SECTION 23 62 01 - ALTERNATE #1 CHILLER

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for water-cooled centrifugal chillers.

1.2 REFERENCES

A. Comply with the following codes and standards: AHRI 550/590, AHRI 575, NEC, ANSI/ASHRAE 15, OSHA as adopted by the State, ETL, ASME Section VIII.

1.3 SUBMITTALS

A. Submittals shall include the following:
   1. Dimensioned plan and elevation view, including required clearances, and location of all field piping and electrical connections.
   2. Summaries of all auxiliary utility requirements such as: electricity, water, air, etc. Summary shall indicate quality and quantity of each required utility.
   3. Diagram of control system indicating points for field interface and field connection. Diagram shall fully depict field and factory wiring.
   4. Manufacturer’s certified performance data at full load plus IPLV or NPLV.
   5. Installation and Operation manuals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the codes and standards in Section 1.2.

B. Chiller manufacturer plant shall be ISO 9001 and14001 Certified.

C. The chiller shall be factory tested at the manufacturer’s plant prior to shipment.

1.5 DELIVERY AND HANDLING

A. Chillers shall be delivered to the job site completely assembled and charged with refrigerant R134a and be shipped on skids with a weather resistant cover.

B. Comply with the manufacturer's instructions for rigging and handling equipment. Leave protective covers in place until installation.

C. Certifications: ETL/cETL Approval AHRI certified to Standard 550/590 The chiller shall meet or exceed the efficiency levels per ASHRAE Standard 90.1.

1.6 WARRANTY

A. 3 Years Entire Unit Parts and Labor warranty. The chiller manufacturer's warranty shall cover parts and labor costs for the repair or replacement of defects in material or workmanship for a period of three year from equipment startup or 18 months from shipment, whichever occurs first. Refrigerant warranty for three years.

1.7 MAINTENANCE

A. Maintenance of the chillers in accordance with manufacturer's recommendations as published in the installation and maintenance manuals shall be the responsibility of the owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design - Daikin WME Series, including the standard product features and all special features required per the plans and specifications.

B. Equal Products - York YMCA Series may be acceptable as an equal. Naming these products as equal does not imply that their standard construction or configuration is acceptable or meets the specifications. Equipment proposed "as equal", must meet the specifications including all architectural, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications.

2.2 UNIT DESCRIPTION

A. Provide and install as shown on the plans a factory assembled, charged, and tested water-cooled packaged centrifugal chiller. Chillers shall have no more than two oil-free, magnetic bearing, semi-hermetic centrifugal compressors (no exceptions). Each compressor shall have an integrated variable-frequency drive operating in concert with inlet guide vanes for optimized full and part load efficiency. On two-compressor units, the evaporator and condenser refrigerant sides and the expansion valve shall be common and the chiller shall be capable of running on one compressor with the other compressor or any of its auxiliaries inoperable or removed.

2.3 DESIGN REQUIREMENTS

A. General: Provide a complete water-cooled, semi- hermetic oil-free centrifugal compressor water chiller as specified herein. The unit shall be provided according to standards indicated in Section 1.2. In general, unit shall consist of one or two magnetic bearing, completely oil-free centrifugal compressors, refrigerant, condenser and evaporator, and control systems including integrated variable frequency drive, operating controls and equipment protection controls. Chillers shall be charged with refrigerant HFC-134a.

B. The entire chiller system, including all pressure vessels, shall remain above atmospheric pressure during all operating conditions and during shut down to ensure that non-condensables and moisture do not contaminate the refrigerant and chiller system. If any portion of the chiller system is below atmospheric pressure during either operation or shut down, the manufacturer shall include, at no charge:

1. A complete purge system capable of removing non- condensables and moisture during operation and shut-down.
2. A 20-year purge maintenance agreement that provides parts, labor, and all preventative maintenance required by the manufacturer's operating and maintenance instructions.
3. The manufacturer shall also include at no charge for a period of 20 years an annual oil and refrigerant analysis report to identify chiller contamination due to vacuum leaks. If the analysis identifies water, acid, or other contaminant levels higher than specified by the manufacturer, the oil and/or refrigerant must be replaced or returned to the manufacturer's original specification at no cost to the owner.
4. The manufacturer shall include a factory-installed and wired system that will enable service personnel to readily elevate the vessel pressure during shutdown to facilitate leak testing.

C. Performance: Refer to chiller performance rating.

D. Acoustics: Sound pressure for the unit shall not exceed the following specified levels. Provide the necessary acoustic treatment to chiller as required. Sound data shall be measured in dB according to AHRI Standard 575 and shall include overall dBA.

Octave Band								Overall (dBA)
63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	
41	57	66	71	73	71	82	70	83.9
							75% Load	79.4
							50% Load	78.4
							25% Load	80.3

2.4 CHILLER COMPONENTS

A. Compressors:
1. The unit shall utilize magnetic bearing, oil-free, semi- hermetic centrifugal compressors. The compressor drive train shall be capable of coming to a controlled, safe stop in the event of a power failure.
2. The motor shall be of the semi-hermetic type, of sufficient size to efficiently fulfill compressor horsepower requirements. It shall be liquid refrigerant cooled with internal thermal sensing devices in the stator windings. The motor shall be designed for variable frequency drive operation.
    a. If the compressor design requires a shaft seal to contain the refrigerant, the manufacturer shall supply a 20 year parts and labor warranty on the shaft seal and a lifetime refrigerant replacement warranty if a seal failure leads to refrigerant loss, or the chiller manufacturer shall assume all costs to supply and install a self-contained air conditioning system in the mechanical space sized to handle the maximum heat output of the open drive motor. The energy required to operate this air conditioning system shall be added to the chiller power at all rating points for energy evaluation purposes.

b. If the compressor/motor uses any form of antifriction bearing (roller, ball, etc), the chiller manufacturer shall provide the following at no additional charge:
c. A 20-year bearing warranty and all preventative maintenance as specified by the manufacturer's published maintenance instructions.
d. At start up a three-axis vibration analysis and written report to establish bearing condition baseline.
e. An annual three-axis vibration analysis and written report indicating bearing condition.

3. The chiller shall be equipped with a refrigerant cooled and integrated Variable Frequency Drive (VFD) to automatically regulate compressor speed in response to cooling load and the compressor pressure lift requirement. If a condenser water-cooled VFD is supplied, the manufacturer shall supply factory installed dual water filters with a bypass valve and pressure differential switch factory wired to the chiller control panel to indicate that a filter has clogged and requires service. The pressure differential switch shall also provide a separate dry contact which can be connected to the BAS system as a means of notifying operating personnel of the need to service the filters. If the condenser cooling circuit includes an intermediate heat exchanger, it must be of the brush cleanable shell and tube style. Brazed plate heat exchangers which cannot be field cleaned are not acceptable. Movable inlet guide vanes and variable compressor speed, shall provide unloading. The chiller controls shall coordinate compressor speed and guide vane position to optimize chiller efficiency.
4. Each compressor circuit shall be equipped with a 5% line reactor to help protect against incoming power surges and help reduce harmonic distortion.

B. Evaporator and Condenser:
1. Provide sufficient isolation valves and condenser volume to hold the full unit refrigerant charge in the condenser during servicing or provide a separate pumpout system and storage tank sufficient to hold the charge of the largest unit being furnished.
2. The evaporator and condenser shall be separate vessels of the shell-and-tube type, designed, constructed, tested and stamped according to the requirements of the ASME Code, Section VIII. The tubes shall be individually replaceable and secured to the intermediate supports without rolling.
3. The evaporator shall be flooded type with copper tubes rolled into carbon steel tubesheets. The evaporator shall have right-hand connections when looking at the unit control panel. The evaporator shall have dished heads with valved drain and vent connections. Water connections shall be grooved suitable for Victaulic couplings. The heads shall be carbon steel and the tubesheets shall be carbon steel. The waterside shall be designed for a minimum of 150 psig non-ASME code. The wall copper tubes shall be 0.025 in.

4. The condenser shall have rolled tube sheets. The condenser shall have left-hand connections when looking at the unit control panel. The condenser shall have dished heads with valved drain and vent connections. Water connections shall be grooved suitable for Victaulic couplings. The heads shall be carbon steel and the tubesheets shall be carbon steel. The wall copper tubes shall be 0.025 in. The waterside shall be designed for a minimum of 150 psig non-ASME code.
5. An electronic expansion valve shall control refrigerant flow to the evaporator. Fixed orifice devices or float controls with hot gas bypass are not acceptable because of inefficient control at low load conditions. The liquid line shall have moisture indicating sight glass.
6. Re-seating type spring loaded pressure relief valves according to ASHRAE-15 safety code shall be furnished. The evaporator shall be provided with single or multiple valves. The condenser shall be provided with dual relief valves equipped with a transfer valve so one relief valve can be removed for testing or replacement without loss of refrigerant or removal of refrigerant from the condenser. Rupture disks are not acceptable.
7. The evaporator vessel, including suction line and any other component or part of a component subject to condensing moisture (excluding the waterbox), shall be insulated with UL recognized 3/4 inch closed cell insulation. All joints and seams shall be carefully sealed to form a vapor barrier.
8. Provide factory-mounted and wired, thermal-dispersion water flow switches on each vessel to prevent unit operation with no or low water flow. Paddle and pressure differential type switches are not acceptable due to high rates of failure and false indications from these types of flow indicators.

C. Provide neoprene waffle-type vibration isolators for each corner of the unit.

D. Power connection shall be single-point to a factory-mounted disconnect switch. Switch shall be 65kAIC rated.

E. Chiller Control:
1. The unit shall have a microprocessor-based control system consisting of a 15-inch VGA touch-screen operator interface and a unit controller.
2. The touch-screen shall display the unit operating parameters, accept setpoint changes (multi-level password protected) and be capable of resetting faults and alarms. The following parameters shall be displayed on the home screen and also as trend curves on the trend screen:
    a. Entering and leaving chilled and condenser water temperatures
    b. Evaporator and condenser saturated refrigerant pressures
    c. Percent of 100% speed (per compressor)
    d. % of rated load amps for entire unit
3. In addition to the trended items above, all other important real-time operating parameters shall also be shown on the touch-screen. These items shall be displayed on a chiller graphic showing each component. At a minimum, the following critical areas must be monitored:
    a. Compressor actual speed, maximum speed, percent speed Evaporator water in and out temperatures, refrigerant pressure and temperature
    b. Condenser water in and out temperatures, refrigerant pressure and temperature

c. Liquid line temperature
d. Chilled water setpoint
e. Compressor and unit state and input and output digital and analog values

4. A fault history shall be displayed using an easy to decipher, color coded set of messages that are date and time stamped. The alarm history shall be downloadable from the unit's USB port. An operating and maintenance manual specific for the unit shall be viewable on the screen and downloadable.
5. All setpoints shall be viewable and changeable (multi- level password protected) on the touch screen and include setpoint description and range of set values.
6. Automatic corrective action to reduce unnecessary cycling shall be accomplished through preemptive control of low evaporator or high discharge pressure conditions to keep the unit operating through abnormal transient conditions.
7. The chiller shall be capable of automatic control of: evaporator and condenser pumps (primary and standby), up to 3 stages of cooling tower fan cycling control and a tower modulating bypass valve or cooling tower fan variable frequency drive.
8. The factory mounted controller(s) shall support operation on Alerton BACnet® network via BACnet IP.
9. The chiller shall be able to maintain operation during a momentary power loss event lasting up to 5 seconds when operated at standard AHRI load and lift conditions. The chiller shall be able to ride through this momentary power loss event without shutting down. Chillers not able to maintain operation during momentary power loss events lasting up to 5 seconds shall include a properly sized thermal storage tank to maintain temperature stability in the system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive chillers for compliance with installation tolerances and other conditions effecting performance and maintenance of chillers.

B. Examine proposed route of moving chillers into place and verify that it is free of interferences.

C. Verify piping roughing-in locations.

D. Verify branch circuit wiring suitability. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PIPING SYSTEM FLUSHING PROCEDURE

A. Prior to connecting chillers to water loops or after connections with the manual valves in the closed position, the piping shall be flushed with a detergent & hot water mixture to remove previously accumulated dirt and other organic.

B. During flushing any strainers in the system shall be examined periodically and cleaned when required. The flushing process should take no less than 6 hours or until the strainers when examined after each flush are clean. After flushing with the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.

3.3 WATER TREATMENT REQUIREMENTS

A. Both water loops shall be analyzed and treated by a professional water treatment specialist to ensure brazed plate heat exchanger longevity by keeping the water within the following parameters:

1.	Sulfates	Less than 200 ppm
2.	pH	7.0 – 9.0
3.	Chlorides	Less than 200 ppm
4.	Nitrate	Less than 100 ppm
5.	Iron	Less than 4.5 mg/l
6.	Ammonia	Less than 2.0 mg/l
7.	Manganese	Less than 0.1 mg/l
8.	Total Dissolved Solids (TDS)	Less than 1000 mg/l
9.	Hardness as $CaCO_3$	30 to 500 ppm
10.	Alkalinity as $CaCO_3$	30 to 500 ppm

Equipment manufacturer shall provide sample bottles and have analysis done at time of start-up of equipment. Owner is responsible for maintaining proper parameters.

3.4 INSTALLATION

A. Install chillers according to manufacturer's written instructions.

B. Install chillers plumb and level, and anchor housekeeping pads to building floor. Anchor chiller and vibration isolators to housekeeping pad.

C. Install vibration isolators according to isolator manufacturer's written instructions.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Install piping connections maintaining clearances for service and maintenance of chillers.

F. Install differential pressure switches across chilled-water and condenser-water connections.

G. Install flange connections at chillers.

H. Install flexible pipe connections for chillers mounted on vibration isolators.

I. Install MAIN shutoff valves at chiller inlet and outlet of both chilled-water and condenser-water connections.

J. Install BYPASS MAIN shutoff valves which can short-circuit chiller inlet to outlet of both chilled-water and condenser-water connections.

K. Install water strainers as required to the evaporator and condenser water systems.

3.5 ELECTRICAL CONNECTIONS

A. Install all necessary electrical wiring devices and services such as fused disconnect switches or circuit breakers to power each module, phase loss monitors. Install all wires and cables routing between each module and the master controller. Install electrical service to the master control panel. All wiring is done in the field and shall be according to local and national electrical codes where applicable.

B. Install and connect remote flow switches, temperature sensors, and remote chiller control panel.

C. Ground equipment.

D. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer’s published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B._

3.6 FIELD QUALITY CONTROL

A. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.7 CLEANING

A. Clean finishes to remove dust and dirt.

B. Touch up scratches in unfinished surfaces to restore corrosion resistance.

C. Touch up scratches in finished surfaces to restore finish.

3.8 START-UP

A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

B. Engage a factory authorized service representative to perform startup service. Verify water source for compliance with manufacturer's requirements for flow and temperature. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

C. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain the entire unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

3.9 DEMONSTRATION

A. Factory-Authorized Startup Services: Engage a factory-authorized service representative to supervise startup services performed by an independent mechanical contractor provided by the Owner, and to demonstrate and train Owner's maintenance personnel as specified below.

B. Train the Owner's maintenance personnel on procedures and schedules related to startup, shutdown, troubleshooting, servicing, and preventive maintenance.

C. Review data in the operation and maintenance manuals.

END OF SECTION