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**“FUNDY ROSE”**  
**Specification for Atrium Modifications & Upgrades**  
**Transport Canada**



**January 2019**

(RDIMS: 14918504)

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**Revision Matrix**

Line Item	Brief description of revisions made	Issued
1	Original	24 January 2019

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## 1 INTRODUCTION

The Fundy Rose is a 123.8m passenger Ro-Pax vessel, owned by Transport Canada. She operates the passenger and vehicle ferry service between Saint John, NB and Digby, NS.

The vessel is under Canadian Registry and is classed by Det Norske Veritas / Germanischer Lloyd (DNV GL), which Society serves as the Recognised Organisation (RO) under the Delegated Statutory Inspection Program (DSIP) by Transport Canada.

This means that the vessel and all the modifications and equipment described in this specification will have to meet 2004 Edition of the SOLAS rules and regulations and the Supplement TP15211. All work, repairs, inspections and renewals and equipment specified herein will have to meet SOLAS and DNV GL standards and the installations shall be to the satisfaction of the technical Authority/ Owner's representative and where applicable to the DNV GL surveyors. Unless otherwise specifically stated, the Technical Authority/ Owner's Representative is the Senior Technical Advisor or delegate.

## 2 "FUNDY ROSE" PRINCIPAL PARTICULARS

Length, O.A.	Approx. 123.80 m
Length, B.P. (at 5.1 W.L.)	117.00 m
Length, W.L. (at 5.1 W.L.)	122.70 m
Breadth (Moulded)	18.90 m
Depth, Main Deck (Moulded)	7.25 m
Depth, Upper Deck (Moulded)	12.25 m
Draft, Design (Moulded)	4.90 m
Draft, Scantl. (Moulded)	5.10 m
Service Speed	23.8 Knots
Classification:	DNV-GL 100A1 Car Ferry A EO
Passengers, Maximum	800
Cars & Trailers:	
Main Deck (Trailers or Cars)	21 or 105 Units
Upper Deck (Cars)	94 Units
Ship Builder	Daewoo Heavy Industries, (now DSME) South Korea,
Hull No.	7504
Year Built	2000
Keel Laid	15/07/1999
IMO#	9203916
DWT	1978
GRT	4987.23
NRT	

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### **3 GENERAL REQUIREMENTS – SHIP REPAIR**

#### **3.1 MANUFACTURER'S RECOMMENDATIONS**

The overhaul and installation of all machinery and equipment specified herein shall be as per the manufacturer's applicable instructions, drawings and specifications. The surface preparation, ambient limitations and coating applications shall be as per the manufacturer's instructions and specifications.

#### **3.2 TESTING AND RECORDS**

All test results, calibrations, measurements and readings are to be recorded. Three typewritten copies, in English, are to be presented to the Technical Authority and one copy to the Design Authority within three days following the completion of the applicable work item. All tests are to be witnessed by the Technical Authority and, where required, DNV GL. The Contractor is responsible for contacting DNV GL when their presence is required for inspections or testing. The Contractor shall advise the Technical Authority in every case when DNV GL arrives onsite for inspection of vessel's equipment or structure.

#### **3.3 WORKMANSHIP**

The Contractor shall use fully qualified, certified and competent tradesmen and supervision to ensure a uniform high level of workmanship as judged by normally accepted shipbuilding standards and to the Owner's satisfaction.

#### **3.4 FACILITIES**

Quotation shall include all of the necessary labor and equipment required for the erection of access staging, rigging, lighting, tugs, pilotage, necessary craneage and line handling.

#### **3.5 MATERIALS AND SUBSTITUTIONS**

All material shall be supplied by the Contractor and all materials shall be new and unused unless otherwise specified. All replacement material in the form of jointing, packing, insulation, small hardware, oils, lubricants, cleaning solvents, preservatives, paints, coatings, etc., shall be in accordance with the equipment manufacturer's drawings, manuals or instructions. Where no particular item is specified, or where substitution must be made, the Owner's representative must approve all material offered.

#### **3.6 REMOVALS**

Any items of equipment to be removed and subsequently reinstalled in order to carry out work specified or for access to carry out the work specified, shall be jointly inspected for damages prior to removal by both the Contractor and Owner's representative.

#### **3.7 EXPOSURE AND PROTECTION OF EQUIPMENT**

The Contractor shall provide adequate temporary protection for any equipment or areas affected by this refit. The Contractor shall take proper precautions to maintain in a proper state of preservation any machinery, equipment, fittings, stores or items of outfit which might become damaged by exposure, movement of materials, sand grit or shot blasting, welding, grinding, burning, gouging, painting or airborne particles of paint. Any damage shall be the responsibility of the Contractor. Government furnished equipment and materials shall be received by the Contractor and stored in a secure warehouse or storeroom having a controlled environment appropriate to the equipment as per the manufacturer's instructions.

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### **3.8 LIGHTING AND VENTILATION**

Temporary lighting and/or temporary ventilation required by the Contractor to carry out any item of this specification shall be supplied, installed and maintained in a safe working condition by the Contractor and removed upon the completion of work.

### **3.9 CLEANLINESS**

The Contractor shall at all times, maintain the work areas to which his personnel have access in a clean condition and free from debris. Dirt & debris generated by the spec items shall be cleaned up and removed from the vessel daily. Upon completion of this refit, the Contractor shall ensure that the vessel is in a clean condition, free from all foreign material in any system or location placed there as a result of this refit. The Contractor shall provide adequate temporary protection for any equipment or areas affected by this refit. The Contractor shall dispose of any and all oil and water residue, which accumulates in the machinery space bilges as a result of any refit work detailed in this specification.

### **3.10 ASBESTOS**

Any and all insulation materials shall be asbestos free and approved for the required application.

### **3.11 ENTRY INTO ENCLOSED SPACES**

The Contractor shall abide by the Bay Ferries Limited policy for enclosed space entry. The policy is listed in the attached Safety Annex as section 7.0.9 and section 7.0.9 (N). Entry certificates shall clearly state the type of work permitted and shall be renewed as required by the regulations. Additional copies of these certificates shall be posted in conspicuous locations for the information of ship and Contractor personnel.

A fire zone shall be established and naked lights shall not be used within this zone until "gas-free" certification has been issued.

The Contractor is to ensure that any work carried out in confined spaces as defined by the Canada Labor Code complies fully with all provisions of the code.

The Contractor shall have in place an Enclosed Space Entry Permit system, equal to or better than the procedure contained in Bay Ferries Limited Safety Management System. Ship's breathing apparatus and EEBD's are not to be used except in an emergency.

The Contractor will maintain a log denoting the date, persons in the tank and times in and out.

### **3.12 SUSPENSION OF WORK**

The Technical Authority reserves the right to suspend work immediately when that work is being performed in contravention of Bay Ferries Limited Safety Management System. Work shall be allowed to resume when the Technical Authority, in consultation with the Contractor and PWGSC, is satisfied that the agreed-upon procedures are in place and being adhered to.

### **3.13 HOT WORK**

Any item of work onboard the ship involving the use of heat in its execution requires that the Contractor advise the vessel's representative prior to starting such heating and upon its completion. The Contractor shall be responsible for maintaining a competent and properly equipped fire watch during and for one full hour after all hotwork. The fire watch shall be arranged such that all sides of surfaces being worked on are visible and accessible. The Contractor shall provide sufficient suitable fire extinguishers and a fire watch during any such heating and until the work has cooled. Ship's extinguishers shall not be used except in an emergency. The Contractor

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must also abide by Bay Ferries Limited Hotwork Policy. A copy will be provided to the contractor at the initial kick-off meeting prior to commencing on-board work. The Contractor must ensure that the Contractor's personnel, including any subcontractors, follow the policy. (See also Appendix B for additional details)

### **3.14 LOCKOUT AND TAGOUT PROCEDURES**

The Refit Contractor shall be responsible to protect persons working on board the vessel while working on or near shipboard systems and equipment from accidental exposure to:

- electrical currents
- hydraulic
- pneumatic
- gas or steam pressure and vacuum
- high temperatures
- cryogenic temperatures
- radio frequency emissions
- potentially reactive chemicals
- stored mechanical energy
- equipment actuation

The Contractor, under the supervision of the Chief Engineer and or the Electrical Officer, shall be responsible for the Lockout and Tagout of equipment and systems listed in the specification.

Prior to the start of work, the Refit Contractor shall supply and install all locks and tags and shall complete the Lockout Tagout log sheet provided and maintained by the Vessel.

Upon completion of the work, and being in all respects ready for the equipment in question to be re-commissioned, the Contractor shall remove all locks and tags and complete the Lockout Tagout Log sheet provided and maintained by the Vessel.

### **3.15 PAINTING**

All new and disturbed steelwork is to be protected with one coat of Contractor supplied primer and one coat of finish paint. Unless otherwise stated in the individual specification item, these paints shall be as per the details given in section 7.2.3.

### **3.16 WELDING**

Welding shall be in accordance with and inspected to DNV GL standards. The Contractor shall be currently certified by the Canadian Welding Bureau (CWB) in accordance with:

- a. CSA W47.1 (current version), Certification of Companies for Fusion Welding of Steel (Minimum Division Level 2);
- b. CSA W47.2 (current version), Certification of Companies for Fusion Welding of Aluminum (Minimum Division Level 2).

Before contract award and within two (2) calendar days of the written request by the Contracting Authority, the successful Bidder must submit evidence demonstrating its or its subcontractor's certification by CWB in accordance with the CSA welding standards.

The Contractor may be required to supply a current welder's qualification certificate(s) for each individual welder that will be involved in this refit.

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### **3.17 SMOKING**

There is to be no smoking in any areas of the ship, other than a designated area where Contractor personnel will be working. The Contractor shall inform any workers or sub-Contractors of this policy and ensure that it is complied with.

### **3.18 RESTRICTED AREAS**

The following areas are out of bounds to The Contractors personnel except to perform work as required by the specifications: all cabins, offices, Wheelhouse, Control Room, Engineer's office, public washrooms, and crew / passenger cafeterias, dining rooms and lounge areas.

### **3.19 ELECTRICAL STANDARDS**

Any electrical installations or renewals shall be in accordance with the latest editions of the following marine standards:

IEEE Standard 45 - Recommended Practice for Electrical Installation on Shipboard

If any cable installed within this contract is found to be damaged, shorted or opened as a result of the manner of installation, the entire length of cable shall be replaced and installed at no cost to the Department. Plastic tie-wraps may be used to secure wiring in panels or junction boxes only. (See also Appendix A.)

### **3.20 DRAWINGS**

All drawings and drawing revisions that the Contractor is requested to do in the execution of this contract shall be of a quality equal to that of the drawings that are requested to be updated. For example, drawings that have been lettered and dimensioned in a professional manner shall not be updated using freehand. Prints and reproductions that any Contractor is required to provide shall be made on one piece of paper.

Sign off and acceptance of jobs will not occur until any and all drawings are updated to the satisfaction of the Owner's representative.

### **3.21 TRANSDUCERS**

The Contractor shall not paint the transducers and all transducers shall be afforded the necessary protection during hull cleaning, blasting, burning, welding and coating operations.

### **3.22 OWNERS REPRESENTATIVE**

Throughout this document, there may be references made to the Owner's Representative. For the purpose of this document, the Owner's representative is defined as the Technical Advisor Air and Marine Programs, or if delegated as such, the Chief Engineer of the Vessel.

### **3.23 REGULATORY AUTHORITY - DEFINITIONS**

The MV Fundy Rose is 'in-Class' with Det Norske Veritas – Germanischer Lloyd (DNV-GL) and delegated under Transport Canada Marine Safety and Security's (TCMSS) Delegated Statutory Inspection Program (DSIP). All work must meet the requirements of DNV-GL and TCMSS including plan review and onsite inspections as required.

### **3.24 REGULATORY AUTHORITY - INSPECTIONS**

The Contractor shall confirm a schedule of inspections with the regulatory authority (DNV GL) for all work described in this specification and shall be responsible for calling them when inspections are required and for ensuring the work is credited by the regulatory authority. The schedule of inspections must be included in the Contractor's schedule/Gantt chart in Section 4, para 4.1.9.

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The Contractor shall ensure the Chief Engineer is informed when the regulating authority is onsite such that the Chief Engineer can witness the inspections by the regulating authority.

Notwithstanding any errors, omissions, discrepancies, duplication or lack of clarity in these project requirements, it shall be the responsibility of the Contractor to ensure that the execution of the work specified herein is to the satisfaction of the Technical Authority. Inspection of any item by the Technical Authority does not substitute for any required inspection by DNV GL.

### **3.25 WASTE OIL PRODUCTS**

Disposal of waste oil products shall be carried out by the Contractor, or subcontractor, with someone who has been licensed by provincial authorities for the disposal of petroleum products. Copies of certificates and disposal receipts must be produced upon request.

### **3.26 WHMIS**

The Contractor shall provide current MSDS sheets for any WHMIS-controlled products used onboard or around the vessel at the start of the work period before the products are used. This includes at the minimum MSDS sheets for any solvents, cleaners, chemicals, coatings and blasting grits to be used. Any neutralizing chemicals or specialized protective equipment required shall be provided by the Contractor at all times these WHMIS-controlled products are onboard the vessel.

### **3.27 DATA BOOK**

The Contractor is to produce two Data Books which shall list products, supplies and other purchases by the Contractor for this refit and which provides details of supplier and contact information. This book shall also include the copies of any readings required for the completion of each specification item. The data book shall be 8" X 12" format and bound. The data book shall be indexed and tabbed in the same order as the refit specifications index. The Contractor shall also provide 1 CD-ROM's of the data book. The CD ROM and data books shall be provided to the Technical Authority prior to the end of refit.

### **3.28 SURPLUS EQUIPMENT DISPOSAL**

All surplus or no longer required items of equipment which may have been uninstalled or otherwise removed from service on the vessel in the course of the work specified herein, and which have demonstrable value in excess of scrap materiel, shall remain the property of Transport Canada as the vessels owner, and who will inform the Contractor of the final disposition of these items.

### **3.29 SITE VISITS – REFIT PREPARATIONS:**

Upon contract award, on an as needed basis to confirm their work proposal is adequate for the MV Fundy Rose prior to the scheduled work period, the MV Fundy Rose will be available, on request, for a site visit for this purpose. The Contractor may perform a site visit to the vessel, either in Digby, Nova Scotia or in Saint John, NB. The Contractor is to contact the Technical Authority to make the necessary arrangements for site visits prior to the work period.

### **3.30 WEATHER CONDITIONS:**

Inclement weather conditions may be encountered during the installation period and location. The Contractor shall be responsible to take appropriate measures to ensure work is completed safely and on schedule taking into consideration the expected conditions. The Contractor shall be set up to work in cold, wet, and possibly icy working conditions and will have appropriate safety measures to protect personnel.

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## 4 RESPONSIBILITIES OF THE CONTRACTOR / RESPONSIBILITIES OF TC:

### 4.1 INDIVIDUAL RESPONSIBILITIES

The following is a list of responsibilities for The Contractor and TC:

- 4.1.1 The Contractor shall be required to actively participate in the overall management of all activities related to the assessment and will be directly responsible for the effective supervision and coordination of the efforts of its personnel in order to minimize the effort required by TC and BFL staff. The contractor shall further function as the prime contractor where any subcontractors are used.
- 4.1.2 General notes as per section 3 of this specification shall also apply to the contractor and their installation work for the new Atrium, along with Appendices A & B.
- 4.1.3 The Contractor shall be responsible for all work produced under the contract, including completeness, accuracy and adherence to all relevant safety & environmental regulations, rules and good practices including those in section 3 of this document.
- 4.1.4 The contractor is required to maintain close contact and coordination with any subcontractor(s) in regards to work planning and work schedules, and also for general coordination of work activities, in order to foresee and avoid any potential conflicts.
- 4.1.5 The Contractor shall be responsible for obtaining and maintaining any hot work certificates which are required to complete the installation work. (See also Appendix B)
- 4.1.6 The Contractor shall be responsible for arranging and funding all onsite inspection and approval for the requirements of DNV-GL. All approved plans as well as all associated approval documentation shall be provided to TC at completion of the contract.
- 4.1.7 The Contractor is to ensure that all components of the Atrium are approved by DNV-GL for installation and use on the vessel. The installation work is to be completed to a standard that complies with DNV-GL and TCMS requirements.
- 4.1.8 The Contractor shall be responsible to ensure that any cabling or cable or pipe penetrations of watertight/fire bulkheads is to be completed such that it complies with all applicable TCMS and DNV-GL standards and regulations for this class of vessel. (See also Appendix A)
- 4.1.9 With respect to Project Management, the Contractor shall provide a schedule and Gantt chart (or similar) for the planned work period and maintain the chart as any alterations to the schedule are required. The Contractor shall be responsible for organizing weekly meetings (or conference calls) and must maintain summary minutes as well as history of all action items and submit it to the Technical Authority.
- 4.1.10 The Contractors personnel must make all necessary preparations in order to actively participate in any meeting convened by the Technical Authority. All meetings will be conducted onboard Fundy Rose, unless otherwise requested by the Technical Authority. In the latter case, the meeting will be conducted in the Contractors offices

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and who must provide all facilities, resources, etc required at no additional cost to the Government of Canada.

- 4.1.11 The Contractor must maintain a history of all meetings as well as of all incremental changes to actions items and submit it to the Technical Authority when requested.
- 4.1.12 The removal and installation of the old and new Atrium, respectively is to be completed during overnight hours while the vessel is berthed at the Bay Ferries terminal at Saint John, NB. The ferry will be made available from approximately 1900 in the evenings to 0730 in the morning. All efforts will be made to make the vessel available at approximately 1900 however unforeseen sailing delays, such as weather, may occasionally delay the contractor's start time. The vessel is scheduled to sail at 0800 daily, therefore the contractor must ensure all Contractor personnel, including subcontractors, and equipment are demobilized from the vessel by 0730 daily

To stay abreast of current sailing plans and any changes there to, Contractors are strongly encouraged to check the ships schedule regularly on the BFL website as follows:

<https://www.ferries.ca/nb-ns-ferry/schedule/#>

- 4.1.13 Office space/work accommodations, or meals will not be provided for the Contractor, either by TC or BFL, the vessels operator.
- 4.1.14 The Contractor must maintain an electronic library of the work in progress and delivered items.
- 4.1.15 All travel-related costs will be the responsibility of The Contractor, and shall be included in the bid price. Travel costs will not otherwise be billable to the Atrium project.
- 4.1.16 To aid The Contractor in the provision of the required services, information materials and assistance will be provided if available and deemed appropriate by the Technical Authority. This shall include all required and available documents and drawings related to the "M.V. Fundy Rose" including those referenced in section 7 of this document.
- 4.1.17 During viewing and inspection, the vessels crew will assist The Contractor to have access to points of interest and areas of inspection. The Technical Authority and/or its delegated representatives will be on site during the viewing period to answer questions and provide clarification.

## **4.2 DELIVERABLES:**

The following are a list of deliverables for the Atrium Project:

- 4.2.1 A meeting will be arranged at the Contractor's place of work, or via teleconference with the Technical Authority to discuss the project and deliverables.
- 4.2.2 Record of Work - A report on the general tasks undertaken to perform the services required as part of this assessment and associated level of effort. The Record of Work will be submitted in a format acceptable to the Technical Authority. The Record of Work is to be attached to the Contractor's invoice

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- 4.2.3 Unless otherwise specified by the Technical Authority, two hard copies and one soft copy of the deliverables must be provided to the Technical Authority. Soft copy deliverables must be provided electronically. In addition, deliverables must be provided according to the following format: MS Word and/or Adobe Acrobat. Other formats may be accepted if approved by the Technical Authority.
- 4.2.4 The deliverables must be in the form of goods and services provided to the Technical Authority in accordance with this statement of work.
- 4.2.5 A project work plan, as set out in item 4.4, is to be provided to the Technical Authority within 7 days of contract award.
- 4.2.6 Documentation attesting to Classification Society and regulatory approval of the installation of the Atrium.
- 4.2.7 Demolition of the existing Atrium components, including plastic panels and HSS frame members.
- 4.2.8 The provision of materials, equipment and labour as required to install the components which comprise the full Atrium system and which is compliant with the requirements of this SOW.
- 4.2.9 The provision of any subcontractors whose services may be required by The Contractor in order to install the new Atrium system.

#### **4.3 QUALITY ASSURANCE & PROOF OF PERFORMANCE**

The Contractor shall provide proof of performance with respect to all work. As a minimum this shall include copies of all inspection points identified within the Contractor's proposed Quality Plan and those identified by the rules and codes. Proof of performance shall also include all inspection check points specifically detailed below:

- a) Inspection of material and their installation.
- b) Verification of section preparation and alignment prior to assembly and, on completion of all construction operations.
- c) Inspection of welds, including non-destructive test examination and verification of the heat treatment process.
- d) Verification of general workmanship including that of furnishings, insulation, outfit, joiner work, stowage, and painting.

#### **4.4 PROJECT SCHEDULE**

The demolition and removal of the existing Atrium, and the installation of the new Atrium system must be carried out between the dates of 04 September 2019 – 04 November 2019. Any changes which may arise to these dates will be communicated to the contractor as soon as they are known.

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## 5 SERVICES

The Contractor is to be responsible for the following services requirements which are applicable in regards to the Atrium Project.

### 5.1 GARBAGE & SCRAP REMOVAL

The contractor is to be responsible for provision of a means of collection and removal from the vessel of all garbage, waste and scrap materials which they may generate in the course of their work activities. All such material shall be collected in a suitable containment while awaiting removal and shall not be placed or stored loosely on the jetty area.

### 5.2 MOVEMENT OF THE VESSEL

The contractor is to note that during the course of the Atrium work, the ship will be berthed at the Bay Ferries Ltd terminal at Saint John, NB. The ship will be operational for scheduled crossings during the day time – approx. 0800 to 1900 daily. Following completion of the daily crossing schedule, the vessel will be at the berth “Port side to” and will be available overnight to the Contractor for carrying out the work associated with the Atrium project.

Prior to or during the work period, it is **NOT** planned that the vessel will be moved from the berth for the purpose of repositioning it “opposite side to”. However, should the contractor unavoidably require any movements of the vessel from the berth in the course of their work, this requirement will need to be communicated with vessel operators well in advance – a minimum of 48 hours notice is required. In such case, the Contractor will be fully responsible for all costs related to the services which may be involved in moving the vessel. These shall include those of the following:

- Ships crew
- Tugs
- Pilots
- Stevedores (mooring line handling, gangway preparation)
- Crane or Forklift (gangway handling, relocation of any dumpsters, equipment)

### 5.3 CRANES

The refit contractor is to be responsible for arranging for the supply of any cranes which may be required in order to complete any item of work in this refit specification. This shall include responsibility for all related costs. The crane to be used shall be capable of reaching from the available working area on the quayside at the Saint John terminal to the extremity of the ship at the Starboard aft corner. This shall be possible while the vessel is berthed in a “Port side to” manner, and during the full high or low tide condition. Weight range of the various Atrium panels which are to be lifted is approx. 0.5 to 1 tonne each.

Whereas the crane will need to be placed on and within the confines of the jetty structure at the Saint John terminal, the planned location, size and weight requirements for the crane are to be verified by a qualified consulting engineer to be hired by The Contractor. A letter and/or report verifying that the intended crane arrangements are within the safe load carrying capacity of the jetty structure shall be provided to the Technical Authority in order that they can be cleared with the Terminal Authority prior to commencement of the project.

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## **5.4 ELECTRICAL SUPPLY – TOOLS AND EQUIPMENT**

The refit contractor is to note that the ships electrical supply insofar as the use of the contractors common power tools and other equipment is non standard with respect to common Canadian electrical equipment and facilities. Instead, it is 230 VAC / 50 Hz and with electrical outlets which are of an incompatible configuration standard.

The refit contractor is responsible for providing any transformers and connection adapters as may be required to use the ships power supplies. Alternately, they shall be responsible for any arrangements as may be needed to bring their own power supply from a shoreside source.

All electric power tools to be used in the completion of this installation work shall have proper grounding and shall be protected with a ground fault circuit.

All tools and equipment should be removed from the vessel daily by 0730. If equipment or tools are to remain onboard while the vessel is in service then Transport Canada and Bay Ferries Limited assumes no responsibility for damages, loss, theft or destruction in whole or in part for any reason whatsoever. The Contractor bears all responsibility for all such items. Furthermore, any and all tools and equipment remaining onboard must be securely stowed by the contractor in accordance with preparing the vessel for sea. Bay Ferries Limited reserves the right to have the Contractor remove tools and equipment that is not securely stowed for sea.

## **5.5 DNV-GL CLASSIFICATION SERVICES**

The Contractor is responsible for provision of a DNV-GL class surveyor with regards to providing the following survey and inspection services related to the Atrium Project. The number and frequency of these surveys shall be in accordance with DNV-GL requirements.

- a) Inspections of aluminum panels with respect to fabrication of their frames and/or bonding of glass panes to the frames while at The Contractors fabrication facility.
- b) Inspections onboard the vessel related to the assembly of the aluminum panels for the Atrium Project.

## **6 ELECTRICAL**

The Atrium project involves no significant electrical work aspects for The Contractor. The only items which are applicable are as follows:

- a) Supply of power for The Contractors use in regards to their tools and lighting arrangements will be as per section 5.4.
- b) The Contractor shall be responsible for the supply of suitable worksite lighting arrangements for their crews who will be working on the Atrium project during overnight periods. (See also item 7.1.1 j)
- c) Power will be disconnected from existing lighting fixtures by the ship's crew prior to demolition of the existing Atrium structure. (See also item 8.1 d)
- d) Lighting fixtures to be used in the new Atrium will be supplied and installed by the ship's crew. The Contractor shall be responsible only for provision of mounting brackets and cable conduits on the individual aluminum-glass panels during the fabrication stage. The lighting plan, including the locations are listed in the reference drawings.

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## 7 ATRIUM SPECIFIC REQUIREMENTS

Work to prefabricate the various components of the new Atrium will initially be carried out at the contractor's workshop facilities and will be completed prior to 01 September, 2019. Components will be stored in accordance with the specific requirements in item 7.3.2 until they are required to be shipped onsite.

During the period in which the existing Atrium is to be demolished, and the new Atrium is to be installed, the vessel will be located at Bay Ferries Ltd terminal in Saint John, NB. This work will be carried out in the two month period from 04 September 2019 to 04 November 2019 including final project completion.

The demolition and installation work phases will be conducted solely on the basis of working in overnight hours during the period the ship is berthed at the BFL terminal in Saint John, NB between daily crossings. All demolition and installation work will be conducted during overnight hours for the totality of the work period for these two particular phases.

For general guidance, the Atrium project will include other distinct work phases as follows, and which will each be further defined in individual sections of the Atrium Technical requirements following:

- 1) Ordering of glass materials – long lead time item
- 2) Ordering of aluminum materials
- 3) Fabrication of Atrium panels at contractors workshops
- 4) Storage of Atrium panels prior to transporting to vessel
- 5) Demolition of the existing Atrium system
- 6) Transport of Atrium panels to the vessel as required for their installation
- 7) Installation of the new Atrium system

### REFERENCE DOCUMENTS

The following documents are referenced for completion of the Atrium Project:

A.	18006-250-S-001	Atrium Aluminum Panel #1 Assembly Fabrication Details
B.	18006-250-S-002	Atrium Aluminum Panel #2 Assembly Fabrication Details
C.	18006-250-S-003	Atrium Aluminum Panel #3 Assembly Fabrication Details
D.	18006-250-S-004	Atrium Aluminum Panel #4 Assembly Fabrication Details
E.	18006-250-S-005	Atrium Aluminum Panel #5 Assembly Fabrication Details
F.	18006-250-S-006	Atrium Aluminum Panel #6 Assembly Fabrication Details
G.	18006-250-S-007	Atrium Aluminum Panel #7 Assembly Fabrication Details
H.	18006-250-S-008	Atrium Aluminum Panel #8 Assembly Fabrication Details
I.	18006-250-S-009	Atrium Aluminum Panel #9 Assembly Fabrication Details
J.	18006-250-S-010	Atrium Aluminum Panel #10 Assembly Fabrication Details
K.	18006-250-S-011	Atrium Aluminum Panel #11 Assembly Fabrication Details
L.	18006-250-S-012	Atrium Aluminum Panel #12 Assembly Fabrication Details
M.	18006-250-S-013	Atrium Aluminum Panel #13 Assembly Fabrication Details
N.	18006-250-S-014	Atrium Aluminum Panel #14 Assembly Fabrication Details
O.	18006-250-S-015	Atrium Aluminum Panel #15 Assembly Fabrication Details
P.	18006-250-S-016	Atrium Aluminum Panel #16 Assembly Fabrication Details
Q.	18006-250-S-017	Atrium Aluminum Panel #17 Assembly Fabrication Details
R.	18006-250-S-018	Atrium Aluminum Panel #18 Assembly Fabrication Details
S.	18006-250-S-019	Atrium Aluminum Panel #19 Fabrication Details
T.	18006-250-S-020	Atrium Aluminum Panel #20 Fabrication Details

U. 18006-250-S-021	Atrium General Fabrication/Installation Details
V. 18006-250-S-022	Existing Atrium Assembly Strip-Out Details
W. 18006-250-S-023	Atrium Assembly General Arrangement
X. 18006-250-S-024	Pane Particulars
Y. 18006-250-S-025	Atrium Structural Steel Ship Interface Details
Z. 18006-250-S-026	Atrium Panels Temporary Chocks for Pane Replacement
AA.18082-890-E-001	Arrangement of Light Fixtures for the Atrium
BB.18082-890-E-002	PA & Alarm Speaker Diagram

The Design Authority for the Atrium Project is as follows:

Allswater  
 1111 Bedford Highway  
 Halifax, NS  
 B4A 1B9

Attn: Tim Haggar  
 Ph: 902-444-7447  
[Tim.haggar@allswater.com](mailto:Tim.haggar@allswater.com)

The Design Authority is the representative of the department or agency for whom the Work is being carried out under the Contract and is responsible to the Technical Authority for all matters concerning the technical content of the Work under the Contract. Technical matters may be discussed with the Design Authority, however the Design Authority has no authority to authorize changes to the scope of the Work. Changes to the scope of the Work can only be made through a contract amendment issued by the Contracting Authority.

## **7.1 TECHNICAL REQUIREMENTS FOR ATRIUM PROJECT**

The requirements for the proposed Atrium removal and installation are broken down into general requirements for technical, materials, handling of aluminum-glass panels, and outfitting as per the subsections below. Unless otherwise specifically defined therein, the Atrium Project must comply with the standards as listed in section 3 of this SOR.

### **7.1.1 GENERAL TECHNICAL REQUIREMENTS**

Further to the general requirements as defined in section 3 of this specification, the following additional requirements shall apply to the Atrium Project:

- a) Prior to the Atrium Structure installation, The Contractor shall perform a visual inspection of the deck plating and superstructure in the areas where the Atrium structure is to be removed and installation of a new Atrium structure is anticipated. As a consequence of this survey, The Contractor shall minimize the risk of hot work damage to the existing ship board services, specifically electrical cabling; HVAC ducting; pipe services (which may include the use of PVC materials); and insulation under decks or behind bulkheads.
- b) Protection of adjacent areas, especially in commissary & HVAC spaces in way of any piping and electrical cabling on the underlying car and truck decks. Any damages to adjacent steelwork and/or coatings done during repairs, to be rectified by the Contractor, and in accordance with section 7.2.3.

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- c) The Contractor shall be responsible for any heat transfer damage to ship board services and any subsequent repairs to any ship board services.
  - d) Any interior joiner panels which may have to be temporarily removed to provide access to the shell plate or deck areas shall be removed in a controlled manner to ensure correct re-installation. Storage of these removed panels shall be in dry and protected area aboard the ship, the location of which shall be determined by TC and ships personnel.
  - e) If piping systems with either flammable liquids or gasses are found to be adjacent to the intended installations, these piping systems shall be drained, shut down and tagged appropriately. The piping systems shall be protected with heat resistant blankets.
  - f) The Contractor shall grind away the paint on the inside surface of the deck plating in way of the intended installation to minimize the gas emitted from burned paint and the risk of setting off alarms.
  - g) The Contractor is responsible to provide a temporary railing system in way of the ships side where any old atrium components have been removed. The railing shall be firmly secured, and be fit for purpose as a safety device while being adequate in height and structure to protect personnel.
  - h) All persons entering any temporary above water staging shall wear fall arrest equipment along with an approved flotation vest. They shall also wear high visibility clothing and/or vests appropriate for the current weather conditions.
  - i) At any time when work is being conducted over the side or in close proximity to it, a safety boat shall be provided by The Contractor and shall be in a state of immediate deployment to serve as a means of rescue should a worker fall in the water.
  - j) Whereas the existing lighting fixtures will be removed when the Atrium is demolished, The Contractor shall be responsible for supplying temporary lighting arrangements for the duration of the demolition and installation phases. The lighting arrangements to be supplied shall be as needed to achieve adequate levels of illumination throughout the Atrium area for safety and for allowing the Atrium work to proceed unimpeded.
  - k) The Contractor shall provide adequate radio communications when required.
  - l) The existing paint shall be ground off in way of the areas where weldment will be directly applied to the outer surface of the hull shell plating, plus the heat affected zone and an additional 50 mm beyond. If defects or deep scrapes on the existing hull surface are found which will impede the installation, the defects or scrapes shall be ground to solid material or be built up using approved weld procedures and qualified welders prior to commencing the installation work.
  - m) Installation and weldment shall to be only performed on clean steel surface. The surface shall also be free of corrosion, loose metal and paint scales.
  - n) Any paint coatings damaged or disturbed in the course of Atrium demolition and installation work shall be repaired in accordance with section 7.2.3.

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### 7.1.2 QUALIFICATIONS OF THE CONTRACTOR

The Contractor shall be a firm who have experience in the fabrication and erection of aluminum structures onboard ships, including glass windows. To be considered qualified for this project, the contractor must provide the following:

1. Full details of a minimum of two similar projects in aluminum which they have successfully completed previously onboard marine vessels.
2. Certification of Company for Fusion Welding of Steel per CSA W47.1. (Minimum division level 2)
3. Certification of Company for Fusion Welding of Aluminum per CSA W47.2. (Minimum division level 2)

### 7.1.3 WELDING AND FABRICATION REQUIREMENTS

The Contractor shall supply all materials for new atrium panels. The material is to be accordance with the project drawings indicated in section 7.0.

- a) The fabrication tolerance for the aluminum panels is 1/16" (1.58 mm).
- b) All welding to be in accordance with DNV-GL requirements performed by CWB certified welders and accepted by DNV-GL for the appropriate welding procedure. (See also Appendix B).
- c) Prior to commencing work and panel fabrication, the contractor shall supply an example of a typical weld sequencing map for an aluminum panel for review by DNV-GL and TC. In the event that DNV-GL determines that weld sequencing is insufficient for the work, the Contractor must make the necessary adjustments to ensure compliance and DNV-GL approval.
- d) The welding sequence is to be submitted for approval to the DNV-GL surveyor. All welding practices and sequences to be carried out with due care to minimize built-in welding stresses.
- e) In general, fillet welding to be double continuous welding. Care to be taken to ensure all welding is returned in way of plate thicknesses at slots, scallops, brackets, etc.
- f) All butt welding to be continuous full penetration welding, welded from both sides with the edges of plates/sections being welded having first been properly edge prepared.
- g) New aluminum or steel work is to be fitted and faired, with due care to ensure proper alignment, i.e., moulded lines in general to be maintained. TC and DNV-GL to be provided the opportunity to witness "fit-up" condition prior to any production welding being carried out.
- h) The Contractor shall remove weld splatter and smooth weld seams and sharp edges and remove grease, smoke, and soot marks.
- i) After completion of all aluminum or steelwork, the entire panel or area to be inspected by TC and DNV-GL and any defects found repaired to their satisfaction.

- j) All metal structures of the panels are to be coated in accordance with section 7.2.3.
- k) Non-destructive testing (NDT) requirements will be in accordance with DNV-GL requirements.
- l) The completed welding is to be visually inspected and 30% is to be subjected to liquid dye penetrant by approved testing personnel. This testing is to be carried out in the presence of the attending DNV-GL Surveyor and TC representative.

The following table of panel sizes provides a summary of the different prefabricated aluminum-glass panels which will be used to form the assembled Atrium structure:

**NB:** In case of any discrepancies between this table and the drawings noted, the information on the drawings shall take precedence and be used accordingly.

PANEL SIZES					
Panel No.	Weight (Kg's)	Dimensions (mm)	Orientation	Side	Drawing No.
1	642	6400 x 2357	Vertical	Port	18006-250-S-001
2	492	6395 x 1652	Horizontal	Port	18006-250-S-002
3	564	5600 x 2357	Vertical	Port	18006-250-S-003
4	429	5600 x 1652	Horizontal	Port	18006-250-S-004
5	642	6400 x 2357	Vertical	Stbd	18006-250-S-005
6	564	5600 x 2357	Vertical	Stbd	18006-250-S-006
7	829	5600 x 3452	Horizontal	Stbd	18006-250-S-007
8	941	6395 x 3452	Horizontal	Stbd	18006-250-S-008
9	950	5595 x 3795	Horizontal	Port	18006-250-S-009
10	950	5595 x 3795	Horizontal	Stbd	18006-250-S-010
11	627	4071 x 3597	Horizontal	Port	18006-250-S-011
12	627	4071 x 3597	Horizontal	Stbd	18006-250-S-012
13	696	4071 x 4192	Horizontal	Port	18006-250-S-013
14	696	4071 x 4192	Horizontal	Stbd	18006-250-S-014
15	682	7276 x 2357	Vertical	Port	18006-250-S-015
16	436	6830 x 1655	Horizontal	Port	18006-250-S-016
17	682	7276 x 2357	Vertical	Stbd	18006-250-S-017
18	436	6830 x 1655	Horizontal	Stbd	18006-250-S-018
19	114	1538 x 2225	Vertical	Port	18006-250-S-019
20-P	125	1625 x 2733	Vertical	Port	18006-250-S-020
20-S	125	1625 x 2733	Vertical	Stbd	18006-250-S-020

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## **7.2 TECHNICAL REQUIREMENTS FOR ATRIUM PROJECT**

The Atrium Project includes a number of specific requirements for the different materials which will be used for this project. These are as defined in the following sections:

### **7.2.1 STEEL MATERIALS**

All steel for the Atrium shall be Classification Grade “A” steel or equivalent as per DNV-GL requirements.

#### **STEEL PREPARATION AND INSPECTION**

- a) TC and DNV-GL to sight all plate/section certificates prior to cutting. Material used without certificates being previously sighted will not be accepted.
- b) All materials shall be new.
- c) Any pre-fabricated steel sections are to be grit blasted to SA 2.5 / SSPC-SP10, inspected, then coated as per item 7.2.3 (or agreed equivalent) prior to delivery onboard.

### **7.2.2 ALUMINUM MATERIALS**

All aluminum for the Atrium shall be grade 6061 T6 or equivalent.

All bolts required for use with the aluminum panels are to be 316 stainless steel.

#### **ALUMINUM PREPARATION AND INSPECTION**

- a) Material certificates for the aluminum are to be provided. Any substitution of a plate or sectional item is to be made by written request and must be accepted by the Technical Authority prior to fabrication.
- b) DNV-GL and TC to sight all plate/section certificates prior to cutting. Material used without certificates being previously sighted will not be accepted.
- c) All materials shall be new.

### **7.2.3 PRIMER AND PAINT COATINGS**

Paint coatings for the Atrium project will be provided and applied in accordance with the following items:

- a) Steel preparation prior to application of primer coat shall be as follows:
  - i. Any pre-fabricated steel sections are to be grit blasted to SA 2.5 / SSPC-SP10,
  - ii. Any existing steel surfaces on site where the paint coatings are disturbed in the course of working on the Atrium shall be prepared with power tools.
- b) Aluminum preparation prior to application of primer coat shall be as follows:

- 
- i. After completion of all welding and grinding, but prior to installation of the glass panes, the completed frames of the aluminum panels are to be completely blasted with a non-metallic abrasive.
  - ii. Blasting is to take place a max. of 4-6 hrs prior to application of the primer coating.
  - iii. Blasting is required to achieve a minimum surface profile of 38 microns.
- c) All paint and primer applied as part of this specification shall be International Paints products or equivalent as noted following and applied as per paint manufacturers requirements:
- i. Primer: 'Intershield 300' (one coat) applied DFT of 125-150 microns
  - ii. Top coat: 'Interthane 990' (one coat) applied DFT of 50-75 microns
  - iii. Top coat shall be in White colour to match the ships existing colour scheme for the hull.
- d) Paint coatings for the aluminum panels are to be applied at The Contractors workshop and prior to the installation of the glass panes.
- e) With regards to painting of the aluminum sections in way of the surface which will have adhesive applied to bond the glass panes, the decision to have these be bare, or to be coated, will be subject to the results of adhesion testing to be carried out as per section 7.2.7. There are two approaches likely following that testing:
- i. If testing is successful, the bonding area where adhesive products are to be applied per section 7.2.6, shall be coated as per items 7.2.3 b) and c) above
  - ii. Alternately, if testing should indicate an incompatibility between the intended paint products and adhesives, the bonding area shall be masked off after blasting and prior to application of any paint coatings in order to maintain a bare surface.
- f) When coatings are found damaged after final welding has been carried out, the damaged area should be suitably surface prepared, adjacent coatings feathered and coatings applied in accordance with original specification.

#### **7.2.4 GLASS MATERIALS**

The Atrium project has been designed around a system of glass panes installed on fully fabricated aluminum frames. Structural and dimensional details of the glass system to be used for the Atrium project are found at the following drawing:

##### **18006-250-S-024 Pane Particulars**

The following points detail the general requirements applicable to the supply of glass panes:

- a) Ordering of the glass panes shall be the responsibility of The Contractor. Drawings of the glass panes will be prepared by the glass supplier and one copy must be supplied to the Design Authority and one copy supplied to the Technical Authority for final approval prior to fabrication of the glass panes.
- b) The glass to be used is of two ply construction using tempered glass with an intermediate layer in accordance with the manufacturer's standards for Dupont "Sentry" type safety

glass or an equivalent. Any equivalent product is to meet the technical data specifications consistent with those of Dupont™ SentryGlas® safety glass. The technical specifications are listed herein.

- c) The panes to be used for the Atrium will be of a total thickness of either 10 mm (2 x 5), or 12 mm (2 x 6) in accordance with the requirements for the specific location it is to be installed.
- d) A select number of the panes will have sniped or radiused corners in accordance with the above noted drawing.
- e) The interior surface of the glass panes will be further supplied with a black “frit” approx. 65mm wide at their perimeters in way of the glass surface area which is to be bonded to the aluminum frame.
- f) The glass panes will be tinted per the following specification:

Compo #1 : PREL-LAM TEMPERED WITH SGP INTERLAYER, Outboard lite grey tint approximately 50% VLT, Inboard lite clear tint with PC-9907 frit contour surface #4, approximate overall thickness 11.15mm

Compo #2 : PREL-LAM TEMPERED WITH SGP INTERLAYER, Outboard lite grey tint approximately 43% VLT, Inboard lite clear tint with PC-9907 frit contour surface #4, approximate overall thickness 13.25mm

- g) All glass to be supplied shall meet the requirements of DNV-GL for use onboard ships.

The following table provides a general summary of the different configurations of glass panes which will be required for use with the aluminum panels being fabricated Atrium project.

**NB:** In case of any discrepancies between the information included in this table and the noted drawing, the information on the drawing shall take precedence and be used accordingly.

<b>GLASS SIZES – “SENTRYGLAS PLUS” SAFETY GLASS</b>				
Reference: Allswater Drawing No. 18006-250-S-024				
<b>Pane No.</b>	<b>Type</b>	<b>Dimensions</b>	<b>Corner</b>	<b>Quan.</b>
1	2 x 6 mm	780 x 2235 mm		43
2	2 x 6 mm	855 x 2235 mm		2
3	2 x 5 mm	780 x 1620 mm	S	22
4	2 x 5 mm	780 x 1620 mm		5
5	2 x 5 mm	780 x 1765 mm	S	12
6	2 x 5 mm	780 x 1765 mm		3
7	2 x 5 mm	780 x 1635 mm	S	12
8	2 x 5 mm	780 x 1635 mm		3
9	2 x 5 mm	780 x 1680 mm	S	16
10	2 x 5 mm	780 x 1680 mm		2
11	2 x 5 mm	780 x 2065 mm	S	12
12	2 x 5 mm	780 x 2065 mm		2

13	2 x 5 mm	780 x 2230 mm	S	8
14	2 x 5 mm	780 x 2230 mm		2
15	2 x 5 mm	780 x 1325 mm	S	8
16	2 x 5 mm	780 x 1325 mm		2
17	2 x 5 mm	780 x 2075 mm	S	12
18	2 x 5 mm	780 x 2075 mm		4
19	2 x 5 mm	1930 x 630 mm	R	2

S = Snipe

R = Radius

### 7.2.5 GLASS TESTING REQUIREMENTS

DNV-GL requires that a sample of the glass to be used for the Atrium panels is subjected to a pendulum test per the European standard EN 12600 for Safety Glazing testing. (See Appendix C for a summary of this test procedure.)

The Contractor shall be responsible to arrange for carrying out this test to the satisfaction of DNV-GL and the Technical Authority. The Contractor shall be further responsible for providing the glass samples which are to be tested. To ensure testing in an expeditious manner, the testing facility is to be located in the Atlantic Canada region.

As part of Contractor's bid submission, they must identify the testing facility and confirm they are capable of performing the required testing.

### 7.2.6 ADHESIVES AND SEALANTS

Construction of the glass panels for the Atrium project is based on bonding the glass panes to the aluminum frames by use of specific adhesive and sealant products such as Sika-268 and Sika-268 Powercure or equivalent. The Contractor is to contact the Technical Authority and provide the technical specifications of any "equivalent" product. For any equivalent product substitutions, the Technical Authority must approve the product prior to the contractor ordering or purchasing. If the product is not deemed equivalent by the Technical Authority, the Contractor must not use the product for this project

- 1) Application details for bonding and sealing the glass panes to the aluminum frames are found in the following drawing:

#### **18006-250-S-024 Pane Particulars**

- 2) The Atrium Contractor is required to make arrangements to have an adhesive technical expert from the supplier available on site at the Contractors workshop when starting the bonding and sealing process for the first panels. The technical expert must provide initial guidance for the Contractor's personnel in the application of the adhesive products being used for the Atrium panels.

The technical expert is to be available on site for a minimum of 3 days. All costs associated with providing the adhesive technical expert shall be included in the Contractor's bid.

- 3) Supply of all adhesive products to be used for bonding and sealing the Atrium glass panes will be the responsibility of the Contractor, and these products will be as follows:

- 
- Sikaflex – 268 or equivalent (Equivalent products are subject to Technical Authority verification and approval)
  - Sikaflex - 268 Powercure or equivalent (Equivalent products are subject to Technical Authority verification and approval).

### **7.2.7 ADHESIVES TESTING REQUIREMENTS**

The Contractor must conduct third party adhesives testing using prepared coupons of the aluminum sections which the glass panes will be bonded to. This test is to verify the compatibility of the materials for use in this project and is to be provided by the adhesive manufacturer prior to installation of the glass to the panels.

Tests of equivalent adhesive products must follow a similar methodology, which must be approved by the Technical Authority, as per SIKA Canada to verify the compatibility of the materials. The SIKA Canada testing procedure is as follows:

“SIKA Canada will perform an internal testing procedure on coupons of the aluminum sections which the glass planes will be bonded to. These tests will be provided by SIKA Canada by virtue of using their products.

The Contractor will be responsible for providing the prepared test coupons to SIKA. The pre-requisites for these test coupons are as follows:

- a) Adhesives testing procedure requires approx. 1 month to complete. The Contractor is required to submit the prepared test coupons to SIKA Canada as soon as possible after award of contract in order that alternative approaches can be determined in the event that the testing is not successful.
- b) Test Coupons will be 300mm long sections of the same grade and supplier of the aluminum materials which will be used to fabricate the aluminum-glass panels per section 7.
- c) Total number of test coupons to be prepared and supplied to SIKA Canada is six (6) each.
- d) Test coupons shall be blasted and painted in the same manner as will eventually be used for finishing the completed aluminum panels, and according to the requirements of section 7.2.3.
- e) Test results must be provided to the Technical Authority. The Technical Authority will approve for use the adhesive material.

### **7.3 HANDLING REQUIREMENTS FOR ATRIUM PROJECT PANELS**

The Atrium Project includes some specific requirements for handling the aluminum-glass panels which are being pre-fabricated for this project. These are as defined in the following sections:

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### **7.3.1 LIFTING ARRANGEMENTS – ALUMINUM & GLASS PANELS:**

Movement of the completed aluminum & glass panels involves the use of specific lifting arrangements for each individual panel. These requirements with respect to attachment points, sling lengths and angles are included on the fabrication drawing for each panel as per the list of Reference Documents included at Item 7.0.

The Contractor shall ensure that these slinging arrangements are strictly adhered to in order that the finished panels are not damaged through incorrect handling.

### **7.3.2 STORAGE – ALUMINUM & GLASS PANELS:**

Following completion of fabrication, coating, and glass installation stages, The Contractor is responsible to provide storage for the aluminum-glass panels until such time as they are required to be shipped to the vessel in Saint John, NB for the installation phase.

Completed panels must be stored inside the Contractor's facility while placed on sufficient blocking, and in a manner which ensures that they are maintained in correct alignment and do not become distorted in any manner which may in turn affect their installation alignment.

During storage, aluminum-glass panels shall be suitably protected from any circumstances whereby they may become damaged – glass panes in particular.

### **7.3.3 TRANSPORTATION – ALUMINUM & GLASS PANELS:**

The Contractor is responsible for all arrangements required in order to transport the completed aluminum-glass panels between the fabrication workshop to any offsite storage facility which may be used, and/or then to the vessel while located at Saint John, NB.

Transportation arrangements to be used shall be selected and executed with due consideration of the light and fragile nature of the aluminum-glass panels which are being transported. These items shall be transported in a way which precludes the chance of any impact damage from roads hazards, and which also maintains the correct alignment of the panels during transport.

## **7.4 OUTFITTING REQUIREMENTS FOR ATRIUM PROJECT**

As part of the Atrium Project, the table and seating arrangements within the Atrium area will be renewed. The requirements for these items are as defined in the following section:

### **7.4.1 ATRIUM OUTFITTING – TABLES & SEATING:**

The Atrium Project will also include the renewal of the table and seating arrangements within the Atrium area. Bidders will submit as part of their bid a quote on providing 200 hours of welding labour, 100 hours general labourer and a \$2000.00 material allowance to be used for installing exterior furniture - a combination of as of yet undefined table and chair sets. This furniture is to be supplied by owner and will be installed in the Atrium deck area according to an arrangement plan which is also to be supplied by owner in accordance with the furniture which is to be used. Actual labour and materials used will be adjusted at contract end.

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#### **7.4.2 ATRIUM OUTFITTING – MOUNTING BRACKETS FOR HANDRAILS**

52 each discs of aluminum plate of min. 6 mm thickness and 80mm diameter, complete with integral web plate 80 x 40 x 6 mm at 90 degrees on disc centerline, are to be fabricated by The Contractor for use as mounting points for a handrail system. These discs will be installed on the edge of the frame member immediately adjacent to the sides of each glass pane. These mounting points shall be arranged in a straight line approx. 1050 mm above the deck.

### **8 ATRIUM DEMOLITION PHASE ONBOARD THE VESSEL**

The existing Atrium on the vessel is being replaced with a completely new Atrium structure. The old Atrium will be removed in its entirety, including panels, supports and foundations. For details of removal requirements for the old Atrium structures, the following drawing shall be referenced:

**18006-250-S-022 “Existing Atrium Assembly Strip-Out Details”.**

#### **8.1 REMOVAL SCOPE FOR OLD ATRIUM**

Items to be removed and disposed of will include the following:

- a) Existing atrium structure including glass/plastic panes, HSS sections and supports.
- b) Profiles at the bulkheads which form part of accommodation block & stair companionways.
- c) Foundations and supports at edge of shell plating.
- d) Lighting fixtures where mounted directly on structure being removed (See also item 6).
- e) Existing tables (78 each 2 person tables with 1 support post per table + 20 each 4 person tables with two support posts per) where the support posts are welded to the ships deck.

#### **8.2 REMOVAL OF DECK COATINGS – ATRIUM AREA**

Following removal of the existing Atrium structure, along with the table sets from the Atrium area, the existing paint coatings on the decks are to be removed to bare steel by vacu-blasting methods using portable unit(s). A primer coating shall be immediately applied in accordance with section 7.2.3 and shall be maintained for the duration of the work period.

#### **8.3 REMOVAL OF HANDRAILS – OUTBOARD GLASS WINDOWS**

The existing Atrium structure is fitted with stainless handrails and matching support points in four (4) in number locations adjacent to outboard glass windows. These handrails shall be carefully removed and retained for re-installation following erection of the new Atrium structure. Details of these handrails are as follows with anchor points typically mounted at 800 mm centres.

Port Fwd Area: Approx. 12.6 m long with 17 anchor points of type 1

Port Aft Area: Approx. 9.3 m long with 12 anchor points of type 2

Stbd Fwd Area: Approx. 11.2 m long with 14 anchor points of type 1

Stbd Aft Area: Approx. 9.3 m long with 12 anchor points of type 2

## 9 ATRIUM INSTALLATION PHASE ONBOARD THE VESSEL

### 9.0 INSTALLATION OF NEW ATRIUM – ALUMINUM-GLASS PANELS

Installation of the new Atrium is based on a series of aluminum & glass panels which are being pre-fabricated in a workshop facility ashore. These panels are each designed for a specific location, and are further designed to be installed in pre-defined sequence after supporting structural components have been placed.

The following drawing provides overview details of the assembly of the new Atrium structure.

#### 18006-250-S-023 “Atrium Assembly General Arrangement”

Prior to erection of the prefabricated aluminum-glass panels, a system of foundations and supports will be installed in the Atrium area. For details of these points, the following drawings shall be referenced:

#### 18006-250-S-021 “Atrium General Fabrication / Installation Details”

#### 18006-250-S-025 “Atrium Structural Steel Ship Interface Details”.

Great care is required to ensure that foundations and supports are installed in correct positions and alignment in order that the prefabricated aluminum-glass panels can be placed in their required locations and will in turn align with the next panel in the installation sequences as per sections 9.1 and 9.2.

All fasteners used to assemble and secure the aluminum-glass panels are to be of stainless steel materials.

### 9.1 INSTALLATION SEQUENCE – ALUMINUM-GLASS PANELS - PORT SIDE

9.1 - PORT SIDE INSTALLATION		
STEP	INSTRUCTION	REFER to DRAWING NO.
1	Install base plate with brackets from frames 31.5 to 48 approx. 95mm above Deck 7 on shell plating edge.	18006-250-S-025, VIEW 1-1D
2	Install bulkhead support angle with brackets on superstructure from frames 33 to 47 approx. 2570mm above Deck 7.	18006-250-S-025, VIEW 2-2D
3	Install bulkhead mounting tab to superstructure at frame 48 port.	18006-250-S-025, VIEW 7-3D
4	Install port companionway new forward steel addition from Frames 31.5 to 33.	18006-250-S-025, VIEW 4-4D
5	Install isolation barrier on base plate and companionway new forward addition steel.	18006-250-S-021
6	Add temporary Bolted lifting lugs to Panel #1 Assembly.	18006-250-S-001
7	Install Panel#1 Assembly on port base plate adjoining to forward companionway steel addition.	

8	Once aligned and plumb, add temporary support bracing as designated to Panel#1 Assembly and tack weld to the deck. Once installed, template bolting pattern from Panel #1 Assembly to adjacent structures and bolt panel assembly to base plate/new steel addition accordingly (Dwg 18006-250-021).	18006-250-S-025, VIEW 8-1D
9	Remove temporary bolted lifting lugs from Panel #1 Assembly.	
10	Install isolation barrier on bulkhead support angle and top of Panel #1 Assembly.	18006-250-S-021
11	Install Panel #2 Assembly on top of bulkhead support angle and Panel #1 Assembly adjoining to companionway new forward steel addition.	18006-250-S-002
12	Align Panel and template bolting pattern from Panel #2 Assembly to bulkhead support angle/companionway new steel addition and bolt panels, support angle, new steel addition together accordingly.	18006-250-S-021
13	Install isolation barrier on base plate and companionway new addition steel.	18006-250-S-021
14	Add temporary Bolted lifting lugs to Panel #3 Assembly.	18006-250-S-003
15	Install Panel #3 Assembly on port base plate adjoining to Panel #1 Assembly.	
16	Once aligned and plumb, add temporary support bracing as designated to Panel#3 Assembly and tack weld to the deck. Once installed, template bolting pattern from Panel #3 Assembly to base plate and bolt Panels and base plate together accordingly.	18006-250-S-025, VIEW 8-1D 18006-250-021
17	Remove temporary bolted lifting lugs from Panel #3 Assembly.	
18	Install isolation barrier on bulkhead support angle and top of Panel# 3 Assembly.	18006-250-S-021
19	Install Panel #4 Assembly on top of bulkhead support angle and Panel#3 Assembly adjoining to Panel #2 Assembly.	18006-250-S-004
20	Align Panel and template bolting pattern from Panel #4 Assembly to bulkhead support angle and bolt panels, support angle together accordingly.	18006-250-S-021
21	Install Panel #20 to adjoining Panels #3/#4 and bulkhead mounting tab, template holes in mounting tab and bolt panels/tab together accordingly.	18006-250-S-020 18006-250-S-021, VIEW 2-4B 18006-250-021
22	Install base plate with brackets from frames 15 to 25 approx. 95mm above Deck 7 on shell plating edge.	18006-250-S-025, VIEW 1-1D
23	Install port companionway new aft steel addition from Frames 24 to 25.	18006-250-S-025, VIEW 4-4D

24	Install bulkhead support angles with brackets on superstructure bulkhead 33 and Tiki Bar curtain plate frames 26 to 33 Longitudinally and frame 26 transversely approx. 2600mm above Deck 7. Port corner drain shall be installed in this sequence, see above drawing reference for details.	18006-250-S-025, VIEW 2-2D
25	Install permanent columns C5, C6, C7, C8, C9, C10, C14 and temporary column TC2. Columns shall require temporary bracing.	18006-250-S-025, VIEW 1-1D 18006-250-S-025, VIEW 8-1D
26	Install isolation barriers on bulkhead/Tiki Bar support angles.	18006-250-S-021
27	Install Panel #9 Assembly on top of bulkhead support angles and temporary column (TC2).	18006-250-S-009
28	Align Panel and template bolting pattern from Panel #9 Assembly to bulkhead support angles and bolt panel to support angles accordingly.	18006-250-S-021
29	Install isolation barrier on Panel #9 Assembly outboard side.	18006-250-S-021
30	Install port companionway new inboard steel addition from Frames 24 to 33. Trim steel (green) to ensure a proper fit-up and weather seal.	18006-250-S-025, VIEW 4-4D
31	Install isolation barrier on base plate and companionway new aft addition steel.	18006-250-S-021
32	Add temporary Bolted lifting lugs to Panel #15 Assembly.	18006-250-S-015
33	Install Panel #15 Assembly on port base plate adjoining to companionway new aft steel addition.	
34	Once aligned and plumb, add temporary support bracing as designated to Panel #15 Assembly and tack weld to the deck. Once installed, template bolting pattern from Panel #15 Assembly to adjacent structures and bolt panel assembly to base plate/new steel addition accordingly.	18006-250-S-025, VIEW 8-1D 18006-250-S-021
35	Remove temporary bolted lifting lugs from Panel #15 Assembly.	
36	Install isolation barrier on top of Panel #15 Assembly and columns (C7, C8, C14).	18006-250-S-021
37	Install Panel#16 Assembly on top of Panel #15 Assembly and columns (C7, C8, C14) adjoining to companionway new aft steel addition.	18006-250-S-016
38	Align Panel and template bolting pattern from Panel #16 Assembly to companionway new aft steel addition and bolt panels, new aft steel addition together accordingly.	18006-250-S-021

39	Install isolation barrier on Panel #16 Assembly and columns (C6, C9) and companion new aft steel addition.	18006-250-S-021
40	Install Panel #13 Assembly on top of columns (C6, C9) adjoining Panel #16 Assembly and companionway new inboard steel addition.	18006-250-S-013
41	Align Panel and template bolting pattern from Panel #13 Assembly to companionway new steel addition and bolt panels, columns, new steel addition together accordingly.	18006-250-S-021
42	Install isolation barrier on Panel #13 Assembly inboard and columns (C5, C10) and Tiki Bar support angle.	18006-250-S-021
43	Install Panel #11 Assembly (Dwg 18006-250-S-011) on top of columns (C5, C10) adjoining Panel#13 Assembly and Tiki Bar support angle.	
44	Align Panel and template bolting pattern from Panel #11 Assembly to columns and Tiki Bar support angle and bolt panels, columns, support angle together accordingly.	18006-250-S-021
45	This completes the port side installation of the Atrium Installation.	

## 9.2 INSTALLATION SEQUENCE – ALUMINUM-GLASS PANELS - STARBOARD SIDE

9.2 - STARBOARD SIDE INSTALLATION		
STEP	INSTRUCTION	REFER to DRAWING NO.
1	Install base plate with brackets from frames 31.5 to 48 approx. 95mm above Deck 7 on shell plating edge.	18006-250-S-025, VIEW 1-1D
2	Install bulkhead support angle with brackets on superstructure from frames 33 to 47 approx. 2570mm above Deck 7	18006-250-S-025, VIEW 2-2D
3	Install bulkhead mounting tab to superstructure at frame 48 Stbd.	18006-250-S-025, VIEW 7-3D
4	Install permanent columns C1, C2. Columns shall require bracing	18006-250-S-025, VIEW 1-1D 18006-250-S-025, VIEW 8-1D
5	Install isolation barrier on base plate	18006-250-S-021
6	Add temporary Bolted lifting lugs to Panel #6 Assembly	18006-250-S-006
7	Install Panel #6 Assembly on starboard base plate.	
8	Once aligned and plumb, add temporary support bracing as designated to Panel #6 Assembly and tack weld to the deck. Once installed, template bolting pattern from Panel #6 Assembly to base plate and bolt accordingly	18006-250-S-025, VIEW 8-1D 18006-250-S-021
9	Remove temporary bolted lifting lugs from Panel #6 Assembly.	
10	Install isolation barrier on bulkhead support angle and top of Panel #6 Assembly	18006-250-S-021

11	Install Panel #7 Assembly on top of bulkhead support angle and Panel #6 Assembly adjoining existing superstructure.	18006-250-S-007
12	Align Panel and template bolting pattern from Panel #7 Assembly to bulkhead support angle and bolt panels, support angle together accordingly.	18006-250-S-021
13	Install isolation barrier on base plate	18006-250-S-021
14	Add temporary Bolted lifting lugs to Panel#5 Assembly	18006-250-S-005
15	Install Panel#5 Assembly on starboard base plate adjoining Panel #6 Assembly.	
16	Once aligned and plumb, add temporary support bracing as designated to Panel #5 Assembly and tack weld to the deck. Once installed, template bolting pattern from Panel #5 Assembly to base plate and bolt panels together accordingly	18006-250-S-025, VIEW 8-1D 18006-250-S-021
17	Remove temporary bolted lifting lugs from Panel #6 Assembly.	
18	Install isolation barrier on bulkhead support angle and top of Panel #5 Assembly	18006-250-S-021
19	Install Panel #8 Assembly on top of bulkhead support angle and Panel #5 Assembly adjoining Panel #7 Assembly.	18006-250-S-008
20	Align Panel and template bolting pattern from Panel #8 Assembly to bulkhead support angle and bolt panels, support angle together accordingly.	
21	Install Panel #20 to adjoining Panels #6/#7 and bulkhead mounting tab, template holes in mounting tab and bolt panels/tab together accordingly	18006-250-S-020 18006-250-S-021, VIEW 2-4B 18006-250-S-021
22	Install isolation barrier on Panel #8 Assembly aft end	18006-250-S-021
23	Install starboard companionway new forward steel addition from Frames 31.5 to 33. Trim steel (green) to ensure a proper fit-up and weather seal.	18006-250-S-025, VIEW 4-1D
24	Install base plate with brackets from frames 15 to 25 approx. 95mm above Deck 7 on shell plating edge.	18006-250-S-025, VIEW 1-1D
25	Install starboard companionway new aft steel addition from Frames 24 to 25	18006-250-S-025, VIEW 4-1D
26	Install bulkhead support angles with brackets on superstructure bulkhead 33 and Tiki Bar curtain plate frames 26 to 33 Longitudinally APPROX. 2600mm above Deck 7. Starboard corner drain shall be installed in this sequence, see above drawing reference for details.	18006-250-S-025, VIEW 2-2D
27	Install permanent columns C3, C4, C11, C12, C13 and temporary column TC1. Columns shall require temporary bracing	18006-250-S-025, VIEW 1-1D 18006-250-S-025, VIEW 8-1D
28	Install isolation barriers on bulkhead/Tiki Bar support angles.	18006-250-S-021

29	Install Panel #10 Assembly on top of bulkhead support angles and temporary column (TC1).	18006-250-S-010
30	Align Panel and template bolting pattern from Panel #10 Assembly to bulkhead support angles and bolt panels to support angles accordingly.	
31	Install isolation barrier on base plate and companionway new aft addition steel.	18006-250-S-021
32	Add temporary Bolted lifting lugs to Panel #17 Assembly	18006-250-S-017
33	Install Panel #17 Assembly on starboard base plate adjoining to companionway new aft steel addition.	
34	Once aligned and plumb, add temporary support bracing as designated to Panel #17 Assembly and tack weld to the deck. Once installed, template bolting pattern from Panel #17 Assembly to adjacent structures and bolt panel assembly to base plate, new steel addition accordingly	18006-250-S-025, VIEW 8-1D 18006-250-S-021
35	Remove temporary bolted lifting lugs from Panel #17 Assembly.	
36	Install isolation barrier on Panel #11 Assembly inboard and columns (C4, C11) and Tiki Bar support angle	18006-250-S-021
37	Install Panel #12 Assembly on top of columns (C4, C11) adjoining Panel #13 Assembly and Tiki Bar support angle.	18006-250-S-012
38	Align Panel and template bolting pattern from Panel #12 Assembly to columns and Tiki Bar support angle and bolt panels, columns, support angle together accordingly.	18006-250-S-021
39	Install isolation barrier on Panel #10 & #12 Assembly and columns (C3, C12).	18006-250-S-021
40	Install Panel #14 Assembly on top of columns (C3, C12) adjoining Panels #10 & #12 Assembly.	18006-250-S-014
41	Align Panel and bolt panels, columns together accordingly.	
42	Install isolation barrier on Panel #10 & #14 Assembly outboard side.	18006-250-S-021
43	Install starboard companionway new inboard steel addition from Frames 24 to 33. Trim steel (green) to ensure a proper fit-up and weather seal.	18006-250-S-025, VIEW 4-1D
44	Template bolting pattern from Panel #10 & #14 Assembly to companionway new inboard steel addition and bolt panels to new steel addition accordingly.	18006-250-S-021
45	Install isolation barrier on top of Panel #17 Assembly and column (C13).	18006-250-S-021
46	Install Panel #18 Assembly on top of Panel #17 Assembly and columns (C3, C128, C13) adjoining to Panel #14 Assembly and companionway new aft steel addition.	18006-250-S-016

47	Align Panel and template bolting pattern from Panel #18 Assembly to columns C3, C12, C13/companionway new aft steel addition and bolt panels, columns, new aft steel addition together accordingly.	18006-250-S-021
48	Temporary bracing can be removed at this point or earlier if deemed necessary.	
49	Install isolation barrier on column C1 mounting tab.	18006-250-S-021, VIEW 2-4D
50	Install Panel #19 Assembly on column C1 mounting tab and Panel #6 Assembly.	18006-250-S-019
51	Align Panel and template bolting pattern from Panel #19 Assembly to mounting tab and bolt panel & mounting tab. .	18006-250-S-021
52	Install handrails in accordance with drawing.	18006-250-S-021
53	This completes the starboard side installation of Atrium Installation.	
54	Atrium structure now completed, touch up painting required prior to furniture installation	

### 9.3 – Handrails – Outboard Windows

Four in number stainless steel pipe handrails and supports which were previously removed per item 8.3 are to be re-installed in the same general locations. Handrail length and spacing interval for support points are to be modified as required to suit the new locations and Atrium structure. Mounting brackets for attachment to Atrium structure are to be provided as per item 7.4.2 and all attachments used are to be secured using stainless bolts, nuts and washers.

### 9.4 Deck Coatings – Atrium Area

Following completion of installation of the new Atrium structure, the decks in the Atrium area (from Fr. 4 to 49) shall have a finish coat applied as follows:

**Top coat: ‘Interthane 990’ (one coat) applied DFT of 75-100 microns with antiskid**

Paint coatings shall also be in accordance with item 7.2.3. The colour shall be as per the tint applicable to the ships colour scheme, and will be supplied by the vessels representative.

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## APPENDIX A – ELECTRICAL & CABLE PENETRATION STANDARDS AND CERTIFICATION

- 1) All electrical installations or renewals shall be in accordance with the latest editions of the following Marine Standards:
  - a) IEEE Standard 45 – Recommended Practice for Electrical Installation on Shipboard
  - b) Cables penetrating ‘A” Class bulkheads and decks are further required to comply with TP11469 E (Guide to Structural Fire Protection) or DNV GL EC Type Examination Certificate #MED-B-9065.

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## APPENDIX B – INSTALLATION, WELDING PROCEDURES

### THE CONTRACTOR MUST ENSURE ALL OF THE FOLLOWING REQUIREMENTS ARE MET:

- 1) All the following work specified herein and all repairs, inspections and renewals shall be completed to the satisfaction of Transport Canada's Technical Authority and DNV-GL. DNV-GL will perform any surveys for compliance with TCMSS requirements as the delegated Responsible Organization (RO). Upon completion of each item of the specification, TC shall be so notified so that the work may be inspected prior to final closing up and after complete closing up. Failure to give notification does not absolve the Contractor of the responsibility of providing TC the opportunity to inspect any item.
- 2) Any item of work involving the use of heat in its execution requires that the Contractor advises Technical Authority (or designate) prior to starting such heating and upon its completion. The Contractor shall be responsible for maintaining a competent and properly equipped fire watch, both during and for one full hour after, all hot work. The fire watch shall be arranged such that all sides of surfaces being worked on are visible and accessible. The Contractor shall provide sufficient suitable fire extinguishers and a fire watch during any such heating and until work has been cooled. Ship's extinguishers are not to be used except in an emergency. The Contractor shall be responsible to ensure that The Contractor's personnel, including all subcontractors, shall follow the hotwork policy. The Contractor must keep in mind that all personnel, including subcontractors, are to depart the vessel by 0730. As such, hotwork is to be completed by 0630 daily in order for the fire watch to complete their duties.
- 3) The Contractor must ensure that welding is performed by a welder certified by the Canadian Welding Bureau (CWB) in accordance with the requirements of the following Canadian Standards Association (CSA) standards:
  - CSA W47.1, Certification for Companies for Fusion Welding of Steel Structures (Minimum division level 2.0); and
  - CSA W47.2-M1987 (R2003), Certification for Companies for Fusion Welding of Aluminum (Minimum division level 2.1).
  - CWB certification of welders for welding aluminum of grade 6061 T6.
- 4) Unless they are specifically defined otherwise in this specification, The Contractor is to include in their quote the costs of any and all transportation, staging, rigging, slinging, crane service, removals, and installations of parts and equipment such as may be required to carry out work.
- 5) Any piping, manholes, parts and/or equipment requiring removal to carry out specified work and/or to gain access shall be replaced upon completion with new jointing, nuts,

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bolts, anti-seize compound, clamps and brackets as applicable (the Contractor's supply), and secured in original condition. Any removals shall be jointly inspected by both The Contractor and TC prior to removal.

- 6) The Contractor to ensure that all spaces, compartments, and areas of the ship, both internal and external, are left, at a minimum in as clean a condition as found. The cost of removing dirt, debris, and associated material shall be included in the quote on each item of this specification.
- 7) The Contractor to supply TC with marine chemist's certificates before any cleaning, painting or hot work is commenced in confined spaces or machinery compartments. Certificates shall clearly state the type of work permitted, and shall be renewed as required by the regulations.
- 8) Whenever any work is being carried out involving a ship's firefighting or fire detecting system, it shall be done in such a way as to leave the vessel and any persons aboard with adequate protection against fire at all times. This may be so accomplished by removal or disarming of only a portion of the system at a time, by replacement with spares while work is in progress or by other reasonable means acceptable to the Technical Authority.
- 9) All materials, unless otherwise specified, shall be supplied by the Contractor. Where a particular item is specified, or where a substitution must be made, the Technical Authority must approve all material offered.
- 10) The Contractor is responsible for calling in the services of DNV-GL, when and as required for survey and inspection. The Contractor is also responsible for the payment of such services which must be reflected in the Contractor's bid submission.
- 11) The Contractor shall use fully qualified, certified and competent tradesmen and supervision to ensure a uniform and high level of workmanship as judged by normally accepted shipbuilding standards to the Technical Authority's satisfaction.
- 12) The Contractor shall provide adequate temporary protection for any equipment or areas affected by this supply/installation. The Contractor shall take proper precautions to maintain in a proper state of preservation any machinery, equipment, fittings, stores or items of outfit which might become damaged by exposure, movement of materials, paint, sand grit or shot blasting, welding, airborne particles from sand grit or shot blasting, welding, grinding, burning, gouging, painting or airborne particles of paint. Any damage so caused shall be the responsibility of The Contractor.

## APPENDIX C – SUMMARY OF STANDARD EN 12600 – SAFETY GLAZING TESTING

### EN 12600 Safety Glazing Testing Summary

This European Standard specifies a pendulum impact test method for single flat panes of glass for use in buildings. The test is intended to classify flat glass products in three principal classes by performance under impact.

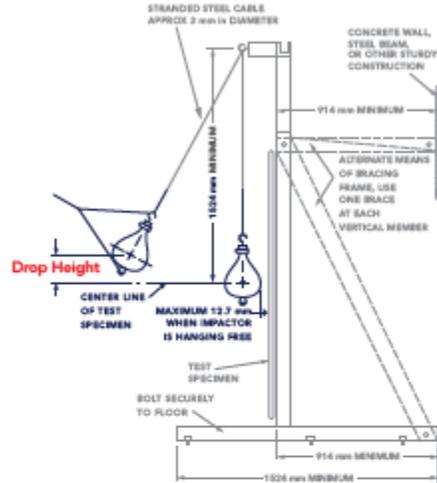
This standard is also referenced in the [CPNI EBP 08/13](#) document for improving the blast resistance of glazing.

The classification by drop height corresponds to the amount of energy transferred by the impactor.

#### Impact Levels

Classification	Drop Height (mm)
3	190
2	450
1	1200

The drop height is the point of release from the center line of the impactor at rest.



#### Mode of breakage

Type A – numerous cracks appear forming separate fragments with sharp edges, some of which are large;

Type B – numerous cracks appear, but the fragments hold together and do not separate;

Type C – disintegration occurs, leading to a large number of small particles that are relatively harmless.

Mode of breakage typical of film coated and laminated glass

The chart below identifies the classification of Armorcoat safety films by thickness and tested glazing.

Film Type	CLASSIFICATION	
	4 mm	6 mm
100 micron (4 mil)	2B2	2B2
175 micron (7 mil)	NT	1B1
200 micron (8 mil)	1B1	1B1
250 micron (10 mil)	1B1	1B1
275 micron (11 mil)	NT	1B1
350 micron (14 mil)	NT	1B1

NT - not tested