SUNSHINE COAST REGIONAL DISTRICT

SUNSHINE COAST ARENA
REFRIGERATION PLANT

AMMONIA / BRINE CHILLER REPLACEMENT
&
REFRIGERATION PLANT 2019 UPGRADE

SPECIFICATIONS

5982 Shoal Way
Sechelt, BC
V0N 3A0

Prepared
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SECTION 1:
INTRODUCTION AND GENERAL DESCRIPTION

Sunshine Coast Arena is located at 5982 Shoal Way in Sechelt, B.C..

1) The Sunshine Coast Arena Chiller Replacement & Ice Plant 2019 Upgrades

The Sunshine Coast Arena chiller replacement & ice plant 2019 upgrade project includes the replacement of the existing shell & tube ammonia/brine chiller & the cold brine pump, the replacement of the existing York RW64A-717A compressor, the replacement of the two existing compressor oil separators, and the installation of a new high pressure ammonia storage receiver. The related piping and electrical upgrades are included in the work scope as well.

A new plate & frame ammonia / brine chiller packaged with a U-Turn surge drum is to be specified in the Specifications for this project.

A Mycom high efficiency N2M compressor is to be specified in the Specifications for the existing York RW64A-717A compressor replacement.

2) *Optional Refrigeration MCC Replacement, 3-Phase Power Field Wiring, Related Refrigeration Equipment Motor, and Control and Field Wiring Upgrade*

The three phase power supply from Hydro to the facility has been upgraded to 575V. It is converted to 480V by a transformer, then feeds to the refrigeration plant.

The existing refrigeration MCC and the major refrigeration equipment motors are with 480V/3Phase/60HZ power service.

The existing condenser water pump motor and compressor oil cooling glycol pump motor and related three phase power supply & disconnect switch with starter panels are with 575V/3Phase/60HZ power service.

The existing refrigeration equipment motors and refrigeration MCC are proposed to be upgraded for 575V service. A new refrigeration MCC is to replace the existing MCC.

The main power supply from the Hydro panel to the new refrigeration MCC is to be supplied and installed by the Contractor. The Contractor will hire an electrical engineer to provide the plant electrical review and design of the plant electrical distribution.

The bidders shall provide a separate additional price to supply and install the new

refrigeration MCC, the related refrigeration electrical motor upgrade, and the electrical field wiring. Price to include the electrical engineering.

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.

This specification documentation shall not be reproduced without the JS Refrigeration Engineering's permission.

Reference to the 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 Sunshine Coast Arena for the Sunshine Coast Regional District according to General Work Scope, Work Scope Item List and Conditions set in these specifications and 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, labor, tools, commissioning, and warranty for the project as per the specifications. All installations shall comply with codes, standards, and regulations listed herein. All installations shall be inspected and approved by Technical Safety BC (TSBC), WorkSafeBC (WCB), and Sunshine Coast Regional District.

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. Prepare 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 equipment & refrigerant disposal service as detailed in the Work Scope Item List.

2.1.9. Supply and install ammonia / brine chiller, cold brine pump, related piping, and electrical upgrade as detailed in the Scope of Work Item List.

2.1.10. Supply and install a new high pressure liquid ammonia storage receiver as detailed in the Scope of Work Item List.

2.1.11. Supply and install a new Mycom N2M compressor to replace the existing York RW64A-717A compressor as detailed in the Scope of Work Item List.

2.1.12. Supply and install plant safety upgrade as detailed in the Scope of Work

Item List.

2.1.13. Supply and install necessary electrical and control system upgrades of the new installed equipment for the refrigeration system operation.

2.1.14. Supply and install field wiring for new equipment power supply and control.

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

2.1.16. Supply and install necessary ammonia piping and brine piping as detailed in the P & I drawing.

2.1.17. Supply and install supports and hangers for new installed pipes and conduits if required.

2.1.18. Supply and install secondary supports, anchors, anchor bolts, concrete pad, and seismic restraints for new installed equipment.

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

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

2.1.21. Coordination of work with other trades, TSBC, WorkSafeBC (WCB), Refrigeration consultant, and the Sunshine Coast Regional District shall be included in the scope of work.

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

2.1.23. The Contractor is responsible for calling TSBC safety officer, WorkSafeBC (WCB) occupational hygiene officer, and electrical inspector and paying all the fees for the inspections.

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

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

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

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

labels.

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

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

2.1.30. Provide piping registration for any pressure piping larger than 3” NPS according to TSBC regulation.

2.1.31. Provide any required electrical, structural and other professional design, review reports, assurance letters.

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

2.1.33. Provide one year onsite labor and material warranty. Warranty starts from the project substantial completion day.

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

2.1.35. Check job site and dimensions during a site visit and confirm existing equipment, electrical panels, motors, controls, the existing main power supply, field wiring of the refrigeration system, and available installation space for new equipment before bidding.

This site visit is mandatory. The Sunshine Coast Regional District and the Engineer don't have the responsibility to provide detail information and site layout of the existing equipment and system.

2.1.36. Voltage

1. Power for three phase motors: 480V / 60HZ / 3PH

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

2.1.37. Bonds

See Sunshine Coast Regional District's requirement

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 shell and tube brine chiller and evaporative condenser into a certified portable HPR receiver. This portable tank shall be provided by the Refrigeration 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 shell and tube brine chillers to an approved portable brine tank. This portable tank shall be provided by the Refrigeration 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. Remove, demolish, and dispose the existing shell and tube brine chiller and related insulation.

5. Remove, demolish, and dispose the existing cold brine pump. The existing 20 HP VFD shall be handed over to the Owner.

6. Remove, demolish, and dispose the existing York compressor package.

2.2.2. Ammonia / Brine Chiller, Cold Brine Pump, Related Piping, and Electrical Upgrade

1. Confirm available space on site for the new equipment installation.

2. Provide final equipment layout based on new equipment.

3. Relocate the two power breaker and starter panels of the existing condenser water pump and compressor oil cooling glycol pump to make space for the new chiller installation.

4. Relocate any pipes and electrical conduits, which are in conflict with the new chiller installation.

5. Supply and install steel frame or concrete pad bases for the new installed equipment (plate and frame type ammonia / chiller with U-Turn surge drum and cold brine pump).

6. Supply and install stainless steel drip pans underneath each new installed ammonia / brine chiller, cold brine pump, control valves, and any in-insulated cold surface to catch condensate. The drip pan shall be sloped allowing for a single drain connection. Supply and install water drain tubes from the drip pans to drain.

7. Supply and install a new factory pre-packaged plate & frame ammonia/brine

(heat exchanger) chiller together with a U-Turn surge drum (supplied by Alfa Laval) as specified in the P & I drawing.

The chiller and the U-Turn surge drum package may need to be dis-assembled and re-assembled on site before the final equipment placement.

8. Supply and install an external oil pot and related piping as specified in the P & I drawing.

9. Supply and Install ammonia isolating valves, safety valves, float switch, pressure gauges, thermometers, temperature transmitters, liquid level gauges, level transmitter, level controller, solenoid valve, motorized liquid make-up valve, and other control valves for the new installed equipment as specified in the specifications and the P & I drawing.

10. Supply and install new ammonia piping for the new chiller and other new refrigeration equipment as specified in the specifications and the P & I drawing.

11. Supply and install a high ammonia level float switch and connect to the compressor safety protection.

12. The high level float switch shall be connected to building security system for remote safety alarming and monitoring.

13. Supply and install one new cold brine pump and new VFD drive as specified in the specifications and the P & I drawing.

14. Supply and install pipe support, hangers, and seismic restrains for new installed ammonia and brine pipes.

15. Supply and install new 6” Sch. 40 steel pipe cold brine supply and return mains, butterfly isolating valves, chiller brine vent & drain valves, and inline brine strainer and connect the new installed chillers and cold brine pump to the existing brine supply and return headers as specified in the specifications and the P & I drawing.

16. Supply and install solar powered thermometers on cold brine supply and return mains.

17. Supply and install new cold brine temperature transmitters (CBS and CBR) and other necessary sensors. The new installed sensors shall be wired to the existing control system for compressor stage control.

18. Supply and install brine pressure gauges at the new cold brine pump suction and discharge.

19. Supply and install flow switch for the cold brine line of the new chiller and wire to safety and control system.

20. Supply and install an (extra large brine bypass filter) system.

21. Supply and install an external brine filtering system during the system commissioning.
22. Supply and install brine mixing and charging valves.

23. Reconnect the existing balance tank to the new brine mains.

24. Supply and install a safety relief valve and piping for the brine system.

25. Supply and install thermal insulation on cold surfaces with temperature below dew point (new installed U-Turn surge drum, low temperature ammonia pipe lines and cold brine pipe lines).

26. Supply and install a standalone controller and related ammonia liquid level probe sensor for chiller ammonia level and makeup ammonia liquid feed control.

27. Confirm the existing power supply and power breaker of the existing cold brine pump. Supply and install new one if required.

28. Supply and install remote installed VFD with across the line starter bypass, and line reactors and power breaker for the new installed cold brine pump.

29. Supply and install new power wiring and control wiring for the new installed equipment and controls.

30. Supply and install new ammonia suction main and discharge main pressure transducers (if required) and wire to control panel if it is required.

31. New plate & frame ammonia/brine chiller performance data sheet must be submitted together with the tender document.

2.2.3. Supply and Install A New High Pressure Liquid Ammonia Storage Receiver

1. Provide concrete housekeeping pad for the new HPR vessel.

2. Supply and install a new horizontal high pressure receiver, related Jerguson flat sight glass liquid level gauge, isolating valves, safety pressure relief valves, bypass valve, equalizing valve, and related ammonia piping as specified in the P & I drawing.

The liquid ammonia high pressure receiver is to be installed, piped, and used as an ammonia storage vessel during the ice plant shut down period or the system service time period.

2.2.4. Supply and Install a Mycom N2M Compressor package (C-1) to Replace the Existing York Compressor package

Supply and install a new Mycom N2M compressor package to replace the existing York compressor package.

1. Supply and install a concrete housekeeping pad for the new compressor package.

2. Supply and assemble one new Mycom N2M reciprocating compressor package with a new 60 HP motor on a structural steel base.

3. Mount the new N2M compressor package on the concrete housekeeping pad.

4. Supply and install belt drive (new pulley, new belts, and any other necessary parts for both compressor and motor) and OSHA standard belt guard for the new compressor package.

5. Supply and install suction and discharge isolating valves, and related ammonia piping for the new compressor as specified in the P & I drawing.

6. Supply and install pressure relief valve and piping to the main relief header as specified in the P & I drawing.

7. Supply and install crankcase heater with thermostat for the new compressor package.

8. Provide initial charge of compressor oil for the new installed compressor before the refrigeration system startup. The total oil charge shall meet Mycom's requirement. The type of oil used for the new compressor shall be identical to the existing compressor.

9. Supply and install one Mypro-CP1A controller for the new compressor. Compressor mechanical safety points (temperature an pressure sensors) shall be connected to the controller.

Supply and install pressure sensors (gauges) for compressor suction, discharge, and oil pressures.

The Mypro-CP1A controller will monitor and control the operating parameters.

10. Provide and install automatic load control for the new compressor (3 stages, 0%, 50% and 100%). The 2M compressor shall have a special equalizing valve to confirm compressor is balanced when it unloads.

11. Supply and install a new HT Industrial / Chil-Con coalescing type oil separator for the new compressor as specified in the P & I drawing and the Specifications.

Supply and install new hot gas discharging piping line to connect the new compressor to the new oil separator.

Supply and install new hot gas discharging piping line with check valve and isolating valve to connect the new oil separator to the new hot gas discharge header.

Supply and install oil return piping line with control valve, isolating valve, and drainer valve to connect new compressor to the new oil separator.

Supply and install safety relief valve and related piping for the new oil separator.

12. Supply and install new three phase power field wiring from the existing MCC to the new installed compressor motor.

13. Supply and install control wiring for the new installed compressor and Mypro-CP1A controller.

14. Retain the existing glycol cooling loop and reconnect to the existing compressor oil cooling glycol supply and return pipe headers for the new compressors oil cooling as specified in the P & I drawing. The existing glycol solenoid valve, isolating valves, pressure gauges, thermometers, temperature control, and water piping shall be retained and reused.

15. Retain and reconnect the existing emergency water supply and return to the new compressor oil cooling loop.

16. Supply and install a new hot gas discharge header for the compressors.

2.2.5. Existing Mycom N8A Compressor (C-2) Upgrade

1. Supply and install a new HT Industrial / Chil-Con coalescing type oil separator to replace the existing one for the existing Mycom N8A compressor C-2 as specified in the P & I drawing and the Specifications.

Supply and install new hot gas discharging piping line to connect the new compressor to the new oil separator.

Supply and install new hot gas discharging piping line with check valve and isolating valve to connect the new oil separator to the new hot gas discharge header.

Supply and install oil return piping line with control valve, isolating valve, and drainer valve to connect new compressor to the new oil separator.

Supply and install safety relief valve and related piping for the new oil separator.

2. Supply and install one Mypro-CP1A controller and related field control wiring for the existing 60 HP MYCOM 8A (C-2) compressor to replace the existing gauge board control. Compressor mechanical safety points (temperature an pressure sensors) shall be connected to the controller. The Mypro-CP1A controller will monitor and control the operating parameters.*

Provide a separate additional price for C-2 compressor Mypro-CP1A installation and commissioning.

2.2.6. Plant Safety Upgrade

1. Provide a code calculation of the pressure relief header and stack size based on the capacity requirement for the new and the existing equipment.

2. Confirm and finalize the each individual relief valve and related relief pipe size to suit for the size of the existing 4" pressure relief header and stack.

3. Replace the existing individual relief valve and related relief pipe if required based on the code calculation.

4. Re-connect the properly sized individual safety relief lines to the existing pressure relief header.

2.2.7. Provide System Commissioning and Startup Service

1. After pressure test completed and approved by TSBC inspector, the Refrigeration 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. Supply and charge new ammonia to the refrigeration system.
The amount of ammonia charge must be confirmed on site based on the plate and frame brine chiller operating liquid level. The final ammonia charge shall be approved by the engineer.

4. Recharge the existing brine solution from the storage tank back to the new chiller and system.

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

6. Supply and add additional calcium chloride to bring to 1.2 specific gravity of the whole brine solution charge.

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

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

9. Provide test and reports for brine solution and ammonia. The test and reports

shall be provided by certified labs.

2.2.8. Scope of Work Item List – Optional Refrigeration MCC Replacement, 3-Phase Power Field Wiring, Related Refrigeration Equipment Motor, and Control and Field Wiring Upgrade

Provide a separate additional price.

1. Supply and replace all existing refrigeration equipment motors with new motors for 575V/3Phase/60Hz service.
(The condenser remote water pump and compressor oil cooling glycol pump have been upgraded to 575V/3Phase/60Hz service in the 2018 plant upgrade.)

2. Disconnect and dispose the existing refrigeration MCC panel.

3. The Contractor will hire an electrical engineer to provide the plant electrical review and design of the plant electrical distribution.

4. The Contractor shall provide fault study, short circuit study, and arc flash study for the related electrical system of the new MCC and the ice plant.
(These studies could be provided by the professional engineer from the new MCC supplier - Eaton Electrical Services & Systems)

5. Supply and install a new MCC for the refrigeration system motors as specified in section 5.

6. Supply and install 575V/3Phase/60Hz new main power supply cables, cable tray, and supports from Hydro panel to the new MCC.

7. Supply and install three phase field power wiring (power cable, conduit, and supports) from the new MCC starters to all the refrigeration equipment motors.

8. Supply and install three phase field power wiring (power cable, cable tray, and supports) from the new MCC power breakers to the remotely installed VFDs.

9. Supply and install 110V control power wiring from new MCC to refrigeration equipment, controls, safety devices, ammonia detector system, etc..

10. Reconnect safety controls of the refrigeration equipment (compressors, condenser, etc.) including high and low pressure cutouts, oil failure switches, high discharge temperature cutout, high level float switch, and etc..

11. Reuse and reconnect Honeywell brine and arena floor thermostats to control compressor operation and brine pumps. Provide related new control wiring.

12. Reconnect the existing floor temperature sensors.

13. Reuse and reconnect head condensing pressure controls to control condenser

operation. Provide related new control wiring.

14. Reuse and reconnect refrigeration plant emergency shutoff switch.

15. Provide a thermal imaging test for the electrical contacts & the new MCC, and submit related report after all the installation of MCC and field wiring completed.

16. Provide commissioning and startup service for the MCC, control, and plant safety.

SECTION 3:
SCHEDULE

1. Tender period: See Schedule provided by the Sunshine Coast Regional District.

2. Site visit: See Schedule provided by the Sunshine Coast Regional District.

3. Award work: See Schedule provided by the Sunshine Coast Regional District.

4. Site ready: See Schedule provided by the Sunshine Coast Regional District.

5. System start-up: See Schedule provided by the Sunshine Coast Regional District.

6. Substantial completion: See Schedule provided by the Sunshine Coast Regional District.

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, WCB regulations, and etc.) including but not necessarily limited to the following:

- CSA B52 - 18 Mechanical Refrigeration Code
- CSA B51-14 Boiler, Pressure Vessels and Pressure Piping Code
- ASME Boiler and Pressure Vessel Code, Section VIII Pressure Vessels, Div. 1 - 2017
- ASME B31.5 - 2016 Refrigeration Piping and Heat Transfer Components Code
- ASHRAE15 – 2016 Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants
- CSA C22.1 - 18 Canadian Electrical Code, Part I
- CSA C22.2 No. 0-10, Canadian Electrical Code, Part II
- CSA C22.2 No 14, Industrial Control Equipment
- 2012 BC Building Code
- 2012 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 units, heat exchangers (chillers), condenser, valves and other pressure containing components shall be with CRN and registered for use in B.C.

4.3. Provide Schedule B (Assurance of professional design and field review) for structural support of major equipment and ammonia piping system.

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

4.5. All work shall be site inspected and approved by TSBC safety officer, WCB occupational hygiene officer, City inspectors, and the Engineers.

4.6. Only experienced ammonia refrigeration contractors are qualified for bidding this project. The Contractor is required to provide at least three references with the

details of similar sized ice arena facility plate & frame brine chiller installation completed in the last five years.

4.7. Only qualified welders with certificate registered to TSBC will be allowed to do welding work. Welder's updated log book must be inspected by 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 TSBC.

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

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

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

4.12. The refrigeration system shall be commissioned by a qualified refrigeration mechanic with at least 5-year ammonia refrigeration experience.

4.13. Ammonia shall not be charged to the system until all the safety equipment and devices are in place and in function. The safety equipment and devices shall be inspected and approved by the TSBC safety officer.

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

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

SECTION 5:
MAJOR EQUIPMENT AND MATERIAL

5.1 Standards

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

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

5.2 Alternates

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

5.3 Major Equipment and Devices

5.3.1 Ammonia / Brine Chiller

New installed equipment (plate & frame chiller ammonia / brine Chiller package C/W U-Turn surge drum) shall be installed on a steel support frame stand base.

The height of the steel support frame stand shall satisfy the external oil pot and the cold brine pump installation.

5.3.1 Ammonia / Brine Heat Exchanger (Ammonia / Brine Chiller)

1. TK20 WB-FD Semi Welded Plate & Frame ammonia / brine Chiller package C/W U-Turn Surge Drum
Package is to be manufactured by Alfa Laval.

2. Chiller material and gaskets to be suitable for ammonia and CaCl2 application

3. Refrigeration Capacity: 110 TR

1) ammonia side
ammonia flow rate at full capacity : according to refrigeration capacity
9 F ammonia E.T.
85 F condensing

2) CaCl2 brine side
1.2 S.G.
flow rate: 950 USGPM 22% CaCl2 brine

13 degree F brine outlet temperature
inlet temperature: according to refrigeration capacity
Pressure drop: no more than 6.5 psig

4. Design Pressure (DWP)
250 psig ammonia side
150 psig brine side

5. The package shall be designed, constructed, and tested to ASME Sec VIII, Div 1, ASME B31.5, CSA B51 Code, and any other necessary codes and regulations.

6. The package shall be with CRN and registered for installation and operation in B.C.

7. The package shall be fabricated by a CSA certified shop. The package MDR's and other construction data reports need to be submitted to TSBC and approved by TSBC.

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

8. Acceptable manufacturers: Alfa Laval.

5.3.2 External Oil Pot

1. Size: 6” Dia x 24” OAL

2. Design Pressure (DWP)
250 psig

3. Oil pot shall be designed, constructed, and tested to ASME Sec VIII, Div 1, ASME B31.5, and CSA B51 Code.

4. Oil pot shall be with CRN and registered for installation and operation in B.C.

5.3.3 Cold Brine Pump

1. Capacity: 950 usgpm of 22% CaCl2 @ 33 psig discharge head, with 25 HP motor.

2. Base mounted, end suction, horizontal centrifugal pump construction, Open drive with flex coupling, coupling guard, manufacturer supplied drain pan, and steel base.

3. Pumps to be suitable for CaCl2 application, all iron construction C/W mechanical shaft seal and stainless steel shaft sleeves.

4. TEFC pump motor, 1775 rpm, 25HP, inverter duty, NEMA premium Energy efficient with 1.15 SF.

5. Accepted pump manufacturer and pump model: Armstrong model 4030 6x5x10 series.

5.3.4 Cold Brine Pump VFD

1. Supply and install new power feeder breaker, VFD pump motor drive with across line starter bypass, line reactors, controls, and field wiring for the 25 HP new pump motor. VFD shall be remotely installed.

2. Accepted VFD Manufacturer: ABB

5.3.5 High Pressure Ammonia Storage Receiver

1. Horizontal high pressure receiver
Size: 20” Dia x 4'-6” OAL

2. Design Pressure (DWP)
250 psig

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

4. Package 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. Contractor shall confirm the connection orientation based on site installation requirement.

8. Provide a 6” dia x 8” long oil drain leg.

9. The high pressure liquid outlet tube shall be positioned in line with the oil drain leg. The high pressure liquid outlet tube shall be extended into the oil drain leg.

10. The vessel shall be C/W support legs. The design and the support legs shall satisfy seismic and structural requirement.

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 gauges and indicate a full range of vessel liquid

level.

14. Acceptable manufacturers: Morfab or approved equivalent.

5.3.6. Compressor C1

Maker: Mycom
Model: N2M
Speed: 1255 rpm
Capacity: 43.6 TR, 50 BHP @ 9 F SST / 85 F SCT, 1255 rpm
Motor: 60 HP, 1800 rpm, 1.15 S.F., open drip proof (ODP)
NEMA premium Energy efficient with 1.15 SF.
Motors shall be squirrel cage induction type with CEMA design B construction.
Motors shall be manufactured by Baldor or approved equivalent

The Refrigeration Contractor shall consider 480V/3ph/60hz power service for the new 60 HP compressor motor of the based bid price.

The Refrigeration Contractor shall consider 575V/3ph/60hz power service for the new 60 HP compressor motor of the extra additional new MCC price.

1. Compressor shall include suction and discharge stop valves, suction and discharge thermometers, oil lubrication, crankcase heater with thermostat, replaceable cylinder liners, mechanical shaft seal, glycol headers and glycol cooled oil cooler, automatic 3 steps (0%, 50%, and 100%) of loading capacity control, and ammonia pressure relief valve.

2. Compressor ammonia pressure relief valve shall be sized according to CSA B52 and ASHRAE 15.

3. Compressor and motor shall be packaged on a solid structural steel base.

4. Belt drive and belt guard shall be included in the package. Belt guard shall comply with OSHA regulations.

The Refrigeration Contractor shall confirm with MYCOM regarding compressor speed to determine compressor and motor pulley size.

5. Provide a Mycom Mypro-CP1A controller for compressor safety and capacity control.

6. Compressor safety controls shall include the followings: compressor low pressure, compressor high pressure, compressor oil failure, compressor high temperature cutout, and chiller high level cutout.

6. A set of compressor tool kit shall be turned over to the owner at the end of the project.

5.3.7. Oil Separator for both Compressors C1 & C2

1. High efficient coalescing type oil separator, 99% efficient

2. The unit shall be sized to handle each compressor discharge gas flow at full capacity.

3. The unit shall be designed, constructed, and tested to ASME Sec VIII, Div 1, ASME B31.5, and CSA B51 Code.

4. The unit shall be with CRN and registered for installation and operation in B.C.

5. 250 psig DWP

6. Accepted Manufacturer: HT Industrial Ltd. /Chil-Con

5.3.8. Ammonia Valves

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

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

3. Valve shall be constructed with steel body. Valves 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 Engineer before the installation.

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

5.3.9 Ammonia Liquid Feed Solenoid Valve & Motorized Valve

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

2. Unit to be suitable for ammonia application.

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

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

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

6. The liquid feed solenoid valve shall be connected to both the level controller and an emergency responding system. This liquid feed solenoid valve shall be turned off remotely system if there is any emergency (a remote shut off switch shall be installed inside the fire box).

5.3.10 Ammonia Liquid Level Probe Transmitter and Level Controller

1. Unit to be suitable for ammonia application.

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

3. Capacitive liquid level probe

4. Liquid level wire probe is not acceptable

5. Level transmitter shall be wired to the standalone level controller.

6. The level controller shall be able to control solenoid valve and motorized valve to maintain proper chiller operating liquid level. Controller shall be programmed to stop the liquid feed when there is a high liquid level alarm, or system power failure, or plant emergency (such as fire alarm or ammonia leak).

7. Acceptable manufacturer:
Hansen liquid level sensor, R/S HBLT-C1 level Controller

5.3.11. Ammonia Liquid Level Flat Glass Gauge

1. Acceptable manufacturers: Jerguson or approved equivalent

2. Unit to have CRN number

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

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

5. Low temperature (P & F chiller) level gauge shall C/W frost-proof extension (shield).

5.3.12. Ammonia Float Switch

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

2. Unit to be suitable for ammonia application.

5.3.13. Ammonia Liquid Drainer

1. Acceptable manufacturer: Armstrong

2. Unit to be suitable for ammonia application at designed operation conditions.

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

4. All stainless steel material

5.3.14. Brine Valves

1. Acceptable manufacturer: Grinnell, Keystone, Bray

2. Butterfly valve - lug style with locking handle

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

5.3.15. Brine In-line Strainer

1. Acceptable manufacturer: Colton, Armstrong, Bray

2. 6" flanged Y strainer, or BF-125 basket strainer, or SG suction guides

3. Strainer material shall be suitable for CaCl2 brine application in the design operating temperature range (Cast iron or steel body with stainless steel screen is acceptable).

4. A 1/16" mesh screen shall be used during the startup. 1/8" standard perforated screen shall be installed to replace the 1/16" mesh screen after system startup.

5.3.16. Brine External Filteration System

1. Acceptable manufacturer: Harmsco

2. Model HIF multi-cartridge filtration product

5.3.17. Optional Refrigeration Motor Control Center (MCC)

1. The MCC is to be for 575V, 3 phase, 60HZ service.

2. The MCC is to be built to CSA, NEMA standard and Provincially approved.

3. The design and installation of the MCC shall be in compliance with Codes, Regulations, and the Provincial Building law for seismic requirements.

4. The MCC enclosure shall be NEMA Type 2 drip proof – indoor, fully gasketed employs a special roof panel with a drip shield. Closed cell neoprene material shall be used for the gasketing.
5. Provide a main power disconnect breaker on the MCC.

6. Provide soft starters and power factor correction capacitors for compressor motors. The power factor correction capacitors could be external mounted.

7. Provide one power feeder breaker on the MCC for each of the remotely mounted variable frequency drive (VFD) (for one cold brine pump motor and one condenser fan motor).

8. Provide across the line type starters for all other motors.

9. Provide a control power transformer and control power circuit section on MCC for control power supply for refrigeration equipment, controls, and other necessary safety system. Control power shall be 120/60/1.

10. Provide a control section with necessary pre-wired relays, timers, and indicating lights for the refrigeration equipment control.

11. Provide main horizontal three phase and neutral copper busing bars extending entire width of the MCC and have bracing and supports suitable to withstand short circuit current.

10. Provide a copper ground bus extending continuously to the entire width of the MCC.

11. Provide vertical copper bus and size for vertical section load and have bracing and supports suitable to withstand short circuit current.

12. Provide wiring gutter on the MCC. Wiring within the MCC will be contained in wiring troughs. Where wiring runs outside the troughs, it will be neatly bundled with nylon straps. All external connections will be brought to terminal blocks. All terminal blocks are to be accessible from the front of the MCC.

13. Enclosure shall be NEMA Type 2, drip-proof with gasketed doors, and separate compartment modules for each starter and feeder separated by steel barriers. Each module to house a combination starter, a MCP, relays with necessary contacts, a HOA selecting switch, and a transformer. Each module shall have individual access door.

15. Motor starters shall be combination type. Size and type shall be confirmed for different applications. All starters shall be equipped with MCP circuit 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.

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

17. The MCC supplier shall provide fault study, short circuit study, and arc flash study for the related electrical system and the MCC.

18. 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.

19. Each terminal shall be numbered.

20. Allow 25% spare power capacity of the MCC for the future plant expansion requirement.

21. It may take 60" (width) x 90" (height) x 21" (depth) space to install three (3) section MCC. The bidder shall confirm the dimensions with the final selection.

22. Acceptable MCC manufacturer: Cutler-Hammer or accepted equivalent

5.3.18. Motors for Refrigeration System

1. Motors shall be manufactured by Baldor

2. Power supply: 575V/3PH/60HZ

3. Contractor to check and confirm existing motor HP before ordering motors.

4. Motors shall be squirrel cage induction type with CEMA design B construction.

5. Motors shall be Super-E® premium efficient.

5. Compressor motors: 1800 rpm, 1.15 S.F., open drip proof (ODP), 60 HP.

6. Pump motors: 1800 rpm, 1.15 S.F., TEFC type, inverter duty, 25 HP.

7. Condenser fan motor: 1800 rpm, 1.15 S.F., TEFC or TEAO type, inverter duty, confirm HP on site.

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. 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.

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

8. 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 large:
ASTM A-120 Schedule 40 black steel

5.4.3. Water 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

5.4.4. 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, cadplated or hot dip galvanized steel.

5.4.6. Insulation

1. Insulation Material: TRYMER PIR (POLYISOCYANURATE) insulation

2. Blue-Skin Vapor Barrier

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	Surge Drum
INSULATION THICKNESS (INCH)	2	2	2	2	2	2	2	2	2	2	2	2-1/2	3

5.4.7. Electrical

1. Conduit: steel galvanized EMT or rigid conduit with reamed ends
screw type steel galvanized 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. Secondary Refrigerant

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

2. Calcium chloride solution to be 1.2 S.G.

5.4.10. Paint

1. Primer: Rustoleum enamel primer V769402

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

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, Code and Regulation requirement.

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

6.1.4. Install stainless steel drip pan and tube it to the drainage for the new plate & frame chiller and cold brine pump.

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

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

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

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

6.1.9. 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".

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

6.1.11. 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.

6.1.12. 1/16" gap is required between the fitting shoulder and pipe end for socket weld fitting welding.

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

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

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

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

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

6.1.18. Brine strainers shall be installed in front of plate & frame chiller and heat exchangers. Strainers are only allowed installed in horizontal runs of pipe.

6.1.19. If basket type or suction guide brine or glycol strainer is installed, it shall be installed on the suction side of related pumps.

6.1.20. Provide blow down valve on each strainer.

6.1.21. 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.

6.2.2. Hold the leak test pressure for 24 hours.

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

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

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

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

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

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

6.2.9. 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.

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

6.2.11. Break the system vacuum with anhydrous ammonia.

6.3. Brine Piping System Pressure Test

6.3.1. Pressure test the new installed brine piping system to 50 psig and hold for 24 hours.

6.4. Painting

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

6.4.2. A coat of primer and a coat of epoxy painting are 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 being 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 system commissioning.

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 operating liquid level.

6.8. CaCl2 Brine Charge

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

6.8.2. 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.

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

6.8.4. Brine solution of whole system shall satisfy 22%, PH, inhibitor level, visible solid level, and all other necessary requirement.

6.9. Insulation

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

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

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

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

6.9.5. Do not insulate control valves or strainer.

6.9.6. Do not insulate plate & frame heat exchanger (chiller).

6.9.7. Do not insulate brine pump and the external oil pot.

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

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

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

6.9.11. All insulation shall be jacketed with aluminum jacket.

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

6.10. Identification of System

6.10.1. 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.

6.10.2. Identify major equipment by self stick Lamacoid nameplates.

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

6.10.4. Provide any necessary system operation instruction and safety signs.

6.10.5. Provide any necessary signs of system name plate and signs.

6.10.6. Provide any necessary signs to indicate the main electrical disconnect switches, any remote control switches, any pressure limiting devices, each pressure vessel, the main shut-off to each vessel, and etc..

6.10.7. Pipe marker system shall be in compliance with IIAR guidelines for Identification of Ammonia Refrigeration Piping and System Components.

6.10.8. The signs, nameplates, instruction shall be in compliance with CSA B52 code, TSBC regulations, and WorkSafeBC regulations.

6.11 Electrical

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

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

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

6.11.4. Supply and install junction boxes for wiring and components.

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

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

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

6.11.8. Before energizing the system, thermography tests on the electrical feeders, circuits, panels, contacts, and the system are required. Any problems discovered are to be corrected by the Contractor. Final test report shall be provided to the Engineer.

6.12 Control of New Installed Chiller

6.12.1. The standalone liquid level controller shall be field wired and programmed in such a way that it is able to maintain the liquid level by controlling of liquid feed solenoid valve and motorized valve.

6.12.2. The high liquid level safety float switch shall be wired to both compressor safeties and control system. The high liquid level alarm shall be monitored both locally and remotely. It is recommended to be connected to building security system as well.

6.13 Control System

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

6.13.2. The standalone liquid level controller shall be field wired and programmed to control the solenoid and motorized ammonia liquid feed valve and chiller ammonia liquid level.

Control system shall monitor the chiller liquid level and be able to provide remote shut off of chiller liquid feed during any emergency situation.

6.13.3. The high liquid level safety float switch shall be wired to both compressor safeties and control system. The high liquid level shall be remotely monitored.

6.13.4. Supply and install new cold brine supply and return brine temperature transmitters and reconnect to the existing Honeywell controllers. The temperature transmitters shall be tested and calibrated on site.

6.13.5. The Refrigeration Contractor shall shall combine the new compressor control with the existing control system for the whole refrigeration system control.

6.13.6. The Refrigeration Contractor shall submit the cold brine pump VFD control procedure to the Engineer for approval. The VFD could be set at 50%, 75%, and 100% for capacity control.

5.13.7. Critical alarm points includes chiller high level, high discharge pressure, and compressor room ammonia concentrations.

6.14 The MCC Installation

6.14.1. The MCC Installation shall satisfy manufacturer's instructions and guidelines.

6.14.2. Provide service access and enough service space to the new installed MCC according to manufacturer's requirement, Code and Regulation requirement.

6.14.3. Place and secure the new MCC on a concrete pad.

6.15.4. Provide seismic restraints and anchorages for the MCC and power cable tray.

6.15 System Commissioning

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

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

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

6.15.4. After system commissioning completed, take brine samples.

6.15.5. The lab test reports of the brine samples shall be submitted to the Engineer and the Owner. The samples shall be tested at certified labs.

6.16 Inspections

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

6.16.2 Final inspection: The refrigeration Contractor shall call the Refrigeration Engineer, TSBC safety officer, WorkSafeBC occupational hygiene officer, and City inspector for a final inspection after the work 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 is any remaining deficiencies at that time.

6.17 Substantial Completion

6.17.1. 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 completed), WorkSafeBC occupational hygiene officer, City inspector, and the Refrigeration Engineer.

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

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

6.17.2 Substantial completion date: See Schedule provided by the Sunshine Coast Regional District.

6.18 Training and Instrumentation

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

6.18.2. Refrigeration knowledge training includes refrigeration basic, system description of this upgraded refrigeration plant, ammonia system safety issues and emergency response procedures.

6.18.3. Compressor room hands on training includes refrigeration equipment operation parameter setup, system start-up and shut-down, equipment daily maintenance, oil drain procedure, and manual air purging procedure.

SECTION 7: SUBMITTALS

7.1 Shop Drawings

7.1.1. The Contractor shall submit shop drawings and product data to the Engineer for review before any work commences. Shop drawings include but are not limited to the following: ammonia/brine chiller C/W U-turn surge drum, brine pump, new equipment assembly with steel support frame, high pressure receiver (HPR), New Mycom N2M compressor package, control panel, level sensor, control valves, wiring diagrams, control procedures, compressor room new equipment plan and elevation layout drawing, chiller liquid level column assembly details, secondary steel support, MCC, electrical and control wiring diagram, wall and roof penetration and seal details, etc.

7.1.2. Review of shop drawing doesn't relieve the 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 drawing shall be submitted to the Engineer after installation completed.

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

7.3 Manuals

7.3.1. Provide three hard copies and one electronic copy of system installation, operation and maintenance manuals to the 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 document, installation permit, TSBC inspection reports, and pressure test reports shall be included in the manual.

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

7.3.9. Pressure Vessel and chiller package equipment MDRs shall be included in the manual.

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

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

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

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

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

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

7.3.16. Fault study, short circuit study, and arc flash study report shall be included in the manual.

7.3.17. Any safety instruction for system operation, maintenance, and service.

SECTION 8:
APPENDIXES

1. Ammonia / Brine Chiller Performance Data Sheet Form
(It must be filled and submitted with the tender by the Contractor)

2. Test Report of the Existing Cold Brine Solution

Plate & Frame Brine Chiller Performance Data

Maker: M/N:

		Hot Side	Cold Side
Fluid		22% CaCl2	Ammonia
Mass flow rate	lb/h		
Fluid condensed/evaporated	lb/h		
Inlet temperature	°F		
Outlet temperature	°F		
Operating pressure (in/out)	psia		
Pressure drop	psi		
Velocity Connection (In/Out)	ft/s		
Heat exchanged	kBtu/h		
Mean Temperature Difference	°F		
Heat transfer coefficient (clean/service)	Btu/ft²,h,°F		
Relative direction of fluids			
Number of passes			
Number of plates			
Extension capacity			
Plate material / thickness			
Sealing material			
Ring gasket			
Connection liner material			
Connection diameter	in		
Nozzle orientation			
Pressure vessel code			
Design pressure	psi		
Test pressure	psi		
Design temperature (max/min)	°F		
Overall length x width x height	in		
Liquid volume	ft³		
Net weight, empty / operating / flooded	lb		

U-Turn Surge Drum

Maker: M/N:

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:**	January 17, 2019
		Attention:	Dean Totten
Address:	700 Park Road	**cc:**	
	Gibsons, B.C.	**E-mail:**	dean.totten@scrd.ca
	V0N 1V8	**Reference:**	**Sunshine Coast Arena ET-1**
Phone:	604-885-6800	**P.O.:**	**N/A**

CONSTITUENT	ET-1	Control Range
Sample Date	**January 15, 2019**	
Appearance	C/C	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)	-21.10	-5.0 °F or -20.5 °C Min
Visible iron	< 30 ppm	< 30 ppm
Complex Phosphate Inhibitor (cPO_4)	29 ppm	20/30ppm cPO_4 at 0.1% Z-5750 HC 10X
pH	10.28	8.50 to 9.50
Dissolved iron	< 10 ppm	< 10 ppm
Ammonia	0 ppm	0 ppm

FINDINGS & RECOMMENDATIONS

Cooling Floor:

pH is high at 10.28.
Visible solids are good at < 30 ppm.
cPO_4 is good at 29 ppm.

1977 to 2019 - 42 Years of Service | **Steve Johnson, Chemical Technologist**