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INSTRUCTIONS

FOR

CHILLER REPLACEMENT

AT

SOCASTEE HIGH SCHOOL

MYRTLE BEACH, SOUTH CAROLINA

PREPARED

BY

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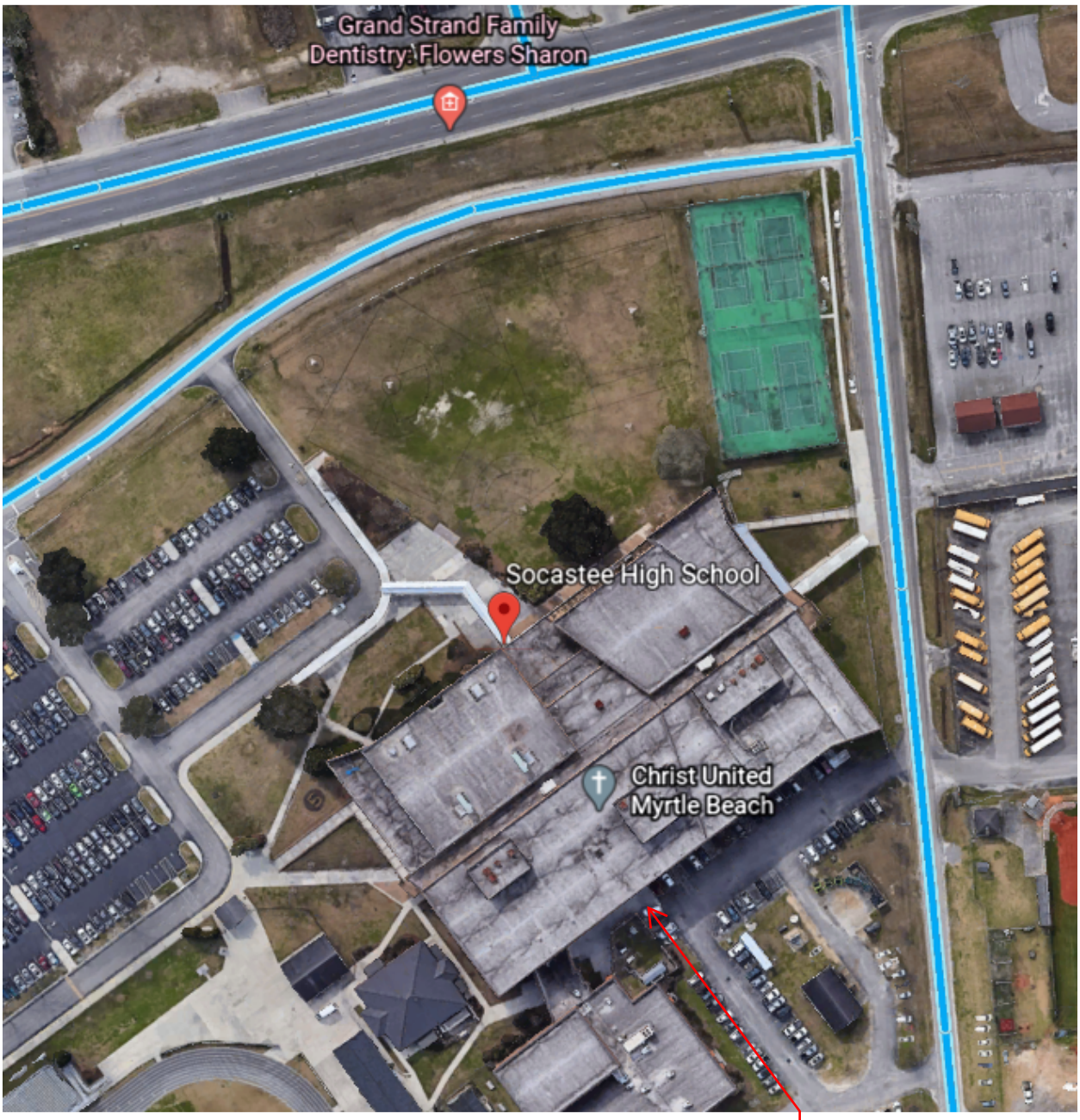
SOCASTEE HIGH SCHOOL CHILLER REPLACEMENT
Prepared by
McKnight Smith Ward Griffin Engineers
February 1, 2021

The scope of work consists of the replacement of an existing water chiller that provides chilled water for a system of terminal devices that cool Socastee High School located in Myrtle Beach, SC. The chiller is to be replaced with a new water chiller of similar type and capacity.



Existing chiller to be removed. Chiller is a York YKCDDDG4-CMD model.

Different view of chiller. Note service door where chiller will be accessed for removal.

Piping connections – End of Chiller opposite the Service Door

Piping connections Service Door End of Chiller

Scope of Work

Chiller shall be a Trane CVHE0400 or equal by preapproved manufacturer. Alternate manufacturers shall submit information for review seven days prior to bid date.

Disconnect existing condenser water piping and chilled water piping at the existing service valves and extend new piping to replacement chiller connections as required.

Modify existing concrete pad as required.

Re-establish interface with building automation system for proper chiller operation. Work will be done directly for HCS through CMI. Work will include replacement of the existing control valve.

Chemical treatment work shall be provided by Nalco Companies, LLC.

Reconnect to the existing power.

Provide factory startup of new chiller. Provide five-year parts, labor, and refrigerant warranty on the new machine.

Test and balance will be performed by the Owner.

Place isolation pads provided by the chiller manufacturer under the unit.

Furnish and install a flow switch with timer or equivalent device in both the chilled water and condenser water piping properly interlocked to ensure that unit can operate only when water flow is established.

Furnish and install taps for thermometers and pressure gauges in water piping adjacent to inlet and outlet connections of both evaporator and condenser.

Furnish and install drain valves to each water box.

Install vent cocks on each water box.

Furnish sufficient refrigerant 25.0 lb. per machine and dry nitrogen 50.0 lb. per machine for pressure testing under manufacturer's supervision.

Insulate evaporator and any other portions of machine required to prevent sweating under normal operating conditions.

Furnish and install vent lines for rupture disk and purge venting to atmosphere per ASHRAE 15 and unit installation manual.

Water Chiller

See performance information for the basis of design chiller at the end of the document.

The new chiller shall be a Trane CVHE0400 water chiller. Chiller shall be rated at 365 tons capacity with 53F entering water and 43F leaving water. Flow rate shall be 871.8 GPM with an evaporator pressure drop of 12.92 ft.

Provide direct drive multiple-stage compressor, multi-stage capacity control guide vanes. Shrouded aluminum alloy impellers dynamically balanced. Motor-compressor assembly balanced to .15 in./sec maximum vibration measured on motor and bearing housings. Refrigerant cooled, hermetically sealed, two-pole, squirrel cage induction motor. Two pressure lubricated bearings support the rotating assembly. A direct drive submerged oil pump motor to provide filtered and temperature-controlled oil to compressor bearings shall be furnished.

Evaporator-Condenser shells shall be carbon steel plate. Evaporator includes rupture disk per BSR/ASHRAE 15 Safety Code. Carbon steel tube sheets shall be drilled, reamed, and grooved to accommodate tubes. Tubes shall be individually replaceable externally finned seamless copper. Tubes shall be mechanically expanded into tube sheets. Eliminators are installed over entire length of the evaporator tube bundle. A multiple orifice control system maintains proper refrigerant flow. Condenser baffle prevents direct impingement of compressor discharge gas upon the tubes. Refrigerant side of the assembled unit shall be tested at both pressure (30.00 psi leak test) and vacuum. Water side shall be hydrostatically tested at one and one-half times design working pressure, but not less than 225 psi.

Furnish a flash economizer with no moving parts to provide power saving capability.

Furnish a purge system including an air-cooled condensing unit, purge tank, drier elements, and a pump-out compressor. The purge shall be designed with an activated carbon filtration system that includes an auto regeneration feature which results in automatic high-efficiency removal of noncondensibles from the chiller without manual carbon maintenance.

Furnish a microprocessor-based chiller control system that provides complete standalone system control and monitoring for the chiller. The controller shall be a factory mounted package including a full complement of controls to safely and efficiently operate the chiller, including oil management, purge operation, interface to the starter, and comprehensive motor protection including three phase solid state motor overload. Inlet and outlet water (fluid) temperature sensors located in the evaporator and condenser water box connections shall be provided.

The display shall be a touch sensitive diagonal color liquid crystal display (LCD) that uses color graphics and animation to ensure ease of use. The touch sensitive interface shall allow the operator to view the chiller graphically and receive a status indication via subsystem animations.

Automatic safety shutdown shall be provided for:

- Low chilled water temperature,
- Low evaporator refrigerant temperature
- High condenser refrigerant pressure
- Evaporator and condenser flow status
- Low evaporator/condenser differential refrigerant pressures
- Low oil pressure
- Oil pressure overdue
- High or low oil temperature
- High bearing oil temperature (requires enhanced protection option)
- High motor current
- High motor temperature
- Starter function faults
- Critical temperature and pressure sensor faults

Chilled water and condenser water pump relays shall be provided and for pump control.

Building automation system shall be mapped to pass all available BACnet direct points to the BAS for use by the owner.

All low temperature surfaces shall be covered with 3/4" Armaflex ll or equal (thermal conductivity=0.28 BTU/hr.-ft sq.), including the evaporator, water boxes and suction elbow. The economizer shall be insulated with 3/8" insulation.

Piping

Condenser and chilled water pipe shall be standard schedule 40 steel pipe as manufactured by Wheatland Tube or equivalent, ASTM A53, Type E, Grade B. Pipe shall be domestically produced.

Provide all piping and connections to all items of equipment as required to fully complete the system indicated, including drains and other connections. All piping shall be reamed or filed and cleaned to remove burrs and other obstructions.

The Contractor shall be responsible for installing all piping work in a neat workmanlike manner. This shall be interpreted to mean that all piping shall be neatly aligned, installed, and supported in equally spaced parallel runs using trapeze hangers where applicable, install square, true and plumb with walls, equipment or other related surfaces using standard fittings. Any pipe work installed in a disorderly or unworkmanlike manner as adjudged by the Architect shall be corrected by the Contractor at the Contractor's expense.

Piping and Pipe Work: Grade all piping properly to insure noiseless circulation of water without formation of pockets. Unless otherwise called for in the plans and specifications, horizonal pipe runs shall be graded to permit complete drainage of the system. Install eccentric reducers to change size of mains installed with eccentricity up to keep the top of mains level in the piping.

Welding: All welding of joints in piping connections done in the field shall be in accordance with the requirements of the American Standard Code for Pressure Piping. Welding may be either by Metal Arc-Welding Process of the Oxyacetylene Welding Process and in general conformance with procedures established in the latest edition of Appendix B to Section 6 of the ASA Code for Pressure Piping B31.1.

Welding fittings shall be used with welded piping. These shall be welding pattern in accordance with ASTM Specifications A-234 and ASA Standard B16.9. Such fittings shall be provided at all changes in direction or changes in pipe size except as hereinafter provided.

Fittings: Fittings in welded piping shall be standard weight welding fittings, with radii of 1-1/2" the diameter and equal to Tube Turns, Ladish, Taylor Forge or approved equal. See "welding" section for lateral connections and welding fittings standards.

During erection, care shall be taken to remove all dirt, scale, and other foreign matter from inside the piping before tying in long sections or installing valves.

All piping and equipment shall be thoroughly blown-out under pressure and clean of all foreign matter wasting condensate through temporary connections so long as necessary to thoroughly clean before system is placed in operation. Use every precaution to prevent pipe compound, scale, dirt, welding, and other objectionable matter getting into piping system and equipment.

All insulated piping shall be provided with insulating protection sheet metal saddles. These shall be 20-gauge galvanized iron. Saddles shall be of a length equal to two times the outside diameter of the insulation and

Pressure test all chilled water and condenser water piping at a pressure of 150 psig for 24 hours.

Insulation

Condenser water supply and return piping and chilled water supply and return piping shall be insulated with 2” thick heavy density fiberglass with an all-service jacket.

Insulation and surfaces to be insulated shall be clean and dry when insulation is installed and during the application of any finish.

All fiberglass pipe covering shall be furnished with self-seal lap and 3" wide butt joint strips. The release paper is pulled from adhesive edge, pipe covering closed tightly around pipe and self-seal lap rubbed hard in place with the blunt edge of an insulation knife. This procedure applies to longitudinal as well as circumferential joints. Under no circumstances will staples be allowed. Care shall be taken to keep jacket clean, as it is the finish on all exposed work. All adjoining insulation sections shall be firmly butted together before butt joint strip is applied, and all chilled water and service lines shall have vapor seal mastic thoroughly coated to pipe at butt joints every 21' and at all fittings. All fittings, valve bodies, unions, and flanges shall be finished as follows:

Apply molded or segmental insulation to fittings equal in thickness to the insulation on adjoining pipe and wire in place with 2#14 copper wires.

Apply a skim coat of insulating cement to the insulated fitting, if needed, to produce a smooth surface. After cement is dry, apply Owens-Corning Fiberglass Fitting Mastic, Type C, UL labeled.

Wrap the fitting with fiberglass reinforcing cloth overlapping the preceding layer by 1 to 2". Also, overlap mastic and cloth by 2" on adjoining sections of pipe insulation.

Apply a second coat of mastic over cloth, working it well into mesh of cloth and smooth the surface. Mastic to be applied at the rate of 40 square feet per gallon. All flanges and fittings on hot and cold lines in utility tunnels shall be insulated according to above. Omit insulation on flanges and unions over 60 degrees F. If painting is required, no sizing is necessary. To maintain the non-combustibility of the system only Glidden acrylic latex paint (#5370) is to be used.

All new pipe insulation shall be covered with an 8 oz. canvas jacket.

Product Data - Centrifugal Water Chiller
Item: B1 Qty: 1 Tag(s): CH-1

Centrifugal liquid chiller with 3 stage compressor
Compressor size: 400 nominal tons
Adaptiview controls
Without enhanced electrical package
Incoming line hertz: 60
Compressor motor voltage: 480 volt 3 phase
Compressor motor power: 234 kW
Motor frame size: 440E
Compressor impeller cutback: 240
Standard cooling
Evaporator shell size: 050 short
Evaporator bundle size: 580 nominal tons
Evaporator tubes: 0.75 inch (19.1 mm) dia. internally enhanced copper
Evaporator tube wall: .025 inch (0.6 mm) thick
Evaporator fluid type: Water
Evaporator waterbox type: Non-marine
Evaporator waterbox construction: Standard
Evaporator water box passes: Two pass
Evaporator waterbox pressure: 150 psig (1034 kPa)
Evaporator waterbox connection: Victaulic
Evap waterbox arrangement: in LH end - out LH end
Thermal dispersion flow switch (IFM) - Field Installed (Fld)
Condenser shell size: 050 short
Condenser bundle size: 500 nominal tons
Condenser tube: 0.75 inch (19.1 mm) internally enhanced copper
Condenser tube wall: .028 inch (0.7 mm) thick
Condenser shell construction: Standard
Condenser fluid type: Water
Condenser waterbox type: non-marine
Condenser waterbox construction: Standard
Condenser water box passes: Two pass
Condenser waterbox pressure: 150 psig (1034 kPa)
Condenser waterbox connection: Victaulic
Condenser waterbox arrangement: in RH end - out RH end
Standard tube sheet construction
Thermal dispersion flow switch (IFM) - Field Installed (Fld)
Orifice size: 450 nominal tons
Agency listing: U.L. listed unit (United States requirement)
Factory performance test: Standard air run and vibration test
Selection tolerance: AHRI Standard tolerance
Unit option: Insulation package
Extended Operation
BACnet
Tracer Internet Protccol
Without enhanced protection
With RuptureGuard-relief valve-field install (Fld)
R514 Refrigerant
Refrigerant Cooled AFD
Unit mounted refrigerant cooled adaptive frequency drive
Adaptive frequency drive maximum RLA: 405 amps
Starter power connection: Circuit breaker
Standard enclosure - Nema 1
5-Year Parts, Labor & Refrigerant Warranty

Performance Data - Centrifugal Water Chiller

Tags	CH-1
Primary cooling capacity (tons)	365.00
Primary power (kW)	204.70
Primary RLA (Incoming line) (A)	265.00
Minimum circuit ampacity (A)	***330.00***
Maximum overcurrent protection (A)	***500.00***
Compressor motor RLA (A)	283.30
Motor locked rotor amps (A)	1903.00
Actual motor voltage full load (V)	471.0
Actual motor frequency (Hz)	58.9
Primary efficiency (kW/ton)	***0.5610***
NPLV (kW/ton)	***0.3546***
Evaporator entering fluid temp (F)	***53.00***
Evaporator leaving fluid temp (F)	***43.00***
Evaporator fluid flow rate (gpm)	***871.80***
Evaporator pressure drop (ft H2O)	***12.95***
Evaporator fouling factor (hr-sq ft-deg F/ Btu)	0.000100
Evaporator fluid concentration (%)	0.00
Condenser entering fluid temp (F)	***85.00***
Condenser leaving fluid temp (F)	***94.77***
Condenser fluid flow rate (gpm)	***1050.00***
Condenser pressure drop (ft H2O)	***16.30***
Condenser fouling factor (hr-sq ft-deg F/ Btu)	0.000250
Condenser fluid concentration (%)	0.00
Refrigerant charge (lb)	600.0
Shipping weight (lb)	18367.0
Operating weight (lb)	20340.0
Unit center of gravity X (in)	25.000
Unit center of gravity Y (in)	45.000
Unit center of gravity Z (in)	54.000
Left Front isolator load (lb)	5174.0
Left Rear isolator load (lb)	3262.0
Right Front isolator load (lb)	7078.0
Right Rear isolator load (lb)	4826.0
Chiller heat rejected to ambient (MBh)	3.50
AFD heat rejected to ambient (MBh)	7.27
Evaporator maximum fluid flow rate (gpm)	1848.40
Evaporator pressure drop maximum flow (ft H2O)	50.91
Evaporator minimum fluid flow rate (gpm)	336.10
Evaporator pressure drop minimum flow (ft H2O)	2.10
Condenser maximum fluid flow rate (gpm)	1688.90
Condenser pressure drop maximum flow (ft H2O)	37.52
Condenser minimum fluid flow rate (gpm)	460.60
Condenser pressure drop minimum flow (ft H2O)	3.75
Compressor Weight (lb)	5418.0
Motor Weight (lb)	1832.0
Starter Weight (lb)	1680.0
Suction Elbow Weight (lb)	280.0
Economizer Weight (lb)	635.0
Evaporator Weight (lb)	4025.0
Evaporator Waterboxes Weight (lb)	630.0
Condenser Weight (lb)	2454.0
Condenser Waterboxes Weight (lb)	399.0
Miscellaneous Weight (lb)	1013.0