination. The Contractor shall also provide safe guarding for all accepted refrigeration systems at its plant until they are received at the base. The storage and safe guarding shall be provided at no cost to Canada. Any damaged, destroyed or missing refrigeration systems shall be replaced or repaired by the Contractor at no cost to Canada. In the event of a damaged refrigeration system and following the Contractor's assessment of the repairs to be done, Canada shall have the final decision if the refrigeration system shall be repaired or replaced by the Contractor.

2.8 Shock and Vibe Testing

2.8.1 Should the refrigeration plant be of an existing design, and previously shock and vibe certified, copies of the certification documents will be required.

2.8.2 If the refrigeration plant is of a new design all shock and vibe testing will be done by the Naval Engineering Test Establishment (NETE). The Contractor will be responsible for all transportation costs to NETE and return to their facility.

- 2.8.3 The Department of National Defence (DND) will pay for the initial shock and vibe testing. Should the unit not pass the initial testing, the Contractor will be responsible for the costs of all subsequent testing required, including transportation costs.
- 2.8.4 When the unit passes the shock and vibe testing the Contractor will overhaul and certify the components prior to delivery to DND. If the components are beyond economic overhaul / repair the Contractor shall provide new components.

2.9 System Delivery

- 2.9.1 The Contractor shall implement any changes or modifications requested by the TA.
- 2.9.2 The Contractor shall build the Provisional Stores Refrigeration Systems as per the final and approved design.
- 2.9.3 National Defence will be responsible for the strip-out and the installation of the four (4) fitted Provisional Stores Refrigeration Systems.
- 2.9.4 The Contractor shall deliver one (1) complete Provisional Stores Refrigeration System to Halifax, Nova Scotia and three (3) systems to Esquimalt, British Columbia.
- 2.9.5 The first Provisional Stores Refrigeration Systems shall be delivered no later than two hundred and twenty (220) days after PDR and final design approval.
- 2.9.6 The three other Provisional Stores Refrigeration Systems shall be delivered as dictated by National Defence. The Contractor shall perform routine maintenance as required on all units held at the Contractor's facility until delivery to DND.

| | |
|-------------------|-----------|
| HMCS Corner Brook | unknown |
| HMCS Victoria | Feb 2015 |
| HMCS Windsor | Aug 2015 |
| HMCS Chicoutimi | June 2016 |

Earlier or later delivery may be requested. The Department of National Defence will give the Contractor 30-60 days advance notice for delivery of units 2-4.

- 2.9.7 All units delivered to DND must consist of new components that have not been shock tested.

2.10 Set-to-Work

- 2.10.1 The Contractor shall provide a Qualified Field Representative during the first installation of the Refrigeration System for both Halifax and Esquimalt locations in order to:
 - a. Conduct on-site 'Train the Trainer' training for the operation and maintenance of the system;
 - b. Validate and provide guidance during the installation of the system; and
 - c. Provide Test Plans for the Set-to-Work activities.
- 2.10.2 The Qualified Field Representative shall be made available given a thirty (30) days notice prior to scheduled installations.

2.11 Integrated logistic Support Requirements

- 2.11.1 The Contractor shall establish, implement and control an Integrated Logistics Support (ILS) Program for the Provisional Stores Refrigeration System and its related logistics support

elements in accordance with A-LM-505-001/AG-001 and A-LM-505-001/AG-002, (section 2.1, Table 1, items 3 and 4) in the TSOR.

- 2.11.2 The Contractor shall conduct Logistics Support Analysis in accordance with Mil-STD 1388-1A, (section 2.2, Table 2 and item 7) in the TSOR.
- 2.11.3 The Contractor shall deliver a Logistics Support Analysis Record in accordance with Mil-STD 1388-2B, (section 2.2, Table 2, item 8) in the TSOR.
- 2.11.4 The Contractor's ILS activities shall form an integral part of all the Refrigeration System planning, development, design, production, design qualification test, installation and set to work efforts associated with this SOW.

2.12 Spares and Special Tools

- 2.12.1 Based on the normal Operation Cycle of the system as described in the TSOR the Contractor shall deliver:
 - a. All required components, sub-components and spares that shall be required to conduct Routine and Planned Maintenance for a period of one (1) year from the installation of the system;
 - b. One (1) set of special tools required to conduct Routine and Planned Maintenance (each system);
 - c. One (1) set of equipment and/or special tools required to conduct an overhaul to be delivered with the first delivery to CFB Halifax and CFB Esquimalt..
- 2.12.2 The Contractor is to provide a complete parts breakdown list in hard copy as well as MS Word or EXCEL soft copy editable. The list is to include lead times for each item.

2.13 Installation Documentation Package

The Contractor shall supply the TA with two (2) copies (one (1) paper and one (1) electronic - MS Word editable) of the detailed installation/assembly instructions. One (1) copy of each (electronic - MS Word Editable and paper) shall be included with each refrigeration system.

- 2.13.1 The Installation drawings shall include:
 - a. Certified footprint and mounting location;
 - b. Condenser pipe connections location and size;
 - c. Overall dimensions;
 - d. Arrangement of equipment on base;
 - e. Schematic arrangement of unit showing all valves, instruments and controls, vibration eliminators and pipe sizes;
 - f. Required maintenance envelope;
 - g. Electrical schematics including detailed wiring between components, cable entries, location and types, panel wiring diagram, etc.; and
 - h. Motor and motor controller master plan drawings.
- 2.13.2 Certification Data Sheets shall be provided for motors, motor controllers, and switches and pilot devices mounted external to the controller in accordance with the governing standard.

2.14 Technical Data Package (TDP)

- 2.14.1 The Contractor shall develop a TDP that consist of the following:
 - a. General information and safety precautions;
 - b. system design;
 - c. detailed drawings up to the sub component level;

- d. bill of materials; and
- e. illustrated parts catalogue in accordance with C-01-100-100/AG-006 (illustrations of components and sub-components with numbered items and corresponding part number)

2.14.2 The Contractor shall supply the TA with two (2) copies (one (1) paper and one (1) electronic - MS Word Editable) of the TDP for the refrigeration system within four (4) weeks after the delivery of the first system.

2.15 Training Manuals

2.15.1 The Contractor shall provide a training manual that shall include, but not limited to:

- a. Function description of refrigeration unit and components;
- b. The operation and maintenance philosophy of the refrigeration system;
- c. Scheduled and corrective maintenance requirements and procedures;
- d. Troubleshooting.

2.15.2 The Contractor shall supply the TA with five (5) English and five (5) French training manuals, in hard copy format.

2.15.3 The Contractor shall supply the TA with one (1) English and one (1) French version of the Training Manuals in soft copy format, (MS Word, Editable).

2.15.4 The Contractor shall deliver a hard copy of the manuals and the electronic versions to the TA prior to delivery of the first system.

2.16 Letter or Certificate of Acceptance

The TA will provide a Letter or Certificate of Acceptance to the Contractor based on the successful review and acceptance of the Provisional Stores Refrigeration System for each submarine.

3 System Constraints

The Contractor shall adhere to the system constraints as detailed in the TSOR.

4 Project Management

4.1 Organization

The Contractor shall have a dedicated Project Manager responsible to carry out the work required for the Provisional Stores Refrigeration System replacement project. The Contractor's Project Manager shall have the authority to plan, direct, control and make decisions for the Contractor.

4.2 Project Management Plan (PMP)

The Contractor shall prepare and deliver a PMP to identify how the Contractor intends to fulfill the project management requirements of this SOW.

4.3 Contents of the PMP

The PMP shall contain, as a minimum, the following sections:

- a. Introduction;
- b. Management Organization and Responsibilities;
- c. Project Management Procedures;
- d. A Work Breakdown Structure (WBS) and WBS Dictionary;
- e. A Project Schedule (PS) and Milestones;
- f. A Risk Management Plan (RMP);

- g. A Configuration Management Plan (CMP);
- h. An Integrated Logistics Support (ILS) Plan;
- i. A Set to Work (STW) Plan, and
- j. A Quality Assurance (QA) Plan.

4.4 Work Breakdown Structure (WBS)

The Contractor shall structure the WBS, in accordance with Section 2.2 of MIL-HDBK-881A.

4.5 Risk Management Plan

The Contractor shall prepare a Risk Management Plan that establishes procedures for identification, assessment, management, reporting, tracking, reduction and elimination of risks arising from the performance of work.

4.6 Configuration Management Plan

The Contractor shall structure the Configuration Management Plan to show all the details of the hardware components of the Provisional Stores Refrigeration system.

4.7 Set To Work (STW) Plan

The Contractor shall structure the STW plan to show how each subsystem functions are planned to be tested and integrated on the submarines.

4.8 Quality Assurance (QA) Plan

The Contractor shall structure the quality assurance plan in accordance with SACC clause D5402C (Quality Plan) dated 2010-01-11.

4.9 Project Meetings

4.9.1 Project Kick-off Meeting

Within one month of the Contract Award, the Contractor shall conduct a project kick-off meeting at the Contract's facility, or another facility as agreed to between the Contractor and DND, or by teleconference or video conference. The discussion shall include but not limited to the review of the:

1. The Project Management Plan;
2. Technical Specification;
3. Critical path activities;
4. Plans for activities during the following week;
5. Approach for initial cadre training and steady state training;
6. Risk management concerns and mitigation actions; and
7. Any other contractual or program issues associated with the project as mutually agreed between the TA, RA, PWGSC and the Contractor.

4.9.2 Project Review Meetings

The Contractor shall conduct and co-ordinate Progress Review Meetings (PRMs) every two months or as mutually agreed between Canada and the Contractor. Canada will decide if the PRM will be held on-site or held via teleconference.

4.9.2.1 The Contractor shall hold the first PRM within one month following the Kick-off Meeting.

4.9.2.2 PRMs shall encompass total project status as of the review date.

4.9.3 Final Project Meeting

A Final Project Review (FPR) meeting is required to provide a complete review of the deliverables.

4.9.3.1 The Contractor shall hold the FPR meeting at a time to be determined by DND but this meeting shall take place no later than 30 days after acceptance of the last deliverable.

4.9.4 Other Scheduled Meetings

The Contractor may identify, through other requirements stipulated in this SOW and the submission of their various plans, the necessity to schedule other meetings.

4.9.4.1 The Contractor shall identify these meetings in the Project Schedule (PS).

4.9.4.2 Canada's approval of the PS will confirm Canada's intention to attend such meetings.

4.9.5 Meeting Arrangements

When the Contractor is tasked to arrange and co-ordinate a meeting, it shall be done IAW this section.

4.9.6 Supporting Documents

4.9.6.1 The Contractor shall prepare and submit supporting documents required (in source format and not in Portable Document Format (PDF) or equivalent format) for a meeting at least five (5) working days in advance of each review or meeting.

4.9.6.2 The Contractor shall prepare and submit an agenda at least five (5) working days in advance of each review or meeting except in the case of unscheduled meetings in which case the Contractor shall submit an agenda prior to the meeting.

4.9.6.3 Canada and the Contractor shall mutually agree to the contents of the agenda.

4.9.7 Meeting Support

4.9.7.1 The Contractor shall host and attend project reviews and meetings as required by this SOW, at the Contractor's facility or elsewhere as agreed to by DND.

4.9.7.2 For all reviews and meetings hosted by the Contractor, the Contractor shall:

1. Arrange the venue;
2. Co-ordinate with Canada as appropriate;
3. Provide all administrative facilities and presentation equipment;
4. Ensure that qualified Contractor and subcontractor personnel attend the reviews or meetings;
5. Ensure and report that action items and decisions under the control of the Contractor as a result of the various meetings and reviews are implemented where applicable; and,
6. Maintain files, records, documents of all reviews and meetings.

4.9.8 Meeting Agendas

The purpose of the Meeting / Teleconference / Conference Supporting Documentation and Agenda is to provide the proposed subject items for review and discussion.

1. Supporting documentation and agenda shall be prepared in the Contractor's format.
2. The Agenda shall include the following:
 - a. Purpose of the meeting.
 - b. List of expected attendees.
 - c. Time, date, location and expected duration of the meeting.

- d. Facilities and equipment to be provided for attending personnel.
 - e. List of data items and documents to be reviewed or provided to support the meeting. Adequate copies of all such data and documentation shall be provided.
 - f. Adequate copies of the current Action Item List where appropriate.
3. Other pertinent information such as security requirements, if laboratory or submarine visits are planned or other relevant information that would assist attending personnel.

4.9.9 Meeting Minutes

4.9.9.1 The Contractor shall record, produce, deliver and revise, as required, minutes for all meetings.

4.9.9.2 The Contractor shall prepare and distribute an electronic copy of the minutes to the Canada attendees in accordance with the following:

- a. Meeting / Teleconference / Conference Minutes shall be prepared in the Contractor's format and shall include the following information:
 1. Date and location of meeting;
 2. Name, organization, phone number, e-mail address and title of each person that attended the meeting;
 3. Statement relating to the purpose and/or objective of the meeting;
 4. The original agenda and any revisions to the agenda - this may be accomplished by reference to attachments or enclosures.
- b. Minutes should include a record of each item discussed or reviewed during the meeting, including:
 1. A brief statement identifying the item or problem and their status;
 2. A summary of pertinent information associated with the item;
 3. A recommendation;
 4. An action item - identifying the person or organization responsible for taking and/or co-ordinating required action with key dates; and
 5. An updated Action Item List (AIL).
- c. Meeting minutes should be distributed, where possible, at the end of the meeting and signed by the responsible parties before leaving. Otherwise the meeting minutes shall be delivered to each attendee five (5) working days after the meeting via e-mail in source format soft copy.

4.9.9.3 Meeting minutes are accepted once signed by Canada. Canada will advise the Contractor of any issues within two (20 working days of receiving the minutes.

4.9.10 Meeting Cancellations

The TA and the RA may cancel PRMs or any other review meetings at their discretion with a minimum of 5 working days notice. Rescheduling of meetings by the Contractor shall be done only with the explicit agreement of DND.

4.11 Reporting and Communications

The Contractor shall monitor progress and deliver one week after the start of the month, by fax or e-mail, monthly Project Status Reports to the TA.

4.11.1 The Project Status Reports shall be prepared in the Contractor's format and contain necessary amendments to the PMP as appropriate.

4.11.2 The Project Status Reports shall include at least the following information:

- a. A narrative report providing sufficient detail to enable the Contracting Authority and the Technical Authority to evaluate the progress of the work to date;

- b. Risk management activities. Significant problems or concerns encountered together with recommended course of action;
- c. Schedules status, schedule changes and planned activities for the next reporting period;
- d. A summary of any issues for meeting requirements / specifications;
- e. Running summary of hardware, software and system observations and problems that have been opened, are in progress or have been resolved; and,
- f. Subset of Action Item List containing all open action items.

4.12 Problem Reporting

The Contractor shall advise the TA by fax or e-mail within three (3) working days of the date the Contractor determines that there is a schedule alteration or contractual issue. Upon such notification the Crown will advise whether a meeting or other actions are required.

4.13 Data Reviews and Revisions

The Contractor shall submit all deliverable data in a draft form that consists of a complete document compliant with the requirements of the SOW for DND to review.

- 4.13.1 Unless otherwise noted, the DND review process will take no more than ten (10) working days from receipt of the data.
- 4.13.2 The provision of comments by the DND on draft deliverables shall not be construed as approval of the data deliverable.
- 4.13.3 Unless otherwise noted, the Contractor shall address the DND comments and resubmit the document within ten (10) working days of reaching agreement on the comments.
- 4.13.4 The Contractor shall ensure that the final documents will consist of the draft document modified to include the changes as authorized by DND.
- 4.13.5 When revisions and amendments have been made to data deliverables required under this SOW, the Contractor shall submit the revisions/amendments to DND.

4.14 Action Item List (AIL)

- 4.14.1 The Contractor shall maintain a historical, chronological and up-to-date list of Action Items resulting from reviews, meetings, or correspondence between the TA and the Contractor in a format acceptable to the TA for the duration of the project.
- 4.14.2 In the list the Contractor shall record, as a minimum: identification number; title or description, date opened, action required, priority, organization responsible for taking action, brief statement of results in sufficient detail to clearly identify and track the action taken, date closed, and, status (open/closed).
- 4.14.3 The Contractor shall ensure that, once entered, no entry is deleted.
- 4.14.4 The Contractor shall include a subset of the list containing all open action items as an attachment to the monthly status reports.
- 4.14.5 The Contractor shall make a copy or reproduction of the most current AIL or any portion thereof available to DND upon request at any time.

4.15 Security Management

Requirements for personnel and facilities security clearances are identified in the Security Requirements Check List.

4.16 Access to DND Facilities

The Contractor may be provided access to DND Facilities, on an as required basis and non-interference basis, to allow the Contractor to view systems and obtain relevant data. Site visits may also be used to interview Customer Subject Matter Experts (SMEs) to determine or confirm equipment functionality and operational parameters.

4.17 Visit Request Notice

The Contractor shall provide at least four (4) weeks notice for visit requests.

4.18 Acceptance Test Plans

4.18.1 Describes the plans for testing of equipment and software interface items and system integration for the submarines. Describe the test environments to be used for the testing, identify the tests to be performed, and provide schedules for test activities.

4.18.2 a. This document shall contain the following generic information items:

1. Date of issue and status;
2. Scope;
3. Issuing organization;
4. References;
5. Approval authority;
6. Planned activities and tasks;
7. Macro references (policies or laws that give rise to the need for this plan);
8. Micro references (other plans or task descriptions that elaborate details of this plan);
9. Schedules;
10. Estimates;
11. Resources and their allocation;
12. Responsibilities and authority;
13. Risks;
14. Quality control measures;
15. Cost;
16. Interfaces among parties involved;
17. Environment/infrastructure, including safety needs;
18. Training;
19. Glossary; and
20. Change procedures and history.

b. This document shall contain the following specific information items:

1. Test levels;
2. Test classes;
3. General test conditions;
4. Test progression;
5. Data recording, reduction, and analysis;
6. Test coverage (breadth and depth) or other methods for assuring sufficiency of testing;
7. Planned tests, including items and their identifiers;
8. Test schedules;
9. Requirements traceability;

4.19. Acceptance Test Procedures

4.19.1 Contractor developed Set-To-Work acceptance test procedures for the Refrigeration System equipment for the submarines.

4.19.2 The Set To Work acceptance test procedure shall contain the following, as a minimum

1. Brief description of the system under test.
2. Set-to-Work set-up description.
3. Set-up plan and procedures.
4. Issuing organization and
5. Approval authority;
6. A clear and concise detailed description of the steps to be followed in the setting to work of the system.
7. Set up Scenarios.
8. Procedures required to perform a system end-to-end calibration.
9. Instructions in a "command-response" type format, stating the commands required and the response that is expected.
10. Conditions, precautions and adjustments required.
11. Expected test results.
12. List of the tools and test equipment required to verify the correct operation of the entire Provisional Stores Refrigeration System and all interfaces to existing equipment, and to all internal and external interfaces to submarine systems.
13. Related Interface Control Documents (ICD).
14. Personnel and Equipment safety precautions.
15. Test equipment calibration certificates, as required

4.20 Acceptance Test Reports

4.20.1 To report on the Set-To-Work results for each submarine and the trainers after completion of the task.

4.20.2 The Set-To-Work Report shall include the following as a minimum:

1. Description of the system and the test set up environment.
2. Copies of the STW test plan, the STW test procedures and the STW acceptance procedure.
3. Copies of all the test reports.
4. A summary of the status of the equipment, any changes / modifications that were made during the set up and details of any failures experienced, and the remedial action that was taken to restore the equipment to its specified operating conditions.
5. A section detailing faulty devices on equipment "set-to-work", which shall include as a minimum:
 - a. Test / measurement plan for testing.
 - b. Test / measurement procedure and instrument listing. If appropriate, calibration data on the instruments.
 - c. Tabular report on the system status, showing the following:
 - i. Operational (Y/N);
 - ii. Within tolerance (Y/N); and
 - iii. Comments.

- d. Include summary of any equipment that are outside the Provisional Stores Refrigeration System operational tolerances.

4.20.3 The summary of any recommendations.

Annex B

**TECHNICAL STATEMENT OF REQUIREMENT FOR THE
VICTORIA CLASS SUBMARINE
PROVISIONAL STORES REFRIGERATION SYSTEM**

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1. SCOPE

1.1 Purpose

1.1.1 This document states the requirements of the Department of National Defence for the replacement of the combined (Cold and Cool room) Provisional Stores Refrigeration System on board each of Canada's four (4) Victoria Class Submarines, HMCS CHICOUTIMI, HMCS CORNER BROOK, HMCS WINDSOR and HMCS VICTORIA.

1.2 Objective

1.2.1 The objective is to replace the current Provisional Stores Refrigeration System with a modern and fully supportable system.

1.3 Background

1.3.1 The Victoria Class submarines were designed and built in the 1980's when the refrigerant of choice was Freon-12. For a variety of reasons, including equipment obsolescence and the need to change refrigerants, the Department of National Defence (DND) plans to replace the Provisional Stores Refrigeration System in its submarines.

1.4 Acronyms and Terminology

Throughout this Technical Statement of Work (TSOR), the following Acronyms and Terminology shall apply:

| | |
|------|--------------------------------|
| ATP | Acceptance Test Procedures |
| CDR | Critical Design Review |
| DND | Department of National Defence |
| FAT | Factory Acceptance Test |
| FoC | First of Class |
| HMCS | Her Majesty's Canadian Ship |
| ILS | Integrated Logistic Support |
| MCC | Machinery Control Console |
| MI | Magnetic Indicator |
| MSDS | Material Safety Data Sheet |
| PDR | Preliminary Design Review |
| PM | Project Manager |
| PMP | Project Management Plan |
| PS | Project Schedule |
| RCP | Refrigeration Control Panel |
| SOW | Statement of Work |
| STW | Set-to-Work |
| TA | Technical Authority |
| TDP | Technical Data Package |
| TSOW | Technical Statement of Work |
| WBS | Work Breakdown Structure |

2. APPLICABLE DOCUMENTS

The following documents form part of this TSOR to the extent specified herein, and are supportive of the TSOR when referenced. All other document references are to be considered supplemental information only. Unless otherwise specified the issue or amendment of documents effective for this contract shall be those in effect on the date of contract award.

2.1 Government Documents

The following documents can be supplied to the winning bidder on request.

| Item | Document Number | Title |
|------|--------------------------------------|--|
| 1 | Annex B | PSRS TSOR |
| 2 | A-SJ-100-001/AS-00 | Security Orders For The Department Of National Defence And The Canadian Forces - Volume 1- General |
| 3 | A-LM-505-001/AG-001 | Guidance Manual, Integrated Logistics Support |
| 4 | A-LM-505-001/AG-002 | Guidance Manual, Logistics Support Analysis |
| 5 | A-LM-505-001/AG-003 1997-05-30 | Military Standard - Logistic Support Analysis |
| 6 | BR 3021 Volume 1 Rev 10 1982 | Shock Manual (Metric) Vol. 1 |
| 7 | BR 3021 Volume 2 Rev 10 1984 | Shock Manual (Metric) Vol. 2 |
| 8 | C-01-100-100/AG-006 1996-03--01 | Specification: Writing, Format and Production of Technical Publications |
| 9 | C-03-007-000/AG-001 | Guide to Development of Engineering Change Installation Package |
| 10 | C-03-005-012/AM-001MOD2 - 2003-04-11 | Naval Maintenance Management System Parts 1 & 2 |
| 11 | C-01-000-102/AG-000 2001-03-01 | National Defence Index of Documentation System |
| 12 | D-03-003-005/SF-000 1994-03-22 | General Electrical Specification for Canadian Forces Ships |
| 13 | D-03-001-HMC/SF-001 2010-05-01 | Specification for Maintenance Painting of HMC Submarines |
| 14 | D-01-400-001/SG-000 1979-04-02 | Engineering Drawing Practices for Class Drawing and Technical Data List |
| 15 | SSKP297000020000 | Surveillance System Cabling Diagram Main Interconnecting Cables (Sheet 7, Rev V01) |
| 16 | SSKP297000020000 | Surveillance System Cabling Diagram Junction Box 1 (Sheet 8, Rev V01) |
| 17 | SSKP297000020000 | Surveillance System Cabling Diagram Cable Schedule (Sheet 34, Rev V01) |
| 18 | SSKY50483D001000 | Ships Stores Refrigeration System (Sheet 1, Rev 08) |
| 19 | SSKP297000008000 | Surveillance Schematic Diag. (Sheet 5, Rev 002) |
| 20 | SSKP297000028000 | ECD Surveillance System (Sheet 14, Rev 005) |
| 21 | SSKP297000020000 | Surveillance System CLD (Sheet 18, Rev 006) |
| 22 | SSKP297000020000 | Surveillance System CLD (Sheet 21, Rev 005) |
| 23 | SSKP297000020000 | Surveillance System CLD (Sheet 34, Rev 007) |
| 24 | SSKP423205047000 | MCC Wiring Schedule Alarms (Sheet 1 to 3, Rev 001) |
| 25 | SSKP423000019000 | Stores Refrig. Schematic Diag. (Sheet 1 to 5, Rev 004) |
| 26 | SSKP297000030 | MCC Equipt. Conns. (Sheet 27, Rev 003) |

Table 1 - List of Government Documents and Drawings

2.2 Non-Government Documents

| Item | Document Number | Title |
|------|------------------|--|
| 1 | SOR/2003-289 | Federal Halocarbon Regulations, 2003 (Environment Canada) http://laws.justice.gc.ca/en/C-15.31/SOR-2003-289/index.html |
| 2 | SOR/SOR/2009-221 | Regulations Amending the Federal Halocarbon Regulations, 2003 http://www.ec.gc.ca/cepregistry/Regulations/DetailReg.cfm?intReg=122 |

| | | |
|---|-------------------|---|
| 3 | Vol. 142, no 27 | Canada Gazette (2008-07-05) http://canadagazette.gc.ca/ |
| 4 | Vol. 143, no 17 | Canada Gazette (2009-08-19) |
| 5 | Report EPS 1/RA/2 | Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (March 2006) (Also Known As - The Refrigerant Code of Practice) http://www.ec.gc.ca/ozone/127A4F77-AFD3-404B-A4E5-96A4BD3737F2/fluoro_cop.pdf |
| 6 | MIL-HDBK-881A | Department of Defence Handbook - Work Breakdown Structures for Defence Materiel Items (30 July 2005) http://www.acq.osd.mil/pm/currentpolicy/wbs/MIL_HDBK-881A/MILHDBK881A/WebHelp3/MIL-HDBK-881A%20FOR%20PUBLICATION%20FINAL%2009AUG05.pdf |
| 7 | MIL-STD-1388-1A | Logistic Support Analysis |
| 8 | MIL-STD-1388-2B | Requirements For A Logistic Support Analysis Record (21 JAN 1993) http://www.everyspec.com/MIL-STD/MIL-STD+(1300+-+1399)/MIL-STD-1388-2B(NOTICE1)_5832/ |
| 9 | MIL-STD - 973 | Configuration Management |

Table 2 - List of Non-Government Documents Available Online

2.3 Order of Precedence

In the event of conflict between these documents the following Order of Precedence shall apply:

- (1) Annex A - Statement of Work;
- (2) Annex B - Technical Statement of Requirement;
- (3) The documents in Table 1 and Table 2.

3 PROVISIONAL STORES REFRIGERATION SYSTEM REQUIREMENTS

3.1 General Description

- 3.1.1 The provisional stores refrigeration system shall be capable of continuously maintaining the contents of the Cold and Cool Rooms at the temperature specified in section 3.3.2 when the surrounding compartment temperatures are within the range of 18°C to 29°C and sea temperatures range from -2°C to 32°C.
- 3.1.2 Two (1 working, 1 standby) 440 Volt AC 3Ph 60Hz 20 amp motor driven refrigeration plants are to be provided and installed to cool refrigerated stores by direct circulation of the refrigerant R-134a or DND approved equivalent (provided that does not contradict the Federal Halocarbon Regulations 2003 or any related regulation) through unit type air coolers.
- 3.1.3 The refrigeration plants will be supplied with cooling water from the chilled water system at a flow rate of 8.0 L/min with a max. pressure of 6 bar and at a temperature range of 6.5 – 9.0°C.
- 3.1.4 Constant circulation of air in the Cold Room and Cool Room is to be achieved by the continuous operation of the unit cooler fan except during the 15 minutes per day of defrosting.
- 3.1.5 The system shall be required to maintain the temperatures as specified in Section 3.3.2 for no less than 18 hours per day with the stand-by plant not in use.
- 3.1.6 The system shall utilize the same space envelope currently occupied by the existing system. This is further defined in Section 3.4.
- 3.1.7 Each unit cooler shall incorporate a defrosting element connected to an 115V 60Hz single phase supply, that shall be capable of defrosting up to 6 mm of frost.

3.2 Provisional Stores Refrigeration System Design

- 3.2.1 The refrigeration system (one for the cool room and one for the cold room) shall comprise of four main units: compressor unit, unit cooler, valve board and control/starter panel.
- 3.2.2 Belt Driven Motors **shall not** be used.
- 3.2.3 The Provisional Stores Refrigeration System shall:
- 3.2.3.1 Use R134a refrigerant or an equivalent refrigerant that does not contradict the Federal Halocarbon Regulations 2003 or any related regulation;
 - 3.2.3.2 Be capable of maintaining the 3.89m³ volume Cold Room (deep freeze) between -18°C and -22°C;
 - 3.2.3.3 Be capable of maintaining the 8.0m³ volume Cool Room between 1°C and 3°C;
 - 3.2.3.4 Be capable of maintaining the refrigerated stores within the temperature limits specified in Para 3.2.3.2 and 3.2.3.3 when surrounding adjacent compartment temperature of no more than 35°C (Hull Side);
 - 3.2.3.5 Incorporate Cold and Cool room temperature gauges that have a temperature range from -50°C to 30°C and are to be located on 2 deck passageway adjacent to the Refrigeration Machinery Space;
 - 3.2.3.6 Facilitate a refrigerant by-pass circuit that enables the drier core to be replaced without interrupting the refrigeration flow;
 - 3.2.3.7 Be capable of operating under the following compartment pressure conditions:
 - a. Normal compartment pressure of between 750 to 1200mbar;
 - b. Abnormal conditions no greater than 1300mbar; and
 - c. No less than 713 mbar for 5 minute durations.
 - 3.2.3.8 Incorporate protection devices such as but not limited to high and low pressure cut outs that shall shut down the compressor and indicate a tripped alarm at the Machinery Control Console (MCC).
 - 3.2.3.9 Shall have local alarm indicators that are clearly visible.
 - 3.2.3.10 Shall have output signal provisions for remote indication of the refrigeration unit operating status and alarms as detailed in Section 5 in the Statement of Work.
 - 3.2.3.11 Provide all the necessary accessories which shall include isolation valves, Thermostatic Expansion valve, condenser, evaporator, liquid receiver, moisture indicator, strainers, charging connection, drier pressure gauges and temperature gauges.
 - 3.2.3.12 Shall have valve covers provisions to preclude tampering of the refrigeration system.
 - 3.2.3.13 Each compressor, condenser and valve board shall be capable of being isolated from each other in order to conduct maintenance and repairs.
 - 3.2.3.14 The compressors shall be capable of being isolated from each other in order to conduct maintenance and repairs.

- 3.2.3.15 Shall incorporate Unit Coolers complete with a drip tray that drains to a stainless steel collecting bottle.
- 3.2.3.16 The refrigeration system shall be of a splash proof design.
- 3.2.3.17 Have the following capabilities:
 - a. Redundancy;
 - b. Defrost Heaters;
 - c. Control indication.
- 3.2.3.18 Have coatings that meet the specifications defined in document D-03-001-HMC/SF-001.
- 3.2.3.19 Be suitable for use in the marine environment.
- 3.2.3.20 Have a life expectancy of not less than ten (10) years from date of installation.
- 3.2.3.21 The Contractor shall be available to provide Technical Advise or respond to Technical queries on a "as required basis" to support equipment.

3.3 Performance Requirements

- 3.3.1 The Refrigeration system during normal operation shall be capable of continuous, automatic, and unattended operation after initial start up during normal operation.
- 3.3.2 Each fully operational plant shall be capable of full duty maintaining the refrigerated stores within the following temperature ranges:
 Cool Room: 1°C to 3°C
 Cold Room: -18°C to -22°C
- 3.3.3 The Refrigeration system shall be capable of operating at a relative humidity level of between 30% and 95%.
- 3.3.4 The refrigeration system pipes shall be capable of remaining mechanically secure so that Grade 2 acoustic clips are used in the cool and cold rooms and Grade 1 acoustic clips elsewhere in the system. The Contractor shall ensure that proper acoustic clips are supplied if needed for the installation of the system. Flexible hoses are fitted between the refrigeration plant, chilled water system, unit coolers and resilient mounted equipment. Piping in cool/cold room shall be protected with aluminum covers to prevent physical damage.
- 3.3.5 The refrigeration system be capable of continuous independent operation under the following operating conditions of inclination:

| | |
|------------------|--|
| Submerged | <p>Heel: 40 degrees for 5 seconds duration, 20 degrees for 45 seconds duration, 10 degrees continuously.</p> <p>Trim: 30 degrees for 30 seconds duration, 22 degrees for 180 seconds duration, 15 degrees continuously.</p> <p>Combined Heel and Trim: 30 degrees Trim, 10 degrees Heel for 30 seconds duration, 15 degrees Trim, 40 degrees Heel for 5 seconds duration.</p> |
| Surfaced | <p>Heel: 10 degrees continuously.</p> <p>Trim: 5 degrees continuously.</p> <p>Roll +/- 30 degrees: 6 seconds period for full cycle.</p> <p>Pitch +/- 2.5 degrees: 5 seconds period for full cycle.</p> |

Table 3-Typical Submarine Motions

3.4 Physical Requirements

3.4.1 The proposed system solution will stay within the same space envelope currently occupied by the system. The Refrigeration unit design shall be such that:

3.4.1.1 Unit Cooler Size

Cool/Cold rooms Unit Cooler (evaporator), (including fan and motor), shall not exceed a length of (610 mm), width of (635 mm) and a height (510 mm).

3.4.1.2 Unit Cooler Mounting Arrangement

Unit coolers shall be designed to reuse existing 'L' type shock mounts in order to minimize structural modifications in way of the new equipment fit. In this regard the securing points and weight distribution shall be suitable for the 'L' type shock mount load range. In addition the 'L' type shock mounts shall be replaced with new stock. Unit Coolers in Cold and Cool Rooms are currently on four (4), 14 Kg 'L' type shock mounts, mounting bolt centers, L (584 mm) x W (508 mm).

3.4.1.3 Sub-Component Maximum Size

3.4.1.3.1 The sub-components shall not exceed a length of (565 mm), width of (450 mm) and height of (850 mm). This is to allow the components to fit through the submarine internal hatches.

3.4.1.3.2 The maximum complete unit allowable size in order to be able to fit the machinery space shall be: Diameter (970 mm) x H (850 mm).

3.4.1.4 Provisional Stores Refrigeration System Space Envelope

3.4.1.4.1 Existing mounting pads (80 mm x 80 mm) in machinery space raised 85 mm off the floor. Threaded hole (M10 x 1.5 – 6g bolts) centers L (1000 mm) x W (440 mm).

3.4.1.4.2 Total equipment envelope shall not exceed 135 mm in front of mounting bolt center or 113 mm behind mounting bolt center.

3.4.1.4.3 Existing compressor skid L (846 mm) x W (688 mm) x H (850 mm) inset of four, 110 Kg noise reduced X-type shock mounts. Below is a general orientation drawing and picture.

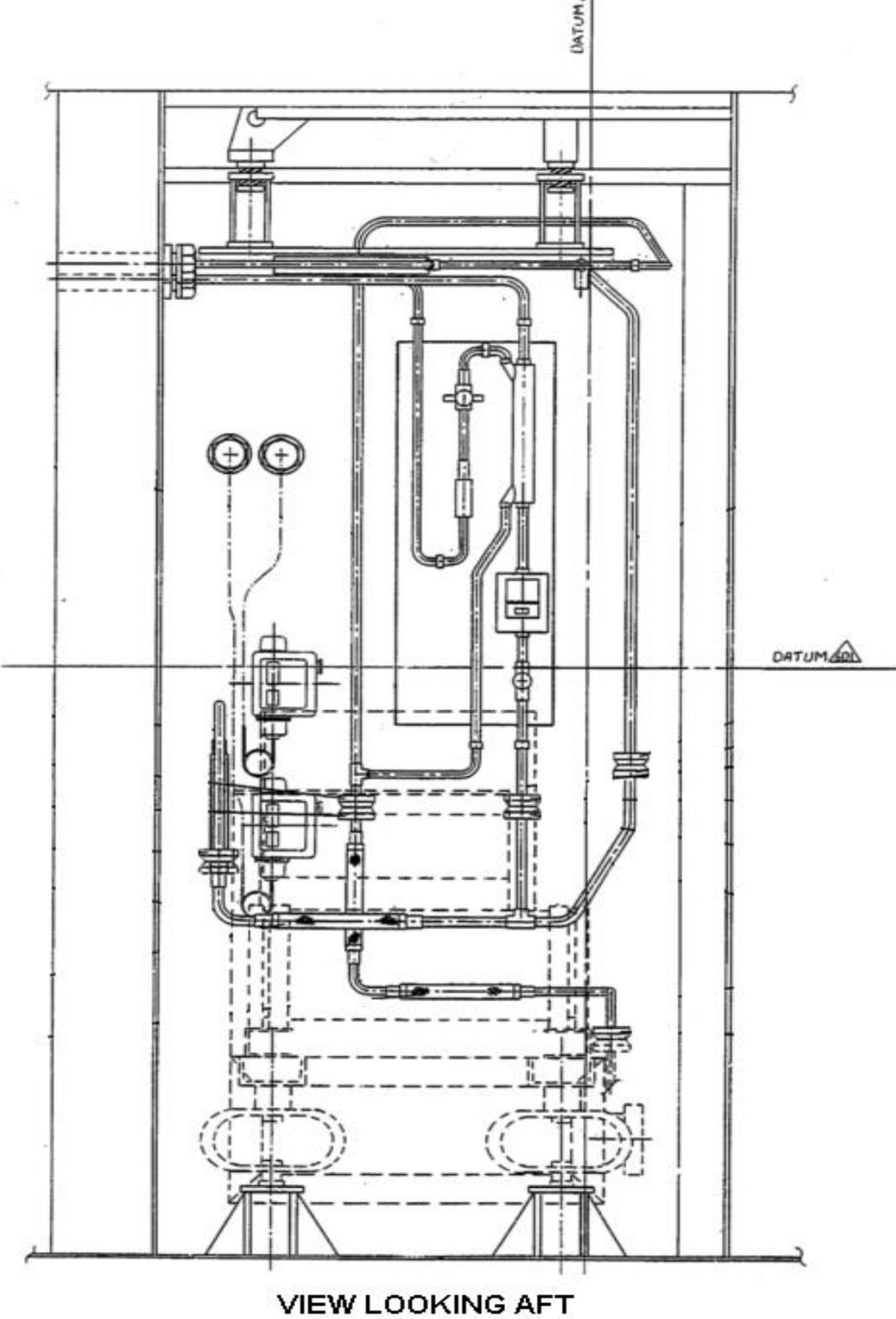
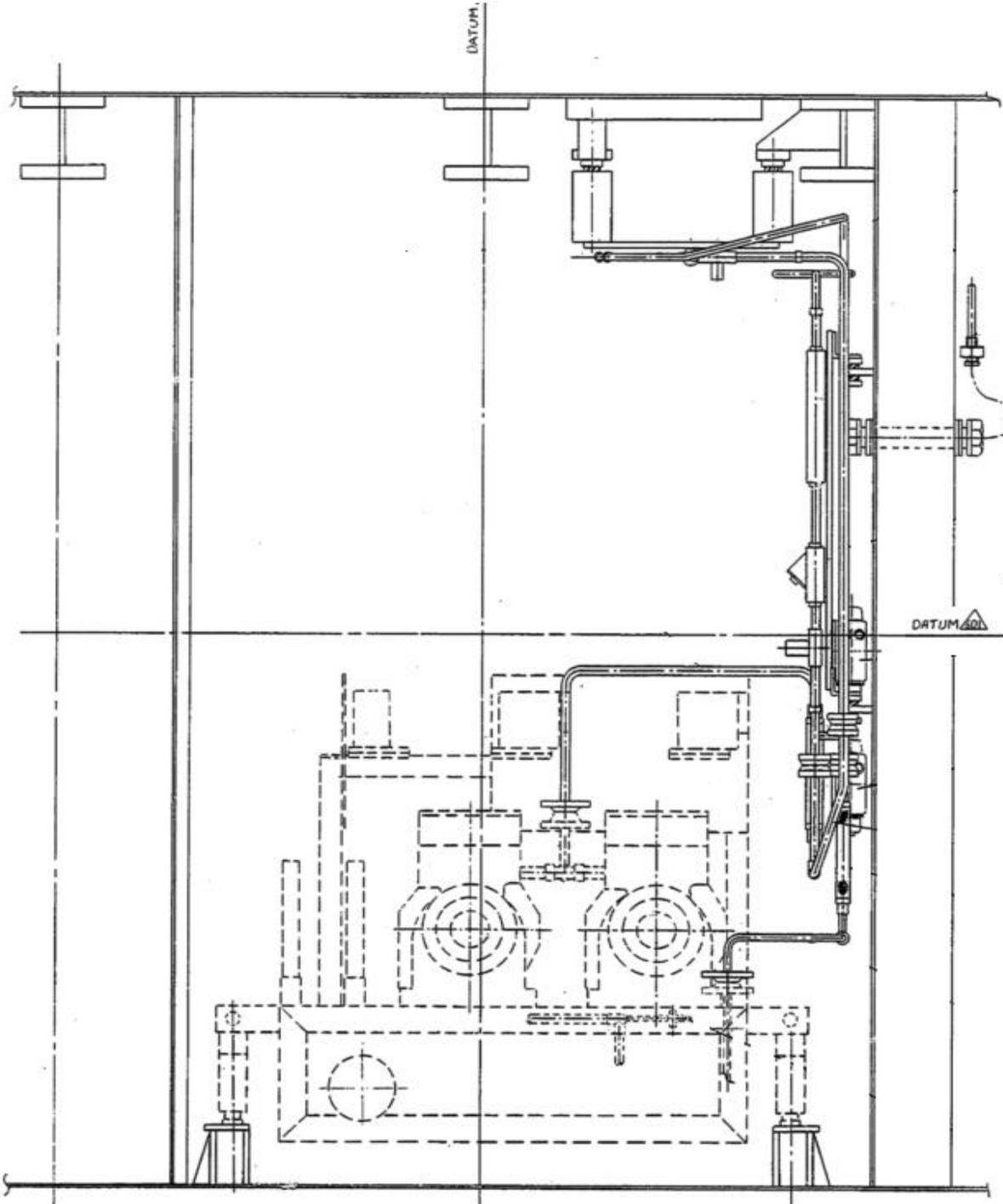


Figure 1 – View Looking AFT



VIEW LOOKING STBD FROM SHIPS C/L

Figure 2 – View Looking STBD From Ships C/L

3.4.1.5 Existing Valve Boards

There are currently two (2) valve boards, each on four, 5 Kg resilient mounts. The mounting arrangements are:

| | Valve Board A | Valve Board B |
|-----------------------|-----------------------|-----------------------|
| Dimensions | L (635mm) x W (350mm) | L (644mm) x W (242mm) |
| Mounting Bolt Centers | L (472mm) x W (327mm) | L (606mm) x W (153mm) |

Table 4 - Current Valve Board Mounting

3.4.1.6 Existing Control Panel

The existing Control Panel (weight 60 Kg in running condition), located in the machinery space, is mounted on four (4) mounting pads with bolt hole centers L (870 mm) x W (407 mm) and on 'J' type mounts.

3.4.1.7 The Control Panel can be installed without impeding operation or maintenance.

3.4.1.8 Sub assemblies and components shall be completely assembled and ready for service upon hook-up to ship services and distribution piping.

3.4.1.9 The refrigeration unit and its constituent components shall be capable of passing through a shipboard hatch measuring 900 mm in diameter.

3.4.1.10 All refrigeration components and piping shall be mounted on a structural base/frame that can be secured to the deck structure of the submarine. Refrigeration unit components shall not be welded to the structural base/frame. Bolting shall be used to facilitate installation and maintenance activities.

3.4.1.11 The refrigeration unit shall be designed to allow for easy access when maintaining the unit and its components as further detailed in Section 3.6.

3.4.2 A statement of the weight of the proposed Provisional Stores Refrigeration System and its sub-assemblies with +/- 10% margin of error shall be submitted along with its Detailed Design for review by the TA or its designated Authority.

3.4.3 Refrigerated Space Surface Area

The following Refrigerated Space Surface Area and current configuration is given as guidance to the Contractor.

| Cold Room | Cool Room |
|--------------------------------------|---|
| Deck Over/under = 6.58m ² | Deck Over/Under = 15.0 m ² |
| Inboard Side = 2.97m ² | Inboard Side to Cold Room = 2.97m ² |
| Forward Side = 4.52m ² | Aft Side to Cold Room = 4.52m ² |
| Aft Side = 4.52m ² | Aft side adjacent compartment = 3.4m ² |
| Hull Side = 3.02m ² | Forward Side = 7.92m ² |
| | Hull Side = 3.24m ² |
| | Inboard Side = 6.15m ² |

Table 5 - Refrigerated Space Surface Area

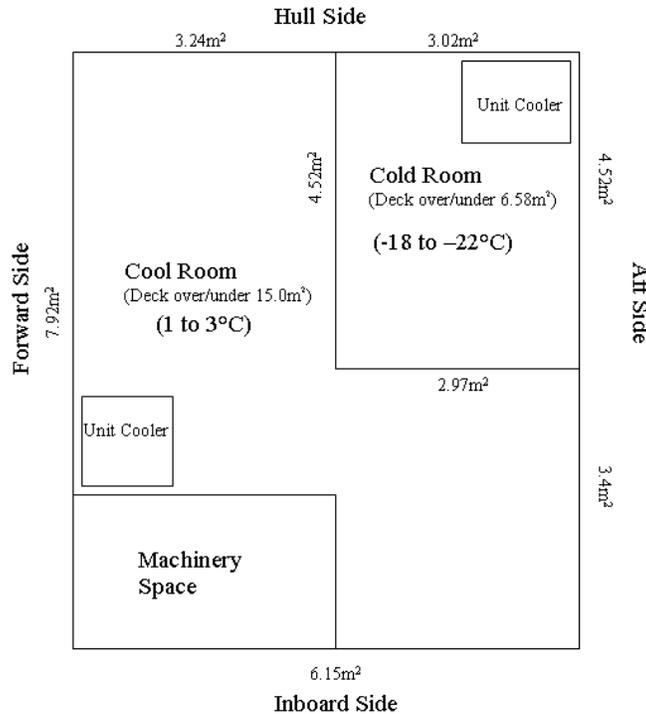


Figure 3 - Refrigerated Space Surface Area Dimensions

3.5 Interface Requirements

- 3.5.1 The electrical services that can be provided for the operation of the refrigeration unit are limited to the following:
 - 3.5.1.1 440 VAC, 3 Phase, 60 HZ, 20 Amps;
 - 3.5.1.2 115 VAC, 1 Phase 60Hz, 40 Amps;
 - 3.5.1.3 Chilled Water at a maximum of 6 bar with a flow rate of 8.0 L/min;
 - 3.5.1.4 The Condenser water flow will be maintained by means of a constant flow valve.
- 3.5.2 The following items required in the submarine installation of the refrigeration unit are to be Government Supplied Material (GSM) and shall not be included with the delivery of the refrigeration unit:
 - a. Electrical supply to control panel;
 - b. Chilled Water Piping and fittings external to the refrigeration unit such as to/from the condenser unit.
 - c. Refrigerant
- 3.5.3 Provision for remote indication of refrigeration unit operating status and alarms shall also be available for interfacing with the existing shipboard Machinery Control Console (MCC) as per Section 5 of the Statement of Work.

3.6 Maintenance Requirements

- 3.6.1 Components shall be arranged so as to provide maximum accessibility for corrective and preventative maintenance.
- 3.6.2 The refrigeration system design shall allow:
 - 3.6.2.1 All maintenance operations to be completed at the front (one side only) of the refrigeration unit;

- 3.6.2.2 Maintenance activities to be easily accomplished by semi-skilled personnel;
 - 3.6.2.3 Routine maintenance operations (defined as having a periodicity of less than 30 days) to be carried out without dismantling external electrical connections, fittings or piping interfaces; and
 - 3.6.2.4 For the monthly maintenance effort to not exceed 2 (two) man-hours of semi-skilled personnel to complete preventive maintenance during normal operation (not including cleaning/preservation functions if required).
- 3.6.3 Cleaning agents, if any are required shall be identified by product name and chemical composition and shall satisfy the following requirements:
- 3.6.3.1 Be safe to handle and store indoors;
 - 3.6.3.2 Shall not produce harmful by-products under normal submarine operating conditions;
 - 3.6.3.3 Shall not contain substances that are toxic, prohibited, restricted, or are subject to notification or consent under the Canadian Environmental Protection Act, 1999 (CEPA, 1999).
- 3.6.4 A receiver capable of capturing the full volume of refrigerant used by the Stores Refrigerant System shall be provided.
- 3.6.5 The maintenance policy will be "Repair by Replacement" of sub-assemblies whenever possible. All on board spares shall be capable of being installed using general shipboard tools. Any speciality tools/equipment required for maintenance shall be clearly identified in the proposal.

3.7 Material Requirements

- 3.7.1 The unit components shall be constructed of marine grade materials thoroughly resistant to corrosive and erosive effects of the marine environment and at temperatures and pressures encountered during normal submarine operation.
- 3.7.2 To address submarine material safety requirements, the Contractor shall supply the following:
- a. a list of all materials;
 - b. technical specifications; and
 - c. Material Safety Data Sheets (MSDS) for all the material that constitutes the Provisional Stores Refrigeration System. The Contractor shall submit this information along with its Detailed Design for review by the TA or its designated Authority.
- 3.7.3 Materials used for construction of the non-wetted components shall be of marine grade and resistant to corrosion in a marine environment.
- 3.7.4 Provisional Stores Refrigeration System shall be designed to ensure maximum protection of components from standard corrosive marine environments. Coatings, if required, shall meet specifications stated in document D-03-001-HMC/SF-001.
- 3.7.5 Valves are to be selected from the standard range given in Def. Stan 02-360 Issue 2 (07 Dec. 2001). However, where suitable valves do not exist, valves from commercial ranges are acceptable subject to TA conformation.
- 3.7.6 All valves are to be welded or brazed into the system in preference to screwed type, except where it is impractical to do so
- 3.7.7 To reduce refrigerant leakage permanent joints are to be welded or brazed and the number of joints are to be kept to a minimum.
- 3.7.8 Plastics shall not be used for structural components, piping or valves and control panels.

- 3.7.9 The following materials **shall not** be used:
- a. Asbestos in any form;
 - b. Cadmium plating;
 - c. Halocarbons;
 - d. Polychlorinated biphenyls (PCB);
 - e. Chlorosulphonated polythene (CSP) and polyvinyl chloride (PVC) as insulators for electrical cables;
and
 - f. Radioactive material.

3.7.10 Workplace Hazardous Material Information (WHMIS) material safety data sheets (MSDS) are to be provided for cleaning agents and any other components that require MSDS under WHMIS legislation.

3.8 Electrical Requirements

3.8.1. Motors supplied as part of the refrigeration unit shall meet the following:

3.8.1.1 Applicable specifications – NEMA MG-1 (or applicable and equivalent metric specification) IEEE 45;

3.8.1.2 Capable of making a minimum of 40 starts a day; and

3.8.1.3 Have built in overload protection.

3.8.2 The Refrigeration Control Panel (RCP) shall provide:

3.8.2.1 Power to AC motors;

3.8.2.2 Defrost Control;

3.8.2.3 Power for control, operational indicators and alarm devices.

3.8.3 Design features of the RCP shall include:

3.8.3.1 Operation – the RCP shall be designed to provide fully automatic and manual override operation complete with switches, push buttons, indicating lights, alarms and emergency shutdown features required to fulfill the requirements of this specification;

3.8.3.2 Loss of Power – shall ensure that in the event of loss of power, the control circuitry will remain de-energized until a RESET push button is depressed; and

3.8.3.3 Alarms – the alarm indicating lights shall be energized by a minimum of the following; loss of power to the unit and temperatures exceed those as laid down in this specification.

3.8.4 The RCP shall include:

a. Hour meter indicating accumulated operating time for each compressor;

b. Main power disconnect switch;

c. Main power distribution terminal block to accept incoming cable and motor feeds;

d. Motor starters;

e. Transformers with fuses (if applicable);

f. Control and a 15 minute time delay to prevent rapid cycling of the compressor;

g. Alarm devices;

h. Terminal strips;

i. Fuses;

j. Switches, push-buttons and indicating lights on the hinged door;

k. Complete wiring within the panel; and

l. Other components and devices necessary to complete the panel as intended by this specification.

- 3.8.5 The RCP shall be designed for and fitted with terminal connections enabling remote monitoring at the MCC through Magnetic Indicators:
 - 3.8.5.1 Running, OFF, Tripped (discrete/visual) indication for both compressors.
- 3.8.6 All control and instrument panel enclosures shall be drip proof and meet NEMA ICS IEEE 45.
- 3.8.7 The control panel shall be mounted in the Refrigeration Machinery space.
- 3.8.8 At present it is not envisioned that there will be a requirement for EMI / EMC specifications however DND reserve the right to implement the specifications during the preliminary design review.
- 3.8.9 The Provisional Stores Refrigeration System control panel shall allow for operation, control, monitoring and self-protection of the refrigeration system in all operational modes (i.e. run, defrost and others.).
- 3.8.10 The control panel shall accommodate both a primary electrical feed and a back up electrical feed via a MANUAL selector.
- 3.8.11 The Provisional Stores Refrigeration System shall interface with the Central Surveillance System Channel No 19-1-01 in the cold room and the Central Surveillance System Channel No 19-1-02 in the Cool Room.
- 3.8.12 This system shall be capable of tracking the total running hours for the primary and standby compressor separately.
- 3.8.13 The Provisional Stores Refrigeration System electrical components shall conform to electrical specification D-03-003-005/SF-000.
- 3.8.14 The control system shall be able to give a visual indication of the state of system for the following:
 - a. run status;
 - b. alarms (visual and audible);
 - c. faults indicating system malfunctions;
 - d. line pressures;
 - e. room temperatures; and
 - f. other parameters necessary to operate, maintain and troubleshoot the refrigeration system.
- 3.8.15 Available Power
The available Power to the Provisional Stores Refrigeration System and Unit Coolers is:

| | Number of Lines | Voltage | Frequency | Phase | Fuse Size |
|--------------------|-----------------|---------|-----------|-------|-----------|
| Main Compressor | 1 | 440V | 60Hz | 3Ph | 20A |
| Back-Up Compressor | 1 | 440V | 60Hz | 3Ph | 20A |
| Unit Coolers | 1 | 115V | 60Hz | 1Ph | 40A |
| | | | | | |

Table 6 - Available Power

Compressor Motor Supply

440V 60Hz three Ph from 20A fuses on FP 1/1 (normal supply) and FP 2/3 (Alternative supply)

Refrigeration Control Panel (RCP)

115V 60 Hz single phase from 40A fuses on FP 1/1/4T

Defrost Heaters (per Unit Cooler)

- Cooling coils Two 115V 60 Hz single phase from RCP
- Drain Line Two 115V 60 Hz single phase from RCP
- Drain Tray One (750W) 115V 60 Hz single phase from RCP

Unit Coolers (one per room)
 Cooling fan Motor One 115V 60 Hz single phase from RCP

3.9 Safety Features

3.9.1 The Refrigeration unit shall incorporate adequate safety interlocks, which prevent damage to equipment or injury to personnel while the equipment is energized.

3.9.2 The refrigeration unit shall be designed so that:

- 3.9.2.1 The unit can be de-energized prior to enabling access to any powered source;
- 3.9.2.2 the complete safety of the operator is ensured at all times.

3.9.3 Surveillance System Alarm

3.9.3.1 Cold and Cool Rooms

From Sensors to JB1:

| | |
|--|--|
| Cabling Schematics and Additional Information | SSKP297000020 Sheets 7,8, 34v01 |
| Sensor Info | SSKY50483D001 Sheet 1 BRF 1966 (24) 01 |
| Cold Room: | Warning at -13°C (rising) |
| Module | 9 |
| Channel | 27 |
| Cable No. | 84 |
| Cable Type | 743-0514 |
| Temperature Switch: | SF TH T1 |
| Location: | SCS |
| Core: | 1-2-SCR |
| Length: | 17 |
| Instrument Ref No. | TX-802-RAC (Thermostat/Sensing Phial) |
| Temperature Range | -20 to 100°C |
| Voltage | 24V DC |
| | |
| Cool Room: | Warning at 5°C (rising) |
| Module | 9 |
| Channel | 28 |
| Cable No. | 85 |
| Cable Type | 743-0514 |
| Temperature Switch: | SF TH T2 |
| Location: | RFG Space |
| Core: | 1-2-SCR |
| Length: | 17 |
| Instrument Ref No. | TX-801-RAC (Thermostat/Sensing Phial) |
| Temperature Range | -20 to 100°C |
| Voltage | 24V DC |

Table 7 - From Sensors to JB1 (Cold and Cool Room)

The sensors for the cold and cool room are digital relay/switch contacts. For signal type it is listed as Contact closure/signal level and the range is listed as Normally Open (N.O.).

From JB1 to LSU1 via JB2:

| | |
|--|---|
| Cabling Schematics and Additional Information | SSKP297000008 Sheets 5 SSKP297000028 Sheet 14 SSKP297000020 Sheet 18 (JB1 to JB2) SSKP297000020 Sheet 21 (JB2 to LSU1) |
| Cold Room | Warning at -13°C rising |
| Surveillance System Channel No. | 19-1-01 |
| Cable No. | 11 |
| Cable Type | 743-0499 |
| Cable Entry to LSU1 | SKT 30 |
| Core: | 7 |
| Pin: | D |
| Voltage | 24V DC |
| Cool Room | Warning at 5°C rising |
| Surveillance System Channel No. | 19-1-02 |
| Cable No. | 11 |
| Cable Type | 743-0499 |
| Cable Entry to LSU1 | SKT 30 |
| Core: | 8 |
| Pin: | X |
| Voltage | 24V DC |

Table 8 - From JB1 to LSU1 via JB2 (Cold and Cool Room)

3.9.3.2 Control and Indications Compressors

3.9.3.2.1 Stores Refrigeration

Two Magnetic Indicators (MI) provide indication of running state of two stores refrigeration compressors.

Indicates: Running, Off, Tripped for Compressor No.1 and No. 2

| Wire Particulars | | Identification Sleeves | From | To |
|------------------|-----------|------------------------|------------|--------|
| No. | Item used | Item Used | | |
| 02103-0 | 62 | 73 | SF/MI1 – A | PL6-H2 |
| 02104-0 | 62 | 73 | SF/MI1 – B | PL6-J1 |
| 02105-0 | 62 | 73 | SF/MI1 – C | PL6-J2 |
| 02106-0 | 62 | 73 | SF/MI2 – A | PL6-J6 |
| 02107-0 | 62 | 73 | SF/MI2 – B | PL6-J7 |
| 02108-0 | 62 | 73 | SF/MI2 – C | PL6-K1 |

Table 9 - Stores Refrigeration Wiring Schedule (SSKP423205047)

Compressor Sensors (SSKY50483D001)

| Instrument Ref No. | Function | Source connection | Range |
|--------------------|--|-----------------------------|---------------------|
| VI-809-RAC | No. 1 Refrig. Plant Running Indication | Refrigeration Control Panel | Running/Off/Tripped |
| VI-810-RAC | No. 2 Refrig. Plant Running Indication | Refrigeration Control Panel | Running/Off/Tripped |
| VI-801-RAC | Comp. No.1 Running Indication | Refrigeration Control Panel | Running |
| VI-802-RAC | Comp. No. 2 Running Indication | Refrigeration Control Panel | Running |
| VI-811-RAC | Comp. No.1 Trip Indication | Refrigeration Control Panel | Tripped |
| VI-812-RAC | Comp. No. 2 Trip Indication | Refrigeration Control Panel | Tripped |

Table 10 - Compressor Sensors

The MCC (Machinery Control Console) Compressor Indicators have a 24V DC supply directly connected to them. (SSKP423000019)

| Additional Connection Info: | Drawing # |
|---|--|
| Stores Refrigeration Electrical Schematic Diagram | SSKP423000019 |
| Terminal Strip Connection Details | SSKP297000030 (Sheet 27 for compressor indicators) |
| Equipment to JB Cabling Schedule | SSKP297000020 Sheet 34 |

Table 11 - Additional Connection from Indicators to Terminal Strip

Rear Connections

| Circuit | Indication | Pin | Wire No. | Destination | Line |
|---|------------|-----|----------|-------------|------|
| Stores Refrig Compressor No. 1 Indication | Tripped | 3 | 2103 | SF/M11 – A | I2 |
| | Common | 4 | 2104 | SF/M11 – B | - |
| | Run | 5 | 2105 | SF/M11 – C | I1 |
| Stores Refrig Compressor No. 2 Indication | Tripped | 6 | 2106 | SF/M12 – A | I2 |
| | Common | 7 | 2107 | SF/M12 – B | - |
| | Run | 8 | 2108 | SF/M12 – C | I1 |

Table 12 - From Indicators to Terminal Strip (Rear Connections)

Front Connections (Terminal Strip 21)

| Circuit | Indication | Pin | Core | Cable Ref |
|---|------------|-----|------|-----------|
| Stores Refrig Compressor No. 1 Indication | Tripped | 3 | 5 | SS761 |
| | Common | 4 | 1 | |
| | Run | 5 | 2 | |
| Stores Refrig Compressor No. 2 Indication | Tripped | 6 | 6 | |
| | Common | 7 | 3 | |
| | Run | 8 | 4 | |

Table 13 - From Indicators to Terminal Strip (Front Connections)

3.10 Availability, Reliability and Maintainability

3.10.1 The time to bring the Refrigeration unit to operational use shall not exceed:

- 3.10.1.1 Fifteen (15) minutes from a shut-down state; and
- 3.10.1.2 Twenty (20) minutes from reverting from standby to operational mode.

3.10.2 Where available the Contractor shall provide details of Mean Time between Failure (MTBF) for the system using minimal maintenance by ship staff.

3.10.3 Availability

- 3.10.3.1 The down time due to any single preventative maintenance activity shall not exceed 30 minutes per 45 day operational period.
- 3.10.3.2 The total down time due to preventative maintenance activities during the 45 day operational period shall not exceed 4 (four) hours.

3.10.3.3 The fridge plant shall have preventative maintenance routines that can be done at sea using onboard spare parts and according to specified procedures conducted by ship staff.

3.10.4 Reliability

3.10.4.1 Where available, the Contractor shall provide MTBF and Mean Time to Repair (MTTR) figures of repairable items/equipment of the refrigeration unit and the source of such information, including calculations and historical data.

3.10.5 Maintainability

3.10.5.1 The median active time to restore/repair the equipment after a failure using supplier specified procedures and resources shall not be greater than one (1) hour.

3.10.5.2 The maximum active time to repair time should not be greater than four (4) hours.

3.11 Noise, Shock and Vibration Qualification

3.11.1 The Contractor shall demonstrate that the proposed system complies with the requirements for shock outlined by D-03-003-007/SG-000 except as noted in the following articles.

3.11.2 As appropriate, shock test certificates and analysis reports shall be provided to demonstrate the equipment will not create a hazard under grade 1 shock.

3.11.3 Airborne Noise Requirements

3.11.3.1 The airborne noise level shall not exceed 75 dB (A) measured at the front, back and two end positions, one meter from the Refrigeration Plant and Compressors at a height 1.5 meters above the deck (factory floor) while the unit is operating under normal conditions.

3.11.4 Vibration Requirements

3.11.4.1 The maximum acceptable vibration levels at each above mount location shall not exceed the levels specified in Table 13, under normal operating conditions.

| VAL* Maximum Acceptable Above Mount Velocity Levels in VdB ref 10 ⁻⁸ m/s | | | | | | | | |
|---|-------|--------|--------|--------|-------|-------|-------|-------|
| 31.5 Hz | 63 Hz | 125 Hz | 250 Hz | 500 Hz | 1 kHz | 2 kHz | 4 kHz | 8 kHz |
| 106 | 100 | 88 | 86 | 85 | 74 | 68 | 62 | 64 |

*VAL is the vertical, athwartship and longitudinal measurement direction

Table 14 - Vibration Requirements

3.11.5 Shock Requirements

3.11.5.1 The Provisional Stores Refrigeration System components and installation shall comply with BR 3021 Shock Manual (Metric) Volumes 1 & 2, shock test qualification grades appropriate to the location of installed equipment. The shock grade levels for this purpose are classified and will be provided to the successful bidder upon establishing appropriate security and non-disclosure agreements. Alternately, qualification to Mil-S-901D, or qualification by extension or similarity based on previous RN submarine shock certifications, will be accepted for the equipment and installation details. In the event test qualification will be based on shock levels expected above the existing shock isolation system, DMSS 2-5 shall provide the shock load definition information.

3.11.5.2 The shock and vibration testing will be done by the Naval Engineering Testing Establishment (NETE). The contractor will be responsible for shipping the unit to NETE and DND will pay the

shipping back to the Contractor. If the unit does not pass the tests the Contractor will modify the unit to ensure the unit meets all certifications and requirements for shock and vibration.

NOTE:

In an effort to assist clarification to shock requirements the following statement has been authorized for release; ***“In a design utilizing “y” type mounts equipment that has been subjected to 20G static shock has been known to survive submarine shock testing”***. Y mounts can be sourced commercially.

4 Logistic Support

4.1 Technical Data Requirements

4.1.1 Engineering Drawings

4.1.1.1 Engineering drawings, Associated Lists and Reference Data shall be provided in accordance with Engineering Drawing Practices for Class Drawing and Technical Data List (D-01-400-001/SG-000).

4.1.1.2 Data Lists and Cover Sheets shall be provided as part of the Engineering Drawing and Technical Data Package and shall be prepared in accordance with Engineering Drawing Practices for Class Drawing and Technical Data List (D-01-400-001/SG-000).

4.1.1.3 All drawings, Data Lists, and Cover Sheets shall be in the English language.

4.1.1.4 All components and sub-components (i.e. valves, pipes etc.) shall have a unique identification number with the prefix RAC.

4.2.3 Drawing Types

4.2.3.1 Parts List – Parts lists shall be prepared integral to the drawings.

4.2.3.2 Electrical and Control Drawings – Electrical and control drawings shall be detailed and in accordance with Engineering Drawing Practices for Class Drawing and Technical Data List (D-01-400-001/SG-000).

4.2.3.3 Units of Measure – The units of measure shall be metric.

5.2.3.4 Integration – The supplier shall be fully responsible for the integration of existing and new drawings to form a complete Engineering Drawing Package.

4.3.4 Quality Assurance Provisions

4.3.4.1 Inspection – Inspection of the engineering drawings and associated lists delivered under this contract is the responsibility of the Contractor.

4.3.4.2 Acceptance – Acceptance of the engineering drawing package shall be the responsibility of the DND Technical Authority.