PART 1 - GENERAL

1.1 SECTION INCLUDES

1. Chiller package
2. Charge of refrigerant and oil
3. Controls and control connections
4. Chilled water connections
5. Refrigerant connections
6. Starters

1.2 RELATED SECTIONS

1. Section \_\_\_\_\_\_ Motors
2. Section \_\_\_\_\_\_ Vibration Isolation
3. Section 23 21 13 Hydronic Piping
4. Section 23 23 00 Refrigerant Piping
5. Section 23 21 23 Hydronic Pumps
6. Section 23 05 93 Testing, Adjusting, and Balancing for HVAC
7. Section 26 00 00 Electrical: Electrical characteristics and wiring connections

1.3 REFERENCES

1. ARI 550/590
2. ASHRAE 15 ‑ Safety Code for Mechanical Refrigeration
3. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Resigential Buildings
4. ASME SEC 8 - Boiler and Pressure Vessel Code
5. NEMA MG 1 - Motors and Generators
6. UL 465 - Central Cooling Air Conditioners
7. ARI 370
8. NFPA 70 – National Electric Code (NEC)

1.4 PERFORMANCE REQUIREMENTS

This section is based on specific selections of equipment. These selections relate to the selection of related equipment Section 23 21 23 Hydronic Pumps. In substituting equipment, ensure that performance selection criteria matches that specified or that the selection of related equipment is acceptable or is revised to suit.

1.5 SUBMITTALS FOR REVIEW

A. PCSB Bid Specification and Contactual requirements and general requirements of Section 01 31 00 Submittal Procedure.

B. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate valves, strainers, and thermostatic valves required for complete system.

C. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

1.6 SUBMITTALS FOR INFORMATION

A. PCSB Bid Specification and Contactual requirements and general requirements of Section 01 31 00 Submittal Procedure.

B. Submit manufacturer's installation instructions.

C. Manufacturer's Certificate: Certify that components of package not furnished by manufacturer have been selected in accordance with manufacturer's requirements.

1.7 SUBMITTALS AT PROJECT CLOSEOUT

A. PCSB Bid Specification and Contactual requirements and general requirements of Section 01 31 00 Submittal Procedure.

B. Operation and Maintenance Data: Include start‑up instructions, maintenance data, parts lists, controls, and accessories. Include trouble‑ shooting guide.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum twenty (20) years experience.

1.9 REGULATORY REQUIREMENTS

A. Provide certification of inspection for conforming to School Board Project Manager’s approval.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.10 DELIVERY, STORAGE, AND PROTECTION

A. Material and Equipment: Transport, handle, store, and protect products.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

C. Contractor shall store and protect units from physical damage.

D. Manufacturer’s techs shall assemble all loose components.

1.11 WARRANTY

A. Provide full one year manufacturer’s warranty on entire machine. Include all parts and labor including refrigerant.

B. Warranty: Include coverage for complete assembly including materials and labor.

1.12 MANUFACTURER’S AND MAINTENANCE SERVICE (BID ALTERNATE)

A. In addition to 1 year warranty, manufacturer shall provide manufacturer’s parts and labor and an OEM full maintenance service warranty in accordance with annual OEM service agreement. Agreement shall include years 1-5 and shall include but not be limited to the following:

1. 3 operating inspections per year and 1 annual shutdown inspection for each of 5 years.
2. Report of work performed
3. Oil analysis every 6 months
4. Oil analysis report
5. Repair work including parts and labor such as belts, filters, seals, etc.
6. Emergency service 24 hours a day 365 days per year. Response time shall be no more than 2 hours for emergency calls.
7. Coil cleaning of airside surface of coil
8. Preventative maintenance as recommended by factory
9. Lubricate as necessary
10. All parts and labor including refrigerant necessary for full warranty

1.13 MAINTENANCE MATERIALS

Per O & M manual

1.14 EXTRA MATERIALS

Per O & M manual

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Carrier (Pre-bid submittal required)
2. Trane (Pre-bid submittal required)
3. McQuay (Pre-bid submittal required)
4. York (Pre-bid submittal required)
5. Substitutions: Not permitted

2.2 MANUFACTURED UNITS

A. Provide factory assembled and tested air cooled liquid chillers consisting of compressors, ­condensers, evaporator, thermal expansion valve, refrigeration accessories, and control panel. Construction and ratings shall be in accordance with ARI 590.

B. Cabinet – Galvanized steel casing zinc phosphatized with electrostatically baked enamel finish.

C. Conform to ASME SEC 8 Boiler and Pressure Vessel Code for construction and testing of water chillers.

D. Conform to ASHRAE 15 code for construction and operation of water chillers.

E. Provide with coil guards.

2.3 HERMETIC COMPRESSORS

A. Scroll Compressors:

1) Unit: Direct drive, hermetic, 3500 RPM, fixed compression, scroll motor‑compressor with control panel.

2) Features: Automatic reversible oil pump, sump oil heater, oil level sight glass, oil charging valve, two point lubrication for each motor bearing, flooded lubrication for the journal and thrust bearings, check valve on scroll discharge port. Operating oil charge, suction and discharge shutoff valves, external vibration isolation.

3) Motor: Suction gas cooled, hermetically sealed, squirrel cage induction. High torque, two pole, with thermal overload protection for each phase.

4) Each compressor shall be equipped with vibration isolation.

5) Control panel: Factory mounted panel with separate starter and refrigeration control sections:

a) Starter section:

1. Non-fused molded case disconnect switch
2. Single point power connection and grounding lug
3. Control power transformer with fuse
4. Solid state overload relay for each compressor
5. Phase loss/reversal monitor
6. Cycle counter and hour meter per compressor

b) Refrigeration section:

1. Anti-recycle timer
2. Reset relay
3. Reset switch
4. Low and high pressure control
5. Motor winding temperature protection

c) Manual reset for compressor overload, high motor temperature, and low and high refrigerant pressure.

6) Sound Attenuation: None

2.4 SEMI-HERMETIC COMPRESSORS

N/A

2.5 OPEN COMPRESSORS

N/A

2.6 EVAPORATOR (COOLER)

A. Provide evaporator of shell and tube type, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral fins, rolled or silver brazed into tube sheets. Provide multiple refrigerant circuits on multiple compressor units.

B. Design, test, and stamp refrigerant side for 450 psig working pressure and water side for 150 psig working pressure, in accordance with ASME SEC 8.

C. Insulate with 0.75 inch minimum thick flexible closed cell polyvinyl chloride foam insulation with maximum K value of 0.28. Insulate all cold parts.

D. Provide water drain connection and thermometer wells for temperature controller and low temperature cutout.

E. Single pass ANSI type 316 stainless steel, brazed plate construction.

F. Incorporate 1 independent refrigeration circuit per compressor.

2.7 CONDENSERS

A. Coil shall be air cooled with integral subcooler, and shall be constructed of aluminum fins mechanically bonded to seamless copper tubes.

B. Design, test, and stamp refrigerant side for 450 psig working pressure in accordance with ASME SEC 8.

C. Tubes shall be cleaned, dehydrated, and sealed.

D. Provide 450 psig safety relief valve on condenser shell.

E. Fans: Condenser fans shall direct driven, reinforced polymer construction, shrouded axial type, statically and dynamically balanced with inherent corrosion protection. Fans shall be protected by coated steel wire safety guards.

F. Coil Coating: (Bid Alternate) Condenser coil shall be factory coated in accordance with the following requirements. Coated aluminum coil shall have a flexible epoxy polymer coating uniformly applied to all coil external surface areas without material bridging between fins and tubes. Coating process shall ensure complete coil encapsulation, including all fin edges. Coating shall have a thickness of 0.8 to 1.2 mil with top coat having a uniform dry film thickness from 1.0 to 2.0 mil on all external coil surface areas including fin edges. Coated coils shall have superior hardness characteristics of 2H per ASTM D3363-00 and cross hatch adhesion of 4B-5B per ASTM D3359-02. Impact resistance shall be up to 160 in./lb (ASTM D2794-93). Coated coil shall have superior impact resistance with no cracking, chipping, or peeling per NSF/ANSI 51-2002 Method 10.2.

G. Coating specification shall include the following requirements:

* 1. Complete immersion
	2. Thermal loss less than 1%
	3. No bridging
	4. Cathodic deposition
	5. Min. 5000 hours salt spray test per ASTM B117-90

2.8 REFRIGERANT CIRCUIT

A. Provide refrigerant circuits, factory supplied and piped. Refer to Section 15535.

B. Provide for each refrigerant circuit:

* 1. Liquid line solenoid valve and shutoff valve
	2. Filter dryer (replaceable core type)
	3. Liquid line sight glass and moisture indicator
	4. Thermal expansion for maximum operating pressure
	5. Charging valve
	6. Insulated suction line
	7. Discharge line check valve
	8. Compressor discharge service valve
	9. Pressure relief device

2.9 CONTROLS

A. Locate on chiller: Microprocessor with nonvolatile memory. Mount steel control panel, containing starters, power and control wiring, molded ­case disconnect switch, factory wired with single point power connection.

B. For each compressor, provide part winding starter, non‑recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection. All relay panels and controllers shall be solid state.

C. Provide devices on control panel face:

1. Compressor run lights
2. System start‑stop switch
3. Control power fuse of circuit breaker
4. Compressor lead‑lag switch
5. Demand limit switch

D. Provide safety controls with indicating lights arranged so any one will shut down ­machine and require manual reset:

* 1. Low chilled water temperature switch
	2. High discharge pressure switch for each compressor
	3. Low suction pressure switch for each compressor
	4. Oil pressure switch
	5. Flow switch in chilled water line
	6. Reverse rotation
	7. Relay for remote mounted emergency shut‑down
	8. Loss of refrigerant charge
	9. Thermal overload

E. Provide operating controls:

* 1. Multi‑step chilled water temperature controller which cycles compressor and activates capacity controls
	2. Five minute off timer prevents compressor from short cycling
	3. Part winding start timer
	4. Periodic pump‑out timer to pump down on chilled water flow and high evaporator refrigerant pressure
	5. Solenoid valve between heat recovery condenser and receiver to limit refrigerant level in condenser
	6. Load limit thermostat to limit compressor loading on high return water temperature
	7. Three phase monitor to protect unit by stopping compressor on phase loss, phase reversal, phase unbalance, or under voltage
	8. Hot gas bypass sized for minimum compressor loading on one compressor only, bypasses hot refrigerant gas to evaporator; or microprocessor control to operate down to a minimum of 19% full load
	9. Cycle counter and operating hour meter
	10. Unit shall be shipped with factory control and power wiring installed

F. Provide pre‑piped gage board with pressure gages for suction and discharge refrigerant pressures, and oil pressures for each compressor.

G. Provide alarm package with test button and indicating lights which indicate control circuit is energized and compressor is running, and will sound an audible alarm and light an indicating light upon detection of compressor malfunction, low chilled water temperature, or evaporator water flow failure.

H. For multiple units, provide remote mounted sequence panel to allow operation in parallel with lead‑lag switching.

2.10 PERFORMANCE

A. Air Cooled Water Chillers: Refer to attached schedule.

B. Conform to ARI 590 code for testing and rating of packaged water chillers.

2.11 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: Refer to attached schedule

B. Motor: NEMA MG1

C. Disconnect Switch: Factory mount non-fused disconnect switch

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service. Refer to Section 16180.

C. Align chiller on concrete foundations, sole plates, and sub‑bases. Level, grout, and bolt in place.

D. Install units on neoprene pad vibration isolation. Refer to Section 15245.

E. Provide connections to chilled water piping. Refer to Section 15510.

1) On inlet, provide:

* + 1. Thermometer well for temperature controller
		2. Thermometer
		3. Strainer
		4. Flow switch
		5. Flexible pipe connecter
		6. Pressure gage
		7. Shut‑off valve

2) On outlet, provide:

* + 1. Thermometer
		2. Flexible pipe connecter
		3. Pressure gage
		4. [Shut‑off] [Balancing] valve

F. N/A

G. N/A

H. Arrange piping for easy dismantling to permit tube cleaning.

3.2 MANUFACTURER'S FIELD SERVICES

A. Section 01 65 00 Product Delivery Requirements: Prepare and start systems.

B. Supply service of factory trained representative to supervise testing, dehydration and charging of machine, start‑up, and instruction on operation and maintenance to Owner.

C. Supply initial charge of refrigerant and oil.

**END OF SECTION**