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ADDENDUM

ADDENDUM NO. [1] **Date: November 23, 2021**

RE: SCHOOL DISTRICT OF LA CROSSE
CENTRAL HS HVAC UPGRADES
1801 LOSEY BLVD SOUTH
LA CROSSE, WI 54601
HSR PROJECT NO. 21035

FROM: HSR Associates, Inc.
 100 Milwaukee Street
 La Crosse, WI 54603
 (608) 784-1830

To: Prospective Bidders

This addendum forms a part of the Contract Documents and modifies the original Bidding Documents dated November 2021. Acknowledge receipt of this Addendum in the space provided on the bid form. Failure to do so may subject the Bidder to disqualification.

This Addendum consists of [2] pages, [2] specification sections, and [3] 30 x 42 drawings.

PRE-BID MEETING SIGN-IN SHEET

1. See pre-bid meeting sign-in sheet attached hereto

CHANGES TO SPECIFICATIONS:

2. Section 23 09 93 SEQUENCE OF OPERATIONS
 - a. See the additional requirements added to the section described in 2a. and 2b. below.
 - b. Paragraph 3.12 COOLING TOWER CONTROL
 - i. Cooling tower sequence shall be capable of condenser water temperature reset within the range of 55-85°F entering the chiller.
 - c. Paragraph 3.14 CLASSROOM UNIT VENTS
 - i. Add actuators and control sequence for face & bypass dampers as noted below. Dampers shall be graphically displayed on BAS.
 - ii. Occupied Heating Mode:
If the space temperature falls below the heating setpoint and the changeover input has enabled heating, the Face and Bypass (F&B) damper shall modulate as required to maintain the heating setpoint. Whenever the damper moves from the full bypass position, the water valve shall be driven fully open by its valve actuator motor. The damper shall be controlled to prevent the discharge air temperature from rising above 140°F at any time. During heating, the fan shall operate at the lowest speed necessary to meet the space load conditions, and to minimize fan noise. If the load increases, the fan speed shall increase. When the load decreases and the space temperature rises, the fan speed shall be reduced. If the space temperature rises further, above the heating setpoint, the F&B damper shall move to the full bypass position and the heating valve shall be driven closed.

- iii. Occupied Cooling Mode:
If the space temperature rises above the cooling setpoint, and if the changeover input has enabled Cooling, the F&B damper shall modulate as required to maintain the cooling setpoint. Whenever the damper moves from the full bypass position, the water valve shall be driven fully open by its valve actuator motor. During cooling, the fan shall operate at the lowest speed necessary to meet the space load conditions, and to minimize fan noise. If the space load increases, the fan speed shall increase to meet the load as required. When the load decreases and the space temperature falls, the fan speed shall be reduced. If the space temperature falls further, below the cooling setpoint, the F&B damper shall move to the full bypass position and the water valve shall be driven closed.

3. Section 23 64 16 WATER COOLED CENTRIFUGAL CHILLERS

- a. Revised section attached hereto.
- b. Revised paragraph 1.06 WARRANTY
- c. Revised paragraph 2.02 I. FREQUENCY DRIVES AND STARTERS

4. Section 26 29 13 ENCLOSED CONTROLLERS

- a. Add new section to the project manual. New section attached hereto.

CHANGES TO DRAWINGS:

5. Sheet M600 HVAC SCHEDULES 30 x 42 sheet attached hereto

- a. Revised Centrifugal Chiller schedule to include chiller selection with VFD in lieu of starter.

6. Sheet E100 FIRST FLOOR BOILER ROOM PLAN 30 x 42 sheet attached hereto

- a. Plan 2/E100:
 - 1) Added Boiler emergency shut off switch.
 - 2) Added electrical connection to refrigerant monitoring panel.
 - 3) Identified location of BCP-1 & 2; VFD locations.
- b. Motor Schedule:
 - 1) Added motor starters (FVNR) starters for: P-7, 8, 9 and 10.
 - 2) Revised HVAC Equipment identifications.
 - 3) Revised starter column text.
 - 4) Revised motor schedule remarks.
- c. Motor Control Center Schedule MCCB:
 - 1) Revised starter sizes.
 - 2) Revised fusible switches.
 - 3) Revised remarks.
- d. Panelboard Schedule:
 - 1) Added circuit breakers.

7. Sheet E101 ELECTRICAL PLAN 30 x 42 sheet attached hereto

- a. Plan 4/E101:
 - 1) Indicated removal of Pump and air handler combination starter/disconnects.
- b. Plan 5/E101:
 - 1) Indicated locations of disconnects and starters for new motors and VFD units.
- c. Specific Notes: Sheet E101:
 - 1) Added notes 3. 4. and 5.

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SECTION 23 64 16

WATER COOLED CENTRIFUGAL CHILLERS

INDEX

PART 1: GENERAL	1	PART 2: PRODUCTS	4
1.01 RELATED DOCUMENTS	1	2.01 GENERAL	4
1.02 RELATED SECTIONS	1	2.02 WATER COOLED CENTRIFUGAL CHILLER	4
1.03 SUBMITTALS	1	2.03 REFRIGERANT MONITOR:	10
1.04 REGULATORY REQUIREMENTS	2	PART 3: EXECUTION	10
1.05 DELIVERY, STORAGE, HANDLING AND EQUIPMENT ROOM REQUIREMENTS	2	3.01 INSTALLATION	10
1.06 WARRANTY	3	3.02 MANUFACTURER'S FIELD SERVICES	11
1.07 MAINTENANCE SERVICES	3	3.03 MECHANICAL EQUIPMENT ROOM VENTILATION	12
1.08 VERIFICATION OF CAPACITY AND EFFICIENCY	3	3.04 CODE REQUIREMENTS	12
1.09 EQUIPMENT START-UP	3		

PART 1: GENERAL

1.01 RELATED DOCUMENTS

- A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.
- B. The requirements of Section 23 05 00 apply to this Section.

1.02 RELATED SECTIONS

- A. Section 23 09 93 – Sequence of Operation
- B. Section 23 95 00 – Refrigerant Detection and Alarm

1.03 SUBMITTALS

- A. Submit in accord with Section 01 30 00.
 1. Shop drawings and descriptive product data describing all material furnished under Part 2 of this Section.
- B. Acceptable refrigerants on which chiller performance is based are HFO-514A and HFO-513A. All proposals for chiller performance must include an AHRI approved selection method for the specified refrigerants.
- C. Submit drawings indicating assembled dimensions, operating weight, load distribution, and required service and access clearances.
- D. Submit product data indicating options and specialties, electrical requirements, and wiring diagrams and connections. Indicate accessories, valves, strainers, and thermostatic valves required for the complete system.
- E. Submit rigging, installation, and startup procedures. Include operations and maintenance data for both the chiller and starter or variable-speed drive. Include location, size, and type of field piping connections.
- F. Submit performance data indicating energy input versus cooling load output from 100 to 25 percent of full load with constant entering condenser water temperature.
- G. Submit compressor and product data in table form indicating impeller speed (RPM), number of bearings, type of bearings, high speed impeller shaft RPM, sound pressure level per AHRI 575-2008 (dB), number of stages, number of sets of inlet guide vanes, amount of refrigerant charge (lb), and amount of oil required (gal).

1.04 REGULATORY REQUIREMENTS

- A. Conform to AHRI Standard 550/590 code for rating and testing of water chillers.
- B. Conform to UL 1995 for Safety for Heating and Cooling Equipment.
- C. Conform to ANSI/ASME SECTION VIII Boiler and Pressure Vessel Code for construction and testing of centrifugal chillers as applicable.
- D. Conform to latest revision of ANSI/ASHRAE STANDARD 15 code for construction and operation of centrifugal chillers.
- E. Unit shall bear the AHRI Certification Label for the specific type of water chiller as applicable.
- F. Chiller manufacturer shall provide LEED-NC EA Credit Calculation for each chiller utilizing the following factors as specified by the U.S. Green Building Council based upon equipment life of 25 years:
 - 1. Next Generation Refrigerants

	R-513A Chillers	R-514A Chillers
ODP	1	1
GWP	573	1.75
Annual Leakage Rate	2.0%	2.0%
End of Life Ref. Loss	10%	10%

- 2. Chiller must ship with low-GWP, next generation refrigerant such as R-513A or R-514A.

1.05 DELIVERY, STORAGE, HANDLING AND EQUIPMENT ROOM REQUIREMENTS

- A. Comply with manufacturer's installation instructions for rigging, chiller loading, local transportation requirements, unloading, storage, and final setting.
- B. Protect chiller and controls from physical damage. Leave factory shipping covers in place until installation. The entire unit must be shrink wrapped with an environmentally recyclable material standard. The material shall include an imbedded desiccant to minimize/eliminate internal moisture.
- C. The chiller shall ship with a dry nitrogen charge to eliminate potential charge loss during delivery and construction. The refrigerant must be shipped separately from the chiller. The refrigerant monitoring system shall be active at the job site prior to the charging of the chiller.
- D. The chiller should ship with a full charge of oil.
- E. Equipment Room Requirements
 - 1. Follow minimum standards for refrigeration systems as required by the latest revision of ANSI/ASHRAE Standard 15, paying special attention to requirements for air monitoring, ventilation, self-contained breathing apparatus, and leak detection to assure the safety of chiller plant operating personnel.
 - 2. Install proper outside exhaust of chiller refrigerant relief device(s), discharge header(s), and purge unit(s). Route exhaust to the outside of the building and away from all air intakes in compliance with the latest revision of ANSI/ASHRAE Standard 15.
 - 3. Per ASHRAE Standard 147, medium pressure units with relief valves only shall have rupture discs in series with relief valves to minimize refrigerant leakage.

4. Field-install as required a refrigerant monitor that can be calibrated for appropriate refrigerant(s), capable of detecting concentrations of minimum ppm for low-level leak detection to assure the safety of chiller plant operating personnel.
5. Field-install as required suitable audible and visual alarms that activate well below the Acceptable Exposure Level (AEL) of the specific refrigerant(s) to alert persons inside and outside of the equipment room that a refrigerant leak condition exists.
6. Storage: Per ASHRAE Standard 147, positive pressure units must have a pumpdown capability that isolates the refrigerant charge for storage in a suitable vessel. If pump down capability does not exist, then the charge must be removed during long idle periods.

1.06 WARRANTY

- A. Provide a standard unit parts and labor warranty for one year from startup or 18 months from shipment, whichever occurs first.
- B. The original equipment purchase shall provide an optional refrigerant warranty for the duration of the 1st year. This warranty will provide for replacement refrigerant, if needed and if the reason for refrigerant loss is found to be a defect in material or workmanship, to restore a unit to the proper refrigerant charge. Replacement parts and labor to add the refrigerant are not covered under this warranty.
- C. Beginning at the expiration of the standard warranty, the original equipment owner shall be provided optional extended warranties.
 1. These warranties shall include:
 - a) Compressor parts and labor for Years 2-5.

1.07 MAINTENANCE SERVICES

- A. All inspections and service of units shall be accomplished by factory trained and authorized servicing technicians.
- B. All labor for leak checking the chiller according to the manufacturer's IOM and documentation must be included.
- C. In conjunction with and supporting Factory warranty OEM shall furnish complete factory authorized service and maintenance for applied chillers for 1 year(s) from the Date of Substantial Completion. All work shall be done by manufacturer's commercial warranty agent.
- D. OEM shall provide and report quarterly, semiannual, and annual maintenance in compliance with or better than ASHRAE Standard 180-2008.
- E. Include maintenance items as recommended in manufacturer's operating and maintenance data.
- F. Submit copy of service call work orders and summary report to the owner, including description of work performed, operating performance status and noted exceptions.

1.08 VERIFICATION OF CAPACITY AND EFFICIENCY

A. PERFORMANCE TOLERANCES

1. The following allowable tolerances must be followed:
 - a) The tolerance on allowable capacity must be as defined by AHRI Standard 550/590.
 - b) The IPLV/NPLV and full load tolerances are as defined by AHRI Standard 550/590, and the tolerances at full load and all part load test points must also be as defined by AHRI Standard 550/590 if applicable.

1.09 EQUIPMENT START-UP

- A. Provide system start-up; the equipment manufacturer's representative will provide supervision and be in attendance during unit start-up.

1. Equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation. Submit four copies of a written startup report following the initial start up to be included to O&M manuals. Include in the report: work done to the system, all readings taken, a statement certifying that the unit(s) have been placed in proper running condition as recommended by the manufacturer and as intended in the drawings and specifications

PART 2: PRODUCTS

2.01 GENERAL

- A. Semi-hermetic, water-cooled, direct-drive centrifugal chillers that shall use HFO-514A.
- B. Description: Factory-assembled and tested water chiller complete with compressor, evaporator, condenser, controls, starter or variable frequency drive, interconnecting unit piping and wiring, indicating accessories, and mounting frame. Performance shall be per specification section 3.03 schedule.
- C. The contractor shall furnish and install centrifugal water chillers as shown and scheduled in the plans and specifications. The units shall produce the specified tonnage per the scheduled data in accordance with the latest revision of AHRI 550/590. The unit shall bear the AHRI certification label as applicable.
- D. Unit shall be painted in accordance with the manufacturer's standard procedures and practices.

2.02 WATER COOLED CENTRIFUGAL CHILLER

- A. Based on product by TRANE.
 1. Trane CenTraVac model CVHF
 - a) Carrier, Daikin and York equals, are approved alternates.
- B. Unit to be of model, type, size and capacities listed in schedule on Drawings.
- C. COMPRESSOR AND MOTOR.
 1. The compressor shall be centrifugal with single or multiple stages.
 2. Low or medium pressure refrigerant machines shall be provided when available.
 3. Chiller should be able to unload to 25.00 % of design tonnage with constant entering water temperature. The minimum unloading point shall be able to be demonstrated if a factory performance test is required. The machine shall be modified to include hot gas bypass if the minimum load cannot be met.
 4. Compressor assembly shall be vibration tested at the factory. Vibration shall not exceed 0.15 inches per second at full load design compressor speed as measured on the motor housing. The test data shall be recorded and provided to the customer for approval.
 5. The motor shall be hermetic and either suction or liquid refrigerant cooled. Hot gas motor cooling is not acceptable.
 6. If an open motor design is used, then the manufacturer shall provide and install a complete chilled water air handling unit (AHU) with a capacity equal to 0.9% of the chiller's tonnage to serve the chiller area, which must be completely operational and include all wiring and automatic temperature controls. The open motor chiller manufacturer must also increase chiller size by an equivalent tonnage with no increase in specified full load kW, and shall list, on the submittal, additional maintenance requirements due to alignment, refrigerant shaft seal, coupling and bearings. Additionally, if an open drive motor is provided, a motor-compressor shaft seal leakage containment system shall be provided with the following inclusions:
 - a) An oil reservoir shall collect any oil and refrigerant that leaks past the seal.

- b) A float device shall be provided to open when the reservoir is full, directing the refrigerant/oil mixture back into the compressor housing.
 - c) Manufacturer shall warrant the shaft seal, reservoir, and float valve system against leakage of oil and refrigerant to the outside of the chiller for a period of 10 years from initial start-up, including parts and labor to replace a defective seal and any refrigerant required to trim the charge to original specifications. Inspections shall be performed a minimum of once a year. See Section 1.05 for more information in warranty.
7. Motors shall have winding 100 ohm platinum RTDs for temperature sensing on each phase. Thermistors and thermal overloads are not acceptable. These temperatures shall be furnished to the unit control panel for monitoring and alarm.
 8. Manufacturers with speed increasing transmissions shall not exceed 10,000 RPM compressor speeds and shall annually inspect the gears and all bearings. A report shall be forwarded to the owner each year over the first five years to confirm completion.
 9. If the manufacturer uses electronic (i.e. magnetic) bearings a 10 year warranty on all chiller compressor capacitors must be provided
 10. The impellers shall be fully shrouded and made of a high strength aluminum alloy. Impellers shall be dynamically balanced and over-speed tested at 1.25 times impeller shaft speed.

D. EVAPORATOR (CHILLER BARREL)

1. The evaporator and condenser shall be built in accordance with ANSI/ASHRAE 15-2001 Safety Code for Mechanical Refrigeration and ASME section VIII as applicable.
2. Evaporator tubes shall be internally and externally enhanced with a 1.00" outer diameter. The tubes shall be securely supported at intermediate supports and physically expanded into both ends of the tube sheets. The evaporator tubes must also be removable from both ends to provide easy access for tube cleaning.
 - a) The minimum evaporator tube wall thickness, root-to-root across the entire tube length shall be 0.025". It is unacceptable to provide this thickness at the intermediate supports only.
3. The evaporator water piping connections shall be grooved.
4. The evaporator waterboxes shall be standard non-marine type with connections per the schedule.
5. Supply and return head waterboxes shall be designed for a working pressure of 150 psi and shall be factory hydrostatic pressure tested at 150 percent of the design pressure. Provide drain and vent connections in water boxes.
6. No unit insulation is required at the time the chiller is shipped from the factory.
7. Units with multi-stage compressors shall incorporate an interstage flash vessel "economizer". All units with single stage compressors shall have the condensers circuited for liquid subcooling and be provided with a thermometer well to monitor the amount of subcooling.
8. Adjustable or float type refrigerant metering devices and thermal expansion valves shall be inspected and adjusted by the manufacturer at the end of each year for the first five years of operation to assure equivalent reliability and maintenance to a fixed orifice system. A written report shall be forwarded to the owner each year to confirm completion.

E. CONDENSER

1. The condenser shall be built in accordance with ANSI/ASHRAE 15-2001 Safety Code for Mechanical Refrigeration and ASME section VIII as applicable.

2. Condenser tubes shall be internally and externally enhanced with a 0.75" outer diameter. The tubes shall be securely supported at intermediate supports and physically expanded into both ends. The condenser tubes must also be removable from both ends to provide easy access for tube changeouts or tube cleaning.
 - a) The minimum condenser tube wall thickness, root-to-root across the entire tube length shall be 0.028". It is unacceptable to provide this thickness at the intermediate supports only.
3. The condenser water piping connections shall be grooved.
4. The condenser waterboxes shall be standard non-marine type with connections per schedule.
5. Supply and return head waterboxes shall be designed for a working pressure of 150 psi and shall be factory hydrostatic pressure tested at 150 percent of the design pressure. Provide drain and vent connections in water boxes.

F. REFRIGERANT

1. Acceptable Refrigerants on which chiller performance is based are low-GWP, next generation refrigerants such as R-513A or R-514A.
2. Refrigeration Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from the chiller to remote systems.
 - a) See Section 1.04 for additional details on refrigerant shipment.
3. Refrigerant Flow Control: Fixed orifice plates at the entrance and exit of the economizer shall be used to control refrigerant flow.
4. Low pressure chillers: Chillers that operate at low pressures must have a high efficiency purge system to ensure that any potential non-condensable leakage into the vessel is immediately eliminated. The purge run time shall be monitored by the main unit controller to act as a leak detector if required, and must have the following specifications:
 - a) The manufacturers of low pressure machines must provide a purge system. Acceptable purges are the Trane EarthWise Purge.
 - b) The purge efficiency must meet ASHRAE Standard 147-2002.
 - c) The purge shall be capable of operating when the chiller is idle in accordance with ASHRAE Standard 147-2002.

G. ELECTRICAL

1. Chiller shall be installed, wired, and functionally tested at the factory before being shipped.
2. Single point power connection - A control power transformer internal to the motor controller/frequency drive and of sufficient size to power all chiller mounted auxiliary loads shall be supplied. No separate power connection shall be required for chiller mounted equipment. The CPT shall tap from the main power connection.
3. Terminal blocks are numbered to match the wiring diagram must be included.

H. CONTROLS

1. The chiller shall be controlled by a unit mounted, stand-alone Direct Digital Control (DDC) system. A dedicated chiller microprocessor control panel is to be supplied with each chiller by the chiller manufacturer.
2. Enclosure shall be unit mounted NEMA 250 Type 1.
3. The chiller manufacturer shall include a pressure, non-mechanical based flow switch that is of the thermal dispersion type for each evaporator and condenser to verify flow through the unit.
4. A color, touch sensitive liquid crystal display (LCD) shall be unit mounted and a minimum of 12.1" diagonal. The display shall be fully adjustable in height and viewing angle. Animated graphical representations of chiller subsystem operation shall be used to enhance the user interface.

5. Display shall consist of a menu driven interface with easy touch screen navigation to organized sub-system reports for compressor, evaporator, condenser, purge and motor information as well as associated diagnostics. The controller shall display all active diagnostics and a minimum of 20 historical diagnostics.
6. The chiller control panel shall provide control of chiller operation and monitoring of chiller modules, sensors, actuators, relays and switches. The chiller control panel shall include controls to safely and efficiently operate the chiller.
7. Control authority must be capable of handling at least four conditions: Off, local manual at the chiller, local automatic at the chiller and automatic control through a remote source.
8. Capability to connect a laptop to service utility with applicable software from manufacturer and obtain enhanced set-up and diagnostics.
9. The front of the chiller control panel shall display the following in clear language, without the use of codes, look-up tables, or gauges:
 - a) Run time.
 - b) Number of starts.
 - c) Current chiller operating mode.
 - d) Chilled water set point and set point source.
 - e) Electrical current limit set point and set point source.
 - f) Entering and leaving evaporator water temperatures.
 - g) Entering and leaving condenser water temperatures.
 - h) Saturated evaporator and condenser refrigerant temperatures.
 - i) Evaporator and condenser refrigerant pressure.
 - j) Oil tank temperature.
 - k) Oil tank pressure.
 - l) Oil pump discharge pressure.
 - m) Differential oil pressure.
 - n) Compressor motor current per phase.
 - o) Compressor motor percent RLA.
 - p) Compressor motor voltage per phase.
 - q) kW energy consumption and power factor.
 - r) Compressor motor winding temperatures per phase.
 - s) Purge operating mode.
 - t) Purge operating status.
 - u) Time until next purge run.
 - v) Daily pumpout - 24 hours.
 - w) Average daily pumpout - 7 Days.
 - x) Purge refrigerant compressor suction temp.
 - y) Purge liquid temp (chiller condenser saturated refrigerant temperature).
 - z) Daily pumpout limit/alarm.
10. The chiller control panel shall provide password protection of all setpoints.
11. The controller shall have the ability to display all primary sub-system operational parameters on dedicated trending graphs. The operator must be able to create up to 6 additional custom trend graphs, choosing up to 10 unique parameters for each graph to trend log data parameters simultaneously over an adjustable period and frequency polling.
12. The chiller control panel shall provide individual relay outputs to start/stop the evaporator and condenser water pumps. The condenser water pump relay output can be used to enable the cooling tower temperature controls.
13. The chiller control panel shall provide leaving chilled water temperature reset based upon return water temperature.
14. The chiller control panel shall be capable of displaying system data in I-P or SI units.

15. Safeties - the chiller control panel shall provide the following safeties:
 - a) Low chilled water temperature.
 - b) Low evaporator refrigerant temperature or pressure.
 - c) High condenser refrigerant pressure.
 - d) Evaporator and condenser water flow status.
 - e) Low oil pressure.
 - f) Low oil temperature.
 - g) High oil temperature.
 - h) High motor winding temperatures.
 - i) High motor current.
 - j) Starter/VFD function faults.
 - k) Sensor faults.
 - l) Unit controls operation.
 - m) The chiller control panel or starter shall incorporate advanced motor protection to safeguard the motor throughout the starting and running cycles from the adverse effects of:
 - 1) Current phase loss.
 - 2) Current phase unbalance.
 - 3) Current phase reversal.
 - 4) Under/Over voltage.
 - 5) Motor current overload.
 - 6) Distribution fault protection with auto restart consisting of three-phase current sensing devices that monitor the status of the current.
 - 7) Starter contactor fault protection.
 - 8) Starter transition failure.
16. The chiller control panel shall provide evaporator freeze protection and low limit control to avoid low evaporator refrigerant temperature trip-outs during critical periods of chiller operation. Whenever this control is in effect, the controller shall indicate that the chiller is in adaptive mode. If the condition exists for more than 30 seconds, a limit warning alarm relay shall energize.
17. The chiller control panel shall be capable of providing short cycling protection.
18. The chilled water controller of each chiller shall include variable water-flow capability to allow the chiller to respond quickly to accelerating or decelerating water, and have the following features:
 - a) The variable water-flow compensation capability shall allow control of the leaving chilled water temperature to within +/- 1.0°F (0.6°C) at a water flow rate change of 10% per minute and will stay online at a water flow rate change of 30% per minute.
19. The chiller, upon power loss restoration, must be able to start the compressor within 60 seconds. The chiller time to fully load up to 80% shall be no longer than 5 minutes. The manufacturer shall supply documentation to support their ability to do this.
 - a) If the documentation is not adequate, the manufacturer must demonstrate this in the factory on an AHRI certified loop.
 - b) See FREQUENCY DRIVES AND STARTERS for more information on restart demonstration.
20. The chiller control panel shall provide hardwire connections for the following binary and analog signals:
 - a) Compressor Running.
 - b) Detection by the panel of a fault requiring manual reset.
 - c) Chiller operation at maximum capacity.
 - d) Chiller operation in condenser limit mode and thereby requesting condenser water temperature relief.

21. The chiller control panel shall provide an analog 2 - 10VDC or 4 - 20mA output signal that shall indicate the Compressor Motor Percent RLA.
22. The chiller should have a condenser pressure output signal of 0 - 10VDC or 4 - 20mA that may be used for head pressure control if required.
23. The chiller control panel shall allow for an analog input for a chilled water setpoint and an electrical current limit set point. These setpoints can be in the form of 4-20 mA or 2-10 Vdc signals from a remote source (i.e. generic building automation system).
24. The chiller controller shall communicate directly to Trane Tracer control panel
25. The unit mounted chiller controller must be able to communicate directly to a building automation system using a BACnet IP (Ethernet) link.

I. FREQUENCY DRIVES AND STARTERS

1. LOW VOLTAGE VARIABLE FREQUENCY DRIVE (VFD), UNIT MOUNTED
 - a) The centrifugal water chiller shall be furnished with a liquid cooled variable frequency drive (VFD) as shown on the drawings. The VFD shall be factory mounted on the chiller and shipped completely factory assembled, wired and tested.
 - b) The VFD will be specifically designed to interface with the centrifugal water chiller controls and allow for the operating ranges and specific characteristics of the chiller. The VFD control logic shall optimize chiller efficiency by coordinating compressor motor speed and compressor inlet guide vane position to maintain the chilled water setpoint while avoiding surge. If a surge is detected, VFD surge avoidance logic will make adjustments to move away from and avoid surge at similar conditions in the future.
 - c) The VFD efficiency shall be 97% or better at full speed and full load. Fundamental displacement power factor shall be a minimum of 0.96 at all loads.
 - d) The VFD shall be solid state, microprocessor based pulse-width modulated (PWM) design. The VFD shall be voltage and current regulated. Output power devices shall be IGBT transistors.
 - e) Power semi-conductor and capacitor cooling shall be from a liquid cooled heatsink.
 - f) The centrifugal water chiller shall be furnished with a refrigerant cooled variable frequency drive (VFD) to minimize maintenance and maximize cooling efficiency. If a water cooling design is used, especially an open loop condenser water design, a cleanable shell and tube heat exchanger must be supplied. Plate and frame heat exchangers are not allowed. The VFD shall be factory mounted on the chiller and shipped completely factory assembled, wired and tested.
 - g) The VFDs shall each be furnished in a Nema 1 metal enclosure having as minimum a short circuit current rating (SCCR) of 65,000 amps per UL 508. It will include three phase input lugs plus a grounding lug for electrical connections, output motor connection via factory installed bus bars and all components properly segregated and completely enclosed in a single metal enclosure.
 - 1) Enclosure shall include a padlockable, door-mounted circuit breaker with shunt trip and AIC rating of 65,000 amps.
 - 2) The entire chiller package shall be UL/CUL listed.
 - h) The VFD shall be tested to ANSI/UL Standard 508 and shall be listed by a Nationally Recognized Testing Laboratory (NRTL) as designated by OSHA.
 - i) The VFD design shall include a standard integrated active rectification control system to limit total demand distortion (TDD) in current at the VFD to less than or equal to 5% as measured at the VFD input, in compliance to recommendations stated in IEEE 519-1992.
 - 1) If optional active or passive filters are used to meet the less than or equal to 5% TDD, then the losses associated with the filter shall be included in the chiller performance on the selection (adjust penalties accordingly).
 - 2) If a remote mounted filter is used to meet the less than or equal to 5% TDD, then the losses associated with the filter shall be included in the chiller performance on

- the selection (adjust penalties accordingly). Additionally, the remote filter must be brought in and tested along with the chiller for all applicable tests.
- 3) If a remote mounted filter is used and is required to be tested, the contractor is responsible for all associated installation costs of the remote filter for testing.
 - j) Input shall be nominal 460. V, three phase, 60. Hz AC power, +/- 10 percent of nominal voltage.
 - k) Motor frequency range 38-60 hertz.
 - l) The VFD shall include the following features:
 - 1) All control circuit voltages are physically and electrically isolated from power circuit voltage.
 - 2) 150% instantaneous torque available for improved surge control.
 - 3) Soft start, adjustable linear acceleration, coast-to-stop.
 - 4) Insensitivity to incoming power phase sequence.
 - 5) Adjustable current limiting and U.L. approved electronic motor overload protection.
 - 6) Output line-to-line short circuit protection.
 - 7) Line-to-ground short circuit protection.
 - 8) Protection from phase loss at VFD input.
 - 9) Protection from phase reversal/imbalance.
 - 10) Protection from over/under-voltage.
 - 11) Protection from over-temperature.
 - m) The following VFD status indicators shall be available to facilitate startup and maintenance:
 - 1) Input line voltage.
 - 2) Output/load amps.
 - 3) Fault.
 - 4) Output speed in hertz and rpm.
 - 5) Input line kW.
 - 6) Average current in percent RLA.
 - 7) Load power factor.
 - 8) VFD transistor temperature.
 - n) Service Conditions - at full output power:
 - 1) No external venting or heat exchangers shall be required.
 - 2) Operating ambient temperature of 32°F - 104°F (0°C - 40°C).
 - 3) Room ambient up to 95% relative humidity.
 - 4) Elevation up to 3300 feet (1000 meters). For every 300 feet (90 meters) above 3300 feet, the rated output current shall be decreased by 1%.

2.03 REFRIGERANT MONITOR:

- A. Provide a refrigerant monitor and sensors as required by ASHRAE 15R.
 1. See Section 23 95 00 for detailed requirements.
- B. The monitor shall be compound specific with a measurement and display range of 0-1000 ppm.
- C. The monitor must be calibrated for the refrigerant and specified with a display accuracy of ± 1 ppm. Display output shall be in parts per million.
- D. Three alarm levels shall be provided, each with a front panel light and a latching binary contact closer to communicate with the Building Automation System under Section 23 09 93.
- E. Also provide a 4-20 Ma analog output signal to BAS to provide a remote indication of the refrigerant level in the equipment room.

PART 3: EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Provide for connection to electrical service. Include for connection of oil pump if required.
- C. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit.
- D. Furnish and install necessary auxiliary water piping for oil cooling units if required.
- E. Chiller vibration isolation and the base type (i.e. floor pad) will be in accordance with ASHRAE Handbook, 1995, HVAC Applications, Chapter 43 Table 42.
- F. Relief Valve: Size as recommended by manufacturer. Extend refrigerant relief discharge full size to exterior, as per Wisconsin State Refrigeration Code. Cover end with a bird screen. Relief valve discharge shall be 20'-0" from any intake or exhaust opening and shall be 15'-0" above the roof or adjacent structural members within 20'-0". Include drip pan and drain piping with relief valve from interior locations.
- G. Chilled water and condenser water piping shall be arranged with flanges to permit easy removal to service unit tube bundles; install thermometers on inlets and outlets.
- H. Insulate all portions of chiller, etc., not factory insulated, including tube sheet supports.

3.02 MANUFACTURER'S FIELD SERVICES

- A. All Startup, maintenance and monitoring functions shall be performed by a manufacturer's commercial agent to confirm, (in writing), that equipment has been correctly installed and passes specification checklist prior to equipment becoming operational and covered under OEM warranty.
- B. The manufacturer shall furnish complete submittal wiring diagrams of the chiller(s) starter(s) and associated components like cooling towers, pumps, interlocks, etc. as applicable for field maintenance and service.
- C. Earthwise Service Extension - Comprehensive startup, training, physical inspection, and remote monitoring are required to maintain specified performance and efficiency of the chiller system and to confirm like new condition prior to the equipment finishing its warranty.
 - 1. EXECUTIVE COORDINATION - Prestart instructions and coordination is to be provided by senior lead technician or supervisor to:
 - a) Review installation checklist with installing contractor.
 - b) Review startup procedures and required support.
 - c) Review training requirements, timing and logistics with the installing contractor.
 - 2. STARTUP - Provide all labor and materials to perform the startup. This shall be done in strict accordance with manufacturer's specifications and requirements.
 - a) Provide a complete log of all operating parameters.
 - b) Assure actual performance matches with submittals and computerized selection programs for other than submittal conditions.
 - c) Submit a hard copy of the service report and logs.
 - 3. TRAINING - Provide a minimum of four hours of training that is a combination of classroom and hands on instruction.
 - 4. INSPECTIONS - For the duration of the warranty, during operation, there shall be inspections in 3 month intervals, to perform the following:
 - a) Check the general operation of the unit.
 - b) Provide a complete log as in item 2 above.
 - c) Check operation of the control circuit.
 - d) Check operation of the lubrication system.
 - e) Check operation of the motor and starter.
 - f) Analyze the record data. Compare the data to the original design conditions.
 - g) Review operating procedures with operating personnel.
 - h) Do one oil analysis and submit the written report. Change the oil and filter as required in the published manufacturer's literature.

- i) Complete all recommended maintenance and tests as documented in the manufacturer's published literature.
 - j) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies.
 - k) At the final inspection (performed within 30 days of warranty expiration), assure that the chillers are functioning correctly and that all warranty items are resolved to the customer's satisfaction.
5. CENTRAL MONITORING - Provide remote monitoring through the building EMCS system as follows:
- a) Critical alarm monitoring.
 - b) Automated alarm routing and notification of local Trane field office service personnel.
 - c) Routine verification of communications link.
 - d) Archived documentation of critical events history.
 - e) Automated alarm activity reports.

3.03 MECHANICAL EQUIPMENT ROOM VENTILATION

- A. The building automation system shall be tied to the Mechanical Equipment Room ventilation system to provide control of both normal and purge ventilation of the Mechanical Equipment Room. This control shall be in parallel to the primary control of the ventilation fans by the refrigerant monitor.

3.04 CODE REQUIREMENTS

- A. The Mechanical Room leak detector shall indicate in parts per million.
- B. Post a permanent sign indicating name and address of installer, refrigerant R designator and quantity and type and amount of oil in the Mechanical Room.
- C. Label all refrigerant piping.
- D. Provide a schematic drawing of the refrigerant piping system.
- E. Provide emergency shutdown procedures, precautions to observe in event of a leak. Include the name, address and day or night telephone numbers for obtaining service and the fire department telephone number on the card or sign.
- F. Register the system on the required State form.

END OF SECTION 23 64 16

SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1: GENERAL

1.01 WORK INCLUDED

- A. Manual motor starters.
- B. Magnetic motor starters.
- C. Combination magnetic motor starters.

1.02 RELATED WORK

- A. Section 26 05 29 – Hangers and Supports for Electrical Systems.
- B. Section 26 05 26 – Grounding and Bonding of Electrical Systems.

1.03 REFERENCES

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- B. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- C. NEMA AB 1 - Molded Case Circuit Breakers.
- D. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- E. NEMA KS 1 - Enclosed Switches.

1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Section 01 30 00.
- B. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
- C. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.
- D. Submit manufacturers' instructions under provisions of Section 01 30 00.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Section 01 70 00.

PART 2: PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS

- A. Cutler-Hammer
- B. General Electric
- C. Siemens
- D. Square D.
- E. Substitutions: Under provisions of Section 01 60 00.

2.02 MANUAL MOTOR STARTERS

- A. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, toggle operator.
- B. Enclosure: ANSI/NEMA ICS 6; Type 1.

2.03 MAGNETIC MOTOR STARTERS

- A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Full Voltage Starting: Non-reversing type.
- C. Coil Operating Voltage: 120 volts, 60 Hertz.
- D. Size: NEMA ICS 2; size as shown on Drawings.
- E. Overload Relay: NEMA ICS 2; melting alloy.
- F. Enclosure: NEMA ICS 6; Type 1.
- G. Combination Motor Starters: Combine motor starters with disconnecting means, type as scheduled.
- H. Auxiliary Contacts: NEMA ICS 2; two field convertible contacts in addition to seal-in contact.
- I. Indicating Lights: NEMA ICS 2; RUN: green in front cover.
- J. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.
- K. Control Power Transformers: 120 volt secondary, in each motor starter.

2.04 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

- A. Molded Case Thermal-Magnetic Circuit Breakers: NEMA AB 1; circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

PART 3: EXECUTION

3.01 INSTALLATION

- A.** Install motor control equipment in accordance with manufacturer's instructions.
- B.** Select and install heater elements in motor starters to match installed motor characteristics.
- C.** Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION

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CENTRAL STATION AIR HANDLING UNITS (23 73 23)														
MARK	MANUFACTURER'S MODEL NO.	SERVING/ LOCATION	CFM	EXT S.P.	% O.A.	FAN RPM	SIZE	TYPE	DRIVE	COILS	MOTOR HP	VOLTPH	ACCESSORIES/ OPTIONS	REMARKS
AHU-7	UGCA-12	Admin Area	5700	1.5	14	1126	-	FC	BELT	HC-7	7.5	4603	1 thru 6	A, a

Based on products by TRANE.
See the specifications for detailed product and installation requirements.

ACCESSORIES/OPTIONS:
1. 2-inch solid double-vent construction.
2. Angled filter section with 2" pleated MERV 8 filters.
3. Heating Coil Access section.
4. Hous fan with vertical top discharge.
5. VAV fan with external VFD.
6. Integral 0" base frame.

REMARKS:
A. Vertical Unit, fan discharge - Top Front.
71"W x 81.82"L x 86.00"H, 1541 lbs installed weight.
11 FLA, 13.75 MCA, MOP 20 Amp.

UNIT ACOUSTICS: dB @ Supply Discharge, Active Band (Hz)
a. 97 88 94 83 88 82 80 74

AHU CHILLED WATER COILS (23 73 23)																			
MARK	COIL SIZE	AIR UNIT	CFM	MAX. PD *	MAX. FV	EAT	WB	DB	WB	LAT	MBH CAPACITY	% PG / WATER	COIL TYPE	FPI ROWS	ACCESSORIES/ OPTIONS	REMARKS			
CC-7		AHU-7	5,700	1.104	464	80.0	67.0	55.0	54.9		213.97	157.08	22.83	45	63.7	2.43	14	8	1, A

Based on products by TRANE.
See the specifications for detailed product and installation requirements.

ACCESSORIES/OPTIONS:
1. Extended drain and vent.

REMARKS:
A. Coil fluid volume 10.34 gallons.

Entering Air Temps. are based on:
DB WB
OAT 91 74

AHU WATER HEATING COILS (23 73 23)																			
MARK	COIL SIZE	UNIT	CFM	MAX. PD *	MAX. FV	EAT	WB	DB	WB	LAT	TOTAL MBH	% PG / WATER	COIL TYPE	FPI ROWS	ACCESSORIES/ OPTIONS	REMARKS			
HC-7		AHU-7	5,700	0.151	464	40	70	154.5	8.29	45	70	1.19		14	1		1		A

Based on products by TRANE.
See the specifications for detailed product and installation requirements.

ACCESSORIES/OPTIONS:
1. Extended drain and vent.

REMARKS:
A. Coil fluid volume 2.21 gallons.
B.
C.

Entering Air Temps. are based on:
DB WB
OAT 72 56
-20 -19

CLASSROOM UNIT VENTILATORS (23 82 23)																						
MARK	AREA SERVED	MODEL NO.	CFM	FAN ESP	HP	EAT	COOLING MODE*	HEATING MODE*	COIL	MIN	ELECT	ACCESS/	REMARKS									
UV-1	English 201	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-2	English 203	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-3	English 207	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-4	English 208	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-5	English 210	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-6	English 211	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-7	English 214	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-8	English 216	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-9	English 220	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-10	English 221	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-11	English 222	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-12	Foreign Lang 224	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-13	Foreign Lang 226	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-14	Foreign Lang 228	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-15	Foreign Lang 229	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-16	Foreign Lang 230	VUVE-125	1250	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.33	0.22	50.8	4	16	250	9	15	1151	2, 3	A,B,C, b
UV-17	Social Studies 301	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-18	Social Studies 304	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-19	Social Studies 305	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-20	Social Studies 307	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-21	Social Studies 308	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-22	Social Studies 310	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-23	Social Studies 311	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-24	Social Studies 314	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-25	Math 317	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-26	Math 319	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-27	Math 320	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-28	Math 321	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-29	Math 322	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-30	Math 325	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-31	Math 328	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B,C, a
UV-32	Math 330	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B, a
UV-33	Math 332	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B, a
UV-34	Social Studies 334	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B, a
UV-35	Science 338	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B, a
UV-36	Teacher Area 338A	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B, a
UV-37	Science 340	VUVE-150	1500	0.0	2 @ 1/4	80 / 67	7.4	3.8	34.9	24.1	50	2.66	0.75	66.9	4	16	250	9	15	1151	2, 3	A,B, a

Based on products by TRANE.
See the specifications for detailed product and installation requirements.

ACCESSORIES/OPTIONS:
1. Extended drain and vent.

REMARKS:
A. Burner existing outside air intake.
B. Standard color selected by Architect.
C. Relocate existing kinetic barrier shelving to fit new longer unit.

UNIT ACOUSTICS: dB @ High Speed
a. 66 72 67 84 63 59 50 50
b. 66 75 69 64 62 58 53 47

WATER BOILERS - HIGH EFFICIENCY (23 52 16)															
MARK	MANUFACTURER	TOTAL MBH	MINIMUM	%	PIPE CONN. SIZE	VENT SIZE	GAS PRESSURE	TYPE	ACCESS/	REMARKS					
BLR-1	FCB-6000	6000.0	5766.0	432	n/a	96	6"	6"	14"	14"	5"	13"	Stainless Steel Fire-Tube	1 - 14	A,B,C,D,E
BLR-2	FCB-6000	6000.0	5766.0	432	n/a	96	6"	6"	14"	14"	5"	13"	Stainless Steel Fire-Tube	1 - 14	A,B,C,D,E

Based on products by LOCHNIVAR.
See the specifications for detailed product and installation requirements.

ACCESSORIES/OPTIONS:
1. 316L Stainless Steel Fire-tube heat exchanger.
2. ASME "W" Stamp Heat Exchanger.
3. 20 to 1 sundown ratio.
4. Realtime O2 trim control (NOT JUST MONITORING).
5. IRI gas train, proof of closure valve.
6. Flow Switch, LWCO, Manual Reset High Limit.
7. Temperature/Pressure gauge.
8. #50 ASME Relief Valve.
9. Room Air Vertical Venting, AL28-4C.
10. Color 10" Capacitive Touchscreen LCD Display.
11. BACnet/MSTP Communications.
12. Bulk-In Circulating Sequencer for up to 8 Boilers.
13. Condensate Trap.

REMARKS:
A. Burner gas train and control wiring shall be the responsibility of the Mechanical Contractor.
B. FFLA @ 4800 electrical power required.
C. Operating weight 6,707 Lbs, 102.75" x 50" x 78", Water volume 304 gallons.
D. Boiler circulator, see HVAC PUMP SCHEDULE.
E. Controls to interface with existing Lochivar Crest boiler.

HVAC PUMPS (23 21 23)																	
MARK	MODEL No.	SYSTEM	TYPE	FLUID	GPM	FT HD	cP	MAX. HD. **	% EFF	NPSH	IMP. DIA.	BHP	HP	RPM	VOLTPH	ACCESS.	REMARKS
P-1	FI-6000D	Circ	Base Mt	40 Deg	1760	68	—	81	24	88	9.45	34.53	40.0	1760	4603	1.5	A, D
P-2	TC-6000D	Water	End Suction	Water	2000	77	—	102	15	77	9.60	51.46	60.0	1760	4603	1.5	A, C, D
P-3	FI-4000D	Heating	Base Mt	160 Deg	50	—	55	11	79	7.55	7.80	10.0	1760	4603	1.5	A, B, C, D	
P-4	5x4x5	Water	End Suction	Water	160	50	—	55	11	79	7.55	7.80	10.0	1760	4603	1.5	A, B, C, D
P-5	KV-4000D	Phy Ed	Vertical	160 Deg	475	55	—	68	8	82	8.25	7.87	10.0	1760	46		



Consultant:

Project Title: **SCHOOL DISTRICT OF LA CROSSE
CENTRAL HS HVAC UPGRADES**
Project Location: 1801 LOSEY BLVD SOUTH
LA CROSSE, WISCONSIN
Sheet Title: **FIRST FLOOR BOILER ROOM PLAN**

HSR Project Number: **21035**

Project Date: **NOVEMBER 2021**

Drawn By: **SMG**

Key Plan:

No.	Description	Date
A01	ADDENDUM NO. 1	11/23/21

Graphic Scale: **VARIES**

Last Update: **11/22/2021 1:15:57 PM**

SPECIFIC NOTES : SHEET 100	
1.	ALTERNATE BID.
2.	EXISTING JUNCTION BOX. SPlice NEW CONDUCTORS ON TO EXISTING AT THIS LOCATION. PROVIDE NEW CONDUCTORS AND CONDUITS TO CHILLER CONTROL PANEL.
3.	PROVIDE FLEXIBLE LIQUIDTIGHT CONDUIT AS FINAL CONNECTION TO CHILLER PANEL. PROVIDE CONDUIT SUPPORTS FROM FLOOR.

GENERAL NOTES : REMODEL	
A	ALL ELECTRICAL DEVICES SHOWN TO BE NEW UNLESS INDICATED OTHERWISE.
B	MAINTAIN OPERATION OF ALL EXISTING ELECTRICAL DEVICES. EXTEND WIRING/CONDUIT AS REQUIRED.
C	PROVIDE GROUND CONDUCTOR IN ALL RACEWAYS
D	PROVIDE SEPARATE NEUTRAL CONDUCTORS FOR EACH BRANCH CIRCUIT.
E	PROVIDE FIRE STOPPING AND SMOKE DRAFT STOPPING AT ALL CONDUIT PENETRATIONS. REFER TO SPECIFICATIONS SECTION 07940 FOR FIRE RESISTIVE AND NON-FIRE RESISTIVE ASSEMBLIES.

GENERAL NOTES : REMOVAL	
A	REMOVE ALL ELECTRICAL DEVICES AND ABANDON WIRING/CONDUIT BACK TO ELECTRICAL PANEL, CABINET, RACK OR TERMINATION BOARD.
B	MAINTAIN OPERATION OF ALL EXISTING RECEPTACLES AND DEVICES TO REMAIN. PROVIDE NEW HOMERUNS OF CONDUIT/WIRING WHERE REQUIRED.
C	PROVIDE COVERPLATES AT ALL OPEN DEVICE AND JUNCTION BOXES.
D	REFER TO MECHANICAL AND PLUMBING DRAWINGS FOR EQUIPMENT TO BE DISCONNECTED FOR REMOVAL.
E	EXTEND CONDUIT AND WIRING FOR ALL RELOCATED DEVICES.
G	DASHED LINES INDICATE ITEMS FOR REMOVAL.

ELECTRICAL SYMBOLS	
	DISCONNECT SWITCH
	MOTOR STARTER
	MOTOR CONNECTION
	EQUIPMENT CONNECTION
	PANELBOARD, TERMINAL CABINET
	JUNCTION BOX OR PULL BOX
	VARIABLE FREQUENCY DRIVE
	STANDARD DUPLEX RECEPTACLE *
	*GFI GROUND FAULT INTERRUPTING
	*WP WEATHERPROOF COVER
	DOUBLE DUPLEX RECEPTACLE *
	NOTE NUMBER

* TYPE AS INDICATED WITH LETTER/NUMBER, REFER TO SPECIFICATIONS OR SCHEDULES.

MOTOR SCHEDULE																			
MOTOR NO.	EQUIPMENT	PLB/G HVC EQUIP. NO.	LOC. ROOM NO.	HP	VOLT	PH	M	E	TYPE	STARTER BY	M	E	TYPE	CONTROL WIRING BY	M	E	TYPE	MOTOR WIRING	REMARK NUMBER
	CHILLER	CLR-1	148	405	480	3			X	CB	X		VFD	X				(2) 3 #20kcmil	#10 Parallel run
	CHILLED WATER PUMP	P-1	148	40	480	3	X			VFD	X		VFD	X				3 #6	#8 1
	CONDENSER WATER PUMP	P-2	148	60	480	3	X			VFD	X		VFD	X				3 #3	#6 1
	HOT WATER PRIMARY PUMP	P-3	148	10	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	HOT WATER PRIMARY STANDBY PUMP	P-4	148	10	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	HEATING PUMP	P-5	148	10	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	HEATING STANDBY PUMP	P-6	148	10	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	HEATING PUMP	P-7	128	5	480	3	X			F	X		FVNR	X				3 #12	#12 1
	UNIT VENTILATOR PUMP	P-8	128	2	480	3	X			F	X		FVNR	X				3 #12	#12 1
	UNIT VENTILATOR PUMP	P-9	128	2	480	3	X			F	X		FVNR	X				3 #12	#12 1
	UNIT VENTILATOR PUMP	P-10	128	2	480	3	X			F	X		FVNR	X				3 #12	#12 1
	AIR HANDLING UNIT	AH-7	128	7.5	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	RETURN AIR FAN	A-4	128	3/4	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	HOT WATER CIRCULATING PUMP	HCP-7	128	1/8	120	1	X			VFD	X		VFD	X				2 #12	#12 1
	BOILER CIRCULATING PUMP	BCP-1	148	5	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	BOILER CIRCULATING PUMP	BCP-2	148	5	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	BOILER BURNER	B-1	148	5	480	3	X			VFD	X		VFD	X				3 #12	#12 1
	BOILER BURNER	B-2	148	5	480	3	X			VFD	X		VFD	X				3 #12	#12 1

* SEE REMARK (NF) FUSED SAFETY SWITCH (NF) NOT FUSED SAFETY SWITCH (VFD) VARIABLE FREQUENCY DRIVE (TG) TOGGLE SWITCH. (FVNR) FULL VOLTAGE NONREVERSING; (CB) CIRCUIT BREAKER.

MOTOR SCHEDULE REMARKS:
1. VFD UNITS ARE FURNISHED BY THE MECHANICAL CONTRACTOR AND INSTALLED AND WIRED BY THE ELECTRICAL CONTRACTOR. PROVIDE ALL MOUNTING HARDWARE REQUIRED.

MOTOR CONTROL CENTER SCHEDULE MCC1										
MARK NO.	MOTOR NO.	MOTOR CONTROL UNIT					CIRCUIT BREAKER UNIT	FUSIBLE SWITCH UNIT	REMARK NUMBER	
		STARTER SIZE	RUNNING PILOT LT.	START-STOP P.B.	H-O-A SWITCH	CONTROL TRANS.				
1	P-1						903		1	
2	B-1						203		1	
3	B-2						203		1	

SERVICE: 480 VOLT, 3 PH, 3 WIRE.

MOTOR CONTROL SCHEDULE REMARKS:
1. REUSE MOTOR CONTROL CENTER CONTROL UNITS TO FEED NEW PUMPS. PROVIDE NEW WIRING AND CONDUITS. CONVERT MCC SECTIONS WITH STARTERS TO FEED ONLY UNITS. REMOVE STARTERS AND OTHER ASSOCIATED ITEMS NOT REQUIRED. PROVIDE NEW CIRCUIT BREAKERS AND OTHER HARDWARE/CONNECTIONS REQUIRED.

MOTOR CONTROL CENTER SCHEDULE MCCB										
MARK NO.	MOTOR NO.	MOTOR CONTROL UNIT					CIRCUIT BREAKER UNIT	FUSIBLE SWITCH UNIT	REMARK NUMBER	
		STARTER SIZE	RUNNING PILOT LT.	START-STOP P.B.	H-O-A SWITCH	CONTROL TRANS.				
1	P-3	1					20 amp fuses		1	
2	P-4	1					20 amp fuses		1	
3	P-2						100 amp fuses		1	
4	P-5	1					20 amp fuses		1	
5	P-6	1					20 amp fuses		1	
6	BCP-1	1					20 amp fuses		1	
7	BCP-2						20 amp fuses		1	

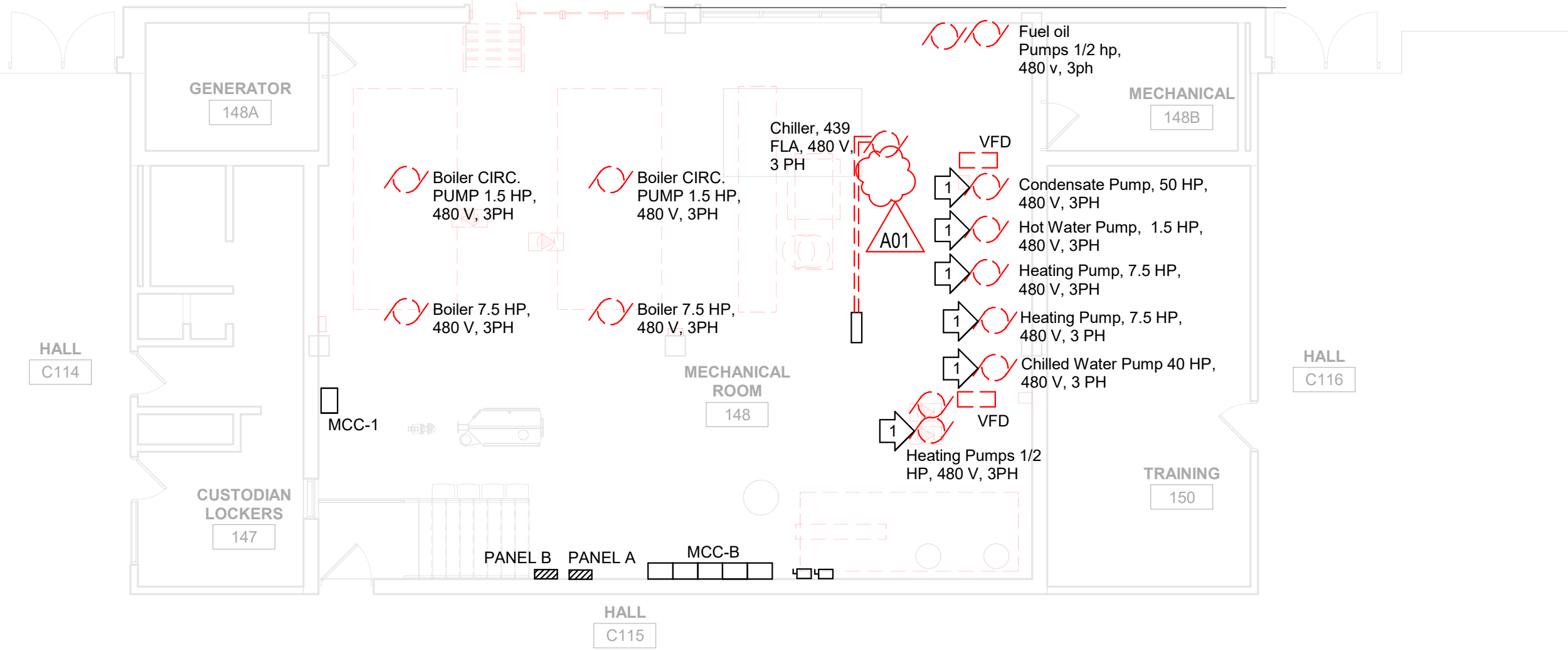
SERVICE: 480 VOLT, 3 PH, 3 WIRE.

MOTOR CONTROL SCHEDULE REMARKS:
1. REUSE MOTOR CONTROL CENTER CONTROL UNITS TO FEED NEW PUMPS/EQUIPMENT. PROVIDE NEW WIRING AND CONDUITS. CONVERT MCC SECTIONS WITH STARTERS TO FEED ONLY UNITS. REMOVE STARTERS AND OTHER ASSOCIATED ITEMS NOT REQUIRED. PROVIDE NEW FUSES AND OTHER HARDWARE/CONNECTIONS REQUIRED.

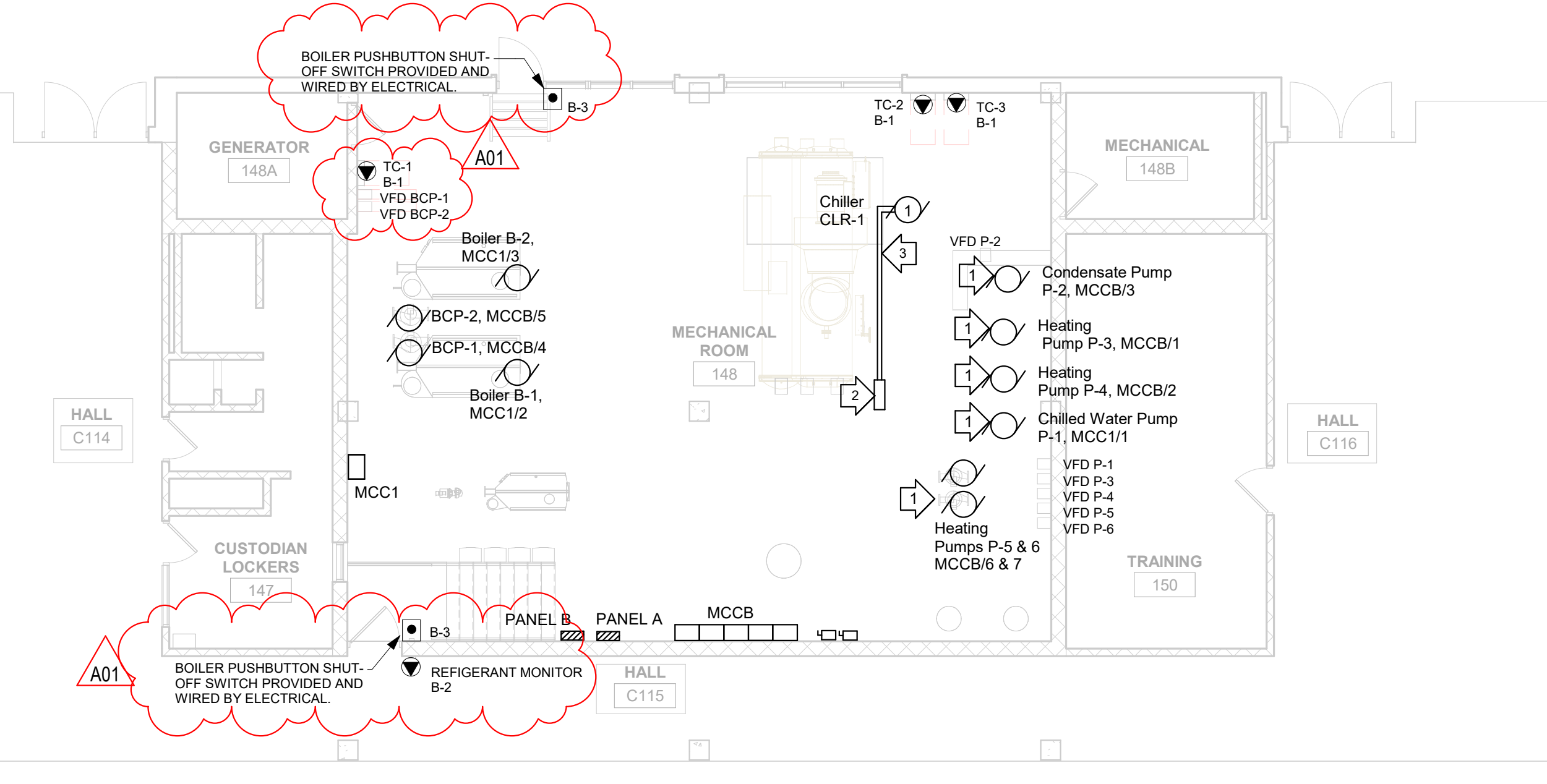
PANELBOARD SCHEDULE																
PANEL TYPE	ROOM NO.	MFR. TYPE	MTG. SIZE				SERVICE	AMP.	LUGS	BREAKER SWITCH	SUB-FEED LUGS	BRANCHES			SPACE	REMARKS
			F	S	W	D						NO.	AMP.	POLE		
A	BOILER ROOM	EXISTING	X				120/208V, 3 PH, 4 W									
B	BOILER ROOM	EXISTING	X				120/208V, 3 PH, 4 W				1	20	1	B-1, Temperature control panels	1	
											2	20	1	B-2,3 boiler shut off switch and refrigerant monitoring		

* SEE REMARKS

PANELBOARD SCHEDULE REMARKS:
1. PROVIDE NEW CIRCUIT BREAKER IN EXISTING PANELBOARD.



1 FIRST FLOOR REMOVAL
1/8" = 1'-0"



2 FIRST FLOOR - POWER
1/8" = 1'-0"



Consultant:

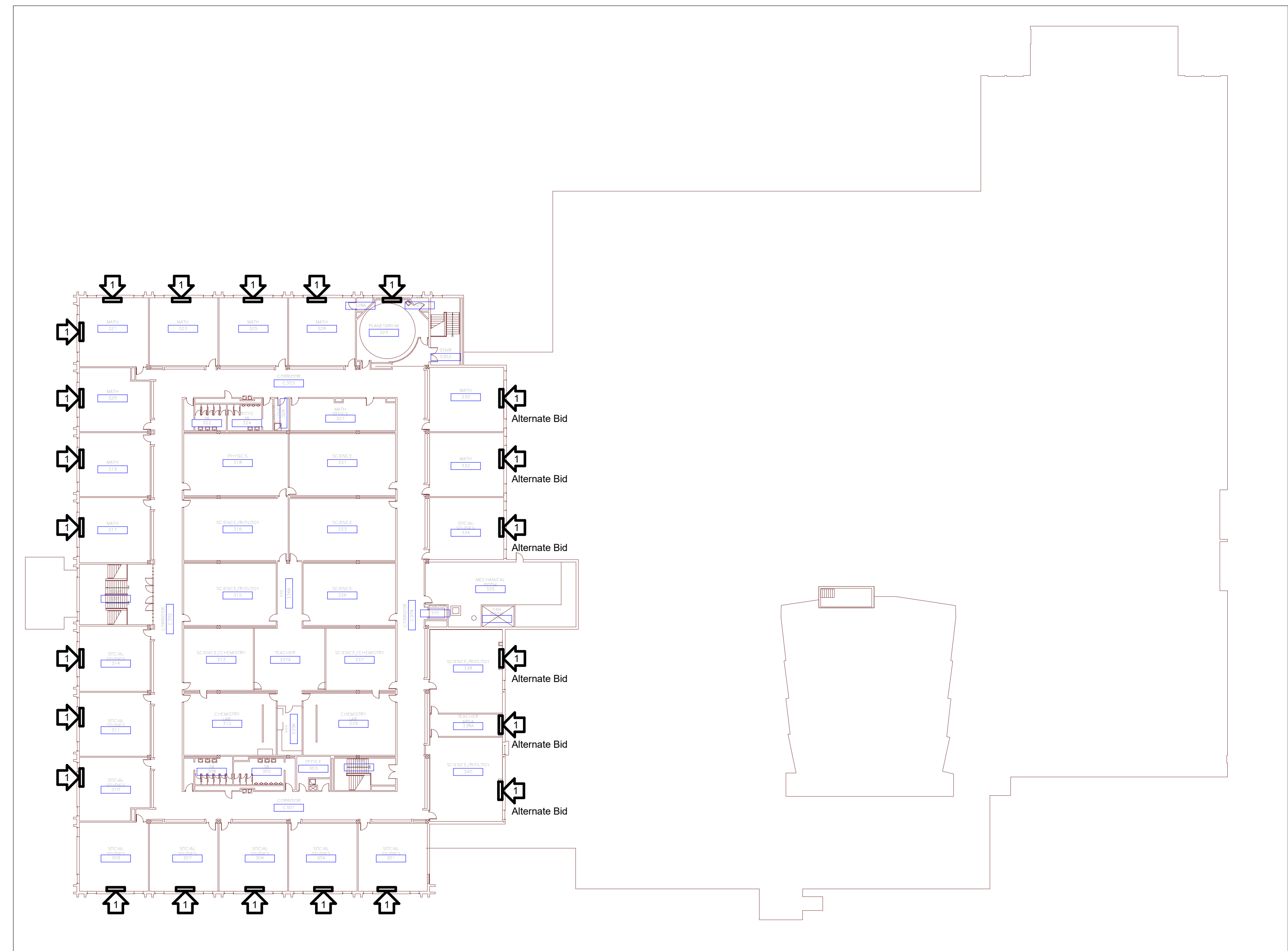
SCHOOL DISTRICT OF LA CROSSE
CENTRAL HS HVAC UPGRADES

Project Location: 1801 LOSEY BLVD SOUTH
LA CROSSE, WISCONSIN

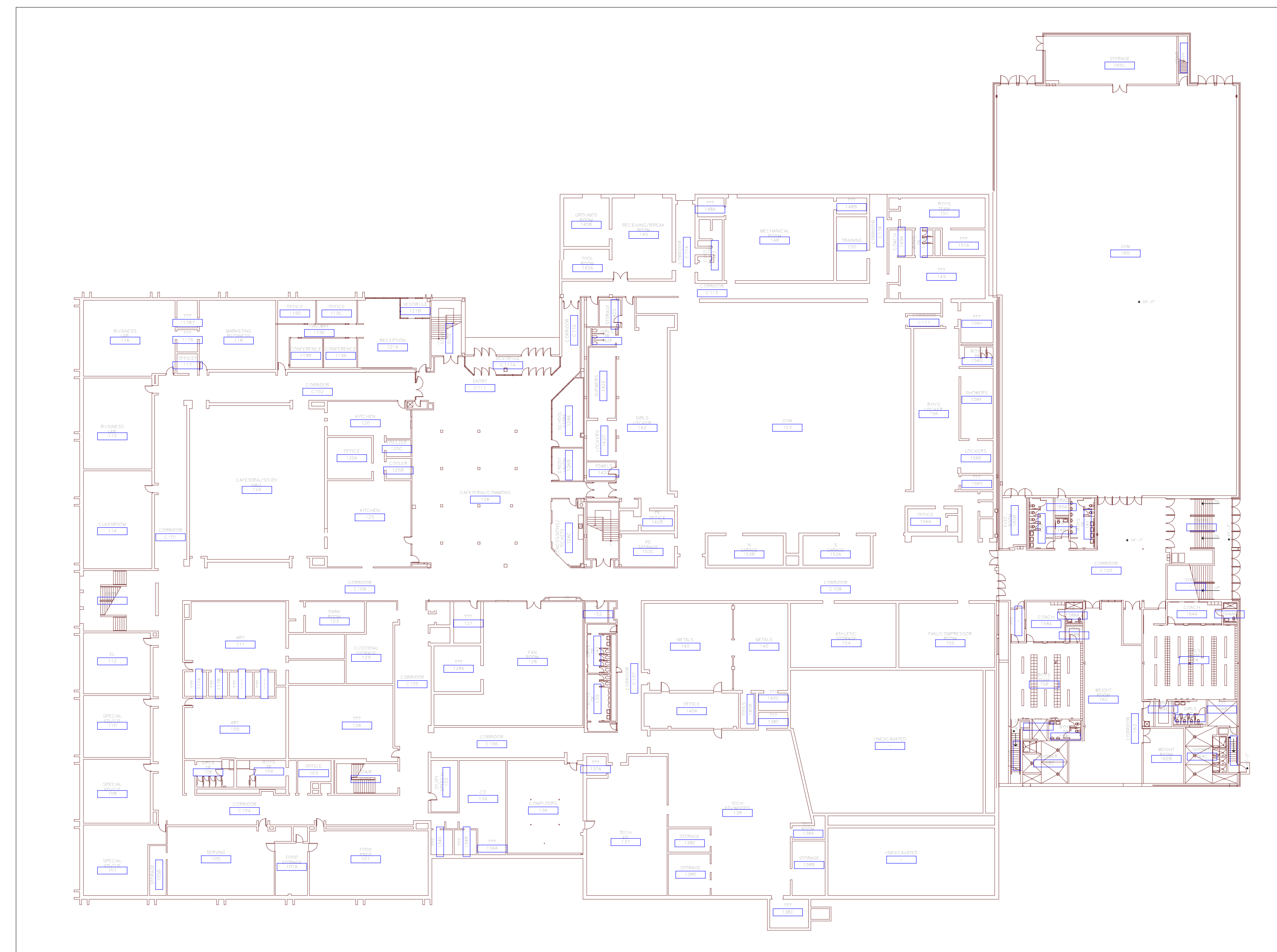
ELECTRICAL PLANS



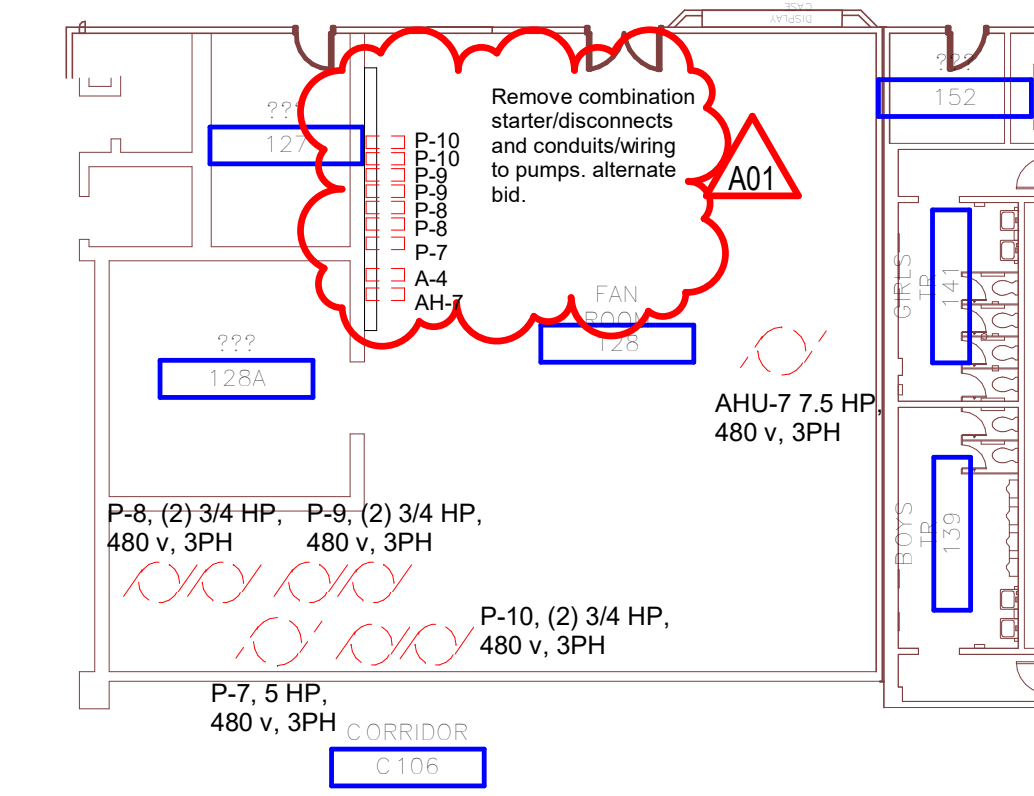
2 Floor Plan second floor
NTS



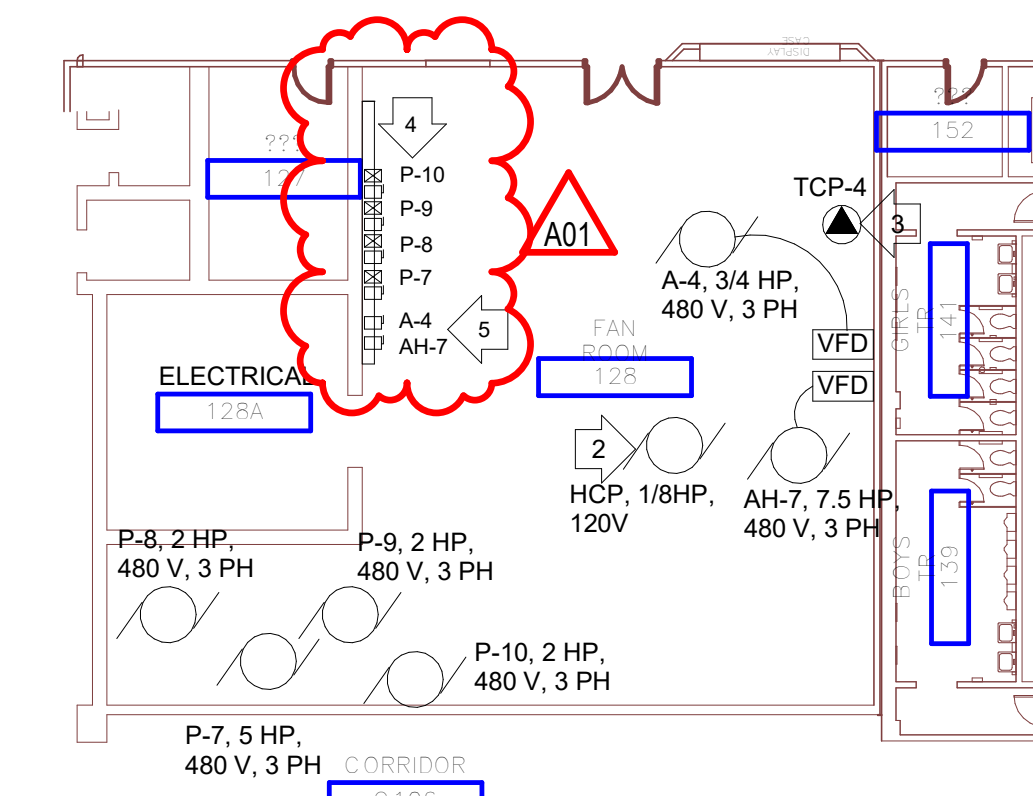
3 Floor Plan third floor
NTS



1 Floor Plan first floor
NTS



4 Floor Plan Fan Room Removal
NTS



5 Floor Plan Fan Room
NTS

GENERAL NOTES : REMOVAL	
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SPECIFIC NOTES : SHEET E101		
1	REMOVE UNIT VENTILATOR, AND REPLACE WITH NEW. REUSE EXISTING BRANCH CIRCUIT. EXTEND WIRING AND RACEWAY TO NEW UNIT VENTILATOR ELECTRICAL CONNECTIONS.	
2	PROVIDE 120 VOLT, 20 AMP BRANCH CIRCUIT FROM EXISTING PANELBOARD. FIELD VERIFY APPROPRIATE ELECTRICAL PANEL TO RUN BRANCH CIRCUIT FROM.	
3	EXTEND EXISTING 120 VOLT (RECEPTACLE) WIRING IN AREA TO NEW TEMPERATURE CONTROL PANEL.	
4	PROVIDE 30 AMP FUSED SAFETY SWITCHES WITH 20 AMP FUSES AND MOTOR STARTERS FOR PUMPS INDICATED. PROVIDE TAPS ON EXISTING WIRE TROUGH. PROVIDE NEW WIRING AND CONDUITS TO PUMPS. ALTERNATE BID	
5	PROVIDE 30 AMP FUSED SAFETY SWITCHES WITH 20 AMP FUSES. PROVIDE TAPS ON EXISTING WIRE TROUGH. PROVIDE NEW WIRING AND CONDUITS TO VFD'S. ALTERNATE BID	

Project Title:

HSR Project Number: 21035

Project Date: NOVEMBER 2021

Drawn By: SMG

Key Plan:

Revisions:

No.	Description	Date
A01	ADDENDUM NO. 1	11/23/21

Graphic Scale:

VARIES

Last Update:

11/22/2021 1:15:57 PM

E101