GIBSONS & AREA COMMUNITY CENTRE

ICE ARENA
REFRIGERATION PLANT

AMMONIA CONDENSER REPLACEMENT
&
2026 REFRIGERATION SYSTEM UPGRADES

SPECIFICATIONS

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700 Park Rd
Gibsons, BC
V0N 1V0

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SECTION 1:
INTRODUCTION AND GENERAL DESCRIPTION

Gibsons & Area Community Centre Ice Arena is located at 700 Park Rd, Gibsons, B.C.

It is a NHL sized (85' x 200') ice arena.

An ammonia refrigeration system with one shell & tube ammonia/brine chiller was originally installed in 2006 by Pace Industrial to make and maintain ice for the Ice Arena.

There was a major system upgrade, which was completed in 2025. The aged originally installed shell & tube ammonia/brine chiller has been replaced with an Alfa Laval plate & frame chiller with a U-Turn surge drum.

Gibsons Ice Arena condenser replacement & refrigeration system 2026 upgrade project includes but is not necessarily limited to the following:

1. To replace the existing Baltimor Aircoil Company (BAC) evaporative condenser with a plate & frame condenser and a glycol fluid cooler;

2. To install a new glycol circulating pump and piping system;

3. To replace the existing under slab (U/S) ammonia/brine heat exchanger and brine pump with a glycol/brine heat exchanger and a new brine pump;

4. The existing snow melting heat exchanger will be replaced with a new warm glycol heating system;

5. To provide a glycol heating loop connections from the new glycol supply header for future potential dehumidifier application;

6. To install an ammonia water diffusion tank and upgrade the ammonia safety relief system (It is an optional plan. Please provide a separate additional price);

7. Necessary ammonia piping, brine piping, and water piping upgrade;

8. Necessary new glycol piping installation;

9. Necessary Motor Control Center (MCC), electrical, and control upgrade;

10. Direct Digital Control (DDC) upgrade.

This project is designed by JS Refrigeration Engineering Inc. This specification

documentation covers the conditions, work scope, material and equipment specification, and installation requirements of the project.

These design specifications are prepared by JS Refrigeration Engineering. It is the property of the Sunshine Coast Regional District and cannot be used or reproduced without the consent of the Sunshine Coast Regional District and JS Refrigeration Engineering Inc.

Reference to the Refrigeration Engineer in these Specifications refers to JS Refrigeration Engineering Inc.

Reference to the Owner refers to the Sunshine Coast Regional District.

Reference to the Contractor refers to the Refrigeration Contractor.

The Contractor shall perform the work at the Gibsons & Area Community Centre according to General Work Scope, Work Scope Item List and Conditions set in these Specifications and relevant drawings.

SECTION 2:
WORK SCOPE

2.1 General Work Scope and Requirement

The work includes but is not necessarily limited to the following:

2.1.1. Supply and install all equipment, material, labour, tools, commissioning, and warranty for the project as per the specifications. All installations will comply with codes, standards, and regulations listed herein. Technical Safety BC (TSBC), WorkSafeBC, the Refrigeration Engineer, and the Owner are required to inspect and approve all installations.

2.1.2. All freight and local cartage costs of the equipment and material for the project to be included in the contract.

2.1.3 All travel and accommodation costs for the project to be included in the contract.

2.1.4. If overtime work is required to meet the completion date, it is to be included in the contract.

2.1.5. Off-loading and rigging costs of all equipment and material for the project to be included in the contract.

2.1.6. Provide shop drawings and as built drawings as detailed in Section 7 Submittals.

2.1.7. Provide system installation and operation manuals as detailed in Section 7 Submittals.

2.1.8. Provide refrigeration system decommissioning and related existing equipment disposal service as detailed in the Work Scope Item List.

Remove and dispose the unnecessary ammonia based on the designed new system ammonia charge.

2.1.9. Confirm available space and location on site for the new equipment installation.

2.1.10. Provide new equipment layout plan.
The Contractor shall confirm the layout and installation space of the new equipment and new piping on site.

2.1.11. Provide electrical and control wiring diagrams as detailed in Section 7

Submittals.

2.1.12. Disconnect the existing compressor oil cooling, head cover, & jacket cooling glycol loop from the existing BAC evaporative condenser. Reconnect it to the new glycol distribution header as detailed on the system P & I drawing.

2.1.13. Supply and install a plate & frame condenser and a main glycol circulating pump as detailed in the Work Scope Item List.

2.1.14. Supply and install a new horizontal high pressure ammonia pilot receiver as detailed in the Scope of Work Item List.

2.1.15. Supply and install a new glycol/brine U/S heater, a new warm brine pump, and a warm brine loop from the new glycol distribution header to the Arena U/S heating brine headers as detailed in the Scope of Work Item List.

2.1.16. Supply and install possible plant safety upgrade as detailed in the Scope of Work Item List.

2.1.17. Supply and install DDC system replacement and upgrade as detailed in the Scope of Work Item List.

2.1.18. Supply and install a warm glycol loop and piping system from the new glycol distribution header to the existing snow melt heating coil as detailed on the system P & I drawing. The existing glycol circulating pump will be replaced and reconnected.

2.1.19. Supply and install a pair of glycol loop connections at the new glycol distribution header to provide a warm glycol supply and return loop to the possible dehumidifier application in the future. The connections need to be capped off.

2.1.20. Supply and install a glycol fluid cooler as detailed in the Scope of Work Item List.

2.1.21. Supply and install a water ammonia diffusion tank and system as detailed in the Scope of Work Item List (to provide a separate additional price).

2.1.22. Supply and install electrical upgrade, which includes refrigeration MCC upgrade, related power supply, starters, electrical panels, controls, and necessary field wiring installation for the new equipment as detailed in the Scope of Work Item List.

2.1.23. Provide system commissioning and startup service as detailed in the Scope of Work Item List.

2.1.24. Supply and install necessary ammonia piping, glycol piping, brine piping, and water piping as detailed in the system P & I drawing and Specifications.

2.1.25. Supply and install supports and hangers for the new installed pipes and conduits.

2.1.26. Supply and install secondary supports, anchors, anchor bolts, concrete house keeping pad, and seismic restraints for the new installed equipment.

2.1.27. Provide cutting, coring and patching service for any duct, pipe or conduit penetrations walls, floor, and ceiling.

2.1.28. Supply and install sleeves, cans, flashing, caulking and sealing for all duct, pipe or conduit penetrations.

2.1.29. Supply and install necessary roofing repair after the steel support frame installation of the new fluid cooler is completed. Roofing repairs must meet RCABC standards to ensure continued coverage of existing RCABC Roofstar Warranty.

2.1.30. Coordination of work with other trades, TSBC, WorkSafeBC, the Refrigeration Engineer, and the Owner shall be included in the scope of work.

2.1.31. The Contractor is responsible for obtaining and paying the fees for refrigeration installation permit, electrical installation permit, and other necessary installation permits.

2.1.32. The Contractor is responsible for calling TSBC safety officer, WorkSafeBC occupational hygiene officer, and the Refrigeration Engineer and paying all the fees for the inspections.

2.1.33. Provide pipe welding information and weld map to TSBC and provide X-ray tests for piping welds per any request from TSBC.

2.1.34. Provide third party pipe welding inspection and report.

2.1.35. Provide pressure test for the new installed pipes and system. Cooperate and coordinate with the safety officer from TSBC for testing witness and documentation sign off.

2.1.36. Supply and install a coat of priming and a coat of finish painting for steel pipes, steel supports, and any unfinished steel surfaces.

2.1.37. Supply and install valve tags, pipe labels, and new equipment identification labels.

2.1.38. Provide system As Built information and transfer information to a hard copy of the P & I drawing, which is to be posted on site during the construction period.

2.1.39. The Contractor is responsible for calling the Refrigeration Engineer for regular inspections and final inspection.

2.1.40. Provide any required piping registration and pay the fees for any pressure piping larger than 3” Nominal Pipe Size (NPS) according to TSBC regulation.

2.1.41. Any required structural, seismic and other professional design, review, and reports for the refrigeration equipment and piping support installation are included in the scope of work. Issuing structural and seismic Schedule B and C-B is the responsibility of the Contractor. Schedule B and C-B shall be provided by a professional structural engineer, which is to be hired by the Contractor. The relevant costs shall be included in the bid base price.

2.1.42. Provide a three-day site instruction and training period to the site operators.

2.1.43. Provide one-year onsite labour and material warranty of the upgraded system. Warranty starts from the project substantial completion day.

2.1.44. Clean up job site on completion of the work including removal of the construction debris.

2.1.45. Check job site during a site visit and confirm existing equipment, electrical panels, MCC, motors, starters, controls, DDC system, field wiring of the refrigeration system, and the available installation space for the new equipment before bidding.

2.1.46. Voltage

1. Power for three phase motors: 575V / 60HZ / 3PH

2. Control power: 120V / 60HZ / 1PH

2.1.47. Bonds
See Owner's requirements

2.2 Scope of Work Item List
The work includes but is not necessarily limited to the following:

2.2.1. Refrigeration System Decommissioning and Related Equipment & Refrigerant Disposal Service

1. Pump out ammonia refrigerant from the existing brine chiller and the evaporative condenser into a certified portable High Pressure Receiver (HPR). This portable tank shall be provided by the Contractor.

2. Dispose the existing ammonia in a safe manner as per applicable regulations and codes by a professional ammonia disposing company. No refrigerant shall be discharged into the environment.

3. Withdraw brine from the existing U/S shell and tube ammonia/brine heater to an approved portable brine tank. This portable tank shall be provided by the Contractor. Brine with the portable tank shall be stored at a safe place (approved machinery room) and in a safe manner as per applicable regulations and codes.

4. Withdraw ethylene glycol from the existing snow melt ammonia/glycol heater and the existing compressor oil cooling glycol loop to an approved portable glycol tank. This portable tank shall be provided by the Contractor. Glycol with the portable tank shall be stored at a safe place (approved machinery room) and in a safe manner as per applicable regulations and codes.

5. Dispose the existing glycol in a safe manner as per applicable regulations and codes by a professional ammonia disposing company. No secondary coolant shall be discharged into the environment.

6. Remove, demolish, and dispose the existing U/S shell and tube brine/ammonia heater.

7. Remove, demolish, and dispose the existing snow melt ammonia/glycol heat exchanger.

8. Remove, demolish, and dispose the existing BAC evaporative condenser and the water pump.

9. Disconnect one existing 20 HP BAC condenser fan motor VFD.

2.2.2. Supply and Install One Plate & Frame Condenser, One Main Glycol Circulating Pump, and Related Piping System

1. Supply and install one plate & frame heat exchanger and pipe it into the refrigeration system as the system condenser.

The installation of the plate & frame condenser and related piping shall allow full draining of the condensate liquid ammonia to the high pressure receiver (HPR) vessel.

2. The plate & frame condenser shall be mounted on a new steel support platform as shown on the refrigeration layout drawing. The design service of the new steel support platform shall be provided by a professional structural engineer, who shall be hired by the Contractor.

3. Supply and install ammonia isolating valves and piping lines for the condenser as specified in the P & I drawing.

4. Supply and install dual pressure relief valves and pipe to the main pressure relief header as specified in the P & I drawing.

5. Supply and install concrete housekeeping pad bases for the condenser steel support platform. The support platform shall come with an access ladder and required safety railing.

6. Supply and install a main glycol circulating pump. This pump could be mounted on the steel platform.

7. Supply and install butterfly isolating valves, check valves, and other necessary

control and access service valves for the main glycol circulating pump.

8. Supply and install glycol pressure gauges at both pump suction and discharge.

9. Supply and install one Armstrong suction guide with strainer at the pump suction.

10. Supply and install glycol expansion tank as specified in these specifications and the P & I drawing.

11. Supply and install glycol isolating butterfly valves, glycol vent & drain service valves, and glycol piping from the plate & frame condenser to a rooftop mounted fluid cooler as specified in the P & I drawing.

12. Supply and install secondary coolant pressure relief valve for the glycol system. Each pressure relief valve shall be piped to a holding tank.

13. Supply and install a 10” warm supply glycol distribution header with necessary pipe connections as specified in the P & I drawing.

14. Supply and install thermometers on the glycol supply and return mains.

15. Supply and install temperature transmitters on the glycol supply and return mains and wire to the DDC system.

16. Supply and install new pressure controllers and provide any other necessary controls for the new installed condenser, fluid cooler, main glycol circulating pump.

2.2.6. Supply and Install One Fluid Cooler

1. Supply and install a steel support platform for the new glycol fluid cooler installation.

The new fluid cooler shall be mounted at the top of a steel support platform as shown on the refrigeration layout drawing.

The Contractor is responsible for providing design, fabrication, and installation of the steel platform. The design service shall be provided by a professional structural engineer, who shall be hired by the Contractor.

2. Supply and install a BAC Nexus modular glycol fluid cooler or approved equivalent as specified in the P & I drawing and the Specifications.

3. Supply and install new glycol isolation valves, service valves, and glycol supply and return piping lines from the plate & frame condenser to the fluid cooler as specified in the P & I drawing.

4. Supply and install city water makeup supply piping, control valve, isolating valves to the glycol fluid cooler as specified in the P & I drawing. Necessary heat

tracing and insulation is required to be installed for the water piping.

5. Supply and install pipe support, hangers, and seismic restrains for new installed glycol and water pipes.

6. Supply and install remote disconnect power switch for the new installed fluid cooler according to code requirement.

7. Supply and install DDC control sensors and provide any other necessary controls for the new installed condenser, fluid cooler, and glycol pump.

8. Supply and install cutting, coring and patching service for any pipe and conduit penetrations on the roof.

9. Supply and install sleeves, cans, flashing, caulking and sealing for the pipe and conduit penetrations.

10. Supply any required roofing repair service.

2.2.7. Install One Water Ammonia Diffusion Treatment System (Optional)

1. Supply and install a concrete housekeeping pad for one water ammonia diffusion tank.

2. Supply and install one water ammonia diffusion tank and necessary control components.

The diffusion tank is to be installed inside the compressor room. The compressor room temperature shall be maintained at least 40 degree F.

3. The Contractor is responsible for providing necessary professional structural and design and site review for the diffusion tank installation.

4. Supply and install necessary seismic anchors and restraints as the structural design.

5. Supply and install required pressure relief RV header piping and diffusion tank vent piping as specified and detailed on the P & I drawing.

The existing ammonia vent line detecting sensor shall be relocated to the new RV header at the diffusion tank inlet.

6. Supply and install required water piping as specified and detailed on the P & I drawing.

7. Supply and install water level inferred sensor (dual sensors are preferred) and controls to provide water level monitoring and alarm for the tank as specified and detailed on the P & I drawing.

8. Supply and install a 3/4” stainless steel atmospheric vacuum breaker for the tank as specified and detailed on the P & I drawing.

9. Supply and install water level indicator of the tank as specified and detailed on the P & I drawing.

10. Supply and install water PH sensor and detector to monitor the PH level of water. Necessary tubing system shall be provided to connect the sensor and the controller. The PH reading shall be inputted to DDC system.

11. Charge water into the tank.
Water level shall be determined to allow the diluted ammonia volume and required ammonia bubbling volume. The water level setup shall be pre-approved by the Refrigeration Engineer.

As soon as the desired water level is approached, the water feed shall be terminated and the water hose shall be disconnected and removed.

12. The Owner is responsible for the water ammonia diffusion system maintenance, ammonia water solution disposal, and other safety procedures.

2.2.8. Provide Modification of the Existing Refrigeration MCC (Motor Control Center) and Related Electrical & Control Upgrade

1. Power supply to the three phase motors: 575Volt / 3Phase / 60Hz

2. Control power: 120Volt / 1Phase / 60Hz

3. The existing refrigeration MCC is to be retained and modified for the upgraded refrigeration ice plant service.

4. Disconnect the existing 25HP condenser fan Variable Frequency Drive (VFD). The existing 40A VFD power supply module could be retained, modified, re-set, and reused for the new fluid cooler power supply.

Supply and install one remotely installed three phase 575V/460V transformer, and other necessary electrical components for the new fluid cooler power application.

5. The existing 7.5 HP power breaker which was originally used for the evaporative condenser water pump motor could be retained, modified, re-set, and used for the main glycol circulating pump motor.

Supply and install a remotely installed VFD for the main glycol circulating pump motor.

5. The existing 7.5 HP power breaker, starter, controls, and other electrical components, which were originally used for the under slab heating brine pump motor could be retained, modified, re-set, and used for the new under slab heating

brine pump motor.

6. The existing 5 HP power breaker, starter, controls, and other electrical components, which were originally used for snow melt pump could be retained, modified, re-set, and used for the snow melt pump motor.

7. Supply and install three phase power field wiring and control field wiring for the new installed and upgraded equipment (condenser, glycol fluid cooler, main glycol circulating pump, under slab heating brine pump, other glycol pump, etc.).

8. Supply and install single phase power (2x1KW) field wiring and control field wiring for the new installed fluid cooler water basin heaters.

9. Supply and install remote power disconnect switches for the remotely installed equipment as per the electrical code requirement.

10. Supply and install additional control hardware (necessary sensors, controllers, and control panels) and field wiring for the control of the new installed and upgraded equipment (condenser, glycol fluid cooler, main glycol circulating pump, under slab heating brine pump, other glycol pump, etc.).

11. Confirm and apply the available 110V control power supply circuits on the existing MCC for the new control components and control panel applications.

12. Supply and install necessary control power and control field wiring for pressure switches, Honeywell thermostats, control valves, safety switches, and other control panels, etc.

13. Provide commissioning service for the upgraded MCC and the upgraded electrical, controls.

14. Provide a thermal imaging test for the electrical contacts, new motors, starters, and the upgraded MCC. The Contractor shall provide necessary correction actions per the test results and recommendations. The report shall be submitted the Refrigeration Engineer for review and approval.

15. Provide updated electrical and control wiring diagrams.

16. Provide sequence of operation of the new installed equipment.

2.2.9. Plant Safety Upgrade

1. A code calculation of the pressure relief header size will be provided by the Refrigeration Engineer.

2. The individual pressure relief valve and relief piping for the new installed equipment shall be sized based on the code calculation.

3. Supply and install safety relief valve for the secondary refrigerant. Each secondary refrigerant relief valve shall be piped to a holding tank.

4. Supply and install necessary lock open devices for the glycol and brine system as required on the P & I drawing.

5. Confirm the existing pressure relief header size is in compliance with the code calculation. Upgrade the pressure relief header if it is required.

6. The existing vent line NH3 sensor shall be relocated to the new RV header (before the water ammonia diffusion tank).

7. Provide a thermal imaging test for the electrical contacts, new motors, and starters. The Contractor shall provide necessary correction actions per the test results and recommendations. The report shall be submitted to the Refrigeration Engineer for review and approval.

2.2.10. DDC System Upgrade

1. Existing DDC System

During the 2025 refrigeration system upgrade, the 2006 installed original DDC system has been upgraded corresponding to the plate & frame brine chiller installation.

The control software and graphic interface have been upgraded to integrate the controls of the P & F chiller & cold brine pump to the existing DDC control system. The chiller liquid ammonia level probe has been wired to relevant standalone controller.

2. DDC System 2026 Upgrade

Provide necessary new sensors, new control panels, new control board, software, programming, graphic interface, equipment, tools, material, and commissioning of a DDC control system upgrade for both the existing and new installed refrigeration equipment.

1. Supply and install enteliweb or approved equivalent to provide an internet browser and remote access from phone and off site computers to the site installed computer.

2. Supply and install a new site computer with most updated Windows operation software. A new laser printer shall be provided as well.

3. Controller firmware shall be Version 3.4

4. Supply and install new DDC control boards, control I/O relays, and other necessary hardware components to replace the existing system for the whole refrigeration system including the existing and 2026 upgrades.

5. Supply and install hand-off-auto switches and relays for all the digital outputs.

6. Provide power protection and back up (UPS) for the DDC control system.

7. Supply and install necessary sensors for the controls and monitoring of the new installed refrigeration equipment and system.

The new installed sensors shall be wired to the new DDC control panel.

8. Supply and install new ammonia suction main and discharge main pressure transducers and wire to the new DDC control panel.

9. Supply and install ambient air temperature and humidity transmitters and wire to the new DDC control panel.

10. Supply and install required warm glycol temperature transmitters (WGS, WGR), and other necessary sensors for the 2026 upgrades new equipment controls and operations as specified on the P & I drawing.

11. The existing DDC control sensors and I/O points for the major existing refrigeration equipment controls shall be replaced other than those replaced during the 2025 Chiller Project. New sensors and I/O points shall be re-connected with the upgraded DDC system.

1) All existing DDC refrigeration control sensors for the existing refrigeration equipment controls should be replaced other than those replaced during the 2025 Chiller Project.

All the sensors shall be reconnect to and terminate at the new DDC input boards.

2) Reconnect the existing control outputs (major equipment on/off, ammonia leak alarming, ventilation failure alarm, etc.) to the new DDC output boards.

3) Reconnect the field wiring of the 2025 installed chiller standalone controller to the new DDC panel and provide data transfer through Modbus communication Protocol.

The operating status data of the chiller liquid level, liquid feed solenoid valve and the motorized liquid feed valve shall be inputted to the DDC from the standalone controller through Modbus communication Protocol.

Provide corresponding equipment operating data graphic.

4) Reconnect the field wiring of the originally installed compressor standalone controllers to the new DDC panel and provide data transfer through Modbus communication Protocol.

The compressor operating status data shall be inputted to the DDC from the standalone controllers through Modbus communication Protocol.

Provide corresponding equipment operating data graphic.

12. Provide field wiring to connect the new fluid cooler standalone controller to the new DDC panel and provide data transfer through Modbus communication or

equivalent Protocol.

13. Supply and install necessary control sensors and I/O control points for the new P & F condenser, new glycol circulating pump motor VFD controls, and the ammonia water diffusion tank water level and water PH monitoring.

14. Provide remote shut off feature of the chiller High Pressure Liquid (HPL) liquid makeup solenoid valve through the DDC system in case of any plant emergency issue.

15. Provide compressor room ventilation failure indication and alarming through the upgraded DDC system. The conditions of the existing exhaust air proving switch and fresh air intake damper position switch need to be site confirmed. They could be replaced and reconnect to and terminate at the new DDC input boards.

Provide corresponding equipment operating data graphic on the DDC graphic.

16. Retain and reconnect the existing two-stage Honeywell cold brine thermostats and related field wiring for a backup operation of the refrigeration plant in case the DDC control system fails.

17. The existing control software, programming, and interface graphic of the existing major equipment shall be retained and modified correspondingly per the operation of the system upgrade.

Interface graphic needs to be updated to be compatible with both onsite (Orcaview) and remote (Orcaweb) platforms. Current interface graphics do not display correctly on the Orcaweb.

18. Provide control software and graphic interface modifications to integrate the new equipment and controls to the existing DDC control system.

19. Provide qualified electricians to do all the shop wiring and field wiring of the DDC control system.

20. All the major equipment and procedure controls (consequences of operation) (chiller liquid level control, cold brine pump VFD operation, fluid cooler fan motor & glycol pump VFD operation, etc.) shall be provided and included in DDC system shop drawing.

21. Provide local and remote monitoring and alarm indication of all operating parameters, system critical safety parameters (ammonia leak, high discharge pressure, and high liquid ammonia level, etc.)

22. Retain and reconnect the field wiring of the refrigeration plant emergency shutoff switches (one inside compressor room, one inside the Vestibule, and one inside the fire box).

23. Provide remote alarm paging or email notification system.

24. Provide system control and DDC wiring diagram.

25. Provide upgraded DDC system I/O list.

26. Download the control program software and provide access to Owner's computers (one onsite and two offsite).

27. Download the control program software and provide access to Refrigeration Engineer's computer.

28. Provide the Owner with the backup software copy and installation instruction documentation.

System access information and password (both operator level and administrator level) shall be part of the documentation.

29. Provide DDC system commissioning service.

30. Provide onsite training to Owner's operating engineers.

2.2.11. Provide System Commissioning and Startup Service

1. After pressure test is completed and approved by TSBC inspector, the Contractor shall evacuate the system by using a vacuum pump and hold for 12 hours without rise in pressure.

2. Break the system vacuum by anhydrous ammonia.

3. Charge new ammonia to the system based on the design system charge. The final ammonia charge shall be approved by the Refrigeration Engineer.

4. Charge inhibited new ethylene glycol to the system with specified 40% density.

5. Recharge the existing brine solution from the storage tank back to the U/S heating system.

6. Reduce visible solids of the warm brine solution to less than 30 ppm by circulating the brine solution through an external filtering system during the system commissioning period.

7. Supply and charge additional calcium chloride to bring to specified density of the whole brine solution charge (21% for the brine solution).

8. Provide treatment of the existing brine solution to bring all the parameters to acceptable control range.

9. Provide system start-up and commissioning service for the new installed equipment and system. Operate equipment and system for three days continuously after the installation is completed.

11. Provide test and reports for brine solution, glycol solution, and ammonia. The test and reports shall be provided by certified labs.

SECTION 3: SCHEDULE

1. Site ready: May 19th, 2026

2. System start-up: July 20th, 2026

3. Substantial completion: See Schedule provided by the Owner

SECTION 4:
QUALITY ASSURANCE & WORKMANSHIP

4.1 Code Compliance

Refrigeration system and Class T compressor room are required to be installed, constructed, operated and maintained in accordance with all current applicable codes and regulations (latest revisions) (Provincial and Local codes, rules, regulations and ordinances, Technical Safety BC regulations, WorkSafeBC regulations, and etc.) including but not necessarily limited to the following:

- CSA B52: Mechanical Refrigeration Code
- CSA B51: Boiler, Pressure Vessels and Pressure Piping Code
- ASME Boiler and Pressure Vessel Code, Section VIII Pressure Vessels, Div.
- ASME B31.5 - Refrigeration Piping and Heat Transfer Components Code
- ASHRAE15 – Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants
- ANSI/ASHRAE Standard 62.1 - Ventilation for Acceptable Indoor Air Quality
- CSA C22.1 - Canadian Electrical Code, Part I
- CSA C22.2 No. 0-10, Canadian Electrical Code, Part II
- CSA C22.2 No 14, Industrial Control Equipment
- BC Building Code
- BC Fire Code
- OSHA Regulations
- Technical Safety BC Regulations and Safety Orders
- Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation under the Safety Standards Act
- WorkSafe BC Regulations

4.2. All pressure vessels, evaporator or condenser units, heat exchangers, valves and other pressure containing components shall be with a Canadian Registration Number (CRN) and registered for use in B.C.

4.3. Provide Schedule B and Schedule C-B for structural & seismic support of major equipment and ammonia piping system (by a structural engineer).

4.4. Provide piping design registration for pressure piping bigger than - NPS 3”.

4.5. Provide TSBC system design registration.

4.6. All work shall be site inspected and approved by the TSBC safety officer, the WorkSafeBC occupational hygiene officer, the Refrigeration Engineer, and the Owner's inspector.

4.7. Only qualified welders with a certificate registered to the TSBC will be allowed to do the welding work. Welder's updated logbook will be inspected and approved by the TSBC safety officer prior to starting any welding work on site.

4.8. All refrigeration piping welds shall be stamped by the welders. A weld map is to be prepared for the approval of the safety officer from the TSBC.

4.9. Welding procedure applied for the ammonia pressure pipe welds shall be registered to TSBC.

4.10. Piping welds shall be inspected by independent professional welding inspectors.

4.11. All tradesmen working on this project shall be qualified under provincial regulations and experienced in ammonia plant installation.

4.12. Workmanship of the refrigeration upgrade installation shall conform to a standard of best industrial practice.

4.13. The refrigeration system shall be commissioned by a qualified refrigeration mechanic with at least five years' ammonia refrigeration experience.

4.14. Ammonia shall not be charged to the system until all the safety equipment and devices are installed and commissioned. The safety equipment and devices shall be inspected and approved by the TSBC safety officer.

4.15. System shall not be started up until the installation is inspected and approved by the Refrigeration Engineer and the TSBC safety officer.

4.16. The Contractor's job site superintendent shall be approved by the Refrigeration Engineer and the Owner. This superintendent shall cooperate and coordinate with the Owner and the Refrigeration Engineer to supervise the whole project.

SECTION 5:
MAJOR EQUIPMENT AND MATERIAL

5.1 Standards

5.1.1. All equipment and materials shall carry CSA approval and conform to all Federal, Provincial, Municipal regulations and standards.

5.5.2. All equipment and materials shall be new, of the best quality, and supplied by the specified manufacturer.

5.2 Alternates

Any request to the use of alternate materials and equipment must be submitted to the Regional District in writing for approval, five days prior to the closing date of tender.

The Regional District will submit the request to the Refrigeration Engineer for review.

5.3 Major Equipment and Devices

5.3.1 Horizontal High Pressure Receiver (HPR)

1. Size: 16” Dia x 4'-0” OAL

2. Design Pressure (DWP): 300 psig

3. Receiver shall be designed, constructed, and tested to
ASME Sec VIII, Div 1 - 2025, ASME B31.5 - 2022, and CSA B51- 2024 Code.

4. Pressure Vessel shall be with CRN and registered for installation and operation in B.C.

5. Connection 1-1/2” and smaller shall be XH couplings.

6. Connection 2” and large shall be butt weld fitting with a 6” stub.

7. The CD inlet connection shall be designed at the bottom of the vessel.

8. Contractor shall confirm the connection details based on site installation requirement.

9. Provide a 6” dia x 10” long oil drain leg for the HPR vessel.

10. The high pressure liquid outlet tube of the HPR receiver shall be positioned in line with the oil drain leg. The high pressure liquid outlet tube shall be extended into the oil drain leg.

11. After pressure testing at manufacturer's shop, vessel shall be cleaned, dried and charged with nitrogen gas. All vessel nozzles shall be sealed before and after shipped to job site.

12. Vessel shall receive one coat of primer before shipped to job site.

13. Provide liquid level flat glass gauge and indicate a full range of vessel liquid level of the HPR receiver.

14. Acceptable manufacturers: Morfab or approved equivalent.

5.3.2 Plate & Frame Ammonia / glycol Condenser

A new plate & frame type ammonia / glycol condenser is to be installed to replace the existing BAC evaporative condenser.

1. The condenser shall be a stainless steel 316 semi-welded plate and frame unit designed for ammonia and ethylene glycol operation.

2. Condenser shall be sized to capture 1,750 MBH compressors' heat rejection. The maximum fluid side pressure drop shall not exceed 5 psig based on a 40% ethylene glycol solution.

3. Condenser shall be sized for a glycol flow rate of 390 usgpm based on 87 ºF glycol outlet and 77ºF glycol inlet with 230 ºF ammonia gas inlet and 90 ºF ammonia condensing temperature approach.

4. Gasket selection is based on 235 ºF ammonia gas inlet.

5. The condenser shall be constructed to ASME Sec VIII, Div 1 - 2025 requirements for 300 psig DWP on the ammonia side and 150 psig DWP on the glycol side.

6. The condenser design shall be registered with the regulatory authority for BC application.

7. The condenser shall be equipped with dual refrigerant pressure relief valves.

8. Accepted Manufacturer and Model: Alfa Laval MK10 BW-FD or approved equivalent.

Approved equivalent: Danfoss SW 40A-140-TM

5.3.3 Main Glycol Circulating Pump

1. Capacity: 390 usgpm of 40% ethylene glycol - @ 50ft discharge head

The Contractor shall be responsible for confirming the pump head to meet the required flow rate.

2. Close-coupled vertical in-line type pump.

3. Pumps to be suitable for ethylene application, bronze impeller, come with mechanical shaft seal and 316 stainless steel shaft sleeves.

3. Totally Enclosed Fan Cooled (TEFC) pump motor, 1765 rpm, 7.5 HP, inverter duty, National Electrical Manufacturers Association (NEMA) premium Energy efficient with 1.15 SF.

4. Accepted pump manufacturer and pump model: Armstrong model 4380 5x5x8 -4P -7.5hp series.

5.3.4 Glycol Fluid Cooler

1. One close loop glycol fluid cooler is to be installed at the location, where the existing BAC evaporative condenser is currently placed.

The existing steel support frame for the existing BAC evaporative condenser shall be modified to suit the new fluid cooler installation. The operating weight of the new fluid cooler is 15,300 lbs. The Contractor shall hire a professional structural engineer to complete the design of the new steel supporting frame.

2. Capacity: The fluid cooler shall cool 390 usgpm of 40% ethylene glycol solution from 87°F to 77°F at 67°F entering air wet-bulb temperature.

The capacity of the fluid cooler is sized for a minimum of 100% of the refrigeration system total heat of rejection (1,735 MBTUH).

The glycol loop pressure drop shall be limited to around 1 psig.

3. Basin heater shall be included in the unit. Basin heater selection shall base on Gibsons' winter climate conditions. Two 1KW / 115V/1 PHASE / 60HZ each heaters are required.

4. A 575/3/60 to 460/3/60 transformer for 32 HP is required.

5. Treated town water supply with proper isolating and solenoid valves shall be piped to the new fluid cooler. The town water supply line shall be heat traced and insulated.

6. Accepted Manufacturer: BAC Nexus Modular unit model NXF-0603N-CS2TS-J4 or approved equivalent

5.3.5 Glycol Expansion Tank

1. Closed steel expansion tank, pre-pressurized bladder or membrane style.

2. Tank is to be sized accordingly to allow for the warm glycol system to expand and contract.

3. Accepted tank manufacturer: Amtrol or approved equivalent

5.3.6 Glycol/brine U/S Heater

1. Type: Shell & Tube

2. Design Pressure (DWP)
150 psig

3. Duty: minimum 180 MBTUH @
Shell Side Primary Coolant: 390 USGPM 40% ethylene glycol flow 80 F inlet
Tube Side Secondary Coolant: 150 USGPM 21% CaCl2 flow, 38 F inlet, 41F outlet

4. Construction
Tube side connection: 4”
Shell side connection: 8” or 10” flange

5. Acceptable manufacturers:
Ultimate Fabrication or approved equivalent

5.3.7 Warm Brine U/S Circulating Pump

1. Capacity: 150 usgpm of 21% CaCl2 brine - @ 57 ft discharge head
The Contractor shall be responsible for confirming the pump head to meet the required flow rate.

2. Pumps to be suitable for brine application, all iron construction, cast iron impeller, casting iron casing, come with mechanical shaft seal, carbon steel pump shaft, stainless steel shaft sleeves.

3. TEFC pump motor, 1765 rpm, 5 HP, inverter duty, NEMA premium Energy efficient with 1.15 SF.

4. Accepted pump manufacturer and pump model: Armstrong model 4030 3x2.5x8 -4P-5hp series or approved equivalent.

5.3.8 Snow Melting Glycol Pump

1. Capacity: 120 usgpm of 40% ethylene glycol - @ 50 ft discharge head
The Contractor shall be responsible for confirming the pump head to meet the required flow rate.

2. Pumps to be suitable for ethylene glycol application, bronze impeller, come with mechanical shaft seal and 316 stainless steel shaft sleeves.

3. TEFC pump motor, 1765 rpm, 3 HP, inverter duty, NEMA premium Energy efficient with 1.15 SF.

4. Accepted pump manufacturer and pump model: Armstrong model 4280 3x1.5x8 -4P -3hp series or approved equivalent.

5.3.9 Water Ammonia Diffusion Tank

1. Water Ammonia Diffusion Tank

1) Vertical construction

2) 32” dia x 74.25” high

The Refrigeration Contractor is responsible for confirming the compressor room door size for the tank site access.

3) Design Pressure (DWP)
75 psig

4) The units shall be designed, constructed, tested, and installed to CSA B51, CSA B52, ASHRAE 15, BC Building Code 2018, and any other applicable codes.

5) Material: ASTM B209 Aluminum and Alloy sheet and plate
ASTM B345 Seamless Pipe

6) The unit shall be suitable for the installation and operation in B.C.

7) Connection 1-1/4” and smaller shall be couplings.

8) Connection 1-1/2” and larger shall be flange (150#) connection.

9) The unit is with a sealed 8” flange connection access.

10) A water level indicator needs to be installed on the unit.

11) A infrared water level sensor is to be installed on the unit.

12) A PH detector shall be installed and connected to a sensor for water/ammonia test and alarm.

13) Supply and install a stainless steel atmospheric vacuum breaker.
The stainless steel atmospheric vacuum breaker shall be site mounted on the relief discharge header as detailed on the P & I drawing.

14) A vent line shall be supplied and piped to the atmosphere as detailed on the P & I drawing. The existing RV relief stack could be used as part of the vent line.

15) Acceptable manufacturers: Ultimate Fabrication Model UF-RT32068-AL177 or approved equivalent

2. Stainless steel atmospheric vacuum breaker
3/4" stainless steel atmospheric vacuum breaker
Manufacturer: Nicholson
or approved equivalent

3. Water level sensor
Infrared dual level sensor and alarm control
Supplier: RCC
or approved equivalent

4. PH sensor for water/ammonia alarm
Manufacturer: HB Products
Model: HBPH-2W-9-MK2
or approved equivalent

5. PH detector for water/ammonia alarm
Manufacturer: HB Products
Model: HBPH-C1-ENC, wall mounted
or approved equivalent

5.3.10 Modification of the Existing Refrigeration Motor Control Center (MCC) & New Refrigeration Equipment Motor List

The following is a proposed new refrigeration equipment motor list for reference. The Refrigeration Contractor shall confirm the final selection of the equipment and finalize the list for the MCC design.

1. The list includes but is not necessarily limited to the following:

Qty	HP	Function	Location	
1 x 7.5 HP		Main glycol circulating pump motor	Compressor room	7.5 HP

The existing 7.5 HP power supply with power breaker for the existing BAC evaporative condenser water pump could be retained, adjusted, and used for the new main glycol circulating pump.

A remotely installed VFD needs to be supplied and installed for the new main glycol circulating pump.

32 HP Fluid (glycol) Cooler			Compr. Rm Rooftop	32 HP

The existing 40A power supply with power breaker for the existing BAC evaporative condenser fan could be retained, adjusted, and used for the new fluid cooler. The existing BAC evaporative condenser fan VFD could be removed.

The Contractor shall confirm the condition of the existing power breaker on site. Replace it if it is required.

Supply and install one remotely installed three phase 575V/460V transformer, power breaker, and other necessary electrical components for the new fluid cooler power supply.

1 x 5 HP U/S heating warm brine pump motor Compressor room 5 HP
Retain, adjust setting, and re-use the existing 7.5 HP power breaker and starter

The Contractor shall confirm the condition of the existing power breaker on site. Replace it if it is required.

1 x 3 HP Snow melt glycol pump motor Compressor room 3 HP
Retain, adjust setting, and re-use the existing 5 HP power breaker and starter

The Contractor shall confirm the condition of the existing power breaker on site. Replace it if it is required.

2. Motor starters shall be combination type. Size and type shall be confirmed for different applications. All starters shall be equipped with Motor Circuit Protection (MCP) breakers with adjustable instantaneous magnetic trip elements.

The circuit breaker shall be operated externally. The external operating circuit break handle shall be mechanically interlocked with the door.

Provide external push button for overload relay manually reset. Reset push buttons and motor "on" indicating lights shall be mounted on door front.

3. Power feeder breakers shall be thermal magnetic type with adjustable trip setting instantaneous elements.

4. Provide Lamicoid nameplate (white base, black letter) on each panel and the MCC to identify name, service rating, power and load.

All door mounted items to be identified with Lamicoid nameplates.

5. Each terminal shall be numbered and tagged.

5.3.11 Remotely Installed VFDs

1. Power: 575V, 3 phase, 60HZ service.

2. Provide power switch, line reactors, controls, and any other necessary electrical components for the VFDs.

3. Provide across line starter bypass as the main glycol circulating pump motor VFD backup.

5. Accepted VFD Manufacturer: ABB or approved equivalent

5.3.12 Pressure and Temperature Controls

1. Accepted Manufacturer: Penn, Honeywell, or approved equivalent

5.3.13 DDC Control System

1. Accepted hardware and programming platform manufacturer: Delta
Delta DDC system is specified for the refrigeration system DDC control installation.

Accepted DDC control subcontractor:
If the Contractor doesn't have an in house programmer to provide the DDC system installation and service directly, a DDC control subcontractor shall be hired by the Contractor. The DDC subcontractor is subject to be approved by the Refrigeration Engineer and the Owner.

2. Operator-access network (PC Network and internet) ensures the control system can be accessed for offsite trouble shooting and monitoring.

3. A dedicated Cat 5 Ethernet line shall be provided by the Owner to the DDC panel to provide remote communication access .

4. Password Protection provides multiple levels (administrator level, contractor level, and operator level) of access restriction to system operation and control. Multiple level account and password information shall be submitted to the facility after projected completed.

5. GCL (General Control Language) shall not be locked up.

6. The refrigeration plant shall be controlled by the electrical-mechanical controllers when the DDC system fails.

7. Control Panel

The existing control panels are to be replaced.

Control panel includes micro-control board, communication board, I/O board, Hand-Off-Auto switches, protected control power supply, and any other necessary components.

The control panels shall be installed in a powder-coated CSA type 4 enclosure.

Control panels are to be CSA listed and conform to OSHA, electrical and other code and regulation requirements.

Allow extra (minimum 25% more than current system requirement) I/O board capacity for future expansion.

Optical isolation relays for I/O control points

Hand-Off-Auto switches located inside control panel on each digital output permit manual operation of motors, control valves and other switched equipment in the

event of DDC system failure.

Controller firmware shall be Version 3.4.

BACnet/IP & BBMD protocol ability ready for the multiple communication options (Ethernet Ports, RS485 connections, USB ports) and support BACnet/Ethernet, BACnet/IP, MS/TP, and Modbus

8. Sensors

The following is a proposed refrigeration DDC control sensor list. This list is just for reference.

It is the Contractor's responsibility to confirm the existing and required control sensors & I/O list for the requirements of the refrigeration control system upgrade and to finalize the sensor and I/O list.

1) Existing Sensors to be retained

The 2006 installed DDC system has been upgraded during the 2025 chiller replacement. The relevant 2025 installed sensors shall be retained.

Refer to the existing DDC system I/O list for the details.

2) New Sensors

New sensors include but is not necessarily limited to the following:

One ammonia suction main temperature sensor.

One ammonia discharge main temperature sensor.

One ammonia suction main pressure transducer.

One ammonia discharge main pressure transducer.

Current Transducers (CTs) for the new U/S heating brine pump and the new glycol pump motors (provided by motor current analog signals from VFDs) & frequency reference signals, all other pump motors.

One condenser CD temperature sensor.

Glycol supply (CGS) temperature sensors and one glycol return (CGR) temperature sensors for the main glycol loop.

One warm brine supply temperature sensor and one warm brine return temperature sensor for the U/S heating system.

One warm glycol supply temperature sensor and one warm glycol return

temperature sensor for snow melting system.

One ambient air dry bulb temperature sensor.

One ambient air humidity sensor.

Compressor oil cooling:

One compressor oil cooling glycol pump motor CT.

One compressor oil cooling glycol supply temperature sensor.

One compressor oil cooling glycol return temperature sensor.

Ammonia water diffusion tank:

One water level sensor.

One water PH sensor.

Any other necessary sensors to complete the refrigeration plant upgrade controls for this facility.

The installation of the necessary temperature sensor wells and pressure transducer isolating valves shall be included in this project.

1) Supply and install the stainless thermowells for the temperature transmitter installations

9. Control software features/capabilities:

Provide control logic and interface of facility scheduled operations of the refrigeration equipment and system. The DDC system shall control all the compressor staging, pumps, fluid cooler, other refrigeration components.

Compressor room ventilation shall be monitored by the DDC system and ventilation failure alarm shall be provided by the DDC system.

Ammonia sensor reading shall be inputted to the DDC system from the ammonia detector through Modbus or BACnet communication protocol.

Compressor control panel reading information shall be inputted to the DDC system through Modbus communication protocol.

The equipment shall be programmed to operate in an energy efficient manner. Dynamic Compressor Staging, optimum motor start selections, etc. PID control loop is to be included in the programming.

Control software/graphic shall be with the following features/capabilities:

1) The existing DDC control sequence and graphic of the existing refrigeration equipment such as compressor staging, compressor Lead/Lag switch over, compressor oil cooling glycol pump, U/S heating control, snow melt system, chiller level monitoring, VFD cold brine pump, compressor room ventilation monitoring, ammonia leak detection & alarm, etc. shall be retained.

Graphic needs to be updated to be compatible with Orcaview and Orcaweb. Current graphic does not display correctly on the Orcaweb.

2) Control for new installed equipment
The DDC control programming shall include the control sequence and graphic of new installed P & F condenser, main glycol circulating pump, and other related refrigeration components.

The DDC control programming shall include the ammonia water diffusion tank water level and PH monitoring.

3) The DDC system shall be able to turn off the ammonia liquid feed to the chiller when there is any emergency situation such as high chiller ammonia level, etc.

4) The DDC system shall be able to turn off the relevant refrigeration equipment and system when there is any critical alarm (high ammonia liquid level, high ammonia discharge pressure, high room ammonia PPM) and any emergency situation.

The existing DDC shall be confirmed if all the critical alarm safeties have been included.

5) Graphic screen shall be upgraded to include the existing and new refrigeration equipment into the overall configuration of the refrigeration plant and the ice rink.

It shall display the overall configuration and the operating data of the refrigeration plant and the ice rink.

Graphical User-Interface displays current operating conditions of all existing and new equipment & sensors using animation and color-coded on/off status and provides one-click links to set points and features.

Graphic screen shall display the ammonia/brine chiller operating liquid level, motorized valve opening, and liquid feed solenoid status.

Graphic screen will display both chiller and brine operation temperatures, ammonia suction and discharge pressures, equipment and valve operating status, motor currents, chiller liquid ammonia level, alarm set point and alarm history.

Graphic screen will display both high pressure and brine operation temperatures, ammonia suction and discharge pressures, equipment and valve operating status, motor currents, chiller liquid ammonia level, alarm set point and alarm history.

Graphic screen will display all the compressor operation temperatures, suction and discharge pressures, equipment and valve operating status, motor currents, chiller liquid ammonia level, alarm set point and alarm history.

Graphic screen will display all the condenser and fluid cooler operation temperatures, equipment and valve operating status, motor currents, alarm set point and alarm history.

Graphic screen will display compressor room ammonia PPM concentrations, alarm set point and alarm history.
Graphic screen will display compressor room ventilation fan status & air proving switch status, alarm set point and alarm history.

Graphic screen will display ammonia water diffusion tank status, water level, water PH, alarm set point and alarm history.

Critical alarm points includes chiller high level, high discharge pressure, and compressor room ammonia concentrations, etc. Critical alarms shall be displayed on the graphic.

6) Trend Logging records all system operating parameters (existing and new equipment) at a user-adjustable interval and is saved to hard-disk daily.

Report Printing of Trend Log Reports with optional automatic time of day/day of week printing feature. Reports may be exported directly to Microsoft Excel.

5.3.14 Ammonia Valves

1. Acceptable manufacturer: R/S, Hansen, and Danfoss or approved equivalent.

2. Isolating valve and hand expansion valve to be seal cap.

3. Valve shall be constructed with steel body. Valve shall be industrial quality

rated for ammonia service and factory tested for 800 psig.

4. All the new installed valves shall be supplied by the same manufacturer.

5. Isolating valves up to and including 4" will be socket weld.

6. Isolating valves 5" and larger will be butt weld.

7. Any screwed valve to be used shall be pre-approved by the Refrigeration Engineer before the installation.

8. Control valve, motorized valve, and hand expansion valve shall be sized based on required refrigeration capacity and operating conditions.

9. Solenoid valve shall be installed together with strainer. Provide blow-down valves for strainers.

10. All solenoids to have encapsulated coil with pilot light (110V).

11. Pressure relief valve shall be supplied by the same manufacturer as for the existing system.

5.3.15 Ammonia Liquid Level Bullseye Sight Glass Gauge

1. Acceptable manufacturers: R/S Parker, Hansen, Phillips or approved equivalent.

2. Unit shall be with CRN and registered for installation and operation in B.C.

3. Unit housing material to be steel, ASME SA36, traceable, zinc chromatic plated.

4. Unit to be suitable for ammonia application at design temperature.

5.3.16 Ammonia Liquid Level Flat Glass Gauge

1. Acceptable manufacturers: Danfoss, Jerguson or approved equivalent.

2. Unit to have CRN number for BC installation and operation.

3. Unit to be suitable for ammonia application at operating temperature (around 2,000 psig).

4. Unit shall have automatically closing shut-off valves.

5.3.17 Brine Valves

1. Acceptable manufacturer: Grinnell, Keystone, Bray,or or approved equivalent.

2. Butterfly valve - lug style with locking handle.

3. Balance valve - Armstrong CBV valve or approved equivalent.

4. Valve material shall be suitable for CaCl2 brine application in the design operating temperature range.

5.3.18 Glycol Valves

1. Acceptable manufacturer: Grinnell, Keystone, Bray, Armstrong or approved equivalent.

2. Butterfly valve - lug style with locking handle.

3. FTV-Flo-Trex valve – Armstrong multiple function valve (shut off valve, check valve, and throttling valve) or approved equivalent.

4. Valve material shall be suitable for ethylene glycol application in the design operating temperature range.

5.3.19 Glycol Pump Suction Guide

1. Acceptable manufacturer: Armstrong model SG or approved equivalent.

2. The unit shall with stainless steel strainer**.**

5.4 Material

5.4.1. Ammonia Pipes and Fittings

1. Ammonia piping shall conform to the latest edition of ASME B31.5, CSA B51, and CSA B52 Code.

2. Mill Test Reports (MTRs) for all pipe and fittings shall be provided for TSBC inspection and kept for records.

3. All fitting designs shall be registered for use in B.C.

4. Pipe shall be clean, new, and free of rust, scale, oil, grease, etc.

5. Pipe up to and including 2" NPS:
Pipe: Sch. 80, SA106 grade B seamless
Fitting: Class 3000, S.W. ASTM A105 forged steel,

6. Pipe 2-1/2" NPS and larger:

Pipe: Sch. 40, SA106 grade B seamless
Fitting: Sch.40 B.W. ASTM A234B

7. Ninety (90) degree branch pipe connection with two pipe size difference

Up to 2" NPS (including 2”): Sockolets will be used.

2-1/2" NPS and larger: Weldolets will be used.

8. Forty five (45) degree branch pipe connection
Factory fabricated fittings with CRN

9. Flanges:
Raised face, CL300, ASTM A105

5.4.2. Brine Pipes and Fittings

1. Pipe 2" NPS or less:
ASTM A120 standard galvanized steel pipe

2. Pipe 2-1/2" NPS or larger:
ASTM A-120 Schedule 40 black steel

5.4.2. Glycol Pipes and Fittings

1. Pipe 2" NPS or less:
ASTM A120 standard galvanized steel pipe

2. Pipe 2-1/2" NPS or large:
ASTM A-120 Schedule 40 black steel

5.4.3. Water Pipes and Fittings
1. Pipe 2" NPS or less:
Copper tube and fitting

2. Pipe 3" NPS or large:

Water Supply
Schedule 80 PVC or ASTM A-120 Schedule 40 black steel

Water Return and Drain
Schedule 40 PVC

5.4.4. Secondary Supports for Major Equipment

1. Secondary supports for new installed equipment could be a painted or hot dip galvanized steel frame or concrete pad.

5.4.5. Pipe Stands and Hangers

1. Floor mounted pipe stands, trapeze type hangers and Clevis hangers will be used for different applications.

2. Pipe stand and hanger material and finish shall be painted, cad-plated or hot dip galvanized steel.

3. All the steel pipe hangers for copper tubes shall be cad-plated and come with rubber sleeves.

5.4.6. Insulation

1. Insulation Material: TRYMER PIR (POLYISOCYANURATE) insulation or approved equivalent.

2. Blue-Skin Vapor Barrier or approved equivalent.

3. Cover vapor barrier with aluminum jacket

4. Saddles: use hot dipped galvanized 12 gauge saddles, 12 inches long.

5. Longitudinal Joints to have Tongue & Groove or Ship Lap Joints.

6. Valves and vessels need to be insulated with pre-molded polyisocyanurate insulation to fit the contour of valve and vessel head.

7. The following table primarily shows the insulation thickness necessary to prevent condensation on the outer surface of the insulation system jacket for indoor application.

PIPE NPS (INCH)	1/2	3/4	1	1-1/2	2	2-1/2	3	4	6	8	10	12	VESSEL
INSULATION THICKNESS (INCH)	2	2	2	2	2	2	2	2	2	2	2	2-1/2	3

5.4.7. Electrical

1. Conduit: Galvanized steel Electrical metallic tubing (EMT) or rigid conduit with reamed ends screw type galvanized steel coupling, connector and other fittings

2. Junction boxes: Galvanized pressed sheet metal steel boxes

3. Conductors: Unless otherwise specified or required by equipment manufacturer, all wires shall be soft-drawn and annealed, shall be copper of 98% conductivity with XLPE insulation.

5.4.8. Refrigerant

1. Refrigerant: Anhydrous ammonia with a minimum purity of 99.95%.

5.4.9. Warm Brine

1. Calcium chloride: Dow 97% Mini-Pellets, Anhydrous Calcium Chloride

2. Calcium chloride solution for chiller warm brine to be 21%.

5.4.10 Glycol

Inhibited 40% ethylene glycol

5.4.11. Paint

1. Primer: Rustoleum enamel primer V769402 or approved equivalent.

2. Finish coat: Rustoleum 3600 system Grey or yellow colour multi-purpose epoxy paint or approved equivalent.

5.4.12. Caulking and Sealants

1. Caulking and sealants shall be premium grade, weatherproof with minimum life span rating of 25 years.

2. Caulking applied to compressor room envelop penetration shall be minimum one hour fire rated. Hilti fire stop sealant is recommended.

SECTION 6: EXECUTION

6.1 System Installation

6.1.1. Equipment Installation shall satisfy manufacturer's instructions and guidelines.

6.1.2. Provide service access and enough service space to the new installed equipment and valves according to manufacturer's requirement and Code & Regulation requirements.

6.1.3. Provide enough space in the front and the inlet/outlet connection end of the new plates plate & frame condenser as manufacturer's instruction for future gasket replacement and necessary maintenance service.

6.1.4. The new plate & frame condenser shall be installed on a steel platform as specified on the Refrigeration Layout 3185 R2 drawing to maintain proper ammonia condensate liquid drain.

6.1.5. The existing support of the BAC evaporative condenser shall be modified as the structural engineer's design for the new fluid cooler installation.

6.1.6. Place and secure the ammonia water diffusion tank on a concrete pad.

6.1.7. Provide seismic restraints and anchorages for the ammonia water diffusion tank.

6.1.8. All pipes shall be shipped plugged, and stored inside building with plugs in place.

6.1.9. Pipes shall be cleaned up internally and exterior before installation.

6.1.10. Pipe ends shall be properly beveled prior to welding. All burns shall be removed.

6.1.11. Welding procedure applied for pressure pipe welds shall be registered to TSBC. All refrigeration piping welds shall be stamped by the welders.

6.1.12. Butt-welding will be used for pipe connection size 2-1/2" and up. Socket-welding will be used for pipe connection size up to 2".

6.1.13. Only factory fabricated fittings (elbows, tees, reducers, caps, etc,) are allowed to be used.

6.1.14. T pipe connections with two pipe sizes smaller than the main could be field fabricated by using weldolets or sockolets. The related procedure shall be registered to TSBC.

6.1.15. 1/16" gap is required between the fitting shoulder and pipe end for socket weld fitting welding.

6.1.16. Only eccentric reducers will be used for horizontal pipe runs.

6.1.17. Limit the thread fittings application in ammonia piping system. Thread joint compound shall be suitable for ammonia application.

6.1.18. All pipe run changes in direction shall be made with long radius 90 degree elbows only.

6.1.19. Pipe and pipe supports shall be installed at slopes in the direction of flow approved by the Refrigeration Engineer for different application.

6.1.20. Isolating valves are to be installed in such a way with manual valve stems in the horizontal position.

6.1.21. Suction guide with strainer shall be installed for the main glycol circulating pump.

6.1.21. Provide blow down valve on the suction guide.

6.1.22. Pressure relief header and stack shall be sized based on the capacity of existing equipment, new installed equipment, and potential future upgrade equipment.

6.2. Pressure Test of the New Installed Ammonia Piping and System

6.2.1. Pressure test (nitrogen) of new installed ammonia piping and system to at least 110% of the design working pressure (shall not exceed 130% of the design working pressure).

6.2.2. Nitrogen shall be used as testing medium.

6.2.3. The testing pressure shall be continuously maintained for time period as required by the Code. It may then be reduced to design working pressure for leak test.

6.2.4. Hold the leak test pressure for 24 hours.

6.2.5. Soap suds leak tests for each joint and valve packing.

6.2.6. Replace defective materials and re-test the system if any leaks found during the test.

6.2.7. The Refrigeration Contractor shall coordinate with the TSBC to provide any required pressure test procedure and other document.

6.2.8. Call TSBC Safety Officer for pressure test witness and inspection.

6.2.9. Submit pressure test documentation to TSBC Safety Officer for approval.

6.2.10. After pressure test is satisfactory and approved by TSBC Safety Officer, blow out system pressure through drain valves.

6.2.11. After pressure test completed, the ammonia piping and system shall be evacuated to minimum 29" mercury by a vacuum pump and hold for 12 hours without rise in pressure.

6.2.12. Owner's representative shall witness and sign off related document for the vacuum process.

6.2.13. Break the system vacuum with anhydrous ammonia.

6.3. Brine & Glycol Piping System Pressure Test

6.3.1. Pressure test the new installed brine main piping system to 75 psig and hold for 24 hours.

6.3.2. Pressure test the new installed glycol piping system to 150 psig and hold for 24 hours.

6.4. Painting

6.4.1. Painting will be done after piping pressure test is completed and approved by TSBC.

6.4.2. A coat of primer and a coat of epoxy painting is required for all ferrous pipes, supports, and unfinished surfaces.

6.5. Penetrations

6.5.1. All pipe and conduit penetrations shall be sealed and finished in an approved procedure and system.

6.5.2. Tightly seal any conduit piercing fire rated walls, floor, and ceiling with certified one-hour fire rating material and system. Only CSA certified fire stop material and system are allowed to be used.

6.6. Secondary Supports

6.6.1. Install secondary supports to primary supports by bolts or in a manner approved by the structural engineer.

6.6.2. Equipment and piping support installation needs to be approved and inspected by the structural engineer.

6.7. System Ammonia Charge

6.7.1. All safety devices are to be tested and approved by TSBC Safety Officer before charging ammonia to the system.

6.7.2. During the system commissioning, the amount of system ammonia charge shall be confirmed on site based on the plate and frame brine chiller and high pressure receiver operating liquid level.

6.8. CaCl2 Brine Treatment

6.8.1. If the visible solids are at high PPM. An external filtering system is required to be installed in order to decrease visible solids to < 30 ppm.

1. CaCl2 brine shall be charged through an external filtering system.

2. The visible solids of the existing CaCl2 brine solution shall be decreased by circulating the solution through the external filtering system during the system commissioning.

6.8.2. Take brine sample and provide test report before the installation and after system started up.

6.8.3. Warm brine solution of whole system shall satisfy 21% density, inhibitor level, PH, and all other necessary requirements.

6.9. Ethylene Glycol Treatment and Charge

6.9.1. If the visible solids are at high PPM. An external filtering system is required to be installed in order to decrease visible solids to < 30 ppm.

6.9.2. Glycol solution of whole system shall satisfy 40% density, inhibitor level, PH, and all other necessary requirements.

6.9.3. Take glycol sample and provide test report before the installation and after system started up.

6.10. Insulation

6.10.1. Follow the instructions of "Installation Guideline for Trymer Insulation of ITW Insulation Systems" for the insulation installation.

6.10.2. Insulation shall not be applied until piping has been leak tested, pressure tested, and painted.

6.10.3. All insulation shall be tightly butted and free of voids and gaps.

6.10.4. Apply insulation in two layers for total thickness of 2” or more.

6.10.5. Do not insulate control valves or strainers.

6.10.6. Do not insulate plate & frame heat exchanger (chiller and condenser).

6.10.7. Do not insulate brine pumps.

6.10.8. Insulate isolating valves and leave valve stems, adjusting stems, and packing nut exposed.

6.10.9. Cover all insulation with a layer of Blue-Skin vapour barrier.

6.10.10. Clean up the insulation surface and get rid of any solid particles before installing of the Blue-Skin vapour barrier.

6.10.11. All insulation shall be jacketed with aluminum jacket.

6.10.12. Insulation shall be installed only by experienced insulation sub-contractor, which is familiar with industrial refrigeration piping insulation.

6.11. Identification of System

6.11.1. All refrigeration valves will be tagged with stainless steel (or match the existing tag material) tags. The tags shall be attached to the valves by stainless steel cable. Valve identification numbers are to be recorded on the as-built drawing.

6.11.2. All restricted used valves shall be tagged with instruction tag. The restricted used valve shall be identified on the system P & I drawing.

6.11.3. Identify major equipment by self stick Lamacoid nameplates or approved equivalent.

6.11.4. Apply self stick vinyl pipe marker for all the refrigeration pipes.

6.11.5. Pipe marker system shall be in compliance with International Institute of Ammonia Refrigeration (IIAR) guidelines for Identification of Ammonia Refrigeration Piping and System Components and the TSBC regulations.

6.12 Electrical

6.12.1. Control and power wiring to be enclosed in rigid conduit or steel EMT.

6.12.2. Main power feed cable to be installed in a cable tray.

6.12.3. Supply and install fastening and supports for conduits and equipment.

6.12.4. Supply and install junction boxes for new wiring and components.

6.12.5. Tightly seal any conduit piercing fire rated walls, floor, and ceiling with CSA certified one-hour fire rating material and system.

6.12.6. Conduit shall run parallel or perpendicular to building lines.

6.12.7. All wiring terminals shall be labelled. The related information shall be transferred to wiring diagram.

6.12.8. The electrical panels and junction boxes shall be labelled.

6.12.9. Before energizing the system, Megger tests on feeders and circuits are required. Any problems discovered are to be corrected by the Contractor. Final test report shall be provided to the Refrigeration Engineer.

6.13 DDC System and the Refrigeration System Control

6.13.1. The Contractor shall confirm the details of the existing refrigeration system control and the existing DDC system before bidding.

6.13.2. The ammonia liquid level probe transmitter analog signal shall be inputted to both the standalone liquid level controller and the DDC control system.

6.13.3. The ammonia liquid level and motorized liquid feed valve for the ammonia/brine chiller shall be controlled by the standalone controller. The DDC system shall be able to monitor and display the liquid level and motorized liquid feed valve status and positions. The DDC system shall be able to change the control parameters remotely.

6.13.4. Both the DDC system and standalone controller shall be programmed to stop the chiller makeup liquid feed when there is a high liquid level alarm, or system power failure, or plant emergency (fire, ammonia leak, etc.).

6.13.5. The high liquid level safety float switch shall be wired to both compressor safeties and DDC system. The high liquid level alarm shall be monitored both locally and remotely.

6.13.6. The U/S heating brine pump and snow melt glycol pump control shall be included.

6.13.7. The Refrigeration Contractor shall submit the VFD control procedures of the cold brine pump, fluid cooler fan, and the main glycol pump to the Engineer for approval. The VFD could be set at 50%, 75%, and 100% for capacity control.

6.13.7. All the temperature transmitters shall be connected to the DDC system, tested, and calibrated on site.

6.13.8. All the major equipment and the consequences of operation procedure shall be included in the upgrade.

6.13.9. Graphical User-Interface shall display current operating conditions of all

the controlled equipment and sensors using animation and color-coded on/off status and provides one-click links to set points and features.

6.13.10. Graphic screen will display all the temperatures, suction and discharge pressures, equipment and valve operating status, chiller ammonia level, alarm set point and history.

6.13.11. Trend Logging records all system operating and alarming parameters at a user-adjustable interval and is saved to hard-disk daily.

6.13.12. Critical safety alarm points includes chiller high level, compressor high discharge pressure, compressor high discharge temperature, and compressor room ammonia concentrations, etc.

6.13.13. There are existing Honeywell 2-stage thermostat controllers with temperature sensors for the cold brine supply and return temperature control. It is field wired and programmed as the compressor stage control and cold brine pump control. This controller shall be retained and integrated into the upgraded refrigeration system controls as a backup of the DDC controls.

6.13.14. Supply and install new pressure control switches of the ammonia main discharge for the fluid cooler fans and remote water pump circulating control.

6.13.15. Supply and install a new Honeywell 2-stage thermostat controller and glycol temperature sensors for the main supply and return glycol. The new installed sensors shall be wired to the new Honeywell 2-stage thermostat controller as part of the condenser, fluid cooler, and related water and glycol pump controls.

6.14 System Commissioning

6.14.1. Start up and adjust all new installed equipment and system for proper operational conditions and procedures after installation completed.

6.14.2. Provide a system commissioning record with control setup parameters, and motor amperage readings.

6.14.3. The Contractor shall provide a safety device (ammonia detector system and compressor room ventilation system) test and report and submit to TSBC for approval before the refrigeration system commissioning.

6.14.4. It is the Contractor's responsibility to call TSBC safety officer and Owner's inspector for the final inspections.

6.14.5. After system commissioning is completed, take brine samples and glycol sample.

6.14.6. The lab test reports of the brine and glycol samples shall be submitted to

the Refrigeration Engineer and the Owner. The samples shall be tested at certified labs.

6.15 Inspections

6.15.1 Regular Inspection: The Contractor is responsible for calling the Refrigeration Engineer for inspection at key construction phases.

6.15.2 Final inspection: The Contractor shall call the Refrigeration Engineer, TSBC safety officer, WorkSafeBC occupational hygiene officer, and Owner's inspector for a final inspection after the work is completed. The Refrigeration Engineer will issue a deficiency list after the final inspection.

The Refrigeration Engineer will do an on-site inspection to verify that all deficiencies have been corrected. The Contractor shall pay the cost of subsequent verification and reports if there are any remaining deficiencies at that time.

6.16 Substantial Completion

6.16.1. Substantial completion is defined as the installation is inspected and approved by TSBC safety officer (A plant operating permit shall be issued after the deficiency items are corrected), WorkSafeBC occupational hygiene officer, Owner's inspector, and the Refrigeration Engineer.

The Contractor is responsible to correct all the deficiency items listed in the deficiency lists, which are issued by the TSBC safety officer, WorkSafeBC occupational hygiene officer, Owner's inspector, and the Refrigeration Engineer.

All the repair works listed in the deficiency lists need to be completed before the substantial completion certificate being issued.

6.16.2. Substantial completion date: See Schedule provided by the Owner.

6.17 Training and Instrumentation

6.17.1. Provide both class room refrigeration knowledge training and compressor room hands on training to the plant operators.

6.17.2. Refrigeration knowledge training includes refrigeration basic, system description of this upgraded refrigeration plant, major equipment controls, plant and equipment operation Standard Operating Procedure (SOP), ammonia system safety issues and emergency response procedures.

6.17.3. Compressor room hands on training includes refrigeration equipment operation parameter setup, system start-up and shut-down, equipment daily maintenance, oil drain procedure, ammonia water diffusion tank maintenance SOP, and manual air purging procedure, restricted used valve operating procedure, etc.

SECTION 7: SUBMITTALS

7.1 Shop Drawings

7.1.1. The Contractor shall submit shop drawings and product data to the Refrigeration Engineer for review before any work commences. Shop drawings include but are not limited to the following: ammonia/glycol plate & frame condenser (heat exchanger), glycol fluid cooler, main glycol circulating pump, glycol/brine heat exchanger, warm brine pump, snow melt glycol pump, ammonia water diffusion tank, steel support frame for major equipment installation, liquid level indicator, liquid drainer, MCC, VFD drive, electrical field wiring diagram, DDC system I/O list & wiring diagram, equipment control procedures, control wiring diagram, control panel, level sensor, control valves, control procedures, compressor room new equipment layout, fluid cooler installation layout, secondary steel support, wall and roof penetration & seal details, etc.

7.1.2. Review of shop drawing doesn't relieve the Refrigeration Contractor's responsibility for correct equipment selections and installations.

7.2 As-Built Drawings

7.2.1. The Refrigeration Engineer will leave a set of hard copy P & I drawing on site. The Contractor is responsible for marking all the changes of the installation and recording of the valve tagging numbers. This set of drawings shall be submitted to the Refrigeration Engineer after installation is completed.

7.2.2. Provide three hard copies and one electronic copy of as-built wiring diagrams to the Refrigeration Engineer.

7.3 Manuals

7.3.1. Provide three hard copies and one electronic copy of system installation, operation and maintenance manuals to the Refrigeration Engineer for approval.

7.3.2. Each manual shall be filed in a three-ring binder.

7.3.3. Equipment maintenance instruction and procedures shall be included in the manual.

7.3.4. Shop drawings and product data shall be included in the manual.

7.3.5. A written description of the system, component, and control details shall be included in the manual.

7.3.6. System control description shall be included in the manual.

7.3.7. All construction documents, installation permits, TSBC inspection reports, and pressure test reports, equipment and plant operation permit shall be included in the manual.

7.3.8. All the Engineer's review reports and Schedule B, letter of structural review shall be included in the report.

7.3.9. Manufacturer's Data Report (MDR) document of pressure vessels shall be included in the manual.

7.3.10. CRN registration information for pressure vessel shall be included in the manual.

7.3.11. Pressure relief pipe and header size code calculation shall be included in the manual.

7.3.12. System operation log sample form shall be included in the manual.

7.3.13. DDC system I/O list, DDC control wiring diagram, and equipment control procedures shall be included in the manual.

7.3.14. System commissioning records and system original operating set point data shall be included in the manual.

7.3.15. System start-up procedure and system shut-down procedure shall be included in the manual.

7.3.16. Oil drain procedure and system air purging procedure shall be included in the manual.

7.3.17. Restricted used valve operating procedures shall be included in the manual.

7.3.18. All shop drawings and system As Built drawings shall be included in the manual.

7.3.19. Piping and system design registration documentation shall be included in the manual.

7.3.20. Electrical thermal imaging test report shall be included in the manual.

7.3.21. Ammonia, glycol, and brine test report shall be included in the manual.

7.3.22 Warranty certificates shall be included in the manual.

SECTION 8:
APPENDIXES

1. Major Equipment

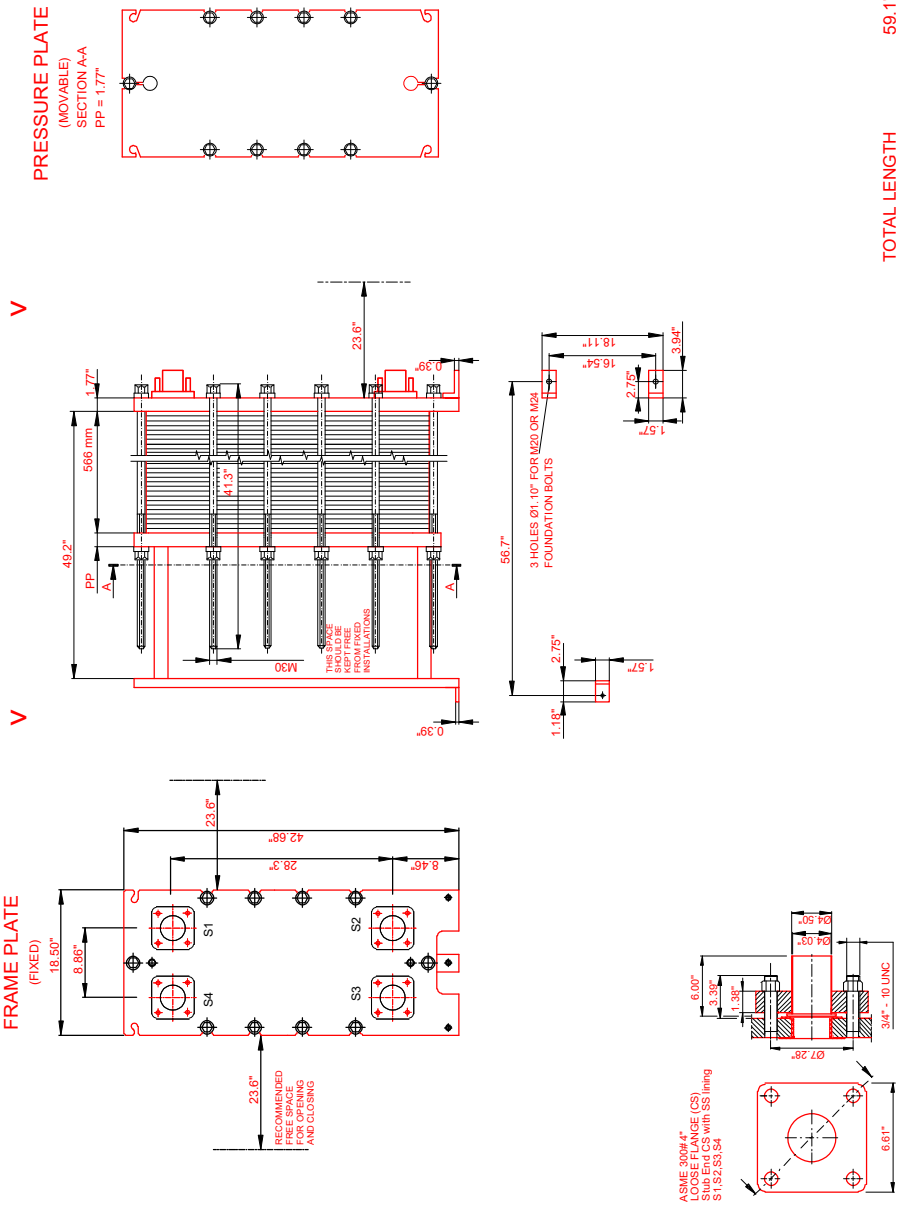
Ammonia Plate & Frame Condenser
Glycol Fluid Cooler
Performance Data Sheet Form

2. Test Report of Existing Warm Brine Solution

3. Existing DDC System I/O List

4. Design drawings

3185 R1 P&I IFT - 36x48
3185 R2 IFT - 36x48
3185 R3 IFT - 36x48



REMARKS:	SIDE 1	SIDE 2		
TEST PRESSURE	390 psi	195 psi	HEAT LOAD	1750 kBtu/h
DESIGN PRESSURE	300 psi	150 psi	GASKET	NBRP/HNBR Clip-on
MIN DESIGN PRESSURE	0 psi	0 psi	PLATE MATERIAL	ALLOY 304
MAX TEMPERATURE	240 °F	200 °F	PLATE THICKNESS	0.50 mm
MIN TEMPERATURE	0 °F	0 °F	HEAT TRANSFER AREA	496 ft²
NETWEIGHT	1482 lb		PLATE GROUPING	1*97MW/1*96MG
			WEIGHT WITH WATER	1683 lb

ALL DIMENSIONS IN INCHES

Do not use this drawing for foundation bolting, piping layout or planning of lifting and handling of the equipment

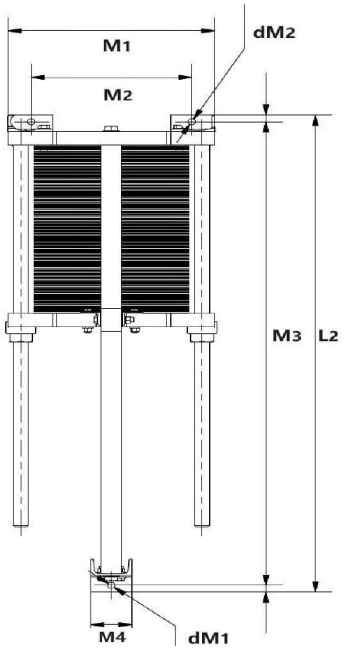
SIDE	MEDIA	INLET	TEMP.	OUTLET	TEMP.	FLOW RATE	PRESSURE DROP	LIQUID VOL.
1	Ammonia	S4	230.0 °F	S3	90.0 °F	3022 lb/h	0.01245 psi	2.182 ft³
2	40.0% Eth.glycol	S2	77.0 °F	S1	87.0 °F	205100 lb/h	2.666 psi	2.16 ft³

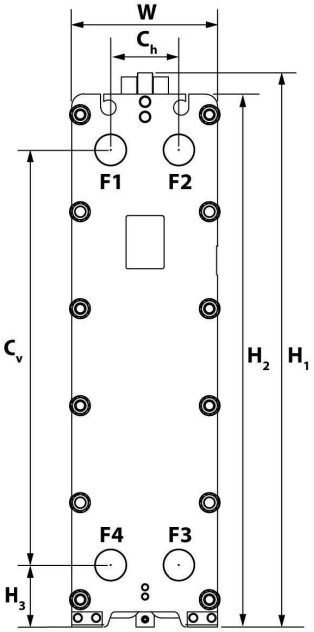
SUPPLIER	REF.	ITEM NO. HX-01 Condenser	PLATE HEAT EXCHANGER
AGENT / REF.			M10-BWFD
CUSTOMER NAME / REF. NO. JS Refrigeration Engineering Inc.			ASME
SIGN. Jorge Caceres Salazar		RISK CATEGORY N/A	

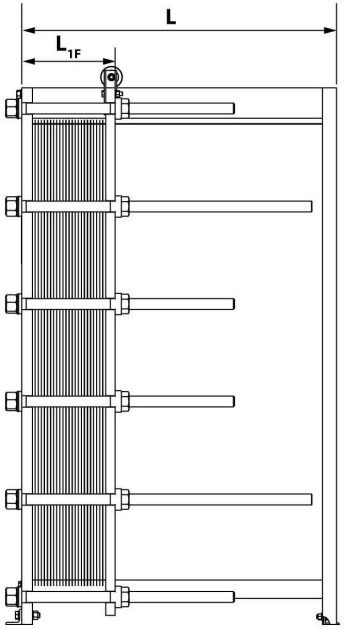
SERIAL NUMBER QU-2510-ED-1512260

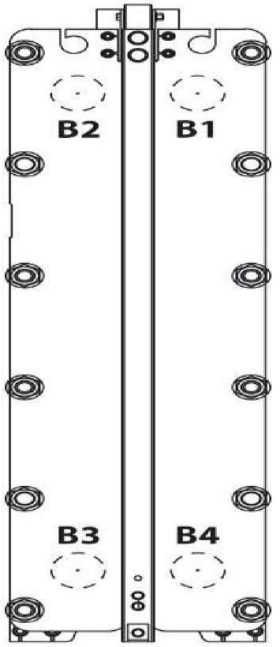
DATE 2025-10-09 REV NO. 0

HIGH LEVEL SCHEMATIC DRAWING - ONLY FOR ILLUSTRATIVE PURPOSES (VALUES IN TABLE BELOW ARE CORRECT)





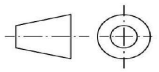




Dimensions			
Cv	41.535 [in]	**L1f**	21.586 [in]
Ch	8.858 [in]	**L**	42.106 [in]
H1	59.409 [in]	**L2**	46.043 [in]
H2	56.654 [in]	**M1**	19.685 [in]
H3	7.874 [in]	**M2**	15.354 [in]
W	19.685 [in]	**M3**	44.469 [in]
dM1/dM2	0.709 / 0.709 [in]	**M4**	3.937 [in]
Tie Bolts	8 pcs. UNC 1 3/8 INCH (4 Short, 4 Long)		

Data	Side 1	Side 2
Inlet Temp.	230.0 [°F]	77.0 [°F]
Outlet Temp.	88.2 [°F]	87.0 [°F]
Flow Rate	3007.70 [lb/h]	205930.93 [lb/h]
Pressure Loss	0.85 [psi(g)]	4.46 [psi(g)]
Fluid Media	R717(Ammonia)	Ethylene glycol (40% mass)
Heat Load	1750000.00 [BTU/h]	
Weight, empty/operating	2065 [lb] / 2065 [lb]	

ISO Projection

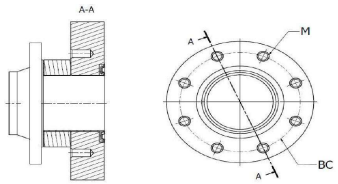


Danfoss
Nordborgvej 81
6430 Nordborg
Denmark

Tolerances:	acc. to ISO 2768-c
Customer Name:	
Calculation:	DS20251027090914
Date of quotation:	2025-10-27
HEXSelector Version	Danfoss HEXSelector 1.5.3
HEX Type:	SW40A-140
Design Code	
Design Temperature:	248.0 [°F]
Design Pressure:	298.8 [psi(g)]
Test Pressure:	[psi(g)]

Connections

Side 1: Inlet

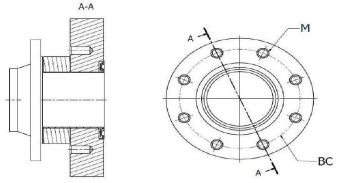


F1:FL 4 INCH 316L CL.300 ANSI B16.5 (RF)

F1:Cn.FL.4 INCH CLASS 300 CS ANSI B16.5 (RF) VARNISH

M:	3/4
BC:	0.66
No. of bolts:	8

Side 1: Outlet



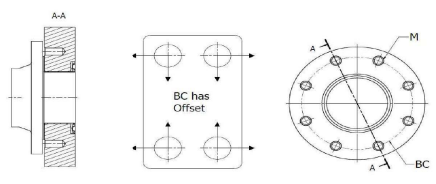
F4:FL 4 INCH 316L CL.300 ANSI B16.5 (RF)

F4:Cn.FL.4 INCH CLASS 300 CS ANSI B16.5 (RF) VARNISH

M:	3/4
BC:	0.66
No. of bolts:	8

Connections

Side 2: Inlet

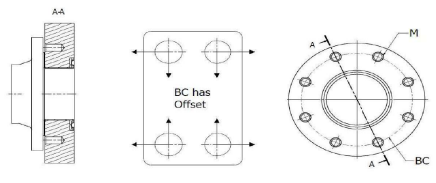


F3:FL 4 INCH 316L CL.150 ANSI B16.5 (RF)

F3:Cn.FL.4 INCH CLASS 150 316L ANSI B16.5 (RF)

M:	5/8
BC:	0.63
No. of bolts:	8
BC Offset, X-direction:	0.098

Side 2: Outlet

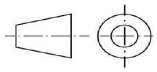


F2:FL 4 INCH 316L CL.150 ANSI B16.5 (RF)

F2:Cn.FL.4 INCH CLASS 150 316L ANSI B16.5 (RF)

M:	5/8
BC:	0.63
No. of bolts:	8
BC Offset, Y-direction:	0.157

ISO Projection



Danfoss
Nordborgvej 81
6430 Nordborg
Denmark

HEX Type:	SW40A-140
Design Code	
Design Temperature:	248.0 [°F]
Design Pressure:	298.8 [psi(g)]
Test Pressure:	[psi(g)]

Tolerances:	acc. to ISO 2768-c
Customer Name:	
Calculation:	DS20251027090914
Date of quotation:	2025-10-27
HEXSelector Version	Danfoss HEXSelector 1.5.3

X1.1-1.5.3

Baltimore Aircoil Company

Closed Circuit Product Selection Report

Version: 7.8.22 NA
Product data correct as of: September 15, 2025

Project Name:
Selection Name:
Project State/Province: British Columbia
Project Country: Canada
Date: October 07, 2025

Model Information

Product Line:	Nexus™ Modular Hybrid Cooler
Model:	NXF-0603N-CS2TS-J4
Number of Units:	1
Heat Exchanger Type:	hCore™ Heat Transfer Technology
Fan Type:	Standard Fan
Fan Motor:	(8) 3.75 = 30.00 HP/Unit
Total Standard Fan Power:	97.73% of Full Speed, (8) 3.50 = 28.00 BHP/Unit
Total Pump Motor Power:	(4) 0.50 = 2.00 HP/Unit
Intake Option:	None
Internal or Const. Option:	None
Discharge Option:	None
External Static Pressure:	0.00 in. of H2O

Design Conditions

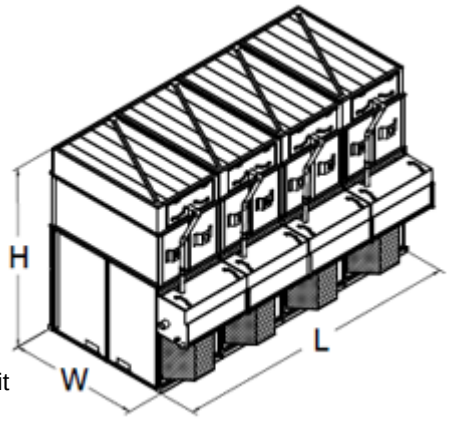
Fluid: EG, 40% by Vol. Freeze Point: -12.00 °F

Flow Rate:	390.00 USGPM
Entering Fluid Temp.:	87.00 °F
Leaving Fluid Temp.:	77.00 °F
Wet Bulb Temp.:	67.00 °F
Dry Bulb Temp.:	37.60 °F
Heat Rejection:	1,734,806 BTUH
Fluid Pressure Drop:	0.55 psi
Reserve Capability at 30.00 HP:	3.37%
Reserve Capability at 28.00 BHP:	1.37%

Thermal performance at design conditions and total standard fan motor power is certified by the Cooling Technology Institute (CTI).

Engineering Data, per Unit

Unit Length:	13' 02.00"	(Total)
Unit Width:	05' 11.50"	
Unit Height:	08' 06.00"	
Approximate Shipping Weight:	12,513	lbs
Heaviest Section with Modular Shipping:	3,128	lbs
Approximate Operating Weight:	15,259	lbs
Air Flow:	51,552	CFM
Spray Water Flow:	200	USGPM
Heat Exchanger Volume:	156	U.S. gallons



Heat Exchanger Connections:

(2) 4" Heat Exchanger Inlet and Outlet, Based on 390.00 USGPM Flow per Unit

Minimum Distance Required:

From Solid Wall:	3.5	ft.
From 50% Open Wall:	3	ft.

Energy Rating:

17.99 USGPM/HP per ASHRAE 90.1, ASHRAE 189 and CA Title 24.

Note: For detailed weights and dimensions, please refer to submittal drawings, and contact your local BAC sales representative for any additional information.

Baltimore Aircoil Company

Closed Circuit Product Selection Report

Version: 7.8.22 NA
Product data correct as of: September 15, 2025

Project Name:
Selection Name:
Project State/Province: British Columbia
Project Country: Canada
Date: October 07, 2025

Model Information

Product Line: Nexus™ Modular Hybrid Cooler
Model: NXF-0603N-CS2TS-J4
Number of Units: 1
Heat Exchanger Type: hCore™ Heat Transfer Technology

Fan Type: Standard Fan
Fan Motor: (8) 3.75 = 30.00 HP/Unit
Total Standard Fan Power: Full Speed, 30.00 BHP/Unit
Total Pump Motor Power: (4) 0.50 = 2.00 HP/Unit
Intake Option: None
Internal or Const. Option: None
Discharge Option: None
External Static Pressure: 0.00 in. of H2O

Design Conditions

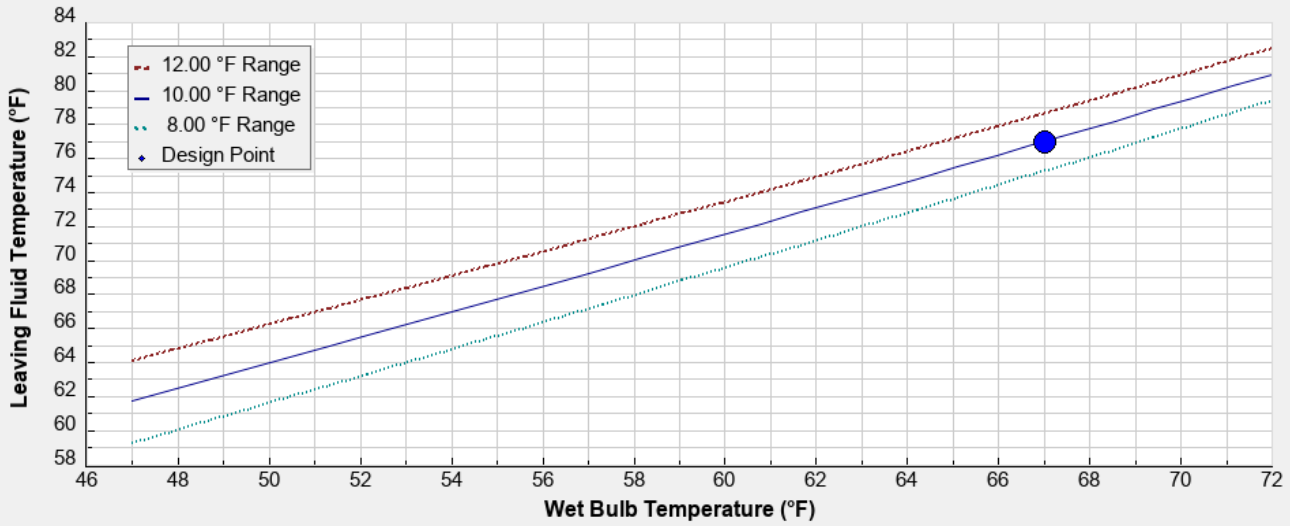
Fluid: EG, 40% by Vol. Freeze Point: -12.00 °F
Flow Rate: 390.00 USGPM
Entering Fluid Temp.: 87.00 °F
Leaving Fluid Temp.: 77.00 °F
Wet Bulb Temp.: 67.00 °F
Dry Bulb Temp.: 37.60 °F

Heat Rejection: 1,734,806 BTUH
Fluid Pressure Drop: 0.55 psi

Design Conditions @ Standard Total Fan Motor Power per Unit (30.00 HP)

Thermal performance at design conditions and total standard fan motor power is certified by the Cooling Technology Institute (CTI).

Predicted Performance
Fan Motor Alternative = Full Speed, 30.00 BHP
Flow Rate = 390.00 USGPM (100.00% of Design)



These performance curves are based on constant fan power.

Warning(s)	Applies to Design Conditions	Applies to Off Design Conditions
1. One or more selection parameters are outside of CTI Certification limits.	No	Yes

Baltimore Aircoil Company

Closed Circuit Product Selection Report

Version: 7.8.22 NA
Product data correct as of: September 15, 2025

Project Name:
Selection Name:
Project State/Province: British Columbia
Project Country: Canada
Date: October 07, 2025

Model Information

Product Line: Nexus™ Modular Hybrid Cooler
Model: NXF-0603N-CS2TS-J4
Number of Units: 1
Fan Type: Standard Fan
Fan Motor: (8) 3.75 = 30.00 HP/Unit
Total Standard Fan Power: 97.73% of Full Speed, 28.00 BHP/Unit
Total Pump Motor Power: (4) 0.50 = 2.00 HP/Unit
Heat Exchanger Type: hCore™ Heat Transfer Technology
Intake Option: None
Internal or Const. Option: None
Discharge Option: None
External Static Pressure: 0.00 in. of H2O

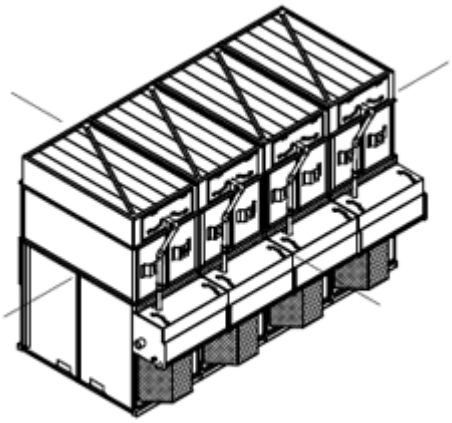
Octave band and A-weighted sound pressure levels (Lp) are expressed in decibels (dB) reference 0.0002 microbar. Sound power levels (Lw) are expressed in decibels (dB) reference one picowatt. Octave band 1 has a center frequency of 63 Hertz.

Top Lp
Sound Pressure (dB)

Octave Band	Distance 5 ft.	Distance 50 ft.
1	76	66
2	89	72
3	80	60
4	77	55
5	75	54
6	73	53
7	72	49
8	67	44
A-wgtd	**81**	**61**

End Opp. Sump
Sound Pressure (dB)

Octave Band	Distance 5 ft.	Distance 50 ft.
1	74	63
2	83	72
3	75	66
4	73	62
5	73	59
6	73	55
7	69	55
8	63	49
A-wgtd	**78**	**65**



Right Side
Sound Pressure (dB)

Octave Band	Distance 5 ft.	Distance 50 ft.
1	70	62
2	83	71
3	71	61
4	68	58
5	64	54
6	59	51
7	58	47
8	50	40
A-wgtd	**71**	**61**

Left Side
Sound Pressure (dB)

Octave Band	Distance 5 ft.	Distance 50 ft.
1	70	62
2	83	71
3	71	61
4	68	58
5	64	54
6	59	51
7	58	47
8	50	40
A-wgtd	**71**	**61**

Sump End
Sound Pressure (dB)

Octave Band	Distance 5 ft.	Distance 50 ft.
1	73	64
2	82	74
3	73	66
4	72	60
5	73	57
6	71	54
7	68	53
8	63	49
A-wgtd	**77**	**64**

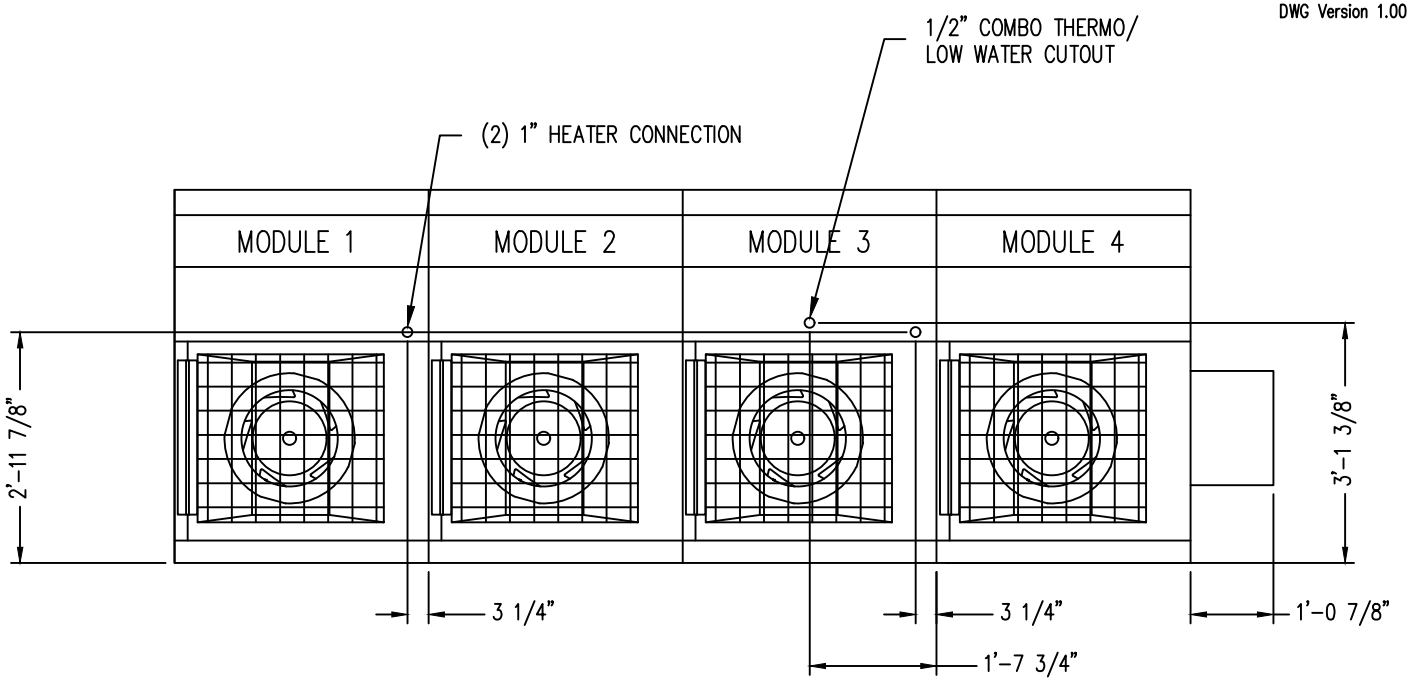
Sound Power (dB)

Octave Band	Center Frequency (Hertz)	Lw
1	63	98
2	125	104
3	250	93
4	500	89
5	1000	87
6	2000	85
7	4000	82
8	8000	77
A-wgtd		**95**

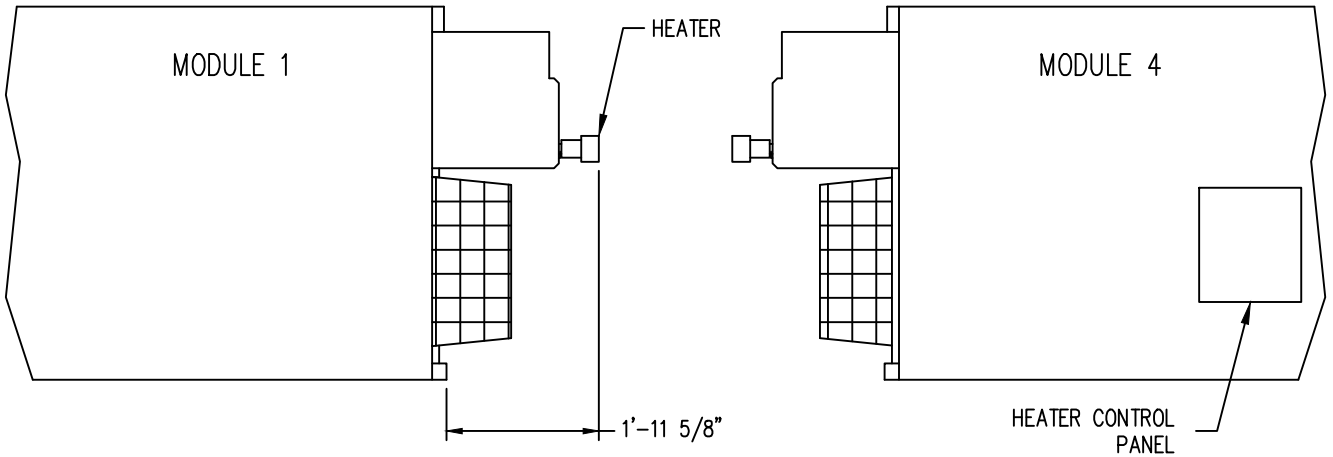
Extra Notes: Sound data provided by CTI ATC-128 sound test code revision 2025

Data Version 1.00
DWG Version 1.00

Notes
1) Refer to the appropriate wiring diagram for heater wiring details.



FACE C



FACE B

FACE A

Ambient Temperature: -20deg. F
Heater Power: 1KW per Heater
Heater Qty: 2
Volts: 115V
Phase: 1
Frequency: 60HZ

QUOTE NO: **77035_NXF-0603N-CS2TS-J4 N/A**		**Nexus™ Modular Hybrid Cooler** **Four Module Basin Accessories**
DATE: **10/30/2025 4:37:43 PM Ver=1**		DRAWING NUMBER: **BA-77035_NXF-0603N-CS2TS-J4**

Zeotec Limited
9643 62 Avenue
Edmonton, AB
T6E 0E1
780.434.5810
www.zeotec.com

REPORT OF CALCIUM CHLORIDE BRINE ANALYSIS

Customer Name:	Sunshine Coast and Regional District	**Date:**	November 3, 2025
		Attention:	Hugh Cottrell
Address:	1975 Field Road	**cc:**	
	Sechelt, B.C.	**E-mail:**	Hugh.Cottrell@scrd.ca
	V0N 3A1	**Reference:**	**GACC V4 HF**
Phone:	604-885-6800	**P.O.:**	**N/A**

CONSTITUENT	Heating Floor	Control Range
Sample Date	**October 30, 2025**	
Appearance	Light Amber/Clear	Clean/Clear
Visible Solids	< 30 ppm	< 30 ppm
Specific Gravity	1.20	1.20 Min.
% Calcium Chloride	21.5	21.5% Min
Freezing Point (°C)	-21.00	-5.0 °F or -20.5 °C Min
Visible iron	< 30 ppm	< 30 ppm
Complex Phosphate Inhibitor (cPO_4)	20 ppm	20/30ppm cPO_4 at 0.1% Z-5750 HC 10X
pH	8.84	8.50 to 9.50
Dissolved iron	11 ppm	< 10 ppm
Ammonia (NH_3)	0 ppm	0 ppm (SM4500-NH_3)

FINDINGS & RECOMMENDATIONS

Heating Floor:
V4

pH is good at 8.84.
Visible solids are good at < 30 ppm.
cPO_4 is good at 20 ppm.

1977 to 2025 - 48 Years of Service

Don Jason Manalac, Chemical Eng. Technologist

Delta CONTROLS

Generated On: 31-Oct-2025 3:47:16 PM

Site: SCRD

Points List

PACE Setter Gibsons (100)

Inputs

Object	Name	Configure	Calibration
BI1	PLC_Switch		
AI2	OAT TT	Temperature 10K -35-240 degF AIC (100.AIC1)	0
AI3	COMMON DIS PT	Pressure 4-20mA 0-500psi AIC (100.AIC12)	0
AI4	COMMON SUC PT	Pressure 4-20mA 0-200 psi AIC (100.AIC13)	0
AI5	ARENA1 CF TT	Temperature 10K -35-240 degF AIC (100.AIC1)	0
AI6	CHILLER OUT TT	Temperature 10K -35-240 degF AIC (100.AIC1)	-2.5
AI7	CHILLER IN TT	Temperature 10K -35-240 degF AIC (100.AIC1)	0
AI8	COMP1 AMPS IT	Current 0-5V (S-100-2 Range 2) 15-150 A AIC (100.	0
AI9	COMP2 AMPS IT	Current 0-5V (S-100-2 Range 1) 10-100 A AIC (100.	0
BI10	COMP1 ALARM		
BI11	COMP2 ALARM		
AI12	ARENA1 CF PUMP IT	Current 0-5V (S-100-1 Range 3) 5-50 A AIC (100.AI	0
AI13	ARENA1 CF PONY PUMP IT	Current 0-5V (S-100-1 Range 2) 2-20 A AIC (100.AI	0
AI14	COMP GLYCOL TT	Temperature 10K -35-240 degF AIC (100.AIC1)	0
AI15	COND PUMP IT	Current 0-5V (S-100-1 Range 1) 1-10 A AIC (100.AI	0
AI16	COND FAN IT	Current 0-5V (S-100-1 Range 3) 5-50 A AIC (100.AI	0

Outputs

Object	Reverse	Name	Configure
BO1	☐	ARENA1 CF PUMP RUN	
BO2	☐	COMP1 RUN	
BO3	☐	COMP2 RUN	
BO4	☐	SLAB COOLING PONY PUMP RU	
BO5	☐	ARENA1 HF PUMP RUN	
BO6	☐	SNOW MELT PUMP RUN	
BO7	☐	COMP GLYCOL PUMP RUN	
BO8	☐	COND PUMP RUN	
BO9	☐	COND FAN RUN	
AO10	☐	COND FAN VFD SPEED	
BO11	☐	HEAT FLOOR HG SOL	
BO12	☐	SNOW MELT HG SOL	
BO13	☐	DESUPERHEATER HG SOL1 & 2	
BO14	☑	SYSTEM ALARM	
BO15	☐	EMERGENCY_SHUTDOWN SW	
BO16	☐	DEHUM RUN	